ANNAMALAI UNIVERSITY

FACULTY OF ENGINEERING AND TECHNOLOGY

DEPARTMENT OF CIVIL AND STRUCTURAL ENGINEERING

B.E. CIVIL AND STRUCTURAL ENGINEERING

(Four Year Degree Programme)

(Choice Based Credit System)

(FULL–TIME)

REGULATIONS AND SYLLABUS

REGULATIONS

1. Condition for Admission

Candidates for admission to the first year of the four year B.E. Degree programmes shall be required to have passed the final examination of the plus 2 Higher Secondary Course with Mathematics, Physics and Chemistry as subjects of study and candidates who have passed the Higher Secondary Examination through vocational stream under Engineering, conducted by the Board of Secondary Education, Government of Tamilnadu or an examination of any other authority accepted by the Syndicate of this University as equivalent thereto. They shall satisfy the conditions regarding qualifying marks, age and physical fitness as may be prescribed by the Syndicate of the Annamalai University from time to time.

Candidates who have passed the Diploma course in Engineering of the State Board of Technical Education, Tamil Nadu (listed in Annexure-1) will be eligible for admission to the second year of the four year degree programme in B.E. under the lateral entry scheme provided they satisfy other conditions.

2. Branches of Study in B.E.

BRANCH I	-	Civil Engineering
BRANCH II	-	Civil and Structural Engineering
BRANCH III	-	Mechanical Engineering
BRANCH IV	-	Mechanical Engineering (Manufacturing)
BRANCH V	-	Electrical and Electronics Engineering
BRANCH VI	-	Electronics and Instrumentation Engineering
BRANCH VII	-	Chemical Engineering
BRANCH VIII	-	Computer Science and Engineering
BRANCH IX	-	Information Technology
BRANCH X	-	Electronics and Communication Engineering

3. Courses of Study

The courses of study and the respective syllabi are given separately.

4. Scheme of Examinations

The scheme of Examinations is given separately.

5. Choice Based Credit System (CBCS)

The curriculum includes six components namely Humanities / Social Sciences /Management, Basic Sciences, Engineering Sciences, Professional Core, Professional Electives and Open Electives in addition to Seminar & Industrial

Training and Project. Each semester curriculum shall normally have a blend of theory and practical courses. The total credits for the entire degree Programme is 176 (135 for lateral entry students).

6. Eligibility for the Degree

A candidate shall be eligible for the degree of Bachelor of Engineering if the candidate has satisfactorily undergone the prescribed courses of study for a period of four academic years and has passed the prescribed examinations in all the four academic years. For the award of the degree, a student has to

1. Earn a minimum of 176 credits (135 for lateral entry students).
2. Serve in any one of the Co-curricular activities such as
    - National Cadet Corps (NCC)
    - National Service Scheme (NSS)
    - National Sports Organization (NSO) and
    - Youth Red Cross (YRC)

for at least one year. The students enrolled in any one of the co-curricular activities (NCC / NSS / NSO / YRC) will undergo training for about 80 hours and attend a camp of about seven days. The training shall include classes on hygiene and health awareness and also training in first-aid. While the training activities will normally be during weekends, the camp will normally be during vacation period.

(or)

Enroll as a student member of a recognized professional society such as

- Student Chapters of Institution of Engineers (India)
- Student Chapters of other Professional bodies like ICI, ISA, IIChE

7. Assignment of Credits for Courses

Each course is normally assigned one credit per hour of lecture/tutorial per week and one credit for two hours or part thereof for laboratory or practical or drawing per week.

8. Duration of the Programme

A student is normally expected to complete the B.E. programme in four years but in any case not more than eight years from the time of admission.

9. Registration for Courses

A newly admitted student will automatically be registered for all the courses prescribed for the first, second and third semesters without any option.

Every other student shall enroll for the courses intended to be credited in the succeeding semester in the current semester itself by completing the registration form indicating the list of courses. This registration will be done a week before the last working day of the current semester.

A student is required to earn 176 (135 for lateral entry students) credits in order to be eligible for obtaining the degree. However the student is entitled to enjoy an option to earn either more or less than the total number of credits prescribed in the curriculum of a particular semester on the following guidelines:

The slow learners may be allowed to withdraw certain courses with the approval by Head of the Department and those courses may be completed by them in the fifth year of study and still they are eligible to be awarded with I Class. A student can withdraw a maximum of 2 courses per semester from IV semester to

VII semester and take up those courses in the fifth year of study. However, courses withdrawn during odd semesters (V and VII) must be registered in the odd semester of fifth year and courses withdrawn during even semesters (IV and VI) must be registered in the even semester of fifth year.

The advance learners may be allowed to take up the open elective subjects of eighth semester in sixth and seventh semesters one in each to enable them to pursue industrial training/project work in the entire eighth semester period provided they should register those courses in the fifth semester itself. Such students should meet the teachers offering those elective courses themselves for clarifications. No specific slots will be allotted in the time table for such courses.

10. Seminar / Industrial Training

The student has to present a seminar on the chosen topic. However, the student can select a topic duly approved by the Seminar Coordinator and the Head of the Department concerned. The student who has presented the seminar has to submit a report and appear for viva-voce examination at the end of the semester.

11. Project Work

The student typically registers for project at the end of seventh semester and completes it at the end of the eighth semester along with the courses prescribed for study in the eighth semester. However a student who has registered and successfully completed the courses of eighth semester by acquiring additional credits in the earlier semesters can attempt to spend his / her period of study in an industry and complete his / her project work, submit the project report and appear for viva-voce examination at the end of eighth semester.

12. Industrial Training (Value added courses)

One credit courses shall be offered by a Department with the prior approval from the Dean, Faculty of Engineering and Technology. For one credit course, a relevant potential topic may be selected by a committee consisting of Head of the department concerned and the Board of Studies member from the Department and a senior faculty member from the department concerned. An expert from industry familiar with the topic chosen may be accordingly invited to handle classes for the students. The details of the syllabus, time table and the name of the industrial expert may be sent by the above committee to the Dean for approval. The credits earned through the one credit courses shall be over and above the total credit requirement prescribed in the curriculum for the award of the degree. Students can take a maximum of two one credit courses (one each in VI and VII semesters). They shall be allowed to take one credit courses offered in other Departments with the permission of Head of the Department offering the course. A separate mark sheet shall be issued for one credit courses.

13. Electives

The elective courses fall under two categories: Professional Electives and Open Electives. The Professional Elective courses are offered in the concerned branch of specialization and a student can choose the Professional Elective courses with the approval of the Head of the Department concerned. Apart from the various Professional elective courses, a student can choose the open electives from any specialization offered in any Department in the Faculty of Engineering &

Technology during the entire period of study, with the approval of the Head of the Department and the Head of the Department offering the course.

Further, the student can also credit not more than two courses offered through the SWAYAM Portal of UGC with the approval of the Head of the Department concerned. These courses will be considered as equivalent of open electives.

14. Assessment

The break-up of continuous assessment and examination marks for theory courses is as follows:

First assessment (Mid-Semester Test-I)	:	10 marks
Second assessment (Mid-Semester Test-II)	:	10 marks
Third Assessment	:	5 marks
End Semester Examination	:	75 marks

The break-up of continuous assessment and examination marks for Practical courses is as follows:

First assessment (Test-I)	:	15 marks
Second assessment (Test-II)	:	15 marks
Maintenance of record book	:	10 marks
End Semester Examination	:	60 marks

The continuous assessment marks for the seminar / industrial training will be 40 and to be assessed by a seminar committee consisting of the Seminar Coordinator and a minimum of two members nominated by the Head of the Department. The continuous assessment marks will be awarded at the end of seminar session. 60 marks are allotted for the seminar / industrial training and viva voce examination conducted based on the seminar / industrial training report at the end of the semester.

The continuous assessment marks for the project work will be 40 and to be assessed by a review committee consisting of the project guide and a minimum of two members nominated by the Head of the Department. One of the committee members will be nominated as the Chairman by the Head of the Department. The Head of the Department may be a member or the Chairman. At least two reviews should be conducted during the semester by the review committee. The student shall make presentation on the progress made before the committee. 60 marks are allotted for the project work and viva voce examination at the end of the semester.

15. Substitute Assessment

A student, who has missed, for genuine reasons accepted by the Head of the Department, one or more of the assessments of a course other than the final examination, may take a substitute assessment for any one of the missed assessments. The substitute assessment must be completed before the date of the third meeting of the respective class committees.

A student who wishes to have a substitute assessment for a missed assessment must apply to the Dean / Head of the Department within a week from the date of the missed assessment.

16. Student Counsellors (Mentors)

To help the students in planning their course of study and for general advice on the academic programme, the Dean / Head of the Department will attach a certain number of students to a member of the faculty who shall function as student counsellor for those students throughout their period of study. Such student counsellors shall advise the students, give preliminary approval for the courses to be taken by the students during each semester and obtain the final approval of the Dean / Head of the Department.

17. Class Committee

For all the branches of study during the first two semesters, a common class committee will be constituted by the Dean of the faculty. From among the various teachers teaching the same common course to different classes during each semester of the first year, the Dean shall appoint one of them as course coordinator. The composition of the class committee during first and second semesters will be as follows:

- Course coordinators of all courses.
- All Heads of the Sections, among whom one may be nominated as Chairman by the Dean.
- The Dean may opt to be a member or the Chairman.

For each of the higher semesters, separate class committees will be constituted by the respective Head of the Departments. The composition of the class committees from third to eighth semester will be as follows:

- Teachers of the individual courses.
- A seminar coordinator (for seventh semester only) shall be appointed by the Head of the Department
- A project coordinator (for eighth semester only) shall be appointed by the Head of the Department from among the project supervisors.
- One Professor or Associate Professor, preferably not teaching the concerned class, appointed as Chairman by the Head of the Department.
- The Head of the Department may opt to be a member or the Chairman.

The class committee shall meet three times during the semester. The first meeting will be held within two weeks from the date of class commencement in which the type of assessment like test, assignment etc. for the third assessment and the dates of completion of the assessments will be decided.

The second meeting will be held within a week after the completion of the first assessment to review the performance and for follow-up action.

The third meeting will be held after all the assessments but before the University semester examinations are completed for all the courses, and at least one week before the commencement of the examinations. During this meeting the assessment on a maximum of 25 marks for theory / 40 marks for seminar / industrial training, practical and project work will be finalized for every student and tabulated and submitted to the Head of the Department (to the Dean in the case of I & II Semester) for approval and transmission to the Controller of Examinations.

18. Attendance requirements

The students with 75% attendance and above are permitted to appear for the University examinations. However, the Vice Chancellor may give a rebate / concession not exceeding 10% in attendance for exceptional cases only on Medical Grounds.

19. Temporary break of Study

A student is permitted to go on break of study for a maximum period of one year either as two breaks of one semester each or a single break of one year.

The student applies for break of study, the student shall apply to the Dean in advance, in any case, not later than the last date of the first assessment period. The application duly filled by the student shall be submitted through the Head of the Department. In the case of short term employment/ training/ internship, the application for break of study shall be approved and forwarded by the Head of the department concerned to the Dean.

However, the student must complete the entire programme within the maximum period of eight years.

20. Procedure for withdrawing from the Examinations

A student can withdraw from all the examinations of the semester only once during the entire programme on valid grounds accepted by the University. Such withdrawal from the examinations of a semester will be permitted only if the candidate applies for withdrawal at least 24 hours before the commencement of the last examination. The letter grade 'W' appears in the mark sheet for such candidates.

21. Passing and declaration of Examination Results

All assessments of all the courses on an absolute marks basis will be considered and passed by the respective results passing boards in accordance with the rules of the University. Thereafter, the Controller of examinations shall convert the marks for each course to the corresponding letter grade as follows, compute the Grade Point Average (GPA) and Cumulative Grade Point Average (CGPA), and prepare the mark sheets.

90 to 100 marks	:	Grade 'S'
80 to 89 marks	:	Grade 'A'
70 to 79 marks	:	Grade 'B'
60 to 69 marks	:	Grade 'C'
55 to 59 marks	:	Grade 'D'
50 to 54 marks	:	Grade 'E'
Less than 50 marks	:	Grade 'RA'
Withdrawn from the examination	:	Grade 'W'

A student who obtains less than 30 / 24 marks out of 75 / 60 in the theory / practical examinations respectively or is absent for the examination will be awarded grade RA.

A student who earns a grade of S, A, B, C, D or E for a course, is declared to have successfully completed that course. Such a course cannot be repeated by the student.

A student who is detained for lack of attendance must re-register for and repeat the courses in the respective semester.

A student who obtains letter grade RA / W in the mark sheet must reappear for the examination of the courses.

The following grade points are associated with each letter grade for calculating the grade point average and cumulative grade point average.

S - 10; A - 9; B - 8; C - 7; D - 6; E - 5; RA - 0

Courses with grade RA / W are not considered for calculation of grade point average or cumulative grade point average.

A student can apply for re-totaling of one or more of his examination answer papers within a week from the date of issue of mark sheet to the student on payment of the prescribed fee per paper. The application must be made to the Controller of Examinations with the recommendation of the Head of the Department.

After the results are declared, mark sheets will be issued to the students. The mark sheet will contain the list of courses registered during the semester, the grades scored and the grade point average for the semester.

GPA is the sum of the products of the number of credits of a course with the grade point scored in that course, taken over all the courses for the semester, divided by the sum of the number of credits for all courses taken in that semester.

CGPA is similarly calculated considering all the courses taken from the time of admission.

22. Awarding Degree

After successful completion of the programme, the degree will be awarded with the following classification based on CGPA.

- For First Class with Distinction, the student must earn a minimum of 176 credits within four years (135 credits within three years for lateral entry students) for from the time of admission , pass all the courses in the first attempt and obtain a CGPA of 8.25 or above for all the subjects from I Semester to VIII Semester (III Semester to VIII Semester for lateral entry students).
- For First Class, the student must earn a minimum of 176 credits within five years (135 credits within four years for lateral entry students) from the time of admission and obtain a CGPA of 6.75 or above for all the subjects from I Semester to VIII Semester (III Semester to VIII Semester for lateral entry students).
- For Second Class, the student must earn a minimum of 176 credits within eight years (135 credits within seven years for lateral entry students) from the time of admission.

23. Ranking of Candidates

The candidates who are eligible to get the B.E. degree in the First Class with Distinction will be ranked together on the basis of CGPA for all the subjects of study from I Semester to VIII Semester (III Semester to VIII Semester for lateral entry students).

The Candidates passing with First Class will be ranked next after those with distinction on the basis of CGPA for all the subjects of study from I Semester to VIII Semester (III Semester to VIII Semester for lateral entry students).

The ranking of candidates will be done separately for each branch of study.

24. Transitory Regulations

The University shall have powers to revise or change or amend the regulations, the scheme of examinations, the courses of study and the syllabi from time to time.

Wherever there had been change of syllabi, examinations based on the existing syllabi will be conducted for three consecutive times after implementation of the new syllabi in order to enable the students to clear the arrears. Beyond that the students will have to take up their examinations in equivalent courses, as per the new syllabi, on the recommendations of the Head of the Department concerned.

Diploma Programmes Eligible for the B.E (Lateral Entry) Programmes offered in FEAT (from 2017-2018)

Sl.No.	Branches of Study	Eligible Diploma Programme (FT / PT / SW)
1.	**Civil Engineering**	i. Civil Engineering ii. Civil Engineering (Architecture) iii. Environmental Engineering and Pollution Control (Full Time) iv. Architectural Assistantship v. Civil Engineering (Rural Tech.) vi. Civil and Rural Engineering
2.	**Civil and Structural Engineering.**	
3.	**Mechanical Engineering**	i. Mechanical Engineering ii. Mechanical and Rural Engineering iii. Mechanical Design and Drafting iv. Production Engineering v. Production Technology vi. Automobile Engineering vii. Automobile Technology viii. Metallurgy ix. Mechatronics Engineering x. Machine Tool Maintenance and Repairs xi. Tool and Die making xii. Tool Engineering xiii. Tool Design xiv. Foundry Technology xv. Refrigeration and Air Conditioning xvi. Agricultural Engineering xvii. Agricultural Technology xviii. Marine Engineering xix. Mechanical Engineering(Production) xx. Mechanical Engineering(Tool &Die) xxi. Mechanical Engineering (Foundry) xxii. Mechanical Engineering(R & A.C.) xxiii. Electronics(Robotics) xxiv. Mining Engineering xxv. Agricultural Engineering and Farm xxvi. Equipment Technology
4.	**Mechanical Engineering (Manufacturing Engineering)**	

Sl.No.	Branches of Study	Eligible Diploma Programme (FT / PT / SW)
5.	**Electrical and Electronics Engineering**	i. Electrical and Electronics Engineering ii. Electronics and Communication Engg. iii. Electronics and Instrumentation Engg iv. Electronics Engineering(Instrumentation) v. Instrument Technology vi. Instrumentation and Control Engineering vii. Electrical Engineering (Instruments and Control) viii. Electrical Engineering ix. Instrumentation Technology x. Electronics (Robotics) xi. Mechatronics Engineering
6.	**Electronics and Instrumentation Engineering**	
7.	**Chemical Engineering**	i. Petrochemical Engineering ii. Chemical Engineering iii. Environmental Engineering and Pollution Control iv. Leather Technology (Footwear) v. Leather Technology vi. Plastic Technology vii. Polymer Technology viii. Sugar Technology ix. Textile Technology x. Chemical Technology xi. Ceramic Technology xii. Petro Chemical Technology xiii. Pulp & Paper Technology xiv. Petroleum Engineering
8.	**Computer Science and Engineering**	i. Electronics and Communication Engineering ii. Computer Technology iii. Computer Science and Engineering iv. Information Technology v. Computer Engineering vi. Computer Networking vii. Electronics(Robotics) viii. Mechatronics Engineering
9.	**Information Technology**	
10.	**Electronics and Communication Engineering**	

FT- Full Time; PT-Part Time; SW- Sandwich.

COURSES AND CREDITS - SUMMARY

Semester	No. of Courses		HS	BS	ES	PC	PE	OE	S&IT	Proj.	Total Credits
	T+P	Total									
I	4+2	**6**	3*	9	5	-	-	-	-	-	17
			1**	3	2						
II	4+4	**8**	4	13	7	-	-	-	-	-	24
			1	5	2						
III	6+2	**8**	3	4	8	8	-	-	-	-	23
			1	1	3	3					
IV	6+2	**8**	-	4	3	16	-	-	-	-	23
				1	1	6					
V	6+3	**9**	-	-	-	17	8	-	-	-	25
						6	3				
VI	6+3	**9**	-	-	-	10	11	3	-	-	24
						4	4	1			
VII	5+3	**8**	3	-	-	5	8	3	1	-	20
			1			2	3	1	1		
VIII	2+1	**3**	-	-	-	-	-	6	-	14	20
								2	-	1	
Total Courses	39+20	**59**	**4**	**10**	**8**	**21**	**10**	**4**	**1**	**1**	**-**
Total Credits		**-**	**13**	**30**	**23**	**56**	**27**	**12**	**1**	**14**	**176**

* - No of Credits ; ** - No of Courses.

DETAILS OF COURSE CODE

Code (First Two digits)	Details
00	Common course for the faculty
01	Civil Engg. Course
02	Civil and Structural Engg. course
03	Mechanical Engg. Course
04	Mechanical Engg (Manufacturing). Course
05	Electrical and Electronics Engg. Course
06	Electronics and Instrumentation Engg. course
07	Chemical Engg. course
08	Computer Science and Engg. course
09	Information Technology course
10	Electronics and Communication Engg. course
XX	Code of the programme concerned (01 to 10)

Code (3rd and 4th Digits)	Details
HS	Humanities Theory
HP	Humanities Practical
BS	Basic Science Theory
BP	Basic Science Practical
ES	Engineering Science Theory
SP	Engineering Science Practical
PC	Professional Core Theory
CP	Professional Core Practical
PE	Professional Elective Theory
EP	Professional Elective Practical
ST	Seminar / Industrial Training
OE	Open Elective Theory
PV	Project and Viva-voce

5th digit represents the semester and 6th and 7th digits represent the serial number of courses.

COURSES OF STUDY AND SCHEME OF EXAMINATIONS

FIRST SEMESTER

Sl. No.	Category	Course Code	Course	L	T	P	Exam	CA	Total	Credits
1	HS-I	00HS101	Technical English	4	-	-	75	25	100	3
2	BS-I	00BS102	Engineering Mathematics I	4	-	-	75	25	100	3
3	BS-II	00BS103	Applied Physics I	4	-	-	75	25	100	3
4	BS-III	00BS104	Applied Chemistry I	4	-	-	75	25	100	3
5	ES-I Lab	00SP105	Computer Programming Laboratory	-	1	3	60	40	100	3
6	ES-II Lab	00SP106	Engineering Workshop	-	-	3	60	40	100	2
			Total	**16**	**1**	**6**	**420**	**180**	**600**	**17**

SECOND SEMESTER

Sl. No.	Category	Course Code	Course	L	T	P	Exam	CA	Total	Credits
1	BS-IV	00BS201	Engineering Mathematics-II	4	-	-	75	25	100	3
2	BS-V	00BS202	Applied Physics-II	4	-	-	75	25	100	3
3	BS-VI	00BS203	Applied Chemistry II	4	-	-	75	25	100	3
4	ES-I	00ES204	Basic Engineering*	4		-	75	25	100	3
5	HS-II	00HP205	Communication Skills and Language Laboratory	-	2	3	60	40	100	4
6	BS-I Lab	00BP206	Applied Physics Laboratory	-	-	3	60	40	100	2
7	BS-II Lab	00BP207	Applied Chemistry Laboratory	-	-	3	60	40	100	2
8	ES-III Lab	00SP208	Engineering Graphics	-	2	3	60	40	100	4
			Total	**16**	**4**	**12**	**540**	**260**	**800**	**24**

* Basic Civil Engg. Course for Mech., Manuf., EEE, EIE, ECE, CSE & IT.
Basic Electrical Engg. Course for Civil, Civil and Structural, Mech., Manuf.,& Chem. Engg.
Basic Mechanical Engg. Course for Civil, Civil and Structural, EEE, EIE, ECE, CSE, IT & Chem. Engg.
L - Lecture; T-Tutorial; P-Practical.
Exam - End Semester Examination; CA-Continuous Assessment.

THIRD SEMESTER

Sl. No.	Category	Course Code	Course	L	T	P	Exam	CA	Total	Credits
1	HS-III	00HS301	Environmental Studies	4	-	-	75	25	100	3
2	BS-VII	00BS302	Engineering Mathematics III	4	1	-	75	25	100	4
3	ES-II	02ES303	Engineering Mechanics	4	-	-	75	25	100	3
4	ES-III	01ES304	Construction Engineering	4	-	-	75	25	100	3
5	PC-I	02PC305	Concrete Technology	4	-	-	75	25	100	3
6	PC-II	01PC306	Mechanics of Fluids	4	-	-	75	25	100	3
7	ES-IV Lab	02SP307	Computer Practical I (Building Drawings)	-	-	3	60	40	100	2
8	PC-I Lab	02CP308	Construction Engineering Lab	-	-	3	60	40	100	2
			Total	**24**	**1**	**6**	**570**	**230**	**800**	**23**

FOURTH SEMESTER

Sl. No.	Category	Course Code	Course	L	T	P	Exam	CA	Total	Credits
1	BS-VIII	00BS401	Probability, Random Processes and Numerical Methods	4	1	-	75	25	100	4
2	ES-IV	02ES402	Solid Mechanics	4	-	-	75	25	100	3
3	PC-III	02PC403	Structural Steel Design I	4	-	-	75	25	100	3
4	PC-IV	02PC404	Structural Concrete Design I	4	-	-	75	25	100	3
5	PC-V	01PC405	Applied Hydraulic Engineering	4	-	-	75	25	100	3
6	PC-VI	01PC406	Surveying	4	-	-	75	25	100	3
7	PC-II Lab	02CP407	Strength of Materials Lab	-	-	3	60	40	100	2
8	PC-III Lab	01CP408	Surveying Lab	-	-	3	60	40	100	2
Total				**24**	**1**	**6**	**570**	**230**	**800**	**23**

FIFTH SEMESTER

Sl. No.	Category	Course Code	Course	L	T	P	Exam	CA	Total	Credits
1	PC-VII	02PC501	Structural Mechanics I	4	-	-	75	25	100	3
2	PC-VIII	02PC502	Structural Steel Design I	4	-	-	75	25	100	3
3	PC-IX	0PC503	Soil Mechanics	4	1	-	75	25	100	4
4	PC-X	02PC504	Structural Concrete Design II	4	-	-	75	25	100	3
5	PE-I	01PE505	Professional Elective I	4	-	-	75	25	100	3
6	PE-II	01PE506	Professional Elective II	4	-	-	75	25	100	3
7	PC-IV Lab	02CP507	Computer Practical II	-	-	3	60	40	100	2
8	PC-V Lab	02CP508	Soil Mechanics Lab	-	-	3	60	40	100	2
9	PE-I Lab	01EP509	Professional Elective Lab I	-	-	3	60	40	100	2
Total				**24**	**1**	**9**	**630**	**270**	**900**	**25**

SIXTH SEMESTER

Sl. No.	Category	Course Code	Course	L	T	P	Exam	CA	Total	Credits
1	PC-XI	02PC601	Structural Mechanics II	4	-	-	75	25	100	3
2	PC-XII	02PC602	Foundation Engineering	4	-	-	75	25	100	3
3	PE-III	02PE603	Professional Elective III	4	-	-	75	25	100	3
4	PE-IV	01PE604	Professional Elective IV	4	-	-	75	25	100	3
5	PE-V	02PE605	Professional Elective V	4	-	-	75	25	100	3
6	OE-I	02OE606	Open Elective I	4	-	-	75	25	100	3
7	PC-VI Lab	02CP607	Advanced Material Testing Lab	-	-	3	60	40	100	2
8	PC-VII Lab	02CP608	Computer Practical III	-	-	3	60	40	100	2
9	PE-II Lab	01EP609	Professional Elective Lab II	-	-	3	60	40	100	2
Total				**24**	**-**	**9**	**630**	**270**	**900**	**24**

* Optional

SEVENTH SEMESTER

Sl. No.	Category	Course Code	Course	L	T	P	S	Exam	CA	Total	Credits
1.	HS-IV	00HS701	Engineering Ethics	4	-	-		75	25	100	3
2.	PC-XIII	02PC702	Prestressed Concrete	4	-	-		75	25	100	3
3.	PE-VI	02PE703	Professional Elective VI	4	-	-		75	25	100	3
4.	PE-VII	02PE704	Professional ElectiveVII	4	-	-		75	25	100	3
5.	OE-II	02OE705	Open Elective II	4	-	-		75	25	100	3
6.	PC-VIII Lab	02CP706	Earthquake Engineering Lab	-	-	3		60	40	100	2
7.	PE-III Lab	02EP707	Professional Elective Lab III	-	-	3		60	40	100	2
8.	S & IT	02ST708	Seminar / Industrial Training*	-	-	-	1	60	40	100	1
Total				**20**	**-**	**6**	**1**	**555**	**245**	**800**	**20**

Optional*

EIGHTH SEMESTER

Sl. No.	Category	Course Code	Course	L	T	P	S	Exam	CA	Total	Credits
1.	OE-III	02OE801	Open Elective III	4	-	-	-	75	25	100	3
2.	OE-IV	02OE802	Open Elective IV	4	-	-	-	75	25	100	3
3.	Project	02PV803	Project Work & Viva Voce	-	-	15	-	60	40	100	14
Total				**8**		**15**	**-**	**210**	**90**	**300**	**20**

(ES) ENGINEERING SCIENCE

1) Engineering Graphics
2) Engineering Workshop
3) Materials Science
4) Basic Civil Engineering
5) Basic Mechanical Engineering
6) Basic Electrical Engineering
7) Basic Electrical Engineering Laboratory
8) Basic Electronics Engineering
9) Basic Electronics Engineering Laboratory
10) Computer Programming
11) Computer Programming Laboratory
12) Computer Practical I (Building Drawings)
13) Construction Engineering
14) Basic Simulation Laboratory
15) Basic Thermodynamics
16) Solid Mechanics
17) Solid Mechanics & Fluid Mechanics
18) Solid Mechanics & Fluid Mechanics Laboratory
19) Engineering Mechanics

SYLLABUS

FIRST SEMESTER

00HS101	TECHNICAL ENGLISH	L	T	P
		4	0	0

COURSE OBJECTIVES

- English technical communication focuses on developing the proficiency of Engineering students in communicative skills, ensuring them to face the demand of their profession with high command in English.
- At the end of the course, the learners will be able to use English for all purposes of technical communication and come out in "flying colours".

Unit–I : Listening Strategies

This unit makes the students to get exposed to the listening exercises and get registered in their minds the nuances of listening and its importance.

1. Listening process.
2. Types of listening.
3. Barriers to listening.
4. Characteristics of good listeners.
5. Team listening and note making.

Unit–II : Critical Reading and Creative Writing Skills

This unit introduces communication model like courtesy, body language, role play and good presentation in an effective manner, where the students are given an opportunity to observe, analyze, interpret, imagine and implement their ideas too.

Poem : Road not taken – Robert Frost
Ulysses – Alfred Lord Tennyson.

Prose : Of Studies – Francis Bacon
Science – Destroyer or creator – J. Bronowski

Play : Pygmalion – Bernardshaw.

Unit–III : Speaking Skill

Students shall be motivated to speak in English on familiar or unfamiliar topics. It is a platform to train the students to achieve competency in oral expression.

1. Interview Techniques
2. Group discussion
3. Making presentation and Discussing on the presentation.
4. Sample interviews
5. Dialogue writing

Unit–IV : Professional Writing

Students shall be trained to create their own proficiency in writing like - calling for quotation, asking clarification, placing orders and so on.

1. Poster making
2. Letter writing (formal and E-mail)

3. Analytical writing
4. Format of memos.
5. Report Writing

Unit–V : Theoretical writing

The nuances of English grammar may be taught to the students so as to present flawless English both in their oral and written communication

1. Vocabulary – Homonyms, Homophones, Acronyms & Abbreviations, Idioms & Phrases.
2. Single word substitution
3. Concord
4. Tag Questions
5. Active voice and passive voice

TEXT BOOKS

1) Rizvi, Ashraf.2006. *"Effective Technical Communication"*. New Delhi. Tata Mc.Graw Hill Publication Company Ltd.

REFERENCE BOOKS

1) Raman, Meenakshi and Sangeetha Sharma.2004. *"Technical Communication: Principles and Practice"*. New Delhi: OUP.
2) Bailey, Stephen. "*Academic Writing: A practical guide for students*". New York: Rutledge.2011.
3) Gerson, Sharon J and Steven M. Gerson. 2007. "*Technical writing: Process and Product*". Delhi: Pearson prentice Hallan, 1980.

COURSE OUTCOMES

1) Understand the role of speaking in English and its contribution to their success.
2) Help the students increase the lingual power and word power, and frame suitable structures to use appropriately in different contexts.
3) Initiate the students to adopt different strategies for personal and professional writing.
4) Train the students use diversified rhetorical functions of technical English.

00BS102	ENGINEERING MATHEMATICS - I	L	T	P
		4	0	0

COURSE OBJECTIVES

To acquaint the student with the concepts in

- matrices,
- differential calculus,
- multiple integrals,
- vector calculus, which are most important in connection with practical engineering problems.

Unit–I : Matrices

Characteristic equation – Eigen values and eigen vectors of a real matrix – Properties – Cayley-Hamilton theorem – Orthogonal transformation of a real

symmetric matrix to diagonal form – Quadratic form – Reduction of quadratic form to canonical form by orthogonal transformation.

Unit–II : Differential Calculus

Curvature in Cartesian and parametric co-ordinates – Centre and radius of curvature – Circle of curvature – Evolutes – Envelopes.

Unit–III : Differential Calculus: Functions of Several Variables

Jacobians – Taylor's and Maclaurin's series expansions of functions of two variables – Maxima and Minima of functions of two variables – Constrained Maxima and Minima by Lagrange Method.

Unit–IV : Multiple Integrals

Double integration – Cartesian and polar co-ordinates – change of order of integration – area as a double integral – triple integration – Volume as a triple integral.

Unit–V : Laplace Transform

Definition, Transform of elementary functions, Properties, Derivatives and integrals of transforms, Transforms of derivatives, Convolution theorem, Transforms of periodic functions, Inverse Laplace transform, Application to solution of linear ordinary differential equations of second order with constant coefficients.

(In all units, proof of theorems are not included)

TEXT BOOKS

1) Venkataraman M K, Engineering Mathematics, Volumes I (2008) and II (2009), The National Publishing Company, Chennai.
2) Veerarajan T, Engineering Mathematics, Second Edition, Tata McGraw Hill Education Private Limited, New Delhi, 2011.

REFERENCE BOOKS

1) Grewal B S, Higher Engineering Mathematics, Khanna Publishers, Delhi, 40th Edition, 2007.
2) 2. Erwin Kreysig, Advenced Engineering Mathematics, John Wiley & Sons, 8th Edition, 2002.

COURSE OUTCOMES

1) This course equips students to have knowledge and understanding in matrices, differential calculus, multiple integrals and Laplace transforms.
2) Students will be able to solve problems related to above fields in engineering applications.

00BS103	APPLIED PHYSICS – I	L	T	P
		4	0	0

COURSE OBJECTIVES

At the end of the course the students would be exposed to fundamental knowledge in various engineering subjects and applications

- Determine the different modulus of elasticity and viscosity of the less and highly viscous liquids.
- Design of acoustically good buildings.

- Interferometric techniques in metrology, communication and civil engineering.
- Application of quantum physics to optical and electrical phenomena.
- Application of ultrasonics and acoustics.
- Structure identification of engineering materials.
- Applications of Radio isotopes and power reactor systems.

Unit–I : Properties of Matter

Introduction to elasticity - Hook's law - Different modulii of elasticity - Bending of beams – Determination of Young's modulus by Uniform and Nonuniform bending – I-shapegirder – Torsional pendulum - Theory – Experiment and its applications. Introduction to Viscosity – streamline and turbulent flow – Poiseuille's equation- capillary flow method – Stoke's law – terminal velocity – determination of viscosity by Stoke's method.

Unit–II : Sound

Introduction to Acoustics - factors affecting acoustics of buildings and their remedies– absorption coefficient– Sabine's formula for reverberation time.

Introduction to Ultrasonics – production – magnetostriction and piezo electric methods – Detection of Ultrasonic waves (Acoustics grating) – Applications.

Unit–III : Optics

Interference – Air wedge – Michelson's interferometer – Diffraction - Dispersive power of prism and grating – Polarisation – Types of Polarisation - theory of plane, Circularly and elliptically polarized light – photo elasticity -Stress optic law – Effect of a stressed model in plane polariscope – Isoclinic and Isochromatic fringes – photo elastic bench – uses.

Unit–IV : Crystal Physics

Lattice - Unit cell - Bravais lattice - Atomic radius, co-ordination number, Packing factor and their calculations of SC,BCC,FCC and HCP crystal structures - Miller indices - Crystal imperfections (Point defect, Line defect, surface defect and volume defect).

Unit–V : Nuclear Physics

Introduction - General properties of Nucleus – Mass defect, Binding energy, Nuclear models – Liquid drop model and Nuclear shell model - Nuclear detector – G.M counter – Scintillation Counter – Ionisation Chamber – Fission, Fusion, Thermonuclear reaction and Stellar energy – Nuclear reactor – General nuclear reactor – Breeder nuclear reactor.

TEXT BOOKS

1) Arumugam M., "Engineering Phyisics", Anuradha Agencies, Kumbakonam, 2000.
2) Gaur R.K. and Gupta S.L., "Engineering Physics", DhanpatRai Publishers, New Delhi, 2003.

REFERENCE BOOKS

1) Pillai S.O., "Solid State Physics", New Age International Publication, New Delhi, Seventh Edition, 2015

2) Palanisamy P.K. "Physics for Engineers", Scitech Publication (India) Pvt. Ltd., Chennai, Second Edition, 2005.
3) Mani. P. "Engineering Phyisics", Dhanam Publication, Chennai, 2011.
4) Rajendran V. and Marikani A., "Applied physics for engineers", Tata McGraw Hill Publishing Company Ltd., New Delhi, 2004.
5) Theraja B.L, "Modern Physics", Chand & company Ltd. , Edition 1990.
6) Tayal D.G., "Nuclear Physics", Himalaya publishing house, 2007.
7) Ghoshal.S.N., "Nuclear Physics", S. Chand & Company Ltd., 2012.
8) Avadhanulu M.N. and Kshirsagar P.G., "A Text Book of Engineering Physics", S. Chand & Company Ltd., 7th Enlarged Revised Ed., 2005.

COURSE OUTCOMES

1) The Engineering students can gain the basic knowledge in the field of optics, sound, nuclear physics and crystalline materials etc.
2) It will be useful to apply in engineering applications.

00BS104	APPLIED CHEMISTRY – I	L	T	P
		4	0	0

COURSE OBJECTIVES

To make the student conversant with the

- Water treatment techniques and disinfection methods.
- Working principle of electrochemical cells.
- Sources, refining and various types of fuels.
- Mechanism, classification, applications of lubricants and introduction adhesives.
- Surface chemistry, principle and applications of chromatography.

Unit–I : Water Treatment

Water – Hardness of water – softening of water by ion-exchange process and zeolite process – boiler feed water – specifications – boiler troubles (Sludge and scale formation, priming and foaming, caustic embrittlement and boiler corrosion) – removal of dissolved CO_2, O_2 and acids – internal treatment of boiler feed water (colloidal, carbonate, phosphate, calgon and EDTA conditioning) – disinfection of water – break point chlorination – desalination of brackish water by reverse osmosis method - Determination of total hardness by EDTA method.

Unit–II : Electrochemistrty

Electrochemical cell – EMF – determination of EMF of electrochemical cell – single electrode potential – standard electrode potential – Nernst equation – reference electrodes – standard hydrogen electrode, calomel electrode, glass electrode – electrochemical series – concentration cell.

Unit–III : Fuels and Combustion

Classification of fuels – calorific value – HCV and LCV – Analysis of coal – proximate and ultimate analysis – carbonization of coal (HTC and LTC) – Manufacture of coke – properties of coke – flue gas analysis by Orsat's apparatus. Petroleum – Refining – Synthetic petrol – Fischer – Tropsch and Bergius process –

cracking – polymerization process – knocking in petrol and diesel engines – octane number and cetane number – properties of straight run, cracked and polymer gasoline.

Unit–IV : Engineering Materials – I

Lubricants and their functions – Mechanisms of lubrication – classification of lubricants with example – lubricating oils – properties of lubricating oils (viscosity index, flash and fire points, cloud and pour points, oiliness, carbon residue and aniline point) – Solid lubricants – Greases – emulsion lubricants. Adhesives – Definition – adhesive action – development of adhesives strength – physical and chemical factors influencing adhesive action – bonding process of adhesives – adhesives for building and constructions – animal glues, casein glues.

Unit–V : Analytical Technique and Surface Chemsitry

Chromatography – Definition – classifications – partition chromatography and adsorption chromatography.

Surfacechemistry – Definition – types of adsorption – characteristics of adsorption – adsorption isotherms – Freundlich's adsorption isotherms and Langmuir's adsorption isotherms – applications of adsorption.

TEXT BOOKS

1) Sivasankar. B (2012)., '*Engineering Chemistry'*, Tata McGraw-Hill Publishing company Limited, NewDelhi.
2) Sivakumar. R and Sivakumar. N (2013)., '*Engineering Chemistry'*, Tata McGraw-Hill Company Limited, NewDelhi

REFERENCE BOOKS

1) Jain.P.C. and Monica Jain (2010)., '*Engineering Chemistry'*, DhanpatRai& Sons, New Delhi
2) Dara.S.S. and Umare.S.S (2014)., '*Text book of Engineering Chemistry*,' S.Chand& Co. Ltd., New Delhi.
3) Gopalan. R, Venkappayya. D, and Nagarajan. S (2008)., '*Engineering Chemistry'*, Tata McGraw Hill Publishing Company Limited, New Delhi.

COURSE OUTCOMES

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

1) Understand and develop innovative methods to produce soft water for industrial use and potable water at cheaper cost.
2) Understand and apply the concepts of electrochemistry including electroplating.
3) Understand the properties, sources of fuel and the concept of combustion
4) Gain the knowledge about types of lubricants, uses & their mechanisms and to understand the binding process of adhesives, and its application in building and construction.
5) Separate and purify various organic and inorganic compounds using different chromatographic techniques.
6) Understand the concept of surface chemistry and its applications.

00SP105	COMPUTER PROGRAMMING LABORATORY	L	T	P
		0	1	3

COURSE OBJECTIVES

- To enable the students to have a good understanding about the concepts of "C" programming.
- To provide the hands on experience in basic concepts of AUTOCAD to students.

C Programs Based on the following Concepts

Basic structure of C Programs – Constants – Variables - Data Types - – Keywords – Identifiers - Operators - Expressions – IF, IF-ELSE, Nested IF-ELSE, Switch, WHILE, DO, FOR and GOTO statements - Arrays: one dimensional and two dimensional – Strings - Functions.

AUTOCAD

Introduction – Terminology – Coordinates - Operations – Control keys – Commands – Utility Commands –File Commands – Edit and Inquiry Commands – Display Control Commands – Modes – Layers – Colors – Blocks.

Special Features – Dimensioning – Angular, Diameter and Radius – Hatching – Patterns – Slides – Attributes – Configuring – Plotting– Exercises in AUTOCAD (2D Drawings only)

TEXT BOOKS

1) E. Balagurusamy, Programming in Ansi C, Tata McGraw-Hill Education, (2012) 6th Edition.
2) Cheryl R. Shrock, AutoCAD Pocket Reference, BPB Publications,(2015)

REFERENCE BOOKS

1) Yashavant P. Kanetkar, Let us C, BPB Publications, 14th Edition, (2016)
2) David Byrnes, AutoCAD 2010 FOR DUMMIES, Wiley Publishing,Inc., (2010)

COURSE OUTCOMES

1) Understand the concepts of C programming.
2) Apply the syntax of conditional and looping statements for writing C programs
3) Use the features of AUTOCAD for 2D drawing

00SP106	ENGINEERING WORKSHOP	L	T	P
		0	0	3

COURSE OBJECTIVES

- To provide the students simple hands-on-experience in the basic aspects of production engineering in fitting, carpentry and sheet metal.

Workshop Practice in the Shops

Carpentry: Use of hand tools – exercises in planning and making joints namely, half lap joint, dovetail joint, mortising and tenoning.

Fitting: Use of bench tools, vice, hammers, chisels, files, hacksaw, centre punch, twist drill, taps and dies – Simple exercises in making T joint and dovetail joints.

Sheet Metal Work: Use of hand tools – Simple exercises in making objects like cone, funnel, tray, cylinder.

Smithy: Demonstration of hand forging and drop forging.

COURSE OUTCOMES

This course

1) Use basic tools of fitting, carpentry and sheet metal fabrication.
2) Experience in the fabrication of simple carpentry joints.
3) Develop skill tomake simple fitting joints.
4) Train to make simple shapes of sheet material.
5) Distinguish hand forging and drop forging operation.

SECOND SEMESTER

00BS201	ENGINEERING MATHEMATICS II	L	T	P
		4	0	0

COURSE OBJECTIVES

- To acquaint the student with the concepts in ordinary differential equations and vector calculus.
- To acquaint the student with the techniques in the theory of analytic functions and complex integration.
- Above topics are most important in connection with practical engineering problems.

Unit–I : Ordinary Differential Equations

Second order linear differential equations with constant coefficients, Second order linear differential equations with variable coefficients (Euler and Legendre's linear equations), Simultaneous first order linear equations with constant coefficients, method of variation of parameters.

Unit–II : Vector Differentiation

Gradient, divergence and curl, directional derivative, unit normal vector, irrotational and solenoidal vector fields, expansion formulae for operators involving ∇.

Unit–III : Vector Integration

Line, surface and volume integrals, Green's theorem in a plane, Gauss divergence theorem, Stoke's theorem – Verification of the above theorems and evaluation of integrals using them.

Unit–IV : Analytic Functions

Functions of a complex variable, Analytic function, the necessary conditions (Cauchy-Riemann equations), sufficient conditions, Properties of analytic functions, harmonic functions, construction of Analytic function by Milne-Thomson method, Conformal mapping: $w = z^2$, $1/z$, e^z, sin z, cos z.

Unit–V : Complex Integration

Statement and application of Cauchy theorem, Cauchy integral formulas, Taylor and Laurent expansion, Singularities – Classification; Residues – Statement

and application of Cauchy residue theorem, Contour integration round the unit circle.

(In all units, proof of theorems are not included).

TEXT BOOKS

1) Venkataraman M K, Engineering Mathematics, Volumes I (2008) and II (2009), The National Publishing Company, Chennai.
2) Veerarajan T, Engineering Mathematics, Second Edition, Tata McGraw Hill Education Private Limited, New Delhi, 2011.

REFERENCE BOOKS

1) Grewal B.S., Higher Engineering Mathematics, Khanna Publishers, Delhi, 40th Edition, 2007.
2) Erwin Kreysig, Advanced Engineering Mathematics, John Wiley & Sons, 8th Edition, 2002.

COURSE OUTCOMES

1) This course equips students to have knowledge and understanding in ordinary differential equations, vector calculus and complex variables.
2) Students will be able to solve problems related to above fields in engineering applications.

00BS202	APPLIED PHYSICS – II	L	T	P
		4	0	0

COURSE OBJECTIVES:

At the end of the course the students would be exposed to fundamental knowledge in various materials and applications

- Application of lasers and fiber optics in engineering and technology.
- Astrophysics is the study of physics of the universe. In various objects, such as stars, planets and galaxies.
- To measure positions, brightness, spectra structure of gas clouds, planets, starts, galaxies, globular clusters, quasars etc.
- Physics of modern engineering materials.
- Electromagnetic phenomena and wave propagation
- Applications of nano materials, nano electronics and optoelectronic devices.
- Design of energy sources and applications of solar energy.

Unit–I: Laser and Fiber Optics

Introduction to laser - Einstein co-efficients (A&B) – properties of Laser- Types of laser – CO_2, Nd-YAG and Semiconductor lasers - Applications – Holography - Construction and reconstruction of hologram - Applications.

Fiber optics - Principle and propagation of light in optical fibers - Numerical aperture and acceptance angle - Types of optical fibers (Material, Mode and refractive index) - Applications - Fiber Optic communication system.

Unit–II : Dielectrics and Superconductors

Introduction to Dielectrics – Types of Dielectric materials - Dielectric constant – Determination of Dielectric constant (ε_r) by Schering Bridge method – Different

types of polarization – Local or Internal field – Clausius-Mosotti Equation – Dielectric Loss – Dielectric breakdown – Dielectric Properties and applications – Superconductivity – Properties – Meissner effect – Type I and Type II superconductors – BCS theory- High temperature Superconductors – Applications.

Unit–III : Nano Materials

Introduction to Nanomaterials – properties – Types of nanomaterials – synthesis of nanomaterials - Top-down approaches – Mechanical grinding, Lithiography – Types of Lithiography - Bottomup approaches – physical vapour deposition method, Sol-gel method. Applications of nanomaterial. Carbon Nanotubes (CNT) – Introduction – Types of Carbon Nanotubes – Synthesis of Carbon Nanotubes – Properties and its application.

Unit–IV : Quantum Mechanics

Heisenberg uncertainty Principle - Wave particle dual nature – De Broglie's matter Waves – wave Velocity and group velocity.

The wave Equation, Schrödinger's Time dependent wave equation, Schrödinger's time independent wave equation - The Wave function and its physical significance - The particle in a box – energy quantization – Eigen values and Eigen functions.

Unit–V : Energy Physics

Introduction to energy source - Energy sources and their availability (Conventional &non-conventional energy sources) – Solar energy – Introduction – Methods of Harvesting Solar energy (Solar cells, Solar battery, Solar heat collectors and Solar water heater) - Wind energy – basic components of a WECS (Wind Energy Conversion System) – Classification of WEC Systems – Advantages and disadvantages of WECS - Biomass – Biomass conversion - Biogas Generation - Classification of Biogas plants.

TEXT BOOKS

1) Arumugam.M. "Engineering Physics", Anuradha agencies, 2nd Edition, 1997.
2) Gaur R.K. and Gupta S.L., "Engineering Physics", DhanpatRai Publishers, New Delhi, 2003.

REFERENCE BOOKS

1) Rajendran.V, "Engineering Physics", Tata McGraw Hill publishers, 2009.
2) Rai G.D., "Non-conventional Energy sources", Khauna Publications, 1993.
3) Martin Harwit, "Astrophysical Concepts", Springer, 4th Edition, 2006.
4) Dimitri Mihalas. "Stellar Atmospheres", San Francisco, W.H, Freeman & Company, 1978.
5) Wilson M., Kannangara K., Smitt G., Simmons M. &Boguse B. "Nanotechnology", Basic science and emergine technology, Raguse Chapman hall Publications, 2002.
6) Kenneth Klabunde.J, "Nanoscale Materials in chemistry", A John Eiley& Sons, Inc., Publication, 2001.
7) Mani. P. "Engineering Phyisics", Dhanam Publication, Chennai, 2011.
8) Agarwal.M.P, "Solar Energy", S.Chand& Co., I Edn, New Delhi, 1983.

9) John Twidell& Tony Weir, " Renewable Energy Resources" , Taylor &
10) Francis, 2005.
11) Carroll B.W. &D.A.Ostlie , "An introduction to Modern Astrophysics", 2nd Edition, 2011.
12) Avadhanulu M.N. and Kshirsagar P.G., "A Text Book of Engineering Physics", S. Chand & Company Ltd., 7th Enlarged Revised Ed., 2005.
13) Rai.G.D. *"Solar Energy* Utilization" Volume-1 & 2 by - Khanna Publishers, New Delhi.
14) Senthilkumar.G, Engineering Physics, VRB Publishers Pvt. Ltd., Chennai.
15) Ravikrishnan.A, Environmental Science and Engineering, Hitech Publishing Company PVT Ltd.
16) Rai.G.D. , *"Non-Conventional Energy Sources"* - Khanna Publishers.
17) Senthilnathan.S, Gnanapoongothai.T, Oudayakumar.K, Jayavarthanan.T, "Material Science", SSMP Publications.

COURSE OUTCOMES

1) The student will have the theoretical knowledge in this field of laser, dielectrics, Nano technique, energy physics etc.
2) It will be very useful to the students to apply in different field of engineering.

00BS203	APPLIED CHEMISTRY II	L	T	P
		4	0	0

COURSE OBJECTIVES

To make the students to understand the

- Types of polymers and polymerization processes.
- Phase rule with different kinds of systems.
- Different types of corrosion and their mechanism.
- Working principle and applications of primary and secondary batteries.
- Engineering materials such as refractories and abrasives.

Unit–I : POLYMERS

High polymers: plastics – Thermoplastics and thermosetting resins. Addition polymerization and condensation polymerization – compounding of plastics – Moulding methods – Compression, injection and blow moulding – Important engineering plastics – polyethylene, PVC, Teflon, Polystyrenes, Nylon 6,6, Bakelite, Polyurethane – Rubber – natural rubber – vulcanization of rubber – Synthetic rubber – buna-S, butyl rubber, neoprene and polyurethane foams.

Unit–II : PHASE RULE

Phase rule – statements and explanation of the terms involved – condensed phase rule – construction of phase diagram – water system – sulphur system – phase rule for two component alloy systems – thermal analysis – eutectic system – Lead-Silver system – simple eutectic formation – Zinc – Magnesium alloy system.

Unit–III : CORROSION AND PREVENTION

Corrosion: Dry and wet corrosion – Pilling-Bedworth rule – mechanism of wet corrosion – types of wet corrosion – galvanic corrosion – differential aeration

corrosion – factors affecting corrosions. Corrosion control methods – design and material selection – cathodic protections – sacrificial anode and impressed current method – corrosion inhibitors – protective coatings – surface preparations – Galvanizations, Tinning – electroplating – anodizing, phosphate coating, hot dipping.

Unit–IV : ENERGY STORAGE DEVICES

Types of battery – commercial voltaic cell – primary battery – secondary storage cell – lead – acid cell, nickel-cadmium cell, lithium battery – fuel cells – hydrogen-oxygen fuel cell – photovoltaic cell – principle, working and applications.

Unit–V : ENGINEERING MATERIALS II

Refractories – classification (acidic, basic and neutral refractories) – properties (refractoriness, refractoriness under load, dimentional stability, porosity, thermal spalling) – fire clay bricks, alumina bricks and zirconia bricks. Abrasives – Moh's scale of hardness – natural abrasive (diamond, corundum, emery, garnets and quartz) – synthetic abrasives – silicon carbide, boron carbide and their uses.

TEXT BOOKS

1) Sivasankar. B (2012)., *'Engineering Chemistry'*, Tata McGraw-Hill Publishing company Limited, NewDelhi.
2) Sivakumar. R and Sivakumar. N (2013)., *'Engineering Chemistry'*, Tata McGraw-Hill Company Limited, NewDelhi.

REFERENCE BOOKS

1) Jain.P.C. and Monica Jain (2010)., *'Engineering Chemistry'*, DhanpatRai& Sons,New Delhi
2) Dara.S.S. and Umare.S.S (2014)., *'Text book of Engineering Chemistry'*, S.Chand& Co. Ltd., New Delhi.
3) Gopalan. R, Venkappayya. D, and Nagarajan. S (2008)., *'Engineering Chemistry'*, Tata McGraw Hill Publishing Company Limited, New Delhi.
4) Gowariker.V.R.,Viswanathan N.V. and JayadevSreedhar, (2006)., *'Polymer Science'*, New Age International P (Ltd.,), Chennai. (Unit–I)
5) Puri. B. R, Sharma. L. R &Pathania. M. S (2013)., *'Principles of Physical Chemistry'*, Vishal Publishing Company, NewDelhi. (Unit–II)

COURSE OUTCOMES

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

1) Understand the synthesis and applications of various types of polymers and moulding processes.
2) Understand the concept of phase rule and its applications, which is applicable in alloy preparation.
3) Understand the concept of corrosion and to apply the knowledge in the protection of different metals from corrosion.
4) Gain the knowledge about various energy storage devices, especially solar energy.
5) Have the knowledge of converting solar energy into most needy electrical energy efficiently and economically to reduce the environmental pollution.
6) Gain knowledge on classification, synthesis and applications of abrasives and refractories.

00ES204	BASIC ENGINEERING (CIVIL)	L	T	P
		2	0	0

COURSE OBJECTIVES

- To inculcate a knowledge on essentials of Civil Engineering
- To expose the students on the role, significance and contributions of Civil Engineering in satisfying societal needs
- To illustrate the concepts of various construction techniques

Module I

Introduction to Civil Engineering - various disciplines of Civil Engineering, relevance of Civil Engineering in the overall infrastructural development of the country. Introduction to various building materials – Stone, Bricks, Steel, Cement, Concrete, Timber – its characteristics, types and uses. Various types of buildings as per nbc; Selection of suitable site for buildings, Components of a residential building – its functions, Orientation of a building, simple definitions - plinth area / built up area, floor area / carpet area – floor space index.

Module II

Surveying - Principles and objectives of surveying; Types, Classifications of surveying, measurement of areas and distances – chain – compass: Introduction to Leveling, Total station, Remote sensing - fundamental principles and applications.

Building construction – foundations; Bearing capacity of soil, functions of foundations, Types - Shallow and Deep. Brick masonry – Header, Stretcher, Flemish and English Bond. Columns, Lintels, Roofs – functions, types, roofing materials, Floors – functions, types, flooring materials. Decorative finishes – plastering, interior design

Module III

Bridges – necessity - selection of site – components of a bridge: Dams – types – selection site - forces acting on a dam – Roads – uses - classification of roads – components of a road; Railways – basic components of permanent way – water supply – per capita requirement – sources – need for conservation of water – rain water harvesting - basic water treatment – Sewage and its disposal – basic definitions – Septic tank - components and functions.

TEXT BOOKS

1) Ramesh babu. V, A text book of Basic Civil Engineering, Anuradha Agencies, Kumbakonam, 1995.
2) Palanichamy M.S., Basic Civil Engineering, Tata McGraw Hill Publishing Company ltd, 2000.

REFERENCE BOOKS

1) Ramamrutham V, Basic Civil Engineering, DhanpatRai Publishing Co. (P) Ltd., 1999.
2) Natarajan K V, Basic Civil Engineering, Dhanalakshmi Publications, Chennai, 2005.
3) SatheeshGopi, Basic Civil Engineering, Pearson Publications, 2010.

COURSE OUTCOMES

1) Understand the basic knowledge on civil engineering materials
2) Develops the skill to satisfy the social needs
3) Describe the suitable method of construction technique

00ES204	BASIC ENGINEERING (ELECTRICAL)	L	T	P
		2	0	0

COURSE OBJECTIVES

- To impart the basic principles of generation of electrical energy.
- To explain the operation of electrical machines and various measuring instruments.
- To understand the basic concepts of circuit analysis.
- To provide an overview of the principles, operation and application of semiconductor devices like diodes, BJT, FET and a basic knowledge of fundamentals of Communication Systems.

Module I

Sources of Electrical energy–Generation of electrical energy – working principles of DC generators and alternators– Advantages of electrical energy over other forms of Energy.

Operating principle of DC motors– Types of DC motors– Characteristics and uses of DC motors. Working principles of Single and Three phase transformers. Operating Principle of three phase and single phase induction motors– types and uses of induction motors.

Working principles of MC and MI voltmeters and Ammeters, Dynamo meter type wattmeter, Induction type energy meter and Multimeter–types of wiring– requirements for house wiring–typical layout for a small house– earthing.

Module II

DC Circuits: Definition of current, voltage, power and energy– DC voltage and current sources– resistance, types of resistors, series and parallel connections of resistors, current and voltage division–loop method of analysis of simple circuits.

AC Circuits: Sinusoidal signals – average, r.m.s values –inductance, capacitance and their V–I relationships. Analysis of simple single phase series circuits– power and power factor–phasor diagrams– Introductions to three phase AC circuits.

Module III

Basic Electronics: Principle and characteristics, uses of PN junction Diode, Zenerdiode, BJT, FET, UJT, Thyristors,- Operating principle of Half wave, Full wave and Bridge rectifiers.

Digital Electronics and Principles of Communication Systems: Symbol, truth table and functions of basic logic gates, universal gates, Half adder, Full adder. Communication systems–Microwave, Satellite, Fibreoptic and ISDN (block diagram description only).

TEXT BOOKS

1) Nagrath, I.J., 2007. Elements of Electrical Engineering, 2nd Edition, 14th reprint, Tata McGraw Hill Publishing Co. Limited, New Delhi.

REFERENCE BOOKS

1) Gupta, B. R., 2002. *Principles of Electrical Engineering*, S. Chand &Co, NewDelhi.
2) Theraja. B.L &Theraja. A.K., 2000. *Electrical Technology, Vol. I, II, and IV*, S. Chand and Co., NewDelhi.
3) Floyd & Jain, 2009. *Digital Fundamentals*, 8th Edition, Person Education.
4) Anok Singh, 2006. *Principles of Communication Engineering*, 6th reprint, S. Chand & Company Ltd., Ram Nagar, NewDelhi.

COURSE OUTCOMES

After the completion of the course, the student should be able to

1) Provide comprehensive idea about simple circuit analysis, working principles of machines and common measuring instruments
2) Analyze the behavior of any dc and ac circuits
3) Characterize semiconductor devices that include diodes, BJT and digital functions.
4) Understand fundamental principles of communication systems.

00ES204	BASIC ENGINEERING (MECHANICAL)	L	T	P
		2	0	0

COURSE OBJECTIVES

- To familiarize the students the functioning of different types of Boilers, the mountings and accessories.
- To provide basic knowledge about the use of various machine tools and the basic principles of welding, brazing and soldering.
- To illustrate the concepts of various metal forming operations and metal joining techniques.

Module I

Boilers: Classification – Description and working of Simple vertical boiler, Cochran boiler, Babcock and Wilcox boiler - Description and working of boiler mountings: water level indicator, Pressure gauge, Dead weight and Spring loaded Safety value, Fusible plug, Feed check value, Steam stop value and Blow–off cock - Description and working of boiler accessories: Economiser and Super heater.

Module II

Prime Movers: Steam turbines: Principles and working of Impulse and Reaction turbines – Comparison. Gas turbines: Principles and working of Open cycle and Closed cycle gas turbines. Internal Combustion Engines: Classification – principal parts – comparison of two strike and four stroke engines – working principle of petrol and diesel engines.

Module III

Machine Tools: Description of parts and operations performed – Lathe, Shaper and Drilling machine.

Metal Forming: Hot working versus cold working; Hand forging – Principle and operations; Rolling – Principle, rolling mill configurations; Extrusion – Direct versus indirect extrusion.

Metal Joining: Gas welding – principle, Oxy-acetylene welding – equipment, types of flames, advantages and disadvantages – Arc welding - principle, advantages and disadvantages – Brazing – Torch brazing, dip brazing, furnace brazing, resistance brazing – Soldering – Comparison of brazing and soldering.

TEXT BOOKS

1) Prabhu T J, Jaiganesh V and Jebaraj S, Basic Mechanical Engineering, Scitech Publications Pvt. Ltd., Chennai, 2000.

2) Venugopal and Prabhuraj T J, Basic Mechanical Engineering, ARS publishers, Sirkali, 1996.

REFERENCE BOOKS

1) Hajra Choudhury S. K., Nirjhar Roy, Hajra Choudhury A. K., Elements of Workshop Technology,(Vol 1 and Vol II,) , Media Promoters, Pvt Ltd. (2008)

2) Rao P. N., Manufacturing Technology : Foundry, Forming and Welding - Vol 1, Mc Graw Hill Education, (2013)

3) Steven R. Schmid, SeropeKalpakjian, Manufacturing Processes for Engineering Materials (English) 5th Edition, Pearson India, (2009)

COURSE OUTCOMES

1) Understand the construction and working principles of boiler operations
2) Distinguish between steam turbines and gas turbines.
3) Select suitable manufacturing methods to produce a new component.

00HP205	COMMUNICATION SKILLS AND LANGUAGE LABORATORY	L	T	P
		0	2	3

COURSE OBJECTIVES

- The Language Lab focuses on the production and practices of sounds of language
- The Language Lab familiarizes the students with the use of English in everyday situations and contexts.

Theoretical Session (Internal Assessment only)

1) English sound pattern
2) Sounds of English
3) Pronunciation
4) Stress and Intonation
5) Situational Dialogues/ Role play
6) Oral presentations- Prepared or Extempore
7) 'Just a Minute' sessions (JAM)

8) Describing Objects /situations/ people
9) Debate
10) Giving Directions

Practical Session

1) To make the students recognize the sounds of English through Audio Visual Aids
2) To enable the students speak fluently without fear
3) To develop their communicative skill with individual practice through the prescribed package
4) The Globarena Package consists of the following exercises
   - Reading comprehension
   - Listening comprehension
   - Vocabulary exercises
   - Phonetics
   - Role Play in dialogues
   - Auto Speak

REFERENCE BOOKS

1) Globarena Package for communicative English
2) Cambridge Advanced Learner's English Dictionary
3) Spoken English (CIEFL) in 3 volumes with 6 cassettes, OUP.
4) English Pronouncing Dictionary Daniel Jones Current Edition with CD.
5) Spoken English- R. K. Bansal and J. B. Harrison, Orient Longman 2006 Edn.
6) A Practical course in English Pronunciation, (with two Audio cassettes) by J. Sethi, KamleshSadanand& D.V. Jindal, Prentice-Hall of India Pvt. Ltd., New Delhi.
7) A text book of English Phonetics for Indian Students by T.Balasubramanian (Macmillan)
8) English Skills for Technical Students, WBSCTE with British Council, OL.

COURSE OUTCOMES

1) Help the students to cultivate the habit of reading passages from the computer monitor, thus providing them with the required facility to face computer-based competitive exams such as GRE, TOEFL, GMAT, etc.
2) Train the students to use language effectively to face interviews, group discussions, and public speaking.
3) Initiate the students into greater use of the computer in resume preparation, report writing, format-making, etc.,

00BP206	APPLIED PHYSICS LABORATORY	L	T	P
		0	0	3

COURSE OBJECTIVES

The ability to offer students a variety of research opportunities

- To determine the radius of curvature of the plano convex lens and the wavelength of the sodium light by measuring the diameter of Newton's rings.
- We can use a spectrometer to measure this angle of deviation.
- To measure the modulus of elastic material by torsional pendulum and bending of a beam.
- To determine the resistivity of a given steel and brass wire.
- To find the velocity of ultrasonic waves in a liquid.
- Less viscosity of the liquid by poiseuille's method.

LIST OF EXPERIMENTS (Any Ten)

1) Non-Uniform Bending - Determination of Young's modulus of the given scale or beam.
2) Newton's rings- Determination of Radius of curvature of the given Plano convex lens.
3) Viscosity –Determination of co-efficient of Viscosity of a highly viscous liquid by Stoke's method.
4) Spectrometer – Dispersive power of a given prism.
5) Torsional Pendulum – Determination of Moment of Inertia of the metallic disc and
6) Rigidity Modulus of the material of a wire.
7) Field along the axis of a coil- Determination of horizontal earth magnetic flux density.
8) Air wedge – Determination of thickness of a given thin wire and paper.
9) Viscosity - Determination of co-efficient of Viscosity of a less viscous liquid by Capillary flow method
10) Uniform bending- Determination of Young's modulus of the given scale or beam.
11) Spectrometer – Determination of wavelength of the prominent spectral lines using Grating.
12) Semiconductor diode laser – Determination of wavelength of Laser source using Grating.
13) Band gap determination of a Semiconductor.

COURSE OUTCOMES

This course

1) To determine resistivity of a given steel and brass wire.
2) To find the velocity of ultrasonic waves in a liquid.
3) To measure the thickness of a thin materials.
4) To determine the band gap of a given semiconductor.
5) Diffraction patterns can be formed by light passing through a series of fine lines
6) Applications of opto electronic devices

00BP207	APPLIED CHEMISTRY LABORATORY	L	T	P
		0	0	3

COURSE OBJECTIVES

- To appreciate the practical significance of acidimetry, alkalimetry and permanganometry
- To analyse quantitatively the amount of a substance present in a given sample.
- To assess the composition of an alloy
- To test the water quality standards.

LIST OF EXPERIMENTS

1) Estimation of Potassium hydroxide
2) Estimation of Acetic acid in vinegar
3) Estimation of Temporary hardness of water sample
4) Estimation of Total hardness of water sample
5) Estimate separate amount of sodium carbonate and sodium hydroxide in a mixture .
6) Estimation of Ferrous sulphate
7) Estimation of Mohr's salt
8) Estimation of ferrous iron
9) Estimation of Oxalic acid
10) Determination of available free chlorine in a water sample.
11) Estimation of copper in brass by iodometry
12) Estimation of iron by dichrometry
13) Estimation of nickel in an alloy

COURSE OUTCOMES

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

1) Gain knowledge in the quantitative chemical analysis of water quality related parameters, acid-base, red-ox and iodometry titrations.

00SP 208	ENGINEERING GRAPHICS	L	T	P
		2	0	3

COURSE OBJECTIVES

- To develop the ability to produce simple engineering drawing and sketches based on current practice.
- To develop the means for communication of ideas, thoughts and design of objects, related to engineering applications, to others though drawing.
- To develop the skills to read manufacturing and construction drawings used in industry.
- To develop a working knowledge of the layout of plant and equipment.
- To develop skills in abstracting information from calculation sheets and schematic diagrams to produce working drawings for manufacturers, installers and fabricators.
- To expose the international standards of technical drawing

Unit–I

Introduction to Engineering Drawing, Use of drafting instruments– Lettering and dimensioning. Construction of conic sections -Ellipse, Parabola & Hyperbola (Eccentricity Method, Rectangle method, Intersecting arcs method) - Special curves- Simple cycloids and involutes– Tangent and normal at points on the curves only.

Unit–II

Orthographic projections - Projections of Points- Projections of Straight lines (given the projections, to determine the true length and true inclinations).

Unit–III

Projections of Solids like prism, pyramid, cylinder, cone, tetrahedron and octahedron in simple positions.

Auxiliary Projections of prism, pyramid, cylinder, cone when the axis is inclined to one plane only.

Unit–IV

Sections of prism, pyramid, cylinder, cone in simple position – true shape of sections. Intersection of surfaces - cylinder to cylinder and cylinder to cone with axis intersecting at right angles. Development of lateral surfaces of prism, pyramid, cylinder, cone and cut solids.

Unit–V

Isometric Projections of simple solids and combinations. Perspective Projections of simple solids. Conversion of Pictorial view of simple objects into Orthographic views

TEXT BOOKS

1) Bhatt, N.D Engineering Drawing -Charotar Bookstall, Anand – 388001.
2) Venugopal, K Engineering Drawing and graphics – New age international (P) Ltd., Publishers, Chennai.

REFERENCE BOOKS

1) Gopalakrishna, K.R. Engineering Drawing Vol.I and Vol. II – Subhas stores, Avenue Road, Bangalore – 560002.
2) Kumar, M.S Engineering Graphics – DD Publications, Chennai – 6400048.

COURSE OUTCOMES

Upon completion of this course, the students will be able to:

1) Construct, read, and understand the Title and Revision Block
2) Usage of common drafting tools to construct engineering drawings enhances
3) Apply dimensions on engineering drawing.
4) Ability of converting sketches to engineered drawings will increase.
5) Developing cognitive and psychomotor skills, visualize images and their dimensions
6) Develop good communication skills and team work.

DEPARTMENT OF CIVIL AND STRUCTURAL ENGINEERING

VISION

The Department of Civil and Structural Engineering came into existence in the year 1978 with a vision to serve the industry, the profession and the society in general. The prime focus is to bring into limelight the inborn and untapped potential of the student fraternity and prepare them to face challenges of the future with confidence, courage and faith.

MISSION

The ultimate goal of the Department of Civil and Structural Engineering is to provide quality education to prepare nationally competitive students and trend setters for the future generation in the realm of technical education. The student should be able to assimilate the available theories, explore new frontiers to propound new theories which will result in improving the quality of the life of the people. It will also to develop their personality in a healthy way and to provide opportunity to acquire knowledge in state-of-the-art research; and to provide service to the university, engineering profession, and the public through consultancy services.

PROGRAMME EDUCATIONAL OBJECTIVES

The following program educational objectives are consistent with the university, college and department missions.

- To develop the technical and engineering skills of the students and to train them in applying fundamental principles in the domain feeding the needs of global expectations with professional competence.
- To explore the students in the field of Civil and Structural Engineering areas both in theory and practice and tuning the academic programmes periodically to make the students fit for a professional job, a research assignment or self-employment.
- To demonstrate their ability to deal effectively with ethical and professional issues, taking into account the broader societal implications.
- To impart communication, analytical and soft skills for the students towards either placing them in a comfort zone in their profession or a path to pursue graduate education master and doctoral degree.

PROGRAMME OUTCOMES

At the completion of the programme the students should be able to;

1) Rudimentary principles of mathematics, basic engineering sciences and their technology applications in the field of Structural engineering problems.
2) Inculcate the analysis and design of concrete and steel structural multistoryed structures, bridge structures, special structures, structural joints etc., under extreme wind and seismic conditions using relevant codal standards.
3) Analyze and to identify the various advancements in Structural engineering materials utilized in the construction industry and its technical knowhow. Also create special concretes with the different waste materials using recycling concept and to reduce the environment pollutions, implementation of suitable

and proper water supply and sanitary systems for the betterment of society and to promote Clean India Movement.

4) Know the advancement in the Engineering measurements using remote sensing techniques to map or survey any inaccessible locations. Also suggest and implement different types of transport systems as per the needs of the society.
5) Understand the fluids characteristics in hydraulic engineering and to know hydraulic machineries performances in industrial design.
6) Assess the soil conditions and their properties for different types of foundations and to carry out relevant sub-structure design.
7) Estimate and to carry out cost analysis of structures with standard format. Also to impart various construction techniques such as PERT/CPM and to manage the construction projects using optimum resources utilization concept.
8) Demonstrate and to conduct different experiments for checking the property and quality of materials, carryout analysis and design of structures using softwares, and exposure in taking up student dissertation works.
9) Gain exposure on curricular, extracurricular activities, different social activities of professionally and ethically responsibility and to apply ethical reasoning to society in case of emergency.
10) Gain knowledge latest and advanced topics in structural engineering like different concreting techniques, selection of concrete, methods of concrete and repair and rehabilitation methodologies and applications for the present and future scenario in the construction of structures.

Mapping PO with PEO				
POs	**PEO1**	**PEO2**	**PEO3**	**PEO4**
PO1	✓			
PO2	✓	✓	✓	✓
PO3	✓	✓	✓	
PO4	✓			✓
PO5	✓		✓	
PO6	✓	✓	✓	
PO7	✓		✓	✓
PO8		✓		
PO9			✓	
PO10				✓

(PE) PROFESSIONAL ELECTIVES

1) Environmental Engineering
2) Transportation Engineering
3) Architecture
4) Engineering Geology
5) Irrigation & Water Power Engineering
6) Structural Concrete Design –III
7) Estimation and Valuation
8) Advances in Concrete Technology
9) Scaffolding and Form work Design in Construction

10) Design of Load Bearing masonry
11) Renewal Energy Engineering
12) Water Supply Engineering
13) Engineering Thermodynamics
14) Composites for Construction
15) Bridge Engineering
16) Earthquake Engineering
17) Advanced Structural Analysis and Experimental Techniques
18) Structural Concrete Design –IV

(PE LAB) PROFESSIONAL ELECTIVE LABORATORIES

1) Fluid Mechanics and Machines Lab
2) Transportation Engineering Lab
3) Computer Practical IV

(OE) OPEN ELECTIVES

1) Finite Element Methods
2) Tall Buildings
3) Construction Techniques and Management
4) Rehabilitation of Concrete Structures
5) Ground Improvement Techniques
6) Introduction to Soil Dynamics and Machine Foundation
7) Artificial Intelligence
8) Theory of Elasticity and Plasticity
9) Contract Laws and Regulations
10) Design of Plates and Shells
11) Economics and Finance for Civil Engineers
12) Services in High Rise Building
13) Disaster Resistant Design of Structures
14) Waste Water Engineering
15) Solid Waste Management
16) Smart Materials and Smart Structures
17) Remote Sensing & GIS
18) Urban & Rural Planning
19) Digital Signal Processing
20) Computer Network
21) Biology for Engineers
22) Disaster Management
23) Entrepreneurship
24) National Service Scheme
25) Human Rights

THIRD SEMESTER

01HS301	ENVIRONMENTAL STUDIES	L	T	P
		4	0	0

COURSE OBJECTIVES

- To make the students conversant with basic principles of natural resources, forest resources, ecosystem and bio-diversity.
- To get knowledge about pollution and its control.

Unit–I

Introduction - Multidisciplinary nature of environmental studies - Definition, scope and importance - Need for public awareness.

Natural resources - Forest resources: use and over-exploitation, deforestation, case studies. Timber extraction, mining, dams and their effects on forest and tribal people. Water resources: Use and over-utilization of surface and ground water, floods, drought, conflicts over water, dams-benefits and problems. 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, fertilizer-pesticide problems, Energy resources: Growing energy needs, renewable and non-renewable energy sources, use of alternate energy sources. Land resources: Land as a resource, land degradation, man induced landslides, soil erosion and desertification - Role of an individual in conservation of natural resources- Equitable use of resources for sustainable lifestyles.

Unit–II

Concept of an ecosystem - Structure and function of an ecosystem - Producers, consumers and decomposers - Energy flow in the ecosystem - Ecological succession - Food chains, food webs and ecological - pyramids - Introduction, types, characteristic features, structure and function of the following ecosystem - Forest ecosystem, Grassland ecosystem, Desert ecosystem, Aquatic ecosystems (ponds, streams, lakes, rivers, oceans, estuaries)

Unit–III

Introduction – Definition: genetic, species and ecosystem diversity - Bio geographical classification of India - Value of biodiversity : consumptive use, productive use, social, ethical, aesthetic and option values - Biodiversity at global, National and local levels - India as a mega-diversity nation - Hot-spots of biodiversity - Threats to biodiversity: habitat loss, poaching of wildlife, man-wildlife conflicts - Endangered and endemic species of India - Conservation of biodiversity: In-situ and Ex-situ conservation of biodiversity.

Unit– IV

Definition - Cause, effects and control measures of Air pollution - Water pollution - Soil pollution - Marine pollution- Noise pollution - Thermal pollution - Nuclear hazards- Solid waste Management: Causes, effects and control measures of urban and industrial wastes - Role of an individual in prevention of pollution -

Disaster management : floods, earthquake, cyclone and landslides. Sustainable development - Urban problems related to energy - 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, global warming, acid rain, ozone layer depletion, nuclear accidents and holocaust.

Wasteland reclamation - Consumerism and waste products - Environment Protection Act - Air (Prevention and Control of Pollution) Act - Water (Prevention and control of Pollution) Act - Wildlife Protection Act - Forest Conservation Act - Issues involved in enforcement of environmental legislation.

Unit–V

Population growth, variation among nations - Population explosion – Family Welfare Programme - Environment and human health - Human Rights - Value Education - HIV/AIDS - Women and Child Welfare - Role of Information Technology in Environment and human health -Case Studies.

TEXT BOOKS

1) Agarwal, K.C. 2001 *Environmental Biology*, Nidi Publ. Ltd. Bikaner.
2) Bharucha Erach, *The Biodiversity of India*, Mapin Publishing Pvt. Ltd., Ahmedabad – 380 013, *India, Email:mapin@icenet.net* (R)

REFERENCE BOOKS

1) Brunner R.C., 1989, *Hazardous Waste Incineration*, McGraw Hill Inc. 480p
2) Clark R.S., *Marine Pollution*, Clanderson Press Oxford
3) Cunningham, W.P. Cooper, T.H. Gorhani, E & Hepworth, M.T. 2001, *Environmental Encyclopaedia*, Jaico Publ. House, Mumbai, 1196p
4) De A.K., *Environmental Chemistry*, Wiley Eastern Ltd.
5) *Down to Earth*, Centre for Science and Environment
6) Gleick, H.P. 1993. *Water in crisis*, Pacific Institute for Studies in Dev., Environment & Security. Stockholm Env. Institute Oxford Univ. Press. 473p
7) Hawkins R.E., *Encyclopaedia of Indian Natural History*, Bombay Natural History Society, Bombay
8) Heywood, V.H & Waston, R.T. 1995. *Global Biodiversity Assessment*. Cambridge Univ. Press 1140p.
9) Jadhav, H & Bhosale, V.M. 1995. *Environmental Protection and Laws*. Himalaya Pub. House, Delhi 284 p.
10) Mckinney, M.L. & School, R.M. 1996. *Environmental Science systems & Solutions*, Web enhanced edition. 639p.
11) Mhaskar A.K., *Matter Hazardous*, Techno-Science Publication
12) Miller T.G. Jr. *Environmental Science*, Wadsworth Publishing Co.
13) Odum, E.P. 1971. *Fundamentals of Ecology*. W.B. Saunders Co. USA, 574p
14) Rao M N. & Datta, A.K. 1987. *Waste Water treatment*. Oxford & IBH Publ. Co. Pvt. Ltd. 345p.
15) Sharma B.K., 2001. *Environmental Chemistry*. Geol Publ. House, Meerut
16) Survey of the Environment, The Hindu (M)

17) Townsend C., Harper J, and Michael Begon, *Essentials of Ecology*, Blackwell Science
18) Trivedi R.K., Handbook of Environmental Laws, Rules Guidelines, Compliances and Stadards, Vol I and II, Enviro Media (R)
19) Trivedi R. K. and P.K. Goel, *Introduction to air pollution*, Techno-Science Publication
20) Wanger K.D., 1998 *Environmental Management*. W.B. Saunders Co. Philadelphia, USA 499p.

Note: (M) Magazine

COURSE OUTCOMES

Students can able

1) To conversant with basic principles of natural resources, forest resources, ecosystem and bio-diversity.
2) To identify the causes of pollution and its control measures.
3) To get the awareness of human rights and human health in the society.

MAPPING WITH PROGRAMME OUTCOMES										
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	✓		✓		✓				✓	
CO2	✓		✓						✓	
CO3	✓		✓						✓	

00BS302	ENGINEERING MATHEMATICS – III	L	T	P
		4	1	0

COURSE OBJECTIVES

- The students will be trained on the basics of chosen topics of mathematics, namely, Partial Differential equations, Fourier series, Boundary value problems, Fourier transform and Z-transform.

Unit–I

Formation of partial differential equations by eliminating arbitrary constants and arbitrary functions - Solution of standard type of first order partial differential equations - Lagrange's linear equation - Linear partial differential equations of second order with constant coefficients.

Unit–II

Dirichle'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.

Unit–III

Solutions of one dimensional wave equation – One dimensional heat equation (without derivation) – Fourier series solutions in Cartesian co-ordinates.

Unit–IV

Fourier integral theorem (without proof) – Fourier transform pair – Sine and Cosine transforms – Properties – Transforms of simple functions – Convolution theorem - Parseval's identity

Unit–V

Z–Transform – Elementary properties – Inverse Z–Transform – Convolution theorem – Solution of difference equations using Z–Transform.

TEXT BOOKS

1) Kandasamy.P, Tilagavathy.K and Gunavathy.K, *Engineering Mathematics*, 6th Edition., (Vol-I & II) S.Chand & Co Ltd., New Delhi, 2006.
2) Venkataraman.M.K. *Engineering Mathematics* - The National Publishing Co., Chennai, 2003.

REFERENCE BOOKS

1) Veerarajan.T, *Engineering Mathematics*, 3rd Edition, Tata McGraw Hill Publication Co. Ltd. New Delhi 2005.
2) Singaravelu.A, *Engineering Mathematics*, Meenakshi Publications, Chennai, 2004.

COURSE OUTCOMES

At the completion of the course students will be able to

1) Do most common partial differential equations, Fourier series, Fourier transform and Z-transform and some methods of solving them.
2) Solve some boundary value problems.
3) Apply the concepts to the engineering problems.

MAPPING WITH PROGRAMME OUTCOMES										
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	✓	✓								
CO2	✓	✓								
CO3	✓	✓								

02ES303	ENGINEERING MECHANICS	L	T	P
		4	0	0

COURSE OBJECTIVES

- To introduce the fundamentals of forces and their effects with their governing laws.
- To understand the definitions of particle, body forces and their equilibrium conditions.
- To understand and predict the forces and its related motions.

Unit–I

Introduction - Units and Dimensions - Laws of Mechanics - Lami's Theorem - Parallelogram, Triangular and Polygon Law of Forces - Classification of Forces - Vectorial Representation of Forces - Coplanar Forces - Resolution of Forces.

Equilibrium of Particle - Vector representation of Space Force - Equilibrium of Particle in Space - Equivalent System of Forces - Principle of Transmissibility.

Unit–II

Free Body Diagram - Types of Supports - Types of loads - Types of beams - Action and Reaction of Forces - Moments and Couples - Moment of a Force - Vectorial Representation of Moments and Couples.

Varignon's Theorem - Stable Equilibrium - Single Equivalent Force - Equilibrium of Rigid Bodies in Two Dimensions and Three Dimensions.

Unit–III

Centroid and Centre of Gravity - Determination of Centroid of Sections of Different Geometry - Centre of Gravity of a Body - Area Moment of Inertia – Parallel Axis Theorem - Perpendicular Axis Theorem - Determination of Moment of Inertia of Rectangular, Triangular, Circular and Semi-circular areas from the first principle- Moment of Inertia of structural Steel Sections of Standard Flanged and Composite Sections.

Polar Moment of Inertia - Radius of Gyration - Principal Moment of Inertia - Mass Moment of Inertia - Determination of Mass Moment of Inertia of a Rod, Thin Rectangular Plate, Thin Circular Disc, Solid Prism, Cylinder, Sphere and Cone from the first principles.

Unit–IV

Introduction - Kinematics and Kinetics - Displacements, Velocity and Acceleration - Equations of Motion - Types of Motion-Rectilinear Motion - Relative Motion - Curvilinear Motion - Projectiles.

Newton's Laws of Motion - Linear Momentum - Impulse and Momentum - D'Alembert's Principle - Dynamic Equilibrium - Work Energy Equations - Law of Conservation of Energy - Principle of Work and Energy.

Unit–V

Friction Force - Laws of Sliding Friction - Equilibrium Analysis of simple systems with Sliding Friction - Wedge Friction.

Rolling Resistance- Translation and Rotation of Rigid Bodies - Velocity and Acceleration - General Plane Motion of Simple Rigid Bodies such as Cylinder, Disc/Wheel and Sphere.

TEXT BOOKS

1) Beer F.P and Johnson R, *Vector Mechanics for Engineers (Statics)*, McGraw- Hill Book Company, New Delhi, 2004.
2) Palanichamy M.S and Nagan, S, *Engineering Mechanics (Statics and Dynamics)*, Tata McGraw Hill Publishing Company, Ltd., New Delhi, 2010.

REFERENCE BOOKS

1) Bansal.R.K, *Engineering Mechanics*, Laxmi Publications, New Delhi, 2007.
2) Bhavikatti.S.S. and Rajasekarappa K.G.,*Engineering Mechanics,* New Agent International (P) Ltd, New Delhi, 1999.
3) Sadhu Sing,*Engineering Mechanics,* Oxford & IBH Publishing Co., New Delhi, 2000.
4) Irving H. Shames,*Engineering Mechanics,* Prentice Hall of India Ltd., New Delhi, 2006.

5) Hibbeller, R.C and Ashok Gupta, *Engineering Mechanics: Statics and Dynamics,* Edition, Pearson Education, Chennai, 2010.

6) Natesan S.C, *Engineering Mechanics (Statics and Dynamics),* First Edition, Umesh Publications, New Delhi,2002.

COURSE OUTCOMES

Students can able

1) To explain the forces and its related laws of mechanics in static and dynamic conditions.
2) To analyse the forces and its motions on particles, rigid bodies and structures.
3) To solve the moment of inertia of any sections and masses for the structural members.

MAPPING WITH PROGRAMME OUTCOMES										
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**
CO1	✓	✓		✓	✓	✓				
CO2	✓	✓		✓		✓				
CO3	✓	✓				✓				

01ES304	**CONSTRUCTION ENGINEERING**	**L**	**T**	**P**
		4	**0**	**0**

COURSE OBJECTIVES

- To expose the students to construction practice through an understanding of different types of construction materials and their properties.
- To understand the techniques of construction, different finishing works and remedial practices for distressed structures.
- To impart knowledge of modern construction materials and equipments.

Unit–I

Stones (Dressed) – Bricks – Cement – Steel – Sand and Quarry Dust – Timber – FRP (Fibre Reinforced Polymer) – Composite materials – Physical and Chemical Properties – Manufacturing Process – Classification – Test on materials – IS Standards and Specifications for use in construction as per SP 21: 1983

Unit–II

Introduction – Types of Soils – Classification of soils as per IS standards – Cohesion and Adhesion of soil – Bearing Capacity of soil – Methods of Assessing Bearing Capacity of Soils – Types of Foundations – Shallow Foundations – Deep Foundations – Special type of Foundations for Shore and Offshore Structures – Foundations with Rock Anchors.

Unit–III

Introduction – Masonry – Types of Masonry – Reinforced Cement Concrete (RCC) works like Footings, Columns, Plinth Beams, Lintels, Sill slab, Sunshades, Roof Beams and Roof Slabs – Fabrication of Steel, Bar Bending as per IS Standards (SP 34: 1987), Cover Blocks, Placing of Bars in Form Work – Types of Roofing

Systems – Types of Stairs – Types of Doors, Windows and Ventilators – Methods of Termite Proofing – Methods of Damp proofing.

Unit–IV

Types of Floor finishes - Mud Flooring, Cement flooring, Ceramic Tile Flooring, Marble and Granite Flooring, Wooden Flooring, Flooring with Puffed Panels – Plastering (Interior and Exterior) – Pointing for Walls and Floors using Grouts – White Washing, Colour Washing with different Colour Shades available in the Markets – Painting – Types of Painting for Interior and Exterior application. Form Work (Shuttering or Scaffolding) - Types of Form Work – Use of Shoring and Underpinning.

Unit–V

Introduction – Glass – Ceramics – PVC – UPVC – Refractory – Aluminium – Lightweight Concrete Blocks – Poly Carbonate Sheets – Insulated Puffed Sheets – Sealant Joints – Uses in construction.

Cracks in Buildings – Causes – Methods of Repairs– Equipments used for Repair works.

TEXT BOOKS

1) Punmia.B.C, *Construction Engineering*, Laxmi Publishers Private Limited, New Delhi, 1993.
2) Arora S.P. & Bindra S.P, *A Text Book of Building Construction*, Dhanpat Rai & Sons, New Delhi, 2010.

REFERENCE BOOKS

1) Rangwala.S.C, *Building Construction*, Charotar Publishing House Pvt. Ltd,Gujarat, 2009.
2) Sharma and Kaul, *Building Construction*, S.Chand & Company, New Delhi, 1987.
3) Rajput.R.K, *Engineering Materials*, S.Chand & Company, New Delhi. 2008.

STANDARDS:

1) SP 21: 1983 Handbook on Summaries of Indian Standards for Building Materials, Bureau of Indian Standards, New Delhi.
2) SP 34: 1987, Handbook on Concrete Reinforcement and Detailing, Bureau of Indian Standards, New Delhi.

COURSE OUTCOMES

At the completion of the course students will be able to

1) Compare the properties of most common and advanced building materials.
2) Understand the typical and potential applications of these materials.
3) Acquire knowledge of testing of construction materials and their strength requirements.
4) Recognize the functions of different building components.
5) Understand the usage of modern building materials and construction equipments.
6) Apply techniques to repair buildings.

MAPPING WITH PROGRAMME OUTCOMES										
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	✓		✓					✓		
CO2	✓		✓							
CO3	✓		✓					✓		
CO4	✓		✓							
CO5	✓		✓							✓
CO6	✓		✓							✓

02PC305	CONCRETE TECHNOLOGY	L	T	P
		4	0	0

COURSE OBJECTIVES

- To develop systematic knowledge about the nature and basic properties of the ingredients of concrete.
- To familiarizes the testing procedures for properties of fresh and hardened concrete.
- To introduce fundamentals and principles of mix design.

UNIT– I

Portland cement– Definition –History–Composition–Hydration of Portland cement – Stiffening and Hardening of cement paste–Specification as per IS269-1989Code– Types of Portland cement–Physical and Chemical Properties of cement – Testing of cement

UNIT– II

Aggregates– Natural and Mineral aggregates– Characteristics of aggregates and their significance–Testing of aggregates properties as per IS:2386 (I to VIII)- 1963– comparison of properties with IS:383-1970.Importance of aggregates properties in concrete –Water–Testing–Specifications.

UNIT– III

Concrete ingredients – Manufacturing process –Storing - Batching – Mixing – Transporting – Placing – Finishing – Curing- Properties of fresh concrete – Workability measurements - Testing methods – Segregation- Bleeding - Slump loss – Concrete at early age – Setting time – Concrete admixture and its types.

UNIT– IV

Hardened concrete- Mechanical Properties and their significance- Testing methods as per IS: 516-1959–Compressive strength of concrete and its influencing factors –Short term and long term properties - Drying shrinkage – Creep – Modulus of elasticity – Resistance to dimensional changes - Resistance to weather– Resistance to chemical attack - Durability of concrete.

UNIT– V

Objectives of mix design –Concept of concrete mix proportioning- Methods of mix proportioning as per IS: 10262-2009 and ACI Committee 211.1.91 method – Fly ash based concrete mix design – Effect of replacement materials for binder and filler in mix design-sustainable concrete.

TEXT BOOKS

1) Mehta P.K., and Montero,P.J.M., Concrete, Microstructure, Properties and Materials, Indian Concrete Institute, Chennai, 1997.
2) Shetty M.S., Concrete Technology, S.Chand & Co., New Delhi, 2002.

REFERENCE BOOKS

1) Neville A.M., *Properties of Concrete*, Pitman Publishing Limited, London, 2011.
2) Gambhir M.L., *Concrete Technology*, McGraw Hill Education Pvt. Ltd., New Delhi, 2013.
3) Neville A.M., and Brooks J.J., *Concrete Technology*, Pearson Education, Indian reprint, Chennai, 2002.

STANDARDS:

1) IS 269: 1989 Specification for Ordinary Portland cement, 33 grade (fourth revision), Bureau of Indian Standards, New Delhi.
2) IS 383: 1970, Specification for Coarse and Fine Aggregate from Natural Sources for Concrete, Bureau of Indian Standards, New Delhi.
3) IS516: 1959,Method of Test for Strength of Concrete (with Amendment No.2),Bureau of Indian Standards, New Delhi.
4) IS 2386 (Part I to VIII):1963, Method of Test for Aggregate for Concrete, Bureau of Indian Standards, New Delhi
5) IS 4031(Part I to X): 1988, Method of Physical Tests for Hydraulic cement, Bureau of Indian Standards, New Delhi.
6) IS 10262: 2009, Recommended Guidelines for Concrete Mix Design, Bureau of Indian Standards, New Delhi.
7) IS 8112 (re-affirmed in 2000), Specification for 43 grade Ordinary Portland cement, Bureau of Indian Standards, New Delhi.
8) IS 12269-1987, Specification for 53 grade Ordinary Portland cement (with Amendment No. 3) Bureau of Indian Standards, New Delhi.
9) SP 23:1982 Hand book on Concrete Mixes, Bureau of Indian Standards, New Delhi.
10) ACI Committee 211.1-91 Standard Practice for Selecting Proportions for Normal, Heavy weight and Mass Concrete, American Concrete Institute, Farmington Hill, Michigan, USA,2002

COURSE OUTCOMES

At the completion of the course, students will be able to

1) Compare the properties of most common and advanced building materials.
2) Understand the typical and potential applications of these materials.
3) Acquire knowledge of testing of construction materials and their strength requirements.

4) Recognize the functions of different building components.
5) Understand the usage of modern building materials and construction equipments.
6) Apply techniques to repair the buildings.

MAPPING WITH PROGRAMME OUTCOMES										
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**
CO1	✓	✓						✓		
CO2	✓	✓								
CO3	✓	✓						✓		
CO4	✓	✓								
CO5	✓	✓								✓
CO6	✓	✓								✓

01PC306	**MECHANICS OF FLUIDS**	**L**	**T**	**P**
		4	**0**	**0**

COURSE OBJECTIVES

- To introduce the mechanics of fluids through a thorough understanding of the properties of the fluids, behavior of fluids under static conditions.
- To learn dynamics of fluids through control volume approach this gives an integrated understanding of the transport of mass, momentum and energy.
- To expose to boundary layer theory.
- To understand the applications of the conservation laws to (a) flow measurements and (b) flow through pipes (both laminar and turbulent).

Unit–I

Properties of fluids – Mass density, specific weight, specific volume, specific gravity, viscosity, vapour pressure, compressibility and elasticity, surface tension and capillarity

Fluid pressure – variation of pressure in a fluid - Pascal's law – atmospheric, absolute, gage and vacuum pressures – measurement of pressure – manometers and mechanical gages

Unit–II

Total pressure and centre of pressure – total pressure on horizontal, vertical and inclined plane surfaces – total pressure on curved surface

Buoyancy and centre of buoyancy – metacentric height – stability of submerged and floating bodies – experimental and analytical methods of determination of metacentric height

Unit–III

Fluid flow fundamentals – velocity of fluid particles – types of fluid flow – types of flow pattern – continuity equation in differential form in Cartesian coordinates – acceleration of a fluid particle rotational and irrotational motion – circulation and vorticity – velocity potential and stream function – streamline, equipotential line and flownet – use and limitations of flow net

Euler's equation of motion in differential form – Bernoulli's equation derived from integration of Euler's equation of motion – applications of Bernoulli's equation - Venturimeter, orificemeter and flow nozzle.

UNIT–IV

Flow measurement: orifices and mouthpieces – classification – determination of C_c, C_v and C_d – submerged orifices – time of emptying a tank – flow of liquid from one vessel to the other

Notches and weirs – classification – flow over a rectangular sharp-crested weir and notch – calibration – ventilation of weirs – flow over a V – notch, trapezoidal notch – broad-crested weirs – submerged weirs – spillways

Other flow measurement devices – rotameter – elbowmeter and pitot tube

Unit–V

Flow through pipes – Reynolds experiment – Darcy-Weisbach equation for head loss due to friction – minor energy losses – HGL and TEL – pipes in series – pipes in parallel – equivalent pipe – branched pipes – siphon – transmission of power through pipes – flow through nozzle – water hammer in pipes

Laminar flow in pipes – Hagen-Poiseuille equation – turbulent flow in pipes – shear stresses – hydrodynamically smooth and rough boundaries – velocity distribution for turbulent flow in pipes.

TEXT BOOKS

1) Modi, P. N., and Seth, S. M., Hydraulics, Fluid Mechanics and Hydraulic Machines, Standard Book Home, New Delhi, 2005.
2) Rajput, R. K., Text Book of Fluid Mechanics and Hydraulic Machinery, S. Chand & Company, Ltd., New Delhi, 2005.

REFERENCE BOOKS

1) Douglas, J. F., Gasiorek, J. M and Swaffield, J. A., Fluid Mechanics 4th Edn. Pearson Education India, 2002.
2) Das M. M, Fluid Mechanics and Turbimachines , Prentice Hall of India (P) Ltd New Delhi, 2008.
3) Arora, K. R, Fluid Mechanics, Hydraulic and Hydraulic Machines, Standard Publishers and Distributors , New Delhi , 2005

COURSE OUTCOMES

At the end of the course students will be able to

1) Understand properties of fluids and acquire knowledge of fluids in static, kinematic and dynamic equilibrium.
2) Identify type of flow and carry out flow measurements.
3) Apply physical laws in addressing hydraulic problems.
4) Analyse flow through pipes and carryout measurement.
5) Understand the impact of engineering solutions for boundary layer theory in the context of submerged bodies.

MAPPING WITH PROGRAMME OUTCOMES										
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	✓				✓			✓		
CO2	✓				✓			✓		
CO3	✓				✓			✓		
CO4	✓				✓	✓		✓		
CO5	✓				✓	✓				✓

02SP307	COMPUTER PRACTICAL I (BUILDING DRAWINGS)	L	T	P
		0	0	3

COURSE OBJECTIVES

- To train the students in developing skills in drawings and detailing of the Building components using AUTOCAD and also develop the skills of using MS office Excel for estimating and costing the Buildings.

LIST OF EXERCISES

Plate 1. Symbols used in Civil Engineering drawings.

Plate 2. Doors, Windows and Ventilators (wooden, glazed and aluminium).

Plate 3. Comprehensive Planning and Drawings of Residential building Layout, plan, elevation & sectional elevation based on the NBC standards

Single Room RCC roof building

Double Room RCC roof building

Bungalow/duplex building with sloped tiled Roof

2BHK types Residential building

Two storied Residential building

Plate 4. Preparation of Layout plan of different types of commercial building Projects.

School building,

Office building (Bank, Government office, IT park)

Hospital building, and

Shopping Mall

Plate 5. Draw the Residential building Layout, plan, elevation & sectional view with all specification and standards of municipal guidelines (Local Bylaws).

MS Office – EXCEL

Exercise 1. Practicing of MS office Excel worksheet – file creation – formulas – chart preparation – pivot table

Exercise 2. Preparation of building Estimation of the practiced drawing

REFERENCE BOOKS

1) Verma B.P, Civil Engineering Drawing and housing Planning, Khanna Publishers,
2) New Delhi 1992.
3) Balagopal T.S. Prabhu, Building drawing and detailing, Spades Publishers, Calicut, 1987.
4) National Building Code of India, Bureau of Indian Standards, New Delhi, 2005.
5) Shah & Kale, Building Drawing, Tata McGraw Hill, New Delhi, 2002.
6) MSOffice Manual

COURSE OUTCOMES

At the completion of the course students will be able

1) To model the building for practical application.
2) To gain experience/ practice on Modern Software in civil engineering field.
3) To understand the design and development of estimation of Building models.

MAPPING WITH PROGRAMME OUTCOMES										
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**
CO1	✓							✓		
CO2	✓						✓	✓		
CO3	✓						✓	✓		

02CP308	**CONSTRUCTION ENGINEERING LABORATORY**	**L**	**T**	**P**
		0	**0**	**3**

COURSE OBJECTIVES

- To train the students in standard testing procedures for different compositions of building materials and provides them an opportunity to design a concrete mix.

LIST OF EXPERIMENTS:

1) Standard Tests on Cement as per IS Standards
2) Standard test on fine and coarse aggregates as per IS Standards
3) Workability tests on Fresh Concrete
4) Tests on Hardened Concrete, Bricks and Tiles as per IS Standards
5) Concrete Mix design as per IS 10262: 2009
6) Study on Reinforcement Detailing for different Structural Components as per SP34: 1987.

REFERENCE BOOKS

1) Mehta P.K.,and Montero, P.J.M., *Concrete, Microstructure, Properties and Materials*, Indian Concrete Institute, Chennai, 1997.
2) Shetty M.S., *Concrete Technology*, S. Chand & Co., New Delhi, 2002.
3) Neville A.M., *Properties of Concrete*, Pitman Publishing Limited, London, 2011.
4) Gambhir M.L., *Concrete Technology*, Tata McGraw Hill Co., New Delhi,2004.
5) Neville A.M., and Brooks J.J., *Concrete Technology*, Pearson Education, Indian Reprint, Chennai, 2002.

6) IS 269: 1989 Specification for Ordinary Portland cement, 33 grade (fourth revision), Bureau of Indian Standards, New Delhi
7) IS 383: 1970, Specification for Coarse and Fine Aggregate from Natural Sources for Concrete, Bureau of Indian Standards, New Delhi.
8) IS 516: 1959, Method of Test for Strength of Concrete (with Amendment No.2), Bureau of Indian Standards, New Delhi
9) IS 2386 (Part I to VIII) :1963, Method of Test for Aggregate for Concrete, Bureau of Indian Standards, New Delhi
10) IS 4031(Part I to X): 1988, Method of Physical Tests for Hydraulic cement, Bureau of Indian Standards, New Delhi
11) IS 8112-1989 (re-affirmed in 2000), Specification for 43 grade Ordinary Portland cement, Bureau of Indian Standards, New Delhi.
12) IS 10262: 2009, Recommended Guidelines for Concrete Mix Design, Bureau of Indian Standards, New Delhi.
13) IS 12269-1987, Specification for 53 grade Ordinary Portland cement (with Amendment No. 3) Bureau of Indian Standards, New Delhi.
14) SP 23:1982 Hand book on Concrete Mixes, Bureau of Indian Standards, New Delhi.
15) SP 34: 1987, Handbook on Concrete Reinforcement and Detailing, Bureau of Indian Standards, New Delhi

COURSE OUTCOMES

At the completion of the course students will be able

1) Identify the concrete properties
2) To test the workability, durability, creep, shrinkage, temperature effects and etc. on concrete.
3) To determine the strength of hardened concrete, bricks, tiles, coarse aggregates, etc.

MAPPING WITH PROGRAMME OUTCOMES										
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**
CO1	✓		✓					✓		
CO2	✓		✓					✓		
CO3	✓		✓					✓		

FOURTH SEMESTER

00BS401	PRABABILITY, RANDOM PROCESSES AND NUMERICAL METHODS	L	T	P
		4	1	0

COURSE OBJECTIVES

- To be exposed to probability, random processes, and statistical methods designed to contribute to the process of making scientific judgments in the face of uncertainty and variation. To develop the skills of the students in numerical mathematics - using method of finite difference interpolation, finding numerical solution of algebraic and transcendental equations, and finding numerical solution of ordinary and partial differential equations.

UNIT–I

Definition – Types of random variables - Probability distribution function - Probability density function – Expectation and moments – Moment generating functions – Joint probability distribution - Marginal probability distribution function – Joint probability density function – Marginal probability density function – Conditional probability density function.

UNIT–II

Classification of random processes – Methods of description of a random process – Special classes of random processes – Average values of random process - Stationarity –Autocorrelation function and its properties - Cross correlation function and its properties.

UNIT–III

Hypothesis, testing – Large sampling tests – Small sampling test based on t, F and chi-square distributions – Interval estimates of mean, standard deviation and proportion.

UNIT–IV

Interpolation: Gregory Newton forward and backward interpolation formula; Stirling's central difference formula; Lagrange's interpolation formula for unequal interval.

Numerical differentiation: Using Newton's forward and backward interpolation formula. *Numerical integration*: Trapezoidal rule, Simpson's one-third and three-eight rules

UNIT–V

Solution of algebraic and transcendental equations: Bolzano's bisection method, Regula-falsi method, Newton–Raphson method.

Solution of simultaneous algebraic equation: Gauss elimination method, Crout's method, Gauss – Seidel iteration method.

Solution of ordinary differential equations: Taylor series method, Runge–Kutta fourth order method, Milne's - Predictor corrector method.

TEXT BOOKS

1) Kandasamy P, Thilagavathy.K, and Gunavathy.K, *Probability and random processes*, S.Chand & Co. Ltd, New Delhi 2010.

2) Veerarajan T, *Probability theory and Random Process*, Tata McGraw- Hill Co., Ltd. New Delhi 2005.

REFERENCE BOOKS

1) Venkataraman.M.K., Numerical method in science and Engineering, National Publishing Co. Chennai - 2003.
2) Lipschutz.S and Schiller. J, Schaums's outlines –Introduction to probability and statistics Tata McGraw Hill Co. New Delhi, 1998.
3) Kandasamy.P, Thilagavathy.K, and Gunavathy.K, Numerical Methods, S.Chand & Co. Ltd., New Delhi. 2004.

COURSE OUTCOMES

At the completion of the course students will be able to

1) Handling situations involving random variables, random processes and to solve problems for engineers using numerical methods.
2) Apply the concepts in the engineering problems
3) Do numerical integrations and interpolations wherever needs.

MAPPING WITH PROGRAMME OUTCOMES										
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	✓	✓								✓
CO2	✓	✓								✓
CO3	✓	✓								✓

02ES402	SOLID MECHANICS	L	T	P
		4	0	0

COURSE OBJECTIVES

- To understand the concept of stresses and strains and associated deformations of solid bodies due to various loading conditions with the application to bars, beams, columns, etc.
- To understand the concept of determinate structures and their equilibrium conditions.
- To understand the concept in the analysis of plane trusses

Unit–I

Definition of stress- Types of stresses: Direct stress (Tensile and compressive), Bending stress, Shear stress, temperature stress, composite stress, Hoop stress. Strains: Linear strain, lateral strain, volumetric strain, temperature strains- Hook's Law- Modulus of elasticity-Axial rigidity-Flexural rigidity - Torsional rigidity – Poisson's ratio. Stress- Strain diagrams for concrete, timber, mild steel sections, and HYSD (High Yield Strength Deformed) bars. Elastic moduli relationships - simple problems.

Stress at a point- Stress tensor- Equations of Equilibrium - Uni-axial state of stress- Stresses on a plane - Transformation of plane stress - Principal stresses and maximum shear stress – Mohr's Circle for Plane stress

Unit–II

Loads: Gravity and lateral loads, concentrated loads, uniformly distributed loads, Hydro static pressure loads, Soil pressure loads, Temperature loads. Beams: Cantilever beams, simply supported beams, single and double over hanging beams. Support conditions: hinged support, Roller support, guided, fixed or restrained and spring supports - Load and reactions – Bending moment and shear force diagrams – Point of contra flexure- Determinate beams and frames - Additional problems with flexural hinges and elastic supports.

Section Modulus – Neutral axis – Moment of Resistance - Simple Bending Theory (Euler Bernoulli Theory) - Bending stress and strain variations for rectangular sections - Shear stress variations for different cross sections – Problems.

Unit–III

Slope and Deflection of statically determinate beams and frames - Moment area Method - Conjugate Beam Method- Strain energy Method - Double Integration (Macaulay's Method) - Graphical methods. Determinate Beams and frames subjected to different types of loads-additional problems with flexural hinges and elastic supports.

Torsion- Theory of Pure torsion in circular shafts- Variation of shear stress distribution across the solid (Circular), hollow (Circular), and thin walled sections - Saint Venant's torsion - warping torsion- Torque transmitted in circular and hollows shafts - combined bending and torsion.

Springs - stiffness- linear stiffness and rotary stiffness- Types of springs - Helical (Open coiled, Close coiled) and leaf springs uses – Spring in series– Spring in parallel - Load- deformation relationship – springs deflection, stiffness and shear stress - Problems.

Unit–IV

Strain Energy- Strain Energy stored due to axial force- Strain Energy stored due to bending - Strain Energy stored due to shear - Strain Energy stored due to torsion - Strain Energy stored in an elastic body due to suddenly applied loads or impact loads- Proof resilience.

Virtual work method (Unit–load method) Castiglione's Theorems – Tension coefficient method - Application of energy theorems for computing deflections in determinate trusses - Analysis of Plane Trusses - Method of Joints – Method of Sections.

Unit–V

Columns and Struts –Effective length of column- Euler column- Limitations of Euler column- columns with different end conditions– Failure types- Critical load- Euler's formula –Secant formula- Rankine's and Gordan's formula - I.S.Code formula –Beam- column subjected to distributed lateral load – Columns with initial curvature.

Thin Cylindrical and Spherical shells- Internal pressure - Change in volume - Minimum thickness of wall - Thick Cylindrical and Spherical shells – Lame's theory - Compound cylinders - Thick spherical shells.

TEXT BOOKS

1) Bansal R.K, *Strength of Materials*, Lakshmi Publications, Chennaii, 2010.
2) Rajput R.K, *Strength of Materials*, S.Chand& Co., Delhii, 2007.

REFERENCE BOOKS

1) Punmia B.C,et al. *Strength of Materials and Theory of Structures - Vol.I,* Lakshmi Publications, Chennai, 2000.
2) Sadhu Singh, *Strength of Materials,* Khanna Publishers, Delhi, 2013.
3) Ramamrutham S, *Strength of Materials,* DhanpatRai Publishing Company, Delhi, 2011.
4) Gambihir M.L, *Fundamentals of Solid Mechanics*,PHI Learning Pvt.Ltd.,New Delhi, 2009.
5) Timoshenko and Gere, *Mechanics of Materials*, Van NosReinbhold, New Delhi, 1995.
6) Vazirani and Ratwani, *Analysis of Structures Vol.I*, Khanna Publishers, New Delhi, 1995.
7) Bhavikatti S.S, *Solid Mechanics*, Vikas Publishing House Pvt. Ltd., New Delhi, 2010.

COURSE OUTCOMES

At the completion of the course students will be able

1) To explain the concepts of stress and strain in solids.
2) To analyse the shear forces, bending moments and deflections of structural members.
3) To analyse plane trusses and assess the stress resultants of columns and cylinders.

MAPPING WITH PROGRAMME OUTCOMES										
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**
CO1	✓	✓	✓					✓		
CO2	✓	✓	✓					✓		
CO3	✓	✓						✓		

02PC403	**STRUCTURAL STEEL DESIGN I**	**L**	**T**	**P**
		4	**0**	**0**

COURSE OBJECTIVES

- To understand the fundamentals of the design of steel Structures.
- To design simple steel elements and the corresponding fasting systems.

UNIT–I

Limit State Design – Basic for Design – Ductility – Partial safety factors for loads – Partial Safety Factors for Materials – Deflection Limits. Bolted connections – Location details of Fasteners – Bearing and Friction Grip type bolts – Long joints –

Shear capacity – Tension capacity – Bearing Capacity – Bolts subjected to combined shear and tension – Slip resistance – Tension resistance – Prying force and Tension – In plane loading – Design of connections as per IS 800 – 2007 provisions. Welded connections – Butt joint – Lap joint – Size of weld – Throat thickness – Weld symbols – Weld types – Long joints – Weld subjected to combination of normal and shear stress – combination of bearing bending and shear – In plane loading – Out of Plane loading – Design of connections as per IS 800 – 2007 provisions.

UNIT–II

Tension members – Types – Design strength due to yielding of cross section – Rupture of critical section – Plates – Threaded rod single Angles – Other sections – Block shear – Bolted and welded connection of Tension members – Design of Tension members as per IS 800 – 2007 provisions.

UNIT–III

Compression members – Effective lengths – Slenderness ratios – Imperfection factor – Stress reduction factor – Bucking class of cross sections – Design details – Column Bases Angle Struts – Laced Columns – Battened columns – Design of compression members as per IS 800 – 2007 provisions.

UNIT–IV

Beams – Effective span of Beams – Design strength in Bending Torsional Buckling – Effective Length for simply supported beams – Shear – Beams of unsymmetrical sections – Design of beams as per IS 800 – 2007 provisions.

UNIT–V

Welded Plate girders – Components of plate girder – Design of web – Design of flanges – Connections – End bearing stiffness – Intermediate stiffness – Web splices – Flange splices – Design of Welded plate girders as per SP: 6 (2)- 1962 and IS 800 – 2007 provisions.

TEXT BOOKS

1) Subramanian N, *Design of Steel Structures*, Oxford University Press, New Delhi, 2008.
2) Bhavikatti S.S, *Design of Steel Structures*, I.K. International Publishing House Pvt. Ltd., New Delhi, 2012.

REFERENCE BOOKS

1) Duggal S.K, *Limit state Design of Steel Structures*, Tata McGraw Hill Education Private Ltd, New Delhi, 2000.
2) Sairam K.S, *Design of Steel Structures*, Pearson Publications, London 2013.
3) Shiyekar, *Limit state Design of Steel Structures*, Phi Learning Pvt. Ltd, Delhi, 2010.

STANDARDS

1) IS 800: 2007, General Construction in Steel, Bureau of Indian Standards, New Delhi.
2) IS 813: 1986, Scheme of symbols for welding, Bureau of Indian Standards, New Delhi.
3) SP: 6(2):1972, Hand book for Structural Engineers, Bureau of Indian Standards, New Delhi.

COURSE OUTCOMES

At the completion of the course students will be able

1) To understand the different types of Steel sections available in the market.
2) To design the connections and different types of members subjected to various loading conditions.
3) To understand the Codal provisions.

MAPPING WITH PROGRAMME OUTCOMES										
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**
CO1	✓	✓	✓							
CO2	✓	✓	✓							
CO3	✓	✓								✓

02PC404	**STRUCTURAL CONCRETE DESIGN I**	**L**	**T**	**P**
		4	**0**	**0**

COURSE OBJECTIVES

- To introduce the different types of Philosophies related to design of basic RCC structural elements such as slab, beam and column which forms the part of any structural system with reference to Indian Standard Code of Practice.

Unit–I

Objectives of RCC structural design – Structural systems- Structural analysis and Design – Use of Design codes and Hand books – Stress-strain curves of concrete and steel as per IS:456-2000 and ACI 318-14 – Modulus of Elasticity of concrete and steel. Design Philosophies-Working stress method-assumptions-Concept of transformed sections-modular ratio- permissible stresses- Stress block characteristics. Ultimate Load method-assumptions- Stress block characteristics. Limit State method-assumptions- Partial Safety Factors for Materials-Partial Safety Factors for loads- Ultimate limit state – Serviceability limit state - Stress block characteristics. Moment of resistance expressions for balanced, under and over reinforced rectangular sections for rectangular beams using working stress method-Simple problems.

Unit–II

Flexure : Analysis and Design of Singly Reinforced rectangular beams, Flanged beams (T& L beams)-Doubly Reinforced rectangular beams – Limit state method – Roof beams, Cantilever beams - Lintel beams- Plinth beams. Reinforcement detailing as per SP 34: 1987 and IS 13920: 1993.

Unit–III

Shear: Shear stresses distribution in rectangular beams-Shear stresses distribution in flanged beams -Shear stresses distribution in rectangular beams due to torsion - Design shear strength of concrete- Flexural shear-Codal provisions for rectangular and flanged sections- Problems. Bond - Factors affecting bond

resistance. As per IS456:2000- Check for development length- Serviceability limit state– Deflection computations-short term and long term-Check for Crack width.

Design of one and two way slabs - Circular slabs – Cantilever slabs- Dog legged staircase as per IS456:2000 standards-Reinforcement detailing as per SP 34: 1987 and IS 13920: 1993.

Unit–IV

Design of Short and Slender Columns as per IS456:2000 standards – Design of Columns subjected to axial compression and uni-axial bending – Columns subjected to axial compression and biaxial bending – Axial load verses moment Interaction charts as per SP-16-1978- Reinforcement detailing as per SP 34: 1987 and IS 13920: 1993.

Unit–V

Design of Isolated rectangular footings with concentric column loads– Design of Isolated rectangular footings with eccentric column loads - Design of Circular footings with concentric column loads - Design of combined footings- Reinforcement detailing as per SP 34: 1987 and IS 13920: 1993.

TEXT BOOKS

1) Unnikrishna Pillai.S and Devdas Menon, *Reinforced Concrete Design*, Tata McGraw Hill, New Delhi, 1988.
2) Krishnaraju.N, *Advanced R.C.Design*, Tata McGraw Hill, New Delhi1995.

REFERENCE BOOKS

1) Shah.V.L& Karve, *Illustrated R.C. Design*, Structures Publications, Pune, 2010.
2) Mallick.S.K&Gupta.A.P,*Reinforced Concrete*, Oxford I B H, New Delhi, 1987.
3) Ramamrutham.S and Narayan.R, *Design of R.C. Structures*, DhanpatRai & Sons, Delhi, 1993.
4) Punmia.B.C, R.C.Structures - Vol.1 &II, Lakshmi Publications, Chennai 1992

STANDARDS

1) IS 456: 2000, Code of Practice for Plain and Reinforced Concrete, Bureau of Indian Standards, New Delhi
2) IS 13920: 1993, Ductile Detailing of Reinforced Concrete Structures Subjected to Seismic Forces, Bureau of Indian Standards, New Delhi.
3) SP 34: 1987, Handbook on Concrete Reinforcement and Detailing, Bureau of Indian Standards, New Delhi
4) SP 16: 1978, Design Aids to IS456: 1978, Bureau of Indian Standards, New Delhi

COURSE OUTCOMES

At the end of the course students will be able

1) To design the structural elements using various design philosophies.
2) To gain knowledge about the rudimentary principles of designing reinforced concrete structural elements as per the existing codes.
3) To understand the details given in the Codes.

MAPPING WITH PROGRAMME OUTCOMES										
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	✓	✓	✓							
CO2	✓	✓	✓							
CO3	✓	✓								✓

01PC405	APPLIED HYDRAULIC ENGINEERING	L	T	P
		4	0	0

COURSE OBJECTIVES

- To the practical aspects involved in the flow problems through open channels and closed channels like pumps.
- To understand the principles of analysis and evaluation of design parameters are dealt with in this course.

UNIT–I

Types of flow in open channels – geometrical properties of channel sections – velocity distribution in a channel section – Chezy's formula – Manning's formula – Most economical sections of a channel – rectangular, trapezoidal, triangular and circular sections – uniform flow computations – specific energy and critical depth – critical flow and its computation.

UNIT–II

Gradually varied flow – dynamic equation – classification of channel bottom slopes – classification of water surface profiles – characteristics of surface profiles – integration of the varied flow equation by the step method.

Hydraulic jump in rectangular channels – types of hydraulic jumps – surges in open channels – positive and negative surges.

UNIT–III

Dimensions – Dimensional homogeneity – Methods of dimensional analysis – Rayleigh's method – Buckingham's π-method – use of dimensional analysis.

Model investigation – similitude – types of similarities – dimensionless numbers – Reynolds, Froude, Euler, Mach and Weber numbers – Model laws – types of models – application of dynamic similarity to specific model investigations – submerged objects and partially submerged objects.

UNIT–IV

Impulse-momentum principle – dynamic force exerted by fluid jet on stationary flat plate: (a) plate normal to jet (b) inclined plate – force on moving flat plate – force on curved stationary plate – force on single moving curved plate – fluid jet on moving curved surface of a turbine blade – velocity diagrams for turbine blades – work done on tangential flow runner – jet propulsion – propulsion of ships – forces caused by flow round a pipe-bend – angular momentum equation – radial flow over turbine blade – work done by radial runner.

Different classification of turbines – Pelton turbine: main components and their functions – design of component parts of Pelton turbine – force, power and efficiency – Francis turbine: different types – main components – design of

components – torque, power and efficiencies – Kaplan turbine: components – force, torque, power and efficiencies – governing of water turbines – selections of turbines.

UNIT–V

Pumps – classification of pumps – working principle of single acting and double acting pumps – slip and coefficient of discharge – rate of delivery – velocity and acceleration of water – speed indicator diagrams – effect of bent delivery pipe on separation – air vessels – suction in pumps with air vessels – pressure in cylinder on delivery stroke with air vessels – maximum speed of pump with air vessel – power required to drive the pump fitted with air vessels.

Comparison with reciprocating pumps – principle and operation – different classifications of centrifugal pumps – specific speed – layout, accessories and starting of centrifugal pumps – static head, manometric head and gross head – power – overall efficiency – loss of head in pipes and fittings – fundamental equations of centrifugal pumps – work done and manometric efficiency – minimum starting speed – priming of pumps – cavitation in pumps – NPSH – multi-stage pumps – deep well pumps.

TEXT BOOKS

1) Jagdish Lal, *Hydraulic machines*, Metropolital Book Co. Pvt. Ltd. Reprint 2011.
2) Subramanya. K., *Flow in open channels*, Tata McGraw Hill, New Delhi 2000.

REFERENCE BOOKS

1) Ven Te Chow, *Open Channel Hydraulics*", McGraw Hill, New York, 2009.
2) Mays. L. W., *Water Resources Engineering*, John Wiley and Sons (WSE), New York, 2005.
3) Jain. A.K., *Fluid Mechanics,* Khanna Publishers, New Delhi. 2010.
4) Srivastava. R., *Flow through open channels*, Oxford University Press, New Delhi, 2008.
5) Modi. P.N. and Seth. S.M*., Hydraulics and Fluid Mechanics*, Standard Book House, New Delhi, 2002.

COURSE OUTCOMES

1) Relate the theory and practice of problems in hydraulic engineering.
2) Apply knowledge of fluid mechanics in addressing open channel flow problems.
3) Solve problems in uniform, gradually varied and rapidly varied flows in steady state conditions.
4) Understand the working principle of pumps and turbines

MAPPING WITH PROGRAMME OUTCOMES										
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**
CO1	✓				✓					
CO2	✓				✓					
CO3	✓				✓					
CO4	✓				✓					

01PC406	SURVEYING	L	T	P
		4	0	0

COURSE OBJECTIVES

- To know the surveying practices and topography of the site this influences the competency of a structural engineer.
- To learn the principles and practices of chain and compass surveying, levelling, Theodolite surveying, tachometric surveying and triangulation.

UNIT–I

Chain and Compass surveying - Description of instruments and accessories for chain and compass survey - Chaining methods and booking - Use of prismatic compass - Local attraction and its correction - Traverse by chain and compass - Adjustment of closing error - Plane table surveying - Merits and demerits - Different equipments - Telescopic and prismatic alidades – relative advantages -Different methods-Radiation, resection and intersection-two and three point problems - Traversing.

UNIT–II

Levelling - Description, setting up and use of dumpy level -Levelling staff - Bench marks recording and reducing levels by different methods - Types of levelling - Permanent adjustments sensitiveness of bubble tube, correction for curvature and refraction - Contouring-Areas and volumes of earth work - Types of levels and clinometer.

UNIT–III

Theodolite Surveying - Use of adjustment of transit Theodolite -Measurements of horizontal angles by repetition and reiteration methods - Measurement of vertical angles, height and distance by single and double plane methods - Traversing calculations and plotting by co-ordinate systems - Omitted measurements.

UNIT–IV

Tachometric surveying - Principles of stadia formula - Substance bar - Precise instruments –Microptic and micrometer theodolite -Nautical and box sextants - Range finders - Instruments of strategic importance.

Introduction to Curves – classification – necessity – elements of simple curve – setting out a simple curve – various methods

UNIT–V

GIS definition – Basic components of GIS – Standard GIS software – Data type – Spatial and non-spatial (attribute) data – Measurement scales – Types of files – Data Base Management Systems (DBMS) types.

Modelling in GIS: Highway alignment studies – Land Information System – Change Detection – Land use/ Land cover mapping – Watershed management – Water quality mapping – surface and groundwater resources mapping.

TEXT BOOKS

1) Kanetkar.T.P & Kulkarni.S.V, *Surveying - Vol. I & II*, Vidyarthi Griha Prakashan, Pune, 1968.
2) Punmia.B.C, *Surveying*, Standard Publications, New Delhi, 1994.

REFERENCE BOOKS

1) Arora, *Surveying - Vol.I & II*, Standard Publishers & Distributors, New Delhi,1987.
2) Kang-Tsung Chang, *Introduction to Geographical Information System*, Tata McGraw-Hill, New Delhi, 2009.
3) Basudeb Bhatta, *Remote Sensing and GIS*, Second Edition, Oxford University Press, New Delhi, 2011.
4) Agor.R, *Surveying & Levelling*, Oscar Publications, Delhi, 1984.
5) Rangwala.S.C, *Surveying and Levelling*, Charotar Publishing House, New Delhi, 2005.
6) Clarke Parks and Crane, Geographical Information Systems and Environmental *Modelling*, Prentice Hall of India, Delhi, 2005.

COURSE OUTCOMES

1) Students will possess knowledge about chain surveying, compass surveying, plane table surveying, Levelling, Theodolite survey, Tachometric survey and contouring.
2) Students will have the knowledge about the Survey Instruments, their care and adjustments and the principles of Chain Surveying.
3) Students can able to understand GIS and its principles.

MAPPING WITH PROGRAMME OUTCOMES										
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**
CO1	✓			✓				✓		
CO2	✓			✓				✓		
CO3	✓			✓				✓		

02CP407	**STRENGTH OF MATERIALS LABORATORY**	**L**	**T**	**P**
		0	**0**	**3**

COURSE OBJECTIVES

- To provide practical training on the testing and studying the stress – deformation response under axial and transverse loading conditions of conventional engineering materials like steel and wood.

LIST OF EXPERIMENTS:

1) Tension test on Steel rods
2) Double Shear test on Steel rods
3) Deflection test on Steel and Wooden beams
4) Compression test on wooden specimen
5) Impact tests
6) Hardness tests on different metals
7) Test on Helical springs
8) Torsion Test.

REFERENCES BOOKS

1) Bansal.R.K, *Strength of Materials*, Lakshmi Publications, New Delhi, December 2005.
2) Rajput.R.K, *Strength of Materials*, S.Chand& Co., New Delhi, September 2000.
3) Punmia.B.C, et al , *Strength of Materials and Theory of Structures - Vol.I,* Laxmi Publications, Chennai, 2000.
4) Sadhu Singh, *Strength of Materials,* Khanna Publishers, Delhi, 1988.
5) Ramamrutham.S, *Strength of Materials, DhanpatRai Son,* New Delhi, 1992.
6) Hiraskar.G.K, *Strength of Materials*, Khanna, Delhi, 1984.

COURSE OUTCOMES

At the end of the course students will be able

1) To find out the material properties.
2) To find out the stress, strain, young's modulus, Poisson's ratio, etc. for different materials.
3) To understand the materials behaviour by their properties.

MAPPING WITH PROGRAMME OUTCOMES										
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**
CO1	✓		✓					✓		
CO2	✓		✓					✓		
CO3	✓		✓					✓		

01CP408	**SURVEYING LABORATORY**	**L**	**T**	**P**
		0	**0**	**3**

COURSE OBJECTIVES

- To conduct experiments on Surveying and Levelling.
- To understand the principles of Surveying.
- To know about compass surveying and plane table surveying.
- To understand the concepts of levelling and its applications.
- To understand the concepts of Theodolite surveying.

LIST OF EXERCISES

I. Chain Surveying

1) Study of Chains and its accessories
2) Ranging a line and taking offsets
3) Cross-Staff Survey (Area of a traversing by Chain triangulation)

II. Compass Surveying

1) Study of prismatic compass and its accessories
2) Determination of area of an extent by radiation methods
3) Determination of distance of two inaccessible points

III. Levelling

1) Study of Dumpy level and telescopic staff
2) Simple Leveling – Determination of Reduced levels
3) Differential Leveling - Determination of Reduced levels

IV. Theodolite and Trigonometric Surveying

1) Study of transit theodolite, fundamental of various axes
2) Measurement of horizontal angle by repetition method
3) Measurement of horizontal angle by reiteration method
4) Heights and distances

V. Tachometric Surveying

1) Determination of tachometric constants
2) Distance and elevation by stadia method
3) Distance and elevation by tangential method
4) Determination of Gradient of a line

Demonstration

1) Study of GPS
2) Study of Total Station.

The syllabus includes a Survey Camp for about one week

TEXT BOOKS

1) Kanetkar.T.P&Kulkarni.S.V, *Surveying - Vol. I & II*, VidyarthiGrihaPrakashan, Pune, 1968.
2) Punmia.B.C, *Surveying Volume-1*, Laxmi Publications, New Delhi, 2005.

REFERENCE BOOKS

1) 1. Arora, *Surveying - Vol.I& II*, Standard Publishers & Distributors, New Delhi, 1987.
2) 2. Agor.R, *Surveying &Levelling*, Oscar Publications, Delhi, 1984.
3) 3. Rangwala.S.C, *Surveying and Levelling*, Charotar Publishing House,Gujarat, 2005.

COURSE OUTCOMES

At the completion of the course students will be able to

1) Do chain surveying, compass surveying, plane table surveying, Levelling, Theodolite survey, Tachometric survey and contouring.
2) Handle the Survey Instruments, their care and adjustments and the, principles of Chain Surveying.
3) Understand the concept of total station.

MAPPING WITH PROGRAMME OUTCOMES										
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**
CO1	✓			✓				✓		
CO2	✓			✓				✓		
CO3	✓			✓				✓		

FIFTH SEMESTER

02PC501	STRUCTURAL MECHANICS I	L	T	P
		4	0	0

COURSE OBJECTIVES

- To understand the complex analysis of structures with different end conditions.
- To learn the concepts of analysis in arches and cables.
- To have knowledge in the various classical methods of analysis of structures.

Unit–I

Linear elastic Analysis - Degree of Redundancy - Degree of Freedom - Static and Kinematic Indeterminacies – Maxwell's Theorem-Betti's law- Method of consistent deformation- sign convention-Clapeyron's theorem of three moments equation method – Problems with concentrated loads, partial or and full UDL, concentrated moments - Propped Cantilever Beams, Fixed Beams and Continuous Beams (restricted to two spans) - Additional problems with flexural hinges, elastic supports and support settlements. All problems shall end with elastic curve, Shear Force Diagrams (SFD) and Bending Moment Diagrams (BMD).

Unit–II

Degree of Redundancy - Static and Kinematic Indeterminacies - Plane frames – Virtual work method (Unit–Load Method) – Castigliano's Theorems – Simple frames (restricted to three members with two redundancies) - Simple trusses (restricted to five members with two redundancies)- Additional problems with flexural hinges, elastic supports and support settlements. All problems shall end with elastic curve, Shear Force Diagrams (SFD) and Bending Moment Diagrams (BMD).

Unit–III

Analysis for moving loads - Influence Line Diagram (ILD) – Muller Breslau Principle for Influence Lines- ILD for simply supported beams - ILD for overhanging beams - ILD for Propped cantilever beams with flexural hinges- simply supported beams with floor girders – Problems with single concentrated loads, two loads, train of loads, UDL longer than span and shorter than span – Maximum SFD and BMDs –Absolute maximum bending moment- ILD for Simple Plane truss. ILD for continuous beams and rigid frames (no problems)- Indirect model analysis for indeterminate structures.

Unit–IV

Arch action – Types of Arches - Analysis of Three-hinged and Two-hinged arches with effect of temperature change, rib shortening - Yielding of supports - Influence lines - Parabolic and Circular arches – Settlement effects.

Unit–V

Cables and Suspension bridges – Cable Theorem – Cable under uniformly distributed loads (Cable Equation) - Horizontal thrust on the cable -Tension in the cable - Length of the cable - Effect of temperature on the cable - Stiffening

girders in suspension bridges - Analysis of three-hinged and two-hinged stiffening girders with different support levels. ILD for moving loads over suspension bridges.

Analysis of Beams Curved in Plan – Analysis of Space trusses using tension coefficient method.

TEXT BOOKS

1) Punmia.B.C, et al, *Theory of Structures- Vol.I& II*, Lakshmi Publications, New Delhi, 2004
2) Ramamrutham.S & Narayan.R, (1993) *Theory of Structures*, Dhanpat Rai and Sons, Delhi, 1992.

REFERENCE BOOKS

1) DevdasMenon, *Structural Analysis*, Narosa Publishing House, New Delhi, 2009.
2) Reddy.C.S, *Basic Structural Analysis*, Tata McGraw Hill Book Co., New Delhi, 1996.
3) Wang.C.K, *Intermediate Structural Analysis,* Tata McGrawHillBook Co., New Delhi,1984.
4) Vazirani and Ratwani, *Analysis of Structures - Vol.I.& II,* Khanna Publishers, Delhi,1996.
5) Viadyanathan. R and Perumal. P, *Comprehensive Structural Analysis Vol. I & II*, Laxmi Publications, New Delhi,2003.
6) Negi.L.SandJangid.R.S, *Structural Analysis*, Tata McGraw Hill Book Co., New Delhi, 2003.
7) Gambhir, M.L., *Fundamentals of Structural Mechanics and Analysis*, PHI Learning Pvt. Ltd., New Delhi,2011.
8) Bhavikatti.S.S, *Structural Analysis,Vol. I and II,* Vikas Publishing House Pvt. Ltd., New Delhi, 2008.

COURSE OUTCOMES

At the completion of the course students will be able

1) To analyze the indeterminate structures like beams and frames with different end conditions.
2) To analyse the arch structures and suspension cable bridges.
3) To solve the structural problems with different methods of analysis.

MAPPING WITH PROGRAMME OUTCOMES										
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**
CO1	✓	✓						✓		
CO2	✓	✓						✓		
CO3	✓	✓						✓		

02PC502	STRUCTURAL STEEL DESIGN - II	L	T	P
		4	0	0

COURSE OBJECTIVES

- To make the students conversant with the design procedures and practices of complex steel structures like industrial structures and Gantry girders as per IS 800 – 2007 procedures.

Unit–I

Wind on Industrial Buildings - Design wind speed and pressure – Internal and external wind pressure coefficients from codes(IS: 875(Part3) &SP 64: 2001) – Wind forces on members with height - Wind forces on Cladding, Louvers, hoarding structures, Microwave Towers –Wind motion due to Vortex Shedding, dynamic response factor for along wind and across wind. Design of purlins, Rafters, Sag rods and Girds.

Unit–II

Industrial buildings – Types – Elements of an industrial building – Loads on industrial buildings – Roof trusses – Components of a roof truss – Loads on roofs – Analysis and Design of roof truss. Pre- Engineered Buildings– Advantages of PEB over Conventional roof trusses- Tubular Trusses, joint details and tubular scaffoldings. Analysis and design of hoarding structures under dead, live and wind loads condition as per IS 875(Part3)&SP 64: 2001.

Unit–III

Design of gantry girder – Gantry supporting columns - Columns with battened plate – column with cap plate details — Stepped columns – Moment Resistant Connections - Beam and column connections – Beam to Beam connections – Braced industrial buildings – Un-braced industrial frames–Base plate with anchor bolt details - Detailing as per IS800 : 2007.

Unit–IV

Plastic analysis and design – Advantages and disadvantages – Plastic neutral axis – Plastic modulus – Plastic moment of resistance – Shape factor – Load factor – Plastic hinge – Collapse mechanisms – Theorems of plastic analysis – Analysis and Design of beams and simple frames – Limitations – Plastic design Versus Elastic design. Design of castellated beam for bending and shear.

Unit–V

Cold Form light gauge sections - Type of cross section, stiffened, multiple stiffened and un-stiffened element, Design of light gauge compression, tension and flexural members as per IS 802(Part 1 to 3):1995.

TEXT BOOKS

1) Duggal.S.K , *Limit State Design of Steel Structures*, Tata McGraw Hill Education Private Ltd, New Delhi, 2000.
2) Sairam.K.S, *Design of Steel Structures*, Pearson Publications, Chennai, 2013.

REFERENCE BOOKS

1) Subramanian.N, Design of Steel Structures, Oxford University Press, New Delhi2008
2) Bhavikatti.S.S, Design of Steel Structures , I.K. International Publishing House Pvt. Ltd, New Delhi, 2012.
3) Shiyekar, *Limit State Design of Steel Structures*, Phi Learning Pvt. Ltd., Delhi, 2010

STANDARDS

1) IS800:2007, General Construction in Steel – Code of Practice, Bureau of Indian Standards, New Delhi.
2) IS 875(Part3): Wind Loads on Buildings and Structures, Bureau of Indian Standards, New Delhi.
3) Teaching resource materials by INSDAG, Kolkata.
4) IS: 802(Part 1 to 3):1995Code of practice for use of cold formed light gauge steel structural members in general building construction, Bureau of Indian Standards, New Delhi.
5) IS 806 :1968 Code of practice for use of steel tubes in general building construction, Bureau of Indian Standards, New Delhi
6) IS 4014 (Part I and II): 1967 Code of practice for steel tubular scaffolding, Bureau of Indian Standards, New Delhi
7) SP: 6 (2)– 1962,Hand book for structural Engineers, Steel beams and plate girders, Bureau of Indian Standards, New Delhi
8) SP: 6 (5)– 1980, Hand book for Structural Engineers, Structural use of light gauge steel, Bureau of Indian Standards, New Delhi
9) IS codes for Aluminium Structures, IS:3908, 3909, 3921, 5384, 6445, 6476, 6475, 6449, 8147, Bureau of Indian Standards, New Delhi
10) SP 64 (2001): Explanatory Handbook on Indian Standard Code of Practice for Design Loads (other than Earthquake), Bureau of Indian Standards, New Delhi

COURSE OUTCOMES

At the completion of the course students will be able

1) To identify the different types of Steel sections available in the market.
2) To design of Connections and Different types of members which are subjected to various loads.
3) To understand the concept of plastic analysis and its effects

MAPPING WITH PROGRAMME OUTCOMES										
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**
CO1	✓	✓								
CO2	✓	✓								
CO3	✓									✓

02PC503	SOIL MECHANICS	L	T	P
		4	1	0

COURSE OBJECTIVES

- To understand the nature, properties and behavioral response of soils is essential for a safe and stable design of foundations.
- To understand the principles involved in the understanding of the behavior of soils as a supporting medium for structures.

Unit–I

Physical & Index properties of soil: Weight- Volume Relationships, In-situ Density, Moisture Content, Specific Gravity, Relative Density, Atterberg's Limits, Soil Indices, consistency of soil , Particle Size Distribution of soil: Sieving, Sedimentation Analysis. Identification & Classification of soil: Field identification of soil, Soil Classification: as per Unified Classification System, IS Code Recommendation as per SP 36 – 1 (1987).

Unit–II

Flow through soil: Darcy's Law, Coefficient of permeability, laboratory and field determination of coefficient of permeability, Permeability for Stratified Deposits, Laplace's Equations, Flow nets, Flow Through Earthen Dam, Estimation of Seepage, Uplift due to seepage. Effective Stress Principles: Effective Stress, Effective pressure due to different conditions, Seepage force, Critical hydraulic gradient, Quick sand condition, Design of filters, Capillarity in soil

Unit–III

Stress Distribution In Soil: Normal and shear stresses, Stress due to point loads, Stress beneath Line, strip & uniformly loaded circular area & rectangular area, pressure bulbs, Newmark's charts- Use for determination of stress due to arbitrarily loaded areas

Unit–IV

Compaction of soil: Principles of Compaction, Compaction Test, Field Compaction, Various methods of field compaction and control. Compressibility & Consolidation of Soil: Terzaghi's theory of one dimensional consolidation, Compressibility characteristics of soils: Compression index, Coefficient of compressibility & volume change, Coefficient of consolidation, Degree & rate of consolidation, Laboratory method of one dimensional consolidation test, Determination of consolidation parameters, Secondary consolidation.

Unit–V

Shear Strength of Soil: Basic concepts, Mohr- Columb's Theory, Laboratory Determination of soil shear parameter- Direct Shear, Tri-axial Test, Unconfined Compression, Vane Shear Test, Sensitivity & thixotropy of clay as per SP 36 – 1 (1987).Slope failure mechanisms - total stress analysis for saturated clays - friction circle method, tension cracks - use of stability number.

TEXT BOOKS

1) Punmia B.C, *Soil Mechanics & Foundation Engineering,* Lakshmi Publications, New Delhi, 2005.
2) Moorthy V.N.S., *Soil Mechanics & Foundation Engineering, CRS Press,* Taylor & Francis Books India Pvt. Ltd, New Delhi, *2002.*

REFERENCE BOOKS

1) ShamsherPrakash, *Problems in Soil Mechanics, Asia Publishing House,* Hyderabad, 1972.
2) Terzaghi, K. and Peck.R.B, *Soil Mechanics in Engineering Practice, John Wiley & Sons, Navi Mumbai, 1996.*
3) Venkataramaiah. C, *Geotechnical Engineering, New Age International Publishers, New*
4) *Delhi, 2006.*
5) Arora, Soil *Mechanics & Foundation Engineering, Standard Publishers Distributors, New Delhi, 2005.*

STANDARDS

1) SP 36 – 1:1987 Compendium of Indian Standards on Soil Engineering: Part-1 Laboratory Testing of Soils for Civil. Bureau of Indian Standards, New Delhi.

COURSE OUTCOMES

At the end of the course students will be able

1) To understand the soil characters such as shear strength and stress distribution.
2) To determine the soil properties.
3) To demonstrate the experiments on different soils.

MAPPING WITH PROGRAMME OUTCOMES										
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**
CO1	✓	✓				✓		✓	✓	
CO2	✓					✓		✓	✓	
CO3	✓					✓		✓	✓	✓

02PC504	**STRUCTURAL CONCRETE DESIGN II**	**L**	**T**	**P**
		4	**0**	**0**

COURSE OBJECTIVES

- To understand the concepts of advanced structural design of building frames, raft foundations, pile foundations and water tanks.
- To enhance the structural design skill to develop confidence in structural design.

Unit–I

Analysis and design of concrete Building frames: load combinations for gravity and lateral loads (wind or seismic)- Substitute frame method for gravity loads - Portal and Cantilever methods for lateral loads - Analysis and design of two storied

two bay concrete Plane frames under gravity and lateral loads- Reinforcement detailing as per SP 34 : 1987 and IS 13920: 1993.

Unit–II

Design of Raft foundation (IS:2950 (Part I) -1981) - Design of Strap footings - Reinforcement detailing as per SP 34 : 1987.

Unit–III

Design of Under-reamed piles with two bulbs(IS : 2911 (part III) – 1980), Design of Bored Pile foundations with Pile cap for two column loads, three column loads, four column loads IS: 2911 (Part 1/Sec 2)- 2010 – Reinforcement detailing as per SP 34 : 1987.

Unit–IV

Design of square, rectangular and circular shape water tanks resting on ground - Design of square, rectangular and circular shape water tanks resting underground(IS 3370 (Part IV) : 1967) - Reinforcement detailing as per SP 34 : 1987. Design of Concrete Domes - Reinforcement Detailing as Per SP:34 -1987.

Unit–V

Design of cantilever type retaining walls without surcharge - Design of cantilever type retaining walls with surcharge and traffic loads - Design of counter-fort type retaining walls without surcharge - Design of counter-fort type retaining walls with surcharge and traffic loads - Reinforcement detailing as per SP 34: 1987.

TEXT BOOKS

1) Krishnaraju.N, *Advanced R.C.Design*,CBS Publishers & Distributors Pvt Ltd, New Delhi 2012.
2) Punmia.B.C, *R.C.Structures - Vol.I & II,* Laxmi Publications (P) LTD,New Delhi 1995,

REFERENCE BOOKS

3) Ramamrutham.S and Narayan.R, *Design of R.C. Structures,* Dhanpat Rai and Sons, Delhi, 1992
4) Dayaratnam P, *Design of RC Structures*, OXFORD & IBH Publishing Co, New Delhi, 2000.
5) Punmia.B.C, *R.C.Structures – Vol. II*, Standard Publishers, New Delhi, 1991.
6) Mallick.S.K & Gupta.A.P, *Reinforced Concrete*, Oxford I B H, New Delhi, 1987.
7) Park and Paulay. T, *R.C.Structures*, Tata McGraw Hill Publications, New Delhi, 1975.

STANDARDS

1) IS 456: 2000, Code of Practice for Plain and Reinforced Concrete, Bureau of Indian Standards, New Delhi.
2) IS 13920: 1993, Ductile Detailing of Reinforced Concrete Structures Subjected to Seismic Forces -Code Of Practice, Bureau of Indian Standards, New Delhi.
3) SP 34: 1987, Handbook On Concrete Reinforcement And Detailing, Bureau of Indian Standards, New Delhi.
4) IS: 2950 (part I) -1981, Code of Practice for Design and Construction of Raft Foundations Bureau of Indian Standards, New Delhi

5) IS 1904: 1986, Code of Practice for Design and Construction of Foundations in Soils : General Requirements, Bureau of Indian Standards, New Delhi
6) IS: 2911 (Part 1/Sec 1)- 2010, Design and Construction of Pile Foundations — Code of Practice, Bureau of Indian Standards, New Delhi
7) IS 2911 (Part III): 1980, Code of Practice for Design and Construction of Pile Foundations (Under-reamed piles), Bureau of Indian Standards, New Delhi
8) IS 3370 (Part IV) :1967, Code Of Practice For Concrete Structures for the Storage of Liquids, Bureau of Indian Standards, New Delhi

COURSE OUTCOMES

1) The students will have the knowledge of analysis and design of multi-storeyed frames and special foundations such as pile, raft, strap, etc.

MAPPING WITH PROGRAMME OUTCOMES										
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	✓	✓								
CO2	✓	✓								
CO3	✓	✓								✓

02CP507	COMPUTER PRACTICAL II	L	T	P
		0	0	3

COURSE OBJECTIVES

- To train the students in the use of latest softwares available to solve structural engineering problems and documentations procedures.

LIST OF EXERCISES

Plate 1. Draw cross section, longitudinal sections of Concrete Beams with reinforcement details as per SP 34: 1987, IS 13920: 1993.

a. Singly and Doubly Reinforced Concrete Beams
b. Flanged beam: T and L shaped Reinforced Concrete Beams
c. Rectangular Continuous Beams
d. Lintel Beams with sunshade
e. Plinth Beams
f. One way and two way slabs.
g. Continuous slabs

Plate 2. Draw cross section, longitudinal sections of Concrete staircase with reinforcement details as per SP 34: 1987, IS 13920: 1993.

a. Dog legged staircase

Plate 3. Draw cross section, longitudinal sections of Column with Footings and reinforcement details as per SP 34: 1987, IS 13920: 1993.

a. Rectangular Column with Isolated Footings
b. Circular Column with Circular Isolated Footings

Plate 4 & 5. Draw cross section, longitudinal sections and reinforcement details for the followings

a. Strap footing
b. Raft foundation (IS: 2950 (Part I) -1981).

Plate 6,7 & 8. Draw cross section, longitudinal section and reinforcement details as per IS: 2911 (Part 1/Sec 1) - 2010, IS 2911 (Part III): 1980 andSP 34: 1987.

a. Pile with Pile cap (Two pile group)
b. Pile with Pile cap (Three pile group)
c. Pile with Pile cap (Four pile group)

Plate 9 & 10. Draw cross section, longitudinal sections and reinforcement details as per SP 34: 1987.

a. Cantilever Type Retaining Wall
b. Counter fort Type Retaining Wall

REFERENCE BOOKS

1) ACAD Manuals.
2) Krishnaraju.N, *Structural Design and Drawing,* Oscar Publications, Delhi, 2005.
3) Punmia, B.C, *Reinforced Concrete Structure Vol. I*, Standard Publishers Distributors,
4) New Delhi, 2007.

STANDARDS

1) IS 456: 2000, Code of Practice for Plain and Reinforced Concrete, Bureau of Indian Standards, New Delhi
2) IS 13920: 1993, Ductile Detailing of Reinforced Concrete Structures Subjected to Seismic Forces -Code of Practice, Bureau of Indian Standards, New Delhi
3) SP 34 : 1987, Handbook On Concrete Reinforcement And Detailing, Bureau of Indian Standards, New Delhi.
4) IS: 2950 (Part I) -1981, Code of Practice for Design and Construction of Raft Foundations. Bureau of Indian Standards, New Delhi
5) IS 1904: 1986, Code of Practice for Design and Construction of Foundations in Soils : General Requirements, Bureau of Indian Standards, New Delhi
6) IS: 2911 (Part 1/Sec 1)- 2010, Design and Construction of Pile Foundations — Code of Practice, Bureau of Indian Standards, New Delhi.
7) IS 2911 (Part III): 1980, Code of Practice for Design and Construction of Pile Foundation (Under-reamed piles),Bureau of Indian Standards, New Delhi,
8) IS 3370 (Part IV): 1967, Code Of Practice For Concrete Structures for the Storage of Liquids, Bureau of Indian Standards, New Delhi.

COURSE OUTCOMES

At the completion of the course students will be

1) Having the Structural Engineering knowledge on Reinforced concrete structural elements for practical application.

2) Able to gain experience/ practice on Modern Software in Civil Engineering field.
3) Able to understand the design and development of Shop drawing for practical purpose

MAPPING WITH PROGRAMME OUTCOMES										
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	✓	✓								
CO2	✓	✓						✓		
CO3	✓	✓						✓		✓

02CP508	SOIL MECHANICS LABORATORY	L	T	P
		4	0	0

COURSE OBJECTIVES

- To train the students in various aspects of soil investigation.
- To determine the basic soil properties, strength, deformation and permeability characteristics of soils through which the students can try to be successful geotechnical engineers.

LIST OF EXPERIMENTS

The Following Laboratory Tests need to be carried out as per SP 36 – 1:1987.

1) Specific Gravity of Soils
2) Visual Classification of Soils
3) Sieve analysis
4) Hydrometer analysis
5) Atterberg Limits
6) Permeability determination (constant head and falling head methods)
7) Optimum Moisture content determination(Proctor compaction, CBR value test)
8) Shear strength determination (Direct shear test , Unconfined compression test, Tri-axial compression test)
9) One-dimensional consolidation test.
10) Determination of Field density

REFERENCE BOOKS

1) Punmia.B.C, *Soil Mechanics & Foundation Engineering,* Laxmi Publications, New Delhi, 2005.
2) Moothy.V.N.S, *Soil Mechanics & Foundation Engineering, CRS Press,* Taylor& Francis Books India Pvt. Ltd, New Delhi, 2002.
3) Arora, *Soil Mechanics & Foundation Engineering, Standard Publishers Distributors, New Delhi, 2005.*
4) Venkataramaiah.C, *Geotechnical Engineering, New Age International Publishers, New Delhi,* 2006.
5) ShamsherPrakash, *Problems in Soil Mechanics, Asia Publishing House,* Hyderabad 1972.

6) Terzaghi.K and Peck.R.B, *Soil Mechanics in Engineering Practice, John Wiley & Sons,* Navi Mumbai, 1996.

7) SP 36 - 1:1987 Compendium of Indian Standards on Soil Engineering: Part-1 Laboratory Testing of Soils for Civil, Bureau of Indian Standards, New Delhi.

COURSE OUTCOMES

At the completion of the course students will be able

1) To understand the soil properties.
2) To gain knowledge about the soil characters.
3) To conduct the different experiments according to the soil types.

MAPPING WITH PROGRAMME OUTCOMES										
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**
CO1	✓	✓				✓		✓	✓	
CO2	✓					✓		✓	✓	
CO3	✓					✓		✓	✓	✓

01EP509	**FLUID MECHANICS AND MACHINES LABARATORY**	**L**	**T**	**P**
		0	**0**	**4**

COURSE OBJECTIVES

- To understand the properties of fluids and fluid statics, methods for determination of co-efficient of discharged are to be explained and computed practically.
- To study of the characteristic features of pumps and turbines using experiments in envisaged.
- To understand the significance and role of such utilities in their further course of study.

LIST OF EXPERIMENTS

1) Determination of Co-efficient of discharge of Mouth Piece
2) Determination of Co-efficient of discharge of Venturimeter
3) Determination of Co-efficient of Head loss due to Sudden Change in Section
4) Determination of Co-efficient of Head loss due to Friction in Pipe
5) Determination of Co-efficient of discharge of Rectangular Notch
6) Determination of Co-efficient of Impact of Jet on Vanes
7) Study of Performance characteristics of Elmo Pump (Centrifugal Pump)
8) Study of Performance characteristics of Sump Pump (Centrifugal Pump)
9) Study of Performance characteristics of Submersible Pump (Centrifugal Pump)
10) Study of Performance characteristics of Gould's Pump (Reciprocating Pump)
11) Study of Performance characteristics of Pelton Turbine (Constant Speed method)
12) Study of Performance characteristics of Francis Turbine (Constant Head method)

13) Determination of Metacentric Height of a floating vessel (Demo Only)
14) Study on Flow through Open Channel (Demo Only)

REFERENCE BOOKS

1) Subramanyan K., *Flow in open channels*, Tata McGraw Hill, New Delhi 2000.
2) Modi P.N. and Seth S.M., *Hydraulics and Fluid Mechanics*, Standard Book House, New Delhi, 2002.
3) Nagaratnam S, *Fluid Machines and Systems*, Tata McGraw Hill, New Delhi1989.

COURSE OUTCOMES

At the completion of this course, a student will be able to

1) Determine the properties of fluids, pressure and their measurements
2) Measure flow in pipes and determine frictional losses
3) Compute forces on immersed plane and curved plates applying continuity equation and energy equation in solving problems on flow through conduits
4) Develop Characteristics of pumps and turbines

MAPPING WITH PROGRAMME OUTCOMES										
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**
CO1	✓				✓			✓		
CO2	✓				✓			✓	✓	
CO3	✓				✓			✓		
CO4	✓				✓			✓	✓	

SIXTH SEMESTER

02PC601	**STRUCTURAL MECHANICS II**	**L**	**T**	**P**
		4	**0**	**0**

COURSE OBJECTIVES

- To understand the complex analysis of indeterminate structures with different end conditions. Through various classical methods of analysis of indeterminate structures.
- To provide advanced and modern methods of structural analysis of simple and complicated structures and structural systems.
- To learn the concept of force method and displacement method of analysis using matrix approach.
- To have the knowledge of plastic analysis of concrete structures.

Unit–I

Slope deflection equations- sign convention - Continuous beams (two spans only) – Simple Plane frames with and without sway (three members only) - Problems with flexural hinges, elastic supports support settlements and non prismatic fixed beams- Problems using Symmetry and Anti-symmetry concepts.

Unit–II

Moment Distribution method (Prof. Hardy Cross Method) – Joint stiffness- Distribution factors- Carry over factors - Analysis of continuous beams – simple Plane frames with and without sways – Problems with flexural hinges, elastic supports and support settlements.

Unit–III

Flexibility or Force equation - Member flexibility – Flexibility coefficients – Equivalent Joint Loads- Choice of Redundant force restricted to two - Analysis of continuous beams, frames (two redundant forces), Analysis of simple plane truss, Problems with temperature changes, pre-strains and support settlements.

Unit–IV

Stiffness or Displacement equation - Member stiffness – Stiffness coefficients – Element and Global stiffness matrices - Transformations of stiffness matrices, load vectors and displacements vectors- Choice of displacements restricted to two - Analysis of continuous beams, frames, Analysis of simple plane truss, Problems with temperature changes, pre-strains and support settlements.

Unit–V

Approximate methods: substitute frame method for gravity loads – Portal and cantilever methods for lateral loads. Simple frames used for water tanks, industrial bends, bunkers and silos staging.

Plastic Bending Beams- Assumptions- Plastic moment of resistance - Plastic Modulus Shape and Load factors-Plastic hinge and mechanism - Plastic analysis of indeterminate beams and frames - Upper and lower bound theorems.

TEXT BOOKS

1) DevdasMenon, *Structural Analysis*, Narosa Publishing House, New Delhi, 2009.
2) Bhavikatti.S.S, *Structural Analysis Vol. I and II,*Vikas Publishing House Pvt.Ltd., New Delhi, 2008.

REFERENCE BOOKS

1) Punmia.B.C, et al, *Theory of Structures- Vol.I& II*, Lakshmi Publications, New Delhi, 2004.
2) Wang.C.K, *Intermediate Structural Analysis,* Tata McGraw Hill Book Co, New Delhi, 1984.
3) Negi.L.S and Jangid.R.S, *Structural Analysis*, Tata McGraw Hill Book Co, New Delhi, 2003.
4) Gambhir, M.L., *Fundamentals of Structural Mechanics and Analysis*, PHI Learning Pvt. Ltd., New Delhi, 2011.
5) William Weaver Jr.&James M.Gere, *Matrix Analysis of framed structures*, CBS Publishers and Distributors, New Delhi, 2004.
6) Viadyanathan. R and Perumal. P, *Comprehensive Structural Analysis Vol. I & II*, Laxmi Publications, New Delhi, 2003.
7) Pandit, G.S. & Gupta, S.P. *Structural Analysis-A Matrix Approach*, Tata McGraw Hill, New Delhi, 2004.

COURSE OUTCOMES

At the completion of the course students will be able

1) To analyze the indeterminate structures like beams and frames with different end conditions through various advanced and modern methods.
2) To solve the structural problems with matrix approach.
3) To do the plastic analysis for concrete structures.

MAPPING WITH PROGRAMME OUTCOMES										
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	✓	✓								✓
CO2	✓	✓								✓
CO3	✓	✓								✓

02PC602	FOUNDATION ENGINEERING	L	T	P
		4	0	0

COURSE OBJECTIVES

- To impart basic knowledge on design of foundations and its behaviours under different soil conditions to carry out proper foundation design.

Unit–I

Field Soil Exploration – Soil exploration techniques – Equipments of soil exploration - Auguring and boring – Wash boring and rotary drilling – Depth of boring – Spacing of bore hole – method of collection of disturbed and un-disturbed soil samples - Split spoon sampler, Thin wall sampler, Stationery piston sampler – Field tests-Penetration tests (SPT and SCPT) – Bore log report – Data interpretation – Strength parameters and Liquefaction potential – Selection of foundation based on soil condition – Discussion on sample Soil investigation report.

Unit–II

Necessity for shallow foundations – Relevant IS code standards–Bearing capacity of shallow foundation on homogeneous deposits- Terzaghi's formula and IS code formula – Factors affecting bearing capacity. Bearing capacity from in-situ tests (SPT, SCPT and plate load) – Effect of water table- Allowable bearing pressure – Safe bearing capacity – Seismic considerations in bearing capacity evaluation. Problems to assess bearing capacity

Settlement of foundations – Immediate, consolidation and secondary(creep) Settlements – Elastic Settlement of footings – Correction for depth and width of foundation - Determination of total Settlement of foundations on cohesion-less and cohesive soils as per relevant IS standards – Total and differential settlements – Allowable settlements as per relevant IS standards – Methods of minimizing total and differential settlements.

Unit–III

Contact pressure distribution on base of footings under rigid and flexible footings - Modulus of sub-grade reaction on rigid and flexible footings – Problems on contact pressure distributions beneath the isolated, combined ,strap and mat

foundations for axial and eccentric column loads. Draw shear force and bending moment diagrams using appropriate contact pressures beneath the foundations.

Unit–IV

Types of piles and their function – Factors influencing the selection of pile – Ground heave and pile heave effects- Effective length –Point of inflection - Load carrying capacity of single pile in cohesion-less or granular and cohesive soils as per relevant IS standards– static formula – Dynamic formulae (Engineering news and Hiley's) – Capacity from in-situ tests (SPT and SCPT) – Negative skin friction – Uplift capacity- Group capacity by different methods – Settlement of pile groups – Interpretation of pile load test (routine test only) – Under reamed piles – Capacity under compression and uplift.

Unit–V

Plastic equilibrium in soils – Active and passive states – Rankine's theory – Cohesion less and cohesive soil – Coulomb's wedge theory – Condition for critical failure plane – Earth pressure on retaining walls of simple configurations with and without surcharge and traffic loads – Culmann Graphical method – Pressure on the wall due to line load – Stability analysis of retaining walls.

TEXT BOOKS

1) Moothy, V.N.S., *Soil Mechanics and Foundation Engineering*, CBS Publishers and Distributers Ltd., New Delhi, 2007.
2) Gopal Ranjan and Rao A.S.R., *Basic and Applied soil mechanics*, New Age International Pvt. Ltd, New Delhi, 2005.

REFERENCE BOOKS

1) Das B.M. *Principles of Foundation Engineering*5th Edition, Thompson Asia Pvt. Ltd.,Singapore, 2003.
2) Kaniraj S.R., *Design aids in Soil Mechanics and Foundation Engineering*, Tata McGraw Hill Publishing Company Ltd., New Delhi, 2002.
3) Punmia B.C. *Soil Mechanics and Foundations*, Laxmi Publications Pvt.Ltd., New Delhi,2005
4) Venkatramaiah C. *Geotechnical Engineering*, New Age International Publishers, New Delhi, 2007 (Reprint)
5) Arora K.R, *Soil Mechanics and Foundation Engineering*, Standard Publishers and Distributors,New Delhi, 2005.
6) Purushothama Raj. P., *Soil Mechanics and Foundation Engineering*, 2nd Edition, Pearson Education, Delhi, 2013
7) Varghese, P.C., *Foundation Engineering*, Prentice Hall of India Private Limited, New Delhi, 2005.

STANDARDS

1) IS6403: 1981 (Reaffirmed 1997), Bearing capacity of shallow foundation, Bureau of Indian Standards, New Delhi.
2) IS 8009 (Part1):1976 (Reaffirmed 1998), Shallow foundations subjected to symmetrical static vertical loads, Bureau of Indian Standards, New Delhi.

3) IS 8009 (Part2):1980 (Reaffirmed 1995), Deep foundations subjected to symmetrical static vertical loading, Bureau of Indian Standards, New Delhi, 1992
4) IS 2911(Part1):1979 (Reaffirmed 1997), Concrete Piles, Bureau of Indian Standards, New Delhi.
5) IS 2911(Part2):1979 (Reaffirmed 1997), Timber Piles, Bureau of Indian Standards, New Delhi.
6) IS 2911(Part 3):1979 (Reaffirmed 1997), Under Reamed Piles, Bureau of Indian Standards, New Delhi.
7) IS 2911 (Part 4):1979 (Reaffirmed 1997), Load Test on Piles, Bureau of Indian Standards, New Delhi.

COURSE OUTCOMES

At the completion of the course students will be able

1) To select type of foundation required for the soil at a place and able to design shallow, foundation, deep foundation and retaining structures.
2) To calculate the safe bearing capacity of soils
3) To advise the type of foundation suitable for the particular soil type.

MAPPING WITH PROGRAMME OUTCOMES										
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**
CO1	✓	✓				✓		✓	✓	
CO2	✓	✓				✓		✓	✓	
CO3	✓	✓				✓		✓	✓	✓

02CP607	**ADVANCED MATERIAL TESTING LAB**	**L**	**T**	**P**
		0	**0**	**3**

COURSE OBJECTIVES

- To demonstrate the model analysis to understand the structural elements behaviour.
- To determine the material properties of different cross sections, steel reinforcements, concrete, etc.
- To understand the behaviour of HPC, HSC and SCC.

LIST OF EXPERIMENTS

1) Model analysis
   a) Continuous beam
   b) Portal frame
2) Flexure test on beams of various cross sections.
3) Flexure test on Continuous beam.
4) Sand heap analogy
5) Modulus of Elasticity of concrete
6) Modulus of Elasticity of Steel by Ewing's Extensometer

7) Modulus of Elasticity of Steel by Whitemore's Strain Gauge
8) Modulus of Elasticity of Steel by Electrical Strain Gauge
9) Unsymmetrical bending
10) Concrete durability tests
11) Preparation of HPC using chemicals and test on HPC
12) Preparation of HSC using chemicals and test on HSC
13) Preparation of SCC using chemicals and test on SCC

REFERENCE BOOKS

1) Sadhu Singh, *Experimental Stress Analysis,* Khanna Publishers, New Delhi, 2009.
2) Srinath.L.S, *Experimental Stress Analysis,* Tata McGraw Hill Publications ,New Delhi, 1984.
3) Ray.T.K, *Experimental Stress Analysis,* Tata McGraw Hill Publications,. New Delhi
4) Sadhu Singh, *Applied Stress Analysis,* Tata McGraw Hill Publications, New Delhi, 1983.
5) Dally & Riley, *Experimental Stress Analysis,* Tata McGraw Hill Publications, New Delhi, 1980.
6) Vazrani&Chandola, *Experimental Stress Analysis,* Tata McGraw Hill Publications, New Delhi, 1980.
7) Durelli A.J, A*pplied Stress Analysis,* Prentice Hall of India, Delhi, 1970.
8) Mehta P.K., and Monteiro, P.J.M., *Concrete, Microstructure, Properties and Materials*, Indian Concrete Institute, Chennai, 1997.
9) Shetty M.S., *Concrete Technology*, S.Chand& Co., New Delhi, 2002.

COURSE OUTCOMES

At the completion of the course students will be able

1) To understand the behaviour of steel elements for practical application.
2) To get experience in Modal analysis.
3) To understand the development of concrete for durability studies.

MAPPING WITH PROGRAMME OUTCOMES										
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**
CO1	✓	✓						✓		✓
CO2	✓	✓						✓		✓
CO3	✓	✓						✓	✓	✓

02CP608	COMPUTER PRACTICAL - III	L	T	P
		0	0	3

COURSE OBJECTIVES

- This course enables the students in studying and understanding structural drawings by training them in doing the structural drawings themselves for various structural elements and systems.

LIST OF EXERCISES

Plate 1. Draw cross section and longitudinal sections of a steel roof truss with Connection details as per SP:38–1987.

Plate 2. Draw cross section and longitudinal section of a welded plate girder as per
SP: 6 (2)- 1962.

Plate 3. Draw cross section, longitudinal section and reinforcement details of bunkers as per IS 4995 (Part I&II): 1974.

Plate 4. Draw cross section, longitudinal section and reinforcement details of silos as per IS 5503 (Part I):1969.

Plate 5 & 6. Draw cross section, longitudinal sections and reinforcement of water tanks resting on ground details as per IS 3370 (Part IV): 1967 and SP:34-1987.

a. Square or Rectangular
b. Circular

Plate 7 & 8. Draw cross section, longitudinal sections of Underground water tanks and reinforcement details as per IS 3370 (Part IV): 1967 and SP:34-1987.

a. Square or Rectangular
b. Circular

Plate 9 &10. Draw cross section, longitudinal section and reinforcement details of Elevated Rectangular and Circular water tanks as per IS 3370 (Part IV): 1967 and SP: 34- 1987.

Plate 11. Draw cross section, longitudinal section and reinforcement detailing of a RC grid floor as per IS 456: 2000.

TEXT BOOKS

1) Unnikrishna Pillai .S and Devdas Menon, *Reinforced Concrete Design*, Tata McGraw Hill Publications, New Delhi, 1988.
2) Krishnaraju.N, *Advanced R.C.Design*, Tata McGraw Hill Publications, New Delhi,1995

REFERENCE BOOKS

1) Shah.V.L&Karve, *Illustrated R.C. Design*, Structures Publications, Pune, 1996.
2) Mallick.S.K&Gupta.A.P, *Reinforced Concrete*, Oxford and IBM Publishing, New Delhi, 1987.
3) Punmia.B.C, et al, *R.C. Structures* - Vol.1 &II, Laxmi Publications (P) LTD, New Delhi, 1992.
4) Ramamrutham.S and Narayan.R, *Design of R.C. Structures*, Dhanpat Rai & Sons, New Delhi, 1993.

STANDARDS:

1) IS 456: 2000, Code of Practice for Plain and Reinforced Concrete, Bureau of Indian Standards, New Delhi.
2) IS 13920: 1993, Ductile Detailing of Reinforced Concrete Structures Subjected to Seismic Forces, Bureau of Indian Standards, New Delhi.
3) SP 34: 1987, Handbook On Concrete Reinforcement And Detailing, Bureau of Indian Standards, New Delhi.
4) IS: 2950 (part I) -1981, Code of Practice for Design and Construction of Raft Foundations. Bureau of Indian Standards, New Delhi.
5) IS 1904: 1986, Code of Practice for Design and Construction of Foundations in Soils : General Requirements. Bureau of Indian Standards, New Delhi.
6) IS: 2911 (Part 1/Sec 1)- 2010, Design and Construction of Pile Foundations Bureau of Indian Standards, New Delhi.
7) IS 2911 (Part III): 1980, Code of Practice for Design and Construction of Pile Foundations (Under-reamed piles).Bureau of Indian Standards, New Delhi.
8) IS 3370 (Part IV): 1967, Code Of Practice For Concrete Structures for the Storage of Liquids, Bureau of Indian Standards, New Delhi.
9) IS 4995 (Part I): 1974, Criteria for Design of Reinforced Concrete Bins for the Storage of Granular and Powdery Materials (General Requirements and Assessment of Bin Loads). Bureau of Indian Standards, New Delhi.
10) IS 4995 (Part II) :1974, Criteria for Design of Reinforced Concrete Bins for Storage of Granular and Powdery Materials (Design Criteria),Bureau of Indian Standards,New Delhi.
11) IS 9178 (Part II) :1979, Criteria for Design of Steel Bins for Storage of Bulk Materials (Design Criteria), Bureau of Indian Standards, New Delhi.
12) IS 5503 (Part I) :1969, General Requirements for Silos for grain storage (Construction requirements), Bureau of Indian Standards, New Delhi.
13) SP: 6 (2) - 1962 Steel beams and plate girders. Bureau of Indian Standards, New Delhi.
14) IS 3370 (Part IV) : 1967, Code Of Practice For Concrete Structures for the Storage of Liquids. Bureau of Indian Standards, New Delhi.

COURSE OUTCOMES

At the completion of the course students will be able

1) To gain knowledge on Steel structural elements for practical application.
2) To get experience / practice on Modern Software in Civil engineering field.
3) To design and development of Shop drawing for practical purpose.

MAPPING WITH PROGRAMME OUTCOMES										
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**
CO1	✓	✓						✓		✓
CO2	✓	✓						✓		✓
CO3	✓	✓						✓	✓	✓

01EP609	TRANSPORTATION ENGINEERING LABORATORY	L	T	P
		0	4	0

COURSE OBJECTIVES

- To introduce the students to various properties of the materials that is commonly used in Transportation engineering construction.
- To conduct tests on various construction materials.

LIST OF EXPERIMENTS

1) To Determine the Crushing Value of Coarse Aggregates.
2) To Determine the Impact Value of Coarse Aggregates.
3) To determine the Flakiness Index and Elongation Index of Coarse Aggregates
4) To determine the Abrasion Value of Coarse Aggregates.
5) To determine the fineness modulus and grading curve of coarse aggregates.
6) To Determine the Flash and Fire point of Bitumen
7) To determine the viscosity of Bitumen.
8) To determine the penetration Value of Bitumen.
9) To determine the Softening Point of Bituminous material.
10) To determine the Ductility Value of Bituminous material.
11) To determine the Flash and Fire Point of Bituminous material.
12) To determine the Marshal Stability Value of Bituminous mixture.

REFERENCE BOOKS

1) Khanna S. K., Justo C.E.G, & Veeraragavan A., *Highway Materials and Pavement Testing*, Nem Chand and Bros., Roorkee- 247 667.
2) Gambhir, M.L., Jamwal Neha, Lab Manual: *Building and construction materials, Testing and Quality Control*" McGraw Hill Education (India), Pvt. Ltd., Noida.
3) Duggal, Ajay K., Puri, Vijay P., *Laboratory Manual in Highway Engineering*, New Age International (P) Limited, Publishers, New Delhi.
4) Sood Hemant, Mittal, L.N., Kulkarni,P.D., *Laboratory Manual on Concrete Technology*" CBS Publishers & Distribiters Pvt. Ltd. New Delhi.

COURSE OUTCOMES

At the end of the course students will be able

1) To gain knowledge about the mechanical properties of materials such as Coarse Aggregate, concrete and bitumen.
2) Check the aggregates quality used for the roads
3) Suggest and advice on the material selection and its purpose.

MAPPING WITH PROGRAMME OUTCOMES										
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	✓		✓					✓		
CO2	✓							✓	✓	
CO3	✓							✓	✓	

SEVENTH SEMESTER

00HS701	ENGINEERING ETHICS	L	T	P
		4	0	0

COURSE OBJECTIVES

- To understand the moral and ethical dimensions in engineering.
- To take balanced decisions.

Unit–I

Senses of 'Engineering Ethics' – Variety of moral issues – Types of inquiry – Moral dilemmas – Moral Autonomy – Kohlberg's theory – Gilligan's theory – Consensus and Controversy – Professions and Professionalism – Professional Ideals and Virtues – Uses of Ethical Theories.

Unit–II

Engineering as Experimentation – Engineers as Responsible Experimenters – Research Ethics - Codes of Ethics – Industrial Standards - A Balanced Outlook on Law – The Challenger Case Study.

Unit–III

Safety and Risk – Assessment of Safety and Risk – Risk Benefit Analysis – Reducing Risk – The Government Regulator's Approach to Risk - Chernobyl Case Studies and Bhopal.

Unit–IV

Collegiality and Loyalty – Respect for Authority – Collective Bargaining – Confidentiality – Conflicts of Interest – Occupational Crime – Professional Rights – Employee Rights – Intellectual Property Rights (IPR) – Discrimination.

Unit–V

Multinational Corporations – Business Ethics - Environmental Ethics – Computer Ethics - Role in Technological Development – Weapons Development – Engineers as Managers – Consulting Engineers – Engineers as Expert Witnesses and Advisors – Honesty – Moral Leadership – Sample Code of Conduct

TEXT BOOKS

1) Govindarajan M, Natarajan S and Senthilkumar, V S, *Professional Ethics and Human Values*, PHI Learning, New Delhi, 2013.
2) Mike Martin and Roland Schinzinger, *Ethics in Engineering*, McGraw Hill, New York, 2005.

REFERENCE BOOKS

1) Charles E Harris, Michael S Pritchard and Michael J Rabins, *Engineering Ethics – Concepts and Cases,*Cengage Learning, Boston, 2013.
2) Charles D Fleddermann, *Engineering Ethics*, Prentice Hall, New Mexico, 1999.
3) John R Boatright, *Ethics and the Conduct of Business*, Pearson Education, Chennai, 2003.
4) Edmund G Seebauer and Robert L Barry, *Fundamentals of Ethics for Scientists and Engineers,* Oxford University Press, Chennai, 2001.
5) David Ermann and Michele S Shauf, *Computers, Ethics and Society*, Oxford University Press, Chennai, 2003.

COURSE OUTCOMES

At the completion of the course students will be able to

1) Understand the relationship between the engineer and the society.
2) Learn the importance of codes in engineering practice.
3) Acquire knowledge on the legal, moral and ethical aspects in engineering.

MAPPING WITH PROGRAMME OUTCOMES										
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	✓								✓	
CO2	✓								✓	✓
CO3	✓								✓	

02PC702	PRESTRESSED CONCRETE	L	T	P
		4	0	0

COURSE OBJECTIVES

- To inculcate the basics of pre-stressing techniques to understand the design concepts used for design of bridge structures.

Unit–I

Prestress basic concepts – Advantages – Tendons, strands, concrete, end anchorages – Systems and methods of pre-stressing- Analysis of sections – Stress concept – Strength concept – Load balancing concept - Effect of loading on the tensile stresses in tendons – Losses of Prestress - Total losses for pre and post tensioning systems.

Unit–II

Flexural strength – Simplified procedures as per codes – Strain compatibility method – Basic concepts in selection of cross section for bending - Design of sections as per code for pre-tensioned and post-tensioned rectangular beams – Check for strength limit based on IS:1343-2012 – Design for shear based on IS:1343-2012. Design of anchorage zone reinforcement (end block)

Unit–III

Composite Sections – Types – Advantages - Analysis of stresses for composite sections – Analysis and Design – Flexural and shear strength of composite members – Shear key.

Unit–IV

Factors influencing deflections – Effect of tendon profile on deflections – Calculation of deflections –Short term deflections of un-cracked members – Prediction of long term deflections due to creep and shrinkage – Check for serviceability limit state of deflection and crack width.

Continuous beams-Method of achieving continuity-Analysis-Concordant cable and linear transformation

Unit–V

Design of concrete pipes - Circular tanks - poles - Rail way sleepers – Partial Prestressing – Applications.

TEXT BOOKS

1) Krishna Raju N, *Pre-stressed concrete*, 5thEdition, Tata McGraw Hill Company, New Delhi, 2012.
2) Pandit.G.S. andGupta.S.P., *Pre-stressed Concrete*, CBS Publishers and Distributers Pvt. Ltd, New Delhi, 2012.

REFERENCE BOOKS

1) Rajagopalan.N, *Pre-stressed Concrete*, Narosa Publishing House, New Delhi, 2002.
2) Dayaratnam.P., *Pre-stressed Concrete Structures*, Oxford and IBH, New Delhi, 2013.
3) Lin T.Y. and Ned.H.Burns, Design of prestressed Concrete Structures, 3rd Edition, Wiley India Pvt. Ltd., New Delhi, 2013.
4) IS1343:1980, Code of Practice for Pre-stressed Concrete, Bureau of Indian Standards, New Delhi, 2012.
5) IS 3370-1:2009 Concrete structures for storage of Liquids. Bureau of Indian Standards, New Delhi, 2012.

COURSE OUTCOMES

At the completion of the course students will be able

1) To gain knowledge on methods of pre-stressing.
2) To design various Pre-stressed concrete structural elements.
3) Understand the deflection criteria and its Codal recommendations
4) Understand the concepts of composite section and its analysis

MAPPING WITH PROGRAMME OUTCOMES										
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**
CO1	✓	✓								
CO2	✓	✓								✓
CO3	✓	✓								✓
CO4	✓	✓								✓

02CP706	**EARTHQUAKE ENGINEERING LABORATORY**	**L**	**T**	**P**
		0	**0**	**3**

COURSE OBJECTIVES

- This course aims at providing practical training in understanding the behaviour of the building elements subjected to earthquake.

LIST OF EXPERIMENTS

1) Free vibration analysis of wooden cantilever beam model.
2) Free vibration analysis of steel cantilever beam model.
3) Free vibration analysis of aluminium cantilever beam model.
4) Free vibration analysis of glass cantilever beam model.

5) Determination of viscous damping co-efficient for wooden cantilever beam model.
6) Determination of viscous damping co-efficient for steel cantilever beam model.
7) Determination of viscous damping co-efficient for aluminium cantilever beam model.
8) Determination of viscous damping co-efficient for glass cantilever beam model.

ADDITIONAL EXPERIMENTS:

1) Dynamics of a three storied building frame subjected to harmonic motion
2) Dynamics of a three storied building frame subjected to periodic (non-harmonic) base motion.
3) Dynamics of a vibration absorber.
4) Dynamics of one-span beams.

REFERENCE BOOKS

1) Anil K Chopra, *Dynamics of Structures*, McGraw-Hill International Edition, New Delhi,1998.
2) Clough, R.W. and Penzien, J., *Dynamics of Structures*, 2nd Edition, McGraw-Hill International Edition, New Delhi, 1993.
3) Mario Paz, *Structural Dynamics: Theory and Computation,* Van Nostrand Reinhold, New York, 1985.

COURSE OUTCOMES

At the completion of the course students will be able

1) To understand the dynamic properties.
2) To gain knowledge about the earthquake occurrence and resistance.
3) To analyse the structure under free and forced vibrations.

MAPPING WITH PROGRAMME OUTCOMES										
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	✓	✓						✓		
CO2	✓	✓							✓	✓
CO3	✓	✓						✓		✓

02EP707	COMPUTER PRACTICAL IV	L	T	P
		0	0	3

COURSE OBJECTIVES

- This course trains the students to carry out basic build frame analysis for symmetrical and un-symmetrical building frames..

LIST OF EXPERIMENTS

Introduction to STADD PRO and ETABs Software

Plate 1. Analysis of Symmetrical Building Frames (Gravity Load Only) using STADD PRO Software.

Plate 2. Analysis of Symmetrical Building Frames(Wind Load Only) using STADD PRO Software.

Plate 3. Analysis of Symmetrical Building Frames(Earthquake Load Only) using STADD PRO Software.

Plate 4. Analysis of Un-Symmetrical Building Frames(Gravity Load Only) using STADD PRO Software.

Plate 5. Analysis of Un-Symmetrical Building Frames(Wind Load Only) using STADD PRO Software.

Plate 6. Analysis of Un-Symmetrical Building Frames(Earthquake Load Only) using STADD PRO Software.

Plate 7. Analysis of Symmetrical Building Frames(Gravity Load Only) using ETABs Software.

Plate 8. Analysis of Symmetrical Building Frames(Wind Load Only) using ETABs Software.

Plate 9. Analysis of Symmetrical Building Frames(Earthquake Load Only) using ETABs Software.

Plate 10. Analysis of Un-Symmetrical Building Frames(Gravity Load Only) using ETABs Software.

Plate 11. Analysis of Un-Symmetrical Building Frames(Wind Load Only) using ETABs Software.

Plate 12. Analysis of Un-Symmetrical Building Frames(Earthquake Load Only) using ETABs Software.

REFERENCE BOOKS

1) STADD PRO and ETABs Software Working Manuals.
2) Krishnaraju.N, *Advanced R.C. Design*, CBS Publishers & Distributors Pvt. Ltd, New Delhi, 2012.
3) Punmia.B.C, et al, *R.C. Structures- Vol.I& II,* Laxmi Publications, Chennai, (P) Ltd., 1995
4) Mallick.S.K&Gupta.A.P, *Reinforced Concrete*, Oxford I B H, New Delhi, 1987.
5) Park and Paulay. T, *R.C. Structures*, Tata McGraw Hill Publications, New Delhi, 1975.

COURSE OUTCOMES

At the completion of the course the student will be able to understand

1) The basic structural analysis of both symmetrical and un-symmetrical frames.
2) Modelling, analysis and design using STAADPro.
3) Modelling, analysis and design using ETABS.

MAPPING WITH PROGRAMME OUTCOMES										
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**
CO1	✓	✓						✓		
CO2	✓	✓						✓		✓
CO3	✓	✓						✓		✓

02ST708	SEMINAR / INDUSTRIAL TRAINING	L	T	P	S
		0	0	0	1

COURSE OBJECTIVES

- To encourage the students to study advanced engineering developments.
- To Prepare and present technical reports.
- To encourage the students to use various teaching aids such as over head projectors, power point presentation and demonstrative models.

METHOD OF EVALUATIONS

- During the seminar session each student is expected to prepare and present the topic on the relevant engineering project topics for duration of about 8 to 10 minutes.
- In a session of 3 periods per week, 15 students are expected to present the seminar.
- Each student is expected to present at least twice during the semester and the student is evaluated based on that.
- At the end of the semester, he/she can submit a report on his/her topic of seminar and marks are given based on the reports.
- A faculty guide is to be allotted and he/she will guide and monitor the progress of the student and maintain attendance also.
- Evaluation is 100% Internal.

EIGHTH SEMESTER

02PV803	PROJECT WORK AND VIVA VOCE	L	T	P
		0	0	15

COURSE OBJECTIVES

- To develop the ability to solve a specific problem right from its identification and literature review till the successful solution of the same.
- To train the students in preparing project reports and to face reviews and viva voce examination.

COURSE OUTCOMES

1) On Completion of the project work students will be in a position to take up any challenging practical problems and find solution by formulating proper methodology
2) Carrying out any experimental works on concrete and steel or any other construction material to know the behavior and properties
3) Understand the modelling, analysis and design concepts by taking up a structure.

MAPPING WITH PROGRAMME OUTCOMES										
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	✓	✓	✓			✓		✓		
CO2	✓	✓	✓			✓		✓		✓
CO3	✓	✓	✓			✓		✓		✓

PROFESSIONAL ELECTIVES

01PEXXX	ENVIRONMENTAL ENGINEERING	L	T	P
		4	0	0

COURSE OBJECTIVES

- To make the students conversant with basic principles of water supply engineering.
- To know quantification of water, analysis, sources, conveyance, treatment and distribution of water.

Unit–I

Objectives of public water supply schemes; Health acceptability, adequacy, convenience and economy. Per Capita Demand- Population forecasting - Variation in demand pattern Surface and Sub- Surface water sources - Typical Characteristics - Impounded storage reservoirs-Mass curve analysis – Infiltration Pipes, Wells and Galleries - Tube wells-Construction - Sea & Back water sources-Intake Structures.

Unit–II

Pipe and Channels for transmitting water- Hydraulics of pipe flow - Use of charts and Nomo grams for flow computations- Materials for pipes and conduits ; Alloys of Steel, Cement Composites and Plastic pipes –Pipe loses - Laying, Jointing and Testing -Appurtenances of pipes- Pumps and Pumping stations- Selection of pumps.

Unit–III

Unit–processes of water treatment- Screening- Coagulation & Flocculation-Clarifier- Clariflocculator- Media Filters: Gravity & Pressure- Filter Medias: Sand, Activated Carbon, Mixing basins - Principles of disinfection – Methods of Disinfection; Chlorination, UV Radiation, Ozonation, etc,.- Water softening: Cationic, Anionic and Mixed Beds - Iron and Manganese removal - Operation and maintenance aspects.

Unit–IV

Sewage, Sewer and Sewerage- Collections & Conveyance of sewage-Classification of sewerage system- Quantity of sewage- Fluctuation of sewage flow – Hydraulics of sewers-Self cleaning velocity- Shapes of sewers- Hydraulic design of sewers-Hydraulic design of storm water drains.

Unit–V

Primary & Secondary Treatment processes in wastewater treatment - Aerobic, Anaerobic and combinations of processes - Screens, Grit chamber, Settling tanks, Septic tanks and disposal arrangements.

Sources and types of municipal solid wastes - Waste generation rates - Factors affecting generation, characteristics- Methods of sampling and characterization; Effects of improper disposal of solid wastes - Public health and environmental effects. Elements of solid waste management – Social and Financial aspects –

Municipal solid waste (M&H) rules – Integrated management - Public awareness; Role of NGO's.

TEXT BOOKS

1) Garg.S.K, *Water Supply Engineering*, Khanna Publishers, Delhi, 2005.
2) Duggal.K.N, *Elements of Environmental Engineering*, S.Chand &Company, New Delhi 2004.

REFERENCE BOOKS

1) Arcadio P.Sincerosr, Gregoria A.Sincero, *Environmental Engineering a Design Approach*, Prentic Hall, New Delhi, 2002.
2) Glynn Henry.J & Gary W Heinke, *Environmental Science and Engineering*, Prentice Hall of India, New Delhi, 2004.
3) Garg.S.K, *Waste Disposal Engineering*, Khanna Publishers, New Delhi, 2005.
4) Manser A.G.R. and Keeling A.A, Practical Handbook of Processing and Recycling of *Municipal solid Wastes*, Lewis Publishers, CRC Press, Taylor & Francis Books India Pvt. Ltd., New Delhi, 1996.
5) Punmia.B.C, *Environmental Engineering-II*, Laxmi Publications (P) LTD, 2005.
6) Garg.S.K, *Sanitary Engineering*, Khanna Publishers, New Delhi, 2005
7) George Tchobanoglous and Frank Kreith, *Handbook of Solid waste Management*, McGraw Hill, New York, 2002.

COURSE OUTCOMES

At the completion of the course students will be able

1) To understand the water supply and distribution systems.
2) To understand the sewage and sewerage systems.
3) To understand the pollutions caused due to water supply and sanitary.

MAPPING WITH PROGRAMME OUTCOMES										
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	✓		✓		✓			✓	✓	
CO2	✓		✓					✓	✓	
CO3	✓		✓					✓	✓	✓

01PEXXX	TRANSPORTATION ENGINEERING	L	T	P
		4	0	0

COURSE OBJECTIVES

- To impart knowledge on the layout, operations and design of Highways, Railways, Waterways and Airways transportation systems which would be of great use for transport engineers.

Unit–I

Highway Planning - Importance of high ways in national development - Highway planning in India - Road Classification in rural and urban areas - Road alignment and surveys - Geometric Design of highways.

Unit–II

Highway Construction and Traffic Engineering - Pavement Design - Principles - Flexible and rigid pavements- Highway materials- Highway construction- Drainage facilities- Volume, speed, capacity and parking studies - Traffic management principles-Basics inter-section design.

Unit–III

Railway Engineering - Reconnaissance and location surveys - Alignments - Permanent way -

Ballast - Sleepers - Rail - Chairs and fastenings, gauges, creep and anticreep appliances – Stations and yards - Proposal location and sites - General equipment and layout - Platforms and engine sheds - Points and crossings - Theory and design - Turn out - Cross - over - Signaling and interlocking - system - Types of slotting arrangements.

unit–IV

Airport Engineering - Airports - Their importance - Spacing and position in relation to their zone - Construction and maintenance of auxillary and terminal building - Location and layout – Traffic control in the vicinity of aero-dromes and its effect on design - International standards. Classification of airports - Structural requirements - Site selection - Airport components – Geometric standards - Runway design - Planning Terminal buildings - Visuals - Air traffic - Airport drainage.

Unit–V

WATERWAYS and other works - Importance of Water Transport- Inland waterways- Components and functions of docks - Harbours and Ports - Classification and requirements - choice of site - Channel regulation - Dredging - Types of dredges - Dock and quay walls - Dock entrances and locks - Floating docks.

TEXT BOOKS

1) Kamala.A, *Transportation Engineering*, Tata McGraw-Hill Publishing Company Limited, New Delhi, 1989.
2) Rangwala.S.C, *Railway Engineering,* Chartor Publishing House, New Delhi, 1992

REFERENCE BOOKS

1) Saxena and Arora, *Railway Engineering*, Dhanpat Rai Publications(P) Ltd., New Delhi, 2010

   Khanna S.K. & M.G. Arora, *Airport Planning & Design*, 6th Edition, New Chand Brothers, New Delhi, 1999.
2) Bindra.S.P, *Docks and Harbour Engineering*, Dhanpat Rai and Sons, New Delhi, 1992.
3) Ahuja.T.D, *Highway Engineering*, Standard Book House, New Delhi, 2010.
4) Srinivasan, *Harbour*, *Dock and Tunnel Engineering,* Chartor Publishing House, New Delhi, 1991

COURSE OUTCOMES

At the completion of the course students will be able

1) To understand the design of highways
2) To understand the design of airways
3) To understand the design of waterways.

MAPPING WITH PROGRAMME OUTCOMES										
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	✓			✓					✓	
CO2	✓			✓					✓	✓
CO3	✓			✓	✓				✓	✓

01PEXXX	ARCHITECTURE	L	T	P
		4	0	0

COURSE OBJECTIVES

- To introduce various architectural aspects.
- To understand the history of architecture.
- To realize the impact of climate on architecture of buildings.

Unit–I

Review of History of Architecture – Egyptian Mesopotamia classical and Indian Buddhist Architecture – Evolution of Hindu temple Architecture- Islamic and Mughal Architecture – Cross culture influences – Influences of Architecture on Nature, Climate, Topography and Materials – Represented plan – Growth of mass from plan – Space organization – Principles of composition, contrast, proportion, scale, balance, unity, character of composition.

Unit–II

Shelter or form – Climate and thermal comfort in India – Passive heating and cooling strategies – settlement patterns and site planning – Openings in Hot climates – Wind, Sun and Shading – Day lighting and shading – Natural ventilation of buildings in India – Appropriate Technology for a Climatically Responsive Low Energy Architecture – Projects and Case studies.

Unit–III

Planning of residential buildings – Space units of Living, Dining, Sleeping areas, Kitchens and Bathrooms – Single storied, Double storied Residential buildings with different roofing systems – Multiple accommodations – Apartments – Group Housing – Gated Communities – Housing for Handicapped – Housing for Elderly – Youth Hostels.

Unit–IV

Planning concept of commercial buildings – Requirements of Spaces – Parking standards – Shopping centre – Banks – Super Markets - Hotel / Motel – Planning concept of Health Structures – requirements of spaces depends on specialty of disease – Medical Centres – Sub Health Centres – Laboratories – Medical Institutions – Concept Line Drawings – Projects.

Unit–V

Planning concept of Institutional Structures – General Planning Concept of Play way / Kinder Garden Schools, Elementary, Secondary and Senior Secondary Schools, Library buildings – Technical Institutions – Institutions for Humanities Studies – Gymnasium and Swimming Pools – Planning concepts of Industrial Structures – General – Workshop – Ware Houses – Machine Housings.

TEXT BOOKS

1) Joseph De Charia & John Callender "*Time saver standards for Building Types*", 3rd Edition, Mc Graw Hill International Edition, 2001.
2) Aravind Krishnan, Simos Y Annas, Nick Baker and S.V. Szokolay "*Climate* responsive architecture (A Design Hand Book for Energy Efficient Buildings)", 2002.

REFERENCE BOOKS

1) Earnest Pickering "*Architecture Design*" John Wiley & Sons, 2009
2) Pratap Rao.M., "Architectural Design - Theory & Design shopping Centre Designs", International Council of Shopping Centres, 2013.

COURSE OUTCOMES

At the end of the course students will be able to

1) Recognize the different qualities of architecture.
2) Understand that architecture can enhance the building in terms of appearance and utility.
3) Realize that architectural design can improve comfort in living conditions of buildings.
4) Apply architectural concept and design buildings according to specific requirements.

MAPPING WITH PROGRAMME OUTCOMES										
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**
CO1	✓		✓							
CO2	✓		✓							
CO3	✓	✓							✓	
CO4	✓	✓								✓

00PEXXX	**ENGINEERING GEOLOGY**	**L**	**T**	**P**
		4	**0**	**0**

COURSE OBJECTIVES

- This course will give the importance of Geology in civil engineering filed during earthquake, volcanism and the action of various geological agencies. The students of civil engineering will realize the importance of this knowledge in projects such as dams, tunnels, bridges, roads, airport and harbour.

Unit–I

Geology in civil engineering – structure of earth (Crust, mantle and Core) – Crust formation- layers of crust - weathering of rocks – scale of weathering – soils -

landforms and processes associated with river, wind, groundwater and sea – relevance to civil engineering. Theory of Plate tectonics – origination of Earth quakes – Seismic zones in India.

Unit–II

Physical properties of minerals – Quartz group, Feldspar group, Pyroxene - hypersthene and augite, Amphibole – hornblende, Mica – muscovite and biotite, Calcite, Gypsum and Clay minerals.

Unit–III

Classification of rocks, distinction between Igneous, Sedimentary and Metamorphic rocks. Engineering properties of rocks. Description, occurrence, engineering properties, distribution and uses of Granite, Dolerite, Basalt, Sandstone, Limestone, Laterite, Shale, Quartzite, Marble, Slate, Gneiss and Schist.

Unit–IV

Geological maps – attitude of beds, study of structures – folds, faults and joints – relevance to civil engineering. Geophysical methods – Seismic and electrical methods for subsurface investigations.

Unit–V

Remote sensing for civil engineering applications; Geological conditions necessary for design and construction of Dams, Reservoirs, Tunnels, and Road cuttings.Coastal protection structures. Investigation of Landslides, causes and mitigation.

TEXT BOOKS

1) Varghese, P.C., *Engineering Geology for Civil Engineering*, PHI Learning Private Limited, New Delhi, 2012.
2) Venkatareddy. D, *Engineering Geology*, Vikas Publishing House Pvt. Ltd., Chennai, 2010.

REFERENCE BOOKS

1) Muthiayya, V.D.“ *A Text of Geology*”, Oxford IBH Publications, Calcutta, 1969.
2) Blyth F.G.H. and de Freitas M.H., *Geology for Engineers*, Edward Arnold, London, 2010.
3) Bell F.G, *Fundamentals of Engineering Geology*, B.S. Publications. Hyderabad 2011.
4) Gokhale, *Principles of Engineering Geology*, BS Publications, Hyderabad, 2011.
5) ChennaKesavulu. N, *Textbook of Engineering Geology*, Macmillan India Ltd., Gurgaon, 2009.
6) Parbin Singh. A Text book of Engineering and General Geology, Katson publishing house, Ludhiana, 2009.
7) Dobrin, M.B, *An introduction to geophysical prospecting*, McGraw-Hill, New Delhi, 1988.
8) *Engineering Geology for Civil Engineers*, PHI Learning Pvt Ltd, New Delhi, 2012.

COURSE OUTCOMES

At the end of the course students will be able

1) To gain knowledge on projects such as dams, tunnels, bridges.

2) To realize the importance of Earthquake, volcanism and the action of various geological agencies.
3) To choose the types of foundations and other related aspects roads, airport and harbour.

MAPPING WITH PROGRAMME OUTCOMES										
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	✓		✓	✓					✓	
CO2	✓		✓	✓		✓			✓	✓
CO3	✓		✓	✓		✓			✓	✓

01PEXXX	IRRIGATION ENGINEERING AND WATER POWER ENGINEERING	L	T	P
		4	0	0

COURSE OBJECTIVES

- This course aims at equipping the structural engineers with a basic understanding of the principles and operation of irrigation works and hydro electric systems which will help them design hydraulic structural systems and water power installations.

Unit–I

Necessity for irrigation - Types of irrigation - Duty - Factors affecting duty - Importance - Expressions for duty.

Unit–II

Diversion head works - Definition - Weirs - Barrages - Causes of failure - Khoslas theory – Blighs theory - Factors governing the design of weir or a barrage - Flood banks - Protective works -Retrogression of levels.

Unit–III

Storage works - Dams - Types - Problems - Methods of construction - Selection of a particular type of a dam - Selection of a dam site - Earth dams - Causes of failure - Stability of slopes – Slope protection - Tank bunds - Minor and major tanks - Design principles.

Unit–IV

Distribution Systems - Design and alignment of main canals - Practical selection of canals -Water logging - Alkalinity of soils - Principles of design of drainage canals - Lining of canals - Works for regulation of water levels - Cross drainage and surplus works - Communication works.

Unit–V

Water power - History and development in India - General principles - classification - High, low, medium head installations - Components of hydroelectric installations.

TEXT BOOKS

1) Punmia B.C. and Pandey B.B.Lal , Irrigation and Water Power Engineering, Lakshmi Publications, New Delhi, 16 th Edition, 2009.
2) Santosh Kumar Garg, Irrigation Engineering and Hydraulic Structures, Khanna Publishers, Delhi, 2011.

REFERENCE BOOKS

1) Sharma R.K. and Sharma T.K., Principles and Practice of Irrigation Engineering, S. Chand & Company Private Limited, New Delhi, 2008.
2) Ward R.C. and Robinson, Principles of Hydrology, Tata McGraw Hill Publishing Co., New Delhi,1990.
3) Dilip Kumar Majumdar, Irrigation Water Management (Principles & Practices), Prentice Hall of India (P) Ltd., New Delhi, 2008.
4) Arora K.R., Irrigation, Water Power and Water Resources Engineering , Standard Publishers Distributors, New Delhi, 2009.
5) Basak N.N., Irrigation Engineering, Tata McGraw Hill Publishing Co., New Delhi, 2008.
6) Asawa G.L., Irrigation Engineering, New Age International Publishers, New Delhi, 2000.
7) Michael A.M., Irrigation Theory and Practice, Vikas Publishing Pvt. Ltd., New Delhi, 2008.

COURSE OUTCOMES

At the end of the course students will be able to

1) Understand the concepts of irrigation.
2) Identify the different types and methods of irrigation suitable for optimum water management.
3) Plan and design structures for irrigation.
4) Apply irrigation management techniques.

MAPPING WITH PROGRAMME OUTCOMES										
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**
CO1	✓				✓				✓	
CO2	✓				✓	✓			✓	
CO3	✓	✓			✓	✓				✓
CO4	✓				✓	✓	✓			✓

02PEXXX	**STRUCTURAL CONCRETE DESIGN - III**	**L**	**T**	**P**
		4	**0**	**0**

COURSE OBJECTIVES

- To make the students to expose with the design practices of elevated water tanks, deep beams, grid floors, flat slabs, concrete walls.

Unit–I

Design of Elevated square, rectangular and circular shape water tanks with staging – Design includes cover slab; side wall, base slab, columns with staging as per IS 11992: 1995, Reinforcement detailing as per SP 34: 1987.

Unit–II

Design of concrete Corbels for crane loads, Design of Deep beams using Strut and tie concept - Reinforcement detailing as per SP 34: 1987.

Unit–III

Design of Ribbed (Voided Slabs), Design of Grid floors - Reinforcement detailing as per SP 34: 1987.

Unit–IV

Design of Flat Slabs using Direct Design Method - Equivalent Frame Method - Reinforcement detailing as perSP 34: 1987.

Unit–V

Design of Concrete Shear Walls - Design of concrete joints - Interior and exterior column beam joints - Reinforcement detailing as per SP 34: 1987.

TEXT BOOKS

1) Krishnaraju.N, *Advanced R.C. Design*, CBS Publishers & Distributors Pvt Ltd, New Delhi, 2012.
2) Punmia.B.C, et al, *R.C. Structures- Vol.I& II,* Laxmi Publications (P) Ltd., Chennai, 1995
3) Mallick.S.K&Gupta.A.P, *Reinforced Concrete*, Oxford &IBH Publishing, New Delhi, 1987.
4) Park and Paulay. T, *R.C. Structures*, Tata McGraw Hill Publications, New Delhi, 1975.

REFERENCE BOOKS

1) Ramamrutham.S and Narayan. R, *Design of R.C. Structures,* Dhanpat Rai and Sons, Delhi,1992.
2) Dayaratnam P, *Design of RC Structures*, OXFORD & IBH Publishing, New Delhi, 2000.
3) Punmia.B.C, *R.C. Structures– Vol. II,* Standard Publishers, New Delhi, 1991.

STANDARDS

1) IS 456: 2000, Code of Practice for Plain and Reinforced Concrete, Bureau of Indian Standards, New Delhi.
2) IS 13920: 1993, Ductile Detailing of Reinforced Concrete Structures Subjected to Seismic Force, Bureau of Indian Standards, New Delhi.
3) SP 34: 1987, Handbook on Concrete Reinforcement And Detailing, Bureau of Indian Standards, New Delhi.
4) IS 3370 (Part IV): 1967, Code Of Practice for Concrete Structures for the Storage of Liquids, Bureau of Indian Standards, New Delhi
5) IS 11992: 1995, Criteria for Design Of RCC Staging For Overhead Water Tanks, Bureau of Indian Standards, New Delhi
6) IS 3370 (PART I): 2009, Concrete Structures for Storage of Liquids, Bureau of Indian Standards New Delhi

COURSE OUTCOMES

At the completion of the course students will be able

1) To design the special structural elements as per relevant IS standards.
2) To design the grid floor and flat slabs as per codal recommendations.
3) To understand the force flow at the joints and design of joints.

MAPPING WITH PROGRAMME OUTCOMES										
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	✓	✓								✓
CO2	✓	✓								✓
CO3	✓	✓								✓

01PEXXX	ESTIMATION AND VALUATION	L	T	P
		4	0	0

COURSE OBJECTIVES

- To equip the students with current practices in cost and material estimates.
- To identify the methods adopted for different structural components.
- To impart knowledge on valuation practices necessary to make the student a complete civil engineer.
- To learn the tender procedure.

Unit–I

Introduction – Philosophy – Purpose – Types of estimates – Units of Measurements – Simple Problems in Approximate method of Estimates – Specifications – necessity – Type of Specifications – Writing Technical Specifications for Earth work excavation, PCC, Brick work, RCC, Plastering, Mosaic Flooring, DPC, Painting, White washing.

Unit–II

Detailed estimates – Types – Estimate for Compound Wall – Simple Load Bearing Buildings and framed Buildings – Septic Tank – Water Sump – Estimates of Bituminous and Cement Concrete Roads – Canals and Embankments.

Unit–III

Purpose – Requirements – Schedule of Rates and Standards Data Book – Preparation of data for different items of construction work – Mortar –Concrete – Brick and R.R Masonry – Plastering works – Pointing – DPC works – Preparation of Abstract.

Unit–IV

Introduction – Types of Tenders – TTA Act 2000 – Drafting Model Tender Notice – Tender documents – Tender Procedure – E-Tendering – Contracts – Types of Contracts – Construction of Contract documents – Essentials of Contract conditions – Introduction to Arbitration and legal Requirements.

Unit–V

Introduction – Necessity – Types of Valuations – Introduction to Important terms like Market value, Scrap value, Guideline value, Earning value, Monopoly value, Distress value, Capital gain, free hold and Lease hold properties, Gift tax – Valuations for Lands and Buildings – Fixation of Rent – Simple Problems.

TEXT BOOKS

1) Dutta B.N., *Estimating and Costing in Civil Engineering*, S.Dutta& Company, Lucknow, 2016.
2) Chakraborthi M., Estimating and Costing Specifications in Civil Engineering, Kolkatta, 2006.

REFERENCE BOOKS

1) Rangwala S.C., Elements of Estimating and Costing in Civil Engineering, Charotar Publishing House, India, Gujarat, 2011.
2) Kohli D.D. and Kohli R.C., A Text Book of Estimating and Costing (Civil)S. Chand & Company, Limited,New Delhi, 2012.
3) Banerjee D.N., *Principles and Practices of Valuation*, 5thEdition, Eastern Law House, Kolkata, 1998.
4) Vazirani, V.N. and Chandola S.P., *Estimating and Costing*, Khanna Publishers, New Delhi, 2011.
5) Rangwala S.C., *Valuations of Real Properties*,Charotar Publishing House, Gujarat, 2008.
6) Hand book of Consolidated Data – 8/2000, Volume I TNPWD, Chennai.
7) Tamilnadu Transparencies in Tender Act, Chennai, 2000.

COURSE OUTCOMES

1) At the completion of the course students will be able to
2) Prepare a detailed estimate for different types of structures.
3) Prepare valuation reports.
4) Understand and execute rate analysis of various works in construction.

MAPPING WITH PROGRAMME OUTCOMES										
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	✓						✓			
CO2	✓						✓			
CO3	✓						✓			
CO4	✓						✓			

02PEXXX	ADVANCES IN CONCRETE TECHNOLOGY	L	T	P
		4	0	0

COURSE OBJECTIVES

- To develop furtherance of knowledge about advances in concrete technology.
- To introduce concept of mix design for special concretes.
- To develop the principles of special concreting techniques and non destructive testing procedures for concrete structures.

Unit–I

Admixtures – Chemical – Mineral – SCMs and CRMs - Pozzolanic classification in concrete – use of fly ash, GGBS, silica fume, metakaolin in concrete –Concept of mix design for HPC, HSC, SCC – special concrete –Types – Classification – Properties – Applications –Pumped concrete – RMC

Unit–II

Definition - Fibre reinforced concrete – Properties of fibres and matrices – Mix proportioning– Properties of fresh and hardened fibre reinforced concrete – Durability – applications– SIFCON – SIMCON – Properties – Applications – Composite manufacturing.

Unit–III

Ferro-cement – Historical development – Constituent materials – Construction procedures – mechanical and durability properties – Design of Ferro-cement product – Applications.

Unit–IV

Special concrete: Light weight concrete – No fine concrete – High density concrete–polymer concrete composite – Classification – Application –Grouts and Grouting – Gunitingand shortcreting – Geopolymer concrete – Properties – Application – Special concreting techniques – Hot weather concreting – Cold weather concreting – Slipform.

Unit–V

Scanning Electron Microscopy (SEM) and X-ray microanalysis to examine cement, mortar concrete - Techniques of SEM and X-ray microanalysis- Simple imaging of fracture surfaces -Advanced techniques using X-ray microanalysis and digital image analysis on polished sections. X-ray spectra of cement clinker minerals and cement hydration products. Identify deleterious process in concrete, including alkali-silica reaction and sulphate attack- Interpretation of example images and X-ray spectra of the principal causes of damage to concrete.

TEXT BOOKS

1) Mehta P.K., and Monteiro, P.J.M., Concrete, Microstructure, Properties and Materials, Indian Concrete Institute, Chennai, 2013.
2) Shetty M.S., *Concrete Technology*, S.Chand&Co. New Delhi, 2007.

REFERENCE BOOKS

1) Neville A.M., *Properties of concrete*, Marshfield, Mass, Pitman Publishing Limited London,1981.
2) Johnnewman and Ban Seng Choo, *Advanced concrete Technology*, (Vol.I to VI) Elsevier, London, 2003.
3) Gambhir. M.L,*Concrete Technology*, Tata McGraw-Hill Education (India) Private limited. New Delhi, 2009.
4) Santhakumar.A.R, *Concrete Technology*, Oxford University Press, New Delhi, 2007.

COURSE OUTCOMES

At the completion of the course students will be able

1) To understand about various types of special concretes and testing techniques.
2) To understand the principles of special concreting techniques and non destructive testing procedures for concrete structures.
3) To prepare and recommending special concrete using admixtures
4) To understand the behaviour of microstructure of concrete.

MAPPING WITH PROGRAMME OUTCOMES										
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	✓		✓							✓
CO2	✓		✓							✓
CO3	✓		✓						✓	✓
CO4	✓		✓							✓

02PE XXX	SCAFFOLDING AND FORMWORK DESIGN IN CONSTRUCTION	L	T	P
		4	0	0

COURSE OBJECTIVES

- To study and understand the overall and detailed planning of formwork, plant and site equipment.
- To understand the Design and erection of forms for various elements such as slabs, beams, columns, walls, shells and tunnels.
- To know the latest methods of form construction.

Unit–I

Definition – Economy of formwork and scaffolding – Care of formwork material – Type of form work materials - Allowable stresses in formwork materials – Factors affecting selection of scaffolding and formwork systems – Equipments -.General objectives of formwork building - Planning for safety - Planning for maximum reuse- Scaffold frames.

Unit–II

Qualities of formwork and scaffolding – Types of formwork – Types of scaffolding: Putlog and independent scaffold -Single pole scaffolds - Truss suspended - Gantry and system scaffolds - Stages in formwork and scaffold – Formwork and Scaffold details for different structural members - Maintenance and Cost of formwork, scaffolding– Advantages of formwork and scaffold – Loads on formwork and scaffolds - Forms for foundations, columns, beams walls etc - Formwork hours- Formwork accessories - Formwork elements.

Unit–III

Basic simplification - Beam formulae - Allowable stresses - Deflection, Bending - Lateral stability - Shear, Bearing - Design of Wall forms - Slab forms - Beam forms - Column forms - Slenderness ratio - Allowable load vs. length behaviour in forms - Forms for Footings - Wall footings - Column footings - Sloped footing forms - Strap footing - Stepped footing - Allowable withdrawal load and lateral load -. Various causes of failures - ACI – Design and deficiencies.

Unit–IV

Pressure of concrete on formwork and scaffolding – Lateral pressure of concrete on formwork and scaffolding – Failures of formwork and scaffolding in different structural members- Pressures on formwork - Examples - Vertical loads for design of slab forms - Laterals loads on slabs and walls.

Unit–V

Hemispherical, Parabolic, Translational shells - Forms for Thin Shell roof slabs design considerations - Building the forms - Placing concrete - Form removed -Strength requirements -Tunnel forming components - Curb forms invert forms - Arch forms - Concrete placement methods - Cut and cover construction - Bulk head method - Pressures on tunnels - Continuous Advancing Slope method - Form construction – Shafts - Slip Forms - Principles -Types - advantages - Functions of various components - Planning -Desirable characteristics of concrete - Common problems faced - Safety in slip forms special structures built with slip form Technique.

TEXT BOOKS

1) Robert. Peurifoy and garold D. Oberlender *Form work for concrete structures;* McGraw -Hill , New Delhi, 1996.
2) *Safety requirements for scaffolding,* American National standards Institute; Broadway; New York.

REFERENCE BOOKS

1) Awad S. Hanna ; *Concrete formwork systems* ; Prentice Hall Inc., New Jersy USA 2003.
2) Stewart champion ; *Access scaffolding* ; Iliffe, London, 2007.
3) Austin, C.K., *Formwork for Concrete*, Cleaver -Hume Press Ltd., London, 1996.

COURSE OUTCOMES

At the end of the course students will be able

1) To know the detailed planning of framework, design of forms and erection of form work.
2) To select the timbers and wooden planks with quality
3) To have an idea of scaffolding fabrication for different works

MAPPING WITH PROGRAMME OUTCOMES										
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**
CO1	✓		✓							✓
CO2	✓		✓							✓
CO3	✓		✓						✓	✓

02PEXXX	**DESIGN OF LOAD BEARING MASONRY**	**L**	**T**	**P**
		4	**0**	**0**

COURSE OBJECTIVES

- Masonry structures need not always be less strong in comparison to structures constructed with other materials.
- If proper principles of analysis and design are scientifically adopted and innovative approach is followed, masonry structures can be as strong and functional as other structures.
- This course deals with the scientific approach to be followed in the design of masonry structures.

Unit–I

Historical development – Classification of masonry construction – Codes and standards – Types of masonry walls – Bricks, Mortar, Grout and Steel reinforcement – Characteristics and Requirements – Loads types and intensities – Basic design data.

Unit–II

Basis of reinforced masonry design – Resistance to axial load, bending, shear – Design of reinforced masonry walls, masonry beams, masonry columns and masonry retaining walls – Detailing of reinforced masonry.

Unit–III

Basis of prestressed masonry design – Basic principles – Design strength – Vertical and Horizontal shear stress – Principal tensile stress – Design of cavity walls, Fin walls, Diaphragm retaining walls and Post – tensioned beams – Detailing of prestressed masonry.

Unit–IV

Connections and joints – Connection resistance – Design considerations – Connection details – Types – Seismic separations – Control joints – Expansion joints.

Unit–V

High-rise masonry – Design factors – Reinforcing details – Floor systems – Construction techniques.

TEXT BOOKS

1) RobertSchneider, R., and Walter DickeyL., "*Reinforced Masonry Design*", Englewood Cliffs, N.J.: Prentice Hall, USA, 1980.
2) Curtin, W.G., ShawG., and Beck J.K., Design of Reinforced and Prestressed Masonry, Thomas Telford, London, 1988.

REFERENCE BOOKS

1) Hendry, A.W., SinhaB.P., and DaviesS.R.,"*An Introduction to Load Bearing Brickwork Design*",Chichester, E.Horwood, Halsted Press, Sydney, 1981.
2) David Lenczher, "Elements of Load Bearing Brick Work Design", Pergamon Press, London, 1972
3) Dayaratnam, P., "*Brick and Reinforced Brick Structures*", Primlani M,for Oxford & IBH Distributed by South Asia Books, New Delhi, 1987.

COURSE OUTCOMES

At the end of the course students will be able

1) To understand the scientific approach to be followed in the design of masonry structures.
2) To analyse the application masonry materials and design related to civil engineering problems.
3) To know the testing of masonry structures.

MAPPING WITH PROGRAMME OUTCOMES										
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	✓		✓							✓
CO2	✓	✓	✓							✓
CO3	✓		✓					✓	✓	✓

00PEXXX	RENEWABLE ENERGY ENGINEERING	L	T	P
		4	0	0

COURSE OBJECTIVES

- To prepare students for the challenges of designing, promoting and implementing renewable energy solutions within society's rapidly-changing energy-related industry cluster.

Unit–I

Traditional and modern energy use; Methods of accounting the role of traditional energy in the overall energy system. Energy consumption patterns in rural areas. Trends of rural energy consumption. Need and development of rural energy data bases (REDB); methodologies for building REDB. Case studies of REDB

Unit–II

Integrated Rural Energy Planning (IREP): Origin, implementation, case studies, critique. Socio economic and environmental issues of traditional energy use. Health impacts of biomass burning in cook stoves. The debate of black carbon from biomass burning. The energy ladder for cooking. Gender issues in biomass collection and processing.

Unit–III

Rural electrification: Overview, current status and future perspectives. Linkages with rural livelihoods, rural industries and social development. Issues of subsidization, last mile access and paying capacity.

Unit–IV

Review and critique of various programs of government: National Program for Biogas Development (NPBD), National Program for Improved Cook stoves (NPIC), Village Energy Security Plan (VESP), Rajiv Gandhi Grameen Vidyutikaran Yojana (RGGVY) etc.

Unit–V

Use of efficient / appropriate/renewable energy technologies for rural areas.

Technologies/products for cooking, water heating, drying, irrigation pumping, small/micro enterprises, lighting, motive power etc.

TEXT BOOKS

1) Report by a Panel of Experts, Rural electrification in Asia and the Far East New York, United Nations, 1963.
2) B. Kaye and William S: Pintz, *Rural electrification issue papers* Honolulu: Pacific Islands Development. 2004.

REFERENCE BOOKS

1) Devadas, Planning for Rural Energy System: Part I & II, V Renewable and Sustainable Energy Reviews, 5 (2001), 203-226, 227-270.
2) Kandpal T.C, Garg, Financial Evaluation of Renewable Energy *Technology*,Macmilan, New Delhi, 2003.
3) Chambers, Ann, Distributed Generation: A Non-technical guide, 4th Ed., Penn well, Oklahoma, 2001.

COURSE OUTCOMES

1) At the end of this course the student is expected to understand what constitutes the renewable energy, how to conserve these resources, what is the role of a human being in using an energy for the future generations.

MAPPING WITH PROGRAMME OUTCOMES										
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**
CO1	✓		✓							✓
CO2										
CO3										

01PEXXX	**WATER SUPPLY ENGINEERING**	**L**	**T**	**P**
		4	**0**	**0**

COURSE OBJECTIVES

- To make the students conversant with basic principles of water supply engineering, this course covers quantification of water, analysis, sources, conveyance, treatment and distribution of water.

Unit–I

Objectives of public water supply schemes; Health acceptability, adequacy, convenience and economy. Per Capita Demand- Standards and planning factors for public water supplies in India- Population forecasting - Variation in demand pattern - Dual Plumbing Systems.

Unit–II

Surface and Sub-Surface water sources - Typical Characteristics - Impounded storage reservoirs-Mass curve analysis – Infiltration Pipes, Wells and Galleries - Tube wells-Construction, development and sanitary protection of wells- Estimating the yield of wells under steady- state conditions- Dupits Equation. Sea & Back water sources- Intake Structures.

Unit–III

Pipe and Channels for transmitting water- Hydraulics of pipe flow - Use of charts and Nomo grams for flow computations- Materials for pipes and conduits ; Alloys of Steel, Cement Composites and Plastic pipes –Pipe loses - Laying, Jointing and Testing -Appurtenances of pipes- Pumps and Pumping stations- Selection of pumps.

Unit–IV

Unit–processes of water treatment- Screening– Coagulation & Flocculation-Clarifier-Clariflocculator- Media Filters: Gravity & Pressure– Filter Medias: Sand, Activated Carbon, Mixing basins – Principles of disinfection – Methods of Disinfection; Chlorination, UV Radiation, Ozonation, etc,.– Water softening: Cationic, Anionic and Mixed Beds- Iron and Manganese removal. Operation and maintenance aspects.

Unit–V

Continuous V_S Intermittent supplies; types, functions and requirements – layout and analysis of distribution networks using Hardy cross method - Equivalent pipes – Methods of pipes sizing – Operation and Maintenance – Leak detection – Equalising and service reservoirs – Elevated and ground level reservoirs– Location and determination of capacity- Appurtenances.

TEXT BOOKS

1) Garg S.K, *Water Supply Engineering*, Khanna Publishers, Delhi, 2005
2) Duggal K.N, *Elements of Environmental Engineering*, S.Chand & company, New Delhi, 2004

REFERENCE BOOKS

1) Fair, G.M.Geyer.,I.C., and Okum, D.A., *Water and Wastewater Engineering*, John Willey & Sons Inc., New York, 1968.
2) ArcadioP.Sincerosr, GregoriaA.Sincero, *Environmental Engineering a Design Approach*, Prentic Hall, USA, 2002
3) Glynn Henry J & Gary W Heinke, *Environmental Science and Engineering*, Prentice Hall of India, New Delhi, 2004

COURSE OUTCOMES

At the end of the course students will be able

1) To understand the identification, cost effective collection and distribution of water supply systems.
2) To have a clear idea of basic water treatment and designing water treatment units.

MAPPING WITH PROGRAMME OUTCOMES										
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**
CO1	✓		✓		✓					✓
CO2	✓	✓			✓					✓
CO3										

03PEXXX	ENGINEERING THERMODYNAMICS	L	T	P
		4	0	0

COURSE OBJECTIVES

- To achieve an understanding of principles of thermodynamics and to be able to use it in accounting for the bulk behaviour of the simple physical systems.
- To provide in-depth study of thermodynamic principles, thermodynamics of state, basic thermodynamic relations, Principle of Psychrometry & Properties of pure substances.
- To enlighten the basic concepts of vapour power cycles.

Unit–I

Basic concepts - Concept of continuum, macroscopic approach, Thermodynamic systems - Closed, open and isolated. Property, State, Path and Process, Quasi-static process, work, modes of work, Zeroth law of thermodynamics – Concept of temperature and heat. Concept of ideal and real gases. First law of thermodynamics – Application to closed and open systems, internal energy, specific heat capacities, enthalpy, steady flow process with reference to various thermal equipments.

Unit–II

Second law of thermodynamics – Kelvin's and Clausius statements of second law. Reversibility and irreversibility. Carnot theorem, Carnot cycle, reversed carnot cycle, efficiency, COP. Thermodynamic temperature scale, Clausius inequality, concept of entropy, entropy of ideal gas, principle of increase of entropy – Availability.

Unit–III

Properties of pure substances – Thermodynamic properties of pure substances in solid, liquid and vapour phases, phase rule, P-V, P-T, T-V, T-S, H-S diagrams, PVT surfaces, thermodynamic properties of steam. Calculations of work done and heat transfer in non flow and flow processes. Standard Rankine cycle, Reheat and regenerative cycle.

Unit–IV

Gas mixtures – Properties ideal and real gases, equation state, Avagadro's Law, Vander Waal's equation of state, Compressability factor, compressability chart – Dalton's law of partial pressure, exact differentials, T-D relations, Maxwell's relations, Clausius Clapeyron equations, Joule –Thomson coefficient.

Unit–V

Psychrometry and psychrometric charts, property calculations of air vapour mixtures. Psychrometric process – Sensible heat exchange processes. Latent heat exchange processes. Adiabatic mixing, evaporative cooling

(Use of standard thermodynamic tables, Mollier diagram, Psychometric chart and Refrigerant property tables are permitted)

TEXT BOOKS

1) Nag.P.K., *Engineering Thermodynamics*, Tata McGraw-Hill, New Delhi, 1998.
2) Cengel, Thermodynamics – An Engineering Approach Third Edition – Tata McGraw Hill, New Delhi, 2003.

REFERENCE BOOKS

1) Holman.J.P., *Thermodynamics*, 3rd Ed. McGraw-Hill, New Delhi, 1995.
2) Venwylen and Sontag, *Classical Thermodynamics*, Wiley Eastern, New Delhi, 1987
3) Arora C.P, "*Thermodynamics*", Tata McGraw-Hill, New Delhi, 2003.
4) Merala C, Pother, Craig W, Somerton, *Thermodynamics for Engineers*, Schaum Outline Series, Tata McGraw-Hill, New Delhi, 2004.

COURSE OUTCOMES

At the end of the course students will be able

1) To gain knowledge on the basic thermo dynamic principles and its applications.

MAPPING WITH PROGRAMME OUTCOMES										
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**
CO1	✓	✓			✓					✓
CO2										
CO3										

02PE XXX	**COMPOSITES FOR CONSTRUCTION**	**L**	**T**	**P**
		4	**0**	**0**

COURSE OBJECTIVES

- To develop an understanding of the behavior and design study of Steel concrete composite elements and structures.

Unit–I

Introduction to composite construction – Basic concepts – Types of composite materials - Application of composite construction in Civil Infrastructure – Durability – Physical and Mechanical properties of composite structures – Influence of moisture at consistent level in composite structure – Construction of composite structures.

Unit–II

Introduction – Fabrication Process – Quality Control during Manufacture – Testing Methodologies – Destructive and Non destructive testing - Mitigation Strategies – Materials and their properties – Stiffness properties – Strength properties – Manufacture of composite materials.

Unit–III

Introduction – Combustion of Polymer Composites – Fire reaction properties of Polymer Composites – Fire resistant Polymer Composites – Structural properties of

Polymer Composites in Fire – Fire protection coatings – Predictive Modelling of Fatigue – Descriptive Modelling of Fatigue.

Unit–IV

Analysis of composite beams – Composite floor – Girders – Slabs - Composite column subjected to axial loads and moment – Shear connectors: functions and types – Maximum stress theory – Maximum strain theory – Stress strain relations - Analysis procedures of building for gravity and lateral loads - Study of IS: 11384 , IRC – 22 and their applications.

Unit–V

Introduction – Classes of joints – Bonded joints – Stress distribution – Modes of failure – Merits and demerits – Mechanical joints – Failure mode – Merits and demerits – Design of bonded and bolted joints – Bending failure – Tension failure – Multi bolt joints and its design.

TEXT BOOKS

1) Madhujitmukhopadhyay; *Mechanics of composite materials and structure,* Universities press, Telangana, 2004.
2) Jones, R.M., *Mechanics of composite materials*, McGraw Hill, Tokyo, 1998.

REFERENCE BOOKS

1) Carlo Pelleqrino, Josesena, Cruz; Design procedure for the use of composites in strengthening of reinforced concrete structures , Springer , 2016.
2) Ravindra K. Dhir, kelvin a paine, moray d. Newlands, Composites materials in concrete construction, Ice publishing, 2012.
3) Vistasp M. Karbhari, Durability of composites for civil structure applications, woodhead publishing, 2012.
4) Lawrance C. Bank, Composite Construction, John Weiley sons & inc, USA, 2006

COURSE OUTCOMES

At the end of the course students will be able

1) To gain knowledge on the composites and its applications.
2) To gain knowledge on the polymers, chemicals, resins, adhesives and its applications.
3) To make the composite sections depends on the purpose with different materials.

MAPPING WITH PROGRAMME OUTCOMES										
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**
CO1	✓	✓	✓							✓
CO2	✓		✓							
CO3	✓		✓							✓

02PEXXX	BRIDGE ENGINEERING	L	T	P
		4	0	0

COURSE OBJECTIVES

- Bridge engineering is a specialized area in structural engineering practice. In this course, the students are taught the IRC loading standards and analysis and design of different types of bridges.

Unit–I

IRC Loading standards – Positioning of IRC loads for maximum moment and shear- Analysis of slabs using Pigeaud's curves- Design of Slab culverts as per IRC: 6-2014 and IRC 21: 2000.

Unit–II

Pipe culverts - General features - Classification - Analysis and design of Pipe Culvert. Box culverts – General features - Analysis and design of Box culverts as per IRC: 6-2014 and IRC 21: 2000.

Unit–III

Tee beam and slab bridges - General features – Pigeaud's curves – Courbon's theory – Design and detailing as per IRC: 6-2014 and IRC 21: 2000 - Balanced cantilever bridges - Bowstring girder bridges - Advantages - General features - Design principles only.

Unit–IV

Pre-stressed concrete bridges - Preliminary dimensions - Flexural and Torsional parameters – Design of girder section - Maximum and minimum pre-stressed forces - Eccentricity - Dead load and Live load moments and shears - Cable zone in girder - Check for stresses - Diaphragms - End block - Short-term and long-term deflections – Design and Detailing as per IS 1343:1980, IRC: 6-2014 and IRC 21: 2000.

Unit–V

Segmental bridges - Segmental bridge design, design for flexure Guidelines as per IRC 18-2000 and detailing as per SP-65:2005. Bridge bearings - Plate, Roller and Rocker bearings - Elastomeric bearings as per IRC: 83(Part I)-1999 and IRC 83(Part II)-1987).

TEXT BOOKS

1) Krishna Raju N, Design *of Bridges*, Oxford & IBH, New Delhi, 2010.
2) Ponnuswamy S, *Bridge Engineering,* Tata McGraw-Hill, New Delhi, 1986.

REFERENCE BOOKS

1) Johnson Victor D, *Essentials of Bridge Engineering,* Oxford & IBH Pub. Co., New Delhi, 2001.
2) Rajagopalan N, *Bridge Super Structure*, Alpha Science International, London, 2006.

STANDARDS:

1) IS 456: 2000, Code of Practice for Plain and Reinforced Concrete, Bureau of Indian Standards, New Delhi.

2) IS 13920: 1993, Ductile Detailing of Reinforced Concrete Structures Subjected to Seismic Forces -Code of Practice
3) SP 34: 1987, Handbook on Concrete Reinforcement And Detailing.
4) IRC: 6-2014, Standard Specifications and Code of Practice for Road Bridges Section: II (Loads And Stresses).
5) IRC 21: 2000, Standard Specifications and Code of Practice for Road Bridges Section: III[Cement Concrete (Plain And Reinforced)].
6) IS 1343:1980, Code of Practice for Pre-stressed Concrete, Bureau of Indian Standards, New Delhi, 2012.
7) IRC: 83(Part I)-1999, Standard Specifications and Code of Practice for Road Bridges Section: IX, Part I (Metallic Bearings).
8) IRC: 83(Part I)-1999, Standard Specifications and Code of Practice for Road Bridges Section: IX, Part II (Elastromeric Bearings).

COURSE OUTCOMES

At the end of the course students will be able

1) To understand the behaviour of bridge structures.
2) To gain knowledge about the rudimentary principles of designing the bridges as per the existing codes.
3) To understand the Codal recommendations for a bridge design.

MAPPING WITH PROGRAMME OUTCOMES										
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**
CO1	✓	✓	✓							✓
CO2	✓	✓	✓							✓
CO3	✓	✓	✓							✓

02PEXXX	**EARTHQUAKE ENGINEERING**	**L**	**T**	**P**
		4	**0**	**0**

COURSE OBJECTIVES

- To make the students to understand Earthquake and Wind excitations are two major dynamic loadings to be considered for many modern civil engineering structures.
- To understand the seismic loadings to ensure the safety and serviceability of structures.

Unit–I

Elements of Earth, core, mantle and crust- Engineering Seismology, Plate tectonic theory, originations of earthquake- Volcanic and tectonic origins, Faults, Dips, slips in crust, seismic zoning map of India & its use.

Earthquake Effects: Land and rock slides, Liquefaction, Fires, Tsunamis, Floods, Release of poisonous gases and Radiation.

Earthquake Phenomenon: - Focus epicentre, Seismic waves, Magnitude, intensity, Ritcher scale, MM scale, Earthquake recording instruments, and Seismic resistant design guidelines

Unit–II

Dynamics: Vibration, frequency, D'alembert's Principle, Dynamic equilibrium equation, inertial force, Damping force, Stiffness force, Mathematical models, and Discrete (lumped parameter) systems: SDOF, MDOF systems, Continuous systems, Formulations of equations of motions for two and three storey building. Free vibration analysis of SDOF systems with and without viscous damping, Experimental methods of assessing viscous damping present in the dynamic systems: logarithmic decrement method, Half power band width method, and simple problems.

Unit–III

Forced Vibration Analysis (Harmonic loading) of Single Degree of freedom systems with and without damping under harmonic excitations, Forced vibration response to harmonic base excitation. Formulation of Response Spectrum, Design Response spectrum as per IS:1893, simple problems using the above response spectrums. Forced vibration analysis of multi Degrees of freedom systems (restricted to two degrees of freedom only) using modal superposition technique.

Unit–IV

Analysis of building frames, Equivalent static method as per IS: 1893- Dynamic analysis using mode superposition concept- Push over analysis. Modelling of Building Frames with Brick and Concrete Walls- Centre of Mass locations- Centre of Stiffness locations- Orientation of Shear walls.

Unit–V

Philosophy and Principles of Earthquake Resistance design- Strength and Stiffness, Ductility Design and Detailing (IS13920: 1993), Concept of Energy Absorbing Devices, Concepts of Seismic Base isolation technique and Seismic Active control methods. Lessons learnt from the Past Earthquakes - Case studies of important Indian Earthquakes, Major world Earthquakes.

TEXT BOOKS

1) Dowrick, D.J., *Earthquake Resistant Design,* John Wiley & Sons, Winchester, U.K., 1977.
2) Paulay, T. and Priestley, M.J.N., Seismic Design of Reinforced and Masonry Buildings, John Wiley & Sons, Inc., New York, 1992.

REFERENCE BOOKS

1) Anil k Chopra, *Dynamics of Structures,* McGraw-Hill International Edition, New Delhi, 1998.
2) Clough, R.W. and Penzien, J., *Dynamics of Structures, Second Edition,* McGraw-Hill International Edition, New Delhi, 1993.
3) Kiyoshi Muto, *Earthquake Resistant Design of Tall Buildings in Japan*, University of California, 1973.

4) Beskos.D.E*, Computer Analysis & Design of Earthquake Resistant Structures- A Handbook Advances in Earthquake Engineering,* Computational Mechanics Inc, Billerica1997.
5) Hiroshi Akiyama, *Earthquake Resistant Limit State Design for Buildings*, University of Tokyo Press, Tokyo, 1985.
6) Paz, M. and Leigh.W. *Structural Dynamics – Theory & Computation*, 4th Edition, CBS Publishers & Distributors, New Delhi, 2006.

STANDARDS

1) IS 1893:2002 Criteria for Earthquake Design of Structures, Bureau of Indian Standards, New Delhi.
2) IS 4236:1976 Code of Practice for Earthquake Resistant Design and Construction of Buildings, Bureau of Indian Standards, New Delhi.
3) IS 13920: 1993 Ductile Detailing of Reinforced Concrete Structures Subjected to
4) Seismic Forces Code of Practice, Bureau of Indian Standards, New Delhi.
5) SP: 22- 1982Explanatory Handbook on Codes for Earthquake Engineering, Bureau of Indian Standards, New Delhi.
6) IS 1382: 1993Guidelines for Improving Earthquake Resistance of Earthen Buildings
7) Bureau of Indian Standards, New Delhi.
8) IS 13828: 1993Guidelines for Improving Earthquake Resistance of Low Strength Masonry Buildings, Bureau of Indian Standards, New Delhi.
9) IS 13935: 1993Guidelines for Repair and Seismic Strengthening of BuildingsBureau of Indian Standards, New Delhi.
10) SP:24 (S&T) - 1983 Explanatory Handbook on Indian Standard Code of Practice for Plain and Reinforced Concrete (IS 456:2000), Bureau of Indian Standards, New Delhi.

COURSE OUTCOMES

At the completion of the course students will be able

1) To design the earthquake resistance structures.
2) To understand the behaviour of structure during earthquake.
3) To recommend the materials used for construction in the earthquake prone areas.

MAPPING WITH PROGRAMME OUTCOMES										
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**
CO1	✓	✓	✓							✓
CO2	✓	✓	✓							✓
CO3	✓	✓	✓						✓	✓

02PEXXX	ADVANCED STRUCTURAL ANALYSIS AND EXPERIMENTAL TECHNIQUES	L	T	P
		4	0	0

COURSE OBJECTIVES

- This course provides advanced experimental measurements of strains and deformations in structural elements.
- This course is fundamental to all researchers in structural engineering.

Unit–I

Experimental stress analysis methods, Errors in measurements - Strain gauge, principle, types, performance and uses. Calibration and temperature compensation cross sensitivity.

Strain Rosette analysis, Wheatstone bridge and potentiometer circuits for static and dynamic strain measurements, strain indicators.

Unit–II

Linear Variable Differential Transformer (LVDT) – Transducers for velocity and acceleration measurements. Accelerometers, Oscilloscope – Seismographs - Digital data Acquisition systems – Wind tunnels – Flow meters – Venturimeter – Digital data Acquisition systems.

Hydraulic jacks and pressure gauges – Electronic load cells – Proving Rings – Calibration of Testing Machines – Long-term monitoring – Vibrating wire sensors– Fibre optic sensors.

Unit–III

Measurement of Structural Vibrations–Wind flowmeasurements- Wind tunnel study, Load testing on structures, buildings, bridges and towers– Techniques for residual stress measurements – Structural Health Monitoring.

Unit–IV

Rebound Hammer – Acoustic emission – Ultrasonic testing principles and application – Holography – Use of laser for structural testing – Brittle coating, Advanced NDT methods – Ultrasonic pulse echo, Impact echo, impulse radar techniques, GECOR , Ground penetrating radar (GPR).

Unit–V

Diagnosis of distress in structures – Crack observation and measurements – Corrosion of reinforcement in concrete – Half cell, construction and use – Damage assessment – Controlled blasting for demolition.

TEXT BOOKS

1) Sadhu Singh, *Experimental Stress Analysis,* Khanna Publishers, Delhi, 2009.
2) Srinath L. S, *Experimental Stress Analysis,* Tata McGraw Hill Publications, New Delhi 1984.

REFERENCE BOOKS

1) Srinath L. S, *Experimental Stress Analysis,* Tata McGraw Hill Publications, New Delhi, 1984.
2) Sadhu Singh, *Applied Stress Analysis,* Tata McGraw Hill Publications, New Delhi, 1983.

3) Vazrani & Chandola, *Experimental Stress Analysis,* Tata McGraw Hill Publications, New Delhi, 1980.
4) Durelli A.J., A*pplied Stress Analysis,* Prentice Hall of India, New Delhi, 1970.
5) Sadhu Singh, *Applied Stress Analysis,* Tata McGraw Hill Publications, New Delhi, 1983.
6) Dally & Riley, *Experimental Stress Analysis,* Tata McGraw Hill Publications, New Delhi, 1991.

COURSE OUTCOMES

At the end of the course students will be able.

1) To know about measurement of strain and vibrations.
2) To analyse the structure by non-destructive testing methods.

MAPPING WITH PROGRAMME OUTCOMES										
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**
CO1	✓	✓	✓							✓
CO2	✓	✓	✓							✓
CO3	✓	✓	✓						✓	✓

02PEXXX	**STRUCTURAL CONCRETE DESIGN IV**	**L**	**T**	**P**
		4	**0**	**0**

COURSE OBJECTIVES

- To understand the concepts of designing bridges deck slab, concrete Pipes, bunkers and silos and chimneys with relevant codal standards.

Unit–I

IRC loadings standards, Bridge deck slab design using Pigeaud's curves – Design of Solid slab bridges as per IRC: 6-2014 and IRC 21: 2000 - Reinforcement detailing as per SP: 34-1987.

Unit–II

Machine Foundations - Types - General Requirements - Design Parameters - Design Criteria and Codal Provisions for Reciprocating and Rotary Type Machines as per IS 2974 (Part I to IV).

Unit–III

Design of prestressed bridges for Buried Concrete Pipes to Carry Water and Gas as perrelevant codes – Design of Post tensioned Concrete slabs - Design of Post tensioned Concrete T section Girders as per IS 1343:2012.

Unit–IV

Design of Concrete Bunkers and Silos as per IS 4995 (Part I, II): 1974, IS 5503 (Part I):1969 – Reinforcement Detailing as per SP:34 -1987.

Unit–V

Design of concrete Chimneys as per IS 4998(Part I):1992 - Stresses in chimneys - Reinforcement detailing as per relevant codes.

TEXT BOOKS

1) Krishnaraju.N, *Advanced R.C. Design*, CBS Publishers & Distributors Pvt. Ltd, New Delhi, 2012.
2) Punmia.B.C, et al, *R.C. Structures- Vol.I& II,* Laxmi Publications (P) Ltd. Chennai, 1995.

REFERENCE BOOKS

1) Ramamrutham.Sand Narayan.R, *Design of R.C. Structures,* Dhanpat Rai and Sons, Delhi, 1992.
2) Dayaratnam P, *Design of RC Structures*, OXFORD & IBH Publishing, New Delhi, 2000.
3) Mallick.S.K&Gupta.A.P, *Reinforced Concrete*, Oxford I B H, New Delhi, 1987.
4) Park and Paulay. T, *R.C. Structures*, Tata McGraw Hill Publications, New Delhi, 1975.
5) Punmia.B.C, *R.C. Structures– Vol. II*, Standard Publishers, New Delhi, 1991.

STANDARDS:

1) IS 456: 2000, Code of Practice for Plain and Reinforced Concrete, Bureau of Indian Standards, New Delhi.
2) IS 13920: 1993, Ductile Detailing of Reinforced Concrete Structures Subjected to Seismic Forces -Code of Practice, Bureau of Indian Standards, New Delhi
3) SP 34: 1987, Handbook on Concrete Reinforcement And Detailing, Bureau of Indian Standards, New Delhi
4) IRC: 6-2014, Standard Specifications and Code of Practice for Road Bridges Section: II (Loads And Stresses), *Indian Roads Congress* , New Delhi.
5) IRC 21: 2000, Standard Specifications and Code of Practice for Road Bridges Section: III [Cement Concrete (Plain And Reinforced)], *Indian Roads Congress* , New Delhi
6) IS 1343:2012, Code of Practice for Pre-stressed Concrete, Bureau of Indian Standards, New Delhi, 2012.
7) IS 2974 (Part I) :1982, Code of Practice for Design and Construction of Machine Foundations (Foundation for Reciprocating Type Machines), Bureau of Indian Standards, New Delhi
8) IS 2974 (Part II) :1980, Code of Practice for Design and Construction of Machine Foundations [Foundations For Impact Type Machines (Hammer Foundations)], Bureau of Indian Standards, New Delhi
9) IS 2974 (Part 3) : 1992, Design and Construction of Machine Foundations - Code of Practice [Foundations for Rotary Type Machines (Medium and High Frequency)], Bureau of Indian Standards, New Delhi
10) IS 2974 (Part IV) :1979, Code of Practice for Design and Construction of Machine Foundations (Foundations for Rotary Type Machines of Low Frequency), Bureau of Indian Standards, New Delhi
11) IS 4995 (Part I): 1974, Criteria for Design of Reinforced Concrete Bins for the Storage of Granular and Powdery Materials (General Requirements and Assessment of Bin Loads), Bureau of Indian Standards, New Delhi
12) IS 4995 (Part II) :1974, Criteria for Design of Reinforced Concrete Bins for Storage of Granular and Powdery Materials (Design Criteria), Bureau of Indian Standards, New Delhi
13) IS 9178 (Part II) :1979, Criteria for Design of Steel Bins for Storage of Bulk Materials (Design Criteria), Bureau of Indian Standards, New Delhi

14) IS 5503 (Part I) :1969, General Requirements for Silos for grain storage (Construction requirements), Bureau of Indian Standards, New Delhi
15) IS 4998 (Part I): 1992, Criteria for Design of Reinforced (Assessment of Loads), Bureau of Indian Standards, New Delhi.

COURSE OUTCOMES

At the end of the course students will be able

1) To design the bridges deck slab as per Indian Standards.
2) To design concrete Pipes as per the codal provisions.
3) To design bunkers, silos and chimneys with relevant IS standards.

MAPPING WITH PROGRAMME OUTCOMES										
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	✓	✓								✓
CO2	✓	✓								✓
CO3	✓	✓								✓

PROFESSIONAL ELECTIVE LABORATORIES

01EPXXX	FLUID MECHANICS AND MACHINES LABARATORY	L	T	P
		0	0	4

COURSE OBJECTIVES

To understand the properties of fluids and fluid statics, methods for determination of co-efficient of discharged are to be explained and computed practically.

To study of the characteristic features of pumps and turbines using experiments in envisaged.

To understand the significance and role of such utilities in their further course of study.

LIST OF EXPERIMENTS

1) Determination of Co-efficient of discharge of Mouth Piece
2) Determination of Co-efficient of discharge of Venturimeter
3) Determination of Co-efficient of Head loss due to Sudden Change in Section
4) Determination of Co-efficient of Head loss due to Friction in Pipe
5) Determination of Co-efficient of discharge of Rectangular Notch
6) Determination of Co-efficient of Impact of Jet on Vanes
7) Study of Performance characteristics of Elmo Pump (Centrifugal Pump)
8) Study of Performance characteristics of Sump Pump (Centrifugal Pump)
9) Study of Performance characteristics of Submersible Pump (Centrifugal Pump)
10) Study of Performance characteristics of Gould's Pump (Reciprocating Pump)
11) Study of Performance characteristics of Pelton Turbine (Constant Speed method)
12) Study of Performance characteristics of Francis Turbine (Constant Head method)

13) Determination of Metacentric Height of a floating vessel (Demo Only)
14) Study on Flow through Open Channel (Demo Only)

REFERENCE BOOKS

1) Subramanya K, "*Flow in open channels*", Tata McGraw Hill, New Delhi 2000.
2) Modi P.N. and Seth S.M, "*Hydraulics and Fluid Mechanics*", Standard Book House, New Delhi, 2002.
3) Nagaratnam, S, *Fluid Machines and Systems*, Tata McGraw Hill, 1989.

COURSE OUTCOMES

At the completion of this course, a student will be able to

1) Determine the properties of fluids, pressure and their measurements
2) Measure flow in pipes and determine frictional losses
3) Compute forces on immersed plane and curved plates applying continuity equation and energy equation in solving problems on flow through conduits
4) Develop Characteristics of pumps and turbines

MAPPING WITH PROGRAMME OUTCOMES										
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	✓				✓			✓		
CO2	✓				✓			✓		
CO3	✓	✓			✓			✓		
CO4	✓				✓			✓		✓

01EP609	TRANSPORTATION ENGINEERING LABORATORY	L	T	P
		0	4	0

COURSE OBJECTIVES

- To introduce the students to various properties of the materials that is commonly used in Transportation engineering construction.
- To conduct tests on various construction materials.

LIST OF EXPERIMENTS

1) To determine the Flakiness Index and Elongation Index of Coarse Aggregates
2) To Determine the Impact Value of Coarse Aggregates.
3) To Determine the Crushing Value of Coarse Aggregates.
4) To determine the Abrasion Value of Coarse Aggregates.
5) To determine the fineness modulus and grading curve of coarse aggregates.
6) To Determine the Flash and Fire point of Bitumen
7) To determine the viscosity of Bitumen.
8) To determine the penetration Value of Bitumen.
9) To determine the Softening Point of Bituminous material.
10) To determine the Ductility Value of Bituminous material.
11) To determine the Flash and Fire Point of Bituminous material.
12) To determine the Marshal Stability Value of Bituminous mixture.

REFERENCE BOOKS

1) Khanna S. K., Justo C.E.G, & Veeraragavan A., *Highway Materials and Pavement Testing*, Nem Chand and Bros., Roorkee- 247 667.
2) Gambhir, M.L., Jamwal, Neha, *Lab Manual: Building and construction materials, Testing and Quality Control* McGraw Hill Education (India), Pvt.Ltd., Noida.
3) Duggal, Ajay K., Puri,Vijay P., *Laboratory Manual in Highway Engineering* New Age International (P) Limited, Publishers, New Delhi.
4) Sood Hemant, Mittal, L.N., Kulkarni,P.D., *Laboratory Manual on Concrete Technology*, CBS Publishers & Distributors Pvt. Ltd. New Delhi.

COURSE OUTCOMES

At the end of the course students will be able to

1) Gain knowledge about the mechanical properties of materials such as Coarse Aggregate, concrete and bitumen.
2) Check the aggregates quality used for the roads
3) Suggest and advice on the material selection and its purpose.

MAPPING WITH PROGRAMME OUTCOMES										
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	✓		✓					✓		
CO2	✓							✓	✓	
CO3	✓							✓	✓	

02EPXXX	COMPUTER PRACTICAL IV	L	T	P
		0	0	3

COURSE OBJECTIVES

- This course trains the students to carry out basic build frame analysis for symmetrical and un-symmetrical building frames.

LIST OF EXERCISES

Introduction to STADD PRO and ETABs Software

Plate 1. Analysis of Symmetrical Building Frames (Gravity Load Only) using STADD PRO Software.

Plate 2. Analysis of Symmetrical Building Frames(Wind Load Only) using STADD PRO Software.

Plate 3. Analysis of Symmetrical Building Frames(Earthquake Load Only) using STADD PRO Software.

Plate 4. Analysis of Un-Symmetrical Building Frames(Gravity Load Only) using STADD PRO Software.

Plate 5. Analysis of Un-Symmetrical Building Frames(Wind Load Only) using STADD PRO Software.

Plate 6. Analysis of Un-Symmetrical Building Frames(Earthquake Load Only) using STADD PRO Software.

Plate 7. Analysis of Symmetrical Building Frames(Gravity Load Only) using ETABs Software.

Plate 8. Analysis of Symmetrical Building Frames(Wind Load Only) using ETABs Software.

Plate 9. Analysis of Symmetrical Building Frames(Earthquake Load Only) using ETABs Software.

Plate 10. Analysis of Un-Symmetrical Building Frames(Gravity Load Only) using ETABs Software.

Plate 11. Analysis of Un-Symmetrical Building Frames(Wind Load Only) using ETABs Software.

Plate 12. Analysis of Un-Symmetrical Building Frames(Earthquake Load Only) using ETABs Software.

REFERENCE BOOKS

1) STADD PRO and ETABs Software Working Manuals.
2) Krishnaraju.N, *Advanced R.C. Design*, CBS Publishers & Distributors Pvt. Ltd, New Delhi, 2012.
3) Punmia.B.C, et al, *R.C. Structures- Vol.I& II,* Laxmi Publications, Chennai, (P) Ltd., 1995
4) Mallick.S.K&Gupta.A.P, *Reinforced Concrete*, Oxford I B H, New Delhi, 1987.
5) Park and Paulay. T, *R.C. Structures*, Tata McGraw Hill Publications, New Delhi, 1975.

COURSE OUTCOMES

At the completion of the course the student will be able to understand

1) The basic structural analysis of both symmetrical and un-symmetrical frames.
2) Modelling, analysis and design using STAADPro.
3) Modelling, analysis and design using ETABS.

MAPPING WITH PROGRAMME OUTCOMES										
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**
CO1	✓	✓						✓		
CO2	✓	✓						✓		✓
CO3	✓	✓						✓		✓

OPEN ELECTIVES

00OE XXX	FINITE ELEMENT METHODS	L	T	P
		4	0	0

COURSE OBJECTIVES

- To learn the analysis of structures with a versatile technique finite element methods which can accommodate variations in material and engineering properties and can tackle multilayered systems and non linearity with ease.

Unit–I

Introduction - Finite Element Formulation – Steps involved - Advantages and Disadvantages - Applications - Two Dimensional Elasticity problems - Plane Stress and Plane Strain - Equilibrium equations -Strain-displacement equations - Compatibility equations - Constitutive equations - Boundary conditions.

Unit–II

Finite Element types – Displacement Function - Natural Coordinates – Shape Functions – Shape functions for truss elements in local and global coordinates - Shape function for beam and frame elements, Triangular elements (CST and LST elements), Rectilinear Iso-parametric elements, Solid elements.

Unit–III

Element stiffness formulation for truss elements in local and global coordinates, beams, CST elements, Load vectors for gravity, surface and body forces.

Unit–IV

Numerical Integration for evaluation of element stiffness – Load vectors-Computation of stresses. Use of Static Condensation Techniques, Axi-symmetric elements, Sub-structuring, Plate bending and shell elements.

Unit–V

Pre and Post Processing – Modelling techniques – Complete algorithms with flow chart for solving FEM problems - Solution Techniques – Linear analysis-Non-linear analysis both material and geometric non-linearity Use of Finite element software packages such as ANSYS, SAP 2000N, STAAD Pro, ETABS, ABAQUS, MSC/NASTRAN, etc.

TEXT BOOKS

1) Seshu P, *Finite Element Analysis,* Prentice Hall of India, New Delhi, 2005.
2) Chandrupatla, T.R. and Belegundu, A.D, *Introduction to Finite Element in Engineering*, Prentice Hall, Delhi, 2003

REFERENCE BOOKS

1) Krishnamoorthy.C.S, Finite Element Analysis - Theory and Programming, Tata McGraw Hill Publications, New Delhi,1995.
2) Rajasekaran.S, Finite Element Analysis in Engineering Design, S.Chand and Co., New Delhi, 2014
3) Cook.R.D, Concepts and Applications of Finite Element Analysis, Tata McGraw Hill Publications, New Delhi,1989.
4) Desai.C.S & Abel.J.F, *Introduction to the FEM,* Affiliated East West Press, New Delhi, 1972.

5) Rao.S.S, The Finite Element Method in Engineering, Butters worth-Heinemann Publishing, Burlington, 2000.
6) Reddy J.N, *An Introduction to Finite Element Method*, International Edition, McGraw Hill, New Delhi, 2006

COURSE OUTCOMES

At the completion of the course students attains

1) The knowledge of solving physical problems using finite element softwares.
2) To develop computer coding for any structural problem and creating software packages.

02OE	TALL BUILDINGS	L	T	P
		4	0	0

COURSE OBJECTIVES

- To understand the concept of different structural systems used for tall structures.
- To understand the types and principles of analysis and design of tall structures.

Unit–I

General – Factors affecting growth, height and Structural systems – Design philosophy – Loads: Gravity and lateral (Wind and Earthquake) – Load combinations – Strength and serviceability criteria – Stability and Drift limitations – Human comfort criteria – Creep, temperature, Fire and Foundation settlement effects – Effects of Soil Structure interaction.

Structural and non-structural systems – Structural system idealisations - Floor slab systems (wall supported slab system, Beam supported slab system, Ribbed slab system, Flat slab system). Vertical framing system (Columns, concrete walls, transfer girders, Suspenders) – Composite floor systems

Modelling for gravity and lateral loads – Assumptions – Modelling for approximate analyses – Modelling for accurate analysis.

Unit–II

Lateral load resisting systems – Behaviour of Rigid frames, Behaviour of Braced Rigid frames, Behaviour of shear wall with Rigid frames, Behaviour of framed-tubes, Behaviour of tube in tube, Behaviour of bundled tubes – Behaviour of In-filled frame structures

Unit–III

Analysis and design concepts of Rigid frames, Rigid frames with bracings, Rigid frames with shear walls, framed-tubes, tube in tube and bundled tubes.

Unit–IV

Stability of tall buildings – Overall buckling analysis of frames (Rigid frames, Rigid frames with bracings, Rigid frames with shear walls, framed-tubes, tube in tube and bundled tubes) using approximate methods — Second order effects– Torsional instability – Effects of foundation settlements – Pounding effects – Temperature effects.

Unit–V

Importance of dynamic analysis as per IS 875(Part 3) and IS 1893(Part 1): 2002 – Methods of analyses as per code –How to minimise dynamic effect –

Response to along and across wind effects as per SP:64-2001 - Response to earthquake motions – Response to ground accelerations – Response spectrum analysis –Estimation of natural frequencies and damping.

TEXT BOOKS

1) Bryan Stafford Smith, Alexcoull, Tall Building Structures, analysis and Design, John Wiley and Sons, Inc., New Delhi, 1991.
2) Taranath B.S., *Structural Analysis and Design of Tall Buildings*, McGraw Hill, New Delhi, 2011.

REFERENCE BOOKS

1) Lin.T.Y,StotesBurry.D, Structural Concepts and systems for Architects and *Engineers*, JohnWiley, Inc.,Navi Mumbai,1988.
2) Lynn S.Beedle, *Advances in Tall Buildings*, CBS Publishers and Distributors, Delhi, 1986.
3) Wolfgang Schueller, *High Rise Building Structures*, John Wiley and Sons, New York, 1977.

STANDARDS

1) IS 875 (Part 3): 1987 Design loads – Wind load for Buildings and Structures, Bureau of Indian Standards, New Delhi
2) IS 1893 (Part 1): 2002, Criteria for Earthquake Resistant Design of Structures, Bureau of Indian Standards, New Delhi
3) SP:64 (S&T)-2001 Design Loads (other than earthquake) for Buildings and Structures, Bureau of Indian Standards, New Delhi.

COURSE OUTCOMES

At the completion of the course students will be able

1) To gain the knowledge about the behaviour of tall buildings subjected to lateral loads and their stability.
2) To design the tall buildings as per the existing codes.

02OEXXX	CONSTRUCTION TECHNIQUES AND MANAGEMENT	L	T	P
		4	0	0

COURSE OBJECTIVES

- To introduce the concept of Construction management, use of Construction Techniques for civil engineering activities and the implementation in construction site.
- To study about the project management system for planning, monitoring and controlling of the projects.

Unit–I

Techniques of Box jacking – Pipe Jacking -under water construction of diaphragm walls and basement– Tunnelling techniques – Piling techniques – Well and caisson – Sinking cofferdam – Cable anchoring and grouting– Driving diaphragm walls, sheet piles – Shoring for deep cutting – Well points – Dewatering and stand by Plant equipment for underground open excavation.

Unit–II

Launching girders, bridge decks, off shore platforms – Special forms for shells – Techniques for heavy decks – In-situ pre-stressing in high rise structures,

Material handling – Erecting light weight components on tall structures – Support structure for heavy Equipment and conveyors – Erection of articulated structures, braced domes and space decks.

Unit–III

Selection of equipment for earth work - Earth moving operations - Types of earthwork equipment - Tractors, motor graders, scrapers, front end waders, earth movers – Equipment for foundation and pile driving. Equipment for compaction, batching and mixing and concreting - Equipment for material handling and erection of structures - Equipment for dredging, trenching, tunnelling.

Unit–IV

Construction management – Necessity of construction management – Objectives of construction management – Function of construction management – Construction economy – Scientific method in construction management – Principals of Scientific management – Role of construction management. Construction Planning – Stage of planning – Types – advantages of planning. Safety in Construction – Causes, classification, cost and measurement of an accident, safety programme for construction, protective equipment, accident report, safety measure.

Unit–V

Scheduling – Classification of scheduling – Construction cost control – Methods of scheduling – Bar charts - Milestone charts – Elements of Network – Development of network. PERT - Time Estimates - Time Computations - Network AnalysisCPM - Network Analysis – Problems. Cost control– stages of cost control – Classifications of cost control – Methods of cost control. Resource Allocation - Resource Smoothing - Resource levelling.

TEXT BOOKS

1) Arora S.P. and Bindra S.P., Building Construction, Planning Techniques and Method of *Construction*, DhanpatRai and Sons, NewDelhi, 1997.
2) Varghese P.C. *Building Construction*, Prentice Hall of India Pvt. Ltd, New Delhi, 2007.

REFERENCE BOOKS

1) Sharma.S.C, *Construction Equipments and Management*, Khanna Publishers, NewDelhi, 2002.
2) Srinath.L.S, *PERT and CPM - Principles and Applications*, East West Press Private Ltd., New Delhi, 1991.
3) Modi P.N, *PERT and CPM Programming*, Tata McGraw Hill Publications, New Delhi, 1990.
4) Pert and CPM Programming, Programme Evaluation and review Technique and Critical *Path Method*, Tata McGraw Hill Publications, New Delhi, 1997.
5) Punmia.B.C, et al, Project Planning and Control with PERT and CPM,Tata McGraw Hill Publications, New Delhi, 1991.

COURSE OUTCOMES

At the completion of the course students will be able

1) To understand the project control and construction management.
2) To gain knowledge about the CPM and PERT.
3) To gain the practical knowledge of construction process and techniques.

02OEXXX	REHABILITATION OF CONCRETE STRUCTURES	L	T	P
		4	0	0

COURSE OBJECTIVES

- To understand the mechanism of deterioration of concrete, damage assessment, repair materials and rehabilitation techniques.

Unit–I

Introduction – Mechanics of deterioration of concrete – Physical Causes – Freeze and Thaw – Water evaporation – Crystallization of salts in pores – Permeation of water and gases – Chemical Causes – Hydrolysis & Leaching – Sulphate attack – Chloride attack – Salt attack.

Unit–II

Effect of Steel chemistry – Effect of Concrete microstructure – Effect of internal stress levels – Effect of steel bar design – Effect of imposed forces – Effect of environments – Corrosion process in RC structures – Corrosion protection techniques.

Unit–III

Investigations – Visual inspection – Inspection by records – Inspection with instruments: – Surface Hardness Methods – Penetration Techniques (Simbi Hammer, Spit Pins, Windsor Probe, PNR Tester) – Pull Out Tests (Lok Test, TNS Tester, Internal Fracture Test, Epoxy Grouted Bolt) – Core Drilling – Resonant Frequency Method – Ultrasonic Pulse Velocity Method – Pulse Attenuation Method – Pulse Echo Method – Radio Active Method – Nuclear Methods – Magnetic Methods – Electrical Methods – Acoustic Emission Technique – Insitu Permeability Test.

Unit–IV

Introduction - Repair materials – Guniting – Grouting – Cement Grouting – Epoxy Grouting – Polymer Grouting – Epoxy Coating – Epoxy Mortar Coating – Sand Blasting – Grinding – Stitching – Dry Pack – Prepacked Concrete – Resurfacing – Acid etching – Caulking.

Unit–V

Methodology for repair materials - Mortar Replacement – Concrete Replacement – Total Replacement – Preplaced aggregate concrete – Jacketing technique – Plate Bonding technique – Fibre Sheet Bonding Technique

TEXT BOOKS

1) Peter H. Emmons, *Concrete Repair and Maintenance*, Galgotia Publishers, New Delhi, 2002.
2) Vidivelli.B, *Rehabilitation of Concrete Structures*, Standard Publishers Distributors, New Delhi, 2007.

REFERENCE BOOKS

1) Ted Kay, *Assessment and Renovation of Concrete Structures*, Longman Scientific & Technical, New York, 1992.
2) Allen, R.T.L. and S.C. Edwards, *The Repair of Concrete Structures*, Blackie & Son Ltd Glasgow, V.K, 1987.

COURSE OUTCOMES

At the completion of the course students will be able

1) To understand about the damages, damage assessments, repair materials and rehabilitation of concrete structures.
2) Perfectly analyze the damage by testing methods, suggestion and recommendations for different damages.

02OE XXX	GROUND IMPROVEMENT TECHNIQUES	L	T	P
		4	0	0

COURSE OBJECTIVES

- This course teaches the advancement in the subsoil stabilization in a modern approach.
- the real problem, methods of improvement over such problems and the methodology are dealt.

Unit–I

Introduction - Methods of ground improvement - Geotechnical problems in alluvial, lateritic

andBlack Cotton soils - Selection of suitable ground improvement methods based on soil conditions.

Unit–II

Drainage and dewatering - Drainage techniques - Vacuum and electro - Osmotic methods – Seepage analysis for 2D flow fully and partially penetrating slots in homogeneous deposits.

Unit–III

In-situ treatment of granular and cohesive soils – In-situ densification of granular soils -consolidation of cohesive soils - Dynamic compaction and consolidation –Vibro-floatation -Sand pile compaction - Preloading with sand drains and fabric drains - Stone columns - Lime piles- Relative merits of various methods and their limitations.

Unit–IV

Earth reinforcement - concept - Types of reinforcing materials - Application of reinforced earth – Geo-textiles in filtration drainage - Separation and road works.

Unit–V

Grouting techniques - Grouting equipments and machinery - Injection methods – Grout monitoring -Stabilization with cement, lime and chemicals - Stabilization of expansive soils.

TEXT BOOKS

1) Robert M Koerner, Construction and Geotechnical Methods in Foundation Engineering, McGraw-Hill, Inc, USA, 1984.
2) Mike Moseley, Klaus Kirsch, Ground Improvement, Taylor & Francis Ltd, Spon Press,London, 2003.

REFERENCE BOOKS

1) Colin J F P Jones, *Earth Reinforcement and Soil Structures*, London; Boston: Butterworths, 1985.
2) Craig R F, *Soil Mechanics,* 7th Edition Taylor & Francis, London, 1992.

COURSE OUTCOMES

1) At the end of this course the student should have an understanding on the behaviour of ground improvement techniques. The students should have knowledge about the rudimentary principles of designing ground piles as per the existing codes.

02OEXXX	INTRODUCTION TO SOIL DYNAMICS AND MACHINE FOUNDATIONS	L	T	P
		4	0	0

COURSE OBJECTIVES

- Structures subjected to dynamic loads in turn affect the foundations and the soil below.
- Hence knowledge of dynamic behaviour of soils and foundations will go a long way in the design of structural systems subjected to dynamic loads.
- This course deals with the principles of analysis and design of foundations subjected to dynamic loads.

Unit–I

Introduction - Nature of dynamic loads - Vibration of elementary system - SDOF system – Free and Forced vibrations - Effect of damping - Vibration measuring techniques.

Unit–II

Waves and Wave propagation - Compression, shear and Rayleigh waves- Waves in elastic half space. Dynamic properties of soils - Determination of soil coefficients - Field tests – Typical values of soil constants - Effect of vibration on dissipative properties of soil - Codal provisions.

Unit–III

Machine foundations - Types - General requirements - Design parameters - Design criteria and Codal provisions for reciprocating and rotary type machines

Unit–IV

General requirements - Design parameters - Design criteria for impact type machines Codal provisions - Constructional details of machine foundations.

Unit–V

Vibration isolation - Passive and Active isolation - Mechanical isolation - Foundation isolation - Isolation by locations and barriers.

TEXT BOOKS

1) Srinivasulu P, Vaidyanathan CV, *Handbook of Machine Foundations,* McGraw-Hill, New Delhi, 1977.
2) ShamsherPrakash and Vijay Puri, *Foundations for Machines,* Wiley,Navi Mumbai, 1987.

REFERENCE BOOKS

1) Moore P.J, Analysis and Design of Foundations for Vibrations, Taylor & Francis, London, 1985.
2) Richart F.E, John R Hall, R D Woods, Vibrations of Soils and Foundations, Englewood Cliffs, N.J., Prentice-Hall, USA, 1970.

COURSE OUTCOMES

1) At the end of this course the student should have an understanding on the behaviour of dynamic behaviour of soils and foundations. The students should have knowledge about the rudimentary principles of Vibration isolation.

06OEXXX	ARTIFICIAL INTELLIGENCE	L	T	P
		4	0	0

COURSE OBJECTIVES

- In the design of intelligent and smart structures, use of artificial intelligence techniques becomes an integral part of structural design. This course is an introductory course to the principles and applications of artificial intelligence in structural engineering.

Unit–I

Definition - The AI problems - Assumptions - AI techniques - Defining a problem as a state space search - Production systems - Problem characteristics - Production system characteristics.

Heuristic search techniques - Hill climbing - Best- First search - Branch and Bound Search - Problem reduction - Constraint satisfaction - Means - Ends analysis.

Unit–II

Knowledge Representation and Mappings - Approaches - Issues - Representing simple facts in logic - Representing Instance and Isa relationships - Resolution - Natural Deduction. Representing knowledge using rules - Logic programming - Forward Vs Backward Reasoning - Matching and Control knowledge.

Unit–III

Symbolic reasoning under uncertainties–Nonmonotonic reasoning - Logics for nonmonotonic reasoning - Implementation issues - Augmenting a problem solver - Implementation of Depth - Implementation of Breadth - First search - Statistical Reasoning - Probability and Bayes Theorem - Certainty factors and Rule - Based systems - Bayesian Networks - Fuzzy logic - Semantic Nets - Frames - Conceptual Dependency - Scripts - CYC.

Unit–IV

Overview of planning - An example domain; The blocks world - Components of a planning system - Goal stack planning.

Introduction to learning - Rote learning - Learning by taking advice - Learning in problem solving - Learning by parameter adjustment - Learning with macro operators - Learning from examples - Introduction - Winstons learning program.

Introduction to expert systems (ES) - Components of an ES - Features of an ES - ES categories - Developing and using an ES - Nodel based ES - Introductory ideas of natural language processing, Computer vision and neural networks.

Unit–V

Elements of PROLOG - Facts - Objects - Predicates - Variables - Bound and free variables - Anonymous variables - Rules - Execution and control. Fail and back tracking - Concept of recursion - The repeat predicate - The cut predicate. Input and output in PROLOG - Readln - Write predicates - Writef predicate - Structures and trees - Lists – Recursive search map- ping - Recursive comparison - Joining structures together.

TEXT BOOKS

1) Elaine Rich, *Artificial intelligence*, Auckland, etc.: McGraw-Hill, New Delhi, 2008.
2) Nils J Nilsson, *Principles of artificial intelligence*, Palo Alto, Calif.: Tioga Pub. Co., Wellsboro, 1980.
3) REFERENCE BOOKS
4) Henry C Mishkoff, Buchanan, *Understanding Artificial Intelligence*, Indianapolis, H.W. Sams & Co., USA, 1985.
5) Patrick Henry Winston, *Artificial Intelligence: Instructors Manual, Reading, Mass Addison*-Wesley Pub. Co., Boston, 1992.
6) Carl Townsend, *Introduction to Turbo Prolog*, Berkeley, Sybex, 1987.
7) Clocksin W F, C S Mellish, *Programming in Prolog*, Springer- Verlag, New York, 1987.

COURSE OUTCOMES

1) Student can design of intelligent and smart structures, use of artificial intelligence techniques.

02OEXXX	THEORY OF ELASTICITY AND PLASTICITY	L	T	P
		4	0	0

COURSE OBJECTIVES

- This course helps the students to understand the elastic and plastic behaviours of engineering materials and to evaluate stresses and strains developed in materials more exactly.

Unit–I

Basic equations - Stress and strain at a point - Generalized Hooke's law - Plane stress and plane strain - Equilibrium conditions - Compatibility conditions. Two-dimensional problems in Cartesian Co-ordinates - Airys stress function.

Unit–II

Three-dimensional problems - Analysis of stress and strain - Pure bending of a prismatic bar – Vector of equilibrium equations - solution of equilibrium equations - Use of potential functions - Bettis method - Method of integral transforms - Simple applications.

Unit–III

Energy methods - Castiglianos theorem - Principle of Virtual work - Principle of stationary potential energy - Principle of least work - Rayleighs method - Rayleigh-Ritz method- inite difference method - Simple applications.

Unit–IV

Plasticity - Plastic deformation - Mechanism - Factors affecting plastic deformation - Strain hardening - Luders lines - Plastic stress-strain relations - Empirical equations - Theory of plastic flow - Concept of plastic potential - Yield criteria - Yield conditions - Experimental evidence - Geometric representation of yield criteria. Plastic deformation in tension – Stress strain curves - Advantages of true Stress strain diagram - Stress in the neck of a cylindrical specimen and in the neck of a flat plate in tension and sphere under internal pressure - Instability in compression.

Unit–V

Plastic bending of beams - Idealised Stress strain diagram - Residual stresses in plastic bending – Plastic bending of unsymmetrical sections - Deflection under plastic bending. Plastic Torsion - Circular and non-circular shafts - Residual stresses - Sand heap analogy – Shape factors in torsion.

TEXT BOOKS

1) Stephen Timoshenko, J N Goodier, Theory of Elasticit,McGraw-Hill, New Delhi, 2003.
2) Sadhusingh, Theory of Elasticity, Khanna Publishers, New Delhi, 1988.

REFERENCE BOOKS

3) Johnson W, P B Mellor, Plasticity for Mechanical Engineers, Princeton, N.J.Van Nostrand, London, 1966.

COURSE OUTCOMES

1) At the end of this course, students can able to understand the elastic and plastic behaviours of engineering materials.

00OEXXX	CONSTRACT LAWS AND REGULATIONS	L	T	P
		4	0	0

COURSE OBJECTIVES

- To study the various types of construction contracts and their legal aspects and provisions. To study the tenders, arbitration, legal requirement, and labour regulations.

Unit–I : Construction Contracts

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

Unit–II : Tenders

Prequalification – Bidding – Accepting – Evaluation of Tender from Technical, Contractual and Commercial Points of View – Contract Formation and Interpretation – Potential Contractual Problems – World Bank Procedures and Guidelines – Tamil Nadu Transparency in Tenders Act.

Unit–III : Arbitration

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

Unit–IV : Legal Requirements

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

Unit–V : LABOUR REGULATIONS

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

REFERENCE BOOKS

1) Gajaria G.T., Laws Relating to Building and Engineering Contracts in India, LexisNexis Butter Worths India, 2000
2) Jimmie Hinze, Construction Contracts, McGraw Hill, New Delhi, 2001.
3) Joseph T. Bockrath, Contracts and the Legal Environment for Engineers and Architects, McGraw Hill, New Delhi, 2000.
4) Kwaku, A., Tenah, P.E. Jose M.Guevara, P.E., Fundamentals of Construction Management and Organisation, Prentice Hall, 1985.M.M.Tripathi Private Ltd., Bombay, 1982.
5) Patil. B.S, Civil Engineering Contracts and Estimates, Orient Black swan, Telangana. 2006.

COURSE OUTCOMES

1) At the end of this course the student should have an understanding of the construction bylaw, Basic regulations to be followed in constructions.

02OEXXX	DESIGN OF PLATES AND SHELLS	L	T	P
		4	0	0

COURSE OBJECTIVES

- This course provides a brief introduction to the analysis of folded plates and knowledge about the formation and classification of shell structures. Preliminary design is also included.

Unit–I

Introduction to plate structures - Thin and thick plates - Structural action of plates – Assumptions involved in plate theories - Differential equation for cylindrical bending of plates – Cylindrical bending of uniformly loaded rectangular plates with simply supported and built-in edges – Small deflection theory of laterally loaded rectangular plates - Kirchoffs boundary conditions - Corner effects

Unit–II

Simply supported rectangular plates under Sinu-soidal load - Navier solution - Levys method - Symmetrical bending of laterally loaded circular plates - Circular plates with simply supported and built-in edges - Bending of annular plates.

Unit–III

Introduction to shell structures - Classification of shells - Membrane action - Stressed shell element and stress resultants - Load transfer mechanism - Characteristics of shell surfaces - tructural behaviour of shells - Membrane theory of cylindrical shells

Unit–IV

Bending theory of circular cylindrical shells - Comparison of various bending theories - Introduction to other types of shells.

Unit–V

Necessary design inputs - Detailed design - Prismatic folded plates - Circular cylindrical barrel shell roofs - Spherical dome - Conical dome - HYPAR shell - Helicoids.

TEXT BOOKS

1) Ramaswamy G.S, Design & Construction of Concrete Shell Roofs, R.E. Krieger, Malabar, USA, 1984.

2) Stephen Timoshenko, S Woinowsky-Krieger, Theory of plates and shells, McGraw-Hill, New Delhi,2010.

REFERENCE BOOKS

1) Mehdi Farshad, Design and Analysis of Shell Structures, Technology, Springer Science, Business Media, Dordrecht, 1992.
2) Rudolph Szilard, Theories and Applications of Plate Analysis, John Wiley, Chapman and Hall, Hoboken, NJ, 2004.
3) Binoy Kumar Chatterjee, Theory and Design of Concrete Shells, Chapman and Hall, London, 1988.
4) 64 Bairagi N.K, Shell Analysis, Khanna Publishers, Delhi, 1986.

COURSE OUTCOMES

1) At the end of this course the student should have an understanding on the behaviour of thin and thick plates. The students should have knowledge about the rudimentary principles of designing to shell structures.

00OEXXX	ECONOMICS AND FINANCE FOR CIVIL ENGINEERS	L	T	P
		4	0	0

COURSE OBJECTIVES

- Business acumen and a deep insight in economics are imminent to be successful in civil engineering practice. This course teaches the basics of economics, finance and accounting necessary for a civil engineering enterprise to be successful and profitable.

Unit–I

Economics - Role of Civil Engineering in Industrial development - Support matters of economy as related to Engineering - Market demand & supply - Choice of technology - Quality control and production - Audit in economic law of returns governing production.

Unit–II

Land and construction economics - Urban land use and values -Construction development in housing, transport and other infrastructures - Economics of ecology, environment, energy resources, local material selection, form and functional designs - Construction workers – Urban problems - Poverty - Migration - Unemployment- Pollution.

Unit–III

Financing - Need for financial management - Types of financing - Short-term and Long-term borrowing - Leasing - Equity financing - Internal generation of funds - External commercial borrowings - Assistance from government - International financial corporation's - Analysis of financial statements - Balance sheet - Profit and loss account - Funds flow statement – Ratio analysis - Investment and Financing decision - Financial control - Job control – Centralised management.

Unit–IV

Accounting method - General - Cash basis of accounting - Accrual basis of accounting -Percentage completion method - Completed contract method - Accounting for tax reporting purposes and financial reporting purposes.

Unit–V

Lending to contractors - Loans to contractors - Interim construction financing - Security and Risk aspects - Principles of BOT - Relevance of BOT in the Indian context.

TEXT BOOKS

1) Werner Zvi Hirsch, *Urban Economic Analysis,* McGraw-Hill, New Delhi, 1973.
2) Joy P.K, *Total Project Management* –The Indian Context, Macmillan, London, 2000.

REFERENCE BOOKS

1) Kwaku A Tenah, Jose M Guevara, Fundamentals of Construction Management and Organization, Reston Publishing Company, Virginia 1985.

COURSE OUTCOMES

1) At the end of this course the student should have an understanding the basics of economics, finance and accounting necessary for a civil engineering enterprise.

02OE XXX	SERVICES IN HIGH RISE BUILDINGS	L	T	P
		4	0	0

COURSE OBJECTIVES

- High rise buildings are a pleasure to watch, but they are made a pleasure to live in only when the functional requirements are adequately provided through proper ventilation, sanitation and water supply in addition to safety measures during calamities like fire.
- This course covers the principles and practices to be followed in the provision of good service systems.

Unit–I

Planning of building services - Important considerations - Floor loadings - Building cost – Material requirements.

Unit–II

Water supply services - Collection and examination of water samples - Standards - Internal storage and distribution - Bulk water supply - Water treatment - Selection of pumps - Pump rooms and sump.

Unit–III

Sanitation services - Sewerage collection and disposal - Storm water drains - Sewage disposal - Septic tanks - Solid waste disposal - Refuse disposal systems.

Unit–IV

Lift and Escalators - Types - Selection - Codes and Rules - Structural provisions – Strength considerations - Pits and overheads - Safety precautions.

Unit–V

Air-conditioning - Provisions in buildings - Systems. Acoustics - Noise in buildings - Noise control - Materials -Methods. Fire fighting services - Classification - Modes of fire - First- aid - Fighting installations – Fire extinguishers - Provisions in building from fire safety angle - Codes and rules.

TEXT BOOKS

1) Jain V.K, Designing and Installation of Services in Building. Complexes & High Rise Buildings, Khanna Publishers, Delhi, 2015.

2) Cyril M Harris, Handbook of Utilities and Services for Buildings: Planning, Design, and Installation, McGraw- Hill, New Delhi, 1990.

COURSE OUTCOMES

1) At the end of this course the student should have an understanding the functional requirements are adequately provided through proper ventilation, sanitation and water supply in addition to safety measures, the principles and practices to be followed in the provision of good service systems.

02OEXXX	DISASTER RESISTANT DESIGN OF STRUCTURES	L	T	P
		4	0	0

COURSE OBJECTIVES

- This course aims in understanding the concept of designing structures to withstand disaster.

Unit–I

Earthquake resistant design of structures - Introduction about earthquakes - Site response to earthquakes -Structural form determination - Form of superstructure – Form of the substructure. Structural response to earthquakes: - Response of structural materials – Methods of seismic analysis – Review of the Indian seismic code IS:1893 – 2002 (Part-I) provisions for buildings – Earthquake design philosophy –Assumptions – Analysis by seismic coefficient and response spectrum methods – Displacements and drift requirements – Provisions for torsion – Analysis of a multi-storeyed building using Seismic Coefficient method.

Unit–II

Plan Configurations – Torsion Irregularities – Re-entrant corners – Nonparallel systems – Diaphragm Discontinuity – Vertical Discontinuities in load path – Irregularity in strength and stiffness – Mass Irregularities – Vertical Geometric Irregularity – Proximity of Adjacent Buildings.

Types – Design of Shear walls as per IS: 13920 – Detailing of reinforcements.

Unit–III

Cyclone-Resistant Design of Buildings as Per Indian Standards - Winds Damage Buildings- Catastrophic Failures- Component Failures- Damaging Effects of Cyclone on Houses- Design Wind Speed and Pressures- Design of the House- Design procedure for wind resistant buildings-Discussion of codal provisions IS 15498-2004 guidelines for improving the cyclonic resistance of low rise houses and other buildings/structures.

Unit–IV

Fire – Fire extinguishing methods- Classification of fire- cause of fire- safety measures- smoke- volume and quality of smoke- Types of fire extinguishers- Types of fire fighting system- Active and passive fire control design of buildings- General design requirements of building design in fire prevention- Review of the Indian standard code of practice for fire safety of buildings IS:1642 – 1989 provisions for buildings.

Unit–V

Blast resistant design of structures – Introduction – Blast force on structures – Response of structures to blast loading – Loads – Stresses – Planning for blast

resistant buildings-Architectural and structural design for blast resistant buildings. Discussion of codal provisions IS 4991 -1968.

TEXT BOOKS

1) Jaikrishna & Chandrasekar, Elements of Earthquake Engineering.
2) Dowrick,D.J., Earthquake Resistant Designs, Wiley, 2nd Edition, New Delhi, 2009.

REFERENCE BOOKS

1) Buchholdt,H.A., *Structural Dynamics for Engineers*, Thomas Telford, London, 1997.
2) Robert Englekirk E. and Gray HartC., *Earthquake Design of Concrete Masonry Buildings*, Englewood Cliffs, N.J, Prentice Hall, USA, 1982.
3) AngusMacDonaldJ., *Wind Loading on Buildings*, Wiley, New Delhi, 1975.
4) Alan Garnett Davenport, "Wind Loads on Structures", National Research Council, Canada.
5) Schroll, R. C. (2002). *Industrial fire protection handbook*. (2nd ed.). CRC Press: Boca Raton, FL. ISBN: 1587160587
6) Cote, A. & Bugbee, P. (1988). *Principles of fire protection*. National Fire Protection Association.
7) Lawson, T.V., *Wind Effects on Buildings*, Applied Science Publishers, London, 1980.

COURSE OUTCOMES

1) The students can able to design a proper disaster resistant design of structures.

01OE XXX	WASTE WATER ENGINEERING	L	T	P
		4	0	0

COURSE OBJECTIVES

- The objectives of this course is to help students develop the ability to apply basic understanding of physical, chemical, and biological phenomena for successful design, operation and maintenance of sewage treatment plants.

Unit–I

Characteristics and composition of sewage - population equivalent -Sanitary sewage flow estimation – Sewer materials – Hydraulics of flow in sanitary sewers – Sewer design – Storm drainage-Storm runoff estimation – Maintenance of sanitary sewerage and storm drainage – sewer appurtenances – corrosion in sewers – prevention and control – sewage pumping drainage in buildings-plumbing systems for drainage.

Unit–II

Objectives – Unit–Operations and Processes – Selection of treatment processes –- Onsite sanitation - Septic tank- Grey water harvesting – Primary treatment – Principles, functions and design of sewage treatment units - screens - grit chamber-primary sedimentation tanks – Construction, Operation and Maintenance aspects.

Unit–III

Objectives – Selection of Treatment Methods – Principles, Functions, - Activated Sludge Process and Trickling filter- other treatment methods – Oxidation ditches, UASB – Waste Stabilization Ponds – Reclamation and Reuse of sewage -

Recent Advances in Sewage Treatment – Construction, Operation and Maintenance aspects.

Unit–IV

Standards for Disposal - Methods – dilution – Self purification of surface water bodies – Oxygen sag curve – de oxygenation and re aeration - Land disposal – Sewage farming – sodium hazards -Soil dispersion system.

Unit–V

Objectives - Sludge characterization – Thickening – Sludge digestion – Biogas recovery – Sludge Conditioning and Dewatering – ultimate residue disposal – recent advances.

TEXT BOOKS

1) Duggal K.N., *Elements of Environmental Engineering* S.Chand and Co. Ltd., New Delhi, 2010.
2) Garg, S.K., *Environmental Engineering Vol. II*, Khanna Publishers, New Delhi, 2003.
3) Punmia, B.C., and Jain.A.K.., *Environmental Engineering*, *Vol.II*, Laxmi Publications, New Delhi, 2010.

REFERENCE BOOKS

1) *Manual on Sewerage and Sewage Treatment*, CPHEEO, Ministry of Urban Development, Government of India, New Delhi, 2003.
2) Metcalf and Eddy- *Wastewater Engineering–Treatment and Reuse*, Tata McGraw-Hill Company, New Delhi, 2003.
3) Gray N.F, *Water Technology*, Elsevier India Pvt. Ltd., New Delhi, 2006.

COURSE OUTCOMES

1) At the end of this course the student should have an understanding on the ability to apply basic understanding of physical, chemical, and biological phenomena for successful design, operation and maintenance of sewage treatment plants.

01OEXXX	SOLID WASTE MANAGEMENT	L	T	P
		4	0	0

COURSE OBJECTIVES

- To make the students conversant with different aspects of the types, sources, generation, storage, collection, transport, processing and disposal of municipal solid waste.

Unit–I

Sources and types of municipal solid wastes-waste generation rates-factors affecting generation, characteristics-methods of sampling and characterization; Effects of improper disposal of solid wastes-Public health and environmental effects. Elements of solid waste management –Social and Financial aspects – Municipal solid waste (M&H) rules – integrated management-Public awareness; Role of NGO's.

Unit–II

On-site storage methods – Effect of storage, materials used for containers – segregation of solid wastes – Public health and economic aspects of open storage –

waste segregation and storage – case studies under Indian conditions – source reduction of waste – Reduction, Reuse and Recycling.

Unit–III

Methods of Residential and commercial waste collection – Collection vehicles – Manpower – Collection routes – Analysis of collection systems; Transfer stations – Selection of location, operation & maintenance; options under Indian conditions – Field problems- solving.

Unit–IV

Objectives of waste processing – Physical Processing techniques and Equipments; Resource recovery from solid waste composting and biomethanation; Thermal processing options – case studies under Indian conditions.

Unit–V

Land disposal of solid waste; Sanitary landfills – site selection, design and operation of sanitary landfills – Landfill liners – Management of leachate and landfill gas- Landfill bioreactor – Dumpsite Rehabilitation

TEXT BOOKS

1) George Tchobanoglous and Frank Kreith, *Handbook of Solid waste Management*, McGraw Hill, New York, 2002.
2) Paul T Willams, *Waste Treatment and Disposal*, John Wiley and Sons,New Delhi, 2000.

REFERENCE BOOKS

1) Manual on Municipal Solid Waste Management, CPHEEO, Ministry of Urban Development, Government of India, New Delhi, 2000.
2) Bhide A.D. and Sundaresan, B.B. Solid Waste Management Collection, Processing and *Disposal*, 2001, ISBN 81-7525-282-0
3) Manser A.G.R. and Keeling A.A., Practical Handbook of Processing and Recycling *of Municipal solid Wastes*, Lewis Publishers, CRC Press, Taylor & Francis Books India Pvt. Ltd., New Delhi, 1996

COURSE OUTCOMES

1) At the end of this course the student should have an understanding on the different aspects of the types, sources, generation, storage, collection, transport, processing and disposal of municipal solid waste.

02OEXXX	SMART MATERIALS AND SMART STRUCTURES	L	T	P
		4	0	0

COURSE OBJECTIVES

- Overview of smart materials, Piezoelectric Ceramics, Piezo-polymers, Magnetostrictive Materials, Electro active Polymers, Shape Memory Alloys, Electro and Magneto Rheological Fluids, Modelling of smart materials, introduction to composite smart materials, Mechanics of smart composite materials, Smart sensors based on high bandwidth low strain smart materials, Low-bandwidth high strain smart actuators, Micro-electro mechanical Smart Systems, Intelligent devices based on smart materials, Applications of Smart Actuators: Active and Hybrid Vibration Control, Active Shape Control, Distributed Sensing and Control of Smart Beams.

Unit–I

Introduction to Smart Materials, Principles of Piezoelectricity, Perovskyte Piezoceramic Materials, Single Crystals vs. Polycrystalline Systems, Piezoelectric Polymers, Principles of Magnetostriction, Rare earth Magnetostrictive materials, Giant Magnetostriction and Magneto-resistance Effect, Introduction to Electro-active Materials, Electronic Materials, Electro-active Polymers, Ionic Polymer Matrix Composite (IPMC), Shape Memory Effect, Shape Memory Alloys, Shape Memory Polymers, Electro-rheological Fluids, Magneto Rheological Fluids.

Unit–II

Piezoelectric Strain Sensors, In-plane and Out-of Plane Sensing, Shear Sensing, Accelerometers, Effect of Electrode Pattern, Active Fibre Sensing, Magnetostrictive Sensing, Villari Effect, Matteuci Effect and Nagoka-Honda Effect, Magnetic Delay Line Sensing, Application of Smart Sensors for Structural Health Monitoring (SHM), System Identification using Smart Sensors.

Unit–III

Modelling Piezoelectric Actuators, Amplified Piezo Actuation – Internal and External Amplifications, Magnetostrictive Actuation, Joule Effect, Wiedemann Effect, Magnetovolume Effect, Magnetostrictive Mini Actuators, IPMC and Polymeric Actuators, Shape Memory Actuators, Active Vibration Control, Active Shape Control, Passive Vibration Control, Hybrid Vibration Control.

Unit–IV

Review of Composite Materials, Micro and Macro-mechanics, Modelling Laminated Composites based on Classical Laminated Plate Theory, Effect of Shear Deformation, Dynamics of Smart Composite Beam, Governing Equation of Motion, and Finite Element Modelling of Smart Composite Beams.

Unit–V

Self-Sensing Piezoelectric Transducers, Energy Harvesting Materials, Autophagous Materials, Self- Healing Polymers, Intelligent System Design, Emergent System Design.

TEXT BOOKS:

1) Brian Culshaw, *Smart Structures and Materials*, Artech House, London, 2000
2) Gauenzi, P, *Smart Structures*, Wiley, New Delhi, 2009

REFERENCE BOOKS

1) Cady, W. G., *Piezoelectricity*, Dover Publication, New York, 1964

COURSE OUTCOMES

1) At the end of this course the student should have an understanding on the Modelling of smart materials, introduction to composite smart materials, Mechanics of smart composite materials.

01PEXXX	REMOTE SENSING TECHNIQUES AND GIS	L	T	P
		4	0	0

COURSE OBJECTIVES

- To introduce the basic concepts of remote sensing.
- To learn the fundamentals of photogrammetry and image interpretation.
- To understand the techniques involved in cartography and GPS.
- To impart knowledge on applications of RS and GIS in resource mapping.

Unit–I

Definition of RS and its components – Electromagnetic spectrum – wavelength regions important to remote sensing – Wave theory, Particle theory, Stefan-Boltzman and Wein's Displacement Law – Atmospheric scattering, absorption – Atmospheric windows – spectral signature concepts – typical spectral reflective characteristics of water, vegetation and soil–types of platforms – orbit types–Sun-synchronous and Geosynchronous – Passive and Active RS –Parameters of Sensors.

Unit–II

Types of data products – types of image interpretation – basic elements of image interpretation –visual interpretation keys – Digital Image Processing – Pre-processing – image enhancement techniques –image classification–Supervised and Unsupervised.

Unit–III

Maps – Definitions – Map coordinate systems – Map projections – types of map projections – Fundamentals of GPS–components of GPS– GPS data collection methods–application of GPS– GIS definition – basic components of GIS – standard GIS software – Data type – Spatial and non-spatial (attribute) data – measurement scales – Types of files – Data Base Management Systems (DBMS) types.

Unit–IV

GIS Data models – vector and raster data – Raster data compression – data input by digitization and scanning– GIS data errors and remedial measures– attribute data analysis – integrated data analysis.

Unit–V

Modeling in GIS: Highway alignment studies – Land Information System– Change Detection– Land use/ Land cover mapping – Watershed management – Water quality mapping – surface and groundwater resources mapping.

TEXT BOOKS

1) Lillesand,T.M., Kiefer, R.W. and Chipman.J.W., *Remote Sensing and Image Interpretation*, John Wiley and Sons (Asia) Private Limited, New York, 2007.
2) Kang-tsung Chang, *Introduction to Geographical Information System*, Tata McGraw-Hill Edition,New Delhi,2009.

REFERENCE BOOKS

1) Basudeb Bhatta, *Remote Sensing and GIS*, Second Edition, Oxford University Press, New Delhi,2011.
2) Agarwal. C.S. and Garg. P.K., *Remote Sensing in Natural Resources Monitoring and Management*, A H Wheeler Publishing Company, Mumbai, 2000.
3) Peter A. Burrough and Rachael A. McDonnell, *Principles of Geographical Information systems for land resource assessment*, Oxford University Press, New Delhi, 2004.
4) Anji Reddy. M., *Textbook of Remote Sensing and Geographical Information System*, 2nd Edition, BS Publications, Hyderabad, 2001.
5) Ian Heywood, Sarah Cornelius, Steve Carver and Srinivasa Raju, *An Introduction to Geographical Information Systems*, Pearson Education, 2nd Edition, London, 2007.
6) Wolf Paul, *Elements of Photogrammetry*, McGraw-Hill Edition, New Delhi, 1998.
7) Clarke Parks and Crane, *Geographical Information Systems and Environmental Modelling*, Prentice Hall of India, New Delhi, 2005.

COURSE OUTCOMES

At the end of the course students will be able to

1) Identify the concepts and characteristics of Remote Sensing.
2) Acquire knowledge of appropriate map projection and coordinate systems.
3) Understand GIS, its structure, quality and standards.
4) Get exposure to several applications of RS and GIS in the various fields of Civil engineering especially resource mapping.

01OEXXX	URBAN AND RURAL PLANNING	L	T	P
		4	0	0

COURSE OBJECTIVES

- To enable students to develop knowledge on Urban and rural planning.
- To introduce the regulations and laws related to urban planning.
- To educate the importance of zoning in planning.
- To get to know the principles involved in planning public buildings.

Unit–I

Objectsoftown planning–Economicjustification–Principlesof Town Planning–Necessity ofTown Planning–Growthof Towns– Naturaland plannedgrowth–stagesin Town Development– Distribution ofLanduse–Forms of planning–Development of Town PlanninginAncient India–Conceptsof Modern Town Planningand its stages.

Unit–II

Types of surveys–Collection of Data– Importance of zoning– Classification of Zoning–Use of zoning–Height zoning–Density zoning –Housing–Planning of neighbourhood units–Types of Layouts – Classification of housing– Housing problems in India.

Unit–III

Parks and Playgrounds–Schools–Public buildings and Town Centres–Industries– Industrial Estates–Communication and Traffic system–Traffic surveys – Traffic congestions– Types of road junctions– Parking facilities –Street lighting.

Unit–IV

Urban Renewal – Replanning of the existing towns – Objects of replanning–Necessity of Replanning – Advantages of Master plan– Data and Maps–Features of Master plan–Implementation of Master Plan–Planning law and Legislation in India–Building Byelaws–Functions of Local authority–Development –Control Rules for Metropolitan and District Municipalities.

Unit–V

Concept of rural planning–Urban and Rural differences– Urbanization – Principles of Ruralplanning–Village redevelopment–Integral Rural development program–Rural housing–Principles–Design of Rural Housing–Rural Housing schemes –Group housing–Environmental Sanitation in Rural planning– Usage of low cost materials.

TEXT BOOKS

1) Hiraskar. K.G., *Fundamentals of Town Planning*, Danpatrai & Sons., New Delhi, 2012
2) Rangwala. S.C., *Town Planning*, Charotar Publishing House Pvt. Limited, Gujarat, 2009.

REFERENCE BOOKS

1) Chennai Metropolitan Development Authority, Second Master Plan for Chennai, Government of Tamilnadu, Chennai, 2008.
2) Tamilnadu Town and Country Planning Act 1971,Government of Tamilnadu, Chennai.
3) Goel. S.L.,Urban Development and Management, Deep and Deep Publications, New Delhi, 2002.
4) Thooyavan. K.R., Human Settlements – A Planning Guide to Beginners, M.A.Publications, Chennai, 2005.

COURSE OUTCOMES

At the end of the course students will be able to

1) Describe basic issues in urban planning.
2) Formulate plans for Urban and rural development.
3) Plan and analyze socio-economic aspects of Urban and rural planning.
4) Understand functions of local authority with a clear idea of control rules.

06OEXXX	DIGITAL SIGNAL PROCESSING	L	T	P
		4	0	0

COURSE OBJECTIVES

- It helps the student to understand the basics of signals and its processing
- Identify the problems in digital signals and make solutions

UNIT–I

Discrete time signals – Properties – Standard test signals -- Operation on signals – Discrete time systems – Properties – Representation of LTI systems – Impulse response – Discrete time Fourier transform (DTFT) – Frequency response – Properties – Sampling analog signals – Shannon's sampling theorem - Aliasing- Multirate sampling – Up sampler – Down sampler.

Unit–II

Discrete Fourier Transform (DFT) – Properties – Circular convolution – Comparison between Linear convolution and Circular convolution – Filtering long duration sequences: Overlap-save method, Overlap-add method – Fast Fourier Transform (FFT): Decimation-in-time (DIT) algorithm – Decimation-in-frequency algorithm – FFT radix-2 DIT, DIF implementation — IDFT using Direct FFT Algorithm – Quantization noise introduced by analog-to-digital conversion – Finite register length effects in the realization of IIR and FIR digital filters and in DFT computation.

Unit–III

Definition of digital filters – Properties of digital filters – Impulse response of FIR and IIR filters – Frequency response of FIR and IIR filters – Linear phase FIR filters – Z-Transforms of FIR and IIR filters – Applications – Definition –Properties – ROC – Transfer function – Poles and Zeros – Z-Transforms and Frequency response relationships – Inverse Z-Transform – Realization of digital filters- direct form- Transposed form – Canonic – Cascade- Parallel and Ladder form.

Unit–IV

FIR filters - Design criteria – Minimizing design criteria (Fourier design technique), Lengths of the filter- Windowing: window responses - Periodic

convolution – Response of uniform window – Von Hann window – Hamming window – Kaisar window – FIR half-band digital filter – Linear phase FIR digital filters – Design of IIR filters: Analog filter approximation, Butterworth, Chebyshev and Elliptic filters – Frequency band transformation – Digital filter design equations low pass, high pass, bans pass and band stop – Impulse Invariant technique for IIR filter – Impulse Invariant pole mapping – Bilinear transformation – Bilinear transformation pole mapping – Introduction to computer – aided design of IIR and FIR Digital Filters (Matlab Analysis).

Unit–V

Generic DSP Architecture – Architecture of TMS 320 F 2407 and TEXAS 5416 processor – memory and I/O Organization – CPU –Program control – Addressing modes – Assembly Language Instructions – On chip peripherals – Clock, watch dog and real time Interrupt, event manager units – Interface units – Simple Programs.

TEXT BOOKS

1) Proakis J.G, Manolakis D.G, "Digital Processing- Principles, Algorithms and Applications, Second Edition, Prentice Hall of India,4th edition, New Delhi, 2007.
2) Mitra S.K, "Digital Signal Processing – A computer Based Approach, Second Edition, Tata McGraw Hill,New Delhi, 2000.

REFERENCE BOOKS

1) Oppenheim A.Vand Schaffer R.W, *Digital Signal Processing*, Prentice Hall, USA 1987.
2) Johnson J.R, *Introduction to Digital Signal Processing*, Prentice Hall of India, New Delhi, *1994.*
3) Simon Haykin, Barry Van Veen., *Signals & Systems*, John Wiley & Sons (ASIA) Private Limited,New Delhi, *1999.*
4) Venkatramani. B and Bhaskar.M, *Digital Signal Processors*, Tata McGraw-Hill Education, New Delhi, 2002.
5) Toliyat A. Campbell, *DSP based Electromechanic Motion Control*, CRC Publications, Texas, 2004.

COURSE OUTCOMES

1) Student can able to identify the problems and can solve problems of digital signals and its processing.

08OEXXX	COMPUTER NETWORKS	L	T	P
		4	0	0

COURSE OBJECTIVES

- To study about Wireless transmission basics and Protocols.
- To explore issues and challenges in designing MAC and TCP Protocols in the context of wireless networks
- To know about Wireless LAN and advanced network architectures.
- To make the students to understand the importance and goals of communication network and information security and introduce him to the different types of attacks.

Unit–I

Connection Oriented Transport Protocol - Reliable Networks Services - Unreliable Network Services -TCP Services-Header format -TCP Mechanisms - TCP Policy options - Congestion Control - Retransmission Timer Management - Window Management - Quality of service - User Datagram Protocol (UDP).

Unit–II

Background - Topologies and Transmission Media - LAN standards IEEE 802 Reference Model - Logical Link Control - Medium Access Control - IEEE 802.3 Medium Access Control - Ethernet - Fast Ethernet - Gigabit Ethernet - Token Ring and FDDI - IEEE 802.5 Transmission Medium Options. Fibre Channel Elements - Fibre Channel Protocol Architecture - Fibre Channel Physical Media and Topologies - Bridge Protocol Architecture - Fixed routing - Spanning tree approach - Virtual LANs - Router and Three layer switches - Connecting Remote LANs - Wireless LANs - IEEE 802.11 - Architecture and Services - Medium Access Control - Physical layer.

Unit–III

Principle - Requirements - Architectural approaches - Connectionless Internetworking - Routing techniques - Dynamic routing - Internet Protocol (IP) - Internet Control Message Protocol (ICMP) - IPV6 structure - Address and Header Formats - ICMPV6 - Unicast and Multicast Routing - Autonomous Systems - Unicast Routing Protocol OSPF - Internet Group Management Protocol (IGMP) - Border Gateway Protocol.

Unit–IV

Passive and Active Attacks - Encryption Algorithms - Traffic padding - Message Authentication - Hash function - Public-key Encryption - RSA Public key Encryption Algorithm - Key Management - Secure Socket layer and Transport layer Security - SSL Architecture - SSL Record Protocol - Change Cipher Spec Protocol - Alert Protocol - Handshake Protocol - IP level Security IPSEC - Application layer Security PGP - Firewall - Virtual Private Networks.Electronic Mail - Simple Mail Transfer Protocol (SMTP) - Multipurpose Internal Mail Extension (MIME) - Client Server Model - Socket Interface - Socket Programming - File Transfer - Simple Network Management Protocol (SNMP) - Hypertext Transfer Protocol (HTTP) overview - World Wide Web (WWW) - HTML - Common Gateway Interface (CGI).

Unit–V

Integrated Services in Internet - Resource Reservation Protocol (RSVP) - Reservation Merging - RSVP Message format - Differentiated Services - DS field - Network Interconnection Models - Overlay Model - Peer-to-Peer Model - Multi-protocol Label Switching (MPLS) - Generalized MPLS (GMPLS) - Real-Time Transport Protocols (RTP) - RTP Control Protocol - Session Control Protocols - Session Initiation Protocol.

REFERENCE BOOKS

1) William Stallings, *Data and Computer Communication*, 8th Eition, Pearson Prentice Hall, New Delhi, 2007.
2) Behrouz A. Forouzan. *Data Communication and Networking*, 4thEdition, McGraw Hill Higher Education, New Delhi, 2007.
3) Alberto Leon-Garcia & Indra Widjaja, *Communication Network*, McGraw Hill, New Delhi, 2007.

COURSE OUTCOMES

At the end of this course a student can

1) Understand Wireless transmission basics and Protocols.
2) Design MAC and TCP Protocols in the context of wireless networks
3) Understand the importance and goals of communication network and information security and introduce him to the different types of attacks.

07OEXXX	BIOLOGY FOR ENGINEERS	L	T	P
		4	0	0

COURSE OBJECTIVES

- The course acts as a bridge between engineering and biology to provide basic understanding of biological mechanisms of living systems from engineering perspective.
- It will illustrate the many possible means to utilize living things' relevance to engineering principles.
- With substantial knowledge and continuing interest will make a student into a specialist in the technical diversity.

Unit–I : Requirements of Biological Systems

Biological Units Need Water; Biological Units Need the Right Amount of Oxygen; Biological Units Need Food and Nutrients; Biological Units Become Ill in the Presence of Wastes; Biological Units Need Heat Sources and Sinks.

Unit–II : Behavior of Biological Systems

Biological Units Adapt to Their Environments; Biological Units Modify Their Environments; Adaptations Require Extra Energy and Resources; Biological Units, If Possible, Move to Friendlier Environments; Biological Units Evolve under Environmental Pressures.

Unit–III : Response to Stress by Biological Systems

Crowding of Biological Units Produces Stress; Biological Units Are Affected by Chemical Stresses; Biological Units Respond to Mechanical Stresses; Optimization Is Used to Save Energy and Nutrient Resources; Biological Units Alter Themselves to Protect against Harsh Environments.

Unit–IV : Existence of Biological Systems

Biological Units Cooperate with Other Biological Units; Biological Units Compete with Other Biological Units; Biological Units Reproduce; Biological Units Coordinate Activities through Communication; Biological Units Maintain Stability with Exquisite Control; Biological Units Go through Natural Cycles; Biological Units Need Emotional Satisfaction and Intellectual Stimulation; Biological Units Die.

Unit–V : Scaling Factors and Biological Engineering Solutions

Allometric Relationships from Evolutionary Pressure; Dimensional Analysis; Golden Ratio; Fractal Scaling within an Organism; Self-Similarity for Tissues and Organs; Self-Similarity in Populations; Systems Approach; Relationships between Engineering and Biology; The Completed Design.

TEXT BOOKS

1) Arthur T. Johnson, " Biology for Engineers", CRC Press, 2010.

REFERENCE BOOKS

1) Aydin Tözeren, Stephen W. Byers, New Biology for Engineers and Computer Scientists, Pearson/Prentice Hall, 2004.
2) S. Thyaga Rajan, N. Selvamurugan, M. P. Rajesh, R. A. Nazeer, Richard W. Thilagaraj, S. Barathi, and M. K. Jaganathan, "Biology for Engineers," Tata McGraw-Hill, New Delhi, 2012.

COURSE OUTCOMES

1) The ability to understand the information known about familiar living systems.
2) The ability to anticipate the properties of an unfamiliar group of living things from knowledge about a familiar group.
3) The ability to demonstrate the relevance of engineering to biological systems.
4) The knowledge about the biological responses and it is scaling with respect to scientific principles that cannot be related back.
5) The knowledge of biological principles and generalizations that can lead to useful products and processes.
6) The ability to avoid or mitigate unintended consequences of dealing with any and all living system.

02OEXXX	DISASTER MANAGEMENT	L	T	P
		4	0	0

COURSE OBJECTIVES

- This course helps in providing the basic concepts of disasters and also gives a thorough knowledge and experience to reduce disaster risks.

Unit–I

Introduction – Disaster- Characteristics and types of Disasters- Causes and effects of Disaster -Risk- Vulnerability – Preparedness- Disaster mitigation and disaster management- Classification of mitigation measures-Vulnerability Analysis- Observation and Perception of Vulnerability- Socio-Economic Factors of Vulnerability- Vulnerability in India- Disaster related policy goals of UNDP UNDRO and Govt. of India- Appraising disaster needs- Needs for technical expertise- Role of various Agencies in Disaster Management and Development -Disaster risk reduction planning- Role of Developmental Planning for disaster Management

Unit–II

Earthquake - Cause of Earthquake- General characteristics- Measuring Earthquakes- Distribution pattern of Earthquakes in India- Earthquake prone areas- case studies of important Indian earthquakes - Forecasting techniques and risk analysis- Possible risk reduction measures- earthquake resistance buildings and re-engineering techniques in India.

Unit–III

Tsunamis- Causes of a Tsunami- General Characteristics- Tsunami warning system-Distribution pattern of Tsunami in India- Possible risk reduction measures-Integrated coastal zone management.

Landslides- Rock falls- Avalanches- Mud flows and glaciers- Landslides and rock falls- landslide hazard zonation- Instrumentation and monitoring- Techniques for reducing landslide hazards.

Unit–IV

Tropical cyclones- Structure of tropical cyclones- Nature of tropical cyclones-Cyclone experience in India and Tamilnadu- Preparedness- Tropical cyclones and their warning systems- Tropical cyclone warning strategy in India special nature of the problem in the region- Classification- Protection of buildings from cyclones of India- Precautions during and before cyclones.

Unit–V

Coastal floods- Intensification of hazards due to human interference-Management-River and coastal floods- Temperature extremes and wild fires-Physiological hazards- Flood forecasting-mitigation- planning- management- flood prone areas the Indian scenario- Flood experience in India and Tamilnadu.

Environmental hazards- Typology- Assessment and response- Strategies -The scale of disaster-Vulnerability- Disaster trends- Paradigms towards a balanced view- Chemical hazards and toxicology-Biological hazards- Risk analysis- Other technological disasters.

TEXT BOOKS

1) David R. Godschalk (Editor), Timothy Beatiey, Philip Berke,.David J. Browt:r, Edward J. Kaiser Charles C. Boh, R. Matthew Goebel, *Natural Hazard Mitigation: Recasting Disaster Policy and Planning* Island Press; (January 1999), ISBN) 559636025.
2) Sinha, P.C. *Wind & Water Driven Disasters*, 1998, 250pp, Anmol Publications.

REFERENCE BOOKS

1) Davide Wikersheimer *Windstorm Mitigation Manual for Light Frame Construction*, DIANE Publishing Co: (Paperback-May 1997)
2) Brown D Redevelopment After the Storm: Hazard Mitigation Opportunities in the Post Disaster Setting. (Paperback – June 1985) Publisher: John Wiley & Sons ISBN:047191505X .
3) Sinha, P.C. *Technological Disasters* , 1997, 516 pp Anmol Publications Trivedi.

COURSE OUTCOMES

1) Develop an understanding of the key concepts, definitions key perspectives of all Hazards Emergency Management.
2) Develop a basic under understanding of Prevention, Mitigation, Preparedness, Response and Recovery.

02OEXXX	ENTREPRENEURSHIP	L	T	P
		4	0	0

COURSE OBJECTIVES

- Develop an entrepreneurship sprit
- Help to identify business opportunities within an organization or independently
- Initiate action on the business plan from the prospective business through EDC

Unit–I

Meaning – Characteristics of management – Nature of management – Process of management – Functional areas of management – Management and administration – Role of management – Level of management – Evolution of management.

Unit–II

Meaning - Nature of planning – Importance of planning – Types of planning – Steps in planning – Decision making – Meaning and definition of organizing – Steps in organizing – Nature of organization – Organization structure – Purpose of organization – Principles of organization – Delegation of authority – Nature and importance of staffing.

Unit–III

Meaning and nature of direction – Principles of directing – Leadership and leadership style – Motivation – Communication – Need and feedback in communication – Importance of communication – Channels of communication – Types of communication – Forms of communication.

Unit–IV

Evolution of concept of entrepreneur – Concept of entrepreneur – Characteristics of entrepreneur – Distinction between entrepreneur and manager – Technical entrepreneur – Charms of being an entrepreneur – Types of entrepreneur – Role of entrepreneurship in economic development – Barriers in entrepreneurship.

Unit–V

Meaning of project – Project classification – Project identification – Meaning and significance of project report – Contents of a project report – Formulation of project report – Planning commission guidelines – Identification of opportunity – Project feasibility study.

TEXT BOOKS

1) Veerabhadrappahavinal, *Management and entrepreneurship*, New age International, New Delhi, 2008.
2) Peter f. Drucker; I*nnovation and entrepreneurship, B*utterworth – Heinemann, London, 1985.

REFERENCE BOOKS

1) *"Creativity, innovation, entrepreneurship and enterprise in construction and development"*, University of Reading, Alan Barrell – Entrepreneur in Residence Entrepreneur in Residence, University of Xiamen, Xiamen 2012.
2) *Entrepreneurship Studies*, National University Commission (Nigerian University System), 2010.

COURSE OUTCOMES

1) At the end of this course the student should have an understanding about entrepreneurship. The students should have knowledge about the principles of business Plan.

02OEXXX	NATIONAL SERVICE SCHEME (N.S.S.)	L	T	P
		4	0	0

COURSE OBJECTIVES

- Understand the community in which they work and their relation
- Identify the needs and problems of the community and involve them in problem-solving
- Develop capacity to meet emergencies and natural disasters
- Practice national integration and social harmony and
- Utilize their knowledge in finding practical solutions to individual and community problems.

Unit–I : National Service Scheme

a. History and its Objectives
b. Organizational structure of N.S.S. at National, State, University and College Levels
c. C)Advisory committee and their functions with special reference to college principal,
d. Programme officer, N.S.S. group leader and N.S.S. volunteers in the implementation.

Unit–II : National Integration

a. Need of National integration
b. Various obstacles in the way of National Integration; such as caste, religion, language and provisional problems etc.

Unit–III : Special Programme

a. Legal awareness
b. Health awareness
c. First-aid
d. Career guidance
e. Leadership training - cum - Cultural Programme
f. Globalization and its Economic Social Political and Cultural impacts.

Unit–IV : Special Camping Programme

a. Nature and its objectives
b. Selection of camp site and physical arrangement
c. Organization of N.S.S. camp through various committees and discipline in the camp.
d. Activities to be undertaken during the N.S.S. camp.
e. Use of the mass media in the N.S.S. activities.

Unit–V : N.S.S. Regular Activities

a. Traffic regulation
b. Working with Police Commissioner's Office
c. Working with Corporation of Chennai

d. Working with Health Department
e. Blind assistance
f. Garments collection
g. Non-formal education
h. 'Environmental Education, Awareness and Training (EEAT)'
i. Blood donation

REFERENCE BOOKS

a. National Service Scheme Manual, Government of India, 2006.
b. Training Programme on National Programme scheme, TISS.
c. Orientation Courses for N.S.S. Programme officers, TISS.
d. Case material as Training Aid for field workers, Gurmeet Hans.
e. Social service opportunities in Hospitals, KapilK.Krishan,TISS.
f. Social Problems in India, Ram Ahuja.

COURSE OUTCOMES

At the end of the course a student can

1) Able to identify the problems and know how to solve according to their needs
2) Develop capacity to meet emergencies and natural disasters
3) Practice national integration and social harmony and
4) Utilize their knowledge in finding practical solutions to individual and community problems

02OEXXX	HUMAN RIGHTS	L	T	P
		4	0	0

COURSE OBJECTIVES

- At the end of this course the student is expected to understand what is human rights,how to obey the rights, what is the role of a human being in making a good society for the future generations.

Unit–I

Definition of Human Rights - Nature, Content, Legitimacy and Priority - Theories on Human Rights - Historical Development of Human Rights.

Unit–II

International Human Rights - Prescription and Enforcement upto World War II - Human Rights and the U .N .O. - Universal Declaration of Human Rights - International Covenant on Civil and Political Rights - International Convenant on Economic, Social and Cultural Rights and Optional Protocol.

Unit–III

Human Rights Declarations - U.N. Human Rights Declarations - U.N. Human Commissioner.

Unit–IV

Amnesty International - Human Rights and Helsinki Process - Regional Developments -European Human Rights System - African Human Rights System - International Human Rights in Domestic courts.

Unit–V

Contemporary Issues on Human Rights: Children's Rights - Women's Rights - Dalit's Rights - Bonded Labour and Wages - Refugees - Capital Punishment.

Fundamental Rights in the Indian Constitution - Directive Principles of State Policy - Fundamental Duties - National Human Rights Commission.

REFERENCE BOOKS

1) International Bill of Human Rights, Amnesty International Publication, London, 1988.
2) Human Rights, Questions and Answers, UNESCO, 1982
3) Mausice Cranston- What is Human Rights
4) Desai, A.R. - Violation of Democratic Rights in India
5) Pandey - Constitutional Law.
6) Timm. R.W. - Working for Justice and Human Rights.
7) Human Rights, A Selected Bibliography, USIS.
8) 8) Johari J.C - Human Rights and New World Order.
9) 9) Bajwa G.S- Human Rights in India.
10) 10) Amnesty International, Human Rights in India.
11) 11) Sinha P.C & - International Encyclopedia of Peace, Security
12) 12) Cheous K (Ed) - Social Justice and Human Rights (Vols 1-7).
13) 13) Devasia, V.V. - Human Rights and Victimology.

COURSE OUTCOMES

1) After completing the course the student can understand the human rights, and know the role of a human being in making a good society for the future generations.