

# KARPAGAM ACADEMY OF HIGHER EDUCATION

(Deemed to be University)

( Established Under Section 3 of UGC Act 1956)

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## B.E. CIVIL ENGINEERING (FULL TIME)

### COURSE OF STUDY AND SCHEME OF EXAMINATIONS

SUB. CODE	TITLE OF THE COURSE	PE O	PO	L	T	P	CRE	CIA	ESE	T
THEORY										
15BECC101	Communicative English –I	1	10	3	0	0	3	40	60	100
15BECC102	Engineering Mathematics - I	1	1	3	2	0	4	40	60	100
15BECC103	Engineering Physics	1,2	3	3	0	0	3	40	60	100
15BECC104	Engineering Chemistry	1,2	3	3	0	0	3	40	60	100
15BECE105	Basic Electrical & Electronics Engineering	1	1	3	0	0	3	40	60	100
PRACTICAL										
15BECC111	Engineering Physics and Chemistry Lab	1,2	3	0	0	3	2	40	60	100
15BECE112	Engineering Practice Laboratory	1	1	0	0	3	2	40	60	100
15BECE113	Engineering Graphics	1	1	1	0	4	3	40	60	100
TOTAL				28 hrs			23	320	480	800
VALUE ADDED COURSE										
15BECC151	Human values	1	12	1	1	0	1	100	-	-
Total Contact Hours				30 hrs						

### SEMESTER II

SUB. CODE	TITLE OF THE COURSE	PE O	PO	L	T	P	CRE	CIA	ESE	T
THEORY										
15BECC201	Communicative English –II	1	10	3	0	0	3	40	60	100
15BECC202	Engineering Mathematics – II	1	11	3	2	0	4	40	60	100
15BECC203	Materials Science	1,2	3	3	0	0	3	40	60	100
15BECC204	Environmental Studies	3	7,12	3	0	0	3	40	60	100
15BECE205	Basic Mechanical Engineering	1	1	3	0	0	3	40	60	100
15BECE206	Computer fundamentals and C Programming	1	2	3	0	0	3	40	60	100
PRACTICAL										
15BECE211	Computer Practice and programming Lab	1	2	0	0	3	2	40	60	100
15BECE212	Building Drawing	1	4,5	1	0	3	2	40	60	100
TOTAL					27 hrs		23	320	480	800
VALUE ADDED COURSE										
15BECC251	Elementary Biology	1	12	1	1	0	1	100	-	-
Total Contact Hours					29 hrs					

L-Lecture T-Tutorial P-Practical CRE-Credit

Total Credit = 23+23=46

\*# The passing minimum for value added course is 50 marks out of 100 marks. There will be two tests, of which one will be class test covering 50% of syllabus for 50 marks and other for 50 marks.

### SEMESTER III

(Applicable to the students admitted from the Academic year 2015)

SUB. CODE	TITLE OF THE PAPER	PEO	PO	L	T	P	CRE	CIA	ESE	T
THEORY										
15BECE301	Methods of Applied Mathematics	1	1	3	2	0	4	40	60	100
15BECE302	Construction Materials & Geology	1	2	3	0	0	3	40	60	100
15BECE303	Mechanics of Fluids	1	3	3	0	0	3	40	60	100
15BECE304	Engineering Mechanics	1	1	3	1	0	4	40	60	100
15BECE305	Surveying I	1	6	3	0	0	3	40	60	100
PRACTICAL										
15BECE311	Survey Practical - I	1	6	0	0	3	2	40	60	100
15BECE312	Construction Materials Laboratory	1,2	2	0	0	3	2	40	60	100
TOTAL					24 hrs		21	280	420	700
VALUE ADDED COURSE										
15BECE351	Communication Skills Development	1	12	0	0	2	1	100	0	100
Total Contact Hours					26 hrs					

### SEMESTER IV

SUB. CODE	TITLE OF THE PAPER	PEO	PO	L	T	P	CRE	CIA	ESE	T
THEORY										
15BECE401	Water Resources Engineering	1,3	6	3	0	0	3	40	60	100
15BECE402	Soil Mechanics	1	3	3	0	0	3	40	60	100
15BECE403	Mechanics of Solids - I	1	3	3	1	0	4	40	60	100
15BECE404	Applied Hydraulics and machinery	1	7	3	0	0	3	40	60	100
15BECE405	Surveying – II	1	6	3	0	0	3	40	60	100
15BECE406	Environmental Engineering I	1,3	6	3	0	0	3	40	60	100
PRACTICAL										
15BECE411	Hydraulics and Hydraulic Machinery Laboratory	1,3	7	0	0	3	2	40	60	100
15BECE412	Scientific Computing Lab	1	1	2	0	2	3	40	60	100
15BECE413	Survey Practical - II	1	6	0	0	3	2	40	60	100
TOTAL					29 hrs		26	360	540	900
VALUE ADDED COURSE										
15BECE451	Soft Skill Development	1	12	0	0	2	1	100	0	100
	Total Contact Hours			31 hrs						

**L-Lecture T-Tutorial P-Practical CRE-Credit**

**Total Credit = 21+26=47**

### SEMESTER V

SUB. CODE	TITLE OF THE PAPER	PEO	PO	L	T	P	CRE	CIA	ESE	T
THEORY										
15BECE501	Environmental Engineering II	1	6	3	0	0	3	40	60	100
15BECE502	Foundation Engineering	1,3	7	3	0	0	3	40	60	100
15BECE503	Mechanics of Solids – II	1	3	3	1	0	4	40	60	100
15BECE504	Structural Analysis –I	1	2,3	3	1	0	4	40	60	100
15BECE5E--	Department Elective I	1	3	3	0	0	3	40	60	100
PRACTICAL										
15BECE511	Strength of Materials Laboratory	1,2	4,9	0	0	3	2	40	60	100
15BECE512	Geotechnical Laboratory	1,3	7	0	0	3	2	40	60	100
15BECE513	Environmental Engineering Laboratory	1	3	0	0	3	2	40	60	100
TOTAL				26 Hrs			23	320	480	800
VALUE ADDED COURSE										
15BECE551	In-plant Training	1	6	0	0	0	1	100*	0	100
15BECE552	Technical Presentation	1	12	0	0	2	1	100**	0	100
	Total Contact Hours			28 Hrs						

### SEMESTER VI

SUB. CODE	TITLE OF THE PAPER	PEO	PO	L	T	P	CRE	CIA	ESE	T
THEORY										
15BECE601	Concrete Technology	1	2	3	0	0	3	40	60	100
15BECE602	Structural Analysis –II	1	3	3	1	0	4	40	60	100
15BECE603	Design of Steel Structures	1	3	3	1	0	4	40	60	100
15BECE604	Design of RC Structures-I	1	3	4	0	0	4	40	60	100
15BECE6E--	Department Elective II	1	3	3	0	0	3	40	60	100
15BECE6E--	Department Elective III	1	3	3	0	0	3	40	60	100
PRACTICAL										
15BECE611	Computer Aided Design Laboratory	1	4,5	0	0	3	2	40	60	100
15BECE612	Concrete and Highway Laboratory	1,2	4,9	0	0	3	2	40	60	100
TOTAL					27 Hrs		25	320	480	800
VALUE ADDED COURSE										
15BECE651	Planning and Execution of Civil Projects	1	6	0	0	2	1	100*	-	100
	Total Contact Hours			29 hrs						

**L-Lecture T-Tutorial P-Practical CRE-Credit**

**Total Credit = 23+25=48**

**NOTE: Credits for value added courses are not counted for computation of CGPA**

### SEMESTER VII

SUB. CODE	TITLE OF THE PAPER	PEO	PO	L	T	P	CRE	CIA	ESE	T
THEORY										
15BECC701	Principles of Management and Entrepreneurship Development	3	8	3	0	0	3	40	60	100
15BECE702	Design of RC Structures-II	1	2,3	3	1	0	4	40	60	100
15BECE703	Estimation and Quantity Surveying	1	11	4	0	0	4	40	60	100
15BECE7E--	Department Elective IV	1	3	3	0	0	3	40	60	100
15BECE7E--	Department Elective V	1	3	3	0	0	3	40	60	100
15BECEOE--	Open Elective	1	3	3	0	0	3	40	60	100
PRACTICAL										
15BECE711	Irrigation and Environmental Engineering Drawing	1	3	0	0	3	2	40	60	100
15BECE712	Structural Detailing and Drawing	1	11	0	0	3	2	40	60	100
TOTAL				26 Hrs			24	320	480	800
VALUE ADDED COURSE										
15BECE751	Mini Project	1,2,3	4,5,9,11	0	0	2	1	100*	0	100
Total Contact Hours				28hrs						

#### SEMESTER VIII

SUB. CODE	TITLE OF THE PAPER	PEO	PO	L	T	P	CRE	CIA	ESE	T
<b>THEORY</b>										
15BECE801	Pre-stressed Concrete Structures	1	3	3	1	0	4	40	60	100
15BECE8E--	Department Elective VI	1	3	3	0	0	3	40	60	100
15BECE8E--	Department Elective VII	1	3	3	0	0	3	40	60	100
<b>PROJECT</b>										
15BECE891	Project Work & Viva voce	1,2,3	4,5,9,11	0	0	24	12	120	180	300
<b>TOTAL</b>				<b>34 hrs</b>			<b>22</b>	<b>240</b>	<b>360</b>	<b>600</b>
#	Open Elective	1	3	3	0	0	3	40	60	100
<b>Total Contact Hours</b>				<b>37hrs</b>						

**L-Lecture T-Tutorial P-Practical CRE-Credit**

**Total Credit = 24+22=46**

**Total credits -187**

**Total Marks - 4800**

**# Note: Interested Students can select one Self Study Course in eighth semester from the list of Open Elective which will be reflected in Mark Sheet only if he/she passes in the course.**

**\*To be evaluated internally by a committee of members**

**Final report + (certificate if necessary) – 50 marks**

**Final presentation and viva voce – 50 marks**

**\*\* To be evaluated internally by a committee of members**

**Review 1& 2 – 60 marks**

**Final presentation and viva voce – 40 marks**

**List of Department Elective Subjects**

**Fifth Semester**

**List of Department Elective Subjects**

**Sixth Semester**

SUB. CODE	TITLE OF THE PAPER	PEO	PO	L	T	P	CRE	CIA	ESE	T
15BECE5E01	Hydrology	1,2	2,4,7,1 5	3	0	0	3	40	60	100
15BECE5E02	Ground water Engineering	1,2	2,3,7	3	0	0	3	40	60	100
15BECE5E03	Cartography	1,2	5,6	3	0	0	3	40	60	100
15BECE5E04	Transportation Engineering	1,2	2,3	3	0	0	3	40	60	100

SUB. CODE	TITLE OF THE PAPER	PEO	PO	L	T	P	CRE	CIA	ESE	T
15BECE6E01	Highway Engineering	1,2	1,3,5 ,5,14	3	0	0	3	40	60	100
15BECE6E02	Design of biological treatment systems	1,2	3,5,7 ,10	3	0	0	3	40	60	100
15BECE6E03	Ground Improvement Techniques	1,2	2,3,4	3	0	0	3	40	60	100
15BECE6E04	Irrigation Engineering	1,2	7,9,1 1	3	0	0	3	40	60	100
15BECE6E05	Structural Dynamics	1,2	2,3,4	3	0	0	3	40	60	100
15BECE6E06	Urban Water Resource Management	1,2	5,7,9	3	0	0	3	40	60	100
15BECE6E07	Remote sensing Techniques and Applications	1,2	5,9,6	3	0	0	3	40	60	100
15BECE6E08	Soil Pollution Engineering	1,2	2,3,4	3	0	0	3	40	60	100
15BECE6E09	Railways, Airports and Harbours	1,2	1,3,4 ,5,14	3	0	0	3	40	60	100

**List of Department Elective Subjects**

**Seventh Semester**

SUB. CODE	TITLE OF THE PAPER	PEO	PO	L	T	P	CRE	CIA	ESE	T
15BECE7E01	Bridge Structures	1,2	1,9,1 2,15	3	0	0	3	40	60	100
15BECE7E02	Tall Buildings	1,2	1,9,1 2,15	3	0	0	3	40	60	100
15BECE7E03	Prefabricated Structures	1,2	1,9,1	3	0	0	3	40	60	100

			2,15							
15BECE7E04	Smart Structures and smart Materials	1,2	5,9,6	3	0	0	3	40	60	100
15BECE7E05	Finite Element Techniques	1,2	1,2,5,9,6	3	0	0	3	40	60	100
15BECE7E06	Municipal Solid Waste Management	1,2	4,7,11,14	3	0	0	3	40	60	100
15BECE7E07	Geographical Information System	1,2	5,9,6	3	0	0	3	40	60	100
15BECE7E08	Construction resource Planning and Management	1,2	1,9,12,15	3	0	0	3	40	60	100

**List of Department Elective Subjects**

**Eighth Semester**

SUB. CODE	TITLE OF THE PAPER	PEO	PO	L	T	P	CRE	CIA	ESE	T
15BECE8E01	Industrial Structures	1,2	1,9,12,15	3	0	0	3	40	60	100
15BECE8E02	Seismic Design of Reinforced Concrete Structures	1,2	1,2,5,9,6	3	0	0	3	40	60	100
15BECE8E03	Introduction to Soil Dynamics and Machine Foundations	1,2	2,3,4	3	0	0	3	40	60	100
15BECE8E04	Repair And Rehabilitation Of Structures	1,2	1,9,12,15	3	0	0	3	40	60	100
15BECE8E05	Environmental Impact assessment of Water resources development	1,2	4,7,11,14	3	0	0	3	40	60	100
15BECE8E06	Industrial Waste Management	1,2	4,7,11,14	3	0	0	3	40	60	100
15BECE8E07	Air Pollution Management	1,2	3,4,5,7	3	0	0	3	40	60	100
15BECE8E08	Construction Management	1,2	3,4,5	3	0	0	3	40	60	100
15BECE8E09	Traffic Engineering and management	1,2	1,3,4,5,14	3	0	0	3	40	60	100

**COURSES OFFERED BY OTHER DEPARTMENTS**  
**LIST OF OPEN ELECTIVES**

SUB. CODE	TITLE OF THE PAPER	PEO	PO	L	T	P	CRE	CIA	ESE	T
<b>SCIENCE AND HUMANITIES</b>										
15BESH0E01	Industrial Mathematics I	1	1	3	0	0	3	40	60	100
15BESH0E02	Industrial Mathematics II	1	1	3	0	0	3	40	60	100
15BESH0E03	Probability and Random Process	1	1	3	0	0	3	40	60	100
15BESH0E04	Probability and statistical Methods	1	1	3	0	0	3	40	60	100
15BESH0E05	Probability and Queuing Theory	1	1	3	0	0	3	40	60	100
15BESH0E06	Fuzzy Mathematics	1	1	3	0	0	3	40	60	100
15BESH0E07	Mathematical Physics	1	1	3	0	0	3	40	60	100
15BESH0E08	Advanced Engineering Mathematics	1	1	3	0	0	3	40	60	100
15BESH0E09	Linear Algebra	1	1	3	0	0	3	40	60	100
15BESH0E10	Transforms and Partial Differential Equation(Only for BE CSE students)	1	1	3	0	0	3	40	60	100
15BESH0E11	Technical Writing	1,2	9,10	3	0	0	3	40	60	100
15BESH0E12	Geophysics	1,2	1,3,5	3	0	0	3	40	60	100
15BESH0E13	Engineering Acoustics	1,2	1,3,5	3	0	0	3	40	60	100
15BESH0E14	Alternate Fuels and Energy Systems	1,2	2,3,5	3	0	0	3	40	60	100
15BESH0E15	Solid Waste Management	1,2	7,11,14	3	0	0	3	40	60	100
15BESH0E16	Green Chemistry	1,2	1,3,5	3	0	0	3	40	60	100
15BESH0E17	Applied Electrochemistry	1,2	1,3,5	3	0	0	3	40	60	100
15BESH0E18	Industrial Chemistry	1,2	1,3,5	3	0	0	3	40	60	100

**COMPUTER SCIENCE  
ENGINEERING**

15BEC SOE01	Python Programming	1,2	1,3	3	0	0	3	40	60	100
15BEC SOE02	Internet Programming	1,2	1,3	3	0	0	3	40	60	100
15BEC SOE03	Multimedia and Animation	2	1,3	3	0	0	3	40	60	100

15BEC SOE04	PC Hardware and Trouble shooting	2	5,6	3	0	0	3	40	60	100
15BEC SOE05	Game Programming	1,2	1,3	3	0	0	3	40	60	100

**ELECTRICAL & ELECTRONICS ENGINEERING**

15BEEEOE01	Electric Hybrid Vehicles	1,2	1,5	3	0	0	3	40	60	100
15BEEEOE02	Energy Management & Energy Auditing	1,2	1,6,7	3	0	0	3	40	60	100
15BEEEOE03	Sensors & Transducers	1	1,4	3	0	0	3	40	60	100
15BEEEOE04	Programmable Logic Controller	1	1,4	3	0	0	3	40	60	100
15BEEEOE05	Renewable Energy Resources	1,2	1,6,7	3	0	0	3	40	60	100
15BEEEOE06	Advanced Control Systems	1,2	1,4	3	0	0	3	40	60	100

**ELECTRONICS COMMUNICATION ENGINEERING**

15BEECOE01	Real Time Embedded Systems	1,2	1,2	3	0	0	3	40	60	100
15BEECOE02	Consumer Electronics	1	1	3	0	0	3	40	60	100
15BEECOE03	Fundamentals of Nanotechnology	1,2	1	3	0	0	3	40	60	100
15BEECOE04	Image & Video Processing	1,2	1,3,5	3	0	0	3	40	60	100
15BEECOE05	VLSI Technology	1,2	1,3,5	3	0	0	3	40	60	100
15BEECOE06	Fundamentals of MEMS	1,2	1,3,5	3	0	0	3	40	60	100
15BEECOE07	Neural Networks and its Applications	1,2	1,5	3	0	0	3	40	60	100
15BEECOE08	Fuzzy Logic and its Applications	1	1,5	3	0	0	3	40	60	100

**BIOTECHNOLOGY (B.Tech)**



15BTBTOE01	Bioreactor Design	1,2	1,3,6	3	0	0	3	40	60	100
15BTBTOE02	Food Processing and Preservation	1	1	3	0	0	3	40	60	100
15BTBTOE03	Molecular Modeling	1	1	3	0	0	3	40	60	100
15BTBTOE04	Bioremediation	1	1	3	0	0	3	40	60	100
15BTBTOE05	Biophysics	1	1	3	0	0	3	40	60	100
5BTBTOE06	Basic Bioinformatics	1	1	3	0	0	3	40	60	100
15BTBTOE07	Fundamentals of Nano Biotechnology	1,2	1	3	0	0	3	40	60	100
<b>MECHANICAL ENGINEERING</b>										
15BEME0E01	Introduction to MEMS	1,2	1	3	0	0	3	40	60	100
15BEME0E02	Robotics	1,2	1,3	3	0	0	3	40	60	100
15BEME0E03	Industrial Safety and Environment	1,2	1,3,1 2	3	0	0	3	40	60	100
15BEME0E04	Transport Phenomena	1,2	1,3,5	3	0	0	3	40	60	100
15BEME0E05	Introduction to Biomechanics	1	1,2	3	0	0	3	40	60	100
<b>AEROSPACE ENGINEERING</b>										
15BTASOE01	Introduction to Space Technology	1,2	1,2,3	3	0	0	3	40	60	100
15BTASOE02	Non Destructive Testing	1,2	1,3,1 2	3	0	0	3	40	60	100
15BTASOE03	Unmanned Aerial Vehicle Systems	1	1,5	3	0	0	3	40	60	100
15BTASOE04	Air Transportation and Aerodrome Design	1	1,2	3	0	0	3	40	60	100
15BTASOE05	Avionics	1	1,2	3	0	0	3	40	60	100
<b>AUTOMOBILE ENGINEERING</b>										
15BEAEOE01	Automobile Engineering	1	1,2	3	0	0	3	40	60	100
15BEAEOE02	Materials and Manufacturing of Automobile Component	1	1,2	3	0	0	3	40	60	100
15BEAEOE03	Automobile Maintenance	1	1,12	3	0	0	3	40	60	100

15BEAEOE04	Introduction to Modern Vehicle Technology	1	1,12	3	0	0	3	40	60	100
<b>CIVIL ENGINEERING (COURSES OFFERED TO OTHER DEPARTMENT)</b>										
15BECEOE01	Housing, Plan and Management	1,2	5,9,6	3	0	0	3	40	60	100
15BECEOE02	Building Services	1,2	8	3	0	0	3	40	60	100
15BECEOE03	Coastal Zone Management	1,2	1,5	3	0	0	3	40	60	100
15BECEOE04	Experimental Methods and Model Analysis	1	1,2	3	0	0	3	40	60	100
15BECEOE05	Management of irrigation systems	1,2	3,4,5,7	3	0	0	3	40	60	100

15BECEOE06	Computer Aided Design of Structures	1,2	1,5,6	3	0	0	3	40	60	100
15BECEOE07	Pavement engineering	1,2	1,3,4,5,14	3	0	0	3	40	60	100
15BECEOE08	Rock engineering	1,2	3,4	3	0	0	3	40	60	100
15BECEOE09	Storage structures	1,2	3,4	3	0	0	3	40	60	100
15BECEOE10	Wind engineering	1,2	3,4	3	0	0	3	40	60	100
15BECEOE11	Advanced construction technology	1,2	3,4,5,7	3	0	0	3	40	60	100

### **REFERENCE**

L – Lecture Hour

T – Tutorial Hour

P – Practical Hour

CRE – Credit

CIA – Continuous Internal Assessment

ESE – End semester Examination

CC – Common Course

NB – Non-circuit branches (Mechanical and Civil Engineering)

CB – Circuit branches (Electrical and Electronics, Electronics and Communication and Computer Science Engineering)

**\*\*-- Skill Development**

**\*\*-- Employability**

**\*\*--Entrepreneurship**

## **PROGRAM OUTCOMES (POs)**

**Engineering Graduates will be able to:**

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

**PO-2 Problem analysis:** Identify, formulate, 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-10 Communication:** Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.

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

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

### **PROGRAMME SPECIFIC OUTCOMES (PSO)**

The B.E. Degree Programme in Civil Engineering is offered in the department with the following programme specific COURSE OUTCOMES(COs):

**PSO-13** 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-14** 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-15** 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
<b>PEO1</b>	✓	✓	✓		✓			✓	✓		✓	✓
<b>PEO2</b>	✓	✓		✓	✓		✓		✓	✓	✓	✓
<b>PEO3</b>			✓		✓	✓	✓	✓		✓	✓	✓

**PEO-PSO mapping**

	PSO1	PSO2	PSO3
<b>PEO1</b>	✓	✓	✓
<b>PEO2</b>	✓	✓	✓
<b>PEO3</b>		✓	✓

# **SEMESTER I**

**OBJECTIVES:**

1. To enable students to attain fluency and accuracy to inculcate proficiency in professional 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 acquire good vocabulary for sentence structure and sentence formation.

**COURSE OUTCOMES(COS):**

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. Acquire good vocabulary for easy communication.
6. Be familiar with sentence structure and sentence formation

**Unit I**

**Listening**– Types of listening - Listening to class reading - Video tapes/ audio tapes. **Speaking** – Introduction on self - Introduction on one's friend. **Reading** - Reading for comprehension – Reading different kind of passages like descriptive, narrative, objective, conversational and argumentative. **Writing** – Free writing on any topic –My favorite place, hobbies, dreams, goals, etc- Writing short messages - To fill in different application forms. **Grammar** – Articles- WH questions –Yes/No Question - Subject Verb agreement. **Vocabulary** - Word Formation – Word expansion (Root word) - Prefix and Suffix.

**Unit II**

**Listening** – Understanding the passage in English –Pronunciation Practice. **Speaking** – Asking and answering questions - Telephone etiquette. **Reading** – Critical Reading – Finding key information in a given text (Skimming - scanning). **Writing** – Coherence and cohesion in writing – Short paragraph writing – Letters to the Editor. **Grammar**– Parts of Speech – Noun – Verb – Adjectives - Adverbs. **Vocabulary**– Compound Nouns/Adjectives – Irregular verbs.

**Unit III**

**Listening** – Listening for specific task – Fill in the gaps. **Speaking** – Phonemes – Syllables – Role play – Conversation Practice. **Reading** – Reading and Comprehension. **Writing** - Autobiographical writing – Biographical writing - Instruction Writing. **Grammar** – Preposition – Infinitive – Gerund – Tenses. **Vocabulary** – Foreign words used in English – British and American usage.



## Unit IV

**Listening** – Responding to questions – Reading in class for complete understanding and for better pronunciation. **Speaking** – Debate, Presentations in seminars. **Reading** – Making inference from the reading passage – Predicting the content of reading passages. **Writing** - Interpreting visual materials (tables, graphs, charts, etc) – Formal and Informal letters. **Grammar** – Sentence Pattern – Voice (active and passive voice). **Vocabulary**– One word substitution.

## Unit V

**Listening** - Listening to different accents, speeches/presentations. **Speaking**- Extempore talk –Just-a-minute talk. **Reading**-Reading strategies–Intensive reading – Text analysis. **Writing** - Creative writing – Writing circulars and notices – Writing proposal. **Grammar** – Direct and Indirect speech – Conditional sentences - Auxiliary verbs. **Vocabulary** – Abbreviations & Acronyms.

Note: Students to have hands on experience in the language lab @ two periods per unit.

### TEXT BOOKS:

S. NO.	AUTHOR(S) NAME	TITLE OF THE BOOK	PUBLISHER	YEAR OF PUBLICATION
1	<a href="#">Sangeeta Sharma</a> , <a href="#">Meenakshi Raman</a>	<a href="#">Technical Communication: Principles And Practice</a> 2 <sup>nd</sup> Edition	OUP	2015

### REFERENCES:

S. NO.	AUTHOR(S) NAME	TITLE OF THE BOOK	PUBLISHER	YEAR OF PUBLICATION
1	Rizvi Ashraf, M	Effective Technical Communication	Tata McGraw-Hill, New Delhi.	2007
2	Rutherford Andrea, J.	Basic Communication Skills for Technology	Pearson Education, New Delhi.	2006
3	Lakshminarayanan, K.R. & Murugavel, T.	Communication Skills for Engineers	SCITECH Publications, Chennai	2008

### WEBSITES:

<a href="http://www.learnerstv.com">www.learnerstv.com</a> <a href="http://www.usingenglish.com">www.usingenglish.com</a> <a href="http://www.englishclub.com">www.englishclub.com</a> <a href="http://www.ispeakyouspeak.blogspot.com">www.ispeakyouspeak.blogspot.com</a> <a href="http://www.teachertube.com">www.teachertube.com</a> <a href="http://www.Dictionary.com">www.Dictionary.com</a>
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**OBJECTIVES:**

1. To develop analysing skills for solving different engineering problems.
2. To understand the concept of Matrices, Sequence and Series.
3. To remember the basics of differential calculus and its applications.
4. To Create knowledge about Hyperbolic functions, Beta and Gamma functions.
5. To apply the problems in differential equations.
6. To enhance the knowledge on the concepts of sequences and series

**COURSE OUTCOMES(COS):**

1. Acquire the basic knowledge and understanding of mathematics
2. Apply advanced matrix knowledge to engineering problems.
3. Improve their ability in evaluating geometrical applications of differential calculus problems.
4. Understand the concepts of sequences and series.
5. Evaluating engineering problems involving hyperbolic functions, Beta and Gamma functions.
6. To solve the problems by applying the differential Equations.

## UNIT I      MATRICES

**Review of Matrix Algebra** - Characteristic equation – Eigenvalues and Eigenvectors of a real matrix – Properties – Cayley-Hamilton theorem (excluding proof) – Orthogonal transformation of a symmetric matrix to diagonal form – Quadratic forms – Reduction to canonical form through orthogonal reduction.

## UNIT II      DIFFERENTIAL CALCULUS

**Overview of Derivatives** - Curvature in Cartesian co-ordinates – Centre and radius of curvature – Circle of curvature – Evolutes – Envelopes- Evolutes as Envelope of normals – **Maxima and Minima of functions of two or more Variables** – **Method of Lagrangian Multipliers**

## UNIT III      SEQUENCES AND SERIES

**Sequences:** Definition and examples – **Series:** Types and Convergence – Series of positive terms – Tests of convergence: Comparison test, Integral test and D'Alembert's ratio test – Alternating series – Leibnitz's test – Series of positive and negative terms – Absolute and conditional convergence.

## UNIT IV      HYPERBOLIC FUNCTIONS, BETA AND GAMMA FUNCTIONS

**Hyperbolic functions:** Hyperbolic functions and Inverse Hyperbolic functions – Identities – Real and imaginary parts – solving problems using hyperbolic functions.

**Beta And Gamma Functions :** Definitions – Properties – Relation between beta and gamma integrals – Evaluation of definite integrals in terms of beta and gamma functions.

## UNIT V      DIFFERENTIAL EQUATIONS

Linear Differential equations of second and higher order with constant coefficients - Euler's form of Differential equations – **Method of variation parameters.**

### TEXT BOOKS:

S. No.	Author(s) Name	Title of the book	Publisher	Year of Publication
1	Hemamalini. P.T	Engineering Mathematics	McGraw Hill Education (India) Private Limited, New Delhi	2014

2	Sundaram, V. Lakhminarayan,K.A. &Balasubramanian,R.	Engineering Mathematics  for first year.	Vikas Publishing Home , New Delhi	2006
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## REFERENCES:

S. No.	Author(s) Name	Title of the book	Publisher	Year of Publication
1	Ramana. B.V	Higher Engineering Mathematics	Tata McGraw Hill Publishing Company, New Delhi.	2007
2	Grewel . B. S.	Higher Engineering Mathematics	Khanna Publications, New Delhi.	2011
3	BhaskarRao. P. B, Sri Ramachary SKVS, BhujangaRao. M	Engineering Mathematics I	BS Publications	2008
4	ShahnazBathul	Text book of Engineering Mathematics(Special Functions and Complex Variables)	PHI Publications	2009
5	Michael D. Greenberg	Advanced Engineering Mathematics	Pearson Education, India	2006

## WEBSITES :

1. <a href="http://www.efunda.com">www.efunda.com</a>
2. <a href="http://www.mathcentre.ac.uk">www.mathcentre.ac.uk</a>
3. <a href="http://www.intmath.com/matrices-determinants">www.intmath.com/matrices-determinants</a>

**15BECC103****ENGINEERING PHYSICS****3 0 0 3 100****OBJECTIVES:**

1. To enhance the fundamental knowledge in Physics and its applications relevant to various branches of Engineering and Technology
2. Understand the basics of laser and optical fiber with appropriate applications.
3. Introduce the concepts of quantum mechanics for diverse applications.
4. Impart the basic knowledge of crystal and its various crystal structures.
5. Disseminate the fundamentals of nuclear physics and their applications.
6. To Illustrate the basic ideas of nuclear reactors for energy resources

**COURSE OUTCOMES(COS):**

1. Identify the elastic nature of materials and its thermodynamic properties.
2. Infer the characteristics of laser and optical fibers for engineering applications.
3. Develop the idea of quantum mechanics through applications.
4. Identify the different atomic arrangements of crystals and its defects
5. Make use of the concepts of sound waves for medical applications
6. Illustrate the basic ideas of nuclear reactors for energy resources

**UNIT I      PROPERTIES OF MATTER AND THERMODYNAMICS**

Three types of modulus of elasticity – basic definitions, relation connecting the moduli (Derivation), poisson ratio- Torsional pendulum- bending of beams- bending moment – basic assumption of moment – uniform and non uniform bending

Concept of entropy- change of entropy in reversible and irreversible processes – refrigeration.

**UNIT II      LASER AND FIBER OPTICS**

Introduction – emission and absorption process- Einstein's coefficients derivation. Types of LASER - CO<sub>2</sub>, Semiconductor LASER Applications of LASER in industry and Medicine.

Total internal reflection – modes of propagation of light in optical fibers – numerical aperture and acceptance angle –derivations, types of optical fibers (Material, refractive index and mode) – fiber optical communication system (Block diagram)

### UNIT III QUANTUM PHYSICS

Introduction to quantum theory – Compton effect- dual nature of matter and radiation – de Broglie wavelength, uncertainty principle – physical significance of wave function, Schrödinger's wave equation – time dependent and time independent equations – particle in one dimensional box. Scanning electron microscope.

### UNIT IV CRYSTAL PHYSICS

Lattice – unit cell – Bravais lattice – lattice planes – Miller indices – calculation of number of atoms per unit cell, atomic radius, coordination number, packing factor for SC, BCC, FCC and HCP structures- crystal defects – point, line and surface defects

### UNIT V NUCLEAR PHYSICS

Introduction – basics about nuclear fission and fusion, nuclear composition – stable nuclei- liquid drop model, Radiation detectors – scintillation counter, semi conductor detector, cloud chamber. Reactors – essentials of nuclear reactor- power reactor, pressurized water reactor, Fast breeder reactor.

#### TEXT BOOK:

S.No	Author(s) Name	Title of the book	Publisher	Year of Publication
1	Ganesan.S and Baskar.T	Engineering Physics I	GEMS Publisher, Coimbatore-641 001	2015

#### REFERENCES:

S.No	Author(s) Name	Title of the book	Publisher	Year of Publication
1	Serway and Jewett	Physics for Scientists and Engineers with	Thomson Brooks/Cole, Indian reprint, New Delhi	2007
2	Gaur, R.K. and Gupta, S.C	Engineering Physics	DhanpatRaiPublications, New Delhi.	2003

#### WEBSITES:

1. <a href="http://www.nptel.ac.in">www.nptel.ac.in</a>
2. <a href="http://www.physicsclassroom.com">www.physicsclassroom.com</a>
3. <a href="http://www.oyc.yale.edu">www.oyc.yale.edu</a>

4. [www.physics.org](http://www.physics.org)

**OBJECTIVES:**

1. To gain knowledge on adsorption phenomena.
2. To make the students conversant with basics of water technology.
3. To make the student acquire sound knowledge of electrochemistry and storage devices.
4. To acquaint the student with concepts of fuels and rocket propellants.
5. To develop an understanding of the basic concepts of corrosion science.
6. To acquaint the students with the basics of surface chemistry.

**COURSE OUTCOMES(COS):**

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1. Outline the basic principles of chemistry for water treatment (K)
2. Examine the electrochemical properties to design non – conventional energy storage devices (S)
3. Apply the concepts combustion of different fuels (S)
4. Identify the concepts of corrosion and its protection in the engineering field (S)
5. Apply the concepts of surface chemistry in the field of engineering (S)
6. Integrate the chemical principles in the projects undertaken in field of engineering and technology (A)

**UNIT I WATER TECHNOLOGY**

Characteristics – Alkalinity – Types of alkalinity and determination – Hardness – Types and estimation by EDTA method (problems) - Domestic water treatment – Disinfection methods (Chlorination, Ozonation, UV treatment) – Boiler feed water – Requirements – Disadvantages of using hard water in boilers – Internal conditioning (Phosphate, Calgon and Carbonate conditioning methods) – External conditioning – Demineralization process – Desalination and Reverse osmosis.

**UNIT II ELECTROCHEMISTRY AND STORAGE DEVICES**

Electrochemical cells – Reversible and irreversible cells – EMF – Measurement of emf – Single electrode potential – Nernst equation – Reference electrodes –Standard Hydrogen electrode - Calomel electrode – Ion selective electrode – Glass electrode and measurement of pH – Electrochemical series – Significance – Potentiometric titrations (Redox -  $\text{Fe}^{2+}$  vs dichromate) – Batteries- Primary batteries-Leclanche cell- Secondary batteries- Lead acid battery.

**UNIT III FUELS AND ROCKET PROPELLANTS**

Coal - Proximate and Ultimate analysis - Metallurgical coke - Manufacture by Otto-Hoffman method - Petroleum processing and fractions - Synthetic petrol - Bergius and Fischer-Tropsch method - Knocking - Octane number and Cetane number - Gaseous fuels - Water gas, Producer gas, An introduction to Fuel Cell,  $\text{H}_2\text{-O}_2$  Fuel Cell -Rocket engines-Types of rocket engines, Basic principles, Mass fraction.

**UNIT IV CORROSION SCIENCE**



Chemical and Electrochemical corrosion - Galvanic corrosion - Differential aeration corrosion - Corrosion control - Sacrificial anode and Impressed current cathodic methods - Corrosion inhibitors - Protective coatings - Paints - Constituents and functions — Metallic coatings - Electroplating (Au) and Electro less plating (Ni) - Surface conversion coating and Hot dipping.

## UNIT V SURFACE CHEMISTRY

Introduction-Adsorption-Types, adsorption of gases on solids, adsorption of solutes from solutions, Adsorption isotherms-Freundlich adsorption isotherm-Langmuir adsorption isotherm-Industrial adsorbent materials- Role of adsorbents in catalysis and water softening-Emulsion-Types-water/oil, oil/water- Applications of adsorption.

### TEXT BOOKS:

S. No.	Author(s) Name	Title of the book	Publisher	Year of Publication
1.	Dr.S.Vairam	Engineering chemistry	Gems publishers	2014
2.	Ravikrishnan, A	Engineering Chemistry I & II	Sri Krishna Hi tech Publishing Company Private Ltd., Chennai.	2012

### REFERENCE BOOKS:

S. No.	Author(s) Name	Title of the book	Publisher	Year of Publication
1.	Kuriakose, J.C. and Rajaram	Chemistry in Engineering and Technology. Vol. I & II 5 <sup>th</sup> edition.	Tata McGraw Hill Publishing Company, New Delhi.	2010
2.	Sharma, B. K	Engineering Chemistry	Krishna Prakasam Media (P) Ltd., Meerut	2001
3.	Raman sivakumar	Engineering Chemistry I & II	McGraw-Hill Publishing Co.Ltd., NewDelhi,3 <sup>rd</sup> reprint.	2013
4.	Dara, S.S	Text book of Engineering Chemistry.	S.Chand&Co.Ltd., New Delhi	2008

### WEBSITES:

1. <http://www.studynotes.ie/leaving-cert/chemistry/>
2. <http://www.rejinpaul.com/2011/04/engineering-chemistry-ii-second.html>

3. <http://www.learnerstv.com/Free-chemistry-Video-lectures-ltv044-Page1.htm>
4. <https://www.sophia.org/subjects/chemistry>
5. <http://ocw.mit.edu/courses/#chemistry>

**15BECE105 BASIC ELECTRICAL AND ELECTRONICS ENGINEERING3 0 03 100****COURSE OBJECTIVES:**

1. To impart the basic knowledge about the Electric circuits.
2. To understand the working of various Electrical Machines.
3. To know about various measuring instruments.
4. To understand the basic concepts in semiconductor devices and digital electronics.
5. To understand and analyze basic electric and magnetic circuits.
6. To gain the basic knowledge about the Electric circuits

**COURSE OUTCOMES(COS):**

1. The students shall develop an intuitive understanding of the circuit analysis, basic concepts of electrical machines, basics of electronics and be able to apply them in practical situation.
2. To study the working principles of electrical machines and power converters.
3. To introduce the components of low-voltage electrical installations.
4. Gained the knowledge in working of Electrical Machines and Transformers.
5. Students will gain the applications of transformers.
6. To understand and analyze basic electric and magnetic circuits.

**UNIT I ELECTRIC CIRCUITS**

Ohm's Law – Kirchoff's Laws – Steady State Solution of DC Circuits – Introduction to AC Circuits – Waveforms and RMS Value – Power and Power factor – Single Phase and Three Phase balanced Circuits.

**UNIT II ELECTRICAL MACHINES**

Construction, Principle of Operation, Basic Equations and Applications of DC Generators, DC Motors, Single Phase Transformer, Single Phase Induction Motor.

**UNIT III MEASURING INSTRUMENTS**

Operating Principles of Moving Coil and Moving Iron Instruments (Ammeters and Voltmeters), Dynamometer type Watt meters and Energy meters.

**UNIT IV SEMICONDUCTOR DEVICES AND APPLICATIONS**

Characteristics of PN Junction Diode – Zener Effect – Zener Diode and its Characteristics – Half wave and Full wave Rectifiers – Voltage Regulation, Bipolar Junction Transistor – CB, CE, CC Configurations and Characteristics.

## **UNIT VDIGITAL ELECTRONICS**

Binary Number System – Logic Gates – Boolean Algebra – Half and Full Adders – Flip-Flops – Registers and Counters – A/D and D/A Conversion (single concepts)

### **TEXT BOOKS**

<b>S.NO</b>	<b>Author(s) Name</b>	<b>Title of the book</b>	<b>Publisher</b>	<b>Year of publication</b>
1	Mittle, V.M	Basic Electrical Engineering	Tata McGraw Hill Edition, New Delhi	2004
2	Sedha R.S	Applied Electronics	S. Chand & Co	2006

### **REFERENCE BOOKS**

<b>S.NO</b>	<b>Author(s) Name</b>	<b>Title of the book</b>	<b>Publisher</b>	<b>Year of publication</b>
1	Muthusubramanian R, Salivahanan S and Muraleedharan K A	Basic Electrical, Electronics and Computer Engineering	Tata McGraw Hill, Second Edition	2006
2	Nagsarkar T K and Sukhija M S	Basics of Electrical Engineering	Oxford press	2005
3	Premkumar N	Basic Electrical Engineering	Anuradha Publishers	2003
4	MahmoodNahvi and Joseph A. Edminister	Electric Circuits	Schaum' Outline Series, McGraw Hill	2002

**OBJECTIVES:**

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(COS):**

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 - CHEMISTRY**

1. Estimation of alkalinity of Water sample
2. Estimation of hardness of Water by EDTA
3. Estimation of Chloride in Water sample (Argentometric method)
4. Determination of corrosion rate by weight loss method.
5. Determination of molecular weight and degree of polymerization using viscometry.
6. Conductometric Titration (Simple acid base).
7. Conductometric Titration (Mixture of weak and strong acids).
8. Conduct metric Titration using  $\text{BaCl}_2$  vs  $\text{Na}_2\text{SO}_4$ .
9. pH Titration (acid & base).
10. Potentiometric Titration ( $\text{Fe}^{2+}$  /  $\text{KMnO}_4$  or  $\text{K}_2\text{Cr}_2\text{O}_7$ ).
11. Determination of water of crystallization of a crystalline salt (Copper sulphate).
12. Estimation of Ferric iron by spectrophotometry.

## LIST OF EXPERIMENTS – PHYSICS

1. Determination of velocity of sound and compressibility of liquid – Ultrasonic interferometer.
2. Determination of wavelength of mercury spectrum – spectrometer grating.
3. Determination of Young's modulus of the material – Non uniform bending or Uniform bending.
4. Determination of Viscosity of liquid – Poiseuille's method.
5. Spectrometer Dispersive power of a prism.
6. Torsional pendulum – Determination of Rigidity modulus.
7. Particle size determination using Diode Laser
8. Determination of Laser parameters – Wavelength, and angle of divergence.
9. Determination of acceptance angle in an optical fiber.
10. Determination of thickness of a thin wire – Air wedge method
11. Determination of Band Gap of a semiconductor material.
12. Determination of Specific resistance of a given coil of wire – Carey Foster Bridge

Semester-I

### 15BECE112ENGINEERING PRACTICE LABORATORY0032 100

#### COURSE OBJECTIVES:

- |   |
|---|
| <ol style="list-style-type: none"><li>1. To provide exposure to the students with hands on experience on various basic Engineering practices in Civil and Mechanical Engineering.</li><li>2. To provide exposure to the students with hands on experience on various basic Engineering practices in Electrical and Electronics Engineering.</li></ol> |
|---|

#### PART – A (CIVIL & MECHANICAL)

##### 1. WELDING

- i. Preparation of arc welding of butt joints, lap joints and tee joints.

##### 2. BASIC MACHINING

- i. Simple Turning and Taper turning
- ii. Drilling and Tapping

##### 3. SHEET METAL WORK

- i. Model making – Trays, funnels, etc.

##### 4. DEMONSTRATION ON

- i. Smithy operations
- ii. Foundry operations
- iii. Plumbing Works
- iv. Carpentry Works

#### PART –B (ELECTRICAL & ELECTRONICS)

##### 5. ELECTRICAL ENGINEERING

- i. Study of electrical symbols and electrical equipments.
- ii. Construct the wiring diagram for Stair case wiring and Fluorescent lamp wiring.
- iii. Construct the wiring diagram for Residential house wiring using switches, fuse, indicator, lamp and energy meter.
- iv. Measurement of electrical quantities – voltage, current, power & power factor in R load.

v. Measurement of energy using single phase energy meter.

## **6. ELECTRONICS ENGINEERING**

- i. Study of Electronic components– Resistor (color coding), capacitors and inductors.
- ii. Soldering practice – Components Devices and Circuits – Using general purpose PCB.
- iii. Study of logic gates AND, OR, NOT, NOR and NAND.
- iv. Study of HWR and FWR.

## **REFERENCES**

1. Jeyachandran, K., Natarajan, S. and Balasubramanian, S, “A Premier on Engineering Practices Laboratory”, Anuradha Publications, Kumbakonam, 2007.
2. Jeyapoovan, T., Saravanapandian, M, “Engineering Practices Lab Manual”, VikasPuplishing House Pvt. Ltd, Chennai, 2006.
3. Bawa, H.S, “Workshop Practice”, Tata McGraw – Hill Publishing Company Limited, New Delhi, 2007.

**\*This course is offered in the first semester to the branches CIVIL,MECH,AUTO and in the second semester to the branches CSE, EEE and ECE.**

**COURSE OBJECTIVES:**

1. To develop in students, graphic skills for communication of concepts, ideas and design of engineering products.
2. To give exposure to solid modeling, computer-aided geometric design, creating working drawings and engineering communication.
3. To develop graphic skill for communication of concepts, ideas and design of engineering products.
4. To give exposure to existing national standards related to technical drawings.
5. To gather skills in technical drawing.
6. To expose them to existing national standards related to technical drawings.

**COURSE OUTCOMES(COS):**

On Completion of the course the student will be able to

1. perform free hand sketching of basic geometrical constructions and multiple views of objects.
2. do orthographic projection of lines and plane surfaces.
3. draw projections and solids and development of surfaces.
4. prepare isometric and perspective sections of simple solids.
5. demonstrate computer aided drafting.
6. Will gather skills in technical drawing

**UNIT I      INTRODUCTION**

Introduction to Engineering Drawing, Bureau of Indian Standards (BIS), 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.

**UNIT II      SCALES AND PLANE CURVES**

SCALES: Reducing Scale, Enlarging Scale, Plain Scale, Diagonal Scale and Vernier Scale. Conics – Construction of Ellipse, Parabola and Hyperbola by eccentricity method

**UNIT III      FREE HAND SKETCHING**

Representation of Three Dimensional objects – General principles of orthographic projection – 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 IV      PROJECTION OF POINTS, LINES AND PLANE SURFACES**



Projection of points and straight lines located in the first quadrant – Determination of true lengths and true inclinations – Traces–Projection of polygonal surface and circular lamina inclined to both reference planes.

## **UNIT V            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.

### **Introduction to Drafting Software/Package (Not for Exam):**

Basic operation of drafting packages, use of various commands for drawing, dimensioning, editing, modifying, saving and printing/plotting the drawings. Introduction to 3D primitives.

### **TEXT BOOKS**

1. Venugopal K and Prabhu Raja V, “Engineering Graphics”, New Age International Publishers, 2007.
2. VTU, “A Primer on Computer Aided Engineering Drawing” Belgaum, 2006.

### **REFERENCES**

1. Kumar M S, “Engineering Graphics”, D D Publications, Chennai, Ninth Edition, 2007.
2. Bureau of Indian Standards, “Engineering Drawing Practices for Schools and Colleges SP 46-2003”, BIS, New Delhi, 2003.
3. Luzadder W J, “Fundamentals of Engineering Drawing”, Prentice Hall Book Co., New York, 1998.

### **WEB REFERENCES**

1. IS 10711 – 2001: Technical products Documentation – Size and lay out of drawing sheets.
2. IS 9609 (Parts 0 and 1) – 2001: Technical products Documentation – Lettering.
3. IS 10714 (Part 20) – 2001 and SP 46 – 2003: Lines for technical drawings.
4. IS 11669 – 1986 and SP 46 – 2003: Dimensioning of Technical Drawings.
5. IS 15021 (Parts 1 to 4) – 2001: Technical drawings – Projection Methods.

**COURSE OBJECTIVES:**

1. To educate the values and meaning of life in the young minds
2. To transform the human values as responsible citizens.
3. To gain self-development of students.
4. To know about student's individual quality.
5. To Analyse the mental strength.
6. To get awareness on physical and mental fitness.

**UNIT – I :** Human life on Earth - Concept of Human Values - Value Education - Aim of education and value education - Types of values - Components of values – Attitudes – types of attitudes

**UNIT – II :** Self Development : Self analysis – Goal Setting - Thought Analysis – Guarding against Anger - Respect to age, experience, maturity, family members, neighbors, co-workers

**UNIT – III :** Individual Qualities – Truthfulness – Constructivity – Sacrifice – Sincerity - Self Control – Altruism – Tolerance - Scientific Vision – Regulating Desire

**UNIT – IV :** Mind Culture - Modern Challenges of Adolescent - Emotions and behavior - Sex and spirituality - Adolescent Emotions - Meditation

**UNIT - V :** Body and Mind Fitness : (a) Physical Exercises (b) Activities: (i) Moralization of Desires (ii) Neutralization of Anger (iii) Eradication of Worries (iv) Benefits of Blessings

**Reference Books**

S.No	Author(s) Name	Title of the book	Publisher	Year of Publications
1	Subramanian. R	Professional Ethics	Oxford, New Delhi	2013
2	Govindarajan. M, Natarajan. S, Senthil Kumar. V.S	Engineering Ethics	Prentice Hall of India, New Delhi	2004
3	Tripathi. A.N	Human Values	New Age International	2009
4	Pope. G. U.	Thirukkural with English Translation	Uma Publication, Thanjavur.	2002

# **SEMESTER II**

**OBJECTIVES:**

1. To motivate learners to acquire listening & speaking skills in both formal and informal context
2. To focus on question forms & to make them understand the important of using question tags and also the functional use of transformation of sentences.
3. To improve their reading habit and to train them in critical and analytical reading
4. To equip them to write for academic as well as work place context
5. To enable students to face interviews
6. To develop admire and appreciate elegancy in communication.

**COURSE OUTCOMES(COS):**

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 as well as creative, critical, analytical and evaluative writing.
4. Enrich the ability to face interviews with confidence.
5. Enable to write documents and formal written communication
6. Admire and appreciate elegancy in communication.

**UNIT-1**

**Listening** - Difference between Hearing & Listening –Listening to informal conversation. **Speaking** - Spoken structures on different situations - Introduction, Greeting, Comments on topics like Films, Games etc, Excuse, Request, Agreement, Disagreement, etc., **Reading** – Extensive and Intensive reading. **Writing** – Report writing - Writing a Covering letter. **Grammar** – Regular & Irregular verbs - Kinds of sentence - Question tags. **Vocabulary** – Homonyms and Homophones.

**UNIT-II****Listening –**

Note Taking- Improving grasping ability. **Speaking** – Welcome Address - Vote of thanks - Master of ceremony. **Reading** – Active and Passive reading - Reading for vocabulary- Reading for a purpose. **Writing** - Writing a review (Film review) - Summary of a story. **Grammar** - Modal verbs – Conjunction - Expression of cause and effect. **Vocabulary** - Phrasal verbs - Idioms.

**UNIT – III**

**Listening** - Barriers to listening (Physical, Psychological, Linguistic & Cultural). **Speaking** – Stress, Pause and Intonation. **Reading** – Rapid Reading – Skimming, Scanning and Surveying. (SQ3R)**Writing** - Essay writing -Minutes of Meeting - Agenda – **Grammar** - Active and Passive voice - Purpose Expression. **Vocabulary** - Same words used as noun and verb - often misspelt and confused words.

## UNIT-IV

**Listening** – Listening to telephone conversation - Viewing model interviews. **Speaking** – Group Discussion - Correlation between verbal & non - verbal communication. **Reading** – Reading Comprehension (short & long text) - Reading job advertisements and profile of a company. **Writing** – Job Application - Resume Writing - Checklist Preparation. **Grammar** - Numerical Expressions – Collocations - **Vocabulary** - Singular and Plural (Nouns)

## UNIT- V

**Listening** – Types of Listening- Improving listening comprehension. **Speaking** - Oral presentation - Vocal communication techniques - voice, quality, volume, pitch etc., **Reading** -Note Making - Making notes from books/ any forms of writing materials. **Writing** - Describing process & products - Recommendation Writing – Short Essays Writing- **Grammar**- Transformation of sentences (Simple, Compound & Complex). **Vocabulary** - Collection of Technical Vocabulary with their meanings.

Note: Students to have hands on experience in the language lab @ two periods per unit.

### TEXT BOOKS:

S. NO.	AUTHOR(S) NAME	TITLE OF THE BOOK	PUBLISHER	YEAR OF PUBLICATION
1	<u>Sangeeta</u> <u>Sharma ,</u> <u>Meenakshi</u> <u>Raman</u>	<u>Technical</u> <u>Communication:</u> <u>Principles And</u> <u>Practice</u> 2 <sup>nd</sup> Edition	OUP	2015

### REFERENCES:

S. NO.	AUTHOR(S) NAME	TITLE OF THE BOOK	PUBLISHER	YEAR OF PUBLICATION
1	Rizvi Ashraf, M	Effective Technical Communication	Tata McGraw-Hill, New Delhi.	2007
2	Rutherford Andrea,J.	Basic Communication Skills for Technology 2 <sup>nd</sup> Edition	Pearson Education, New Delhi.	2006
3	Lakshminarayanan, K.R. & Murugavel, T.	Communication Skills for Engineers	SCITECH Publications, Chennai	2008

### WEBSITES :

<a href="http://www.learnerstv.com">www.learnerstv.com</a> <a href="http://www.usingenglish.com">www.usingenglish.com</a> <a href="http://www.englishclub.com">www.englishclub.com</a> <a href="http://www.ispeakyouspeak.blogspot.com">www.ispeakyouspeak.blogspot.com</a> <a href="http://www.teachertube.com">www.teachertube.com</a> <a href="http://www.Dictionary.com">www.Dictionary.com</a>
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**OBJECTIVES:**

1. To understand the concepts and applications of partial differential equations
2. Determine mathematical tools needed in evaluating multiple integrals and their usage.
3. Utilize Gauss, Stokes and Greens theorems to simplify calculations of integrals and prove simple results.
4. Apply the knowledge of Mathematics in various Engineering fields by making them to identify the functions in engineering problems as analytic function and their analyze as a function of a complex variables.
5. 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 Analyse the concept of 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.

**COURSE OUTCOMES(COS):**

1. The student will be able to Understand how to solve the given standard partial differential equations.
2. The students will be able to understand mathematical tools needed in evaluating multiple integrals and their usage. Find the areas and volumes using multiple integrals
3. To calculate with them and apply them and also to calculate grad, div and curl in Cartesian and other simple coordinate systems.
4. Improve their ability in Vector calculus
5. To find the Analytic functions using the Cauchy Riemann equations and they will learn mapping properties of elementary functions and mapping properties of some special transcendental functions. They will understand relations between conformal mappings and quadratic differentials and how geometric structures are changing under conformal mappings.
6. 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.

**UNIT- I      PARTIAL DIFFERENTIAL EQUATIONS**

Formation of partial differential equations by elimination of arbitrary constants and arbitrary functions  
– Solution of standard types of first order partial differential equations – Lagrange’s linear equation –  
Linear partial differential equations of second and higher order with constant coefficients.

**UNIT-II      MULTIPLE INTEGRALS**

Double integral – Cartesian coordinates – Polar coordinates – Change of order of integration – Triple  
integration in Cartesian co-ordinates – Area as double integrals.

**UNIT-III      VECTOR CALCULUS**

Gradient, Divergence and Curl – Directional derivative – Irrotational and Solenoidal vector fields –  
Vector integration – Green’s theorem, Gauss divergence theorem and Stoke’s theorems (Statement  
Only)- Surfaces : hemisphere and rectangular parallelopipeds.

**UNIT-IV      ANALYTIC FUNCTIONS**

Analytic functions - Cauchy-Riemann equations in Cartesian and polar forms – Sufficient condition  
for an analytic function (Statement Only) - Properties of analytic functions – Constructions of an  
analytic function - Conformal mapping:  $w = z+a$ ,  $az$ ,  $1/z$ ,  $z^2$  and bilinear transformation.

**UNIT-V      COMPLEX INTEGRATION**

Complex Integration - Cauchy’s integral theorem and integral formula (Statement Only) – Taylor series  
and Laurent series - Residues – Cauchy’s residue theorem (Statement Only) - Applications of Residue  
theorem to evaluate real integrals around unit circle and semi circle (excluding poles on the real axis).

**TEXT BOOK:**

S. No.	Author(s) Name	Title of the book	Publisher	Year of Publication
1	Hemamalini. P.T	Engineering Mathematics I & II	McGraw-Hill Education Pvt.Ltd, New Delhi	2014
2	Grewal, B.S.	Higher Engineering Mathematics	Khanna Publishers, Delhi.	2011

**REFERENCES:**

S.	Author(s) Name	Title of the book	Publisher	Year of
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No.				Publication
1	Erwin Kreyszig	Advanced Engineering Mathematics.	John Wiley & Sons. Singapore	2011
2	Venkataraman, M. K.	Engineering Mathematics.	The National Publishing Company, Chennai	2004
3	Narayanan. S, Manicavachagampillay.T.K and Ramaniah.G	Advanced Mathematics for Engineering Students.	Viswanathan S.(Printers and Publishers) Pvt. Ltd. Chennai.	2002
4	Michael D. Greenberg	Advanced Engineering Mathematics	Pearson Education, India	2006

#### WEBSITES:

1. <a href="http://www.maths-dur.ac">www.maths-dur.ac</a> 2. <a href="http://www.efunda.com">www.efunda.com</a> 3. <a href="http://www.mathcentre.ac.uk">www.mathcentre.ac.uk</a> 4. <a href="http://www.sosmath.com/diffeq/laplace/basic/basic.html">www.sosmath.com/diffeq/laplace/basic/basic.html</a>
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**OBJECTIVES:**

1. To enrich the understanding of various types of materials and their applications in engineering and technology
2. Introduce the concepts of classical and quantum electron theories for diverse applications.
3. Understand the basics of magnetic materials and its properties.
4. Impart the basic knowledge of superconducting and dielectric materials.
5. Inculcate the technology in synthesization of nano materials.
6. To Summarize the basics of nano structures and synthesizing techniques

**COURSE OUTCOMES(COS):**

1. Explain the ideas of classical and quantum electron theories and energy band structures.
2. Illustrate the basics of semiconductor physics and its related concepts.
3. Compare the different magnetic materials, its properties and infer its role in various fields.
4. Identify the properties of superconducting materials and its engineering applications.
5. Extend the various polarization techniques and applications of dielectric materials.
6. Summarize the basics of nano structures and synthesizing techniques

**UNIT I CONDUCTING MATERIALS**

Conductors – classical free electron theory of metals – Electrical and thermal conductivity – Wiedemann – Franz law – Lorentz number – Draw backs of classical theory – Quantum theory – Fermi distribution function – Effect of temperature on Fermi Function – Density of energy states – carrier concentration in metals.

**UNIT II SEMICONDUCTING MATERIALS**

Intrinsic semiconductor – carrier concentration derivation – Fermi level – Variation of Fermi level with temperature – electrical conductivity – band gap determination – extrinsic semiconductors – carrier concentration derivation in n-type semiconductor – variation of Fermi level with temperature and

impurity concentration – compound semiconductors – Hall effect –Determination of Hall coefficient – Applications.

### UNIT III      MAGNETIC AND SUPERCONDUCTING MATERIALS

Origin of magnetic moment – Dia and para magnetism – Ferro magnetism – Domain theory – Hysteresis – soft and hard magnetic materials – anti – ferromagnetic materials – Ferrites – applications.

Superconductivity : properties - Types of super conductors – BCS theory of superconductivity(Qualitative) - High Temperature superconductors – Applications of superconductors – magnetic levitation.

### UNIT IV      DIELECTRIC MATERIALS

Electrical susceptibility – dielectric constant – electronic, ionic, orientational and space charge polarization – frequency and temperature dependence of polarisation – internal field – Claussius – Mosotti relation (derivation) – dielectric loss – dielectric breakdown – Applications of dielectric materials – ferroelectricity and applications.

### UNIT V      ADVANCED MATERIALS

Metallic glasses: preparation, properties and applications.

Shape memory alloys (SMA): Characteristics, properties of NiTi alloy, application.

Composite materials, Aircraft materials and non-metallic materials.

Nano materials: synthesis – Physical and chemical vapour deposition – ball milling - properties of nanoparticles and applications. Carbon nanotubes: structure – properties and applications.

#### TEXT BOOK:

S.No	Author(s) Name	Title of the book	Publisher	Year of Publication
1	Ganesan.S and Baskar.T	Engineering Physics II	GEMS Publisher, Coimbatore-641 001	2 <sup>nd</sup> Edition- 2015

#### REFERENCES:

S.No	Author(s) Name	Title of the book	Publisher	Year of Publication
1	William D CallisterJr	Material Science and Engineering-An Introduction	John Wiley ans Sons Inc., , New York,	6 <sup>th</sup> Edition 2003

2	James F Shackelford	Introduction to materials Science for Engineers	Macmillan Publication Company, New York	6 <sup>th</sup> Edition 2004
3	Charles Kittel	Introduction to Solid State Physics	John Wiley & sons, Singapore.	7 <sup>th</sup> Edition 2007

### **WEBSITES:**

1. <a href="http://www.nptel.ac.in">www.nptel.ac.in</a> 2. <a href="http://www.physicsclassroom.com">www.physicsclassroom.com</a> 3. <a href="http://www.oyc.yale.edu">www.oyc.yale.edu</a> 4. <a href="http://www.physics.org">www.physics.org</a>
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**OBJECTIVES:**

1. To give a comprehensive insight into natural resources, ecosystem and biodiversity.
2. To educate the ways and means of the environment
3. To protect the environment from various types of pollution.
4. To impart some fundamental knowledge on human welfare measures
5. To impart knowledge on ecosystem and biodiversity.
6. To Integrate the environmental principles in the projects undertaken in field of engineering and technology

**COURSE OUTCOMES(COS):**

1. Recognize the importance of natural resources (S)
2. Associate themselves with the various ecosystems (S)
3. Describe the importance of biodiversity (S)
4. Identify and minimize the difference pollutions (S)
5. Prioritize and analyses the social issues (S)
6. Integrate the environmental principles in the projects undertaken in field of engineering and technology (A)

**UNIT I: INTRODUCTION TO ENVIRONMENTAL STUDIES AND NATURAL RESOURCES**

Definition, Scope and Importance – Need for public awareness -Forest resources: Use and over-exploitation, deforestation- Water resources-Use and over-utilization of surface and ground water, floods, drought, conflicts over water- Land resources-Land as a resource, land degradation, man induced landslides, soil erosion and desertification –Mineral resources: Use and exploitation, environmental effects of extracting and using mineral resources- Food resources-World food problems, changes caused by agriculture and overgrazing, effects of modern agriculture- Energy resources-Growing energy needs, renewable and non renewable energy sources, use of alternate energy sources-role of an individual in conservation of natural resources.

**UNIT II: ECOSYSTEM**

Chemistry and Environment- Environmental segments, Composition and Structure of atmosphere- Concept of an ecosystem- Structure, components and function of an ecosystem Energy flow in the ecosystem – Food chain, food web and ecological pyramids, Structure and function of Terrestrial ecosystem (Forest, Desert and Grassland ecosystem) and Aquatic ecosystem (Fresh water and Marine ecosystem)

**UNIT III: BIODIVERSITY**

Introduction to biodiversity, Definition- Genetic diversity, species diversity and ecosystem diversity, Biogeographical classification of India, Importance of biodiversity-Value of biodiversity- Hot Spots of biodiversity-Threats to biodiversity-Endangered and endemic Species of India – Conservation of biodiversity- In- Situ and Ex-Situ conservation of biodiversity.

#### **UNIT IV: ENVIRONMENTAL POLLUTION**

Definition – Causes, effects and control Measures of Air pollution, Water pollution, Soil pollution, Marine pollution, Noise pollution and Thermal pollution. Solid waste management-.Causes, effects and control measures of urban and industrial wastes– Role of an individual in prevention of pollution–Disaster management:-earthquake, tsunami, cyclone and landslides.

#### **UNIT V: SOCIAL ISSUES AND ENVIRONMENT**

From Unsustainable to Sustainable development, Urban problems related to energy sources, Water conservation, Rain water harvesting and watershed management, Resettlement and rehabilitation of people, its problems and concerns, Environmental ethics- Issues and possible solutions- Climate change- Green house effect and global warming, acid rain, ozone layer depletion, Wasteland reclamation- Environment Protection Act- Human Rights- Value Education, Role of Information Technology in Environment and human health-Population growth, variation of population among nations-Population explosion.

#### **TEXT BOOKS:**

<b>S.No</b>	<b>Author(s) Name</b>	<b>Title of the book</b>	<b>Publisher</b>	<b>Year of Publication</b>
1.	Ravikrishnan, A	Environmental Science	Sri Krishna Hi tech Publishing Company Private Ltd., Chennai	2012
2.	Anubhakaushik C.P. Kaushik	Environmental Science and Engineering	New Age International (p) Ltd., New Delhi.	2010

#### **REFERENCES:**

<b>S.No</b>	<b>Author(s) Name</b>	<b>Title of the book</b>	<b>Publisher</b>	<b>Year of Publication</b>
1.	Linda D. Williams	Environmental Science Demystified	Tata McGraw -Hill Publishing Company Limited, New Delhi.	2005
2.	Tyler Miller G. Jr	Environmental Science	Thomson & Thomson Publishers, New Delhi.	2004

3.	William P.Cunningham	Principles of Environmental Science	Tata McGraw -Hill Publishing Company, New Delhi.	2008
4.	BharuchaErach	Environmental Science Demystified	Mapin Publishing Private Limited, Ahmadabad	2005
5.	Trivedi, R.K. and Goel, P.K	Introduction to Air Pollution	Techno-Science Publications.	2003

### **WEBSITES:**

1. <http://people.eku.edu/ritchisong/envscinotes1.html>
2. <http://nptel.ac.in/courses.php?disciplineId=120>
3. [www.newagepublishers.com/samplechapter/001281](http://www.newagepublishers.com/samplechapter/001281).
4. [www.unesco.org/ext/field/beijing/scienceb.htm](http://www.unesco.org/ext/field/beijing/scienceb.htm), [www.infinitepower.org/education.html](http://www.infinitepower.org/education.html)
5. <http://www.sciencedaily.com/news/top/environment>

**COURSE OBJECTIVES:**

1. To impart the basic knowledge of various basic fields of Mechanical Engineering.
2. To Study about basic manufacturing and machining processes.
3. To study about power plants.
4. To study about basic machining process.
5. To study about power plants.
6. To study about automobile engineering

**COURSE OUTCOMES(COS):**

1. To impart the basic knowledge of various basic fields of mechanical engineering.
2. To Study about basic manufacturing processes.
3. To study about basic machining process.
4. To study about power plants.
5. To study about 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:**

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

Semester-II

**15BECE206      COMPUTER FUNDAMENTALS AND C PROGRAMMING      3 0 0 3 100****COURSE OBJECTIVES:**



1. Identify and understand the working of key components of a computer system.
2. Identify and understand the various kinds of input-output devices associated with computer.
3. Identify and understand the different types of storage media commonly associated with a computer
4. To gain the knowledge of the basic computer networks.
5. To work more effectively in the spreadsheet.
6. To run a programme using a C Programming language

#### **COURSE OUTCOMES(COS):**

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

1. Understand the concepts of computer systems.
2. Find the various kinds of input-output devices associated with computer
3. understand the different types of storage media commonly associated with a computer
4. Gain the knowledge of the basic computer networks.
5. Work more effectively in the spreadsheet.
6. Run a programme using a C Programming language.

#### **UNIT I Overview of Computer**

What is computer- Computer Components-Generation of Computers- Memory Organization-Memory Types- Input and Output Devices- Concepts of Hardware and Software- What is OS-Windows and Unix OS- Programming Languages- Basics of Computer Networks- LAN, WAN-Concept of Internet- ISP- Basics of word processing- Basics of spreadsheet – Basics of presentation Software

#### **UNIT II Overview of 'C'**

Algorithms-Representation of Algorithms-Flowchart- Introduction to programming Languages-What is C- C Character set- Constants, Variables and Keywords-General form of C Program-The First C Program-Data types- Arithmetic Instructions- Type conversions- Relational and Logical Operators-Hierarchy and associativity

#### **UNIT III Selection and Iteration**

Selection Structures- If and nested if - Loops-Definition and types-While loop-for loop- do-while loop- break and continue- Nested loops- Advantages of iteration-Menu driven programs-Switch Case

#### **UNIT IV Functions**

Functions- Definition-types-Functions without arguments- Functions with Input arguments- Functions with output parameters-local and global variables- advantages of functions- Call by value and Call by reference- Recursion- Function as an argument

#### **UNIT V Arrays and Strings**

Arrays-definition- Declaring and referencing arrays- Array initialization- Using for loops for accessing arrays- Passing array elements as function arguments-2D Array - Matrix Addition and multiplication- Introduction to Strings- declaration and Initialization--String constant -Strings as Array of Character

#### **REFERENCES:**

1. E. Balagurusamy, "Computing Fundamentals and C Programming", TMH Education, 5<sup>th</sup> Edition, 2014
2. Yashavant Kanetkar, "Let us C", BPB Publications, 13<sup>th</sup> Edition, 2013
3. H. M. Deitel and D. J. Deitel, 'C: How to Program', Prentice Hall, 7<sup>th</sup> Edition, 2012
4. E. Balagurusamy, "Programming in ANSI C", TMH Education, 6<sup>th</sup> edition, 2012

**\*This course is offered in the first semester to the branches CSE, EEE, ECE and in the second semester to the branches CIVIL, MECH and AUTO.**

Semester-II

### **15BECE211COMPUTER PRACTICE AND PROGRAMMING LAB 0032100**

#### **COURSE OBJECTIVES:**

1. Identify and understand the working of key components of a computer system.
2. Identify and understand the various kinds of input-output devices and different types of storage media commonly associated with a computer
3. Understand, analyze and implement software development tools like algorithm, pseudo codes and programming structure
4. Study, analyze and understand logical structure of a computer program, and different construct to develop a program in 'C' language.

#### **COURSE OUTCOMES(COS):**

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

1. Understand the concepts of computer systems.
2. Find the various kinds of input-output devices associated with computer
3. understand the different types of storage media commonly associated with a computer
4. Gain the knowledge of the basic computer networks.
5. Work more effectively in the spreadsheet.
6. Run a programme using a C Programming language.

#### **List of Experiments**

1. Working with word Processing, Spreadsheet and presentation software in Linux
2. Programming in Scratch:  
Practicing fundamental concepts of programming like sequence, selection decision statements, working of loops and event driven programming
3. C Programming:  
Practicing programs to get exposure to basic data types, algebraic expressions, Conditional statements, Input and Output Formatting, Decision Statements, Switch Case, Control structures, arrays, Strings and funct

**\*This course is offered in the first semester to the branches CSE, EEE, ECE and in the second semester to the branches CIVIL, MECH and AUTO.**

Semester-II

**15BECE212**

**BUILDING DRAWING**

**1 0 3 2 100**

**Objectives:**

1. At the end of this course students should have learnt to draft on building drawings using computers
2. (Plan, elevation and sectional views) in accordance with development.
3. To gain the software knowledge in building drawings.
4. To gain the knowledge of detailed drawings.
5. To Gain Planning Knowledge
6. To gain the Drawing skills in software.

## **COURSE OUTCOMES**

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

1. Apply the principles of planning and bylaws used for building planning.
2. Draw plan, elevation and section for various structures.
3. To gain the software knowledge in building drawings.
4. To gain the knowledge of detailed drawings.
5. To Gain Planning Knowledge
6. To gain the Drawing skills in software.

### Drawing manually by Conventional methods

1. Conventional signs
2. Bonds in brick and stone masonry
3. Plan, elevation and section of simple buildings.

### Computer Aided Drawing

1. Buildings with load bearing walls (Flat and pitched roof) – Including details of doors and windows
2. Detailed drawings of floor plans, Elevations and Sections to show various features in a Building
3. Preparation of plot plans with study of property lines and Location of Buildings on site
4. RCC framed structures
5. Industrial buildings – North light roof structures – Trusses
6. Perspective view of one and two storey buildings

## **TEXT BOOKS**

Sl.No	Title of Book	Author of Book	Publisher	Year of Publishing
1	Building Drawing	Shah, Kale and	Tata McGraw-Hill Co.	2004

		Patki	Ltd, New Delhi	
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## REFERENCES

Sl.No	Title of Book	Author of Book	Publisher	Year of Publishing
1	Building planning & Drawing	Dr.N. Kumaraswamy, A. Kameswara Rao	Charotar Publishing, Gijarat	2007
2	Civil Engineering. Drawing & House Planning	B.P. Verma	Khanna Publishers, Delhi	2013

## WEBSITES:

<ul style="list-style-type: none"> <li>➤ <a href="http://www.icivilengineer.com">http://www.icivilengineer.com</a></li> <li>➤ <a href="http://www.engineeringcivil.com/">http://www.engineeringcivil.com/</a></li> <li>➤ <a href="http://www.aboutcivil.com/">http://www.aboutcivil.com/</a></li> <li>➤ <a href="http://www.engineersdaily.com">http://www.engineersdaily.com</a></li> <li>➤ <a href="http://www.asce.org/">http://www.asce.org/</a></li> <li>➤ <a href="http://www.cif.org/">http://www.cif.org/</a></li> <li>➤ <a href="http://icevirtuallibrary.com/">http://icevirtuallibrary.com/</a></li> <li>➤ <a href="http://www.ice.org.uk/">http://www.ice.org.uk/</a></li> <li>➤ <a href="http://www.engineering-software.com/ce/">http://www.engineering-software.com/ce/</a></li> </ul>
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**15BECC251**

**ELEMENTARY BIOLOGY**

**Semester-II**

**1101100**

## OBJECTIVE

1. To understand the basics of biomolecules, human anatomy and physiology.
2. To have better understanding of advancements in biology.
3. To understand the basics of biology
4. To gain knowledge about different biomolecules
5. To get familiarize with human diseases
6. To learn about different clinical investigations

## 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: BASICSOFCCELLBIOLOGY

History, Cell theory, Cell Structure-Prokaryotic and Eukaryotic cells, Animal and Plant Cell. Cell cycle, Mitosis, Meiosis and Reproductive cycle.

### UNIT-II: BIOMOLECULES

Carbohydrates-Classification, Qualitative tests for sugars, Lipids-Definition, Classification; Proteins-classification and functions; Nucleic acids- basic structure; Hormones- definition, importance; Vitamins.

### UNIT-III: HUMANANATOMYANDPHYSIOLOGY

Levels of Structural organization, the eleven systems of human body, central nervous system- cardio vascular system and immune system.

### UNIT-IV: GENETICSANDGENETICDISORDERS

History of genetics-Scope and Importance of genetics, Mendel and his work, DNA stores genetic information- gene mutation, disorders due to mutant genes.

### UNIT-V: TECHNOLOGICAL ADVANCES IN BIOLOGY

Biopharmaceuticals, Genetherapy, genetically modified crops, probiotics.

## Text Book

S.No	Author(s)Name	Title of the book	Publisher	Year of Publications
1	Verma,P.S.,Agarwal,V.K.	Cell Biology, Genetics, Molecular Biology, Evolution and Ecology	S.Chand &Compan y Ltd.,	2006

## Reference Books

S.No	Author(s)Name	Title of the book	Publisher	Year of Publications
1	Nelson,D. L.andCox,M.M	Lehninger Principles of Biochemistry4 <sup>th</sup> Edition	Freeman, W.H.&Company	2004
2	Tortora,G.J.,Derrickson,B	Principles of Anatomy And Physiology,  11 <sup>th</sup> Edition	John Wiley&Sons	2006

### Website

1. <http://www.biotechonweb.com/Application-of-biotech-in-Medical.html>

# SEMESTER III

Semester-III

**15BECE301**

**METHODS OF APPLIED MATHEMATICS**

**3 2 0 4 100**

## **OBJECTIVES:**

1. The purpose of this unit to gain familiarity with Laplace transforms, including the Laplace transforms of step functions and related functions.
2. Fourier series to apply physical science and signal systems.
3. Some standard functions and some of the properties of the Fourier transform.
4. To study the basic principles of different transforms and Partial Differential Equations.

5. In mathematics and signal processing, the Z-transform converts a discrete time-domain signal, which is a sequence of real or complex numbers, into a complex frequency-domain representation.
6. To enhance the transform techniques.

### **COURSE OUTCOMES(COS):**

1. Apply Laplace transform for analyzing linear time invariant systems.
2. To apply Fourier series in sinusoidal signals, such as engineering, physics and applied mathematics.
3. To be able to solve wave equation using Fourier transform.
4. To recognize the heat conduction equation and the wave equation and have some knowledge of their applicability.
5. To equip the student with the capability of applying Z-transform to solve difference equations.
6. The Learners can equip themselves in the transform techniques.

### **UNIT- I LAPLACE TRANSFORM**

Transforms of elementary functions – Basic properties – Transforms of derivatives and integrals – Initial and final value theorems. Inverse Laplace transforms – Convolution theorem (statement only) – Solution of Ordinary Differential Equations with constant coefficients using Laplace transforms – Transform of periodic functions

### **UNIT- II FOURIER SERIES**

Dirichlet's conditions – General Fourier series – Odd and even functions – Half range sine series – Half range cosine series – Complex form of Fourier Series – Parseval's identity – Harmonic Analysis.

### **UNIT -III FOURIER TRANSFORM**

Fourier integral theorem (Statement Only) – Fourier transform pair –Sine and Cosine transforms – Properties – Transforms of simple functions – Convolution theorem – Parseval's identity – Relation between Fourier and Laplace transforms

**UNIT- IV APPLICATIONS OF PARTIAL DIFFERENTIAL EQUATIONS** Classification of second order quasi linear partial differential equations – Solutions of one dimensional wave equation – One dimensional heat equation – Steady state solution of two-dimensional heat equation (Insulated edges excluded)

### **UNIT- V Z -TRANSFORM AND DIFFERENCE EQUATIONS**

Z-transform - Elementary properties – Inverse Z – transform – Convolution theorem -Formation of difference equations – Solution of difference equations using Z - transform.

### **TEXT BOOK:**

S.	Author(s)	Title of the book	Publisher	Year of
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No.	Name			Publication
1	Grewal, B.S.	Higher Engineering Mathematics	Khanna Publishers, Delhi.	2011
2	Erwin Kreyszig	Advanced Engineering Mathematics.	John Wiley & Sons. Singapore	2011

## REFERENCES:

S. No.	Author(s) Name	Title of the book	Publisher	Year of Publication
1	Venkateswarlu S	Engineering Mathematics, Vol I	Anuratha Agencies and Publishers, Kumbakonam.	2003
2	Narayanan, S., Manicavachagom Pillay, T.K. and Ramaniah, G	Advanced Mathematics for Engineering Students. Volumes II and III,	Viswanathan S Printers and Publishers Pvt. Ltd. Chennai.	2002
3	Bali N P.	A text book of Engineering Mathematics	Laxmi Publications Pvt. Ltd.	2000
4	Ramana B V	Higher Engineering Mathematics	Tata McGraw Hill Publishing Co. Ltd. New Delhi.	2007

## WEBSITES:

1. <a href="http://www.sosmath.com">www.sosmath.com</a>
2. <a href="http://mathworld.wolfram.com/FourierSeries.html">http://mathworld.wolfram.com/FourierSeries.html</a>
3. <a href="http://www.math.umn.edu/~olver/pdn.html">http://www.math.umn.edu/~olver/pdn.html</a>
4. <a href="http://tutorial.math.lamar.edu/classes/DE/IntroPDE.aspx">http://tutorial.math.lamar.edu/classes/DE/IntroPDE.aspx</a>

Semester-III

**15BECE302 CONSTRUCTION MATERIALS & GEOLOGY**

**3 0 0 3 100**

## COURSE OBJECTIVES:

1. At the end of this course the students should have learnt about the various materials, (both conventional and modern) that are commonly used in civil engineering construction.
2. Further students should be familiar about the geological processes, minerals/ rock classification,
3. Students are able to know the engineering properties of rocks and geological structures of outer surface which help in construction of dam, bridge, building etc.
4. Students will gain the knowledge of different materials used in construction.
5. To gain the knowledge of manufacturing of different construction materials.
6. To gain the applications of materials in various fields.

## COURSE OUTCOMES

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

1. Will be able to understand the importance of geological knowledge such as earth, earthquake, volcanism and the action of various geological agencies.
2. Will realize the importance of this knowledge in projects such as dams, tunnels, bridges, roads, airport and harbor
3. Can choose the types of foundations and other related aspects.
4. Students are able to know the engineering properties of rocks and geological structures of outer surface which help in construction of dam, bridge, building etc.
5. Students will gain the knowledge of different materials used in construction.
6. To gain the knowledge of manufacturing of different construction materials.

### UNIT- I: STONES, BRICKS, CONCRETE BLOCKS

9

Stone as building material – criteria for selection – test on stones – Deterioration and preservation of stone work – Bricks – classification and types– Tests on bricks – Bricks for special use – Refractory bricks – Concrete hollow blocks.

### UNIT- II: CEMENT, AGGREGATE AND SAND

9

Cement – Ingredients – Manufacturing processes – Types and grades – Properties of cement and cement mortar – Hydration- applications

Aggregate – Natural stone aggregate – crushing strength – Impact strength – Flakiness – abrasion - Sand – bulking – code practices. Concrete – Ingredients- types – manufacturing, Batching Plants

### UNIT- III: TIMBER, STEEL, PAINTS AND OTHER MODERN MATERIALS.

9

Timber –Market forms –Industrial timber– Plywood, Veneer, laminates.

Steel, Aluminum & other materials – composition– uses – market forms– Mechanical treatment.

Paints, varnishes, distempers.

Glass– ceramic– sealants for joints – fiber glass reinforced plastic– clay products– glass refractoriness.

### UNIT- IV: GENERAL GEOLOGY, STRUCTURAL GEOLOGY & THEIR APPLICATIONS.

9

Geology in civil engineering– Earth processes– weathering– geological work of river, wind and sea– seismic activity– seismic zones in India – ground water.

Structural geology –study of structures – dip and strike – fold, faults and joints – Their significance.

### UNIT -V: MINERALS, ROCKS AND THEIR ENGINEERING SIGNIFICANCE

9

Elementary knowledge on minerals – Physical properties of minerals – study of following rock forming minerals – Quartz , Feldspar, Pyroxene, Hornblende & Mica family –Ore minerals – Clays minerals and their significance. Classification of rocks-Igneous, Sedimentary, Metamorphic rocks

**TOTAL HRS:45**

#### Text Books:

S.No.	Title of the book	Author of the book	Publisher	Year of publication
1.	Engineering materials	Dr. R.K. Bansal	Lakshmi publications Pvt. Ltd., New Delhi	2010
2.	Engineering and General Geology	Parbin Singh	S.K.Kataria& sons, New Delhi	2011

**Reference books:**

S.No.	Title of the book	Author of the book	Publisher	Year of publication
1.	Building construction	S.C. Rangwala	Charotar Publishing Company, Anand- 388 001	2009
2.	Engineering Geology and Geotechniques	Krynine and Judd	McGraw-Hill Book company, Newyork	2002
3.	Geology and Engineering	Legeet	McGraw-Hill Book company, Newyork	2004
4.	Engineering materials	Dr. R.K. Rajput	S. Chand & Company Ltd., New Delhi	2000

**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/>
- <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/>

**Semester-III****15BECE303****MECHANICS OF FLUIDS****3 0 0 3 100****COURSE OBJECTIVES:**

1. At the end of this course students should have learnt the definition and properties of fluid, principles of fluid statics, kinematics and dynamics.
2. Understand the basic principles of fluid mechanics.
3. Understand the concepts of statics and dynamics of fluid flow.
4. Develop skills in analyzing fluid flows through the proper use of modeling and the application of the basic fluid-flow principles.
5. Acquire knowledge in the selection of type of turbine required with reference to available head of water and also used for Identification of type of turbine with estimated specific speed.
6. Capable of estimating efficiency of different pumps and performance of the pumps with the study of characteristics curves.

## COURSE OUTCOMES

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

1. Understand the basic principles of fluid mechanics.
2. Understand the concepts of statics and dynamics of fluid flow.
3. Develop skills in analyzing fluid flows through the proper use of modeling and the application of the basic fluid-flow principles.
4. Acquire knowledge in the selection of type of turbine required with reference to available head of water
5. Identification of type of turbine with estimated specific speed.
6. Capable of estimating efficiency of different pumps and performance of the pumps with the study of characteristics curves.

### UNIT I

9

**Properties of fluids:** Introduction of Basic properties – Viscosity compressibility, surface tension – Real and ideal fluids.

**Fluid statics:**

Fluid Pressure-various methods of measurement. Total pressure and centre of pressure – determination on plane surface only – Equilibrium of floating bodies – conditions and analysis.

### UNIT II

9

**Kinematics of fluid flow:** Classification of fluid flow – stream function and velocity potential – (Reynolds number and its application) - Linear acceleration and constant rotation of fluids in a container – application and simple problems.

### UNIT III

9

**Dynamics of fluid flow:** Euler's equation of motion – Bernoulli's theorem – Limitation of Bernoulli's theorem – Application – simple problems. Venturimeter – Flow nozzle meter – Bend meter – Pitot tube – current meter.

### UNIT IV

9

**Flow through pipes:** Laminar and Turbulent flow – friction and minor losses (Study of Moody's diagram). Transmission of power through pipes – flow between reservoirs – parallel, series and siphon pipes – water hammer.

### UNIT V

9

**Dimensional and model analysis**

Dimensional Homogeneity – Need – Rayleigh's method & Buckingham's  $\pi$ theorem – Significance of dimensionless numbers-Reynolds number, Froude number, Euler's number, Mach number and Weber number – Distorted models – Scale effect

**TOTAL HRS:45**

### TEXT BOOKS:

S.No	Title of the Book	Author of the Book	Publisher	Year of Publishing
1	Text book of Fluid Mechanics and Hydraulic Machines	Bansal. R.K	Lakshmi Publications, Madras	2005

**REFERENCES:**

S.No	Title of the Book	Author of the Book	Publisher	Year of Publishing
1	Fluid Mechanics & Hydraulic Machines	<a href="#">R K Rajput</a>	M/s. S.Chand Co., Madras	2008
2	Engineering Fluid Mechanics	Kumar. K.L	M/s. S.Chand Co., Madras	2003
3	Fluid Mechanics, Hydraulics & Fluid Machinery	Ramamrutham.S	M/s.Dhanpatrai& Sons, New Delhi	2006
4	Hydraulics, Fluid Mechanics & hydraulic Machinery	Modi.P.N, &Seth.S.M	Standard Book House, New Delhi	2005
5	Fluid Mechanics, Hydraulics and Hydraulic machines	Arora K.R	Standard Publishers Distributors, New Delhi	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/>

**15BECE304****ENGINEERING MECHANICS****Semester-III****3 1 0 4 100****COURSE OBJECTIVES:**

1. In this course students should can learnt about basic principles and mechanics of particles and rigid bodies.
2. To explain the differential principles applies to solve engineering problems dealing with force, displacement, velocity and acceleration.
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-world problems

**COURSE OUTCOMES(COS):**

1. Ability to explain the differential principles applies to solve engineering problems dealing with force, displacement, velocity and acceleration.
2. Ability to analyses the forces in any structures.
3. Ability to solve rigid body subjected to dynamic forces.
4. Analyses the forces in any structures.
5. Solve rigid body subjected to dynamic forces.
6. Gain basic knowledge about the forces and moments.

#### UNIT – I

12

**Statics of Particles:** Forces in plane and space - Vector addition of concurrent forces in plane and space-Problems involving the equilibrium of a particle - Free body diagram - Equilibrium of particle in space.

#### UNIT – II

12 Statics of

**Rigid Bodies in Two Dimensions:** Rigid bodies -Two dimensional structure - Moment of force about a point and about an axis - Moment of a couple - Equivalent systems of coplanar forces - Rigid body in equilibrium - Problems involving equilibrium of rigid body

**Application of Statics:** Types of supports - Reactions of beams and rigid frames -

#### UNIT – III

12

**Friction:** Laws of friction - Coefficient of friction - Problems involving dry friction - Wedge & ladder friction.

**Introduction To Vibration:** Simple Harmonic Motion - Mass spring system-Free vibration(elementary treatment only)

#### UNIT – IV

12

**Kinematics of Particles:** Introduction - Plane, Rectilinear motion -Time dependent motion-Rectangular coordinates - Projectile motion.

**Kinetics of Particles:** Equation of motion - Rectilinear motion - Work energy method - Potential energy - Kinetic energy - Conservation of energy.

#### UNIT – V

12

**Impulse & Momentum:** Impulse - momentum principle - Concept of conservation of momentum - Impact-Direct central impact- Oblique central impact

**TOTAL HRS:60**

#### TEXT BOOKS:

S.No	Title of the Book	Author of the Book	Publisher	Year of Publishing
1	Engineering Mechanics- Statics and Dynamics	Kottiswaran N	Sri Balaji Publications	2010

#### REFERENCE BOOKS:

S.No	Title of Book	Author of Book	Publisher	Year of Publishing
1	Vector Mechanics for Engineers, Statics & Dynamics	Beer F P and Johnston E R	Tata Mc-Graw Hill Publishing Co., Ltd, New Delhi.	2007
2	Engineering Mechanics-	Irving H Shames	Pearson	2003

	Statics and Dynamics, IV Edition		Education Asia PvtLtd,Singapore	
3	Engineering Mechanics, Vol I, Statics and Vol II Dynamics	Hibbeller R C	Pearson Education Asia Pvt Ltd, Singapore	2009
4	Engineering Mechanics	Bhavikatti S S&Rajasekarappa KG	New Age International (P) Ltd., New Delhi	2008
5	Engineering Mechanics	Bansal R K	Laxmi Publications (P), New Delhi.	2007
6	Engineering Mechanics- Statics and Dynamics	Rajasekaran S and Sankarasubramanian G	Vikas Publishing House Pvt. Ltd, New Delhi.	2005
7	Engineering Mechanics- Statics and Dynamics	Natesan S.C	Umesh Publications, New Delhi	2002

## 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/>

Semester-III

**15BECE305**

**SURVEYING- I**

**3 0 0 3 100**

## COURSE OBJECTIVES:

1. To gain basic knowledge about surveying and its principle.
2. To learnt about different types of surveying
3. To gain practical knowledge in the field of surveying.
4. Numerical solutions for carrying out surveying in civil engineering field. Advanced surveying equipment's.
5. Work with survey observations, and perform calculations,
6. To Provides independent knowledge for carrying out individual projects.

## COURSE OUTCOMES

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

1. Explore the different surveying instruments for surveying.
2. Describe the methods of measurement using level instrument and theodolite.
3. Provides independent knowledge for carrying out individual projects.
4. Able to identify and calculate the errors in measurements
5. Apply the knowledge, techniques, skills, and applicable tools of the discipline to engineering and surveying activities
6. Translate the knowledge gained for the implementation of Civil infrastructure facilities

## UNIT I

9

**Introduction** -Definition , Principles and Classification of surveying- Field work and office work - Scales - Conventional signs - Survey instruments, their care and adjustment - Ranging - Reciprocal ranging - Setting perpendiculars – well-conditioned triangles - Traversing - Plotting - Enlarging and reducing figures.

## UNIT II

9

**Compass Surveying And Plane Table Surveying** :Prismatic compass - Surveyor's compass - Bearing - Systems and conversions - Local attraction - Magnetic declination - Dip - Traversing - Plotting - Adjustment of errors - Plane table instruments and accessories –Merits and demerits - Methods - Radiation - Intersection - Resection – Traversing- **Two point and three point problem.**

## UNIT III

9

**Levelling And Applications:** Level line - Horizontal line - Levels and Staves - Spirit level - Sensitiveness - Bench marks - Temporary and permanent adjustments - Fly and check levelling - Booking - Reduction - Curvature and refraction - Reciprocal levelling - Longitudinal and cross sections - Plotting - Calculation of areas and volumes - Contouring - Methods - Characteristics and uses of contours - Plotting - Earth work volume - Capacity of reservoirs.

## UNIT IV

9

**Theodolite Surveying:** Theodolite - Vernier and microptic - Description and uses - Temporary and permanent adjustments of vernier transit - Horizontal angles - Vertical angles - Heights and distances - Traversing - Closing error and distribution - Gale's tables - Omitted measurements.

## UNIT V

9

**Engineering Surveys** :Reconnaissance, preliminary and location surveys for engineering projects - Lay out - Setting out works - Route Surveys for highways, railways and waterways - Curve ranging - Horizontal and vertical curves - Simple and reverse curves - Setting with chain and tapes, tangential angles by theodolite, double theodolite - Transition curves - Functions and requirements

**TOTAL HRS:45**

## TEXT BOOKS



Sl.No	Title of Book	Author of Book	Publisher	Year of Publishing
1	Surveying&levelling	N.N.Basak	Tata McGraw Hill	2011
2	Surveyingvol I	Dr.B.C.Punmia	Laxmi Publications	2011

#### REFERENCES

Sl.No	Title of Book	Author of Book	Publisher	Year of Publishing
1	Plane and Geodetic Surveying, Vols. I and II	Aylmer Johnson	CRC Press	2004
2	Introduction to Surveying	James M.Anderson and Edward M.Mikhail	McGraw-Hill Book Company,New Delhi.	2005

#### 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/>

**Semester-III**

**15BECE311**

**SURVEY PRACTICAL -I 0 0 3 2 100**

#### COURSE OBJECTIVES:

At the end of the course the student will possess knowledge about Survey field techniques

1. Study of chains and its accessories
2. Aligning, Ranging and Chaining
3. Chain Traversing
4. Compass Traversing
5. Plane table surveying: Radiation
6. Plane table surveying: Intersection
7. Plane table surveying: Traversing
8. Plane table surveying: Resection –Three point problem

9. Plane table surveying: Resection – Two point problem
10. Study of levels and levelling staff
11. Fly levelling using Dumpy level
12. Check levelling
13. LS and CS
14. Study of Contouring

## REFERENCES

Sl.No	Title of Book	Author of Book	Publisher	Year of Publishing
1	Surveying	Bannister A. and Raymond S	ELBS, Seventh Edition, Canada	2004
2	Surveying and Levelling Part 1 & 2 , 23 <sup>rd</sup> edition,	Kanetkar.T.P. &S.V.Kulkarni,	Punavidyarthigriha , Prakashan,	2008

**Semester-III**

**15BECE312 CONSTRUCTION MATERIALS LABORATORY 0 0 3 2 100**

### **COURSE OBJECTIVES:**

At the end of this course students should have learnt the methodology of carrying out various tests on properties of materials used for construction.

### **COURSE OUTCOMES(COS):**

1. Understand the basic building materials to be used in construction work
2. Know the various construction practices in the field and the different construction equipment used in the field
3. Make aware of the various construction techniques, practices and the equipment needed for different types of construction activities.

## **TEST ON MATERIALS**

### **1. ORDINARY PORTLAND CEMENT:**

- Determination of the specific gravity of cement using Le-chaletier flask and the fineness by sieve analysis.
- Determination of the normal consistency and setting times.
- Determination of the soundness of OPC using Lechaletier apparatus.
- Determination of the compressive strength of Ordinary Portland cement.

### **2. TEST ON AGGREGATE:**

- Determination of the Specific gravity, Bulk density and Water Absorption of Aggregates.
- Study of the phenomenon of Bulking of sand – River Sand and M Sand
- Determination of fineness modulus for fine and coarse aggregates by drawing grading curves - River Sand and M Sand.
- Determination of the impurities in aggregates.

### **3. TEST ON BRICKS:**

- Determination of the compressive strength.
- Determination of the water Absorption.
- Determination of the degree of efflorescence.
- Checking of dimensional tolerance and warpage.

## **REFERENCES**

<b>Sl.No</b>	<b>Title of Book</b>	<b>Author of Book</b>	<b>Publisher</b>	<b>Year of Publishing</b>
1	Building Construction, Planning Techniques and Method of Construction	Arora S.P. and Bindra S.P	DhanpatRai and Sons, New Delhi	2008
2	Construction Planning, Equipment and Methods	Peurifoy, R.L., Ledbetter, W.B. and Schexnayder, C	5th Edition, McGraw Hill, Singapore,	2004

## **CODE BOOKS**

- 1. IS 269 for 33 Grade cement**
- 2. IS 8112 for 43 Grade Cement**
- 3. IS 12269 for 53 Grade Cement**

#### **4. IS 383 for Testing of Aggregates**

#### **VALUE ADDED COURSE**

<b>15BECE351</b>	<b>COMMUNICATION SKILLS DEVELOPMENT</b>	<b>0 0 2 1 100</b>
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#### **OBJECTIVES:**

1. To assist students to understand the role of thinking in all forms of communication.
2. To help students with 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. To make soft skills will be incorporated and have a good listening capability.

## **COURSE OUTCOMES(COS):**

1. Speak clearly, confidently, comprehensibly, and communicate with one or many listeners using appropriate communicative strategies.
2. Write cohesively, coherently and flawlessly avoiding grammatical errors, using a wide vocabulary range, organizing their ideas logically on a topic.
3. Listen to/ view and comprehend different spoken discourses/ excerpts in different accents.
4. Take national and international examination and enhance the performance at Placement Interviews.
5. Be motivated to lead a group and able to guide the group with confidence.
6. Soft skills will be incorporated and have a good listening capability.

### **UNIT - I    ESSENTIALS OF COMMUNICATION**

Communication: Definition-Process-Scope-Types- Barriers- Dyadic Communication exercises.

### **UNIT - II        SPEECH PROCESS**

Pronunciation – Voice quality – Vowels – Consonants – Diphthongs – Syllables – Word stress - Sentence Stress – Pause - Intonation – Accent.

### **UNIT - III        ORAL COMMUNICATION**

Distinguishing between Formal and Informal speech – Defining and Describing objects and people – Self Introduction – Extempore talk on a given topic - Asking questions politely, disagreeing politely in formal contexts – Speaking to a group - Giving oral presentations – Group discussion – Debates- Types of Interview.

### **UNIT - IV        WRITTEN COMMUNICATION**

Formal Reports - Project Proposals - Book reviews - Official Correspondence - Proof Reading & Editing.

### **UNIT – V        ENGLISH FOR COMPETITIVE EXAMINATION**

Synonyms, Antonyms –Grammar and usage – Error Identification – Reading comprehension- Verbal analogy- Verbal Test.

## **TEXT BOOK:**

<b>S. NO.</b>	<b>AUTHOR(S) NAME</b>	<b>TITLE OF THE BOOK</b>	<b>PUBLISHER</b>	<b>YEAR OF PUBLICATION</b>
1	<a href="#">Jane</a>	Communication	Wiley	2009

	<a href="#">Summers &amp; Brett Smith</a>	Skills Handbook: How to Succeed in Written and Oral Communication		
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## REFERENCES:

S. NO.	AUTHOR(S) NAME	TITLE OF THE BOOK	PUBLISHER	YEAR OF PUBLICATION
1	Anderson, Paul V	Technical Communication	Thomson and Wadsworth Publishers.	2007
2	Barun, Mitra K	Effective Technical Communication – A Guide for Scientists and Engineers	Oxford University Press, New Delhi.	2006
3	Seely, John.	The Oxford Guide to Effective Writing and Speaking	Oxford University Press, New Delhi.	2005

## WEBSITES :

<a href="http://www.learning-development.hr.toolbox.com">www.learning-development.hr.toolbox.com</a> <a href="http://www.englishclub.com">www.englishclub.com</a> <a href="http://www.ispeakyouspeak.blogspot.com">www.ispeakyouspeak.blogspot.com</a> <a href="http://www.teachertube.com">www.teachertube.com</a> <a href="http://www.Dictionary.com">www.Dictionary.com</a>
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Lab Requirements: (i) Teacher console and Systems for students.  
(ii) English Lab Software.

# SEMESTER IV

<b>15BECE401</b>	<b>WATER RESOURCES ENGINEERING</b>	<b>3 0 0 3 100</b>	<b>Semester IV</b>
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## **COURSE OBJECTIVES:**

1. To build on the student's background in hydrology and hydraulics an understanding of water resources systems.
2. To develop the skills in modeling of flood flows and flood routing
3. To develop skills in the ground water flow, type of aquifer and yield from the well.
4. To provide the knowledge of design of reservoir, operation and sedimentation
5. To know the different aquifers and the water table level.
6. To planning of reservoirs and storage tanks.

## **COURSE OUTCOMES**

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

1. Incorporate the analytical abilities in the planning and design of water resource systems.
2. Apply the knowledge on reservoir planning and investigation
3. Model the flood flows and flood routings.
4. Gain the knowledge of design of reservoir, operation and sedimentation

5. Will know the different aquifers and the water table level.
6. Planning of reservoirs and storage tanks.

## UNIT I

9

**Introduction:** Irrigation – Need and mode of irrigation – Merits and demerits of irrigation – environmental impacts of irrigation- Classification of irrigation projects - Crop and crop seasons – consumptive use of water – Duty, Delta and Base period – Factors affecting duty – Irrigation efficiencies.

**Precipitation:** Types of precipitation – Forms of precipitation – Measurement of Rainfall –Losses from precipitation-- Hydrograph - Factors affecting Hydrograph – Base flow separation – Unit hydrograph – S curve hydrograph

## UNIT II

9

**River Engineering:** Rivers –Types and Behavior

**Water Logging:** Causes of water logging - Effects of water logging – Remedial measures for water logging

**Drainage:** Necessity – Advantages – Methods.

**River structures:** Diversion Head works- Brief Description of component parts and their functions- - Seepage theories.

## UNIT III

9

**Canal Engineering:** Alignment of canals – Classification of canals - Distribution network - Canal Losses - Cross sectional details - Sedimentation in canals - Silt theories - Balancing depth of cutting

**Canal lining:** Types, Construction and Maintenance

**Canal and River structures:** Canal regulators and Types - Canal Falls and Types

**Cross Drainage Works:** Types- Selection -River Training works – types.

## UNIT IV

9

**Rigid Storage Structures:** Gravity dams Description– Arch and Buttress dam – Spillways – Factors affecting location and type of dams – Forces on a dam – Galleries and types.

**Non Rigid Storage Structures:** Earth dams - Causes of failure - Typical cross sections to suit site conditions and available materials - Phreatic line – Tanks – Classification – Components - types of Bunds

## UNIT V

9

**Reservoir Planning:** Reservoirs- Types- Zones of storage – Capacity - Yield- Area - Elevation and capacity- Elevation curves - Mass curve analysis - Capacity for specific demand and yield for given capacity- Fixing reservoir capacity- Reservoir sedimentation and control- Selection of site for reservoir

**Other Irrigation Structures:** Surplus Weir- Tower Head Sluice- Wing wall type- (Theoretical Approach only)- Culverts- Small ROAD bridges across drains- Canal outlets and flumes- Types (Theoretical Aspect only).

**TOTAL HRS:45**



**TEXT BOOKS:**

Sl.No	Title of Book	Author of Book	Publisher	Year of Publishing
1	Irrigation Engineering and Hydraulic structures	Garg, S.K	KhannaPublishers,New Delhi	2012

**REFERENCES:**

Sl.No	Title of Book	Author of Book	Publisher	Year of Publishing
1	Irrigation and Water Power Engineering	Punmia B.C., Pande B.B.Lal	Lakshmi Publications, Chennai.	2012
2	Irrigation Engineering and Hydraulic Structures	SahasraBudhe S.R	S.K. Kataria &Sons, Chennai	2014
3	Irrigation Engineering	RK Sharma, TK Sharma	S.Chand& Company Ltd., New Delhi	2009

**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/>

**Semester-IV****15BECE402****SOIL MECHANICS****3 0 0 3 100****COURSE OBJECTIVES:**

1. To explain what Geotechnical Engineering is and how it is important to civil engineering
2. To explain how three phase system is used in soil
3. To know the soil properties estimated using three phase system
4. To explain role of water in soil behavior and how soil stresses, permeability and quantity of seepage including flow net are estimated
5. To determine shear parameters and stress changes in soil due to foundation loads
6. To estimate the magnitude and time-rate of settlement due to consolidation

**COURSE OUTCOMES**

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

1. Carry out soil classification.
2. Solve three phase system problems.
3. Solve any practical problems related to soil stresses estimation,

4. Gain the knowledge in permeability and seepage including flow net diagram
5. Estimate the stresses under any system of foundation loads.
6. Solve practical problems related to consolidation settlement and time rate of settlement.

### **UNIT I Basic properties of soils**

**9**

Soil formation-Soil problems in Engineering –Physical properties of soil –Phase relations-Index properties of soil – Grain size distribution –Atterberg limits – classification of soils as per BIS –Fixed identification –simple tests

#### **COMPACTION:**

Compaction-laboratory test –Standard proctor's compaction –Modified proctors compaction – moisture density relation –Factors affecting compaction –Field compaction methods –Compaction control.

### **UNIT II Stresses in soils**

**9**

Soil water statics – Concept of effective and neutral stresses – Capillary phenomenon –Vertical stress distribution in soil –Boussinesq equation – Westerguards equation – Line load –uniformly distributed loads –New marks chart –construction and use –Pressure bulb .

### **UNIT III Permeability and seepage**

**9**

One dimensional flow through soil –permeability –Darcy's law –field and laboratory permeability tests –Flow through stratified soil –Seepage pressure quick sand condition-Two dimensional flow –Laplace equation –Electrical analogy –Flow net –Methods of construction –properties –Applications –sheet pile cut off and earth dam –Phreatic line.

### **UNIT IV Consolidation and Settlement**

**9**

Consolidation –consolidation settlement –Laboratory test -Determination of  $C_v$  by curve fitting methods –Terzaghi's one dimensional consolidation –Definition of terms –Normally consolidated clay –Over consolidated clay –Under consolidated clay –Field curve –Pre consolidation pressure – $e$  vs  $p$  curve –Boundary condition –Time Factor –Time of consolidation. –computation of rate of settlement – Types of Settlements – Components of settlements – Factors affecting settlements

### **UNIT V Shear strength**

**9**

Shear strength of soil –importance and use –Mohr –coloumbs' theory –Factors affecting the shear strength. –Laboratory test –Direct shear test –Tri-axial compression test –types of triaxial test based on drainage conditions –UCC test –Field test

**TOTAL HRS:45**

#### **TEXT BOOKS**

<b>Sl.No</b>	<b>Title of Book</b>	<b>Author of Book</b>	<b>Publisher</b>	<b>Year of Publishing</b>
1	Soil mechanics and foundations	Punmia. B.C	Laxmi Publications pvt.Ltd,New Delhi	2012

**REFERENCE BOOK:**

Sl.No	Title of Book	Author of Book	Publisher	Year of Publishing
1	Basic and Applied Soil Mechanics	GopalRanjan and Rao, A.S.R	Wiley eastern Ltd., New Delhi	2009
2	A Text Book of Soil Mechanics and Foundation Engineering.	V.N.S.Moorthy	Marcel Dekker, Inc, Newyork	2013
3	Soil Mechanics and Foundation Engineering	Arora.K.R	Standard Publishers and Distributors, New Delhi	2012

**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/>

**Semester-IV****15BECE403****MECHANICS OF SOLIDS - I 3 1 0 4 100****COURSE OBJECTIVES:**

1. To determine deflection of a beam for various loading conditions.
2. To apply unit load method to find the deflection of truss.
3. To find impact value and crushing value of coarse aggregates
4. To find the compressive strength of concrete cubes and bricks
5. To find stiffness of open coiled and closed coiled springs
6. To find the physical properties of given coarse aggregate, fine aggregate and cement samples

**COURSE OUTCOMES**

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

1. Apply the principle of virtual work.
2. Determine deflection of a beam for various loading conditions.

3. Apply unit load method to find the deflection of truss.
4. Determine different stresses developed in thick cylinders.
5. Visualize the behavior of column for combined bending and axial loading.
6. Determine the deflections of beam using different methods

## UNIT I

12

**Simple stresses and Strains**-Hooke's Law-Principle of superposition-Composite Sections-Temperature Stress-Hoop Stress-Elastic Constants-Principal Stresses and Strains-Mohr's Circle-Strain Energy and impact loading-Stresses due to gradual, sudden and impact loading-Proof resilience-Shear resilience.

## UNIT II

12

**Geometrical properties of Sections**-Centroid-Centre of mass-Centre of gravity-Moment of inertia-Area moment of inertia-Mass Moment of inertia-Rectangular moment of inertia-Polar moments of inertia-Radius of gyration of an area-Perpendicular axis theorem-Parallel axis theorem-Moment of inertia.

## UNIT III

12

**Shear force(S.F) and Bending moment (B.M)**-Types of beams-Types of loads-Sketching of B.M.D. and S.F.D for Cantilever beams, Simply Supported beams and Overhanging beams subjected to various types of loading-Udl, Point Load, Uvl-Relation among loading, SFD&BMD.

## UNIT IV

12

**Deflection of beams**-Slope and Deflection at a point-Estimation of slope and deflection for Cantilever, Simply Supported and Overhanging beams subjected to various types of loading (Only application of formulae) -Mohr's theorem-Strain energy method.

## UNIT V

12

**Torsion of shafts**-Assumptions-horse power transmitted by a shaft-Strength of solid shaft, Hollow shafts, composite shafts& stepped shafts-Torsional strain energy.  
**Spring**-Leaf spring-Helical springs-Strain energy stored in a spring.

**TOTAL HRS:60**

### TEXT BOOKS:

Sl.No	Title of Book	Author of Book	Publisher	Year of Publishing
1	Strength of Materials (Mechanics of Solids)	Rajput R.K	S.Chand & Company Ltd., New Delhi	2012

### REFERENCE BOOKS:

Sl.No	Title of Book	Author of Book	Publisher	Year of Publishing
1	Strength of Materials and Theory of Structures Vol.I	Dr.B.C.Punima	Laxmi Publication, New Delhi	2013
2	Engineering Mechanics of	EhorP.Popov	Prentice Hall of	2002

	Solids		India Pvt., New Delhi	
3	Strength of Materials	S.Ramamrutham	DhanpatRai Publishing Company, New Delhi	2012
4	Strength of Materials (Mechanics of Solids)	Khurmi R.S.	S.Chand& Company Ltd., New Delhi	2012

#### 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/>

Semester-IV

**15BECE404 APPLIED HYDRAULICS AND MACHINERY 3 0 0 3 100**

#### COURSE OBJECTIVES:

1. To classify the types of flows in open channel and also to design open channel sections in a most economical fashion with minimum wetted perimeter and learn about critical flows.
2. To study about non uniform flows in open channel and longitudinal slopes in open channel
3. To learn about the characteristics of hydraulic jump.
4. To develop an understanding of fluid flow patterns
5. To use boundary layer theory and Drag.
6. To provide insights to the Open channel hydraulics and introduce dimensional analysis for fluid flow problems.

#### COURSE OUTCOMES

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

1. Acquire specific knowledge regarding fluid flow phenomena observed.
2. Understand the basic principles of fluid flow patterns and boundary layer theory

3. Develop skills in analyzing fluid flows in open channel hydraulics and measurements such as weirs and flumes.
4. Will gain knowledge about the Open channel flow.
5. Understand hydraulic jump phenomenon
6. Design open channels for rectangular and non-rectangular channels for GVF and RVF.

### **UNIT I Uniform flow in open channels:**

**9**

Uniform flow – chezy's equation – Manning's equation-hydraulically best section of rectangular, trapezoidal and circular sections – circular sections not running full-flow measurement using orifices, mouthpieces, notches and weirs.

### **UNIT II Non-uniform flow in open channels**

**9**

Introduction - Critical depth – Specific Energy – Characteristics of non uniform flow – Analysis of hydraulic Jump – Back water curves – venturiflume – Surges in channels.

### **UNIT III Impact Of Jets**

**9**

Flow over immersed bodies: Drag and lift – stream lined Bluff bodies – Terminal velocity – Estimation of drags and lift forces. Impulse – Momentum principle – and its application – dynamic force upon a body in motion – Torque in rotating machines – jet propulsion.

### **UNIT IV Turbine**

**9**

Classifications – velocity triangles for turbines, work done and efficiency – study of pelton wheel, Francis and axial flow turbines – governing of turbines – characteristic curves – Specific speed – Model testing – Selection of turbines – Simple Problems to determine geometric dimensions.

### **UNIT V Pumps**

**9**

Classification of pumps – Centrifugal pumps – Reciprocating Pumps – Deep well pumps – Airlift Pump – Working principle only – Characteristic curves – Selection of pumps and Simple problems.

**TOTAL HRS:45**

### **TEXT BOOK:**

Sl.No	Title of Book	Author of Book	Publisher	Year of Publishing
1	A Text book of Fluid Mechanics and Hydraulic Machines	Bansal.R.K	Lakshmi Publication, Madras	2012
2	Fluid Mechanics, Hydraulics & Fluid Machines	Ramamrutham. S	DhanpatRai& Sons, New Delhi	2013

### **REFERENCE BOOKS:**

Sl.No	Title of Book	Author of Book	Publisher	Year of Publishing
1	Engineering Fluid Mechanics	Kumar.K.L	S. Chand Co., Madras	2012
2	Hydraulics, Fluid Mechanics & Hydraulic Machinery	Modi P.M, &Seth.S.M	Standard Book House, New Delhi	2008
3	Fluid Mechanics, Hydraulics and Hydraulic Machines	Arora, K.R	Standard Publishers Distributors, Delhi	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/>

Semester-IV

**15BECE405**

**SURVEYING -II**

**3 0 0 3 100**

#### COURSE OBJECTIVES:

1. Skill to carry survey and to decide appropriate type of execution in construction works.
2. Numerical solutions for carrying out surveying in civil engineering field. Advanced surveying equipment's.
3. Work with survey observations, and perform calculations,
4. To Provides independent knowledge for carrying out individual projects.
5. To know the different surveys used in civil field.
6. To have confidence in carrying out individual projects

#### COURSE OUTCOMES

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

1. Explore the different surveying instruments for surveying.

2. Describe the methods of measurement using level instrument and theodolite.
3. Provides independent knowledge for carrying out individual projects.
4. Able to identify and calculate the errors in measurements
5. Apply the knowledge, techniques, skills, and applicable tools of the discipline to engineering and surveying activities
6. Translate the knowledge gained for the implementation of Civil infrastructure facilities

#### UINT-I

9

**Tacheometric Surveying:** Tacheometric systems - Tangential, stadia and subtense methods - Stadia systems - Horizontal and inclined sights - Vertical and normal staffing - Fixed and movable hairs - Stadia constants - Analytic lens - Subtense bar.

#### UINT-II

9

**Control Surveying:** Working from whole to part - Horizontal and vertical control methods - Triangulation - Signals - Base line - Instruments and accessories - Corrections - Satellite station - Reduction to Centre – Trigonometric levelling - Single and reciprocal observations - Modern trends – Bench marking

#### UINT-III

9

**Survey Adjustments:** Errors - Sources, precautions and corrections - Classification of errors - True and most probable values - weighted observations - Method of equal shifts - Principle of least squares - Normal equation - Correlates - Level nets - Adjustment of simple triangulation networks.

#### UINT-IV

9

**GIS/REMOTE SENSING:** Field of Applications –Natural Resources-Agriculture-Soil-Water Resources-Wasteland Management-Social resources-Cadastral Records-LIS

#### UINT-V

9

**Other Topics:** Fundamental principal:(Demo)Photogrammetry - Introduction - Terrestrial and aerial Photographs - Stereoscopy - Parallax –Introduction to Total Station- Electromagnetic distance measurement - Carrier waves - Principles - Instruments - Trilateration - Hydrographic Surveying - Tides - MSL - Sounding methods - Location of soundings and methods

**TOTAL HRS:45**

#### TEXT BOOKS

S.No	Title of Book	Author of Book	Publisher	Year of Publishing
1	Surveying, Volume I, II and III	Punmia B.C	Laxmi Publications, Delhi	2012

#### REFERENCES

S.No	Title of Book	Author of Book	Publisher	Year of Publishing
1	Plane and Geodetic Surveying, Volume I and II	Aylmer Johnson	CRC Press , New York	2004



2	Introduction to Surveying	James M.Anderson and Edward M.Mikhail	McGraw-Hill Book Company, New York, Fifth Edition	2009
3	Elements of Cartography	Harley	McGraw-Hill Book Company New York, Fifth Edition	2001
4	Surveying and Levelling, Volume I and II	Kanetkar T.P	United Book Corporation, Pune	2007
5	Surveying	Bannister A. and Raymond S	ELBS, Seventh Edition	2004
6	Surveying and Levelling	Basak.N.N	McGraw-Hill Book Company	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/>

**Semester-IV**

**15BECE406**

**ENVIRONMENTAL ENGINEERING I**

**3 0 0 3 100**

### COURSE OBJECTIVES:

1. To make the students conversant with sources and its demand of water
2. To understand the basic characteristics of water and its determination
3. To expose the students to understand the design of water supply lines
4. To provide adequate knowledge about the water treatment processes and its design
5. To have adequate knowledge on operation and maintenance of water supply
6. To gain the knowledge of distribution system and their methods

### COURSE OUTCOMES

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

1. Identify the source of water and water demand.
2. Apply the water treatment concept and methods.
3. Apply water distribution processes and operation and maintenance of water supply.
4. Prepare basic process designs of water and wastewater treatment plants collect, reduce
5. To analyze, and evaluate basic water quality data.

6. Gain the knowledge of distribution system and their methods.

## UNIT I

9

**Planning for water Supply Systems:** Planning Factors for Water Supply schemes-Population forecasting – Design period – Variations in demand pattern-Water demand characteristics - Standards – Water quality parameters & significance

## UNIT II

9

**Water :**Sources of water –Intake structures, Wells, Infiltration Gallery, Tube wells- Construction & Development-Sanitary Protection of wells- yield of wells.

## UNIT III

9

**Conveyance of water:** Pipes and channels for transmitting water -Selection of materials for pipes and conduits-Laying, jointing & testing of pipes – Pipe appurtenances-Various types of pumps-Pump selection–Pumping station.

## UNIT IV

9

**Water Treatment:** General layout of a water treatment plant– Principles of screening, flocculation, flash mixing, sedimentation, filtration-various techniques of disinfection–Brief on water softening, De-mineralization, and aeration

## UNIT V

9

### **Distribution & Storage:**

Service reservoirs-elevated and ground level reservoirs-equalizing and service storage-factors affecting storage capacity-distribution network patterns – Analysis of distribution network – Hardy Cross method – Equivalent Pipe method – Leak detection in pipe network - Corrosion control, Lining of pipes-Appurtenances

**TOTAL HRS:45**

## TEXT BOOKS

Sl.No	Title of Book	Author of Book	Publisher	Year of Publishing
1	Water Supply Engineering	Garg, S.K	KhannaPublishers,New Delhi	2012

## REFERENCES

Sl.No	Title of Book	Author of Book	Publisher	Year of Publishing
1	Hand book on Water Supply and Drainage-SP35		B.I.S,New Delhi	2007
2	Water supply Engineering	Fair G.M, Geyer.J.C	Khanna Publishing Co., New Delhi	2007

3	Water Supply Engineering	Punmia B C Ashok Jain Arun Jain	Laxmi Publications, Delhi	2010
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#### **WEBSITES:**

- <http://www.icivilengineer.com>
- <http://www.engineeringcivil.com/>
- <http://www.aboutcivil.com/>
- <http://www.engineersdaily.com>
- <http://www.asce.org/>
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- <http://icevirtuallibrary.com/>
- <http://www.ice.org.uk/>
- <http://www.engineering-software.com/ce/>

**Semester-IV**

### **15BECE411 HYDRAULICS & HYDRAULIC MACHINERY LABORATORY**

**0 0 3 2 100**

#### **OBJECTIVES:**

1. To understand the flow measurement in a pipe flow
2. To understand the flow measurement in a pipe flow using Constant Head method
3. To determine the energy loss in pipe flow
4. To study the characteristics of turbines
5. To study the characteristics of pumps
6. To measure the discharge in a open channel flow

#### **COURSE OUTCOMES**

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

1. Measure discharge in pipes.
2. Determine the energy loss in conduits.

3. Demonstrate the characteristics curves of pumps
4. Demonstrate the characteristics curves of turbines.
5. Carry out discharge measurements in open channel.
6. understand the flow measurement in a pipe flow using Constant Head method

### LIST OF EXPERIMENTS

1. Determination of co-efficient of discharge for orifice
2. Determination of co-efficient of discharge for venturimeter
3. Determination of co-efficient of discharge for orifice meter
4. Friction losses in pipes(Major& minor)
5. Determination of performance characteristics of Francis turbine
6. Determination of performance characteristics of Centrifugal pumps (Constant speed / variable speed)
7. Study on performance characteristics of Reciprocating pump.
8. Determination of performance characteristics of Submersible pump.
9. Experiment on Bernoulli's theorem

### REFERENCES

Sl.No	Title of Book	Author of Book	Publisher	Year of Publishing
1	A text book of Fluid Mechanics	Rajput, R.K	S.ChandPublishers,New Delhi	2012
2	Fluid Mechanics, Hydraulics & Fluid Machines	Ramamrutham. S	DhanpatRai& Sons, New Delhi	2013

**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 introduce students to numerical methods used to solve engineering problems.
4. Fundamentals of numerical methods/algorithms to solve systems of different mathematical equations (e.g. linear/ non-linear algebraic equations, ordinary /partial differential equations), will be introduced.
5. The course would enable students to write their own computer programs using programming languages like C and software like Excel.
6. To give the practical knowledge on the solving of partial differential equations using programming languages like C and software like Excel.

**COURSE OUTCOMES(COS):**

1. To solve engineering problems involving Linear and non-linear equations.
2. Hands-on experience will be provided to apply these computer programs to solve problems in different areas of engineering.
3. To acquire skills in handling situations involving linear/ non-linear algebraic equations, ordinary /partial differential equations
4. To solving actual engineering problems through computer programming and coding.
5. To solve ordinary and partial differential equations using programming languages like C and software like Excel.
6. Student will understand procedure-oriented Excel concepts. Student will be capable of writing C and Excel programs efficiently.

**LIST OF EXPERIMENTS**

1. Finding solution of Transcendental equation
  - i) Newton – Raphson Method
  - ii) Bisection method
  - iii) Iterative method by reducing the equation to the form  $x = f(x)$
2. Finding the dominant eigenvalue and eigenvector by power method
3. Numerical integration
  - i) Gauss 2 point and 3 point formulae
  - ii) Trapezoidal method
  - iii) Simpson's 1/3 rule

#### 4. Solution of initial value problems governed by ODE

- i) Runge - Kutta 4<sup>th</sup> order method
- ii) Modified Euler's method
- iii) Milne's method
- iv) Adam – Bashforth method

#### 5. Solution of BVP governed by PDE

- i) Laplace Equation
- ii) One – dimensional heat equation
  - a) Explicit method : Bender – Schmidt's method
  - b) Implicit method : Crank - Nicolson's method
- iii) One dimensional wave equation
  - Implicit method

#### REFERENCE BOOKS:

S. No.	Author(s) Name	Title of the book	Publisher	Year of Publication
1	Curtis F. Gerald and Patrick O. Wheatley	Applied Numerical Analysis	Pearson Education, South Asia	2009
2	Steven C. Chapra, Raymond P. Canale	Numerical Methods for Engineers	McGraw - Hill Pub. Co. Ltd	2014

**OBJECTIVES:**

The Lab sessions would include experiments on

1. Introduction to Chain Surveying
2. Traverse using Compass Surveying.
3. Plane Table Surveying – Radiation, intersection, Traverse, Resection, Leveling.
4. Tachometry and Theodolite survey trigonometric leveling to determine heights/elevations.
5. Total Station.
6. Setting out of curves (horizontal and vertical)

**Course outcomes**

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

1. Use conventional surveying tools such as chain/tape, compass, plane table, level in the field of civil engineering applications such as structural plotting and highway profiling.
2. Apply the procedures involved in field work and to work as a surveying team.
3. Plan a survey appropriately with the skill to understand the surroundings. Take accurate measurements, field booking, plotting and adjustment of errors can be understood.
4. Traverse using Compass Surveying.
5. Plane Table Surveying – Radiation, intersection, Traverse, Resection, Leveling.
6. Setting out of curves (horizontal and vertical)

**List of Experiments:**

1. Study of Theodolite, Total Station and GPS
2. Measurement of horizontal angles by reiteration and repetition and vertical angles
3. Heights and distances - Triangulation - Single plane method.
4. Tacheometry - Tangential system - Stadia system - Subtense bar.
5. Setting out works - Foundation marking - Simple curve (right/left-handed).
6. Distance, height and area measurements using total station
7. Horizontal curve setting using total station for roads

**REFERENCES**

Sl.No	Title of Book	Author of Book	Publisher	Year of Publishing
1	Surveying	Bannister A. and Raymond S	ELBS, tenth Edition, Canada.	2008
2	“Surveying and Levelling Part 1 & 2 ”, 23rd edition,	Kanetkar.T.P. &S.V.Kulkarni,	Punavidyarthigriha , Prakashan,	2012

**OBJECTIVES:**

1. To help students comprehend the role of listening skills in effective communication.
2. To familiarize students with verbal and non-verbal communication.
3. To expose students to neutral accent.
4. To develop emotional intelligence skills in them for enhancing their self-esteem.
5. To assist them in setting goals and developing positive attitude.
6. To enable students to acquire decision making skills, problem solving skills and assertive skills.

**COURSE OUTCOMES(COS):**

1. Equip students of engineering and technology with effective speaking, writing and listening and reading skills in English.
2. Develop their soft skills and inter personal skills, which will make the transition from college to workplace smoother and help them excel in their job.
3. Equip students of engineering and technology with group discussion and other recruitment exercises.
4. Use both verbal and non-verbal skills cohesively and develop confidence in participating in seminars, conferences, technical and extracurricular activities for lifelong learning.
5. Overall attitude of students will enhanced and know the social responsibilities.
6. Understand the importance of Human values for the betterment of society and nation.

**UNIT - I THE ART OF LISTENING**

The art of listening - The importance of listening - The difference between listening and hearing- Barriers to listening - Remedies for listening problems - Listening through English.

**UNIT - II VERBAL AND NON-VERBAL COMMUNICATION**

Non - verbal communication - Eye contact - Facial Expressions - Posture - Gestures - Body language - Etiquette.

Verbal communication - Importance of voice modulation - Accent - Diction – Functional Grammar - Sentence Construction - Effective vocabulary, Idioms, Phrases, Jargons - How to get others to listen.

**UNIT - III INTRAPERSONAL AND INTERPERSONAL SKILLS**

Intrapersonal skills - Self-analysis - Thought process -Understanding one's potential and limitations - Developing problem solving skills - Ability to self-reflect - Self-control - Improving self-esteem  
Interpersonal skills - Confidence building -Resolving conflicts - Negotiation - Handling difficult people - Valuing diversity - Adaptability and Flexibility – Inter Cultural Communication.



## UNIT - IV GOAL SETTING AND POSITIVE ATTITUDE

Difference between goals and dreams - SMART goal setting - 3 Ds of goal setting- Determination, Discipline and Direction - Developing the right attitude - Motivation - Intrinsic and Extrinsic motivation - Dealing with change - Dedication - Taking responsibilities - Decision making.

## UNIT - V MANAGERIAL SKILLS

Analytical skills - Team Building - Leadership skills - Planning/organizing - Ability to work independently - Professional Ethics - Preparing the résumé - Writing the covering letter - Communicating via e-mail.

### TEXT BOOK:

S. NO.	AUTHOR(S) NAME	TITLE OF THE BOOK	PUBLISHER	YEAR OF PUBLICATION
1	Gopalaswamy Ramesh & Mahadevan Ramesh	The Ace of Soft Skills	Cactus Game Design	2014 August

### REFERENCES:

S. No.	Author(s) Name	Title of the book	Publisher	Year of Publication
1	Jagadeesan, G & Santanakrishnan, R.	Soft Skills Development: Training and Evaluation.	The ICFAI University Press, Hyderabad.	2008
2	Sherfield, Robert M., Rhonda J. Montgomery, & Patricia G. Moody	Developing Soft Skills.	Pearson Education, New Delhi.	2005
3	Murthy, G .R. K.	Soft Skills for Success.	The ICFAI University Press, Hyderabad.	2008

### WEBSITES:

<a href="http://www.englishclub.com">www.englishclub.com</a> <a href="http://www.ispeakyouspeak.blogspot.com">www.ispeakyouspeak.blogspot.com</a> <a href="http://www.teachertube.com">www.teachertube.com</a> <a href="http://www.learning-development.hr.toolbox.com">www.learning-development.hr.toolbox.com</a> <a href="http://www.Dictionary.com">www.Dictionary.com</a>
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Lab Requirements: (i) Teacher console and Systems for students.  
(ii) English Lab Software.

# **SEMESTER V**

**OBJECTIVE**

1. To learn the basics of sewage composition and its characteristics
2. To depict the information about various sewage treatment processes
3. To provide the adequate information on various disposal standards for industrial effluents
4. To study the information about air pollution and its effects
5. To understand the knowledge about solid waste generation and disposal methods.
6. To gain knowledge information about various sewage treatment processes

**COURSE OUTCOMES**

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

1. Determine the sewage characteristics and design various sewage treatment plants.
2. Analyze the status of surface water and ground water quality and the remediation technologies.
3. understand the information about air pollution and its effects
4. gain knowledge information about various sewage treatment processes
5. Carry out municipal water and wastewater treatment system design and operation.
6. Manage hazardous wastes, risk assessment and treatment technologies apply environmental treatment technologies and design process.

**UNIT****9**

**Sewerage System:** Definitions-Classification – Quantity of sewage – Fluctuations in Flow pattern- Estimation of storm run off-Design of flow for separate and combined systems- Design of sewers — Sewer appurtenances – Pump selection

**UNIT II****9**

**Sewage Collection:** Sanitary Fixtures and Fittings- Systems of House Drainage- General Layout- Anti siphonage- Connection of House sewer to public sewer- Materials for sewers- – Laying, jointing and testing of sewers- Sewer Maintenance- Sewage pumping- Types of pumps

**UNIT III****9**

**Sewage Treatment- Physico Chemical:** Characteristics and Composition of sewage-Analysis- Cycles of decomposition- Objectives and basic principles of sewage treatment- screen chamber, grit chamber, primary sedimentation tanks- Types and Design- Sewagetreatment plants (Principal and working)

**UNIT IV****9**

**Sewage Treatment- Biological:** Fundamentals of microbiology of waste water- Basic Principles of Biological Treatment- Trickling filter –Principles and Description of operation of standard high rate filters- Recirculation- activated sludge process-Modifications- Low cost treatment methods

**UNIT V****9**

**Sludge Treatment and Effluent Disposal:** Objectives of sludge treatment- Properties and characteristics of sludge- Conventional and high rate digesters- Sludge Lagooning- Sludge thickening

methods- Effluent disposal on land- Sewage farming practices- Dilution- Disposal into water bodies  
Eutrophication- Oxygen sag curve- Recycle and reuse of waste effluents

**TOTAL HRS:45**

**TEXT BOOKS:**

Sl.No	Title of Book	Author of Book	Publisher	Year of Publishing
1	Sewage and waste Disposal Engineering	Garg, S.K	Khanna Publishers, New Delhi	2012

**REFERENCES:**

Sl.No	Title of Book	Author of Book	Publisher	Year of Publishing
1	Wastewater Engineering – Treatment & Reuse	Metcalf and Eddy, M.C	Tata McGraw-Hill Publications, New Delhi	2003
2	Water supply Engineering	Fair G.M, Geyer.J.C	Khanna Publishing Co., New Delhi	2002
3	Water Supply and Sanitary Engineering	Birdie G.S	DhanpatRai& Sons, New Delhi	2003
4	Environmental engineering II Waste water engineering (including air pollution)	Punmia B.C Ashok K Jain Arun K Jain	Laxmi Publications, Delhi	2010

**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/>

**COURSE OBJECTIVES:**

1. To carry out soil classification.
2. To Solve three phase system problems.
3. To Solve any practical problems related to soil stresses estimation,
4. To Gain the knowledge in permeability and seepage including flow net diagram
5. To Estimate the stresses under any system of foundation loads.
6. To Solve practical problems related to consolidation settlement and time rate of settlement.

**COURSE OUTCOMES**

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

1. Carry out soil classification.
2. Solve three phase system problems.
3. Solve any practical problems related to soil stresses estimation,
4. Gain the knowledge in permeability and seepage including flow net diagram
5. Estimate the stresses under any system of foundation loads.
6. Solve practical problems related to consolidation settlement and time rate of settlement.

**UNIT I****9**

**Site Investigation And Selection Of Foundation:** Scope and Objectives – Methods of exploration - Borings for Exploration – Wash boring and rotatory drilling – Depth of boring - Sampling – Representative and undisturbed sampling – sampling techniques – Split spoon sampler, Thin tube sampler, Stationary piston sampler – Penetration tests (SPT and SCPT) – Corecutter method, its significances and applications- Selection of foundation based on soil condition.

**UNIT II****9**

**Shallow Foundation:** Introduction – Location and depth of foundation — bearing capacity of shallow foundation on homogeneous deposits – Terzaghi's formula and BIS formula – factors affecting bearing capacity – problems - Bearing Capacity from insitu tests (SPT, SCPT and plate load) –Settlement – Components of settlement –Methods of minimizing settlement, differential settlement - subsoil stabilization - codal provisions .

**UNIT III****9**

**Footings and Rafts:** Types of foundation – Raft foundation - Deep foundations – Dewatering system – - Contact pressure distribution below footings & raft - Isolated and combined footings – Types – proportioning - Mat foundation – Types – use - proportioning – Floating foundation.

**UNIT IV****9**

**Piles:** Types of piles and their function – Factors influencing the selection of pile – Load Carrying capacity of single pile in granular and cohesive soil - Static formula - dynamic formulae (Engineering News and Hiley's) – Negative skin friction – Settlement of pile groups – Underreamed piles .

## UNIT V

9

**Retaining Walls:** Plastic equilibrium in soils –Types of Retaining Wall – Active and Passive states – Rankine's theory – cohesionless and cohesive soil – Coloumb's wedge theory – Graphical methods (Rebhann and Culmann) - Pressure on the wall due to line load – Stability of Retaining walls.

Introduction to Geo textiles – applications.

**TOTAL HRS:45**

## TEXT BOOKS

Sl.No	Title of Book	Author of Book	Publisher	Year of Publishing
1	Soil Mechanics and Foundations	Punmia B.C	Laximi Publications Pvt. Ltd., New Delhi	2012

## REFERENCES

Sl.No	Title of Book	Author of Book	Publisher	Year of Publishing
1	Basic and Applied Soil Mechanics	GopalRanjan and Rao A.S.R.	Wile Eastern Ltd., New Delhi, India	2012
2	Principles of Foundation Engineering (Fifth edition)	Das, B.M.	Thomson Books, New Delhi	2012
3	Analysis and Design of Structures – Limit state Design	Swami saran	Oxford IBH Publishing Co-Pvt. Ltd., New Delhi	2012
4	Foundation analysis and design	Bowles J.E	McGraw-Hill, New Delhi	2008
5	Theory and Practice of Foundation Design	N.N. Som and S.C. Das	Prentice Hall of India Pvt. Ltd., New Delhi	2003
6	Foundation Engineering Standard	Varghese P C	Publishers Distributors New Delhi	2005

7	Soil Mechanics and Foundations Engineering	Arora K.R	Published by A.K Jain, New Delhi	2012
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#### 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/>

**COURSE OBJECTIVES:**

1. To impart to the students the concepts of stresses and strains and Hooke's law.
2. To enlighten the students about different types of truss analysis.
3. To teach the students about the beam analysis
4. To teach about thin cylindrical and spherical shell analysis when subjected to internal pressure
5. To impart ideas of torsional stresses
6. To evaluate it in circular sections and its applications in spring analysis.

**COURSE OUTCOMES**

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

1. Carry out soil classification.
2. Solve three phase system problems.
3. Solve any practical problems related to soil stresses estimation,
4. Gain the knowledge in permeability and seepage including flow net diagram
5. Estimate the stresses under any system of foundation loads.
6. Solve practical problems related to consolidation settlement and time rate of settlement.

**UNIT I****12**

**Forces in statically determinate frames**-Method of joints-Method of sections-Graphical method - Deflection of perfect frames-Unit load method-Graphical method-Forces in redundant frames-Castigliano's theorem-Maxwell's method-Tension Co-efficient method.

**UNIT II****12**

**Unsymmetrical bending**-stresses in beams subjected to unsymmetrical bending-Deflection of beams – simply supported beams – fixed end beams – Over hanging beams – different load conditions (point load, udl, uvl) - under unsymmetrical bending-shear centre.

**UNIT III****12**

**Combined bending and direct stresses**-Eccentric loading-Middle third rule-Core of a section-Wind pressure on masonry dams-Theories of failure.  
Columns and struts-types-failure modes-Euler's formula-Rankine's formula-Johnson's-IS code formula-practical end conditions and effective length factors-Built-up columns.

**UNIT IV****12**

**Thin Cylindrical and Spherical shells**- Assumptions-Internal pressure-Change in volume-Minimum thickness of wall plates.



**UNIT V**

**12**

**Elementary theory of vibrations** - Simple harmonic motion - Longitudinal vibration - Helical and Compound springs -Transverse vibrations of beams with point loads and UDL - Torsional vibrations of shafts.

**TOTAL HRS:60**

**TEXT BOOKS:**

S.No	Title of Book	Author of Book	Publisher	Year of Publishing
1	Strength of materials and Theory of Structures Vol.I	Dr. B.C.Punmia	Laxmi Publications, Chennai	2011

**REFERENCE BOOKS:**

S.No	Title of Book	Author of Book	Publisher	Year of Publishing
1	Applied mechanics	V.Devarajan	Padma Publications, New Delhi.	2012
2	Applied Mechanics and Strength of Materials	R.S.Khurmi	Niraja Construction and Development Limited, Tenth Edition, New Delhi,	2012
3	Elements of Strength of materials	Dr.P.Purushothamaraj, VRA.Saathappan, V.Ramasamy	Raamalingaa Publications, New Delhi.	2002

**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/>

**COURSE OBJECTIVES:**

1. To understand the concept of analysis of indeterminate structures by various classical methods
2. To study the use of ILD for determinate structure
3. To learn the concepts of moving loads and its effect on structures
4. To understand the concept of equivalent UDL
5. To study the reversal of stress under live load
6. To determine the reversal of stresses in trusses using ILD.

**COURSE OUTCOMES**

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

1. Use various classical methods for analysis of indeterminate structures.
2. Determine the effect of support settlements for indeterminate structures.
3. Apply the concepts of ILD and moving loads on determinate structures.
4. Apply the concept of equivalent UDL.
5. Determine the reversal of stresses in trusses using ILD.
6. To Analyse the building using different methods available for designing and analysing.

**UNIT I INTRODUCTION****12**

Degree of static and kinematic indeterminacies of frames- analysis of indeterminate frame- Degree of redundancy-Static and Kinematic indeterminacies-propped cantilever and fixed beams- reaction-B.M.D. and S.F.D.

**UNIT II MOMENT DISTRIBUTION METHODS****12**

Moment-Distribution and carryover of moments – Stiffness and carryover of factors – Analysis of Continuous beams – Analysis of Simple frames – Plane rigid frame with and without sway - Two cycle moment distributions method (No problems)

**UNIT III INFLUENCE LINE DIAGRAM****12**

Analysis for moving loads-Influence line Diagram (ILD) –ILD for beam with point loads, UDL shorter than span and several point loads at a section -Equivalent UDL-Absolute maximum bending moments for two wheel loads at a fixed distance apart.

**UNIT IV ARCHES****12**

Arches as structural forms-Examples of arch structures-types of arches-Three-hinged arches-Horizontal thrust-Effect of Temperature change-Straining actions-Parabolic and Circular arches-Two-hinged arches-Horizontal thrust-Effect of temperature change-Straining actions-Parabolic and Circular arches.

**UNIT V CABLES AND SUSPENSION BRIDGES****12**

Equation of the cable-Horizontal thrust on the cable-Tension in the cable-Length of the cable-Effect of temperature on the cable-Stiffening girders in suspension bridges-with three-hinged and two-hinged stiffening girders

**TOTAL HRS:60**

**TEXT BOOKS:**

S.No	Title of Book	Author of Book	Publisher	Year of Publishing
1	Strength of materials and Theory of Structures Vol.I& II	Dr. B.C.Punmia	Laxmi Publications, Chennai	2011

**REFERENCE BOOKS:**

S.No	Title of Book	Author of Book	Publisher	Year of Publishing
1	Intermediate Structural Analysis	C.K. Wang	McGraw Hill, New Delhi	2012
2	Introduction to Structural Analysis	<u>B. D. Nautiyal</u>	New Age International (P) Ltd	2010
3	Theroy of Simple Structures	.C.Shedd&J.Vauter	T, Wiley Eastern Ltd.	2001
4	Fundamentals of Structural Mechanics and Analysis	Gambhir. M.L.	PHI Learning Pvt. Ltd., New Delhi	2011
5	Theory of structures	S.Ramamrutham&R.Narayan	DhanpatRai Publishing Co, New Delhi	2013
6	Structural Analysis – Vol. 1 & Vol. 2	BhavaiKatti, S.S	Vikas Publishing Pvt Ltd., New Delhi	2008

**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/>

**Semester-V**

**15BECE5E--DEPARTMENT ELECTIVE I      3 0 0 3 100**

**TOTAL HRS:45**

**COURSE OBJECTIVES:**

1. To find the Young Modulus, torsional strength, hardness and tensile strength of given specimens
2. To find impact value and crushing value of coarse aggregates
3. To find the compressive strength of concrete cubes and bricks
4. To find stiffness of open coiled and closed coiled springs
5. To find the physical properties of given coarse aggregate, fine aggregate and cement samples

**COURSE OUTCOMES**

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

1. Evaluate Young Modulus, torsional strength, hardness and tensile strength of given specimens.
2. Determine the strength of coarse aggregates.
3. Find the compressive strength of concrete cubes and bricks.
4. Find stiffness of open coiled and closed coiled springs.
5. Determine the physical properties of given coarse aggregates, fine aggregates and cement samples.

**LIST OF EXPERIMENTS**

1. Study of UTM, Torsion testing machine, Hardness tester, Compression testing machine
2. Tension Test on M.S. and HYSD bars
3. Test involving Torsion to obtain the Torque vs. Angle of twist and hence the stiffness
4. Test on Timber beam – Bending test - compression test on timber specimens
5. Tests on Metals
  - Hardness test on metals (Brinell and Rockwell Tests)
  - Impact test. (Izod and Charpy Tests)
  - Shear test
6. Tests on springs for Stiffness

The student should learn the use of deflectometer, extensometer, and strain gauges.

## REFERENCES

Sl.No	Title of Book	Author of Book	Publisher	Year of Publishing
1	Solid Mechanics	Kazimi S.M.A	Tata McGraw-Hill Publishing Co, New Delhi	2003
2	Theory and Problems of Strength of Materials	William Nash	Schaum's Outline Series, McGraw-Hill International, Delhi.	2005
3	Advanced Mechanics of Solids	Srinath L.S	Tata McGraw-Hill Publishing Co., Delhi	2003
4	Strength of Materials	R.S. Khurmi	S. Chand & Company Ltd, New Delhi	2008

## 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/>

**COURSEOBJECTIVES:**

1. To estimate index properties of soils (coarse and fine).
2. To estimate consistency limit of fine grained soils.
3. To estimate shear strength of soils by direct shear test, triaxial shear test, vane shear test & unconfined compressive test.
4. To estimate the engineering properties of the soils by density test, CBR test
5. To estimate the engineering properties of permeability test and consolidation test.
6. To classify the soil by physical observation of soil.

**COURSE OUTCOMES**

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

1. Classify soil by physical observation of the soils.
2. Classify soil based on estimated index and engineering characteristics of soils.
3. Carry out interpolation among the estimated soil design parameters.
4. Estimate shear strength of soils by direct shear test, triaxial shear test, vane shear test & unconfined compressive test.
5. Estimate the engineering properties of the soils by density test, CBR test
6. Estimate the engineering properties of permeability test and consolidation test.

**LIST OF EXPERIMENTS**

1. Specific gravity of soil grains(Specific gravity bottle &Pycnometer )
2. Grain size distribution - Sieve analysis
3. Relative density of sands
4. Atterberg limits test
  - a) Liquid Limit
  - b) Plastic Limit
  - c)Shrinkage Limit
- Determination of moisture - Density relationship using standard Proctor test.
- Permeability determination (constant head and falling head methods)
- Determination of shear strength parameters.
  - a) Direct shear test on cohesionless soil
  - b) Unconfined compression test on cohesive soil
  - c) Triaxial compression test (Study Experiment)
- One dimensional consolidation test (Determination of co-efficient of consolidation only, Study Experiment)
- Field density test
  - a) Core cutter and
  - b) Sand replacement methods

## REFERENCES

Sl.No	Title of Book	Author of Book	Publisher	Year of Publishing
1	Manual of Soil Laboratory Testing (Vol-1 to 3),	Head, K.H	John Wiley & Sons, Chichester	2009
2	Soil Testing for Engineers	Lambe T.W	John Wiley and Sons, New York	2009
3	Measurement of Engineering Properties of Soils,	Saibaba Reddy, E. and Rama Sastri, K	New Age International Publishers, New Delhi	2002
4	I.S.Code of Practice (2720) Relevant Parts, as amended from time to time			



**COURSE OBJECTIVES:**

1. To quantify the water and wastewater pollutant
2. To measure the concentration of air pollutants
3. To analyze the characteristics of water
4. To analyze the characteristics of wastewater and ambient air
5. To determine the characteristics of ambient air
6. To study the growth of microorganism and its quantification

**COURSE OUTCOMES**

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

1. Quantify the pollutant concentration in water, wastewater and ambient air.
2. Recommend the degree of treatment required for the water and wastewater.
3. Analyse the survival conditions for the microorganism and its growth rate.
4. Quantify the water and wastewater pollutant
5. Measure the concentration of air pollutants
6. Analyze the characteristics of water

**LIST OF EXPERIMENTS**

1. Sampling and preservation methods and significance of characterization of water and wastewater.
2. Determination of
  - i) PH and turbidity
  - ii) Hardness
3. Determination of iron & fluoride
4. Determination of residual chlorine
5. Determination of Chlorides
6. Determination of Ammonia Nitrogen
7. Determination of Sulphate
8. Determination of Optimum Coagulant Dosage
9. Determination of available Chlorine in Bleaching powder
10. Determination of dissolved oxygen
11. Determination of suspended, volatile and fixed solids
12. B.O.D. test
13. C.O.D. test
14. Introduction to Bacteriological Analysis (Demonstration only)

**REFERENCES**

Sl.No	Title of Book	Author of Book	Publisher	Year of Publishing
1	Standard methods for the examination of water and wastewater	Handbook	APHA, 20th Edition, Washington	2010
2	Environmental Engineering Vol. I & II	Garg, S.K	Khanna Publishers, New Delhi	2003

**VALUE ADDED COURSE****15BECE551                                    INPLANT TRAINING    0 0 0 1    100****OBJECTIVE**

1. At the end of this course students should be able to know the practical applications of theory in the field.
2. Students are emphasised to take one month intensive training in reputed construction or design or architecture firm.

**Semester-V****15BECE552                                    TECHNICAL PRESENTATION    0 0 2 1    100****COURSE OBJECTIVES:**

1. At the end of this course students should have learnt the presentation skills needed for the presentation in national and international conferences.
2. Topics are given in the current real time problems and students are required to present solutions to the problems by referring to Journals, magazines or by consulting experts.

# **SEMESTER VI**

**COURSE OBJECTIVES:**

1. To understand the properties of ingredients of concrete
2. To study the behavior of concrete at its fresh and hardened state
3. To study about the concrete design mix
4. To know about the procedures in concreting
5. To understand special concrete and their use.
6. To know the recent research technologies.

**COURSE OUTCOMES**

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

1. Test all the concrete materials as per IS code.
2. Design the concrete mix using ACI and IS code methods.
3. Will Determine the properties of fresh and hardened of concrete.
4. To Design special concretes and their specific applications.
5. Ensure quality control while testing/ sampling and acceptance criteria.
6. Recent advancements in the field of concrete Technology.

**UNIT I****9**

**Cements & admixtures:** Portland cement – ferro cement-chemical composition – Hydration, Setting of cement – Structure of hydrate cement – Test on physical properties – Different grades of cement – Admixtures – Mineral and chemical admixtures.

**UNIT – II****9**

**Aggregates:** Classification of aggregate – Particle shape & texture – Bond, strength & other mechanical properties of aggregate – Specific gravity, Bulk density, porosity, adsorption & moisture content of aggregate – Bulking of sand – Deleterious substance in aggregate – Soundness of aggregate – Alkali aggregate reaction – Thermal properties – Sieve analysis – Fineness modulus – Grading curves – Grading of fine & coarse Aggregates – Gap graded aggregate – Maximum aggregate size.

**UNIT – III****9**

**Fresh concrete:** Workability – Factors affecting workability – Measurement of workability by different tests – Setting times of concrete – Effect of time and temperature on workability – Segregation & bleeding – Mixing and vibration of concrete – Steps in manufacture of concrete – Quality of mixing water.

**UNIT IV****9**

**Hardened concrete :** Water / Cement ratio – Abram's Law – Gelspaoe ratio – Nature of strength of concrete – Maturity concept – Strength in tension & compression – Factors affecting strength – Relation between compression & tensile strength - Curing.

**Testing of hardened concrete:** Compression tests – Tension tests – Factors affecting strength – Flexure tests – Splitting tests – Non-destructive testing methods – codal provisions for NDT.

**UNIT V****9**

**Mix design:** Factors in the choice of mix proportions – Durability of concrete – Quality Control of concrete – Statistical methods – Acceptance criteria – Proportioning of concrete mixes by various methods – BIS method of mix design.

**Special concretes:** Light weight aggregates – Light weight aggregate concrete – Cellular concrete – No-fines concrete – High density concrete – Fibre reinforced concrete – Polymer concrete – Types of Polymer concrete – Properties of polymer concrete – Applications – High performance concrete – Self consolidating concrete

**TOTAL HRS:45****TEXT BOOKS:**

Sl.No	Title of Book	Author of Book	Publisher	Year of Publishing
1	Concrete Technology	M.S.Shetty	S.Chand&Co, Uttar Pradesh	2004

**REFERENCES:**

Sl.No	Title of Book	Author of Book	Publisher	Year of Publishing
1	Concrete Technology	M.L. Gambhir	Tata Mc. Graw Hill Publishers, New Delhi	2004
2	Properties of Concrete	A.M.Neville	Canadian GovtPublishing Centre, Ottawa	2011
3	Concrete Technology	A.R.Santha Kumar	Oxford university Press, New Delhi	2006

**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/>

**COURSE OBJECTIVES:**

1. To understand the influence line concepts for indeterminate structures
2. To understand the methods of analysis of intermediate trusses for external loads, lack of fit and thermal effect
3. To study behaviour of arches and their methods of analysis
4. To know the concept and analysis of cable stayed bridge
5. To study the multi storey frames subjected to gravity loads and lateral loads
6. To apply the methods of indeterminate truss analysis

**COURSE OUTCOMES**

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

1. Demonstrate the concepts of qualitative influence line diagram for continuous beams and frames
2. Apply the methods of indeterminate truss analysis.
3. Demonstrate the behavior of arches and their methods of analysis.
4. Analyse cable suspension bridges.
5. Analyse multistorey frames subjected to gravity loads and lateral loads.
6. Analyse multi storey frames subjected to gravity loads and lateral loads

**UNIT I****12**

**Slope deflection method** - Continuous beams and Rigid beams ( with and without sway ) – Simplification of hinged end – support displacement- Simple frames - Portal frames - Consistent-deformation method-continuous beams.

**UNIT II****12**

**Strain energy method**- Castigliano's theorem- Deflection by strain energy method – evaluation of strain energy in member under different loading – Application of strain energy method for Beams and frames - Beams curved in plan.

**UNIT III****12**

**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 IV****12**

**Stiffness method**-Beams-Trusses-Simple frames-Portal frames-Grids-Lack of fit-Temperature stresses-Support settlements-Elastic supports.(Direct approach)

**Introduction to Finite element:** Introduction –Discretization of a structure – Displacement functions – Truss element – Beam element – Plane stress and Plane strain Triangular elements (Theory only )

**UNIT V****12**

**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.

**TOTAL HRS:60**

**TEXT BOOKS:**

Sl.No	Title of Book	Author of Book	Publisher	Year of Publishing
1	Strength of materials and Theory of Structures Vol.I, II	Dr.B.C.Punmia	Laxmi Publication, New Delhi	2012

**REFERENCE BOOKS:**

Sl.No	Title of the Book	Author of the Book	Publisher	Year of Publishing
1	Intermediate Structural Analysis	C.K. Wang	McGraw-Hill, New Delhi	2002
2	Matrix Analysis of Framed structures	W.Weaver and J.M Gere	Van NostrandReinhold,New York	2003
3	Structural analysis, a matrix approach	G.S.Pandit and S.P.Gupta	Tata McGraw Hill	2004
4	Theory of structures	S.Ramamrutham&R.Narayan	DhanpatRai Publishing Co, New Delhi	2013
5	Analysis of Structures-Vol.II	Prof.V.N. Vazirani, Dr.M.M.Ratwani, Dr.S.K.Duggal	Khanna Publishers, Chennai	2012

**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/>

**COURSE OBJECTIVES**

1. To learn IS 800-2007 code of practice for the design of Compression, Tension and Flexural members using various cross-sections.
2. To study the behaviour and design of compression and tension members using simple and built-up sections.
3. To understand behaviour of flexural members and the design laterally restrained and unrestrained beams.
4. To study the components of truss, loads on trusses, analysis
5. To design of purlins and truss members.
6. To study the design of bolted and welded connections and arranging field visit to industries.

**COURSE OUTCOMES**

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

1. Apply the IS code of practice for the design of steel structural elements.
2. Design compression and tension members using simple and built-up sections.
3. Calculate forces on the various members of the truss and design them.
4. Analyze the behavior of bolted connections and design them.
5. Design welded connections for both axial and eccentric forces.
6. Design components of truss, loads on trusses, analysis and design of purlins and truss members

**UNIT I****12**

**Introduction:** Properties of steel – Structural steel sections – Limit State Design Concepts – Loads on Structures – Metal joining methods using, welding, bolting – Design of bolted, and welded joints – Eccentric connections - Efficiency of joints – High Tension bolts

**UNIT II****12**

**Tension Members:** Types of sections – Net area – Net effective sections for angles and Tee in tension – Design of connections in tension members – Use of lug angles – Design of tension splice – Concept of shear lag

**UNIT III****12**

**Compression Members:** Types–Basis of codal provision for compression member design – Slenderness ratio – Design of single section and compound section– Design of lacing and battening– Design of column bases – Gusseted base

**UNIT IV****12**

**Beams:** Design of laterally supported and unsupported beams – Built up beams – Design of plate girders bolted and welded – Intermediate and bearing stiffeners – flange and Web splices

**UNIT V****12**

**Roof Trusses and Industrial Structures:** types of Roof trusses – Roof and side coverings –Design loads, design of purlin and elements of truss; end bearing - Design of Gantry Girders

**TOTAL HRS:60**



**TEXT BOOKS:**

Sl.No	Title of Book	Author of Book	Publisher	Year of Publishing
1	Design of Steel Structures – Vol. I & II	Ramachandra, S	Standard Publication, New Delhi	2009

**REFERENCES:**

Sl.No	Title of Book	Author of Book	Publisher	Year of Publishing
1	Design of Steel Structures, Second edition	Dayaratnam, P	S. Chand & Company, Uttar Pradesh	2003
2	Design of Steel Structures	Gaylord, E.H., Gaylord, N.C., and Stall Meyer, J.E	McGraw-Hill Publications. New Delhi	2005
3	IS 800-2007 Code of Practice for General Construction in Steel IS 875 Part I,II,III			

**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/>

**COURSE OBJECTIVES**

1. To study the stress strain behavior of steel and concrete
2. To understand the concept of working stress and limit state methods
3. To gain the knowledge of limit state design for flexure, shear, torsion, bond and anchorage
4. To understand the behavior of columns subjected to eccentric load and use of interaction diagrams
5. To design the beams, slab, stairs, column and footing.
6. To draw detailing of various RCC structural elements

**COURSE OUTCOMES**

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

1. Apply the fundamental concepts of working stress method and limit state method.
2. Use IS code of practice for the design of concrete elements.
3. Design the beams, slab, stairs, column and footing.
4. Draw detailing of various RCC structural elements.
5. understand the behavior of columns subjected to eccentric load and use of interaction diagrams
6. gain the knowledge of limit state design for flexure, shear, torsion, bond and anchorage

**UNIT I****INTRODUCTION****12**

Materials for concrete-Stress-Strain curve for concrete in compression-Concrete mix proportioning-Design concrete mix and nominal concrete mix-Types of reinforcement-Plain and deformed bars-Stress-strain curve for reinforcing steel.

Concept of WSD (No problems) and LSD-Difference between WSD and LSD-Characteristic loads and strengths-Partial safety factor-Various limit states.

**DESIGN FOR FLEXURE:**

Design of singly and doubly reinforced rectangular and flanged sections for BM and SF

**UNIT II****DESIGN BASICS FOR SHEAR, BOND AND TORSION****12**

Design for shear-concept of bond and anchorage-Design for torsion-IS code provision for the design of beams-Design of lintels-Design of continuous beams using B.M. and S.F. co-efficient as per IS code-detailing.

**UNIT III****DESIGN OF SLABS****12**

Types of slabs-IS code regulations-Stiffness requirements-Design of one-way simply supported and continuous slab using BM and SF co-efficient as per IS code-Principles of Rankine-Grashof's method(no problems)-design of two way, simply supported and continuous slab as per IS code.

**UNIT IV****DESIGN OF COLUMNS****12**

IS-code regulations-Design of short rectangular and circular columns subjected to axial compressive load-Design of short columns subjected to combined axial compressive load and uni-axial and biaxial bending moments using design aids(SP 16)- Introduction to long column design

## UNIT V

### DESIGN OF FOOTINGS

12

Design of wall footings- Design of isolated, square and rectangular footings.-combined rectangular and trapezoidal footings.

**TOTAL HRS:60**

### TEXT BOOKS:

Sl.No	Title of Book	Author of Book	Publisher	Year of Publishing
1.	Reinforced Concrete Design	Unnikrishna Pillai & Devados Menon	Tata McGraw Hill Publishing Co, New Delhi	2012
2.	IS 456-2000 Indian Standard Code of practice for Reinforced Concrete.			
3	SP-16 Design Aids for IS 456-1978. IS 875-1987-Code of Practice for Design Loads			

### REFERENCE:

Sl.No	Title of Book	Author of Book	Publisher	Year of Publishing
1.	Reinforced Concrete	Mallick, S.K., and Gupta, A.P	Oxford & IBH Publishing Co., New Delhi	2008
2.	Reinforced Concrete Design	Sibha, S.N.	Tata McGraw-Hill Publishing Co, Ltd., New Delhi	2001
3.	Reinforced Concrete Mechanics and Design	MacGregor J.G	Prentice Hall, New Jersey	2008
5	Reinforced Concrete Structural Elements Behaviour Analysis and Design	Purusothaman	Tata McGraw hill Publishing Co., Limited, New Delhi	2012

3.	Reinforced Concrete limit state design	Ashok K Jain	Nem Chand Bros, Roorkee	2012
4.	Limit State Design of R.C.Structures	Varghese, P.C	<a href="#">PHI Learning Pvt. Ltd.</a> New Delhi	2008

#### 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/>

#### Semester-VI

**15BECE6E-- DEPARTMENT ELECTIVE II 3 0 0 3 100**

**TOTAL HRS:45**

#### Semester-VI

**15BECE6E-- DEPARTMENT ELECTIVE III 3 0 0 3 100**

**TOTAL HRS:45**

**COURSEOBJECTIVES**

1. Students should be trained about the STAAD commands and input instructions and command formats and analysis of various structures.
2. They should also get familiar with various unit systems, co-ordinate systems and various structural analysis.
3. To create a building using space coordinates,
4. To import a model from AutoCAD
5. To analyze a structure using software.
6. To get the SFD,BMD and Deflection diagrams through post processing mode.

**COURSE OUTCOMES(COS):**

1. Students should be trained about the STAAD commands and input instructions and command formats and analysis of various structures.
2. Familiar with various unit systems, co-ordinate systems and various structural analysis.
3. Create a building using space coordinates,
4. Import a model from AutoCAD
5. Analyze a structure using software.
6. Extracting SFD,BMD and Deflection diagrams through post processing mode.

**LIST OF EXPERIMENTS**

1. Model generation using Node/Beam Editor
2. Assigning Properties, Supports, Loads and Analysis for 2 storey building
3. Analysis of Framed Structure and Applying Floor Loads and Wind load for 3 storey building
4. Analysis of Framed Structure and Applying Seismic Analysis for 3 storey building
5. Analysis of 3 storey school building and generate the stress diagrams on each beam and column
6. Analysis of Retaining Wall

**REFERENCES:**

Sl.No	Title of Book	Author of Book	Publisher	Year of Publishing
1	Structural Design & Drawing – Reinforced Concrete and Steel	N. Krishna Raju	University Press, Chennai	2012

**COURSE OBJECTIVES**

1. To find impact value and crushing value of coarse aggregates
2. To find the compressive strength of concrete cubes and bricks
3. To find the physical properties of given coarse aggregate, fine aggregate
4. To find the physical properties of given cement samples
5. To learn the characteristics, properties and testing procedures of aggregate
6. To learn the characteristics, properties and testing procedures of bitumen

**COURSE OUTCOMES**

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

1. Determine the strength of coarse aggregates.
2. Find the compressive strength of concrete cubes and bricks.
3. Determine the physical properties of given coarse aggregates, fine aggregates and cement samples.
4. Characterize the aggregate used for road construction
5. Characterize the bitumen used for road construction.
6. Know the characteristics, properties and testing procedures of bitumen

**LIST OF EXPERIMENTS****A. TEST ON CONCRETE**

- Workability test on concrete- Slump, Compaction factor and Vee –Bee test
- Strength test on concrete – Compressive Strength ,Direct tensile strength, Split tensile strength test and Flexural strength test

**B. TEST ON AGGREGATE**

- Flakiness Index and Elongation Index
- Crushing Value and Impact Value
- Abrasion test- Deval abrasion test

**C. TEST ON BITUMEN**

- Ductility Test
- Viscosity Test
- Specific Gravity Test
- Flash and Fire Point Test

## REFERENCES

S.No	Title of Book	Author of Book	Publisher	Year of Publishing
1	Specifications for Road and Bridges, MORTH (India)			1985
2	IS 1489 (Part 1 and 2) Specifications for Portland Pozzolana Cement			1976
3	IS 2386 (Part 1 to 8) Methods of Test for Aggregates for Concrete			1986
4	IS 10262-1982 Recommended Guidelines for Concrete Mix Design			1982
5	IS 1199 1959 methods of Sampling and Analysis of Concrete			1959
6	Bureau of Indian Standards (BIS) Publications on Highway Materials			1965
7	Highway Engineering	Khanna K and Justo C E G	Khanna Publishers, Roorkee	2012
10	Concrete Technology	A.R. Santha Kumar	Oxford university Press, New Delhi	2012

VALUE ADDED COURSE

**15BECE651** **PLANNING AND EXECUTION OF CIVIL PROJECTS** **0 0 2 1 100**

OBJECTIVE

1. The students are emphasized to learn the by- laws (NBC),planning,marking, testing of materials and implementation procedures of the building structures
2. Site visit of live project



# **SEMESTER VII**

**COURSE OBJECTIVES**

1. To enable the students to create an awareness on Engineering Ethics, to instill Moral and Social Values and Loyalty and to appreciate the rights of others.
2. To familiarize the students to what constitutes professional practice, introduction of various stakeholders and their respective roles; understanding the fundamental ethics governing the profession
3. To give a good insight into contracts and contracts management in civil engineering, dispute resolution mechanisms; laws governing engagement of labour.
4. To give an understanding of Intellectual Property Rights, Patents.
5. To make the students understand the types of roles they are expected to play in the society as practitioners of the civil engineering profession
6. To develop good ideas of the legal and practical aspects of their profession

**COURSE OUTCOMES(COS):**

1. To familiarize the students to what constitutes professional practice, introduction of various stakeholders and their respective roles; understanding the fundamental ethics governing the profession
2. To give a good insight into contracts and contracts management in civil engineering, dispute resolution mechanisms; laws governing engagement of labour.
3. To give an 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

**UNIT I****MANAGEMENT AND PLANNING****9**

Definition - nature - functions – Levels of Management-Roles of a Manager- Evolution of management thought -Planning - Definition - Nature and importance – steps involved in planning - types of planning -Objectives - MBO -policy and strategy -Forecasting -Decision making

**UNIT II****ORGANIZING AND STAFFING****9**

Definition - Nature - purpose - organizational structure - Theories of organization – Types of Business Organization- span of control - Line and staff functions - centralization and decentralization - Recruitment, selection, training and development.

**UNIT III****DIRECTING AND CONTROLLING****9**

Nature of directing - leadership qualities - styles -motivation – Theories of motivation – communication-process and types of communication- The objectives and process of control –types of control- Controlling techniques –budgetary and non budgetary.

Entrepreneur –Meaning – Definition -characteristics and Functions of entrepreneur -types of entrepreneurs – IntrapreneurVs Entrepreneur- Role of Entrepreneurship in economic development – Factors affecting entrepreneur growth

**UNIT – V BUSINESS PLAN PREPARATION****9**

Sources of Product for Business - Prefeasibility Study - Criteria for Selection of Product - Ownership - Capital - Budgeting Project Profile Preparation - Matching Entrepreneur with the Project - Feasibility Report Preparation and Evaluation Criteria

**TOTAL HRS:45****Text Books**

1. Koontz H and Weihrich H, Essentials of Management: An International Perspective, Tata McGraw Hill, 2007
2. Prasad L M, Principles and Practices of Management, Sultan Chand and Sons, 2001
3. S.S.Khanka, Entrepreneurial Development, S.Chand and Company Limited, New Delhi, 2001

**Reference Books**

- 1.T.Ramasamy,2010,"Principles of management", Himalaya publishing House.
2. Vasant Desai – Dynamics of ED and Management, Mumbai – Himalaya Publishing house.

**COURSE OBJECTIVES**

1. To understand the design concept of various structures and detailing of reinforcements.
2. To understand the design of underground and elevated liquid retaining structures.
3. To study the design of material storage structures.
4. To know the effect of temperature on concrete structures.
5. To study the design of bridges subjected to IRC loading.
6. To draw the various reinforcements of structures

**COURSE OUTCOMES**

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

1. Apply the concepts of liquid retaining structures.
2. Design material storage structures using various theories.
3. Apply the concepts of environmental and transportation structures.
4. Demonstrate the detailing of reinforcement.
5. Draw the various RCC structures.
6. design of material storage structures

**UNIT 1****YIELD LINE THEORY****12**

Introduction-Assumptions - Characteristics of yield line - Determination of collapse load / plastic moment- Application of virtual work method - square, rectangular, circular and triangular slabs With point load and UDL (Simply support and Fixed support)- Design problems.

**UNIT II****BUILDING FRAMES**

Multi storeyed load bearing structures and framed structures-Elastic analysis ,Suitable substitute frames for gravity loadings-Approximate analysis of single and two bay frames up to three storeys using portal method and cantilever method.

**UNIT III****RETAINING WALLS**

Design of Cantilever retaining wall – Design of Counterfort Retaining walls-Stability Analysis.

**UNIT IV****WATER TANKS      12**

Classification-IS code provisions-Principles of design-Design of rectangular and circular water tanks , below ground level, tanks resting on ground and Elevated tanks – Intze type water tank (Theory only)

**UNIT V****SELECTED TOPIC****12**

Design of staircases (ordinary and doglegged) – Design of flat slabs – Design Principles of Mat foundation and box culvert.

**TOTAL HRS:60****TEXT BOOKS:**

Sl.No	Title of Book	Author of Book	Publisher	Year of Publishing
1	R.C.C. Designs Reinforced Concrete Structures	Punmia B.C, Ashok Kumar Jain, ArunK.Jain	Laxmi Publications Pvt. Ltd., New Delhi	2006

**REFERENCES:**

Sl.No	Title of Book	Author of Book	Publisher	Year of Publishing
1	Advanced Reinforced Concrete Design	Varghese.P.C	Prentice Hall of India Pvt. Ltd New Delhi.	2012
2	Reinforced Concrete	Mallick, D.K. and Gupta A.P	Oxford and IBH Publishing Company, New York	2003
3	Reinforced Concrete Structures	Syal, I.C. and Goel, A.K	A.H. Wheelers & Co. Pvt. Ltd., Chennai	2001
4	Design of Reinforced Concrete Structures	Gambhir.M.L	Prentice Hall of India Private Limited, New york	2012

**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/>

**COURSE OBJECTIVES**

1. To know the importance of preparing the types of estimates under different conditions.
2. To know about the rate analysis and bill preparations.
3. To study about the specification writing.
4. To understand the valuation of land and buildings.
5. To gain the knowledge of contracts.
6. To rate analysis and bill preparations

**COURSE OUTCOMES**

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

1. Apply different types of estimates in different situations.
2. Carry out analysis of rates and bill preparation at different locations.
3. Demonstrate the concepts of specification writing.
4. Carry out valuation of assets.
5. The rate analysis and bill preparations
6. The types of estimates under different conditions

**UNIT-I****Introduction****12**

Types of estimates – Units of measurements – Methods of estimates – Advantages - cost analysis – Detailed Estimate- Abstract estimate – Calculation of quantities by centre line method – Long wall – Short wall method – Load bearing and framed structures.

**UNIT-I****12**

**Estimate of Buildings:** Detailed and abstract estimate–Estimate of joineries for panelled and glazed doors, windows, ventilators, handrails etc.

**UNIT-III****12**

**Estimate of other structures:** Estimating of septic tank, soak pit – water supply pipe line – sewer line – estimate of bituminous and cement concrete roads – estimate of retaining walls – culverts.

**UNIT-IV****12**

**Rate, Specifications and Tenders:** Data – Schedule of rates – Analysis of rates – Specifications – Detailed and general specifications – Tenders – Contracts – Types of contracts – Arbitration and legal requirements.

**UNIT-V****12**

**Valuation & Report Preparation:** Necessity – Basics of value engineering – Capitalised value – Depreciation – Escalation – Value of building – Calculation of Standard rent – Mortgage – Lease -

Principles for report preparation – report on estimate of residential building , Culvert , Roads , Water supply and sanitary installations , Tube wells and Open wells.

**TOTAL HRS:60**

**TEXT BOOKS**

Sl.No	Title of Book	Author of Book	Publisher	Year of Publishing
1	Estimating and Costing in Civil Engineering	Dutta, B.N	UBS Publishers & Distributors Pvt. Ltd, Delhi	2013

**REFERENCES:**

Sl.No	Title of Book	Author of Book	Publisher	Year of Publishing
1	Civil Estimating and Costing	Mahajan	SathyaPrakashan,New Delhi	2012
2	Civil Estimating Costing and Valuation	Aggarwal	B.D Kataria and Sons, Ludhiana	2012
3	A Text Book of Estimating and Costing (Civil	Kohli, D.D and Kohli, R.C	S.Chand& Company Ltd, Uttar Pradesh	2012

**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/>

**15BECE7E-- DEPARTMENT ELECTIVE -IV 3 0 0 3 100**

**TOTAL HRS:45**

**15BECE7E-- DEPARTMENT ELECTIVE - V 3 0 0 3 100**

**TOTAL HRS:45**

**15BECEOE-- OPEN ELECTIVE 3 0 0 3 100**

**TOTAL HRS:45**



**COURSEOBJECTIVES:**

1. To learn the software developing skills for structural design.
2. To understand the computing techniques in the field of transportation.
3. To gain knowledge in problem solving in water resources.
4. To apply computing techniques to transportation engineering.
5. To apply computing skills to water resources and environmental engineering.
6. To apply computing skills to geotechnical engineering.

**COURSE OUTCOMES**

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

1. Apply the software skills in the design of infrastructure.
2. Apply computing techniques to transportation engineering.
3. Apply computing skills to water resources and environmental engineering.
4. Apply computing skills to geotechnical engineering.
5. Learn the software developing skills for structural design.
6. Understand the computing techniques in the field of transportation.

1. Tank surplus weir
2. Tank sluice with tower head
3. Canal drop(Notch Type)
4. Canal regulator
5. Siphon aqueduct

**ENVIRONMENTAL ENGINEERING DRAWING**

1. General layout of water and waste treatment plants
2. Sedimentation aided with coagulation
3. Slow sand filter
- 4 Rapid sand filter
- 5 Trickling filter
- 6 Septic tank

**TEXT BOOKS**

Sl.No	Title of Book	Author of Book	Publisher	Year of Publishing
1	Irrigation Engineering and Design of Structures	Garg, S.K	Published by Mrs. L.Banumathi,Tuni	2012
2	Irrigation Design and Drawing	Satyanarayana Murthy	East Godavari District, A.P	2002
3	Irrigation Engineering and Hydraulic Structures	Sharma R.K	Oxford and IBH Publishing Co., New Delhi	2002

## REFERENCES

Sl.No	Title of Book	Author of Book	Publisher	Year of Publishing
1	Manual on Water Supply and Treatment, CPHEEO, Government of India, New Delhi			1999
2	Manual of Sewerage and Sewage Treatment, CPHEEO, Government of India, New Delhi			1993
4	Environmental Engineering	Peary, H.S., Rowe, D.R., and Tchobanoglous, G	McGraw-Hill BookCo., New Delhi	2005
5	Wastewater Engineering (Treatment and Reuse)", 4th Edition	Metcalf & Eddy	Tata McGraw- Hill, New Delhi	2003

**COURSE OBJECTIVES**

1. To learn the software skills in structural engineering.
2. To learn the software skills in the field of transportation engineering.
3. To learn the software skills in water resources engineering.
4. To apply the software skills in the field of transportation engineering.
5. To apply the software skills in the field of water resource engineering.
6. To apply the software skills in the field of geotechnical engineering.

**COURSE OUTCOMES**

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

1. Apply the software skills in the field of structural engineering.
2. Apply the software skills in the field of transportation engineering.
3. Apply the software skills in the field of water resource engineering.
4. Apply the software skills in the field of geotechnical engineering.
5. Learn the software skills in structural engineering.
6. Learn the software skills in the field of transportation engineering.

**Concrete structures:**

1. Design and detailing of R.C ( Residential building)
2. Design and detailing of frame structure
3. Design and detailing of underground structure

**The drawing includes**

Design and detailing of RC beams (Simple Beam/Lintel, 'T' Beam floor)  
 Design and detailing of RC slabs  
 Design and detailing of RC columns  
 Design and detailing of RC footings  
 Design and detailing of RC retaining walls

**Steel structures:**

1. Design and detailing of industrial structures

**The drawing includes**

Design and detailing of beam column connection  
 Design and detailing of column and gusset plate connection  
 Design and detailing of trusses  
 Design and detailing of beams  
 Design and detailing of columns  
 Design and detailing of simple beam to column connection

**REFERENCES:**

Sl.No	Title of Book	Author of Book	Publisher	Year of Publishing
1	Structural Design & Drawing – Reinforced Concrete and Steel	N. Krishna Raju	University Press, Chennai	2012

**VALUE ADDED COURSE****15BECE751****MINI PROJECT****0 0 2 1 100**

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**OBJECTIVE**

1. At the end of this course, the students shall be able to work individually 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 and also provide opportunity to utilise the creative ability and inference capability

# **SEMESTER VIII**

**OBJECTIVE**

1. To gain the knowledge of pre stresses concrete structures.
2. To Design the structures in pretension.
3. To Gain the knowledge of composite construction.
4. To Design and Analyse the bridge structures.
5. To Design the structures-based n IS codal specifications.
6. To Applications of pre stresses structures.

**COURSE OUTCOMES(COS):**

At the end of course, students will be able to

1. Gain the knowledge of pre stresses concrete structures.
2. Design the structures in pretension.
3. Gain the knowledge of composite construction.
4. Design and Analyse the bridge structures.
5. Design the structures-based n IS codal specifications.
6. Applications of pre stresses structures.

**UNIT-I Introduction – Theory and Behaviour:** Basic concepts – Advantages – Materials required – Systems and methods of prestressing – Analysis of sections – Stress concept – Strength concept – Load balancing concept – Effect of loading on the tensile stresses in tendons – Effect of tendon profile on deflections – Factors influencing deflections – Calculation of deflections – Short term and long term deflections - Losses of prestress – Estimation of crack width

**UNIT II****12**

**Design:** Flexural strength – Simplified procedures as per codes – strain compatibility method – Basic concepts in selection of cross section for bending – stress distribution in end block, Design of anchorage zone reinforcement – Limit state design criteria – Partial prestressing – Applications.

**UNIT III****12**

**Circular Prestressing:** Methods of circular prestressing – types classifications - merits and demerits – effects - Design of prestressed concrete tanks – Poles and sleepers –Applications.

**UNIT IV****12**

**Composite Construction :** Various types of composite construction - Analysis for stresses – Estimate for deflections – Flexural and shear strength of composite members

**UNIT V****12**

**Pre-Stressed Concrete Bridges :** General aspects –Methods of pre and post tensioning- pre-tensioned slabs- pre-tensioned bridge decks – Post tensioned pre-stressed bridge decks – Principles of design only.

**TOTAL HRS:60**

**TEXT BOOKS:**

Sl.No	Title of Book	Author of Book	Publisher	Year of Publishing
1	Prestressed concrete	Krishna Raju N	Tata McGraw Hill Company, New Delhi	2012
2.	IS 1343-2000 –Code of Practice For Prestressed Structures SP-16 Design Aids for IS 456-1978. IS 875-1987-Code of Practice for Design Loads			

**REFERENCES:**

Sl.No	Title of Book	Author of Book	Publisher	Year of Publishing
1	Modern prestressed concrete design	Ramaswamy G.S	Arnold Heinimen, New Delhi	2003
2	Design of prestressed concrete	Raymond Ian Gilbert and Neil Mickleborough	CRC Press, Pune	2004
3	Plant Cast precast and prestressed concrete – A design guide	David.A. Sheppard, William.R..and Philips	McGrawHill, New Delhi.	2003
4	Prestressed concrete	Mallic S.K. and Gupta A.P.,	Oxford and IBH publishing Co. Pvt. Ltd. New York	2010

**WEBSITES:**

- <http://www.icivilengineer.com>
- <http://www.engineeringcivil.com/>
- <http://www.aboutcivil.com/>
- <http://www.engineersdaily.com>
- <http://www.asce.org/>
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- <http://icevirtuallibrary.com/>
- <http://www.ice.org.uk/>
- <http://www.engineering-software.com/ce/>

**15BECE8E-- DEPARTMENT ELECTIVE -VI 3 0 0 3100**

**Semester-VII**

**TOTAL HRS:45**

**15BECE8E-- DEPARTMENT ELECTIVE -VII 3 0 0 3 100**

**Semester-VII**

**TOTAL HRS:45**



**15BECE891 PROJECT WORK & VIVA VOCE 0 0 24 12 300****COURSE OUTCOMES(COs):**

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.

**#OPEN ELECTIVE      3 0 0 3   100**

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**TOTAL HRS:45**

List of Department Elective Subjects

Fifth Semester

**15BECE5E01**

**HYDROLOGY**

**3 0 0 3 100**

**COURSE OBJECTIVES:**

1. To know the types of aquifers
2. To understand the surface and subsurface investigation in detail
3. To integrate the fundamental and basic knowledge of ground water movement
4. To understand the process of sea water intrusion and recharge
5. To introduce the different model studies
6. To visualize the occurrence and movement of groundwater.

**COURSE OUTCOMES**

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

1. Identify types of aquifers.
2. Carry out surface and subsurface investigation to locate groundwater.
3. Visualize the occurrence and movement of groundwater.
4. Select suitable type of ground water recharge.
5. Assess sea water intrusion and its control.
6. Understand the process of sea water intrusion and recharge

**UNIT I**

**9**

**Precipitation:** Hydrologic cycle – Types of precipitation – Forms of precipitation – Measurement of Rainfall – Spatial measurement methods – Temporal measurement methods – Frequency analysis of point rainfall – Intensity, duration, frequency relationship – Probable maximum precipitation.

**UNIT II**

**9**

**Abstraction From Precipitation:** Losses from precipitation – Evaporation process – Reservoir evaporation – Infiltration process – Infiltration capacity – Measurement of infiltration – Infiltration indices – Effective rainfall.

**UNIT III**

**9**

**Hydrographs:** Factors affecting Hydrograph – Base flow separation – Unit hydrograph – Derivation of unit hydrograph – S curve hydrograph – Unit hydrograph of different deviations - Synthetic Unit Hydrograph

**UNIT IV**

**9**

**Floods And Flood Routing:** Flood frequency studies – Recurrence interval – Gumbel's method – Flood routing – Reservoir flood routing – Muskingum's Channel Routing – Flood control

**UNIT V**

**9**

**Ground Water Hydrology:** Types of aquifers – Darcy's law – Dupuit's assumptions – Confined Aquifer – Unconfined Aquifer – Recuperation test – Transmissibility – Specific capacity – Pumping test – Steady flow analysis only.

**TOTAL HRS : 45**

**TEXT BOOKS:**

Sl.No	Title of Book	Author of Book	Publisher	Year of Publishing
1	Engineering Hydrology	Subramanya, K	Tata McGraw-Hill Publishing Co,Ltd.New Delhi	2000
2	Hydrology	Raghunath, H.M	Wiley Eastern Ltd, New York	2000

**REFERENCES:**

Sl.No	Title of Book	Author of Book	Publisher	Year of Publishing
1	Hydrology for Engineers	Chow, V.T. and Maidment	McGraw-Hill Inc., Ltd, New Delhi	2000
2	Hydrology	Singh, V.P	McGraw-Hill Inc.,Ltd. New Delhi	2000

**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/>

**OBJECTIVES:**

1. To introduce the student to the principles of Groundwater governing Equations and Characteristics of different aquifers,
2. To understand the techniques of development and management of groundwater.
3. To understand aquifer properties and its dynamics after the completion of the course.
4. It gives an exposure towards well design and practical problems of groundwater aquifers.
5. To understand the importance of artificial recharge and groundwater quality concepts.
6. To know the State of aquifers

**COURSE OUTCOMES**

1. Students will be able to understand aquifer properties and its dynamics after the completion of the course.
2. It gives an exposure towards well design and practical problems of groundwater aquifers.
3. Students will be able to understand the importance of artificial recharge and groundwater quality concepts.
4. Understand the techniques of development and management of groundwater.
5. Understand aquifer properties and its dynamics after the completion of the course.
6. Exposure towards well design and practical problems of groundwater aquifers.

**UNIT I****9**

**Fundamentals of Ground Water:** Introduction – Characteristic of Ground water – Distribution of water - ground water column –Permeability - Darcy's Law - Laboratory permeability test - Types of aquifers - Hydrogeological Cycle – water level fluctuations.

**UNIT II****9**

**Hydraulics of Flow:** Storage coefficient - Specific field - Heterogeneity and Anisotropy - Transmissivity - Governing equations of ground water flow - Steady state flow - Dupuit Forchheimer assumptions - Velocity potential - Flow nets

**UNIT III****9**

**Estimation Of Parameters:** Transmissivity and Storativity – Pumping test - Unsteady state flow - Thiess method - Jacob method - Image well theory – Effect of partial penetrations of wells - Collectors wells.

**UNIT IV****9**

**Ground Water Development:** Infiltration gallery - Conjunctive use - Artificial recharge -Safe yield - Yield test – Geophysical methods – Selection of pumps.

**UNIT V****9**

**Water Quality:** Ground water chemistry - Origin, movement and quality - Water quality standards - Saltwater intrusion –Environmental concern requirements.

**TOTAL HRS : 45**

**TEXT BOOKS:**

Sl.No	Title of Book	Author of Book	Publisher	Year of Publishing
1	Ground Water Hydrology	Raghunath H.M	Wiley Eastern Ltd., New York	2000
2	Ground Water Hydrology	Todd D.K	John Wiley and Sons, New York	2000

**REFERENCES:**

Sl.No	Title of Book	Author of Book	Publisher	Year of Publishing
1	Ground Water Resource Evaluation	Walton.C	McGraw-Hill Publications, New Delhi	2002

**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/>

**COURSE OBJECTIVES:**

1. To develop an understanding of cartography (earth-map relationship, map design, sources of data)
2. To expose the students to the integration of computers, automated surveying, remote sensing, GPS, and GIS for the cartographic process.
3. To get the sources of data's from maps.
4. To produce map.
5. To learnt the Nature and history of cartography
6. To learn about the Earth-Map relation

**COURSE OUTCOMES**

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

1. learnt the Nature and history of cartography
2. Earth-Map relation
3. Sources of data
4. Perception and design
5. Map production
6. Reproduction.

**UNIT I****9**

**Introduction:** Cartography today - Nature of Cartography - History of Cartography - Graticules – Cartometry – applications.

**UNIT II****9**

**Earth:** Earth-Map Relations - Basic Geodesy - Map Projections, Scale, Reference and Coordinate system - Transformation - Basic Transformation - Affin Transformation.

**UNIT III****9**

**Sources of Data:** Sources of data - Ground Survey and Positioning - Remote Sensing data collection - Census and sampling - data - Models for digital cartographic information, Map digitizing.

**UNIT IV****9**

**Perception and Design:** Cartographic design - Color theory and models - Color and pattern creation and specification - Color and pattern - Typography and lettering the map - Map compilation.

**UNIT V****9**

**Cartography Abstract:** Selection and Generalisation Principles - Symbolisation - Topographic and thematic maps - Map production and Reproduction - Map series.

**TOTAL HRS : 45**

**TEXT BOOKS**

Sl.No	Title of Book	Author of Book	Publisher	Year of Publishing
1	Basic Cartography for students and Technicians. Vol. I, II and III	Anson. R.W. and F.J. Ormeling	Elsevrrir Applied SciencePublishers 2nd Edition,Canada	2002

**REFERENCES:**

Sl.No	Title of Book	Author of Book	Publisher	Year of Publishing
1	Elements of Cartography, Sixth Edition	Arthur, H. Robinson Et al	John Wiley and Sons, New York	2001
2	Cartography: Visualisation and spatial data	Kraak M J and Ormeling F J	Prentice Hall, Canada	2013

**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/>



**OBJECTIVES:**

1. To understand the importance of transportation and characteristics of road transport
2. To know about the history of highway development, surveys and classification of roads
3. To study about the geometric design of highways
4. To study about traffic characteristics and design of intersections
5. To know about the pavement materials and design
6. To design flexible and rigid pavements as per IRC.

**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 cross section elements, sight distance, horizontal and vertical alignment.
3. Implement traffic studies, traffic regulations and control, and intersection design.
4. Determine the characteristics of pavement materials.
5. Design flexible and rigid pavements as per IRC.
6. Will gain the knowledge of horizontal and vertical curves.

**UNIT I****9**

Classification of roads-Highway alignment and surveys-Highway economics and financing.

Geometric design of High way-design speed-Cross sectional elements-super elevation-sight distances-Gradients-extra widening at curves.

**UNIT II****9**

Highway Materials-Aggregates and Bituminous Materials-Selection and testing-Construction methods for Earth roads,gravel,W.B.M, roads, Bituminous pavements and Cement concrete pavements

**UNIT III****9**

Traffic Engineering-Traffic volume-Speed and delay studies-Parking and accident studies-Traffic signs, marking and signals-road intersections-Traffic forecasting-Need-limitation-Types of traffic-Forecasts of traffic. Traffic Compositions-Future traffic estimates-Design Vehicle-Dimensions-Types of Design Vehicles.

**UNIT IV****9**

Nature of traffic problems in cities: Growth of towns-Growth of Traffic-Nature of Present Difficulties-Measures to meet problems-Need for Study-Land use and City Planning Controls-Restrain measures-Public transport-Promotion of public transport pedestriauisation-Staggy traffic hours.

Traffic and free environment-Effects of traffic on the environment-Noise-Air-Vibration-Degrading the aesthetic-Land consumption-Evaluation procedures-Environmental areas-computer application in traffic engineering-Public transport systems-Simulation, Traffic Planning and Computer application-situation in India.

Airports-their importance-spacing and position in relation to their zone-details of their location and layout-auxiliary and terminal buildings-their location and layout.

Runway lighting and drainage-Other accessories such as hangers and repair yards-airport zoning.

**TOTAL HRS : 45**

**TEXT BOOKS:**

Sl.No	Title of Book	Author of Book	Publisher	Year of Publishing
1	Highway Engineering	C.E.G.Justo and S.K. Khanna	New Chand & Bros.,Roorkee	2000
4	Highway Engineering	Rangwala	Charotar Publications,Pune	2002

**REFERENCE BOOKS:**

Sl.No	Title of Book	Author of Book	Publisher	Year of Publishing
1	Highway Engineering	L.Kadiyali	Nath Market, Naisarak Delhi-110 006	2002
2	Highway Engineering	Paul K Wright and Karen K. Dixon	Replica Press Limited, Kundli, Seventh Edition	2009
3	Transportation Engineering & Planning,	C.S. Papacostas, P.D.Prevedouros	Prentice Hall of India, Third Edition, New York	2001

**WEBSITES:**

1. <http://www.icivilengineer.com>
2. <http://www.engineeringcivil.com/>
3. <http://www.aboutcivil.com/>
4. <http://www.engineersdaily.com>
5. <http://www.asce.org/>
6. <http://www.cif.org/>
7. <http://icevirtuallibrary.com/>
8. <http://www.ice.org.uk/>
9. <http://www.engineering-software.com/ce/>

## **List of Department Elective Subjects**

### **Sixth Semester**

**15BECE6E01**

**HIGHWAY ENGINEERING**

**3 0 0 3 100**

#### **OBJECTIVES:**

1. To understand the importance of transportation and characteristics of road transport
2. To know about the history of highway development, surveys and classification of roads
3. To study about the geometric design of highways
4. To study about traffic characteristics and design of intersections
5. To know about the pavement materials and design
6. To select pavement materials and design

#### **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 cross section elements, sight distance, horizontal and vertical alignment.
3. Implement traffic studies, traffic regulations and control, and intersection design.
4. Determine the characteristics of pavement materials.
5. Design flexible and rigid pavements as per IRC.
6. The pavement materials and design

#### **UNIT I**

**9**

Highway Planning And Alignment: Macadam's method of Road Construction, Highway Development in India - Jayakar Committee Recommendations Twenty-year Road Development Plans, Concepts of On-going Highway Development Programmed at National Level- Indian Roads Congress, Highway Research Board, National Highway Authority of India, Ministry of Road Transport and Highways (MORTH) and Central Road Research Institute. Requirements of Ideal Alignment, Factors Controlling Highway Alignment -Engineering Surveys for Alignment - Classification and Cross Section of Urban and Rural Roads (IRC), Highway Cross Sectional Elements – Right of Way, Carriage Way, Camber, Kerbs, Shoulders and Footpaths [IRC Standards],

#### **UNIT II**

**9**

Geometric Design Of Highways: Design of Horizontal Alignments – Super elevation, Widening of Pavements on Horizontal Curves and Transition Curves [Derivation of Formulae and Problems]-Design of Vertical Alignments – Rolling, Limiting, Exceptional and Minimum Gradients, Summit and Valley Curves-Sight Distances - Factors affecting Sight Distances, PIEV theory, Stopping Sight Distance (SSD), Overtaking Sight Distance (OSD), Sight Distance at Intersections, Intermediate Sight Distance and Illumination Sight Distance [Derivations and Problems in SSD and OSD]-Geometric Design of Hill Roads [IRC Standards Only]

#### **UNIT III**

**9**

Design Of Rigid And Flexible Pavements: Rigid and Flexible Pavements- Components and their Functions-Design Principles of Flexible and Rigid Pavements, Factors affecting the Design of Pavements - ESWL, Climate, Sub-grade Soil and Traffic-Design Practice for Flexible Pavements [CBR method, IRC Method and Recommendations- Problems]-Design Practice for Rigid Pavements – [IRC Recommendations-Problems] – Joints

#### UNIT IV

9

Highway Materials And Construction Practice: Desirable Properties and Testing of Highway Materials: Soil – California Bearing Ratio Test, Field Density Test- Aggregate - Crushing, Abrasion, Impact Tests, Water absorption, Flakiness and Elongation indices and Stone polishing value test-Bitumen - Penetration, Ductility, Viscosity, Binder content and Softening point Tests.-Construction Practice - Water Bound Macadam Road, Bituminous Road and Cement Concrete Road [as per IRC and MORTH specifications]-Highway Drainage [IRC Recommendations]

#### UNIT V

9

Highway Maintenance: Types of defects in Flexible pavements – Surface defects, Cracks, Deformation, Disintegration – Symptoms, Causes and Treatments. Types of Pavement, Failures in Rigid Pavements – Scaling, Shrinkage, Warping, Structural Cracks Spalling of Joints and Mud Pumping – and Special Repairs. Pavement Evaluation – Pavement Surface Conditions and Structural Evaluation, Evaluation of pavement Failure and strengthening - Overlay design by Benkelman Beam Method [Procedure only], Principles of Highway Financing

**TOTAL HRS : 45**

#### TEXT BOOKS

Sl.No	Title of Book	Author of Book	Publisher	Year of Publishing
1	Highway Engineering	Khanna K and Justo C E G	Khanna Publishers, Roorkee	2009

#### REFERENCES

Sl.No	Title of Book	Author of Book	Publisher	Year of Publishing
1	Principles and Practice of Highway Engineering	Kadiyali L R	Khanna Technical Publications, Delhi.	2004

IRC Standards (IRC 37 - 2001 & IRC 58 -1998)

Bureau of Indian Standards (BIS) Publications on Highway Materials  
Specifications for Road and Bridges, MORTH (India)

#### WEBSITES

- <http://www.icivilengineer.com>
- <http://www.engineeringcivil.com/>
- <http://www.aboutcivil.com/>
- <http://www.engineersdaily.com>
- <http://www.asce.org/>

**OBJECTIVE**

1. To learn the basics of sewage composition and its characteristics
2. To depict the information about various sewage treatment processes
3. To provide the adequate information on various disposal standards for industrial effluents
4. To study the information about air pollution and its effects
5. To understand the knowledge about solid waste generation and disposal methods.
6. To gain knowledge information about various sewage treatment processes

**COURSE OUTCOMES**

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

1. Determine the sewage characteristics and design various sewage treatment plants.
2. Analyze the status of surface water and ground water quality and the remediation technologies.
3. understand the information about air pollution and its effects
4. gain knowledge information about various sewage treatment processes
5. Carry out municipal water and wastewater treatment system design and operation.
6. Manage hazardous wastes, risk assessment and treatment technologies apply environmental treatment technologies and design process.

**UNIT I INTRODUCTION****9**

Objectives of biological treatment – significance – Principles of aerobic and anaerobic treatment - kinetics of biological growth – Factors affecting growth – attached and suspended growth - Determination of Kinetic coefficients for organics removal – Biodegradability assessment –selection of process- reactors-batch-continuous type.

**UNIT II AEROBIC TREATMENT OF WASTEWATER****9**

Design of sewage treatment plant units –Activated Sludge process and variations, Sequencing Batch reactors, Membrane Biological Reactors-Trickling Filters-Bio Tower-RBC-Moving Bed Reactors-fluidized bed reactors, aerated lagoons, waste stabilization ponds – nutrient removal systems – natural treatment systems, constructed wet land – Disinfection – disposal options – reclamation and reuse – Flow charts, layout, PID, hydraulic profile, recent trends.

**UNIT III ANAEROBIC TREATMENT OF WASTEWATER****9**

Attached and suspended growth, Design of units – UASB, up flow filters, Fluidized beds MBR, septic tank and disposal – Nutrient removal systems – Flow chart, Layout and Hydraulic profile – Recent trends.

**UNIT IV SLUDGE TREATMENT AND DISPOSAL****9**

Design of sludge management facilities, sludge thickening, sludge digestion, biogas generation, sludge dewatering (mechanical and gravity) Layout, PID, hydraulics profile – upgrading existing plants – ultimate residue disposal – recent advances.

## UNIT V CONSTRUCTION OPERATIONS AND MAINTENANCE ASPECTS

9

Construction and Operational Maintenance problems – Trouble shooting – Planning, Organizing and Controlling of plant operations – capacity building - Retrofitting Case studies – sewage treatment plants – sludge management facilities.

**TOTAL HRS : 45**

### TEXT BOOKS:

Name of the Book	Author Name	Publisher	Year
Wastewater Treatment for Pollution Control	Arceivala, S.J	TMH, New Delhi, Second Edition	2000
Manual on “Sewerage and Sewage Treatment”	CPHEEO	Ministry of Urban Development, Government of India, New Delhi	2002

### REFERENCES:

Name of the Book	Author Name	Publisher	Year
Wastewater Engineering – Treatment and Reuse	Metcalf & Eddy, INC,	Fourth Edition, Tata Mc Graw-Hill Publishing Company Limited, New Delhi	2003
Hand Book of Water and Wastewater Treatment Plant operations	F.R. Spellman	CRC Press, New York	2009
Fundamentals of Water Treatment Process	David Hendricks	CRC Press, New York	2011

### WEBSITES:

- [www.springer.com](http://www.springer.com)
- [www.nptel.com](http://www.nptel.com)
- [www.wikipedia.com](http://www.wikipedia.com)
- [www.civil.ubc.ca](http://www.civil.ubc.ca)
- [www.aboutcivil.com](http://www.aboutcivil.com)

**COURSE OBJECTIVES:**

- At the end of the course student is expected to identify the problematic soil and suitable suggest remedial measures
- To understand the different problematic soils and effect of ground improvement techniques.
- To describe the seepage analysis and suitable dewatering systems for the particular soil conditions.
- To express the concept of compaction efforts on ground improvement and their installation and working principles.
- Describe the load transfer mechanism and effect of geo textiles reinforcements in ground improvement.
- Describe the various stabilization methods for the different types of problematic soils.

**COURSE OUTCOMES**

1. Student will be in a position to identify and evaluate the deficiencies if any in the deposits of a project area.
2. Capable of providing alternate methods to improve its character suitable to the project, so that the structures built will be stable and serve.
3. Describe the dewatering systems for different soil conditions and their effect.
4. Express the working principles of different compaction methods on improving weak deposits.
5. Express the design of geo textiles reinforcements for ground improvement.
6. Express the soil stabilization methods for the problematic soils.

**UNIT I****9**

**Introduction:** Role of ground improvement in foundation engineering - methods of ground improvement – Geotechnical problems in alluvial, laterite and black cotton soils -Selection of suitable ground improvement techniques based on soil condition.

**UNIT II****9**

**Drainage and Dewatering:** Drainage techniques - Well points - Vacuum and electro osmotic methods - Seepage analysis for two-dimensional flow-fully and partially penetrating slots in homogenous deposits (Simple cases only).

**UNIT III****9**

**Insitu Treatment of Cohesion less and Cohesive Soils :** Insitu densification of cohesionless and consolidation of cohesive soils -Dynamic compaction and consolidation – Vibro flotation - Sand pile

compaction - Preloading with sand drains and fabric drains – Stone columns – Lime piles - Installation techniques only - relative merits of various methods and their limitations.

#### UNIT IV

9

**Earth Reinforcement:** Concept of reinforcement - Types of reinforcement material - Applications of reinforced earth – use of Geotextiles for filtration, drainage and separation in road and other works.

#### UNIT V

9

**Grout Techniques:** Types of grouts - Grouting equipment and machinery - Injection methods - Grout monitoring – Stabilisation with cement, lime and chemicals - Stabilisation of expansive soils.

**TOTAL HRS : 45**

#### TEXT BOOKS:

Sl.No	Title of Book	Author of Book	Publisher	Year of Publishing
1	Ground Improvement Techniques	Purushothama Raj, P	Tata McGraw-Hill Publishing Company, New Delhi	2012

#### REFERENCES:

Sl.No	Title of Book	Author of Book	Publisher	Year of Publishing
1	Ground Improvement	Michael P. Moseley, Klaus Kirsch	Blockie Academic and Professional, Chapman and Hall, Glasgow	2004
2	Design with Geosynthetics, (3rd Edition)	Koerner, R.M.	Prentice Hall, New Jersey	2002
3	Soil Reinforcement with Geotextiles	Khedkar, M. S., and Mandal, J. N.	CIRIA special publication, London	2009
4	Construction and Geotechnical Methods in Foundation Engineering	Koerner R.M	McGraw-Hill, New Delhi	2000

#### 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/>



**OBJECTIVES:**

1. To understand the basic types of irrigation, irrigation standards and crop water assessment
2. To study the different aspects of design of hydraulic structures
3. To provide knowledge on various hydraulic structures such as energy dissipaters, head and cross regulators, canal falls and structures involved in cross drainage works
4. To understand the analysis of seepage and hydraulic jump
5. To design different types of dams.
6. To understand the different types of cross drainage works

**Course outcomes**

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

1. Find the crop water requirement for various crops in the command area.
2. Understand the complete design of Dams and channel systems.
3. Understand the different types of cross drainage works.
4. Design various river training methods.
5. Gained Knowledge on various hydraulic structures such as energy dissipaters, head and cross regulators
6. design different types of dams

**UNIT I****9**

**Introduction:** Irrigation – Need and mode of irrigation – Merits and demerits of irrigation – environmental impacts of irrigation-History of irrigation development in India-Classification of irrigation projects Crop and crop seasons – consumptive use of water – Duty – Factors affecting duty – Irrigation efficiencies – Planning and Development of irrigation projects.

**UNIT II****9**

**Irrigation Methods:** Requirement of an irrigation method- sub surface irrigation-surface irrigation-burried irrigation-seepage line irrigation- Canal irrigation – Lift irrigation – Tank irrigation – Flooding methods – Merits and demerits – Sprinkler irrigation – Drip irrigation – barrow pit method-participatory approach – water user associations- social aspects in water pricing .

**UNIT III****9**

**Diversion And Impounding Structures:** Weirs – elementary profile of a weir – weirs on pervious foundations - Types of impounding structures - Tanks, Sluices and Weirs – Gravity dams – Earth dams – Arch dams – Spillways – Factors affecting location and type of dams – Forces on a dam – Hydraulic design of dams.

**UNIT IV****9**

**Canal Irrigation:** Design of irrigation channels - Alignment of canals – Classification of canals – Typical capacity – statement of roughness coefficient- Maximum and minimum permissible velocity - Canal drops – side slopes of banks- side slopes of canal- Hydraulic design of drops – Cross drainage works – Hydraulic design of cross drainage works – Canal Head works – Canal regulators – River Training works.

**UNIT V****9**

**Irrigation Water Management:** Need for optimisation of water use – Minimizing irrigation water losses – On farm development works – Percolation ponds – Participatory irrigation management – Water users associations – Changing paradigms in water management – Performance evaluation. Selection of site for hydropower plant- essential data for waterpower studies- requirement of water for hydel power

**TOTAL HRS: 45****TEXT BOOKS:**

Sl.No	Title of Book	Author of Book	Publisher	Year of Publishing
1	Irrigation Engineering	Asawa, G.L	New Age International Publishers, New Delhi	2012
2	Irrigation Engineering	Sharma R.K., and Sharma T.K	S. Chand and company, New Delhi	2011
3	Irrigation Engineering	Gupta, B.L, & Amir Gupta	Satya Praheshan, New Delhi	2011

**REFERENCES:**

Sl.No	Title of Book	Author of Book	Publisher	Year of Publishing
1	Irrigation Water Management (Principles & Practices)	Dilip Kumar Majumdar	Prentice Hall of India (P), Ltd, New york	2004
2	Irrigation Engineering	Basak, N.N	Tata McGraw-Hill Publishing Co, New Delhi	2009
3	Irrigation Engineering	Garg, S.K.,	Tata McGraw-Hill Publishing Co, New Delhi	2002

**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/>

**COURSE OBJECTIVES:**

1. To introduce the basics of Earthquake Engineering
2. To introduce the engineering seismology, building geometrics & characteristics, structural irregularities,
3. To introduce tips on earthquake engineering - do's and don'ts
4. To introduce cyclic loading behaviour of RC, steel and pre-stressed concrete elements
5. To discuss code provisions and their application on different types of structures
6. To apply codal provisions on different types of structures

**COURSE OUTCOMES**

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

1. Apply the basics of Earthquake Engineering
2. Demonstrate the dynamics of structural system under earthquake load
3. Analyze the influence of the structural / geometrical design in building characteristics
4. Demonstrate the cyclic loading behaviour of RC steel and pre-stressed concrete elements
5. Apply codal provisions on different types of structures.
6. Cyclic loading behaviour of RC, steel and pre-stressed concrete elements

**UNIT I****9**

Static Loading and Dynamic Loading :Difference between static loading and dynamic loading – Nature of dynamic loads – Wind, Earthquake and Impact Loads – Damping – Viscous and structural damping – single degree of freedom (SDOF) Systems – Formulation of equation of motion – Newton's Law and D'Alembert's principles – Examples of SDOF modeling.

**UNIT II****9**

**Vibration Response :** Free vibration response of SDOF system – Response of undamped and damped SDOF system to harmonic excitation – characteristic of resonance – Response to impulse and an arbitrary forcing function – Duhamel Integral formulation.

**UNIT III****9**

**MDOF systems:** MDOF systems – examples – Lumped parameter model – Formulation of equation of motion – Free vibration of MDOF systems as Eigen value problem – concept of mode shapes and natural frequencies – 2 DOF example – orthogonal properties of normal modes.

**UNIT IV****9**

**Harmonic Excitation.** :Harmonic excitation of 2 DOF system – Principle of mode superposition (principle only) for dynamic analysis – vibration isolation – vibration measuring instruments.

**UNIT V****9**

**Wind and Earthquake on Structures :** Effect of wind and earthquake on structures – Principles of aseismic design – Methods of vibration control – codal provisions for design for wind and earthquake (explanation of provisions only – no design)

**TOTAL HRS : 45****TEXT BOOKS:**

Sl.No	Title of Book	Author of Book	Publisher	Year of Publishing
1	Structural Dynamics Theory and Computation	Mario Paz	Van Nostrand Reinhold, New York	2009
2	Dynamics of Structures Theory and Applications to Earthquake Engineering	Anil K.Chopra	Pearson Education, Gurgaon.	2003

**REFERENCES:**

Sl.No	Title of Book	Author of Book	Publisher	Year of Publishing
1	Theory of Vibration and Applications	Thomson W.T	Prentice Hall of India, New York	2011
2	Dynamics of Structures	Clough R.W. and Penzien, J	McGraw-Hill, New Delhi	2009
3	Structural Dynamics – An Introduction to Computer Methods	Craig R.R. Jr	John Wiley and Sons, New York	2008

**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/>

**COURSE OBJECTIVES:**

1. To identify and quantify the hydrological data inputs necessary for various design applications in the field of water resources.
2. To introduce to the quantitative relationship that explains the understanding of hydrological processes in answering scientific and water-resources-management questions.
3. To know about urban hydrological cycle
4. To gather knowledge of urban water resources management models
5. To find the different and Effective urban water user organizations
6. To get the knowledge of Operation and maintenance of hydraulic structures.

**COURSE OUTCOMES**

Students will be able to understand

1. About urban hydrological cycle,
2. urban water resources management models,
3. urban storm water management,
4. Effective urban water user organizations,
5. Operation and maintenance of hydraulic structures.
6. Quantify the hydrological data inputs necessary for various design applications in the field of water resources.

**UNIT IURBAN HYDROLOGIC CYCLE****9**

Water in the urban eco-system – Urban Water Resources – Major problems – Urban hydrological cycle – Storm water management objectives and limitations – Storm water policies – Feasibility consideration.

**UNIT II URBAN WATER RESOURCES MANAGEMENT MODELS****9**

Types of models – Physically based – conceptual or unit hydrograph based – Urban surface runoff models – Management models for flow rate and volume control rate – Quality models.

**UNIT IIIURBAN STORM WATER MANAGEMENT****9**

Storm water management practices (Structural and Non-structural Management measures) – Detention and retention concepts – Modelling concept – Types of storage – Magnitude of storage – Hydraulic analysis and design guidelines – Flow and storage capacity of urban components – Temple tanks.

**UNIT IV MASTER PLANS****9**

Planning and organizational aspects – Inter dependency of planning and implementation of goals and measures – Socio – economics financial aspects – Potential costs and benefit measures – Measures of urban drainage and flood control benefits – Effective urban water user organizations.

**UNIT V OPERATION AND MAINTENANCE****9**

General approaches to operations and maintenance – Complexity of operations and need for diagnostic analysis – Operation and maintenance in urban water system – Maintenance Management System – Inventories and conditions assessment – Social awareness and involvement.

**TOTAL HRS : 45**

**TEXT BOOKS:**

<b>Name of the Book</b>	<b>Author Name</b>	<b>Publisher</b>	<b>Year</b>
Role of Water in Urban Ecology	Hengeveld, H. and C. De Vocht	John Wiley and sons, New York	2000

**REFERENCES:**

<b>Name of the Book</b>	<b>Author Name</b>	<b>Publisher</b>	<b>Year</b>
Storm Water Management	Martin, P. Wanelista and Yousef, A. Yousef	John Wiley and sons, New York	2000
Urban Water Infrastructure Planning, Management and Operations	Neil S. Grigg	John Wiley and Sons, New York	2002
Storm Water Modelling	Overtens D.E. and Meadows M.E	Academic Press, New York	2001

**WEB SITES:**

1. <a href="http://www.springer.com">www.springer.com</a>
2. <a href="http://www.nptel.com">www.nptel.com</a>
3. <a href="http://www.wikipedia.com">www.wikipedia.com</a>
4. <a href="http://www.civil.ubc.ca">www.civil.ubc.ca</a>
5. <a href="http://www.aboutcivil.com">www.aboutcivil.com</a>

## **15BECE6E07 REMOTE SENSING TECHNIQUES AND APPLICATIONS 3 0 0 3 100**

### **COURSE OBJECTIVES:**

1. To gain a sound fundamental understanding of the GIS and remote sensing technologies
2. To understand the basic principles underlying the GIS/model-based management of water resources and environment.
3. To become familiar with the GIS-based analytical and problem-solving techniques for sustainable planning and management of water resources and environmental problems.
4. Different types of remotely sensed images and data available for water resource applications.
5. To apply the GIS-based analytical and problem-solving techniques for sustainable planning and management of water resources and environmental problems.
6. To develop a project report and can develop Water Resource Information Systems (WRIS) for regional and basin scale.

### **COURSE OUTCOMES**

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

1. Develop fundamental understanding of the GIS and remote sensing technologies
2. Understand the basic principles underlying the GIS based management of water resources and environment.
3. Apply the GIS-based analytical and problem-solving techniques for sustainable planning and management of water resources and environmental problems.
4. Understand the types of remotely sensed images and data available for water resource applications.
5. Develop a project report and can develop Water Resource Information Systems (WRIS) for regional and basin scale.
6. Understand the basic principles underlying the GIS/model-based management of water resources and environment.

### **UNIT I**

**9**

**Introduction:** Definition – Physics of remote sensing – electromagnetic radiation (EMR) – remote sensing windows – interaction of EMR with atmosphere, earth surface, soil, water and vegetation – platform and sensor – image interpretation.

### **UNIT II**

**9**

**Land Use Studies:** Definition of land use – land use / land cover classification – schemes and levels of classification systems with RS data – land use mapping – change detection – urban land use planning, site suitability analysis, transportation planning.

### UNIT III

9

**Water Resources :**Area assessment of surface water bodies – Capacity survey of water bodies – mapping of snow-covered areas – flood risk zone mapping – identification of groundwater potential zones, recharge areas – droughts-definition-drought assessment and management.

### UNIT IV

9

**Agriculture, Soil And Forestry:** Crop inventory mapping – production estimation – command area monitoring – soil mapping – crop stress detection - estimation of soil erosion – forest types and density mapping – forest fire risk zone mapping.

### UNIT V

9

**Earth Science:** Lithology – lithological mapping – structural mapping – Geomorphology – nature and type of landforms – identification – use of remote sensing data for land slides – targeting mineral resources – Engineering geology and Environmental geology.

**TOTAL HRS : 45**

#### TEXT BOOKS:

Sl.No	Title of Book	Author of Book	Publisher	Year of Publishing
1	Remote sensing methods and application	Michael Hord, R	John Wiley and Sons, New York	2004
2	Remote sensing principles and interpretation	Sabins, F.F.Jr	W.H.Freeman &Co.New York	2007

#### REFERENCES:

Sl.No	Title of Book	Author of Book	Publisher	Year of Publishing
1	Remote Sensing and Image interpretation	Lillesand, T.M and Kicter R.W	John Willey and sons, inc. New York	2002
2	Application of Remote sensing in Agriculture	Steven, M.D, and Cllark, J.A	Butterworths, London	1990
3	Manual for Forest mapping and Damage detection using satellite data- Space Applications Centre,1990, Report No.IRS-UP/SAC/FMDD/TN/16/90,1990			
4	Manual of Remote Sensing Vol. II. American Society of Photogrammetry			



## **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/>

**COURSE OBJECTIVES:**

The students will

1. To develop an understanding of the classification, sources and effects of pollutants
2. To understand the fundamentals of meteorology
3. To study the principles and equipment description of control technologies
4. To review the sources and control of soil pollution.
5. To understand the sources and effects of key types of environmental pollutants
6. To have insight into fundamentals of meteorology

**COURSE OUTCOMES**

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

1. Understand the sources and effects of key types of environmental pollutants
2. Have insight into fundamentals of meteorology
3. Appreciate different pollution control strategies
4. Understand indoor air pollution and be aware of the control technologies
5. Develop an understanding of the classification, sources and effects of pollutants
6. Understand the fundamentals of meteorology

**UNIT I PHYSICS AND CHEMISTRY OF SOIL****9**

Soil formation – composition – soil fabric – mass-volume relationship – Index properties and soil classification – hydraulic and consolidation characteristics – Chemical properties – soil pH – Surface charge and point of zero charge – Anion and Cation exchange capacity of clays– Specific surface area-bonding in clays-soil pollution-factors governing soil-pollutant interaction.

**UNIT II INORGANIC AND ORGANIC GEOCHEMISTRY****9**

Inorganic geochemistry – Metal contamination – Distribution of metals in soils – Geochemical processes controlling the distribution of metals in soils – Chemical analysis of metal in soil – Organic geochemistry – Organic contamination – Distribution of NAPLs in soils – Process controlling the distribution of NAPLs in soil – Chemical analysis of NAPLs in soils.

**UNIT III CONTAMINANT FATE AND TRANSPORT IN SOIL****9**

Transport processes – advection – diffusion – dispersion – chemical mass transfer processes – sorption and desorption – precipitation and dissolution – oxidation and reduction – acid base reaction – complexation – ion exchange – volatilization – hydrolysis – biological process-microbial transformation of heavy metals.

**UNIT IV GROUND IMPROVEMENT TECHNIQUES IN WASTE MANAGEMENT****9**

Role of Ground Improvement-Drainage and Ground Water Lowering-Electro osmotic Methods- Diaphragm walls-Thermal and Freezing methods - Insitu Densification - Deep Compaction -Dynamic Compaction -Blasting Sand piles pre-loading with sand drains-Stone Columns Lime piles- Earth reinforcement -rock bolts Cables and guniting Geotextiles as reinforcement Filtration. Drainage and Erosion control.

## UNIT V SOIL REMEDIATION TECHNOLOGIES

9

Contaminated site characterization – Containment – Soil vapour extraction - Soil washing – Solidification and Stabilization – Electro-kinetic remediation – Thermal desorption – Vittrification – In-situ and Ex-situ Bioremediation – Phytoremediation – Soil fracturing – Biostimulation – Bioaugmentation –Chemical oxidation and reduction.

**TOTAL HRS : 45**

### TEXT BOOKS:

Sl.No	Title of Book	Author of Book	Publisher	Year of Publishing
1	An Introduction to the Environmental Physics of Soil, Water and Water Sheds	Calvin Rose	Cambridge University Press, London	2004
2	Reclamation of Contaminated Land	Paul Nathanail C. and Paul Bardos R	John Wiley & Sons Limited, New York	2004

### REFERENCES:

Name of the Book	Author Name	Publisher	Year
Geo-Environmental Engineering : Site Remediation, Water Contaminant and Emerging Water Management Technologies	Hari D. Sharma and Krishna R. Reddy	John Wiley & Sons Limited, New York	2004
Groundwater Geochemistry : Fundamentals and Applications to Contamination	William J. Deutsch	Lewis Publishers, London.	2002

### WEB SITES:

1. [www.springer.com](http://www.springer.com)
2. [www.nptel.com](http://www.nptel.com)
3. [www.wikipedia.com](http://www.wikipedia.com)
4. [www.civil.ubc.ca](http://www.civil.ubc.ca)
5. [www.aboutcivil.com](http://www.aboutcivil.com)

**COURSE OBJECTIVES:**

1. To expose the students to Railway planning, design, construction and maintenance and planning and design principles of Airports and Harbours.
2. Understand the history and development, role of railways, railway planning and development based on essential criteria's.
3. Learn different types of structural components, engineering properties of the materials, to calculate the material quantities required for construction
4. Understand various aspects of geometric elements, points and crossings, significance of maintenance of tracks.
5. Design and plan airport layout, design facilities required for runway, taxiway and impart knowledge about visual aids
6. Apply design features of tunnels, harbours, dock and necessary navigational aids; also expose them to various methods of tunneling and tunnel accessories.

**COURSE OUTCOMES**

1. At the end of this course the students should have learnt the Railway planning and design, railway track construction, Maintenance and operation, Airport planning and designing,
2. Airport layout, visual aids and air traffic control, Harbour engineering and other modes of transport.
3. acquires capability of choosing alignment and also design geometric aspects of railway system, runway and taxiway.
4. Suggest and estimate the material quantity required for laying a railway track and also will be able to determine the hauling capacity of a locomotive.
5. Develop layout plan of airport, harbor, dock and will be able relate the gained knowledge to identify required type of visual and/or navigational aids for the same.

Apply the knowledge gained to conduct surveying, understand the tunneling activities.

**UNIT I****9**

**Railway Planning And Design:** Role of Indian Railways in National Development - Engineering Surveys for Track Alignment – Obligatory points - Permanent Way, its Components and Functions of each Component: Rails - Types of Rails, Rail Fastenings, Concept of Gauges, Coning of Wheels, Creeps and kinks Sleepers-Density- Ballasts - Materials, Ballast less- Tracks -Geometric Design of Railway Tracks – Gradients and Grade Compensation, Super-Elevation, Widening of Gauges in Curves, Transition Curves, Horizontal and Vertical Curves (Derivations of Formulae and Problems)

**UNIT II****9**

**Railway Track Construction, Maintenance And Operation:** Points and Crossings - Design of Turnouts, Working Principle -Signaling, Interlocking and Track Circuiting-Construction & Maintenance – Conventional, Modern methods and Materials, Track Drainage-Track Modernization– Automated maintenance and upgrading, Technologies, Re-laying of Track -Lay outs of Railway Stations and Yards, Rolling Stock, Tractive Power, Track Resistance, Level Crossings

**UNIT III****9**

**Airport Planning And Design:** Advantages and Limitations of Air Transport, Components of Airports- Airport Planning – Air traffic potential, Site Selection, Design of Components- Institutional arrangements- Runway Design- Orientation, Cross wind Component, Wind rose Diagram (Problems), Geometric Design and Corrections for Gradients (Problems), Drainage-Taxiway Design – Geometric

#### UNIT IV

9

**Airport Layouts, Visual Aids, And Air Traffic Control:** Airport Layouts – Apron, Terminal Building, Hangars, Motor Vehicle Parking Area and Circulation Pattern, Case studies of Airport Layouts-Airport Buildings – Primary functions, Planning Concept, Principles of Passenger Flow, Passenger Facilities -Visual Aids – Runway and Taxiway Markings, Wind Direction Indicators, Runway and Taxiway Lightings-Air Traffic Control – Basic Actions, Air Traffic Control Network-Helipads, Hangars, Service Equipments.

#### UNIT V

9

**Harbour Engineering & Other Modes Of Transport:** Harbours, Ports, Docks, Tides and Waves, Littoral Drift, Sounding, Area, Depth, Satellite Ports-Requirements and Classification of Harbours– Speed of water, Dredging, Range of Tides, Waves and Tidal Currents, Soundings, Anchoring Grounds-Winds & Storms, Position and Size of Shoals-Shore Considerations- Coast Lines- Dry and Wet Docks,, Planning and Layouts- Position of Light Houses, Navigating -Terminal Facilities – Port Buildings, Warehouse, Transit Sheds -Coastal Structures- Piers, Breakwaters Spring Fenders-Coastal Shipping, Inland Water Transport and Container Transportation-Pipe Ways, Rope Ways,

**TOTAL HRS : 45**

#### TEXT BOOKS

Sl.No	Title of Book	Author of Book	Publisher	Year of Publishing
1	A Course in Railway Engineering	Saxena Subhash C and Satyapal Arora	Dhanpat Rai and Sons, Delhi	2000
2	Airport Planning and Design	Khanna S K, Arora M G and Jain S S	Nemchand and Brothers, Roorkee	2002
3	A Course in Docks and Harbour Engineering	S P Bindra, 1993	Dhanpat Rai and Sons, Delhi	2002

#### REFERENCES

Sl.No	Title of Book	Author of Book	Publisher	Year of Publishing
1	Railway Engineering	Rangwala	Charotar Publishing House, Gujarat	1995
2	Airport Engineering	Rangwala	Charotar Publishing House, Gujarat	1996

#### WEB SITES:

1. [www.springer.com](http://www.springer.com)
2. [www.nptel.com](http://www.nptel.com)
3. [www.wikipedia.com](http://www.wikipedia.com)
4. [www.civil.ubc.ca](http://www.civil.ubc.ca)
5. [www.aboutcivil.com](http://www.aboutcivil.com)

## List of Department Elective Subjects

### Seventh Semester

**15BECE7E01**

**BRIDGE STRUCTURES**

**3 0 0 3 100**

#### **COURSE OBJECTIVES:**

1. To develop an understanding of basic concepts in bridge engineering like components, classification, importance, investigation of bridges and loading conditions.
2. To study the design of Culvert, Foot Bridge, Slab Bridge, T-beam Bridge and Box Culvert using IRC.
3. To study the design of various sub-structures like piers, abutments, foundations
4. To study the importance of the bearing and joints in construction of the bridge.
5. To select the suitable site and type of the bridge.
6. To prepare a detailed project report for the construction of bridge giving hydraulic particulars of the river and soil details

#### **COURSE OUTCOMES**

Upon completion of this course, the student will be able to:

1. Prepare a detailed project report for the construction of bridge giving hydraulic particulars of the river and soil details
2. Select the suitable site and type of the bridge.
3. Design various types of bridges like Culvert, Slab Bridge and T-beam Bridge using provisions of IRC.
4. Design pier, abutment, foundations, bearing and detailing of joints.
5. Design of Culvert, Foot Bridge, Slab Bridge, T-beam Bridge and Box Culvert using IRC.
6. understanding of basic concepts in bridge engineering like components, classification, importance, investigation of bridges and loading conditions

#### **UNIT I**

**9Introduction:** History of Bridges - Components of a Bridge and its definitions- Classification of Road Bridges - Selection of Site and Initial Decision Process - Survey and Alignment; Geotechnical Investigations and Interpretations. River Bridge: Selection of Bridge site and planning - Collection of Bridge design data - Hydrological calculation Road Bridges - IRC codes - Standard Loading for Bridge Design - Influence lines for statically determinate structures - I.L. for statically indeterminate structures - Transverse distribution of Live loads among deck longitudinal - Load combinations for different working state and limit state designs Railway Bridges: Loadings for Railway Bridges; Railroad data. Pre-design considerations-Railroad vs. Highway bridges

#### **UNIT II**

**9Steel Bridges** : Design of through type steel highway bridges for IRC loading - Design of stringers, cross girders and main girders- Design of deck type plate girder railway bridges for railway loading- Design of main girders

#### **UNIT III**

**9Reinforced Concrete Slab Bridges** : Design of solid slab bridges for IRC loading - Pigeaud's curves- Design of panel and cantilever for IRC loading

#### **UNIT IV**

**9Reinforced Concrete Girder Bridges** : Courbon's theory – Design of Tee beam Girder bridges - Deck slab -Main girder-Cross girder - Design of PSC bridge.

**Substructure, bearings and deck joints, parapets and railings**

Substructure - Pier; Abutment - Wing walls- Importance of Soil-Structure Interaction - Types of foundations - Open foundation- Pile foundation- Well foundation- Simply supported bridge- Continuous Bridge - Bearings and Deck Joints - Different types of bridge bearings and expansion joints - Parapets and Railings for Highway Bridges

**TOTAL HRS : 45****TEXT BOOKS:**

Sl.No	Title of Book	Author of Book	Publisher	Year of Publishing
1	Essentials of Bridge Engineering	Johnson Victor D	Oxford and IBH Publishing Co. New York	2010
2	Design of Bridges	Krishna raju N	Oxford and IBH Publishing Co. New York	2010

**REFERENCES:**

Sl.No	Title of Book	Author of Book	Publisher	Year of Publishing
1	Bridge Engineering	Phatak D.R	Satya Prakashan, New Delhi	2010
2	Bridge Engineering	Ponnuswamy S	Tata McGraw-Hill, New Delhi	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/>

**COURSE OBJECTIVES:**

1. To learnt the general planning consideration of various load factors, vertical structure
2. To plan High rise building structure and their behavior
3. To analysis and design and also other high rise building structure.
4. To design aspects and analysis methodologies of tall buildings will be introduced.
5. To know the stability analysis of tall buildings is another important objective of this course.
6. To gain knowledge of high raised buildings.

**COURSE OUTCOMES(COS):**

1. Learnt the general planning consideration of various load factors, vertical structure
2. Plan High rise building structure and their behavior
3. Analysis and design and also other high rise building structure.
4. Design aspects and analysis methodologies of tall buildings will be introduced.
5. stability analysis of tall buildings is another important objective of this course.
6. Gain knowledge of high raised buildings.

**UNIT I****9**

**Introduction:** The Tall Building in the Urban Context - The Tall Building and its Support Structure - Development of High Rise Building Structures - General Planning Considerations. Dead Loads - Live Loads-Construction Loads -Snow, Rain, and Ice Loads - Wind Loads-Seismic Loading –Water and Earth Pressure Loads - Loads - Loads Due to Restrained Volume Changes of Material - Impact and Dynamic Loads - Blast Loads -Combination of Loads.

**UNIT II****9**

**The Vertical Structure Plane:** Dispersion of Vertical Forces- Dispersion of Lateral Forces - Optimum Ground Level Space - Shear Wall Arrangement - Behaviour of Shear Walls under Lateral Loading. The Floor Structure or Horizontal Building Plane Floor Framing Systems-Horizontal Bracing- Composite Floor Systems The High - Rise Building as related to assemblage Kits Skeleton Frame Systems - Load Bearing Wall Panel Systems - Panel – Frame Systems - Multistory Box Systems.

**UNIT III****9**

**Common High-Rise Building Structures and Their Behavior Under Load:** The Bearing Wall Structure- The Shear Core Structure - Rigid Frame Systems- The Wall - Beam Structure: Interspatial and Staggered Truss Systems - Frame - Shear Wall Building Systems - Flat Slab Building Structures - Shear Truss - Frame Interaction System with Rigid - Belt Trusses - Tubular Systems-Composite Buildings - Comparison of High - Rise Structural Systems Other Design Approaches Controlling Building Drift Efficient Building Forms - The Counteracting Force or Dynamic Response.

**UNIT IV****9**

**Approximate Structural Analysis and Design of Buildings:** Approximate Analysis of Bearing Wall Buildings The Cross Wall Structure - The Long Wall Structure The Rigid Frame Structure Approximate Analysis for Vertical Loading - Approximate Analysis for Lateral Loading - Approximate



## UNIT V

9

**Other High-Rise Building Structure:** Deep - Beam Systems -High-Rise Suspension Systems - Pneumatic High -Rise Buildings - Space Frame Applied to High - Rise Buildings - Capsule Architecture.

**TOTAL HRS : 45**

### TEXT BOOKS:

Sl.No	Title of Book	Author of Book	Publisher	Year of Publishing
1	High - rise building Structures	Wolfgang Schueller	John Wiley and Sons, New York	2001
2	Tall Building Structures , Analysis and Design	Bryan Stafford Smith and Alex Coull	John Wiley and Sons, Inc, New York	2005

### REFERENCES:

Sl.No	Title of Book	Author of Book	Publisher	Year of Publishing
1	Tall Buildings	Coull, A. and Smith, Stafford, B	Pergamon Press, London,	2006
2	Structural Concepts and Systems for Architects and Engineers	Lin T.Y. and Burry D.Stotes	John Wiley, New York	2008
3	Advances in Tall Buildings	Lynn S.Beedle	CBS Publishers and Distributors, Delhi	2010
4	Structural Analysis and Design of Tall Buildings	Taranath.B.S.,	Mc Graw Hill, New Delhi.	2010

### 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/>

**COURSE OBJECTIVES:**

1. To impart knowledge to students on modular construction, industrialized construction
2. To design of prefabricated elements and construction methods.
3. To know the different components of Prefabricated structures.
4. To design joint flexibility.
5. To understand the assembling and dismantling of prefabricated components
6. To understand the joining techniques in prefabrication

**COURSE OUTCOMES**

1. The student shall be able to design some of the prefabricated elements
2. The procedure of prefabrication
3. Have the knowledge of the construction methods in using these elements.
4. Design joint flexibility.
5. Familiarize with joining techniques used for prefabrication.
6. Abnormal loads which are hazardous to the prefabricated structures.

**UNIT I****9**

**Introduction:** Need for prefabrication – Principles – Materials – Modular coordination – Standardization – Systems – Production – Transportation – Erection.

**UNIT II****9**

**Prefabricated Components:** Behavior of structural components – Large panel constructions – Construction of roof and floor slabs – Wall panels – Columns – Shear walls

**UNIT III****9**

**Design Principles:** Disuniting of structures- Design of cross section based on efficiency of material used – Problems in design because of joint flexibility – Allowance for joint deformation.

**UNIT IV****9**

**Joint in Structural Members:** Joints for different structural connections – Dimensions and detailing – Design of expansion joints

**UNIT V****9**

**Design for Abnormal Loads:** Progressive collapse – Code provisions – Equivalent design loads for considering abnormal effects such as earthquakes, cyclones - Importance of avoidance of progressive collapse.

**TOTAL HRS : 45****TEXT BOOKS:**

Sl.No	Title of Book	Author of Book	Publisher	Year of Publishing
1	CBRI, 1990, Building materials and components, India			
2	Knowledge based process planning for construction and manufacturing	Gerostiza C.Z., Hendrikson C. and Rehat D.R	Academic Press Inc.,	2012

**REFERENCES:**

Sl.No	Title of Book	Author of Book	Publisher	Year of Publishing
1	Manual of precast concrete construction, Vols. I, II and III, Bauverlag, GMBH	Koncz T	Bauverlag, GMBH	1971
2	Structural design manual, Precast concrete connection details 1978. Society for the studies in the use of precast concrete Netherland Beton Verlag			

**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/>

**COURSE OBJECTIVES:**

1. To learn the smart materials and structures
2. To learn about the various strain measuring instruments
3. To learn about the sensors and its physical measurements
4. To learn about the signal processing and control systems
5. To know about the sensor technologies in the field of Civil engineering.
6. To gain knowledge of Data Acquisition and Processing

**COURSE OUTCOMES**

Upon completing of this course, the students should be able to:

1. Learn the types of smart material and its response, Strain measuring techniques, Sensing technology, Actuator techniques ,Signal processing and control systems.
2. Learn about the various strain measuring instruments
3. The sensors and its physical measurements
4. The signal processing and control systems
5. Know about the sensor technologies in the field of Civil engineering.
6. Gain knowledge of Data Acquisition and Processing

**UNIT I****9**

**Introduction :** Introduction to Smart Materials and Structures – Instrumented structures functions and response – Sensing systems – Self diagnosis – Signal processing consideration – Actuation systems and effectors.

**UNIT II**

**9Measuring Techniques :** Strain Measuring Techniques using Electrical strain gauges, Types – Resistance – Capacitance – Inductance – Wheat stone bridges – Pressure transducers – Load cells – Temperature Compensation – Strain Rosettes.

**UNIT III****9**

**Sensors :** Sensing Technology – Types of Sensors – Physical Measurement using Piezo Electric Strain measurement – Inductively Read Transducers – The LVDT – Fiber optic Techniques. Chemical and Bio-Chemical sensing in structural Assessment – Absorptive chemical sensors – Spectroscopes – Fibre Optic Chemical Sensing Systems and Distributed measurement.

**UNIT IV****9**

**Actuators :** Actuator Techniques – Actuator and actuator materials – Piezoelectric and Electrostrictive Material – Magneto structure Material – Shape Memory Alloys – Electro archeological Fluids– Electro magnetic actuation – Role of actuators and Actuator Materials.

**UNIT V****9**

**Signal Processing and Control Systems :** Data Acquisition and Processing – Signal Processing and Control for Smart Structures – Sensors as Geometrical Processors – Signal Processing – Control System – Linear and Non-Linear.

**TOTAL HRS : 45**

## TEXT BOOKS

Sl.No	Title of Book	Author of Book	Publisher	Year of Publishing
1	Smart Structure and Materials	Mel Schwartz	Artech House .Borton. London	2008

## REFERENCES

Sl.No	Title of Book	Author of Book	Publisher	Year of Publishing
1	Experimental Stress Analysis	Srinath.L.S	Tata McGraw-Hill, New Delhi	2003
2	Experimental Stress Analysis	J. W. Dally.J.W. & W. F. Riley.	Tata McGraw-Hill ,New Delhi	2003

## . 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/>

**COURSE OBJECTIVES:**

1. To apprise the students about the basics of Finite Element theory
2. To know the implementation of computer and its practical applications.
3. To learn basic principles of finite element analysis procedure.
4. To learn the theory and characteristics of finite elements that represent engineering structures.
5. To learn and apply finite element solutions to structural, thermal, dynamic problem.
6. To develop the knowledge and skills needed to effectively evaluate finite element analyses.

**COURSE OUTCOMES**

1. Students will be in a position to develop computer codes for any physical problems using FE techniques.
2. Understand the concepts behind formulation methods in FEM.
3. Identify the application and characteristics of FEA elements such as bars, beams, plane and iso-parametric elements.
4. Develop element characteristic equation and generation of global equation.
5. Apply suitable boundary conditions to a global equation for bars, trusses, beams, circular shafts, heat transfer, fluid flow
6. Apply suitable boundary conditions to axis symmetric and dynamic problems and solve them displacements, stress and strains induced.

**UNIT I****9**

**Variational Formulation:** General field problems in Engineering – Modelling – Discrete and Continuous models – Characteristics – Difficulties involved in solution – The relevance and place of the finite element method – Historical comments – Basic concept of FEM, Boundary and initial value problems – Gradient and divergence theorems – Functionals – Variational calculus – Variational formulation of VBPS. The method of weighted residuals – The Ritz method.

**UNIT II****9**

**Finite Element Analysis of One Dimensional Problems :** One dimensional second order equations – discrimination of domain into elements – Generalised coordinates approach – derivation of elements equations – assembly of elements equations – imposition of boundary conditions – solution of equations – Cholesky method – Post processing – Extension of the method to fourth order equations and their solutions – time dependant problems and their solutions – example from heat transfer, fluid flow and solid mechanics.

**UNIT III****9**

**Finite Element Analysis of Two Dimensional Problems :** Second order equation involving a scalar-valued function – model equation – Variational formulation – Finite element formulation through generalised coordinates approach – Triangular elements and quadrilateral elements – convergence criteria for chosen models – Interpolation functions – Elements matrices and vectors – Assembly of element matrices – boundary conditions – solution techniques.

**UNIT IV****9**

**Isoparametric Elements and Formulation:** Natural coordinates in 1, 2 and 3 dimensions – use of area coordinates for triangular elements in - 2 dimensional problems – Isoperimetric elements in 1,2 and 3

dimensional – Largrangean and serendipity elements – Formulations of elements equations in one and two dimensions - Numerical integration.

## UNIT V

9

**Applications to Field Problems in Two Dimensionals :** Equations of elasticity – plane elasticity problems – axisymmetric problems in elasticity – Bending of elastic plates – Time dependent problems in elasticity – Heat – transfer in two dimensions – incompressible fluid flow.

**TOTAL HRS : 45**

### TEXT BOOK:

Sl.No	Title of Book	Author of Book	Publisher	Year of Publishing
1	Introduction to Finite Element in Engineering, Third Edition	Chandrupatla, T.R., and Belegundu, A.D	Prentice Hall, India	2010

### REFERENCES:

Sl.No	Title of Book	Author of Book	Publisher	Year of Publishing
1	An Introduction to Finite Element Method	Reddy J N	McGraw-Hill, Intl. Student Edition, New Delhi	2009
2	The finite element method, Basic formulation and linear problems, Vol.1	Zienkiewics	McGraw-Hill, Book Co, New Delhi	2000
3	The Finite Element Method in Engineering	Rao. S.S	Pergaman Press.New Delhi.	2010

### 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/>

**COURSE OBJECTIVES:**

1. To understand the components of solid waste management system
2. To learn about recycling, reuse and reclamation of solid wastes
3. To study the collection, transfer, and transport of municipal solid waste
4. To examine the operation of a resource recovery facility
5. To study the design and operation of a municipal solid waste landfill
6. To study the different disposal methods of MSW

**COURSE OUTCOMES**

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

1. Review the components of solid waste management system
2. Be aware of the significance of recycling, reuse and reclamation of solid wastes
3. Develop an insight into the collection, transfer, and transport of municipal solid waste
4. Understand the importance and operation of a resource recovery facility
5. Understand the design and operation of a municipal solid waste landfill

**UNIT I****9**

**Sources and Types of Municipal Solid Wastes:** Sources and types of solid waste - Quantity – factors affecting generation of solid wastes; characteristics – methods of sampling and characterization; Effects of improper disposal of solid wastes – public health effects. Principle of solid waste management – social & economic aspects; Public awareness; Role of NGOs; Legislation.

**UNIT II****9**

**On-Site Storage & Processing :** On-site storage methods – materials used for containers – on-site segregation of solid wastes – public health & economic aspects of storage – options under Indian conditions – Critical Evaluation of Options.

**UNIT III****9**

**Collection and Transfer :** Methods of Collection – types of vehicles – Manpower requirement – collection routes; transfer stations – selection of location, operation & maintenance; options under Indian conditions.

**UNIT IV****9**

**Off-Site Processing :** Processing techniques and Equipment; Resource recovery from solid wastes – composting, incineration, Pyrolysis - options under Indian conditions.

**UNIT V****9**

**Disposal:** Dumping of solid waste; sanitary land fills – site selection, design and operation of sanitary landfills -Landfill liners- Management of leachate and landfill gas- Leachate collection & treatment

**TOTAL HRS : 45****TEXT BOOKS**

Sl.No	Title of Book	Author of Book	Publisher	Year of Publishing



1	Integrated Solid Waste Management	George	McGraw-Hill Publishers, New Delhi	2002
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## REFERENCES

Sl.No	Title of Book	Author of Book	Publisher	Year of Publishing
1	Manual on Municipal Solid Waste Management, 2000,CPHEEO, Ministry of Urban Development, Government of India, New Delhi			
2	Municipal Solid Wastes – problems and Solutions	R.E.Landreth and P.A.Rebers	Lewis Publishers	1997

## 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/>

**COURSE OBJECTIVES:**

1. To know about the principles of remote sensing and spectral signatures
2. To know about satellites, types of remote sensing and digital image processing
3. To study about the history and components of GIS
4. To study about data types and operations.
5. To know the applications of remote sensing and GIS for various applications on Civil Engineering.
6. To apply the concepts of DBMS in GIS.

**COURSE OUTCOMES**

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

1. Demonstrate the concepts of Electro Magnetic energy, spectrum and spectral signature curves.
2. Apply the concepts of satellite and sensor parameters and characteristics of different platforms.
3. Apply the concepts of DBMS in GIS.
4. Analyze raster and vector data and modeling in GIS.
5. Apply GIS in land use, disaster management, ITS and resource information system.

**UNIT I****9**

**GIS Technique And Data Input :** Development of GIS – Components of GIS – Hardware, software- MAP – Types of Maps.

**UNIT II****9**

**Data Analysis And Modelling :** Simple Analysis – Spatial Analysis – Overlay – Vector Data Analysis – Raster Data Analysis – Data Retrieval – Query –Modelling using GIS – Digital Elevation Model – Cost and path analysis – Expert Systems – Artificial Intelligence – Integration with GIS

**UNIT III****9**

**Data Output And Error Analysis :** Data Output – Types – Devices used – Raster and Vector Display Devices – Printers – Plotters – Photo write Devices – Sources of Errors – Types of Errors – Elimination – Accuracies

**UNIT IV****9**

**GIS Applications In Resource Management:** Fields of Applications – Natural Resources – Agriculture – Soil – Water Resources – Wasteland Management – Social Resources – Cadastral Records – LIS

**UNIT V****9**

**Advanced Gis Application :** AM/FM – Utility Network Management – Integration with Remote Sensing – Knowledge based techniques – Multicriteria Techniques – Introduction to Object Oriented Data base Models.

**TOTAL HRS : 45**

**TEXT BOOKS:**

Sl.No	Title of Book	Author of Book	Publisher	Year of Publishing
1	Principles of GIS for Land Resources Assessment	Burrough P A	Oxford Publication, New York	2000
2	Fundamentals of Geographical Information Systems, Second Edition	Michael N Demers	John Wiley Publications.New York	2002

**REFERENCES:**

Sl.No	Title of Book	Author of Book	Publisher	Year of Publishing
1	Geographical Information Systems Volume I and II, Second Edition	Paul A Longley, Michael F Goodchild	John Wiley Publications,New York	2001

**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/>

**15BECE7E08 CONSTRUCTION RESOURCE PLANNING AND MANAGEMENT**  
**3 0 0 3 100**

**COURSE OBJECTIVES:**

At the end of this course the students should have learnt construction planning, Scheduling procedures and techniques, cost control monitoring and accounting, Quality control and safety during construction, Organization and use of project information

**UNIT I**

**9**

**Construction Planning:** Basic concepts in the development of construction plans-choice of Technology and Construction method-Defining Work Tasks- Definition- Precedence relationships among activities-Estimating Activity Durations-Estimating Resource Requirements for work activities-coding systems

**UNIT II**

**9**

**Scheduling Procedures And Techniques:** Relevance of construction schedules-Bar charts - The critical path method-Calculations for critical path scheduling-Activity float and schedules-Presenting project schedules-Critical path scheduling for Activity-on-node and with leads, Lags and Windows-Calculations for scheduling with leads, lags and windows-Resource oriented scheduling-Scheduling with resource constraints and precedences -Use of Advanced Scheduling Techniques-Scheduling with uncertain durations-Crashing and time/cost trade offs -Improving the Scheduling process – Introduction to application software

**UNIT III**

**9**

**Cost Control Monitoring And Accounting:** The cost control problem-The project Budget-Forecasting for Activity cost control - financial accounting systems and cost accounts-Control of project cash flows-Schedule control-Schedule and Budget updates-Relating cost and schedule information

**UNIT IV**

**9**

**Quality Control And Safety During Construction:** Quality and safety Concerns in Construction-Organizing for Quality and Safety-Work and Material Specifications-Total Quality control-Quality control by statistical methods -Statistical Quality control with Sampling by Attributes-Statistical Quality control by Sampling and Variables-Safety.

**UNIT V**

**9**

**Organization And Use Of Project Information:** Types of project information-Accuracy and Use of Information-Computerized organization and use of Information -Organizing information in databases-relational model of Data bases-Other conceptual Models of Databases-Centralized database Management systems-Databases and application programs-Information transfer and Flow.

**TOTAL HRS : 45**

**TEXT BOOKS**

Sl.No	Title of Book	Author of Book	Publisher	Year of Publishing
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1	Construction Project Management Planning, Scheduling and Control	Chitkara, K.K	Tata McGraw-Hill Publishing Co., New Delhi	2002
2	Project Management for Construction–Fundamentals Concepts for Owners”	Chris Hendrickson and Tung Au	Prentice Hall, Pittsburgh	2000

## REFERENCES

Sl.No	Title of Book	Author of Book	Publisher	Year of Publishing
1	Scheduling Construction projects	Willis. E.M.,	John Wiley and Sons, New York	2000
2	Financial and cost concepts for construction Management	Halpin, D.W	John Wiley and Sons New York	2002

## 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/>

**List of Department Elective Subjects**  
**Eighth Semester**

**15BECE8E01**

**INDUSTRIAL STRUCTURES**

**3 0 0 3 100**

**COURSE OBJECTIVES:**

1. This course deals with some of the special aspects with respect to Civil Engineering structures in industries.
2. To Know the different classification of industrial structures.
3. To Know the functional requirement of industrial structures.
4. To design Bunkers and silos.
5. To design the RC structures like Chimneys, bunkers and silos.
6. To know the principles of roof trusses.

**COURSE OUTCOMES**

1. At the end of this course the student shall be able to design some of the structures used in industries.
2. Special aspects with respect to Civil Engineering structures in industries.
3. The different classification of industrial structures.
4. The functional requirement of industrial structures.
5. Design Bunkers and silos.
6. Design the RC structures like Chimneys, bunkers and silos.

**UNIT I**

**9**

**Planning :** Classification of Industries and Industrial structures – General requirements for industries like cement, chemical and steel plants – Planning and layout of buildings and components.

**UNIT II**

**9**

**Functional Requirements :** Lighting – Ventilation – Accounts – Fire safety – Guidelines from factories act.

**UNIT III**

**9**

**Design of Steel Structures :** Industrial roofs – Crane girders – Mill buildings – Design of Bunkers and Silos

**UNIT IV**

**9**

**Design of R.C. Structures :** Silos and bunkers – Chimneys – Principles of folded plates and shell roofs

**UNIT V**

**9**

**Prefabrication :** Principles of prefabrication – Prestressed precast roof trusses- Functional requirements for Precast concrete units

**TOTAL HRS : 45**

**TEXT BOOKS:**

Sl.No	Title of Book	Author of Book	Publisher	Year of Publishing
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1	Reinforced Concrete Structural elements	Purushothaman .P.	Tata McGraw-Hill Publishing Company Ltd.New Delhi	2000
2	Design of Steel Structure	Pasala Dayaratnam	Oxford and IBH PublishingCo. New York	2002

#### REFERENCES:

Sl.No	Title of Book	Author of Book	Publisher	Year of Publishing
1	Buildings for Industry, vols. I and II	Henn W	London Hill Books	2000
2	Handbook on Functional Requirements of Industrial buildings, SP32 – 1986, Bureau of Indian Standards, New Delhi			
3	Course Notes on Modern Developments in the Design and Construction of Industrial Structures, Structural Engineering Research Centre,1982. Madras.			

#### WEBSITES:

10. <http://www.icivilengineer.com>
11. <http://www.engineeringcivil.com/>
12. <http://www.aboutcivil.com/>
13. <http://www.engineersdaily.com>
14. <http://www.asce.org/>
15. <http://www.cif.org/>
16. <http://icevirtuallibrary.com/>
17. <http://www.ice.org.uk/>
18. <http://www.engineering-software.com/ce/>

**COURSE OBJECTIVES:**

1. To introduce the basics of Earthquake Engineering
2. To introduce the engineering seismology, building geometrics & characteristics, structural irregularities,
3. To introduce tips on earthquake engineering - do's and don'ts
4. To introduce cyclic loading behaviour of RC, steel and pre-stressed concrete elements
5. To discuss code provisions and their application on different types of structures
6. To apply codal provisions on different types of structures

**COURSE OUTCOMES**

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

1. Apply the basics of Earthquake Engineering
2. Demonstrate the dynamics of structural system under earthquake load
3. Analyze the influence of the structural / geometrical design in building characteristics
4. Demonstrate the cyclic loading behaviour of RC steel and pre-stressed concrete elements
5. Apply codal provisions on different types of structures.
6. Cyclic loading behaviour of RC, steel and pre-stressed concrete elements

**UNIT I****9**

**Single Degree Of Freedom Systems:** Formulation of equation of motion, Free and forced vibrations, Damping, Types of Damping – Damped and undamped vibrations, Response to dynamic loading. Introduction of Free and forced vibration of undamped and damped MDOF systems

**UNIT II****9**

**Engineering Seismology:** Elements of Engineering Seismology, Characteristics of Earthquake Engineering, Earthquake History, Indian Seismicity. Performance of structures under past earthquakes, Lessons learnt from past earthquakes.

**UNIT III****9**

**Seismic Analysis:** Seismic Design Concepts- Calculation of base shear as per IS1893- Lateral Load analysis of building frames by Portal method and Cantilever method.

**UNIT IV****9**

**Earthquake Resistant Design:** Concept of Earthquake Resistant Design, Provisions of Seismic Code IS 1893 (Part I), Response Spectrum, Design Spectrum, Design of Buildings.

**UNIT V****9**



**Ductile Detailing:** Ductility- Assessment of Ductility- Member/ Element ductility, Structural Ductility- Factors affecting ductility-Ductile Detailing, Provisions of IS 13920.for beams, columns and footings-Special Confining Requirements.

**TOTAL HRS : 45**

**TEXT BOOKS:**

Sl.No	Title of Book	Author of Book	Publisher	Year of Publishing
1	Earthquake Resistant Design of Structures,	Agarwal and Shrikhande	Prentice Hall of India,	2007

**REFERENCES:**

Sl.No	Title of Book	Author of Book	Publisher	Year of Publishing
1	Structural Dynamics – Theory and Computations, Third Edition	Mario Paz	CBS publishers, New York	2007
2	Design of Earthquake Resistant Buildings	Agarwal Pankaj and Shrikhande Manish	Mc- Graw Hill Book Company, New York	2006
3	Dynamics of Structures	Humar J	Prentice Hall, India	2012
4	Dynamics of structures – Theory and applications to Earthquake Engineering	Anil K Chopra	Prentice Hall Inc, India	2001
5	Earthquake Tips	C V R Moorthy	NICEE, IIT Kanpur	2004
6	Dynamics of Structures, Second Edition	Clough R.W, and Penzien J,	McGraw – Hill International Edition, New Delhi	2003

**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/>

**15BECE8E03INTRODUCTION TO SOIL DYNAMICS AND MACHINE**  
**FOUNDATIONS      3 0 0 3 100**

**COURSE OBJECTIVES:**

At the end of this course the students should have learnt the vibration of elementary system, free and forced vibration, Waves and wave propagation, Dynamic properties of soils, Design procedures for foundation under reciprocating machines, Vibration isolation.

**UNIT I**

**9**

**Introduction :** Vibration of elementary systems-vibratory motion-single degree freedom system-free and forced vibration with and without damping

**UNIT II**

**9**

**Waves and Wave Propagation:** Wave propagation in an elastic homogeneous isotropic medium-Raleigh, shear and compression waves-waves in elastic half space

**UNIT III**

**9**

**Dynamic Properties of Soils:** Elastic properties of soils-coefficient of elastic, uniform and non-uniform compression - shear-effect of vibration dissipative properties of soils-determination of dynamic properties of soil- codal provisions

**UNIT IV**

**9**

**Design Procedures:** Design criteria -dynamic loads - simple design procedures for foundations under reciprocating machines - machines producing impact loads - rotary type machines

**UNIT V**

**9**

**Vibration Isolation:** Vibration isolation technique-mechanical isolation-foundation isolation-isolation by location-isolation by barriers- active passive isolation tests.

**TOTAL HRS : 45**

**TEXT BOOKS:**

Sl.No	Title of Book	Author of Book	Publisher	Year of Publishing
1	Soil Dynamics and Machine Foundations	Swamisaran	Galgotia Publications Pvt. Ltd.Chennai	2011

**REFERENCES:**

Sl.No	Title of Book	Author of Book	Publisher	Year of
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				<b>Publishing</b>
1	Vibration Analysis and Foundation Dynamics	Kameswara Rao	Wheeler Publishing, New Delhi	2002
2	IS code of Practice for Design and Construction of Machine Foundations, McGraw-Hill,			
3	Foundation for machines	<b>S. Prakash</b> and T. Fennessey	McGraw-Hill, New Delhi.	2003
4	Hand book of Machine Foundations	Srinivasulu, P & Vaidyanathan	McGraw-Hill New Delhi	2007
5	Geotechnical Earthquake Engineering	Kramar S.L	Prentice Hall International series, Pearson Education (Singapore) Pvt. Ltd	2003
6	Dynamics Soil Tests and Applications	Kameswara Rao	Wheeler Publishing, New Delhi,	2000

#### **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/>

**COURSE OBJECTIVES:**

1. To make the students to gain the knowledge on quality of concrete, durability aspects, causes of deterioration.
2. To the assessment of distressed structures, repairing of structures and demolition procedures.
3. To gain the knowledge of available techniques and their application for strengthening or upgrading existing structural system
4. To conduct field monitoring and non-destructive evaluation of concrete structures.
5. To have a brief knowledge on various Nondestructive testing's.
6. To gain some knowledge on the different materials used for maintenance of structures.

**COURSE OUTCOMES**

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. Assessment of distressed structures, repairing of structures and demolition procedures.
3. Available techniques and their application for strengthening or upgrading existing structural system
4. Conducting field monitoring and non-destructive evaluation of concrete structures.
5. Knowledge on various Nondestructive testing's.

**UNIT – I INTRODUCTION 9**

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 9**

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 9**

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 9**

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 9**

Non-destructive Testing Techniques , Corrosion protection techniques , Guniting 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

**TOTAL HRS : 45**

**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/>

**COURSE OBJECTIVES:**

1. To be introduced to environmental impact assessment and the current legislation covering it.
2. To understand Prediction and Assessment of Impact.
3. To learn planning for mitigation of adverse impact on environment.
4. To Analyse case studies.
5. Through case studies, learn to present and explain the components and decision-making processes involved in environmental assessment.
6. To present and explain the components and decision-making processes involved in environmental assessment through various case studies.

**COURSE OUTCOMES**

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

1. Review the key concepts of environmental impact assessment and the current legislation covering it
2. Understand the Prediction and Assessment of Impact on land, water, air, noise and energy, flora and fauna and Socio Economics
3. Plan options for mitigation of adverse impact on environment
4. Present and explain the components and decision-making processes involved in environmental assessment through various case studies.
5. Learn planning for mitigation of adverse impact on environment.
6. Analyse case studies.

**UNIT I ENVIRONMENTAL ISSUES****9**

Water resources development and environmental issues – Environment in water resources project planning – Environmental regulations and requirements – The EIA (Environmental Impact Assessment) notification.

**UNIT II EIA FUNDAMENTALS****9**

Environmental Impact Assessment (EIA) – Environmental Impact Statement – EIA in Project Cycle – Legal and Regulatory aspects in India according to Ministry of Environment and Forests – Types and limitations of EIA – Cross sectoral issues and terms of reference in EIA –Participation of Public and Non-Governmental Organizations in environmental decision making

**UNIT III ENVIRONMENTAL IMPACTS****9**

Hydrological and water quality impacts – Ecological and biological impacts – Social and cultural impacts – Soil and landscape changes – Agro economic issues – Human health impacts – Ecosystem changes.

**UNIT IV METHODS OF EIA****9**

EIA team formation – Development of scope, mandate and study design – Base line survey – Check lists – Ad hoc procedures – Network and matrix methods – Semi-quantitative methods – ICID checklist – Economic approaches – Environmental Impact Statement (EIS) preparation.

## UNIT V ENVIRONMENTAL MANAGEMENT

9

In-stream ecological water requirements - Public participation in environmental decision making – Sustainable water resources development – Ecorestoration – Hydrology and global climate change – Human ecology – Ecosystem services – Environmental monitoring programs.

**TOTAL HRS : 45**

### TEXT BOOKS

Sl.No	Name of the Book	Author Name	Publisher	Year
1	Environmental Impact Assessment	Canter, L.W	McGraw Hill International Edition, New York	2008
2	Environmental Impact Assessment	Barathwal, R.R	New Age International Publishers, New Delhi	2002

### REFERENCES:

Sl.No	Name of the Book	Author Name	Publisher	Year
1	Handbook of Environmental Impact Assessment	Petts, J	Blackwell Science London	1999
2	Environmental Impact Assessment – Practical solutions to recurrent problems	Lawrence, D.P	Wiley-Inter Science, New Jersey	2003
3	Hydrology and global environmental change	Arnel, N	Prentice Hall, Harlow	2002

### WEB SITES:

1. [www.springer.com](http://www.springer.com)
2. [www.nptel.com](http://www.nptel.com)
3. [www.wikipedia.com](http://www.wikipedia.com)
4. [www.civil.ubc.ca](http://www.civil.ubc.ca)
5. [www.aboutcivil.com](http://www.aboutcivil.com)



**COURSE OBJECTIVES:**

1. To impart knowledge on sources and characteristics of various industrial wastes and strategies for its prevention and control.
2. To know the Industrial waste generation patterns, as well as management and disposal techniques
3. To gain knowledge of Central and state pollution control board guidelines on industrial waste management
4. To know the schemes, incentives, policies on industrial waste management
5. To overview of product design for waste minimization
6. Cost benefit analysis of different waste management techniques

**COURSE OUTCOMES**

The students completing the course will have

1. An insight into the pollution from major industries including the sources and characteristics of pollutants
2. Ability to plan minimization of industrial wastes
3. Ability to design facilities for the processing and reclamation of industrial waste water.
4. Industrial waste generation patterns, as well as management and disposal techniques
5. Knowledge of Central and state pollution control board guidelines on industrial waste management.
6. To know the schemes, incentives, policies on industrial waste management

**UNIT I****9**

**Introduction:** Types of industries and industrial pollution – Characteristics of industrial wastes – Population equivalent – Bioassay studies – effects of industrial effluents on streams, sewer, land, sewage treatment plants and human health – Environmental legislations related to prevention and control of industrial effluents and hazardous wastes

**UNIT II****9**

**Cleaner Production:** Waste management Approach – Waste Audit – Volume and strength reduction – Material and process modifications – Recycle, reuse and byproduct recovery – Applications.

**UNIT III****9**

**Pollution from Major Industries:** Sources, Characteristics, waste treatment flow sheets for selected industries such as Textiles, Tanneries, Pharmaceuticals, Electroplating industries, Dairy, Sugar, Paper, distilleries, Steel plants, Refineries, fertilizer, thermal power plants – Wastewater reclamation concepts

**UNIT IV****9**

**Treatment Technologies:** Equalisation – Neutralisation – Removal of suspended and dissolved organic solids - Chemical oxidation – Adsorption - Removal of dissolved inorganics – Combined treatment of industrial and municipal wastes – Residue management – Dewatering - Disposal

**UNIT V****9**

**Hazardous Waste Management :** Hazardous wastes - Physico chemical treatment – solidification – incineration – Secured land fills

**TOTAL HRS : 45**

**TEXT BOOKS:**

Sl.No	Title of Book	Author of Book	Publisher	Year of Publishing
1	Wastewater Treatment	M.N.Rao & A.K.Dutta	Oxford - IBH Publication. New York	2002
2	Industrial Water Pollution Control	W.W. Eckenfelder Jr	McGraw-Hill Book Company, New Delhi	2000

**REFERENCES:**

Sl.No	Title of Book	Author of Book	Publisher	Year of Publishing
1	Industrial Wastewater Systems Hand book	Stephenson R L and Blackburn J B., Jr	Lewis Publisher, New York	2000
2	Industrial Pollution Prevention Hand Book	H.M.Freeman	McGraw-Hill Inc., New Delhi	2002

**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/>

**COURSE OBJECTIVES:**

The students will

1. Develop an understanding of the classification, sources and effects of pollutants
2. Understand the fundamentals of meteorology
3. Study the principles and equipment description of control technologies
4. Review the sources and control of indoor air pollution.
5. To induce operational considerations under the processing and control monitoring.
6. To apply sampling techniques of gaseous contaminants.

**COURSE OUTCOMES**

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

1. Understand the sources and effects of key types of environmental pollutants
2. Have insight into fundamentals of meteorology
3. Appreciate different pollution control strategies
4. Understand indoor air pollution and be aware of the control technologies
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****9**

**Sources and Effects of Air Pollutants:** Classification of air pollutants – Particulates and gaseous pollutants – Sources of air pollution – Source inventory – Effects of air pollution on human beings, materials, vegetation, animals – global warming-ozone layer depletion, Sampling and Analysis – Basic Principles of Sampling – Source and ambient sampling – Analysis of pollutants – Principles.

**UNIT II****9**

**Dispersion of Pollutants:** Elements of atmosphere – Meteorological factors – Wind roses – Lapse rate - Atmospheric stability and turbulence – Plume rise – Dispersion of pollutants – Dispersion models – Applications.

**UNIT III****9**

**Air Pollution Control:** Concepts of control – Principles and design of control measures – Particulates control by gravitational, centrifugal, filtration, scrubbing, electrostatic precipitation – Selection criteria for equipment - gaseous pollutant control by adsorption, absorption, condensation, combustion – Pollution control for specific major industries.

**UNIT IV****9**

**Air Quality Management:** Air quality standards – Air quality monitoring – Preventive measures - Air pollution control efforts – Zoning – Town planning regulation of new industries – Legislation and enforcement – Environmental Impact Assessment and Air quality

**UNIT V****9**

**Noise Pollution:** Sources of noise pollution – Effects – Assessment - Standards – Control methods - Prevention

**TOTAL HRS : 45**

**TEXT BOOKS:**

Sl.No	Title of Book	Author of Book	Publisher	Year of Publishing
1	Air Pollution and Control Technologies	Anjaneyulu, D	Allied Publishers, Mumbai	2002
2	Environmental Pollution Control Engineering	Rao, C.S	Wiley Eastern Ltd., New Delhi	2002
3	Air Pollution Control	Rao M.N., and Rao H. V. N	Tata-McGraw-Hill, New Delhi	2000

**REFERENCES:**

Sl.No	Title of Book	Author of Book	Publisher	Year of Publishing
1	Industrial Air Pollution Control Systems	W.L.Heumann	McGraw-Hill, New York	2001
2	Pollution Control in Process Industries	Mahajan S.P	Tata McGraw-Hill Publishing Company, New Delhi	2005
3	Environmental Engineering Vol. II	Garg, S.K	Khanna Publishers, New Delhi	2005
4	Pollution Control in Process Industries	Mahajan, S.P.	Tata McGraw-Hill, New Delhi	2004

**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/>

**OBJECTIVE**

At the end of this course students should have learnt to plan for construction projects, schedule the activities using network diagrams and should have determined the cost of the project, control the cost of the project by creating cash flows.

**UNIT I CONSTRUCTION PLANNING****9**

Basic concepts in the development of construction plans-choice of Technology and Construction method-Defining Work Tasks- Definition- Precedence relationships among activities-Estimating Activity Durations-Estimating Resource Requirements for work activities-coding systems

**UNIT II SCHEDULING PROCEDURES AND TECHNIQUES****9**

Relevance of construction schedules-Bar charts - The critical path method-Calculations for critical path scheduling-Activity float and schedules-Presenting project schedules-Critical path scheduling for Activity-on-node and with leads, Lags and Windows-Calculations for scheduling with leads, lags and windows-Resource oriented scheduling-Scheduling with resource constraints and precedence -Use of Advanced Scheduling Techniques-Scheduling with uncertain durations-Crashing and time/cost tradeoffs -Improving the Scheduling process – Introduction to application software

**UNIT III COST CONTROL MONITORING AND ACCOUNTING****9**

The cost control problem-The project Budget-Forecasting for Activity cost control - financial accounting systems and cost accounts-Control of project cash flows-Schedule control-Schedule and Budget updates-Relating cost and schedule information

**UNIT IV QUALITY CONTROL AND SAFETY DURING CONSTRUCTION****9**

Quality and safety Concerns in Construction-Organizing for Quality and Safety-Work and Material Specifications-Total Quality control-Basic elements of quality – management quality control, factors affecting quality of construction- safety management – common causes of accidents, safety precautions at construction sites.

**UNIT V ORGANIZATION AND USE OF PROJECT INFORMATION****9**

Types of project information-Accuracy and Use of Information-Computerized organization and use of Information -Organizing information in databases-relational model of Data bases-Other conceptual Models of Databases-Centralized database Management systems-Databases and application programs-Information transfer and Flow.

**TOTAL HRS : 45****TEXT BOOKS:**

Sl.No	Title of Book	Author of Book	Publisher	Year of Publishing
1	Construction Project Management Planning,	Chitkara, K.K	Tata McGraw-Hill Publishing	2008

	Scheduling and Control		Co., New Delhi.	
2	Project Management with CPM, PERT and Precedence Diagramming	Moder.J. C.Phillips and Davis	Third Edition Van No strand Reinhold Co	2005

#### REFERENCES:

Sl.No	Title of Book	Author of Book	Publisher	Year of Publishing
1	Scheduling Construction projects	Willis. E.M.	John Wiley and Sons.New York	2008
2	Financial and cost concepts for construction Management	Halpin, D.W	John Wiley and Sons, New York	2010
3	Project Management for Construction – Fundamentals Concepts for Owners	Chris Hendrickson and Tung Au	Engineers,Architects and Builders, Prentice Hall, Pittsburgh.	2003

#### 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/>

**COURSE OBJECTIVES:**

1. To learn the fundamentals of traffic engineering
2. To learn the methods of intersection design
3. To learn the skills of traffic control
4. To be introduced to the different theories of traffic flow
5. To be aware of the importance of traffic safety
6. To be aware of traffic flow theory

**COURSE OUTCOMES**

Upon completing of this course, the students should be able to:

1. Carry out traffic studies
2. Design intersections
3. Implement traffic system management
4. Be aware of traffic flow theory
5. Enhance safety in all design aspects
6. The skills of traffic control

**UNIT I**

**9**

**Introduction:** Significance and scope, Characteristics of Vehicles and Road Users, Skid Resistance and Braking Efficiency (Problems), Components of Traffic Engineering- Road, Traffic and Land Use Characteristics

**UNIT II**

**9**

**Traffic Surveys And Analysis :** Surveys and Analysis - Volume, Journey time, Capacity, Speed and Delays, Origin and Destination, Parking Survey, Pedestrian Studies, Accident analysis and Safety Level of Services- applications and significance.

**UNIT III**

**9**

**Traffic Control:** Traffic signs, Road markings, Design of Traffic signals and Signal co-ordination (Problems), Traffic control aids and Street furniture, Street Lighting, Computer applications in Signal design

**UNIT IV**

**9**

**Geometric Design Of Intersections :** Conflicts at Intersections, Classification of Intersections at Grade, - Chanallised and Unchanallised Intersection - Grade Separators (Concepts only), Principles of Intersection Design, Elements of Intersection Design, Chanallisation and Rotary design (Problems), Grade Separators

**UNIT V**

**9**

**Traffic Management:** Area traffic Management system- Traffic System Management (TSM) and Travel Demand Management (TDM), Traffic Forecasting techniques, Restrictions on turning movements, One-way Streets, Traffic Segregation, Traffic Calming, Tidal flow operations, Exclusive Bus Lanes - Introduction to Intelligence Transport System (ITS)-enforcement and education.

**TOTAL HRS : 45**

**TEXT BOOKS:**

Sl.No	Title of Book	Author of Book	Publisher	Year of Publishing
1	Highway Engineering,	Khanna K and Justo C E G	Khanna Publishers, Roorkee	2001
2	Traffic Engineering and Transport Planning	Kadiyali L	Khanna Technical Publications, Delhi	2000

**REFERENCES:**

Sl.No	Title of Book	Author of Book	Publisher	Year of Publishing
1	Indian Roads Congress (IRC) specifications: Guidelines and special publications on Traffic Planning and Management			
2	Guidelines of Ministry of Road Transport and Highways, Government of India.			
3	A Course in Traffic Planning and Design	Subhash C.Saxena	Dhanpat Rai Publications, New Delhi	2002

**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/>



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 acquaint the student to solve problems in different environments and develop critical thinking

**COURSE OUTCOMES(COS)::**

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

**UNI****T I LINEAR PROGRAMMING PROBLEM****(9)**

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****(9)**

Transportation Model, finding initial basic feasible solutions, moving towards optimality, Degeneracy.

**UNIT III ASSIGNMENT PROBLEM****(9)**

Solution of an Assignment problem, Multiple Solution, Hungarian Algorithm, Maximization in Assignment Model, Impossible Assignment.

**UNIT IV INTEGER PROGRAMMING****(9)**

Integer Programming Problem – Gomory's fractional cut Method – Branch Bound Method

**UNIT V NETWORK ANALYSIS****(9)**

PERT & CPM- network diagram-probability of achieving completion date- crash time- cost analysis.

**Total : 45****TEXT BOOKS:**

S. NO.	AUTHOR(S) NAME	TITLE OF THE BOOK	PUBLISHER	YEAR OF PUBLICATION
1	Hamdy Taha. A.	Operations Research	Prentice – Hall of India Private Limited, New Delhi .	2013

2	Kanti Swarup, Manmohan, Gupta	Operations Research	Sultan Chand & Sons, New Delhi.	2010
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#### REFERENCES:

S. NO.	AUTHOR(S) NAME	TITLE OF THE BOOK	PUBLISHER	YEAR OF PUBLICATION
1	Natarajan A.M., Balasubramani P., Thamilarasi A	Operations Research	Pearson Education, New Delhi.	2005
2	Srinivasan G	Operations Research: Principles and Applications	PHI Private Limited, New Delhi.	2007
3	Winston	Operations Research, Applications and Algorithms	Cengage Learning India Pvt. Ltd, New Delhi.	2004

#### WEBSITES:

1. <a href="http://www.mathworld.wolfram.com">www.mathworld</a> . Wolfram.com
2. <a href="http://www.mit.edu">www.mit.edu</a>
3. <a href="http://www.nptel.com">www.nptel.com</a>

**OBJECTIVES:**

1. To kindle analytical skills for solving engineering problems
2. To impart 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 enhance the students to solve problems using non integer programming.

**COURSE OUTCOMES(COS)::**

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****(9)**

Economic order quantity models-techniques in inventory management-ABC analysis.

**UNIT – II NON LINEAR PROGRAMMING****(9)**

Khun-tucker conditions with non-negative constraints- Quadratic programming- Wolf's modified simplex method.

**UNIT – III SIMULATION MODELS****(9)**

Elements of simulation model -Monte Carlo technique – applications. Queuing model: problems involving (M\1): ( $\infty$ \FIFO) , (M\M\c): ( $\infty$ \FIFO) Models.

**UNIT -IV DECISION MODELS****(9)**

Decision Analysis – Decision Making environment – Decisions under uncertainty – Decision under risk – Decision – Tree Analysis.

**UNIT -V REPLACEMENT MODELS****(9)**

Models based on models that gradually deteriorate with time-whose maintenance cost increase with time- Replacement of items that fail suddenly and completely.

**Total : 45**

**TEXT BOOKS:**

S.	AUTHOR(S) NAME	TITLE OF	PUBLISHER	YEAR OF
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NO.		THE BOOK		PUBLICATION
1	Hamdy Taha. A.	Operations Research	Prentice – Hall of India Private Limited, New Delhi .	2013
2	Kanti Swarup, Manmohan, Gupta	Operations Research	Sultan Chand & Sons, New Delhi.	2010

#### REFERENCES:

S. NO.	AUTHOR(S) NAME	TITLE OF THE BOOK	PUBLISHER	YEAR OF PUBLICATION
1	Natarajan A.M., Balasubramani P., Thamilarasi A	Operations Research	Pearson Education, New Delhi.	2005
2	Srinivasan G	Operations Research: Principles and Applications	PHI Private Limited, New Delhi.	2007
3	Winston	Operations Research, Applications and Algorithms	Cengage Learning India Pvt. Ltd, New Delhi.	2004

#### WEBSITES:

1. <a href="http://www.mathworld">www.mathworld</a> . Wolfram.com
2. <a href="http://www.mit.edu">www.mit.edu</a>
3. <a href="http://www.nptel.com">www.nptel.com</a>

**OBJECTIVES:**

1. To gain knowledge in measures of central tendency.
2. To provide necessary basic concepts in probability and random processes for applications such as random signals, linear systems in communication engineering.
3. To understand the basic concepts of probability, one and two dimensional random variables and to introduce some standard distributions applicable to engineering which can describe real life phenomenon.
4. To understand the basic concepts of random processes which are widely used in IT fields.
5. To understand the concept of correlation and spectral densities.
6. To acquire the knowledge on random process in engineering disciplines.

**COURSE OUTCOMES(COS):**

1. Learners acquire skills in handling situations involving more than one random variable and functions of random variables.
2. The students will have an exposure of various distribution functions, correlation and spectral densities.
3. To understand the fundamental knowledge of the concepts of probability and have knowledge of standard distributions which can describe real life phenomenon.
4. To understand the basic concepts of one and two dimensional random variables and apply in engineering applications.
5. To apply the concept random processes in engineering disciplines.
6. To understand and apply the concept of correlation and spectral densities.

**UNIT- I MEASURES OF CENTRAL TENDENCY AND PROBABILITY****(9)**

Measures of central tendency – Mean, Median, Mode - Standard Deviation

Probability - Random variable - Axioms of probability - Conditional probability - Total probability – Baye's theorem.

**UNIT- II STANDARD DISTRIBUTIONS****(9)**

Functions of a random variable - Binomial, Poisson, Uniform, Exponential, Gamma(one Parameter only) and Normal distributions - Moment generating functions, Characteristic function and their properties – Chebyshev's inequality.

**UNIT -III TWO DIMENSIONAL RANDOM VARIABLES****(9)**

Joint distributions - Marginal and conditional distributions - Probability mass function - Probability density functions – Covariance - Correlation and regression

**UNIT- IV CLASSIFICATION OF RANDOM PROCESS****(9)**

Definition and examples - first order, second order, strictly stationary, wide – sense stationary and Ergodic processes - Markov process - Binomial, Poisson and Normal processes - Sine wave process.

**UNIT -VCORRELATION AND SPECTRAL DENSITIES (9)**

Auto correlation - Cross correlation - Properties – Power spectral density – Cross spectral density - Properties – Wiener-Khintchine relation – Relationship between cross power spectrum and cross correlation function - Linear

**TEXT BOOK:**

<b>S. NO.</b>	<b>AUTHOR(S) NAME</b>	<b>TITLE OF THE BOOK</b>	<b>PUBLISHER</b>	<b>YEAR OF PUBLICATION</b>
1	Peebles Jr, P.Z	Probability Random Variables and Random Signal Principles	Tata McGraw-Hill Publishers, New Delhi.	2002

**REFERENCES:**

<b>S. NO.</b>	<b>AUTHOR(S) NAME</b>	<b>TITLE OF THE BOOK</b>	<b>PUBLISHER</b>	<b>YEAR OF PUBLICATION</b>
1	Ross, S	A first Course in Probability	Pearson Education, New Delhi (Chap 2 to 8)	2012
2	Gupta, S.C. and Kapoor, V.K	Fundamentals of Mathematical Statistics	Sultan Chand and Sons, New Delhi.	2014
3	Veerarajan,T.	Probability, Statistics and Random process	Tata McGraw-Hill Education pvt. Ltd., New Delhi	2008
4	Henry Stark and John W. Woods	Probability and Random Processes with Applications to Signal Processing	Pearson Education, Third edition, Delhi	2002

**WEBSITES:**

1. <a href="http://www.cut-theknot.org/probability.shtml">www.cut-theknot.org/probability.shtml</a>
2. <a href="http://www.mathcentre.ac.uk">www.mathcentre.ac.uk</a>
3. <a href="http://www.mathworld">www.mathworld</a> . Wolfram.com

**OBJECTIVES:**

1. To gain knowledge in measures of central tendency and probability.
2. To introduce the concept of random variable and functions of random variables.
3. To introduce the basic concepts of two dimensional random variables.
4. To acquaint the knowledge of testing of hypothesis for small and large samples which plays an important role in real life problems
5. To introduce the basic concepts of classifications of design of experiments.
6. To sampling distributions and statistical techniques used in engineering and management problems.

**COURSE OUTCOMES(COS):**

1. The student gain the knowledge in measures of central tendency and probability
2. Understand the fundamental knowledge of the concepts of probability and have knowledge of standard distributions which can describe real life phenomenon.
3. Understand the basic concepts of two dimensional random variables and apply in engineering applications.
4. Apply the concept of testing of hypothesis for small and large samples in real life problems.
5. Apply the basic concepts of classifications of design of experiments and statistical quality control.
6. Have the notion of sampling distributions and statistical techniques used in engineering and management problems.

**UNIT- I            MEASURES OF CENTRAL TENDENCY AND PROBABILITY            (12)**

Measures of central tendency – Mean, Median, Mode and Standard Deviation – SPSS Software Demonstration. Probability - Random variable - Axioms of probability - Conditional probability - Total probability – Baye's theorem - Probability mass function - Probability density function.

**UNIT- II            STANDARD DISTRIBUTIONS            (12)**

Functions of a random variable - Binomial, Poisson, Uniform, Exponential, Gamma, and Normal distributions - Moment generating functions, Characteristic function and their properties.

**UNIT- III            TWO DIMENSIONAL RANDOM VARIABLES            (12)**

Joint distributions - Marginal and conditional distributions – Covariance - Correlation and Regression - Transformation of random variables - Central limit theorem.

**UNIT- IV            TESTING OF HYPOTHESIS            (12)**

Sampling distributions – Testing of hypothesis for mean, variance, proportions and differences using Normal, t, Chi-square and F distributions - Tests for independence of attributes and Goodness of fit.

**UNIT- V            DESIGN OF EXPERIMENTS            (12)**

Analysis of variance – One way classification – CRD – Two way classification – RBD - Latin square.

**TEXT BOOKS:**

S. NO.	AUTHOR(S) NAME	TITLE OF THE BOOK	PUBLISHER	YEAR OF PUBLICATION
1	Gupta, S.C. and Kapoor, V.K	Fundamentals of Mathematical Statistics	Sultan Chand and Sons, New Delhi.	2014
2	<a href="#">Athanasios Papoulis</a> and S Unnikrishna Pillai	Probability Random variables and Stochastic Processes	McGraw-Hill Publications, New Delhi.	2002

**REFERENCES:**

S. NO.	AUTHOR(S) NAME	TITLE OF THE BOOK	PUBLISHER	YEAR OF PUBLICATION
1	Walpole, R.E., Myers, R.H., Myers, S.L and Ye, K	Probability and Statistics for Engineers and Scientists	Pearson Education Inc., Delhi.	2007
2	Lipschutz, S. and Schiller, J	Schaum's outlines - Introduction to Probability and Statistics	McGraw-Hill, New Delhi.	1998
3	Ross, S	A first Course in Probability	Pearson Education Inc., Delhi.	2014
4	Johnson, R.A, Irwin Miller	Miller & Freund's Probability and Statistics for Engineers	Pearson Education, Delhi	2014

**WEBSITES:**

1. <a href="http://www.cut-theknot.org/probability.shtml">www.cut-theknot.org/probability.shtml</a>
2. <a href="http://www.mathcentre.ac.uk">www.mathcentre.ac.uk</a>
3. <a href="http://www.mathworld">www.mathworld</a> . Wolfram.com



### OBJECTIVES:

1. To understand the fundamental knowledge of probability theory.
2. To introduce the concept of random variable and functions of random variables.
3. To introduce the basic concepts of two dimensional random variables.
4. To introduce the concepts of random processes and Markov chain
5. To understand the different Queuing models and solve problems

**COURSE OUTCOMES(COS):**

1. The student gain the knowledge in measures of central tendency and probability
2. Understand the fundamental knowledge of the concepts of probability and have knowledge of standard distributions which can describe real life phenomenon.
3. Understand the basic concepts of two dimensional random variables and apply in engineering applications.
4. Understand the concepts of random process and markov chains
5. They will be able to solve the Queuing models
6. The students understand and characterize phenomena which evolve with respect to time in a probabilistic manner.

**UNIT- I                      PROBABILITY AND RANDOM VARIABLE                      (9)**

Axioms of probability - Conditional probability - Total probability – Baye's theorem- Random variable - Probability mass function - Probability density function - Properties - Moments - Moment generating functions and their properties.

## UNIT- II STANDARD DISTRIBUTIONS (9)

Functions of a random variable - Binomial, Poisson, Geometric, Negative Binomial, Uniform, Exponential, Gamma, Weibull and Normal distributions and their properties.

**UNIT- III      TWO DIMENSIONAL RANDOM VARIABLES      (9)**

Joint distributions - Marginal and conditional distributions – Covariance - Correlation and Regression - Transformation of random variables - Central limit theorem.

**UNIT -IV      RANDOM PROCESS AND MARKOV CHAINS      (9)**

Classification - Stationary process - Markov process - Poisson process - Birth and death process - Markov chains  
- Transition probabilities - Limiting distributions.

**UNIT-V                      QUEUEING THEORY** (9)

Markovian models - M/M/1, M/M/C, finite and infinite capacity - M/M/ $\infty$  queues - Finite source model - M/G/1 queue (steady state solutions only) - Pollaczek - Khintchine formula - Special cases.

**Total : 45**

**TEXT BOOKS:**

S. NO.	AUTHOR(S) NAME	TITLE OF THE BOOK	PUBLISHER	YEAR OF PUBLICATION
1	Ross,S	A first course in probability	Pearson Education, Delhi	2014
2	Medhi,J	Stochastic Process	New Age Publishers ,New Delhi	2014

**REFERENCES:**

S. NO.	AUTHOR(S) NAME	TITLE OF THE BOOK	PUBLISHER	YEAR OF PUBLICATION
1	Veerarajan,T	Statistics and Random Processes	Tata McGraw-Hill, 2 <sup>nd</sup> Edition, New Delhi.	2008
2	Allen,O	Probability, Statistics and Queuing Theory	Academic press, New Delhi.	1999
3	Gross, D., Shortle, J. F., Thompson J.M. and Harris, C.M	Fundamentals of Queuing theory	John Wiley and Sons Inc., New Jersey.	2008
4	Taha,H.A	Operations Research - An Introduction	Pearson Education Edition Asia, Delhi.	2006

**WEBSITES:**

<ol style="list-style-type: none"> <li>1. <a href="http://www.mathcentre.ac.uk">www.mathcentre.ac.uk</a></li> <li>2. <a href="http://www.mathworld">www.mathworld</a>. Wolfram.com</li> <li>3. <a href="http://www.mit.edu">www.mit.edu</a></li> </ol>
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**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 acquire the knowledge on various topics such as fuzzy algebra, fuzzy theory and fuzzy technology

**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****(9)**

Fuzzy Sets : Basics Classical sets vs Fuzzy Sets – Need for fuzzy sets – Definition and Mathematical representations – Level Sets – F u z z y functions - Zadeh's Extension Principle

**UNIT II OPERATIONS ON FUZZY SETS****(9)**

Operations on Fuzzy Sets Operations on  $[0,1]$  – Fuzzy negation, triangular norms, tconorms, fuzzy implications, Aggregation Operations, Fuzzy Functional Equations

**UNIT III FUZZY RELATIONS****(9)**

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****(9)**

Possibility Theory Fuzzy Measures – Evidence Theory – Necessity and Belief Measures – Probability Measures vs Possibility Measures

**UNIT V FUZZY INFERENCE****(9)**

Approximate Reasoning Fuzzy Decision Making - Fuzzy Relational Inference – Compositional rule of Inference - Efficiency of Inference - Hierarchical

**Total : 45****TEXT BOOK:**

S. NO.	AUTHOR(S) NAME	TITLE OF THE BOOK	PUBLISHER	YEAR OF PUBLICATION
1	George J Klir and Bo Yuan	Fuzzy Sets and Fuzzy Logic : Theory and Applications	Prentice Hall of India, New Delhi.	2003

**REFERENCES:**

<b>S. NO.</b>	<b>AUTHOR(S) NAME</b>	<b>TITLE OF THE BOOK</b>	<b>PUBLISHER</b>	<b>YEAR OF PUBLICATION</b>
1	Zimmermann H.J.	Fuzzy Set Theory and its Applications	Kluwer Academic publishers, USA.	2001
2	Michal Baczynski and Balasubramaniam Jayaram	Fuzzy Implications	Springer-Verlag publishers, Heidelberg	2008
3	Kevin M Passino and Stephen Yurkovich	Fuzzy Control	Addison Wesley Longman publishers, USA	1998

**WEBSITES:**

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| <ol style="list-style-type: none"><li>1. <a href="http://www.mathcentre.ac.uk">www.mathcentre.ac.uk</a></li><li>2. <a href="http://www.mathworld">www.mathworld</a>. Wolfram.com</li><li>3. <a href="http://www.calvin.edu/~pribeiro/othrlnks/Fuzzy/fuzzysets.htm">www.calvin.edu/~pribeiro/othrlnks/Fuzzy/fuzzysets.htm</a></li></ol> |
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**OBJECTIVES:**

1. To understand the proficiency in mathematics and the mathematical concepts needed for a proper understanding of physics.
2. To Learn about special type of matrices that are relevant in physics and then learn about tensors.
3. To introduce the Special functions like Bessel, Legendre , Hermite and Laguerre functions and their recurrence relations
4. To introduce the concepts of fuzzy relations.
5. To make the students to analyse the application of fuzzy logic control to real time systems.
6. The acquaint the students to have an exposure on various topics such as fuzzy algebra, fuzzy theory and fuzzy technology.

**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****(8)**

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****(8)**

Series Solution : Classification of singularities of an ordinary differential equation - Series solution-Method of Frobenius - indicial equation - examples

**UNIT III           SPECIAL FUNCTIONS****(8)**

Basic properties (Recurrence and Orthogonality relations, series expansion) of Bessel, Legendre , Hermite and Laguerre functions – Generating Function

**UNIT IV           CALCULUS OF VARIATIONS****(9)**

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****(12)**

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 a integral 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.

**Total : 45****REFERENCES:**

S. NO.	AUTHOR(S) NAME	TITLE OF THE BOOK	PUBLISHER	YEAR OF PUBLICATION
1	Dr. Grewal B.S.	Higher Engineering Mathematics	Khanna Publishers, New Delhi	2013
2	Murray R Spiegel, Seymour Lipschutz, Dennis Spellman	Vector Analysis	Tata Mc Graw 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

**WEBSITES:**

1. [www.mathcentre.ac.uk](http://www.mathcentre.ac.uk)
2. [www.mathworld](http://www.mathworld). Wolfram.com
3. [www.nptel.ac.in](http://www.nptel.ac.in)

**OBJECTIVES:**

1. To introduce the concepts of special functions.
2. To find the solutions to partial differential equations and their applications
3. To study about mathematical physics and perturbation techniques
4. To learn replacement models and simulation models
5. To provide techniques for effective methods to solve nonlinear programming and decision making
6. To understand how to model and solve problems using non integer programming.

**COURSE OUTCOMES(COS):**

1. Students know the concepts of improper integrals, Beta and Gamma functions.
2. The students acquire sound knowledge of techniques in solving PDE that model engineering problems.
3. Identify the situations where singular perturbations are needed. They will be able to use various modifications of matched asymptotic expansions techniques to derive asymptotic solutions.
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 INTRODUCTION TO SOME SPECIAL FUNCTIONS (9)**

Gamma function, Beta function, Bessel function, Error function and complementary Error function, Heaviside's function, pulse unit height and duration function, Sinusoidal Pulse function, Rectangle function, Gate function, Dirac's Delta function, Signum function, Saw tooth wave function, Triangular wave function, Half wave rectified sinusoidal function, Full rectified sine wave, Square wave function.

**UNIT II PARTIAL DIFFERENTIAL EQUATIONS AND APPLICATIONS (9)**

Formation PDEs, Solution of Partial Differential equations  $f(x,y,z,p,q) = 0$ , Nonlinear PDEs first order, Some standard forms of nonlinear PDE, Linear PDEs with constant coefficients, Equations reducible to Homogeneous linear form, Classification of second order linear PDEs. Separation of variables use of Fourier series, D'Alembert's solution of the wave equation, Heat equation: Solution by Fourier series and Fourier integral

**UNIT – III PERTURBATION TECHNIQUES (9)**

Singular perturbations (algebraic example). Notion of the boundary layer. Inner and outer solutions. Overlap region. Matching of the asymptotic expansions. Ordinary differential equations with singular perturbations. Methods to determine location of the boundary layer.

#### UNIT -IV SIMULATION MODELS

(9)

Elements of simulation model -Monte Carlo technique – applications. Queuing model: problems involving  $(M/M/1): (\infty/FIFO)$  ,  $(M/M/c): (\infty/FIFO)$  Models.

#### UNIT V DECISION MODELS

(9)

Decision Analysis – Decision Making environment – Decisions under uncertainty – Decision under risk – Decision – Tree Analysis.

**Total : 45**

#### REFERENCES:

S. NO.	AUTHOR(S) NAME	TITLE OF THE BOOK	PUBLISHER	YEAR OF PUBLICATION
1	Kreyszig,E	Advanced Engineering Mathematics	John Wiley & Sons, New Delhi.	2014
2	Gupta, A.S.	Calculus of Variations with Applications	Prentice Hall of India Pvt. Ltd., New Delhi	2008
3	Sankara Rao, K.	Introduction to Partial Differential Equations	Prentice Hall of India Pvt. Ltd., New Delhi	2010
4	Ali H Nayfeh	Perturbation Methods	John Wiley & Sons, New Delhi.	2008
5	Hamdy Taha. A.	Operations Research	Prentice – Hall of India Private Limited, New Delhi .	2010

#### WEBSITES:

1. <a href="http://www.mathworld.wolfram.com">www.mathworld.wolfram.com</a>
2. <a href="http://www.efunda.com">www.efunda.com</a>
3. <a href="http://www.nptel.ac.in">www.nptel.ac.in</a>



**LINEAR ALGEBRA**

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 give the knowledge on the importance of Linear Algebra

**COURSE COURSE OUTCOMES(COS):**

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 (9)**

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 (9)**

Eigen values and Eigen vectors - Diagonalization - Power method - QR decomposition

**UNIT III SYSTEM OF LINEAR EQUATIONS (9)**

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 (9)**

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 (9)**

The Dot Product on  $\mathbb{R}^n$  and Inner Product Spaces - Orthonormal Bases - Orthogonal Complements - Application : Least Squares Approximation - Diagonalization of Symmetric  $M$  - Application: Quadratic Forms

**Total : 45**

**REFERENCES:**

S. NO.	AUTHOR(S) NAME	TITLE OF THE BOOK	PUBLISHER	YEAR OF PUBLICATION
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

#### WEBSITES:

<ol style="list-style-type: none"> <li>1. <a href="http://www.sosmath.com">www.sosmath.com</a></li> <li>2. <a href="http://www.nptel.ac.in">www.nptel.ac.in</a></li> <li>3. <a href="http://www.mathworld.wolfram.com">www.mathworld.wolfram.com</a></li> </ol>
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**TRANSFORMS AND PARTIAL DIFFERENTIAL EQUATIONS  
(ONLY FOR BE CSE STUDENTS)**

**OBJECTIVES:**

1. To introduce Fourier series analysis which is central to many applications in engineering apart from its use in solving boundary value problems
2. To acquaint the student with Fourier series techniques in solving heat flow problems used in various situations.
3. To acquaint the student with Fourier transform techniques used in wide variety of situations.
4. To introduce the basic concepts of PDE for solving standard partial differential equations
5. To introduce the effective mathematical tools for the solutions of partial differential equations that model several physical processes and to develop Z transform techniques for discrete time systems.
6. To develop the use of effective mathematical tools for the solutions of partial differential equations by using Z transform techniques for discrete time systems

**COURSE OUTCOMES(COS):**

1. Solve differential equations using Fourier series analysis which plays a vital role in engineering applications.
2. The learners can equip themselves in the transform techniques and solve partial differential equations
3. Understand how to solve the given standard partial differential equations.
4. Understand the mathematical principles on transforms and partial differential equations would provide them the ability to formulate and solve some of the physical problems of engineering.
5. Appreciate the physical significance of Fourier series techniques in solving one and two dimensional heat flow problems and one dimensional wave equations.
6. Use the effective mathematical tools for the solutions of partial differential equations by using Z transform techniques for discrete time systems.

**UNIT- I            FOURIER SERIES****(10)**

Dirichlet's conditions – General Fourier series – Odd and even functions – Half range sine series – Half range cosine series – Complex form of Fourier Series – Parseval's identify – Harmonic Analysis.

**UNIT -II            FOURIER TRANSFORM****(9)**

Fourier integral theorem (without proof) – Fourier transform pair –Sine and Cosine transforms – Properties – Transforms of simple functions – Convolution theorem – Parseval's identity.

**UNIT- III            PARTIAL DIFFERENTIAL EQUATIONS****(9)**

Formation of partial differential equations by elimination of arbitrary constants and arbitrary functions – Solution of standard types of first order partial differential equations – Lagrange's linear equation – Linear partial differential equations of second and higher order with constant coefficients.

**UNIT- IV            APPLICATIONS OF PARTIAL DIFFERENTIAL EQUATIONS****(9)**

Classification of second order quasi linear partial differential equations – Solutions of one dimensional wave equation – One dimensional heat equation – Steady state solution of two-dimensional heat equation (Insulated edges excluded) – Fourier series solutions in Cartesian coordinates.

#### UNIT- V Z -TRANSFORM AND DIFFERENCE EQUATIONS

(8)

Z-transform - Elementary properties – Inverse Z – transform – Convolution theorem -Formation of difference equations – Solution of difference equations using Z - transform.

**Total : 45**

#### TEXT BOOKS:

S. NO.	AUTHOR(S) NAME	TITLE OF THE BOOK	PUBLISHER	YEAR OF PUBLICATION
1	Grewal, B.S.	Higher Engineering Mathematics	Khanna Publishers, Delhi.	2013
2	Erwin Kreyszig	Advanced Engineering Mathematics.	Wiley India (P) Ltd, New Delhi.	2014

#### REFERENCES:

S. NO.	AUTHOR(S) NAME	TITLE OF THE BOOK	PUBLISHER	YEAR OF PUBLICATION
1	Venkateswarlu S	Engineering Mathematics, Vol I	Anuratha Agencies and Publishers, Kumbakonam.	2007
2	Narayanan, S., Manicavachagom Pillay, T.K. and Ramaniah, G	Advanced Mathematics for Engineering Students. Volumes II and III,	Viswanathan S Printers and Publishers Pvt. Ltd. Chennai.	2002
3	Bali N P., Manish Goyal	A text book of Engineering Mathematics	Laxmi Publications Pvt. Ltd., New Delhi	2006
4	Ramana B V	Higher Engineering Mathematics	Tata Mc Graw Hill Publishing Co. Ltd. New Delhi.	2008

#### WEBSITES:

<ol style="list-style-type: none"> <li>1. <a href="http://www.sosmath.com">www.sosmath.com</a></li> <li>2. <a href="http://mathworld.wolfram.com/FourierSeries.html">http://mathworld.wolfram.com/FourierSeries.html</a></li> <li>3. <a href="http://www.nptel.ac.in">www. nptel.ac.in</a></li> </ol>
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**PURPOSE:**

It provides techniques of writing and also trains the students to write without their influence of mother tongue. In addition to honing their skills as professional writers, students will develop technical vocabularies that will aid writing research articles and discussing articles produced by their peers.

**OBJECTIVES:**

1. To Develop abilities to write technically and expressively,
2. To Recognize writing as a constructive, meaningful process,
3. To Practise using reading strategies for effective writing.
4. To equip them to write for academic as well as work place context.
5. To enable students to be familiar with structure and style of formal written communication
6. To Improve their writing skills and be ready with documents related ideas and notions.

**COURSE OUTCOMES(COS):**

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. Know the value of LSRW skills in document writing.
5. Understand the structure, content and format of technical documents.
6. Improve their writing skills and be ready with documents related ideas and notions.

**UNIT – I      BASICS OF WRITING****(7)**

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****(9)**

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****(9)**

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 (9)**

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 (11)**

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.

##### **TEXT BOOK:**

<b>S.NO</b>	<b>AUTHOR(S) NAME</b>	<b>TITLE OF THE BOOK</b>	<b>PUBLISHER</b>	<b>YEAR OF PUBLICATION</b>
1	V.N. Arora & Lakshmi Chandra	Improve Your Writing: Revised First Edition	OUP, New Delhi.	2014

##### **REFERENCES:**

<b>S.NO</b>	<b>AUTHOR(S) NAME</b>	<b>TITLE OF THE BOOK</b>	<b>PUBLISHER</b>	<b>YEAR OF PUBLICATION</b>
1	David Morley	The Cambridge Intro. to Creative Writing	CUP, New Delhi.	2010
2	Graham King	Collins Improve Your Writing	Collins; First edition, UK	2009
3	Crème, P. and M. Lea.	Writing at University: A guide for students.	OUP, New Delhi.	2003

##### **WEBSITES:**

<http://www.stevpavlina.com/blog/2006/08/10-ways-to-improve-your-technical-skills/> -Unit-I  
<http://www.nyu.edu/classes/keefer/brain/net2.html> - Unit-I, II, & III  
<https://www.udemy.com/technical-writing-and-editing/> - Unit-IV & V  
<http://techwhirl.com/what-is-technical-writing/> - All Units

**OBJECTIVES:**

1. To inculcate the basics of brief history of Earth sciences
2. To divulge knowledge on the basics of structure of earth and earth's gravitational field.
3. To disseminate the fundamentals of magnetic field and thermal distribution of earth.
4. To introduce the concepts of seismology and seismic waves .
5. To impart the basic knowledge of oceans
6. To Apply the knowledge gained from this course to solve the relevant problems in engineering stream.

**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 problems in engineering stream.

**UNIT I ORIGIN OF EARTH****(9)**

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****(9)**

Chemical composition of Earth, Rheological behavior of crust and upper mantle, viscoelasticity 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****(9)**

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 (9)**

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 (9)**

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

**Total: 45**

#### **TEXT BOOK:**

<b>S.NO</b>	<b>AUTHOR(S) NAME</b>	<b>TITLE OF THE BOOK</b>	<b>PUBLISHER</b>	<b>YEAR OF PUBLICATION</b>
1	B.F. Howell	Introduction to Geophysics	McGraw-Hill	2007

#### **REFERENCES:**

<b>S.NO</b>	<b>AUTHOR(S) NAME</b>	<b>TITLE OF THE BOOK</b>	<b>PUBLISHER</b>	<b>YEAR OF PUBLICATION</b>
1	W. Lowrie	Fundamentals of Geophysics	Cambridge University Press,	2007
2	J.A. Jacobs, R.D. Russel	Physics and Geology	McGraw-Hill	2002

#### **WEBSITES:**

1. <a href="http://www.ocw.mit.edu">www.ocw.mit.edu</a> 2. <a href="http://www.physicsclassroom.com">www.physicsclassroom.com</a> 3. <a href="http://www.nptel.ac.in">www.nptel.ac.in</a> 4. <a href="http://www.physics.org">www.physics.org</a>
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**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)

**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. Illustrate 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 (9)**

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 of images.

**UNIT II RADIATION AND RECEPTION OF ACOUSTIC WAVES (9)**

Radiation from a pulsating sphere – Acoustic reciprocity – continuous line source radiation 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 (9)**

Resonance in pipes - standing wave pattern absorption of sound in pipes – long wavelength limit – Helmholtz 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 – combining band levels and tones – detecting signals in noise – fundamental properties of hearing – loudness level and loudness – pitch and frequency – voice.

**UNIT IV ARCHITECTURAL ACOUSTICS (9)**

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 (9)**

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 electroynamics microphone piezoelectric microphone – calibration of receivers

**Total: 45**

**TEXT BOOK:**

S.NO	AUTHOR(S) NAME	TITLE OF THE BOOK	PUBLISHER	YEAR OF PUBLICATION
1	Lawrence E.Kinsler, Austin R.Frey,	Fundamentals of Acoustics	John Wiley & Sons	4th edition 2000

**REFERENCE:**

S.NO	AUTHOR(S) NAME	TITLE OF THE BOOK	PUBLISHER	YEAR OF PUBLICATION
1	<u>E.</u> <u>Alton Everest &amp;</u> <u>Ken Pohlmann</u>	Master Handbook of Acoustics	McGraw Hill Professional	6 <sup>th</sup> edition 2014

**WEBSITES:**

1. <a href="http://www.acousticalsociety.org">www.acousticalsociety.org</a> 2. <a href="http://www.acoustics-engineering.com">www.acoustics-engineering.com</a> 3. <a href="http://www.nptel.ac.in">www.nptel.ac.in</a> 4. <a href="http://www.ocw.mit.edu">www.ocw.mit.edu</a>
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**OBJECTIVES:**

1. To understand about the fuel
2. To study about the alcohols and its importance in engine
3. To gain knowledge on the fuel gas and oils
4. To get the information on fuel cell
5. To understand electric, hybrid and solar cars
6. To Develop their knowledge in studies of vegetable oils

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**COURSE OUTCOMES(COS):**

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1. Students will know about the basic concepts of alternate fuels
  2. Students will know about the basic concepts of alcohols.
  3. Students will understand about fuel gas and oils
  4. Students can enrich their knowledge about the alternate fuels and energy systems
  5. Develop their knowledge in studies of vegetable oils
  6. Students knows about the importance of electric, hybrid and solar cars
- 

**UNIT I INTRODUCTION (9)**

Need for alternate fuel, availability and properties of alternate fuels, general use of alcohols, LPG, hydrogen, ammonia, CNG and LNG, vegetable oils and biogas, merits and demerits of various alternate fuels, introduction to alternate energy sources and significance.

**UNIT II ALCOHOLS (9)**

Properties as engine fuel, alcohols and gasoline blends, performance in SI engines, methanol and gasoline blends, combustion characteristics in CI engines, emission characteristics, DME, DEE properties performance analysis, performance in SI & CI Engines.

**UNIT III NATURAL GAS, LPG, HYDROGEN AND BIOGAS (10)**

Availability of CNG, properties, modification required to use in engines, performance and emission characteristics of CNG & LPG in SI & CI engines, performance and emission of LPG. Hydrogen storage and handling, performance and safety aspects. Production of Biogas and its applications

**UNIT IV VEGETABLE OILS (8)**

Various vegetable oils for engines, esterification, performance in engines, performance and emission characteristics, biodiesel and its characteristics.

**UNIT V ELECTRIC, HYBRID, FUEL CELL AND SOLAR CARS (9)**

Layout of an electric vehicle, advantage and limitations, specifications, system components, electronic control system, high energy and power density batteries, hybrid vehicle, fuel cell vehicles, solar powered vehicles.

**Total: 45**

**TEXT BOOKS:**

S. NO.	AUTHOR(S) NAME	TITLE OF THE BOOK	PUBLISHER	YEAR OF PUBLICATION
1.	Jain, P.C. and Monika Jain	Engineering Chemistry	Dhanpat Rai Publishing Company (P) Ltd., New Delhi.	2009
2.	Richard.L.Bechfold	Alternative Fuels	SAE International , USA	2002

#### REFERENCE BOOKS:

S. NO.	AUTHOR(S) NAME	TITLE OF THE BOOK	PUBLISHER	YEAR OF PUBLICATION
1.	Saeid Mokhatab William A Poe	Hand book of Natural Gas Transmission and Processing, 2 <sup>nd</sup> edition.	Gulf Professional Publisher, USA	2012
2.	Nagpal G.R	Power Plant Engineering	Khanna Publishers, Delhi.	2002

#### WEBSITES:

1. <a href="http://www.fao.org/docrep/t4470e/t4470e08.htm">www.fao.org/docrep/t4470e/t4470e08.htm</a>
2. <a href="http://www.exergy.se/goran/hig/ses/06/alternative%20fuels">http://www.exergy.se/goran/hig/ses/06/alternative%20fuels</a>

**OBJECTIVES:**

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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 managements.
5. To acquaint the students with the basics of energy generation from waste materials.
6. To get the information on energy conservation.

**COURSE OUTCOMES(COS):**

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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 (9)**

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 (9)**

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 (9)**

Sanitary Land Fill Method of Solid Waste Disposal – Land Fill Classification, 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 (9)**

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, Remediation, risk assessment.

**UNIT V ENERGY GENERATION FROM WASTE (9)**

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.

**Total: 45**

**TEXT BOOK:**

S. NO.	AUTHOR(S) NAME	TITLE OF THE BOOK	PUBLISHER	YEAR OF PUBLICATION
1.	Dara.S.S,Mishra.D.D	A Text book of Environmental Chemistry and Pollution Control	S.Chand and Company Ltd., New Delhi.	2011

**REFERENCE BOOKS:**

S. NO.	AUTHOR(S) NAME	TITLE OF THE BOOK	PUBLISHER	YEAR OF PUBLICATION
1.	Naomi B. Klinghoffer and Marco J. Castaldi	Waste to Energy Conversion Technology (Woodhead Publishing Series in Energy)	Woodhead Publishing Ltd., Cambridge, UK	2013
2.	<u>Frank Kreith, George Tchobanoglous</u>	Hand Book of Solid Waste Management- 2 <sup>nd</sup> edition	McGraw Hill Publishing Ltd., Newyork	2002
3.	Shah, L Kanti	Basics of Solid & Hazardous Waste Management Technology	Prentice Hall (P) Ltd., New Delhi.	1999

**WEBSITES:**

- 1.[www.iitk.ac.in/3inetwork/html/reports/IIR2006/Solid\\_Waste](http://www.iitk.ac.in/3inetwork/html/reports/IIR2006/Solid_Waste).
- 2.<http://www.unep.or.jp/ietc/ESTdir/Pub/MSW/>
- 3.[www.alternative-energy-news.info/technology/garbage-energy/](http://www.alternative-energy-news.info/technology/garbage-energy/)

**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 basic information on catalysis.
6. To inculcate the chemical principles in the field of engineering and technology

**COURSE OUTCOMES(COS):**

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 (9)**

Definition, tools, and twelve principles of green chemistry, solvent-less reactions and reactions in water, microwaves and fluorosolvents, 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 (9)**

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 (9)**

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 (9)**

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 (9)**

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.

**Total: 45**

**TEXT BOOKS:**

S. NO.	AUTHOR(S) NAME	TITLE OF THE BOOK	PUBLISHER	YEAR OF PUBLICATION
1.	Sanjay K. Sharma, Ackmez Mudhoo	Green Chemistry for Environmental Sustainability	CRC Press , London	2010
2.	Ahluwalia V. K. and M.Kidwai	New Trends in Green Chemistry 2 <sup>nd</sup> edition	Anamaya publishers., New Delhi.	2007

**REFERENCE BOOKS:**

S. NO.	AUTHOR(S) NAME	TITLE OF THE BOOK	PUBLISHER	YEAR OF PUBLICATION
1.	Dr. Sunita Ratan	A Textbook of Engineering Chemistry	S.K. Kataria and Sons., New Delhi.	2012
2.	Mukesh Doble. Ken Rollins, Anil Kumar	Green Chemistry and Engineering, 1 <sup>st</sup> edition	Academic Press, Elsevier., New Delhi.	2007
3.	Desai K. R.	Green Chemistry	Himalaya Publishing House, Mumbai.	2005
4.	Matlack A. S.	Introduction to Green Chemistry	Marcel Dekker: New York	2001

**WEBSITES:**

1. <http://www.organic-chemistry.org/topics/green-chemistry.shtm>
2. <http://www.essentialchemicalindustry.org/processes/green-chemistry.html>
3. [http://www.chm.bris.ac.uk/webprojects2004/vickery/green\\_solvents.htm](http://www.chm.bris.ac.uk/webprojects2004/vickery/green_solvents.htm)
4. <http://www.epa.gov/research/greenchemistry/>



**OBJECTIVES:**

1. To make the students conversant with **the information on electrochemical material**.
2. To make the student acquire sound knowledge of **conducting polymers**.
3. To acquaint the student with concepts of Energy storage devices.
4. To develop energy storage devices.
5. To impart knowledge on basic principals of solar cells and its applications
6. To inculcate the chemical principles in the field of engineering and technology

**COURSE OUTCOMES(COS):**

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****(9)**

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****(9)**

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****(9)**

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****(9)**

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****(9)**

Solar cells- Preparation of CdS/Cu<sub>2</sub>S 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**

**TEXT BOOKS:**

S. NO.	AUTHOR(S) NAME	TITLE OF THE BOOK	PUBLISHER	YEAR OF PUBLICATION
1.	Cynthia G. Zoski	Hand Book of Electrochemistry	Academic Press, Elsevier., UK	2007
2.	D.Pletcher and F.C.Walsh	Industrial Electrochemistry	Chapman and Hall, London	1990

**REFERENCE BOOKS:**

S. NO.	AUTHOR(S) NAME	TITLE OF THE BOOK	PUBLISHER	YEAR OF PUBLICATION
1.	M. Barak	Electrochemical Power Sources	IEEE series, Peter Peregrinus Ltd, Steverage, U.K.	1997
2.	Bruno Scrosati	Applications of Electroactive Polymers	Chapman & Hall, London	1993
3.	K.L. Chopra and I. Kaur	Thin Film Devices and their Application	Plenum Press, New York.	1983
4.	M.M.Baizer	Organic Electrochemistry	Dekker Inc. New York	1983

**WEBSITES:**

1. <http://www.anoplate.com/finishes/>
2. <http://hyperphysics.phy-astr.gsu.edu/hbase/electric/battery.html>
3. [http://inventors.about.com/od/sstartinventions/a/solar\\_cell.htm](http://inventors.about.com/od/sstartinventions/a/solar_cell.htm)

**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 inculcate the chemical principles in the field of engineering and technology

**COURSE OUTCOMES(COS):**

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****(9)**

Manufacture of Portland cement – setting and 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****(9)**

Abrasives – hard abrasives – siliceous abrasives – soft abrasives – artificial abrasives – uses. Refractories – definition – classification – acid refractories – basic refractories – neutral refractories – properties – uses.

**UNIT III INORGANIC CHEMICALS****(9)**

Common salt and soda ash – manufacture – different grades – products – alkalis –  $\text{Na}_2\text{CO}_3$ , 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  $\text{H}_2\text{SO}_4$  – chamber – contact processes – industrial uses.

**UNIT IV EXPLOSIVES****(9)**

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****(9)**

Fertilizers – organic and inorganic – ammoniated superphosphates, sodium nitrate, solid pellets – potassium salts – pesticides – fungicides – herbicides – their preparations and characteristics – environmental impacts.

**TEXT BOOKS:**

S. NO.	AUTHOR(S) NAME	TITLE OF THE BOOK	PUBLISHER	YEAR OF PUBLICATION
1.	Harikrishan	Industrial Chemistry	Goel Publishing House, Meerut.	2014
2.	B.K. Sharma	Industrial Chemistry	Goel Publishing House, Meerut.	2000

**REFERENCE BOOKS:**

S. NO.	AUTHOR(S) NAME	TITLE OF THE BOOK	PUBLISHER	YEAR OF PUBLICATION
1.	B.N.Chakrabarty	Industrial Chemistry	Oxford and IBH Publishing CO. New Delhi.	1998
2.	James A. Kent	Hand Book of Industrial Chemistry, 9 <sup>th</sup> edition	Van Nostrand Reinhold, New York.	1992
3.	R.N. Sherve	Chemical Process Industries	McGraw-Hill, Kugakuisha Ltd., Tokyo.	1984
4.	S.D. Shukla and G.N. Pandy	A Text book of Chemical Technology	Vikas Publishing House (P) Ltd, New Delhi.	1979

**WEBSITES:**

1. <http://en.wikipedia.org/wiki/Cement>
2. <http://www.hon.ch/HONselect/Selection/D01.html>
3. <http://fas.org/man/dod-101/navy/docs/fun/part12.htm>

**COURSE OBJECTIVES:**

1. To learn how to use and manipulate several core data structures: Lists, Dictionaries, Tuples, and Strings
2. To study decision structures and loops
3. To understand the process and skills necessary to effectively deal with problem solving in relation to writing programs
4. To understand the process and skills necessary to effectively deal with problem solving
5. To discuss in relation to writing programs
6. To study various program object and graphics based on python

**COURSE COURSE OUTCOMES(COS):**

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

1. Develop algorithmic solutions to simple computational problems Read, write, execute by hand simple Python programs
2. Structure simple Python programs for solving problems
3. Decompose a Python program into functions.
4. Represent compound data using Python lists, tuples, dictionaries
5. Read and write data from/to files in Python Programs
6. Understand various program object and graphics based on python

<b>UNIT I</b>	<b>Fundamentals</b>	<b>9</b>
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The Universal Machine-Program power- What is Computer Science?-Hardware Basics- Programming Languages-Python-Inside Python program-Software Development Process- Example program- Elements of programs- Output statements- Assignment Statements- Data types-Type conversions

<b>UNIT II</b>	<b>Decision Structures and Loops</b>	<b>9</b>
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Simple Decisions-Two-way decisions-Multi-way decisions-Exception handling-for loops-indefinite loops-common loop patterns-Booleans

<b>UNIT III</b>	<b>Functions</b>	<b>9</b>
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Function of functions-Functions and Parameters-Function that returns values-Function that modifies parameters-Functions and program structures

<b>UNIT IV</b>	<b>Sequences</b>	<b>9</b>
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String data type- String Processing-List as sequences-String Representation-String Methods-I/O as String manipulation-File Processing

<b>UNIT V</b>	<b>Objects and Graphics</b>	<b>9</b>
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Overview-Object of Objects-Simple Graphics Programming-Using Graphical Objects-Choosing Coordinates- Interactive Graphics-Graphics module reference

**Total Hours: 45**

**References:**

1. John Zelle, “ Python Programming: An Introduction to Computer Science”, 2<sup>nd</sup> Edition, Franklin & Associates, 2009
2. Mark Lutz, “Learning Python”, OReily, 2013
3. David Beazly & Brian K. Jones, “Python Cookbook”, OReily, 2013

**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 COURSE OUTCOMES(COS):**

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****9**

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****9**

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****9**

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****9**

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****9**

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.

**Total Hours: 45**

**References:**

1. Web Technology: A Developer's Perspective, N.P. Gopalan and J. Akilandeswari, PHI Learning, Delhi, 2013.
2. Internetworking Technologies, An Engineering Perspective, Rahul Banerjee, PHI Learning, Delhi, 2011.



**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.

<b>UNIT I</b>	<b>Introduction</b>	<b>9</b>
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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**      9

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 &amp; its Concepts      9

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      9

## Formats – Methods – Usages – Expression – Motion Capture Software’s – Script Animation Usage – Different Language of Script Animation Among the Software.

<b>UNIT V</b>	<b>Concept Development</b>	<b>9</b>
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Story Developing –Audio & Video – Color Model – Device Independent Color Model – Gamma and Gamma Correction - Production Budgets- 3D Animated Movies.

**Total Hours: 45**

**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. Computer Graphics, Multimedia and Animation-Malay K. Pakhira, PHI Learning Pvt Ltd, 2010
4. Encyclopedia of Multimedia and Animations-Pankaj Dhaka, Anmol Publications-2011

**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****9**

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****9**

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****9**

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****9**

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****9**

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.

**Total Hours: 45**

**References:**

1. B. Govindarajalu, “IBM PC Clones Hardware, Troubleshooting and Maintenance”, 2/E, TMH, 2002.
2. Peter Abel, Niyaz Nizamuddin, “IMB PC Assembly Language and Programming”, Pearson Education, 2007
3. Scott Mueller, “Repairing PC's”, PHI, 1992

**COURSE OBJECTIVES:**

1. To understand the basic requirements, installation and structure of gaming using Java
2. Discuss various aspects of safe cracker projects
3. Discuss various aspects of match game projects
4. Discuss various aspects of pizza delivery projects
5. Discuss various aspects of moon landing projects
6. Discuss the process of development of gaming using Java

**COURSE OUTCOMES(COS):**

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

1. Interpret various concepts of gaming based on Java
2. Design the frame and code to develop safe cracker project
3. Design the frame and code to develop match game project
4. Design the frame and code to develop pizza delivery project
5. Design the frame and code to develop moon landing project
6. Design and develop various games using Java

<b>UNIT I</b>	<b>Introduction</b>	<b>9</b>
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Introducing Games with Java- Requirements-Installing Netbeans IDE-Structure of Java Program-Structure of Java GUI-Swing controls-Stopwatch Project-Creating Frames-Adding Controls-Adding Event methods-Writing Code

<b>UNIT II</b>	<b>Safecracker Project</b>	<b>9</b>
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Frame design-Grid Bag Layout Manager-Code Design-Adding Sounds-Tic Tac Toe Project-Frame Design-Code Design-Adding Events-Adding Sounds

<b>UNIT III</b>	<b>Match Game Project</b>	<b>9</b>
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Preview-Frame Design-Photo Selection-Code Design-Timer Objects- Adding Delays-one player Solitaire game-Computer Moves

<b>UNIT IV</b>	<b>Pizza Delivery Project</b>	<b>9</b>
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Preview- Frame Design-Adding Clock-Game Design-Multiple Frames GUI- Leap Frog Project-Preview-Frame Design-Code Design- Introduction to OOP-Sprite Class-Collision detection between objects- Updating Scores

<b>UNIT V</b>	<b>Moon Landing Project</b>	<b>9</b>
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Preview-Frame Design- Code Design- Graphics Methods- Graphics 2D Objects-Stroke and Paint Objects-Shapes and Drawing Methods-Line, Rectangle and Ellipse-Scrolling Background-Sprite Animation

**Total Hours:**  
**45**

**References:**

1. Philip Conrod, Lou Tylee, "Programming Games with Java",2013
2. Timothy M.Right, "Fundamental 2D Game Programming with Java",Cengage Learning PTR,2015
3. Wayne Holder,Doug Bell, "Java Game Programming for Dummies",

**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 COURSE OUTCOMES(COs):**

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 III ELECTRIC 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 V ENERGY 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 Fundamentals	CRC Press	2003

## REFERENCES

S. No.	Author(s) Name	Title of the book	Publisher	Year of Publication
1	Mehrdad Ehsani, Yimi Gao, Sebastian E. Gay, Ali Emadi	Modern Electric, Hybrid Electric and Fuel Cell Vehicles: Fundamentals, Theory and Design	CRC Press	2004
2	James Larminie, John Lowry	Electric Vehicle Technology Explained	Wiley	2003



## **15BEEEOE02 ENERGY MANAGEMENT AND ENERGY AUDITING L T P C 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.

### **Course COURSE OUTCOMES(COs):**

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 Butterworth	<i>Energy Management</i>	<i>Heinemann Publications</i>	2007

### Reference Books

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	John Wiley and Sons, 7th Edition	2009
3	Paul o' Callaghan	Energy Management	Mc-Graw Hill Book Company – 1st edition	1998

**Course Objectives**

1. It deals with various types of Sensors & Transducers and their working principle
2. It deals with resistive transducers
3. It deals with capacitive transducers
4. It deals with inductive transducers
5. It deals with some of the miscellaneous transducers
6. It deals with characteristics of transducers

**Course Outcomes (COs)**

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

1. understand all types of sensors and transducers.
2. Justify the concept and working principle of different transducers and sensors
- 3 Justify the transducers that will be utilised in the electrical industries
4. Identify recent developments in transducer domain
5. Discover the knowledge for small technology up gradations in it
6. Analysis the real time application.

**UNIT I INTRODUCTION OF TRANSDUCERS**

Transducer – Classification of transducers – Basic requirement of transducers.

**UNIT II CHARACTERISTICS OF TRANSDUCERS**

Static characteristics – Dynamic characteristics – Mathematical model of transducer – Zero, first order and second order transducers – Response to impulse, step, ramp and sinusoidal inputs.

**UNIT III RESISTIVE TRANSDUCERS**

Potentiometer –Loading effect – Strain gauge – Theory, types, temperature compensation – Applications – Torque measurement – Proving Ring – Load Cell – Resistance thermometer – Thermistors materials – Constructions, Characteristics – Hot wire anemometer.

**UNIT IV INDUCTIVE AND CAPACITIVE TRANSDUCER**

Self inductive transducer – Mutual inductive transducers– LVDT Accelerometer – RVDT – Synchros – Microsyn – Capacitive transducer – Variable Area Type – Variable Air Gap type – Variable Permittivity type – Capacitor microphone.

**UNIT V MISCELLENEOUS TRANSDUCERS**

Piezoelectric transducer – Hall Effect transducers – Smart sensors – Fiber optic sensors – Film sensors – MEMS – Nano sensors, Digital transducers.

## TEXT BOOKS

S. No.	Author(s) Name	Title of the book	Publisher	Year of Publication
1	Sawhney A.K	A Course in Electrical and Electronics Measurements and Instrumentation	18th Edition, Dhanpat Rai & Company Private Limited	2007
2	Renganathan. S	Transducer Engineering	Allied Publishers, Chennai	2003

## REFERENCES

S. No.	Author(s) Name	Title of the book	Publisher	Year of Publication
1	Doebelin. E.A	Measurement Systems – Applications and Design	Tata McGraw Hill, New York	2000
2	Patranabis. D	Sensors and Transducers	Prentice Hall of India	1999
3	John. P, Bentley	Principles of Measurement Systems	III Edition, Pearson Education	2000
4	Murthy.D.V.S	Transducers and Instrumentation	Prentice Hall of India	2001

**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 know 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
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1	JR Hackworth and F.D Hackworth – Jr	Programmable Logic Controllers – Programming Method and Applications	Pearson	2006
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## REFERENCES

<b>S. No.</b>	<b>Author(s) Name</b>	<b>Title of the book</b>	<b>Publisher</b>	<b>Year of Publication</b>
1	John Webb and Ronald A Reiss	Programmable Logic Controllers – Principle and Applications	Fifth edition, PHI	
2	W.Bolton	Programmable Logic controller	Elsevier Newnes Publications, Fourth Edition	2006

## WEBSITE

<http://www.mikroe.com/old/books/plcbook/chapter1/chapter1.htm>, - Introduction to programmable Logic controller

**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 resources of energy	Khanna publishers ,Fourth edition	2010
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, Fourth edition	2005
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	2006
4	Mittal K.M	Non-Conventional Energy Systems	Wheeler Publishing Co. Ltd	1997

## WEBSITES

1. [www.energycentral.com](http://www.energycentral.com)
2. [www.catelectricpowerinfo.com](http://www.catelectricpowerinfo.com)



**Course Objectives**

1. To study the state variable analysis
2. To provide adequate knowledge in the phase plane analysis and also describing function analysis.
3. To study the analysis discrete time systems using conventional techniques.
4. To analyze the stability of the systems using different techniques.
5. To study the design of optimal controller.
6. To study the types of compensators

**Course Outcomes**

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

1. understand the state variable analysis, Z- transform, state equation
2. Construct the frequency response of the system using various plots
3. Correlate the time and frequency domain specifications and effect of compensation
4. Design the different types of compensators using frequency response plots to stabilize the control system
5. Explain the state variable representation of physical systems with the effects of state feedback its assessment for linear-time invariant systems

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**UNIT 1 STATE VARIABLE ANALYSIS**

Concept of state – State Variable and State Model – State models for linear and continuous time systems – Solution of state and output equation – controllability and observability - Pole Placement – State observer Design of Control Systems with observers

**UNIT II PHASE PLANE AND DESCRIBING FUNCTION ANALYSIS**

Features of linear and non-linear systems - Common physical non-linearities – Methods of linearising non-linear systems - Construction of phase portraits – Singular points – Limit cycles Basic concepts, derivation of describing functions for common non-linearities – Describing function analysis of non-linear systems – Conditions for stability – Stability of oscillations.

**UNIT III Z-TRANSFORM AND DIGITAL CONTROL SYSTEM**

Z transfer function – Block diagram – Signal flow graph – Discrete root locus – Bode plot.

**UNIT IV STATE-SPACE DESIGN OF DIGITAL CONTROL SYSTEM**

State equation – Solutions – Realization – Controllability – Observability – Stability – Jury's test.

**UNIT V OPTIMAL CONTROL**

Introduction -Decoupling - Time varying optimal control – LQR steady state optimal control – Optimal estimation – Multivariable control design.

### TEXT BOOKS

S. No.	Author(s) Name	Title of the book	Publisher	Year of Publication
1	I.J. Nagrath and M. Gopal	Control Systems Engineering	New Age International Publishers	2003
2	Ashish Tewari	Modern control Design with Matlab and Simulink	John Wiley, New Delhi	2002
3	Benjamin C. Kuo	Digital Control Systems	Oxford University Press	1992
4	George J. Thaler	Automatic Control Systems'	Jaico Publishers	1993

### REFERENCES

S. No.	Author(s) Name	Title of the book	Publisher	Year of Publication
1	George J. Thaler	Automatic Control Systems	Jaico Publishers	1993
2	M.Gopal	Modern control system theory	New Age International Publishers	2002
3	Gene F. Franklin, J. David Powell and Abbasemami-Naeini	Feedback Control of Dynamic Systems	Fourth edition, Pearson Education, Low price edition	2002
4	Raymond T. Stefani & Co	Design of feedback Control systems	Oxford University	2002

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 – ARM 7

### **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 – Intertask Communication – Message Mailboxes – Message Queues - Interrupts - Task Management – Memory Management - Time Management – Clock Ticks.

### **UNIT - III TASK MANAGEMENT**

Introduction -  $\mu$ C/OS-II Features - Goals of  $\mu$ C/OS-II - Hardware and Software Architecture – Kernel Structures: Tasks – Task States – Task Scheduling – Idle Task – Statistics Task – Interrupts Under  $\mu$ C/OS-II – Clock Tick -  $\mu$ C/OS-II Initialization. Task Management: Creating Tasks – Task Stacks – Stack Checking – Task's Priority – Suspending Task – Resuming Task. Time Management: 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 at a 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 with  $\mu$ C/OS-II – Installing  $\mu$ C/OS-II – Porting  $\mu$ C/OS-II: Development Tools – Directories and Files – Testing a Port - IAR Workbench with  $\mu$ C/OS-II -  $\mu$ C/OS-II Porting on a 8051 CPU – Implementation of Multitasking - Implementation of Scheduling and Rescheduling – Analyze the Multichannel ADC with help of  $\mu$ C/OS-II.

#### **REFERENCES**

<b>S.NO</b>	<b>Author(s) Name</b>	<b>Title of the book</b>	<b>Publisher</b>	<b>Year of publication</b>
1	Jean J. Labrosse	MicroC/OS – II The Real Time Kernel	CMP BOOKS	2009
2	David Seal	ARM Architecture Reference Manual.	Addison-Wesley	2008
3	Steve Furbe,	ARM System-on-Chip Architecture,	Addison-Wesley Professional, California	2000

**15BEEC\_OE02**

**CONSUMER ELECTRONICS**

**3 0 0 3 100**

#### **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 - Colour TV systems – NTSC, PAL, SECAM - Components of a Remote Control.

## **UNIT – III OPTICAL RECORDING AND REPRODUCTION**

Audio Disc – Processing of the Audio signal –read out 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

## **UNIT – V HOME APPLIANCES**

Basic principle and block diagram of microwave oven; washing machine hardware and software; components of air conditioning and refrigeration systems.

### **Text Book:**

1.S.P.Bali, “Consumer Electronics”, Pearson Education, 2005.

## **15BEEC\_OE03                      FUNDAMENTALS OF NANOTECHNOLOGY   3 0 0 3 100**

### **Course Objectives**

1. To familiar with the important concepts applicable to small electronic devices, their fabrication, characterization and application
2. To have a solid understanding of Nanotechnology concepts.
3. To introduce the basic concepts of Nanotechnology and its applications in various domain
4. To understand the molecular structure of carbon nano tube
5. To educate how to use Nanotechnology to solve real-world problems
6. To familiar with the structure and application of carbon nano tube

### **Course Outcomes**

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

1. Understand the basic concepts of Nanotechnology and its applications in various domain
2. Ability to develop how to use Nanotechnology to solve real- world problems
3. Understand solid understanding of Nanotechnology concepts
4. Understand the important concepts applicable to small electronic devices, their fabrication, characterization and application
5. Understand the molecular structure of carbon nano tube
6. Familiar with the structure and application of carbon nano tube

## UNIT I-LIMITATIONS OF CMOS

Fundamentals of MOSFET devices-Scaling of CMOS-Limitations- Alternative concepts in materials – Structures of MOS devices: SOI MOSFET, FINFETs, Dual Gate MOSFET, Ferroelectric FETs.

## UNIT II-MICRO AND NANOFABRICATION

Optical Lithography-Electron beam Lithography –Atomic Lithography– Molecular beam epitaxy-Nanolithography.

## UNIT III-CHARACTERIZATION EQUIPMENTS

Principles of Electron Microscopes-Scanning Electron Microscope- Transmission Electron Microscope-Atomic Force Microscope-Scanning Tunneling Microscope.

## UNIT IV-NANODEVICES-I

Resonant tunneling diodes –Single electron devices-Josephson junction- Single Flux Quantum logic-Molecular electronics.

## UNIT V-NANODEVICES – II

Quantum computing: principles– Qbits-Carbon nanotubes (CNT): Characteristics, CNTFET, Application of CNT-Spintronics: Principle, Spin valves, Magnetic Tunnel Junctions, SpinFETs, MRAM

### TEXT BOOK:

S.NO .	Author(s) Name	Title of the book	Publisher	Year of publication
1	Rainer Waser (Ed)	Nanoelectronics and information technology	Wiley-VCH. 3 <sup>rd</sup> Edition	2012

### REFERENCES:

S.N O.	Author(s) Name	Title of the book	Publisher	Year of publication
1	Thomas Heinzel	A Microscopic Electronics in Solid State Nanostructure	Wiley-VCH	2008
2	Mick Wilson, Kamali Kannangara, Geoff Smith, Michelle Simmons, Burkhard Raguse	Nanotechnology – (Basic Science and Emerging Technologies)	Overseas Press	2002

3	Mark Ratner, Daniel Ratner	Nanotechnology: A Gentle introduction to the Next Big idea	Pearson education	2003
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**15BEEC\_OE04**

**IMAGE AND VIDEO PROCESSING**

**3 0 0 3 100**

### **OBJECTIVES**

1. To study the image fundamentals and mathematical transforms necessary for image processing.
2. To study the image enhancement techniques
3. To study the image compression procedures.
4. To study the image segmentation and representation techniques.
5. To study the video processing fundamentals
6. To know the concepts of motion estimation

### **COURSE OUTCOMES(COS)::**

1. Understand the image fundamentals and mathematical transforms necessary for image processing.
2. Understand the image enhancement techniques
3. Understand the image compression procedures.
4. Understand the image segmentation and representation techniques.
5. Understand the video processing fundamentals
6. Understand motion estimation concepts

### **UNIT**

**FUNDAMENTALS OF IMAGE PROCESSING AND IMAGE TRANSFORMS** Basic steps of Image processing systems sampling and quantization of an Image – Basic relationship between pixels Image Transforms: 2-D Discrete Fourier Transform, Discrete Cosine Transform, Discrete Wavelet transforms.

### **UNIT II IMAGE PROCESSING TECHNIQUES**

Image Enhancement: Spatial Domain methods: Histogram Processing, Fundamentals of Spatial Filtering, Smoothing Spatial filters, Sharpening Spatial filters, Frequency Domain methods: Basics of filtering in frequency domain, image smoothing, image sharpening, selective filtering.

### **UNIT III IMAGE SEGMENTATION AND COMPRESSION**

Segmentation concepts, point, line and Edge detection, Thresholding, region based segmentation Image Compression Image compression fundamentals – coding Redundancy, spatial and temporal redundancy. Compression models: Lossy and Lossless, Huffman coding, Arithmetic coding, LZW coding, run length coding, Bit Plane coding, transform coding, predictive coding, wavelet coding, JPEG standards.

### **UNIT IV BASICS OF VIDEO PROCESSING**

Analog video, Digital Video, Time varying Image Formation models : 3D motion models, Geometric Image formation, Photometric Image formation, sampling of video signals, filtering operations.

### **UNIT V 2-D MOTION ESTIMATION**

Optical flow, general methodologies, pixel based motion estimation, Block matching algorithm, Mesh based motion Estimation, global Motion Estimation, Region based

motion estimation, multiresolution motion estimation. Waveform based coding, Block based transform coding, predictive coding, Application of motion estimation in video coding.

### **TEXTBOOKS**

1. Gonzalez and Woods, "Digital Image Processing", 3<sup>rd</sup> edition Pearson
2. Yao Wang, Joern Ostermann and Ya-Qin Zhang, "Video processing and communication", 1<sup>st</sup> edition PHI

### **REFERENCE BOOKS**

1. M. Tekalp, "Digital video Processing", Prentice Hall International
2. Anerozdemir, "Inverse Synthetic Aperture Radar Imaging with MATLAB Algorithms", John Wiley & Sons
3. Chris Solomon, Toby Breckon, "Fundamentals of Digital Image Processing A Practical Approach with Examples in Matlab", John Wiley & Sons,



**Course Objectives**

1. To learn the processing steps in fabrication of VLSI devices.
2. To learn the concepts of assembling and packaging for VLSI devices.
3. To impart a good knowledge in reactive plasma etching techniques and equipment.
4. To familiarize the students with the NMOS and CMOS IC technology.
5. To make the student acquire reactive Plasma Etching techniques and Equipment.
6. To acquaint the student with the VLSI assembly technology and package fabrication technology

**Course outcomes**

After completing this course, the students will be able to

1. List out various fabrication techniques
2. Understand the etching principle in IC fabrication
3. Gain knowledge on deposition and diffusion methods
4. Understand the process simulation and integration.
5. Assembling and packing techniques
6. various technologies used for fabricating VLSI devices

**UNIT 1**

Introduction to MOS Technologies: MOS, CMOS, BiCMOS Technology, Trends and Projections. Basic Electrical Properties of MOS, CMOS & BiCMOS Circuits:  $I_{ds}$ - $V_{ds}$  relationships, Threshold Voltage  $V_t$ ,  $G_m$ ,  $G_{ds}$  and  $\omega_o$ , Pass Transistor, MOS, CMOS & Bi CMOS Inverters,  $Z_{pu}/Z_{pd}$ , MOS Transistor circuit model, Latch-up in CMOS circuits.

**UNIT II:**

Layout Design And Tools: Transistor structures, Wires and Vias, Scalable Design rules, Layout Design tools.

Logic Gates & Layouts: Static Complementary Gates, Switch Logic, Alternative Gate circuits, Low power gates, Resistive and Inductive interconnect delays.

**UNIT III:**

Combinational Logic Networks: Layouts, Simulation, Network delay, Interconnect design, Power optimization, Switch logic networks, Gate and Network testing.

**UNIT IV:**

Sequential Systems: Memory cells and Arrays, Clocking disciplines, Design, Power optimization, Design validation and testing.

**UNIT V:**

Floor Planning & Architecture Design: Floor planning methods, off-chip connections, High-level synthesis, Architecture for low power, SOCs and Embedded CPUs, Architecture testing.

**TEXT BOOKS:**

1. Essentials of VLSI Circuits and Systems, K. Eshraghian Eshraghian. D, A.Pucknell, 2005, PHI.

2. Modern VLSI Design - Wayne Wolf, 3rd ed., 1997, Pearson Education.

**REFERENCES:**

1. Principals of CMOS VLSI Design – N.H.E Weste, K.Eshraghian, 2nd ed., Adisson Wesley.

**Course Objectives**

1. To study materials used for MEMS and its working
2. To study the fabrication process used for MEMS
3. To study the packaging process used for MEMS
4. To familiarize the students with various micro actuators and micro sensors.
5. To learn the survey of materials central to micro engineering.
6. To impart good knowledge in micro system packaging materials

**Course Outcomes**

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

1. Appreciate the underlying working principles of MEMS devices.
2. Understand the working of Micro sensors and actuators
3. Explain the IC fabrication processes
4. Gain knowledge on bulk manufacturing
5. Understand the Design of Micro systems.
6. Design and model MEMS devices.

**UNIT I-INTRODUCTION TO MEMS AND MICRO FABRICATION**

History of MEMS Development, Characteristics of MEMS-Miniaturization-Microelectronics integration-Mass fabrication with precision. Sensors and Actuators-Energy domain. Sensors, actuators Micro fabrication-microelectronics fabrication process-Silicon based MEMS processes-New material and fabrication processing-Points of consideration for processing. Anisotropic wet etching, Isotropic wet etching, Dry etching of silicon, Deep reactive ion etching (DRIE), and Surface micromachining process-structural and sacrificial material.

**UNIT II-ELECTRICAL AND MECHANICAL CONCEPTS OF MEMS**

Conductivity of semiconductors, crystal plane and orientation, stress and strain-definition-Relationship between tensile stress and strain-mechanical properties of Silicon and thin films, Flexural beam bending analysis under single loading condition- Types of beam-longitudinal strain under pure bending -deflection of beam- Spring constant, torsional deflection, intrinsic stress, resonance and quality factor.

**UNIT III-ELECTROSTATIC AND THERMAL PRINCIPLES SENSING AND ACTUATION**

Electrostatic sensing and actuation-Parallel plate capacitor-Application- Inertial, pressure and tactile sensor parallel plate actuator- comb drive Thermal sensing and Actuators-Thermal sensors- Actuators- Applications Inertial, flow and infrared sensors.

**UNIT IV-PIEZORESISTIVE, PIEZOELECTRIC AND MAGNETIC PRINCIPLES SENSORS AND ACTUATOR**

Piezoresistive sensors- piezoresistive sensor material-stress in flexural cantilever and membrane- Application-Inertial, pressure, flow and tactile sensor. Piezoelectric sensing and actuation- piezoelectric material properties-quartz- PZT-PVDF -ZnO-Application-Inertial, Acoustic, tactile, flow-surface elastic waves Magnetic actuation-Micro magnetic actuation principle-Deposition of magnetic materials-Design and fabrication of magnetic coil.

**UNIT V - POLYMER AND OPTICAL MEMS**

Polymers in MEMS - polyimide-SU-8 Liquid crystal polymer (LCP)-PDMS – PMMA-Parylene-Fluorocarbon, Application - Acceleration, pressure, flow and tactile sensors. Optical MEMS - passive MEMS Optical components - lenses - mirrors - Actuation for active optical MEMS.

**TEXT BOOK:**

S.NO.	Author(s) Name	Title of the book	Publisher	Year of publication
1	Chang Liu	Foundations of MEMS	Pearson Indian Print, 1 <sup>st</sup> Edition	2012

**REFERENCES:**

S.NO.	Author(s) Name	Title of the book	Publisher	Year of publication
1	Gaberiel M. Rebiz	RF MEMS Theory, Design and Technology	John Wiley & Sons	2003
2	Charles P. Poole and Frank J. Owens	Introduction to Nanotechnology	John Wiley & Sons	2003
3	Julian W. Gardner and Vijay K. Varadhan	Microsensors, MEMS and Smart Devices	John Wiley & Sons	2001

**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 ATTRACTOR 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 Typewriter Learning Ballistic Arm Movements

**REFERENCES:**

1. Simon Haykin, "Neural Networks and Learning Machines" -3/E - Pearson/ Prentice Hall 2009
2. Satish Kumar- "Neural Networks : A Classroom Approach"-TMH-2008

3. Freeman J.A., Skapura D.M."Neural networks, algorithms, applications, and programming techniques" -Addition Wesley, 2005.
4. Laurene Fausett, "Fundamentals of Neural Networks: Architectures, Algorithms, and Applications" - Pearson/ Prentice Hall
5. Robert J Schalkoff-"Artificial Neural Networks,McGraw Hill"-1997

**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 (Fkbc): Basic concept structure of FKBC, choice of membership functions, scaling factors, rules, fuzzyfication and defuzzyfication 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.

**TEXT BOOKS:**

1. An Introduction to Fuzzy Control- D. Diankar, H. Hellendoom and M. Reinfrank- Narosa Publishers India, 1996.
2. Fuzzy Sets Uncertainty and Information- G. J. Klir and T. A. Folger- PHI IEEE, 1995.

**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 COURSE OUTCOMES(COs):**

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 ENGINEERING PROPERTIES AND STORAGE TANK (9)**

Introduction to various mechanical properties of material to be used material of construction, design of cylindrical storage tank.

**UNIT II REACTOR DESIGN (9)**

Design of Air lift fermentor, Bubble column reactor and Continuous stirred tank reactor.

**UNIT III HEAT TRANSFER EQUIPMENTS (9)**

Design of Shell and tube Heat exchanger, Double pipe heat exchanger, long tube vertical evaporator and forced circulation evaporator.

**UNIT IV MASS TRANSFER EQUIPMENTS (9)**

Design of Bollmann extractor, fractionating column, packed tower and spray tray absorber

**UNIT V SEPARATION EQUIPMENTS (9)**

Design of plate and frame filter press, leaf filter, rotary drum filter, disc bowl centrifuge, rotary drum drier and Swenson-walker crystallizer.

**TEXTBOOKS:**

S.No	Author(s) Name	Title of the book	Publisher	Year of Publications



1	James Edwin Bailey, David F. Ollis	Biochemical Engineering Fundamentals	McGraw- Hill	2007
2	Don W. Green, Robert H. Perry	Chemical Engineer Handbook	The McGraw- Hill Companies,	2008

## REFERENCE BOOKS

S.No	Author(s) Name	Title of the book	Publisher	Year of Publications
1	Pauline M. Doran	Bioprocess Engineering Principles	Academic Press	2013

**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 (9)**

Properties of food- Physical, thermal, mechanical, sensory. Raw material Preparation - Cleaning, sorting, grading, peeling.

**UNIT II PROCESSING METHODS (9)**

Heating- Blanching and Pasteurization. Freezing- Dehydration- canning- additives- fermentation- extrusion cooking- hydrostatic pressure cooking- dielectric heating- microwave processing and aseptic processing- Infrared radiation processing- Concepts and equipment used.

**UNIT III FOOD CONVERSION OPERATIONS (9)**

Size reduction- Fibrous foods, dry foods and liquid foods- Theory and equipments- membrane separation- filtration- equipment and application.

**UNIT IV FOOD PRESERVATION BY COOLING (9)**

Refrigeration, Freezing- Theory, freezing time calculation, methods of freezing, freezing equipments, freeze drying, freeze concentration, thawing, effect of flow temperature on food. Water activity, methods to control water activity.

**UNIT V PRESERVATION METHODS FOR FRUITS AND VEGETABLES (9)**

Preprocessing 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.

### TEXTBOOKS

S.No	Author(s)Name	Title of the book	Publisher	Year of Publications
1	R.Paul Singh, Dennis R. Heldman	Introduction to food engineering.	Academic Press	2001
2	P.Fellows.	Food Processing Technology, Principles and practice.	Woodhead Publishing Ltd	2000
3	Mircea Enachescu Dauthy	Fruit and Vegetable Processing	FAO agricultural services bulletin	1995

### REFERENCE BOOKS

S.No	Author(s)Name	Title of the book	Publisher	Year of Publications
1	M.A. Rao, Syed S.H. Rizvi, Ashim K. Datta	Engineering properties of foods	CRC Press	2005
2	B. Sivasankar	Food processing and preservation	PHI Learning Pvt. Ltd	2002

**Course Objectives**

- To learn the scope and importance of Molecular modeling.
- To impart basic knowledge in quantum mechanics.
- To familiarize the students on the concepts of molecular mechanics.
- To extend the brief knowledge in molecular dynamics simulation.
- To study the drug design by using modeling tools.
- To understand molecular docking and ligand based drug design methods

**Course Outcomes**

- Summarize the importance of Molecular modeling.
- Extend the knowledge in quantum mechanics
- Analyze the general features of molecular mechanics.
- Illustrate the molecular dynamics by using simple models.
- Outline the drug design by using modeling tools.
- Describe the molecular docking and ligand based drug design methods

**UNIT-I MOLECULARMODELLING****(9)**

Introduction to concept of molecular modeling, molecular structure and internal energy, applications of molecular graphics, coordinate systems, potential energy surfaces, discussion of local and global energy minima

**UNIT-II QUANTUMMECHANICS****(9)**

Introduction to the computational quantum mechanics; one electron atom, poly electronic atoms and molecules, Hartree Fock equations; calculating molecular properties using ab initio and semiempirical methods.

**UNIT-III MOLECULARMECHANICS****(9)**

Molecular mechanics; general features of molecular mechanics force field, bond stretching, angle bending, torsional terms, non-bonded interactions; force field parameterization and transferability; energy minimization; derivative and non-derivative methods, applications of energy minimization.

**UNIT-IV MOLECULARDYNAMICS****(9)**

Molecular dynamics simulation methods; molecular dynamics using simple models, molecular dynamics with continuous potential, setting up and running a molecular dynamics simulation, constraint dynamics; Monte Carlo simulation; Monte Carlo simulation of molecules.

**UNIT-V MODELLINGANDDRUGDESIGN****(9)**

Macromolecular modeling, design of ligands for known macromolecular target sites, Drug-receptor interaction, classical SAR/QSAR studies and their implications to the 3D modeler, 2-D and 3-D database searching, pharmacophore identification and novel drug design, molecular docking, Structure-based drug design for all classes of targets.

### TEXTBOOKS

S.No.	Author(s) Name	Titleofthebook	Publisher	Year of Publications
1	Andrew Leach	Molecular Modelling: Principles and Applications	Prentice Hall	2001
2	N. Claude Cohen	Guidebook on Molecular Modeling in Drug Design	Academic Press	1996

### REFERENCE BOOKS

S.No.	Author(s) Name	Titleofthebook	Publisher	Year of Publications
1	Yvonne C. Martin, editor, Peter Willett	Designing bioactive molecules : three- dimension techniques and applications	Washington, DC : American Chemical Society	1998
2	Matthew F. Schlecht	Molecular Modeling on the PC	Wiley- Blackwell; Ha	1998

**Course Objectives**

1. To impart basic knowledge in Bioremediation.
2. To study the different bio filters and bio film processes.
3. To understand the concept of bioremediation for soil environment.
4. To extend the knowledge in filtration processes of bioremediation.
5. To learn about the bioremediation of metals.
6. To apply the concept of bioremediation to reduce pollution.

**Course COURSE OUTCOMES(COs):**

- Summarize the basic concepts in Bioremediation.
- Design the bio filters and bio film processes.
- Elaborate the concept of bioremediation for soil environment.
- Construct the filtration processes of bioremediation.
- Describe the bioremediation of metals.
- Outline the concept of bioremediation to reduce pollution.

**UNIT-I OVERVIEW OF BIOREMEDIATION (9)**

Pollution : Types and its consequences, History of bioremediation, Sources of contamination, Bioremediation processes, Environments where bioremediation is used, Microbiology of bioremediation.

**UNIT-II BIOFILM PROCESSES (9)**

Trickling Filters and Biological Towers, Rotating Biological Contactors, Granular Media Filters, Fluidized-bed Reactors, Hybrid Biofilm Processes

**UNIT-III BIOREMEDIATION FOR SOIL ENVIRONMENT (9)**

Environment of Soil Microorganisms, Soil Organic Matter and Characteristics, Soil Microorganisms Association with Plants, Pesticides and Microorganisms, Petroleum Hydrocarbons and Microorganisms, Industrial solvents and Microorganism, Biotechnologies for Ex-Situ Remediation & In-Situ Remediation of Soil Phytoremediation Technology for Soil Decontamination

**UNIT-IV BIOREMEDIATION FOR AIR AND WATER ENVIRONMENT (9)**

Atmospheric Environment for Microorganisms, Microbial Degradation of Contaminants in Gas Phase, Biological Filtration Processes for Decontamination of Air Stream- Biofiltration, Bio-trickling Filtration, Bioscrubbers, Contaminants in Groundwater, Landfill Leachate Biotreatment Technologies, Industrial Wastewater Biotreatment Technologies, Biotreatment of Surface Waters

**UNIT-V      BIOREMEDIATION OF METALS****(9)**

Microbial Transformation of Metals, Biological Treatment Technologies for Metals Remediation, Bioleaching and Bioremediation, Bioaccumulation, Oxidation/Reduction Processes, Biological Methylation

**TEXTBOOKS**

S.No.	Author(s) Name	Title of the book	Publisher	Year of Publications
1	Rittmann, B.E., and McCarty, P.L.,	Environmental Biotechnology : Principles and Applications.	McGraw Hill,	2001
2	John Cookson	Bioremediation Engineering: Design and Applications	McGraw- Hill Education	1995

**REFERENCE BOOKS**

S.No.	Author(s) Name	Title of the book	Publisher	Year of Publications
1	Prescott, L.M., Harley, and Klein, D.A	Microbiology	McGraw- Hill Higher Education	2008

**Course Objectives**

- To learn the molecular structure of biological systems.
- To impart basic knowledge in conformation of nucleic acids.
- To familiarize the students on the concepts of conformation of proteins.
- To extend the brief knowledge in kinetics of ligand interactions.
- To understand the techniques for the study of biological structure & function.
- To study the transport and dynamics properties of biological systems.

**Course Outcomes**

- Summarize the importance of molecular structure of biological systems.
- Extend the knowledge in conformation of nucleic acids.
- Analyze the concepts of conformation of proteins.
- Illustrate the kinetics of ligand interactions.
- Outline the techniques for the study of biological structure & function.
- Describe the transport and dynamics properties of biological systems.

**UNIT I      MOLECULAR STRUCTURE OF BIOLOGICAL SYSTEMS      (9)**

Intramolecular bonds—covalent—ionic and hydrogen bonds—biological structures—general features — water structure— hydration — interfacial phenomena and membranes — self assembly and molecular structure of membranes.

**UNIT II      CONFORMATION OF NUCLEIC ACIDS      (9)**

Primary structure—the bases—sugars and the phosphodiester bonds—double helical structure—A, B and Z forms—properties of circular DNA—topology—polymorphism and flexibility of DNA—structure of ribonucleic acids—hydration of nucleic acids.

**UNIT III      CONFORMATION OF PROTEINS      (9)**

Conformation of the peptide bond—secondary structures—Ramachandran plots—use of potential functions—tertiary structure—folding—hydration of proteins—hydropathy index.

**UNIT IV      Energetics & Dynamics of Biological Systems      (9)**

Kinetics of ligand interactions; Biochemical kinetics studies, uni-molecular reactions, simple bimolecular multiple intermediates, steady state kinetics, catalytic efficiency, relaxation spectrometry, ribonuclease as an example.

**UNIT V      APPLIED TECHNIQUES      (9)**

Techniques for the study of biological structure & function: Size and shape of macromolecules—methods of direct visualization—macromolecules as hydrodynamic particles—macromolecules diffusion—ultra centrifugation—viscometry—X-ray crystallography—determination of molecular structures, X-ray fibre diffraction—electron microscopy—neutron scattering—light scattering.



**TEXTBOOKS:**

S.No	Author(s)Name	Titleofthebook	Publisher	Year of Publications
1	RolandGlaser	Biophysics	Springer Science &Business Media	2001
2	MichelDaune	Molecular Biophysics: StructuresinMotion	Oxford University Press	1999
3	CharlesR.Cantor	BiophysicalChemistry, Part2:Techniques of theStudy ofBiologic StructureandFunction	W. H. Freeman and Company	1980

**Course Objectives**

- To understand the available tools and databases for performing research in bioinformatics.
- To expose students to sequence alignment tool in bioinformatics.
- To construct the phylogenetic trees for evolution.
- To get familiar with the 3D structure of protein and classification.
- To acquire basic knowledge in protein secondary structure prediction.
- 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****(9)**

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****(9)**

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****(9)**

Phylogenetics, cladistics & ontology; building phylogenetic trees; evolution of macromolecular sequences. Sequence annotation: principles of genome annotation; annotation tools & resources.

**UNIT IV STRUCTURAL BIOINFORMATICS****(9)**

Conceptual model 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

comparativemodeling;secondary  
predictionstrategies.

structureprediction;advancedproteinstructureprediction&

## UNITV MICROARRAYDATAANALYSIS

(9)

Microarray

data,analysismethods;microarraydata,tools&resources;sequencesampling&SAGE.Bioinformatics  
inpharmaceuticalindustry:informatics&drugdiscovery; pharmainformatics  
resources.Basicprinciplesofcomputinginbioinformatics:runningcomputer  
software;computeroperatingsystems;softwaredownloading &installation;database management.

## TEXTBOOK

S.No.	Author (s) Name	Titleof thebook	Publisher	Year of Publication
1	Dan E. Krane, Micha L. Rayme	Fundamental Concepts of Bioinformatics	Pearsoneducation	2004
2	Andreas D. Baxevanis, B. F. Francis Ouellette	Bioinformatics: A Practical GuidetotheAnalysisofGenes andProteins	Wiley-Interscience	2004
3	David W. Mount	SequenceandGenomeAnalysis	ColdSpringHarbor Laboratory	2004
4	Jonathan Pevsner	Bioinformatics and Functional Genomics	Wiley-Liss	2003

## REFERENCEBOOKS

S.No.	Author (s) Name	Titleof thebook	Publisher	Year of Publication
1	Michael J. Korenberg	Microarray Data Analysis: MethodsandApplications	Springer Science & BusinessMedia	2007

**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****(9)**

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 NANOPARTICLES****(9)**

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, Nanowires and Nanotubes.

**UNIT III APPLICATIONS****(9)**

Nanomedicine, Nanobiocensor and Nanofluidics. Nanocrystals in biological detection, Electrochemical DNA sensors and Integrated Nanoliter systems. Nano-Biodesigns and Systems. Fabrication of Novel Biomaterials through molecular self assembly-Small scale systems for in vivo drug delivery-Future nanomachine.

**UNIT IV NANOBIO TECHNOLOGY****(9)**

Clinical applications of nano devices. Artificial neurons. Real-time nanosensors-Applications in cancer biology. Nanomedicine. Synthetic retinal chips based on bacteriorhodopsins. High throughput DNA sequencing with nanocarbon tubules. Nanosurgical devices.

Introduction, Socioeconomic Challenges, Ethical Issues in Nanotechnology: With Especial  
 Referenceto 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.

**TEXTBOOKS**

S.No.	Author(s) Name	Title of the book	Publisher	Year of Publications
1	Niemeyer, C.M. and Mirkin, C.A	Nanobiotechnology: Concepts, Applications and Perspectives	Wiley- VCH	2004
2	Goodsell, D.S.	Bionanotechnology	John Wiley and Sons, Inc	2004

**REFERENCE BOOKS**

S.No.	Author(s) Name	Title of the book	Publisher	Year of Publications
1	Shoseyov, O. and Levy, I	Nanobiotechnology: Bioinspired Devices and Materials of the Future	Humana Press	2007
2	Bhushan, B.	Springer Handbook of Nanotechnology	Springer- Verlag Berlin Heidelberg	2004
3	Freitas Jr R.A	Nanomedicine	Landes Biosciences	2004
4	Kohler, M. and Fritzsche, W.	Nanotechnology – An Introduction to Nanostructuring Techniques	Wiley- VCH	2004

**Course Objective**

1. To explain to the students about MEMS Technology, Present, Future and Challenges.
2. To gain a knowledge of basic approaches for microsystem design.
3. To gain a knowledge of state-of-the-art lithography techniques for microsystems.
4. To learn new materials, science and technology for microsystem applications.
5. To understand materials science for microsystem applications.
6. To understand state-of-the-art micromachining and packaging technologies.

**Course Outcome**

1. Students will explain MEMS Technology, Present, Future and Challenges.
2. Gain a knowledge of basic approaches for microsystem design
3. Gain a knowledge of state-of-the-art lithography techniques for microsystems
4. Learn new materials, science and technology for microsystem applications
5. Understand materials science for microsystem applications
6. Understand state-of-the-art micromachining and packaging technologies

**UNIT I INTRODUCTION**

Intrinsic Characteristics of MEMS – Energy Domains and Transducers- Sensors and Actuators – Introduction to Micro fabrication - Silicon based MEMS processes – New Materials – Review of Electrical and Mechanical concepts in MEMS – Semiconductor devices – Stress and strain analysis – Flexural beam bending- Torsional deflection.

**UNIT II SENSORS AND ACTUATORS-I**

Electrostatic sensors – Parallel plate capacitors – Applications – Interdigitated Finger capacitor – Comb drive devices – Micro Grippers – Micro Motors - Thermal Sensing and Actuation – Thermal expansion – Thermal couples – Thermal resistors – Thermal Bimorph - Applications – Magnetic Actuators – Micromagnetic components – Case studies of MEMS in magnetic actuators- Actuation using Shape Memory Alloys

**UNIT III SENSORS AND ACTUATORS-II**

Piezoresistive sensors – Piezoresistive sensor materials - Stress analysis of mechanical elements – Applications to Inertia, Pressure, Tactile and Flow sensors – Piezoelectric sensors and actuators – piezoelectric effects – piezoelectric materials – Applications to Inertia , Acoustic, Tactile and Flow sensors.

**UNIT IV MICROMACHINING**

Silicon Anisotropic Etching – Anisotropic Wet Etching – Dry Etching of Silicon – Plasma Etching – Deep Reaction Ion Etching (DRIE) – Isotropic Wet Etching – Gas Phase Etchants – Case studies - Basic surface micro machining processes – Structural and Sacrificial Materials – Acceleration of sacrificial Etch – Striction and Antistriction methods – LIGA Process - Assembly of 3D MEMS – Foundry process.

**UNIT V POLYMER AND OPTICAL MEMS**

Polymers in MEMS– Polimide - SU-8 - Liquid Crystal Polymer (LCP) – PDMS – PMMA – Parylene – Fluorocarbon - Application to Acceleration, Pressure, Flow and Tactile sensors- Optical MEMS – Lenses and Mirrors – Actuators for Active Optical MEMS.

**TEXT BOOKS**

1. Chang Liu, "Foundations of MEMS", Pearson Education Inc., 2006.
2. Stephen D Senturia, "Microsystem Design", Springer Publication, 2000.
3. Tai Ran Hsu, "MEMS & Micro systems Design and Manufacture" Tata McGraw Hill, New Delhi, 2002.

**REFERENCES**

1. Nadim Maluf, "An Introduction to Micro Electro Mechanical System Design", Artech House, 2000.
2. Mohamed Gad-el-Hak, editor, "The MEMS Handbook", CRC press Baco Raton, 2000

3. Julian w. Gardner, Vijay K. Varadan, Osama O. Awadelkarim, "Micro Sensors MEMS and Smart Devices", John Wiley & Son LTD, 2002
4. James J. Allen, "Micro Electro Mechanical System Design", CRC Press Publisher, 2010
5. Thomas M. Adams and Richard A. Layton, "Introduction MEMS, Fabrication and Application," Springer 2012.

**Course Objective**

1. To develop the student's knowledge in various robot structures and their workspace.
2. To develop student's skills in performing spatial transformations associated with rigid body motions.
3. To develop student's skills in perform kinematics analysis of robot systems.
4. To provide the student with knowledge of the singularity issues associated with the operation of robotic systems.
5. To provide the student with some knowledge and analysis skills associated with trajectory planning.
6. To provide the student with some knowledge and skills associated with robot control.

**Course Outcome**

1. Develop the student's knowledge in various robot structures and their workspace.
2. Develop student's skills in performing spatial transformations associated with rigid body motions.
3. Develop student's skills in perform kinematics analysis of robot systems.
4. Provide the student with knowledge of the singularity issues associated with the operation of robotic systems.
5. Provide the student with some knowledge and analysis skills associated with trajectory planning.
6. Provide the student with some knowledge and skills associated with robot control.

**UNIT I FUNDAMENTALS OF ROBOT**

Robot – Definition, Need for Robots, Robot Anatomy, Co-ordinate systems, Work Envelope, types and classification – specifications – Pitch, yaw, Roll, Joint Notations, Speed of Motion, Pay Load – Robot Parts and their functions, grippers types. Forward kinematics, inverse kinematics- Manipulators with two, three degrees of freedom in 2D - Derivations and problems.

**UNIT II DRIVES AND SENSORS**

Drives- hydraulic, pneumatic and electrical. Force sensing, touch and tactile sensors, proximity sensors, non contact sensors and Machine vision sensors. Safety considerations in robotic cell, proximity sensors, fail safe hazard sensor systems, and compliance mechanism.

**UNIT III PROGRAMMING AND APPLICATIONS**

Robot programming languages – VAL programming – Motion Commands, Sensorscommands. Role of robots in inspection, assembly, material handling, underwater, space, nuclear, defence and medical fields.

**UNIT IV MACHINE VISION**

Machine Vision - Sensing - Low and higher level vision - Image acquisition and digitization - Cameras, CCD,CID, CPD, etc., - Illumination and types - Image processing and analysis - Feature extraction - Applications.

**UNIT V IMPLEMENTATION AND ROBOT ECONOMICS**

RGV, AGV; Implementation of Robots in Industries-Variou Steps; Safety Considerations for Robot Operations - Economic Analysis of Robots.

**TEXT BOOKS**

1. Klafter R.D., Chmielewski T.A and Negin M., "Robotic Engineering - An Integrated Approach", Prentice Hall, 2003.
2. Groover M.P., "Industrial Robotics -Technology Programming and Applications", McGraw Hill, 2001.

**REFERENCES**

1. Craig J.J., "Introduction to Robotics Mechanics and Control", Pearson Education, 2008.
2. Deb S.R., "Robotics Technology and Flexible Automation" Tata McGraw Hill Book Co., 1994.
3. Koren Y., "Robotics for Engineers", Mc Graw Hill Book Co., 1992.



4. Fu.K.S.,Gonzalz R.C. and Lee C.S.G., “Robotics Control, Sensing, Vision and Intelligence”, McGraw Hill Book Co., 1987.
5. Janakiraman P.A., “Robotics and Image Processing”, Tata McGraw Hill, 1995.
6. Rajput R.K., “Robotics and Industrial Automation”, S.Chand and Company, 2008.
7. Surender Kumar, “Industrial Robots and Computer Integrated Manufacturing”, Oxford and IBH Publishing Co. Pvt. Ltd., 1991.

**Course Objective**

1. To recognize and evaluate occupational safety and health hazards in the workplace.
2. To determine appropriate hazard controls following the hierarchy of controls.
3. To analyse the effects of workplace exposures, injuries and illnesses, fatalities.
4. To prevent incidents using the hierarchy of controls, effective safety and health management systems and task-oriented training.
5. To teach student the concept of Industrial Safety & provide useful practical knowledge for workplace safety.
6. To prevent or mitigate harm or damage to people, property, or the environment.

**Course Outcome**

1. Recognize and evaluate occupational safety and health hazards in the workplace.
2. Determine appropriate hazard controls following the hierarchy of controls.
3. Analyse the effects of workplace exposures, injuries and illnesses, fatalities.
4. Prevent incidents using the hierarchy of controls, effective safety and health management systems and task-oriented training.
5. Understand the concept of Industrial Safety & provide useful practical knowledge for workplace safety.
6. Prevent or mitigate harm or damage to people, property, or the environment.

**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 framework - 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

**TEXT BOOKS**

1. Shari.P.B and Lassen.T.S, "Managing the global supply chain", Viva books, New Delhi, 2000.
2. Ayers.J.B, "Hand book of supply chain management", The St. Lencie press, 2000.

**REFERENCES**

1. Nicolas.J.N, "Competitive manufacturing management - continuous improvement", Lean production, customer focused quality, McGrawHill, New York, 1998.
2. Steudel.H.J and Desruelle.P, "Manufacturing in the nineteen - How to become a mean, lean and world class competitor", Van No strand Reinhold, New York, 1992.

**Course Objective**

1. To generalized equations for mass, momentum and heat.
2. To understand the concepts of Reynolds and Gauss theorems.
3. To learn combined diffusive and convective transport.
4. To apply Film- and penetration models for mass and heat transfer.
5. To apply Stefan-Maxwells equations for multi-component diffusion.
6. To Solve the given set of equations either analytically or numerically.

**Course Outcome**

1. Generalized equations for mass, momentum and heat.
2. Understand the concepts of Reynolds and Gauss theorems.
3. Learn combined diffusive and convective transport.
4. Apply Film- and penetration models for mass and heat transfer.
5. Apply Stefan-Maxwells equations for multi-component diffusion.
6. Solve the given set of equations either analytically or numerically.

**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

**REFERENCES**

1. Geankoplis, C. J. 2003. Transport Processes and Separation Processes Principles. 4th Edition. Prentice Hall.
2. <https://laulima.hawaii.edu/portal>

**Course Objective**

1. To describe the principles of the study of human movement.
2. To describe the range of factors that influence the initiation, production and control of human movement.
3. To identify the body's lever systems and their relationship to basic joint movement and classification.
4. To distinguish between biomechanical principles of kinetics and kinematics when applied to the analysis of human movement.
5. To explain joint and muscle function and the forces acting upon the human body during various sporting activities.
6. To relate the different body systems necessary for human movement to occur.

**Course Outcome**

1. Describe the principles of the study of human movement.
2. Describe the range of factors that influence the initiation, production and control of human movement.
3. Identify the body's lever systems and their relationship to basic joint movement and classification.
4. Distinguish between biomechanical principles of kinetics and kinematics when applied to the analysis of human movement.
5. Explain joint and muscle function and the forces acting upon the human body during various sporting activities.
6. Relate the different body systems necessary for human movement to occur.

**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

**REFERENCES**

1. Duane Knudson, "Fundamentals of Biomechanics", Springer Science+ Business Media, LLC, 2007
2. C. Ross Ethier Craig A. Simmons, "Introductory Biomechanics", Cambridge University Press, 2007

**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. Identify and explain the types of steering system.

**Course COURSE OUTCOMES(COs):****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

**UNIT -III 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.

**UNIT-IV 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).

**UNIT -V 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 Publishes	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”, 3 <sup>rd</sup> Edition	McGraw-Hill Book Co., Inc., New York.	1986
3.	N.Newton, W. Steeds and T.K.Garrett	The Motor vehicle, 13th edition	SAE Inc	2001



**Course Objectives**

1. The objective of this course is to make the students to know and understand the constructional details, operating characteristics and design aspects of Two and Three wheelers.
2. Construct the frames of two and three wheelers of different layouts.
3. Demonstrate the constructional details and principle of operation of various engine components.
4. Identify and explain the types of transmission systems.
5. Identify and explain the types of steering and suspension systems.
6. Classify and describe the types of wheels, tyres and brakes for 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 stroke and 4 stroke 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.	M.M.Griffin.	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

**Course Objectives**

1. The objective of this course is to make the students to know and understand the maintenance and fault diagnosis of basic systems in Automobile.
2. Describe and differentiate the types of maintenance.
3. List the procedure for dismantling, servicing and assembling of engine components.
4. Demonstrate the servicing of transmission and driveline components.
5. Discuss the procedure for steering and suspension
6. Discuss the procedure for wheel and brake maintenance.

**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**

<b>SL.NO.</b>	<b>AUTHOR(S)</b>	<b>TITLE OF THE BOOK</b>	<b>PUBLISHER</b>	<b>YEAR OF PUBLICATION</b>
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			

**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 COURSE OUTCOMES(COs):****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 VTELEMATICS**

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.	Ljubo Vlacic, 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”, 5 <sup>th</sup> Edition	Butterworth Heinemann Woburn.	1998
2.	Bechhold,	“Understanding Automotive Electronics”	SAE	1998
3.	Robert Bosch,	“Automotive HandBook”, 5 <sup>th</sup> Edition	SAE	2000

**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****9**

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****9**

Basic Concepts, Contents and Standards for Housing Programmes - Sites and Services, Neighbourhoods, Open Development Plots, Apartments, Rental Housing, Co-operative Housing, Slum Housing Programmes, Role of Public, Private and Non-Government Organisations.

**UNIT III PLANNING AND DESIGN OF HOUSING PROJECTS****9**

Formulation of Housing Projects – Site Analysis, Layout Design, Design of Housing Units (Design Problems)

## **UNIT IV CONSTRUCTION TECHNIQUES AND COST-EFFECTIVE MATERIALS      9**

New Constructions Techniques – Cost Effective Modern Construction Materials, Building Centers – Concept, Functions and Performance Evaluation

## **UNIT V      HOUSING FINANCE AND PROJECT APPRAISAL      9**

Appraisal of Housing Projects – Housing Finance, Cost Recovery – Cash Flow Analysis, Subsidy and Cross Subsidy, Pricing of Housing Units, Rents, Recovery Pattern (Problems).

**TOTAL HRS : 45**

### **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.



**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****9**

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****9**

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****9**

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 – Utilisation factor – Depreciation factor – MSCP – MHCP – Laws of illumination – 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****9**

Thermodynamics – Heat – Temperature, measurement transfer – Change of state – Sensible heat – Latent heat of fusion, evaporation, sublimation – saturation temperature – Super heated vapour – Subcooled 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**

**9**

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

**TOTAL HRS : 45**

### **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.

**OBJECTIVES:**

1. To understand the coastal processes, coastal dynamics, impacts of structures like docks, harbours and quays leading to simple management perspectives along the coastal zone.
2. To describe the Coastal zone regulations, coastal processes and wave dynamics.
3. To forecast waves and tides and plan coastal structures including harbours.
4. To explain which scientific background values that are necessary for a successful planning,
5. To apply knowledge about ecosystem values and management in the planning process,
6. To plan and carry out a simplified consultation process for activities in the coastal zone

**COURSE OUTCOMES(COS):**

- Understand the coastal processes, coastal dynamics, impacts of structures like docks, harbours and quays leading to simple management perspectives along the coastal zone.
- The Coastal zone regulations, coastal processes and wave dynamics.
- Forecast waves and tides and plan coastal structures including harbours.
- To explain which scientific background values that are necessary for a successful planning,
- To apply knowledge about ecosystem values and management in the planning process,
- To plan and carry out a simplified consultation process for activities in the coastal zone

**UNIT I. COASTAL ZONE 9**

Coastal zone – Coastal zone regulations – Beach profile – Surf zone – Off shore – Coastal waters – Estuaries – Wet lands and Lagoons – Living resources – Non living resources.

**UNIT II. WAVE DYNAMICS 9**

Wave classification – Airy's Linear Wave theory – Deep water waves – Shallow water waves – Wave pressure – Wave energy – Wave Decay – Reflection, Refraction and Diffraction of waves – Breaking of waves – Wave force on structures – Vertical – Sloping and stepped barriers – Force on piles.

**UNIT III. WAVE FORECASTING AND TIDES 9**

Need for forecasting - SMB and PNJ methods of wave forecasting – Classification of tides – Darwin's equilibrium theory of tides – Effects on structures – seiches, Surges and Tsunamis.

**UNIT IV. COASTAL PROCESSES 9**

Erosion and depositional shore features – Methods of protection – Littoral currents – Coastal aquifers – Sea water intrusion – Impact of sewage disposal in seas.

**UNIT V. HARBOURS 9**

Types of classification of harbours – Requirements of a modern port – Selection of site – Types and selection of break waters – Need and mode of dredging – Selection of dredgers.

**TOTAL HRS : 45**

**TEXT BOOKS**

1. Richard Sylvester, “Coastal Engineering, Volume I and II”, Elseiner Scientific Publishing Co., 2006
2. Quinn, A.D., “Design & Construction of Ports and Marine Structures”, McGraw-Hill Book Co., 2007

**REFERENCES**

1. Ed. A.T. Ippen, “Coastline Hydrodynamics”, McGraw-Hill Inc., New York, 2002
2. Dwivedi, S.N., Natarajan, R and Ramachandran, S., “Coastal Zone Management in Tamilnadu”

**COURSE OBJECTIVES:**

1. To Describe some of the factors affecting reproducibility and external validity.
2. To List the different types of formal experimental designs (e.g. completely randomised, randomised block, repeated measures, Latin square and factorial experimental designs).
3. To explain the concept of variability, its causes and methods of reducing it
4. To describe possible causes of bias and ways of alleviating it
5. To identify the experimental unit and recognise issues of non-independence (pseudo-replication).
6. To describe the six factors affecting significance, including the meaning of statistical power and “p-values”.

**COURSE OUTCOMES(COS):**

1. Describe some of the factors affecting reproducibility and external validity.
2. List the different types of formal experimental designs (e.g. completely randomised, randomised block, repeated measures, Latin square and factorial experimental designs).
3. Explain the concept of variability, its causes and methods of reducing it
4. Describe possible causes of bias and ways of alleviating it
5. Identify the experimental unit and recognise issues of non-independence (pseudo-replication).
6. Describe the six factors affecting significance, including the meaning of statistical power and “p-values”.

**UNIT I MEASUREMENTS 9**

Basic Concept in Measurements, Measurement of displacement, strain pressure, force, torque etc, Type of strain gauges (Mechanical, Electrical resistance, Acoustical etc..).

**UNIT II GAUGING 9**

Strain gauge circuits – The potentiometer and Wheatstone bridge – use of lead wires switches etc. Use of electrical resistance strain gauges in transducer applications.

**UNIT III RECORDING DEVICES 9**

Indicating and recording devices - Static and dynamic data recording –Data (Digital and Analogue) acquisition and processing systems. Strain analysis methods – Rosette analysis. Static and dynamic testing techniques. Equipment for loading-Moire’s techniques.

**UNIT IV NON DESTRUCTIVE TESTING TECHNIQUES 9**

Non destructive testing techniques. Photoelasticity – optics of photoelasticity – Polariscope – Isoclinics and Isochromatics - methods of stress separation.

**UNIT V LAWS OF SIMILITUDE 9**

Laws of similitude - model materials – model testing – testing large scale structures – holographic techniques

**TEXT BOOKS**

1. Dally J W and Riley W.F, Experimental stress Analysis, McGraw-Hill, Inc. New York, 2005.
2. Srinath L S et al, Experimental Stress Analysis, Tata McGraw-Hill Publishing co., Ltd., New Delhi, 2006.

**REFERENCE BOOKS**

1. Rangan C S et al., Instrumentation – Devices and Systems, Tata McGraw-Hill Publishing Co., Ltd., New Delhi, 2002.
2. Sadhu Singh, Experimental Stress Analysis, Khanna Publishers, New Delhi, 2006.

**OBJECTIVES**

1. To enable the students for a successful career as water management professionals.
2. To create a potential among students in the area of irrigation management with specific enrichment to synthesis of data and their analysis.
3. To expose the students the need for an interdisciplinary approach in irrigation water management
4. To providing a platform to work in an interdisciplinary team.
5. To provide students an ability to understand the applications of mathematical and scientific concepts to analyse intricate technical, social and environmental problems in irrigation water management and finding solutions for them.
6. To promote student awareness for a life-long learning process and inculcate professional ethics and codes of professional practice in water management.

**OUTCOME**

At the end of this the students will be in a capacity to

1. Understand the concepts of soil-water-plant relationship as well as to expose them to the principles and practices of crop production.
2. Exposure to ground water, hydraulics of ground water related to drainage, drainage concepts, planning, design and management of drainage related irrigation system management
3. Understand the various principles of irrigation management and to analyse the different types of irrigation systems and their performances based on service oriented approach.
4. Gain insight on local and global perceptions and approaches to participatory water resource management
5. Learn from successes and failures in the context of both rural and urban communities of water management.
6. Exposure on the use of economic concepts in irrigation development and to impart knowledge on economic planning so as to enable viable allocation of resources in the irrigation sector.

**UNIT I. IRRIGATION SYSTEM REQUIREMENTS****9**

Irrigation systems – Supply and demand of water – Cropping pattern – Crop rotation – Crop diversification – Estimation of total and peak crop water requirements – Effective and dependable rainfall – Irrigation efficiencies.

**UNIT II. IRRIGATION SCHEDULING****9**

Time of irrigation – Critical stages of water need of crops – Criteria for scheduling irrigation – Frequency and interval of irrigation

**UNIT III. MANAGEMENT****9**

Structural and non-structural strategies in water use and management – Conjunctive use of surface and ground waters – Quality of irrigation water.

**UNIT IV. OPERATION****9**

Operational plans – Main canals, laterals and field channels – Water control and regulating structures – Performance indicators – Case study

Farmer's participation in System operation – Water user's associations – Farmer councils – Changing paradigms on irrigation management – Participatory irrigation management

**TOTAL HRS : 45**

**TEXT BOOKS**

1. Dilip Kumar Majumdar, "Irrigation Water Management – Principles and Practice", Prentice Hall of India Pvt. Ltd., New Delhi, 2000
2. Hand book on Irrigation Water Requirement, R.T. Gandhi, et. al., Water Management Division, Department of Agriculture, Ministry of Agriculture, New Delhi

**REFERENCES**

1. Hand Book on Irrigation System Operation Practices, Water Resources Management and Training Project, Technical report No. 33, CWC, New Delhi, 2000
2. Maloney, C. and Raju, K.V., "Managing Irrigation Together", Practice and Policy in India, Stage Publication, New Delhi, India, 2000





**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

- a. Develop Parametric design and the conventions of formal engineering drawing
- b. Produce and interpret 2D & 3D drawings
- c. Communicate a design idea/concept graphically/visually
- d. 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.
- e. Get a Detailed study of an engineering artifact
- f. Planning and designing of structures

<b>UNIT I</b>	<b>INTRODUCTION</b>	<b>9</b>
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Fundamentals of CAD - Hardware and software requirements -Design process - Applications and benefits.

<b>UNIT II</b>	<b>COMPUTER GRAPHICS</b>	<b>9</b>
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Graphic primitives - Transformations -Wire frame modeling and solid modeling -Graphic standards –Drafting packages

<b>UNIT III</b>	<b>STRUCTURAL ANALYSIS</b>	<b>9</b>
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Fundamentals of finite element analysis - Principles of structural analysis -Analysis packages and applications.

<b>UNIT IV</b>	<b>DESIGN AND OPTIMISATION</b>	<b>9</b>
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Principles of design of steel and RC Structures -Applications to simple design problems – Optimisation techniques - Algorithms - Linear Programming – Simplex method

<b>UNIT V</b>	<b>EXPERT SYSTEMS</b>	<b>9</b>
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Introduction to artificial intelligence - Knowledge based expert systems -Rules and decision tables – Inference mechanisms - Simple applications.

**TOTAL HRS : 45**

**TEXT BOOKS**

1. Groover M.P. and Zimmers E.W. Jr., "CAD/CAM, Computer Aided Design and Manufacturing", Prentice Hall of India Ltd, New Delhi, 2005.
2. Krishnamoorthy C.S.Rajeev S., "Computer Aided Design", Narosa Publishing House, New Delhi, 2000

## **REFERENCES**

1. Harrison H.B., "Structural Analysis and Design", Part I and II Pergamon Press, Oxford, 2002.
2. Rao S.S., "Optimisation Theory and Applications", Wiley Eastern Limited, New Delhi, 2002.
3. Richard Forsyth (Ed), "Expert System Principles and Case Studies", Chapman and Hall, London, 2000.

**OBJECTIVES:**

1. To understand the importance of transportation and characteristics of road transport
2. To know about the history of highway development, surveys and classification of roads
3. To study about the geometric design of highways
4. To study about traffic characteristics and design of intersections
5. To know about the pavement materials and design
6. To design flexible and rigid pavements as per IRC.

**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 cross section elements, sight distance, horizontal and vertical alignment.
3. Implement traffic studies, traffic regulations and control, and intersection design.
4. Determine the characteristics of pavement materials.
5. Design flexible and rigid pavements as per IRC.
6. Will gain the knowledge of horizontal and vertical curves.

**UNIT I. TYPE OF PAVEMENT AND STRESS DISTRIBUTION ON LAYERED SYSTEM****9**

Introduction - Pavement as layered structure - Pavement types - rigid and flexible -Stress and deflections in pavements under repeated loading

**UNIT II. DESIGN OF FLEXIBLE PAVEMENTS****9**

Flexible pavement design - Empirical - Semi empirical and theoretical Methods - Design procedure as per latest IRC guidelines – Design and specification of rural roads

**UNIT III. DESIGN OF RIGID PAVEMENTS****9**

Cement concrete pavements - Modified Westergard approach - Design procedure as per latest IRC guidelines - Concrete roads and their scope in India.

**UNIT IV. PERFORMANCE EVALUATION AND MAINTENANCE****9**

Pavement Evaluation [Condition and evaluation surveys (Surface Appearance, Cracks, Patches And Pot Holes, Undulations, Ravelling, Roughness, Skid Resistance), Structural Evaluation By

Deflection Measurements, Present Serviceability Index] Pavement maintenance. [IRC Recommendations Only]

## **UNIT V. STABILISATION OF PAVEMENTS**

**9**

Stabilisation with special reference to highway pavements - Choice of stabilisers -Testing and field control –Stabilisation for rural roads in India -use of Geosynthetics (geotextiles & geogrids) in roads.

**TOTAL HRS : 45**

### **TEXT BOOKS**

1. Kadiyali, L.R., “Principles and Practice of Highway Engineering”, Khanna tech. Publications, New Delhi, 2007.
2. Croney, D., Design and Performance of Road Pavements, HMO Stationary Office, 2005.
3. Wright, P.H., “Highway Engineers”, John Wiley & Sons, Inc., New York, 2001
4. Design and Specification of Rural Roads (Manual), Ministry of rural roads, Government of India, New Delhi, 2001

### **REFERENCES**

1. Yoder R.J and Witczak M.W., “Principles of Pavement Design”, John Wiley, 2003.
2. Guidelines for the Design of Flexible Pavements, IRC:37 - 2001, The Indian roads Congress, New Delhi.
3. Guideline for the Design of Rigid Pavements for Highways, IRC:58-2001, The Indian Roads Congress, New Delhi.

### **Article I.**

**OBJECTIVES:**

- To understand the role of geology in the design and construction process of underground openings in rock.
- To apply geologic concepts and approaches on rock engineering projects
- To identify and classify rock using basic geologic classification systems.
- To use the geologic literature to establish the geotechnical framework needed to properly design and construct heavy civil works rock projects.
- To sequential design process used in geotechnical engineering practice.
- To Require civil engineering students to read and summarize geologic literature for site specific projects.

**COURSE OUTCOMES(COS):**

- Understand the role of geology in the design and construction process of underground openings in rock.
- Geologic concepts and approaches on rock engineering projects
- Identify and classify rock using basic geologic classification systems.
- Use the geologic literature to establish the geotechnical framework needed to properly design and construct heavy civil works rock projects.
- Sequential design process used in geotechnical engineering practice.
- Require civil engineering students to read and summarize geologic literature for site specific projects.

**UNIT I. CLASSIFICATION AND INDEX PROPERTIES OF ROCKS 9**

Geological classification – Index properties of rock systems – Classification of rock masses for engineering purpose.

**UNIT II. ROCK STRENGTH AND FAILURE CRITERIA 9**

Modes of rock failure – Strength of rock – Laboratory and field measurement of shear, tensile and compressive strength – Stress strain behaviour in compression – Mohr-coulomb failure criteria and empirical criteria for failure – Deformability of rock.

**UNIT III. INITIAL STRESSES AND THEIR MEASUREMENTS 9**

Estimation of initial stresses in rocks – influence of joints and their orientation in distribution of stresses – technique for measurements of insitu stresses.

**UNIT IV. APPLICATION OF ROCK MECHANICS IN ENGINEERING 9**

Simple engineering application – Underground openings – Rock slopes – Foundations and mining subsidence.

**UNIT V. ROCK BOLTING 9**

Introduction – Rock bolt systems – rock bolt installation techniques – Testing of rock bolts – Choice of rock bolt based on rock mass condition.

**TOTAL HRS : 45**

**TEXT BOOKS**

1. Goodman P.E., "Introduction to Rock Mechanics", John Wiley and Sons, 2005.
2. Stillborg B., "Professional User Handbook for rock Bolting", Tran Tech Publications, 2006.

#### **REFERENCES**

1. Brow E.T., "Rock Characterisation Testing and Monitoring", Pergaman Press, 2002.
2. Arogyaswamy R.N.P., "Geotechnical Application in Civil Engineering", Oxford and IBH, 2000.
3. Hock E. and Bray J., "Rock Slope Engineering, Institute of Mining and Metallurgy", 1991.

**COURSE OBJECTIVES:**

1. To learnt the design of various steel water tanks, concrete water tanks, steel bunkers and silos, concrete bunkers and silos and prestressed concrete water tanks
2. To design the storage structures.
3. To gain knowledge of steel water tanks and their design.
4. To get a brief idea about concrete water tanks.
5. To design steel bunkers and silos
6. To design prestressed concrete water tanks

**COURSE OUTCOMES(COS):**

1. The design of various steel water tanks, concrete water tanks, steel bunkers and silos, concrete bunkers and silos and prestressed concrete water tanks
2. Design the storage structures.
3. Gain knowledge of steel water tanks and their design.
4. Get a brief idea about concrete water tanks.
5. Design steel bunkers and silos
6. Design prestressed concrete water tanks

**UNIT I. STEEL WATER TANKS****9**

Design of rectangular riveted steel water tank – Tee covers – Plates – Stays –Longitudinal and transverse beams – Design of staging – Base plates – Foundation and anchor bolts – Design of pressed steel water tank – Design of stays – Joints – Design of hemispherical bottom water tank – side plates – Bottom plates – joints – Ring girder – Design of staging and foundation

**UNIT II. CONCRETE WATER TANKS****9**

Design of Circular tanks – Hinged and fixed at the base – IS method of calculating shear forces and moments – Hoop tension – Design of intze tank – Dome – Ring girders – Conical dome – Staging – Bracings – Raft foundation – Design of rectangular tanks – Approximate methods and IS methods – Design of under ground tanks – Design of base slab and side wall – Check for uplift.

**UNIT III. STEEL BUNKERS AND SILOS****9**

Design of square bunker – Jansen's and Airy's theories – IS Codal provisions – Design of side plates – Stiffeners – Hooper – Longitudinal beams – Design of cylindrical silo – Side plates – Ring girder – stiffeners.

**UNIT IV. CONCRETE BUNKERS AND SILOS****9**

Design of square bunker – Side Walls – Hopper bottom – Top and bottom edge beams – Design of cylindrical silo – Wall portion – Design of conical hopper – Ring beam at junction.



## **UNIT V. PRESTRESSED CONCRETE WATER TANKS**

**9**

Principles of circular prestressing – Design of prestressed concrete circular water tanks.

**TOTAL HRS : 45**

### **TEXT BOOKS**

1. Rajagopalan K., Storage Structures, Tata McGraw-Hill, New Delhi, 2002.
2. Krishna Raju N., Advanced Reinforced Concrete Design, CBS Publishers and Distributors, New Delhi, 2000

### **REFERENCES**

1. R.G.Hopkinson and J.D.Kay, “The Lighting of buildings”, Faber and Faber, London, 2000
2. William H.Severns and Julian R.Fellows, “Air-conditioning and Refrigeration”, John Wiley and Sons, London, 2000.

**OBJECTIVES:**

1. To understand the need of energy conversion and the various methods of energy storage
2. To explain the field applications of solar energy
3. To identify Winds energy as alternate form of energy and to know how it can be tapped
4. To explain bio gas generation and its impact on environment
5. To understand the Geothermal & Tidal energy, its mechanism of production and its applications
6. To illustrate the concepts of Direct Energy Conversion systems & their applications.

**COURSE OUTCOMES(COS):**

1. Understand the need of energy conversion and the various methods of energy storage
2. Explain the field applications of solar energy
3. Identify Winds energy as alternate form of energy and to know how it can be tapped
4. Explain bio gas generation and its impact on environment
5. Understand the Geothermal & Tidal energy, its mechanism of production and its applications
6. Illustrate the concepts of Direct Energy Conversion systems & their applications.

**UNIT I. INTRODUCTION****9**

Terminology – Wind Data – Gust factor and its determination - Wind speed variation with height – Shape factor – Aspect ratio – Drag and lift.

**UNIT II. EFFECT OF WIND ON STRUCTURES****9**

Static effect – Dynamic effect – Interference effects (concept only) – Rigid structure – Aeroelastic structure (concept only).

**UNIT III. EFFECT ON TYPICAL STRUCTURES****9**

Tall buildings – Low rise buildings – Roof and cladding – Chimneys, towers and bridges.

**UNIT IV. APPLICATION TO DESIGN****9**

Design forces on multistorey building, towers and roof trusses.

**UNIT V. INTRODUCTION TO WIND TUNNEL****9**

Types of models (Principles only) – Basic considerations – Examples of tests and their use.

**TOTAL HRS : 45****TEXT BOOKS**

1. Peter Sachs, “Wind Forces in Engineering, Pergamon Press, New York, 2002.
2. Lawson T.V., Wind Effects on Buildings, Vols. I and II, Applied Science and Publishers, London, 2005

**REFERENCES**

1. Devenport A.G., “Wind Loads on Structures”, Division of Building Research, Ottawa, 2003

2. Wind Force on Structures – Course Notes, Building Technology Centre, Anna University, 2002.

**COURSE OBJECTIVES:**

1. To give an experience in the implementation of new technology concepts which are applied in field of Advanced construction.
2. To study different methods of construction to successfully achieve the structural design with recommended specifications.
3. To involve the application of scientific and technological principles of planning, analysis, design and management to construction technology.
4. To study of construction equipment's, and temporary works required to facilitate the construction process
5. To provide a coherent development to the students for the courses in sector of Advanced construction technology.
6. To present the new technology of civil Engineering and concepts related Advanced construction technology.

**COURSE OUTCOMES(COS):**

1. Implementation of new technology concepts which are applied in field of Advanced construction.
2. Different methods of construction to successfully achieve the structural design with recommended specifications.
3. Application of scientific and technological principles of planning, analysis, design and management to construction technology.
4. Will gain the Knowledge of construction equipment's, and temporary works required to facilitate the construction process
5. Development to the students for the courses in sector of Advanced construction technology.
6. The new technology of civil Engineering and concepts related Advanced construction technology.

**UNIT - I      MODERN CONSTRUCTION METHODS      9**

Open Excavation, Shafts and Tunnels- Preparation of foundation, Cofferdams, Caisson, Piled Foundation, Prestressed Concrete Construction, Pre-cast Concrete Construction.

**UNIT - II      CONSTRUCTION METHODS FOR SPECIAL STRUCTURES      9**

Construction Methods For Bridges, Construction Methods for Roads, Construction Methods For Special Structures for Railways, Construction Methods for Dams, Construction Methods for Harbour, Construction Methods for River Works Pipelines

**UNIT - III      MODERN CONSTRUCTION EQUIPEMENTS -I      9**

Construction Equipment used for Earth Moving, Excavating, Drilling, Blasting, Tunneling and hoisting

**UNIT - IV    MODERN CONSTRUCTION EQUIPEMENTS -II****9**

Construction Equipment used for Conveying, Hoisting, Dredging, Dewatering Systems, Paving and concreting Plant

**UNIT - V    PRINCIPLES AND PRACTICES OF TEMPORARY STRUCTURES****9**

Principles and Practices of Temporary structures, Shoring, and Strutting, Underpinning, Principles and Design of Formwork, Scaffolding, Operation and maintenance of construction equipments

**TOTAL HRS : 45****TEXT BOOKS**

1. Peurifoy, R. L., , Ledbette, W.B., Construction Planning , Equipment and Methods, Mc Graw Hill Co., 2000.

2. Antill J.M., PWD, Civil Engineering Construction, Mc Graw Hill Book Co., 2005

**REFERENCE**

1. Varma, M Construction Equipment and its Planning & Applications, Metropolitan Book Co., 2000

2. Nunnally, S.W., Construction Methods and Management , Prentice – Hall, 2000

3. Ataev, S.S., Construction Technology, MIR , Pub. 2000