ANNAMALAI UNIVERSITY
FACULTY OF ENGINEERING AND TECHNOLOGY

B.E. (Four Year) DEGREE PROGRAMME
Choice Based Credit System (CBCS)
(Students Admitted From the Academic Year 2016-2017)

VISION

To become

School of Excellence in Civil Engineering

with**Conformity, Quality and Standards**in

teaching, research, training and **consultancy**

towards producing globally competent Civil Engineers**.**

MISSION

M1: To Promote quality in education, research and professional training for satisfying the needs of industry and society.

M 2: To provide state-of-the-art facilities and resources that contributes to a congenial learning environment.

M 3: To establish Centers of Excellence in emerging areas of Civil Engineering for the students to acquire domain specific expertise and also facilitate Industry- Institution interaction.

M 4: To inspire the students to pursue higher education and take competitive examinations and various career enhancing programs.

M 5: To instill the professional ethics and their role forsustainable development and corruption-free country.

PROGRAM EDUCATIONAL OBJECTIVES

PEO 1	To impart knowledge in the fundamentals of Civil Engineering such as Surveying, Planning, Structural Analysis, Design, Costing and Construction.
PEO 2	To develop soft skill and value addition through software platforms such as SURFER, 3D Home Architect, ARCHICAD, STAAD Pro, ArcGIS, QGIS, ANSYS, ERDAS, etc.
PEO 3	To ensure necessary aptitude and ethics through class room teaching, laboratory practice and field demonstration towards pursuing a quality professional practice.
PEO 4	To sensitize the need and importance to pursue for higher studies, research and exclusive preparations for competitive examinations.
PEO 5	To provide the subject specific expertise with objective information on the professional challenges with rational methodologies towards innovative solutions.

PROGRAMME OUTCOMES

After the successful completion of the B.E. (Civil Engineering) Degree Programme, the graduates will be able to:

PO 1: Engineering Knowledge: Apply knowledge of mathematics, science and engineering concepts to solve problems related to civil engineering.

PO 2: Problem Analysis: Identify, formulate and analyze Civil Engineering problems using the first principles of mathematics, sciences and engineering sciences and reach substantiate conclusions.

PO 3: Design/Development of Solutions: Design solutions for complex Civil Engineering problems and design system components satisfying standards laid by Indian Standard codes or processes to meet societal needs within realistic constraints.

PO 4: .Conduct Investigations of Complex Problems: Develop skills, select and apply modern engineering tools such as FEM, CAD, GIS and techniques for soft computing and optimization, including prediction and modelling of complex civil engineering problems.

PO 5: Modern Tool Usage: Function effectively as an individual and as a member or leader in diverse teams and in multidisciplinary settings.

PO 6: The Engineer and Society: Assess the societal needs and bring solutions with ethical principles in professional civil engineering practice with commitment, adhering to the norms of Civil Engineering practice.

PO 7: Environmental and Sustainability: Interact effectively with the engineering community and properly communicate with the society as well, by being able to comprehend through effective technical reports, documents, presentations and drawings, give and receive clear instructions, imperative to decision making for successful execution.

PO 8: Ethics: Demonstrate the knowledge and understanding of the engineering and management principles and apply these to one's work in construction, finance & asset management, public policy and administration in executing projects, as a member or leader in a team with self-confidence and courage.

PO 9: Individual and Teamwork: Appreciate the need to develop ability to design, implement and evaluate a field program to meet desired requirements within dynamic constraints related to economy, environment, social, political, health and safety aspects, manufacturability and sustainability, precisely the ability to engage in lifelong learning in the broadest context of technological change.

PO 10: Communications: Recognize the importance of Civil Engineering professional development by pursuing postgraduate studies or face competitive examinations that offer challenging and rewarding careers.

PO 11: Project Management and Finance: Create innovative construction materials to improve the performance of infrastructure in case of buildings and transportation systems.

PO 12: Life-Long learning: Develop and apply high performance structural materials and disaster-resistant systems.

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Program Specific Outcomes:

The Civil Engineering curriculum prepares graduates to attain:

PSO 1: Apply principles of engineering, basic science and mathematics to model, analyze, design civil systems and processes.

PSO 2: Plan, operate, control, maintain and improve civil systems, components and processes.

PSO 3: Prepare the students to work professionally as civil engineers.

Mapping of POs with PEOs				
PO	**PEO1**	**PEO2**	**PEO3**	**PEO4**
PO1	✓			
PO2	✓			
PO3	✓	✓		
PO4	✓	✓	✓	✓
PO5		✓	✓	
PO6		✓	✓	✓
PO7			✓	✓
PO8			✓	
PO9			✓	✓
PO10		✓	✓	✓
PO11	✓	✓		
PO12	✓		✓	✓

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 Tamil Nadu 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.

<div align="center">(OR)</div>

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.

Annexure-1

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)
2	**Civil and Structural Engineering.**	iv. Architectural Assistantship v. Civil Engineering (Rural Tech.) vi. Civil and Rural 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
4	**Mechanical Engineering (Manufacturing 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

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**

Legend:

HS	-	Humanities / Social Sciences / Management
BS	-	Basic Science
ES	-	Engineering Science
PC	-	Professional Core
PE	-	Professional Elective
OE	-	Open Elective
S&IT	-	Seminar / Industrial Training
Proj.	-	Project
T	-	Theory
P	-	Practical
*	-	No of Credits
**	-	No of Courses

B.E. (Four Year) DEGREE PROGRAMME
Choice Based Credit System (CBCS)

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. Subject for Mech., Manuf., EEE, EIE, ECE, CSE & IT
Basic Electrical Engg. Subject for Civil, Civil and Structural, Mech., Manuf.,& Chem. Engg.
Basic Mechanical Engg. Subject 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	Subject Code	Subject	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	00ES303	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	01SP307	Building Drawing	-	-	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	Subject Code	Subject	L	T	P	Exam	CA	Total	Credits
1	BS-VIII	01BS401	Probablity, Random Process & Numerical Methods	**4**	**1**	**-**	**75**	**25**	**100**	**4**
2	ES-IV	01ES402	Solid Mechanics	4	-	-	75	25	100	3
3	PC-III	01PC403	Surveying I	4	-	-	75	25	100	3
4	PC-IV	02PC404	Structural Concrete Design-I	4	-	-	75	25	100	3
5	PC-V	01PC405	Applied Hydraulics Engineering	4	-	-	75	25	100	3
6	PC-VI	01PC406	Engineering Geology	4	-	-	75	25	100	3
7	PC-II Lab	01CP407	Surveying Lab I	-	-	3	60	40	100	2
8	PC-III Lab	02CP408	Strength of Materials Lab	-	-	3	60	40	100	2
			Total	**24**	**1**	**6**	**570**	**230**	**800**	**23**

Sl. No.	Category	Subject Code	Subject	L	T	P	Exam	CA	Total	Credits
			FIFTH SEMESTER							
1	PC-VII	02PC501	Structural Mechanics-I	4	1	-	75	25	100	4
2.	PC-VIII	01PC502	Surveying II	4	-	-	75	25	100	3
3	PC-IX	02PC503	Soil Mechanics	4	-	-	75	25	100	3
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	01CP507	Surveying Lab II	-	-	3	60	40	100	2
8	PC-V Lab	02CP508	Soil Mechanics Laboratory	-	-	3	60	40	100	2
9	PE-I Lab	01EP509	Professional Elective -I Lab	-	-	3	60	40	100	2
			Total	**24**	**1**	**9**	**630**	**270**	**900**	**25**

Sl. No	Category	Subject Code	Subject	L	T	P	Exam	CA	Total	Credits
			SIXTH SEMESTER							
1	PC-XI	02PC601	Structural Mechanics II	4	-	-	75	25	100	3
2	PC-XII	01PC602	Estimation & Valuation	4	-	-	75	25	100	3
3	PE-III	01PE603	Professional Elective –III	4	-	-	75	25	100	3
4	PE-IV	01PE604	Professional Elective –IV	4	-	-	75	25	100	3
5	PE-V	01PE605	Professional Elective –V	4	-	-	75	25	100	3
6	OE-I	01OE606	Open Elective –I	4	-	-	75	25	100	3
7	PC-VI Lab	01CP607	Hydraulics Lab	-	-	3	60	40	100	2
8	PC-VII Lab	01CP608	Transportation Engineering Lab	-	-	3	60	40	100	2
9	PE-II Lab	01EP609	Professional Elective -II Lab	-	-	3	60	40	100	2
			Total	**24**	**-**	**9**	**630**	**270**	**900**	**24**

SEVENTH SEMESTER											
Sl. No.	Category	Subject Code	Subject	L	T	P	S	Exam	CA	Total	Credits
1	HS-IV	00HS701	Engineering Ethics	4	-	-	-	75	25	100	3
2	PC-XIII	02PC702	Structural Steel Design	4	-	-	-	75	25	100	3
3	PE-VI	01PE703	Professional Elective –VI	4	-	-	-	75	25	100	3
4	PE-VII	01PE704	Professional Elective -VII	4	-	-	-	75	25	100	3
5	OE-II	01OE705	Open Elective –II	4	-	-	-	75	25	100	3
6	PC-VIII Lab	01CP706	Environmental Engineering Laboratory	-		3	-	60	40	100	2
7	PE-III Lab	01EP707	Professional Elective -III Laboratory	-	-	3	-	60	40	100	2
8	S & IT	01ST708	Seminar / Industrial Training	-	-	-	1	60	40	100	1
			Total	**20**	**-**	**6**	**1**	**555**	**245**	**800**	**20**

EIGHTH SEMESTER										
Sl. No.	Category	Subject Code	Subject	L	T	P	Exam	CA	Total	credits
1	OE-III	01OE801	Open Elective –III	4	-	-	75	25	100	3
2	OE-IV	01OE802	Open Elective-IV	4	-	-	75	25	100	3
4	Proj.	01PV803	Project Work & Dissertation	-	-	15	60	40	100	14
			Total	**8**		**15**	**210**	**90**	**300**	**20**

LIST OF 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. Basic Simulation Laboratory
13. Basic Thermodynamics
14. Solid Mechanics
15. Engineering Mechanics
16. Construction Engineering
17. Building Drawing Laboratory

LIST OF PROFESSIONAL ELECTIVES

1. Hydrology
2. Construction Management
3. Water Supply Engineering
4. Foundation Engineering
5. Transportation Engineering
6. Wastewater Engineering
7. Pre-Stressed Concrete
8. Safety in Civil Engineering Practices
9. Ground Water Engineering
10. Numerical Methods applied to civil engineering

11. Civil Engineering Systems Analysis

12. Irrigation Engineering

13. Bridge Engineering

14. Architecture

15. Services in High Rise Buildings

16. Construction Techniques

17. Ground Improvement Techniques

18. Repair and Rehabilitation of structures

19. River Engineering

20. Tall Buildings

21. Earthquake Engineering

22. Watershed conservation & Management

23. Special Concrete Structures

24. Prefabricated Structures

25. Hydropower Engineering

26. Traffic Engineering

LIST OF PROFESSIONAL ELECTIVES LAB

1. Design & Drawing Laboratory - I

2. Civil Engineering Software Laboratory

3. Design & Drawing Laboratory - II

LIST OF OPEN ELECTIVES

1. Urban & Rural Planning

2. Solid Waste Management

3. Airports, Harbours & Dock Engineering

4. Remote Sensing & GIS

5. Renewable Energy Engineering

6. Economics and Finance for Civil Engineering

7. Environmental Impact Assessment

8. Air & Noise Pollution

9. Operations Research for Civil Engineers

10. Soil & Water Conservation Engineering

11. Engineering Thermodynamics

12. Refrigeration & Air-Conditioning

13. Biology for Engineers

14. Disaster Management

15. Entrepreneurship

16. National Service Scheme

DETAILS OF COURSE CODE

Code (First Two digits)	Details	Code (3rd and 4th Digits)	Details
00	Common course for the faculty	HS	Humanities Theory
01	Civil Engg. Course	HP	Humanities Practical
02	Civil and Structural Engg. Course	BS	Basic Science Theory
03	Mechanical Engg. Course	BP	Basic Science Practical
04	Mechanical Engg (Manufacturing). Course	ES	Engineering Science Theory
05	Electrical and Electronics Engg. Course	SP	Engineering Science Practical
06	Electronics and Instrumentation Engg. Course	PC	Professional Core Theory
07	Chemical Engg. course	CP	Professional Core Practical
08	Computer Science and Engg. Course	PE	Professional Elective Theory
09	Information Technology course	EP	Professional Elective Practical
10	Electronics and Communication Engg. Course	ST	Seminar / Industrial Training
XX	Code of the programme concerned (01 to 10)	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

SYLLABUS

FIRST SEMSTER

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 Book:

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, proofs 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.
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 ($\sum r$) 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.

UnitV :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 & Francis, 2005.
10. Carroll B.W. &D.A.Ostlie , "An introduction to Modern Astrophysics", 2nd Edition, 2011.
11. Avadhanulu M.N. and Kshirsagar P.G., "A Text Book of Engineering Physics", S. Chand & Company Ltd., 7th Enlarged Revised Ed., 2005.
12. Rai.G.D. "Solar Energy Utilization" Volume-1 & 2 by - Khanna Publishers, New Delhi.
13. Senthilkumar.G, Engineering Physics, VRB Publishers Pvt. Ltd., Chennai.
14. Ravikrishnan.A, Environmental Science and Engineering, Hitech Publishing Company PVT Ltd.
15. Rai.G.D. , "Non-Conventional Energy Sources" - Khanna Publishers.
16. 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:

- PO1: To impart the basic principles of generation of electrical energy.
- PO2: To explain the operation of electrical machines and various measuring instruments.
- PO3: To understand the basic concepts of circuit analysis.
- PO4: 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).

TextBooks:

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. CO1: Provide comprehensive idea about simple circuit analysis, working principles of machines and common measuring instruments
2. CO2: Analyze the behavior of any dc and ac circuits
3. CO3: Characterize semiconductor devices that include diodes, BJT and digital functions.
4. CO4: 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.

00HS205	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
11.

Practical Session

- ➢ To make the students recognize the sounds of English through Audio Visual Aids
- ➢ To enable the students speak fluently without fear
- ➢ To develop their communicative skill with individual practice through the prescribed package

- ➢ The Globarena Package consists of the following exercises
    1. Reading comprehension
    2. Listening comprehension
    3. Vocabulary exercises
    4. Phonetics
    5. Role Play in dialogues
    6. Auto Speak

Minimum Requirement:

The English Language Lab shall have two parts:
    The Computer aided Language Lab for 60 students with 60 systems, one master console, LAN facility and English language Globarena software for self- study by learners and Library with Books to improve their proficiency in English.

Suggested Software:
1. **Globarena** Package for communicative English
2. Cambridge Advanced Learner's English Dictionary

Books to be procured for English Language Lab Library:

1. Spoken English (CIEFL) in 3 volumes with 6 cassettes, OUP.
2. English Pronouncing Dictionary Daniel Jones Current Edition with CD.
3. Spoken English- R. K. Bansal and J. B. Harrison, Orient Longman 2006 Edn.
4. 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.
5. A text book of English Phonetics for Indian Students by T.Balasubramanian (Macmillan)
6. English Skills for Technical Students, WBSCTE with British Council, OL.

DISTRIBUTION AND WEIGHTAGE OF MARKS

English Language Laboratory Practical Paper:
1. The practical examinations for the English Language Laboratory shall be conducted as per the University norms prescribed for the core engineering practical sessions.
2. For the Language lab sessions, there shall be a continuous evaluation during the year for 40 sessional marks and 60 year-end Examination marks. The year- end Examination shall be conducted by the teacher concerned with the help of another member of the staff of the same department of the same institution.

Course Outcomes:
1. Help the students 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 Rigidity Modulus of the material of a wire.
6. Field along the axis of a coil- Determination of horizontal earth magnetic flux density.
7. Air wedge – Determination of thickness of a given thin wire and paper.
8. Viscosity - Determination of co-efficient of Viscosity of a less viscous liquid by Capillary flow method
9. Uniform bending- Determination of Young's modulus of the given scale or beam.
10. Spectrometer – Determination of wavelength of the prominent spectral lines using Grating.
11. Semiconductor diode laser – Determination of wavelength of Laser source using Grating.
12. 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 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.

THIRD SEMESTER

01HS301	**ENVIRONMENTAL STUDIES**	L	T	P
		4	**0**	**0**

Objectives:

- To realize the importance of environment for engineering students.
- To understand the basis of ecosystems
- To make aware the student about global environmental problems and natural disasters.
- To give the ideas about advance technologies of Engineering that will useful to protect environment.

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.

Field work

        Visit to a local area to document environmental assets-river/forest/grassland/hill/mountain - Visit to a local polluted site-Urban/Rural/Industrial/Agricultural - Study of common plants, insects, birds - Study of simple ecosystems-pond, river, hill slopes, etc. **(Field work Equal to 5 lecture hours)**

Text Books:

1.   Agarwal, K.C. Environmental Biology, Nidi Publ, Ltd. Bikaner, 2001
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 (TB)
3.   Cunningham, W.P. Cooper, T.H. Gorhani, E & Hepworth, M.T. 2001, Environmental Encyclopedia, Jaico Publ. House, Mumabai, 1196p

4.	De A.K., Environmental Chemistry, Wiley Eastern Ltd.
5.	Down to Earth, Centre for Science and Environment (R)
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., Encyclopedia of Indian Natural History, Bombay Natural History Society, Bombay (R)
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 (TB)
12.	Miller T.G. Jr. Environmental Science, Wadsworth Publishing Co. (TB)
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 (TB)
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 (TB)
20.	Wanger K.D., 1998 Environmental Management. W.B. Saunders Co. Philadelphia, USA 499p

Outcomes:

At the end students can able to

1. Understand the importance of environment.
2. Analyze the importance of environment in engineering.
3. Apply their own ideas and demonstrate advanced technologies that will be useful to protect environment.
4. Employ awareness among the society about environmental problems and natural disasters.
5. Practice according to the present and future environmental issues.

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	✓	✓										
CO2		✓	✓									
CO3					✓		✓		✓	✓		
CO4				✓		✓			✓		✓	
CO5						✓			✓			✓

MAPPING PROGRAMME OUTCOMES WITH COURSE OUTCOMES

01BS302	ENGINEERING MATHEMATICS III	L	T	P
		4	1	0

Objectives:

- To learn, partial differential equations, Fourier series, Boundary value problems.
- To learn the transforms such as Sine, Cosine, Fourier transform and Z-transforms.
- To gain knowledge of the method to find the Solution of difference equations.

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. 2006, New Delhi.
2. Ventakataraman M K, "Engineering Mathematics", The National Publishing Co., Chennai, 2003.

Reference Books:

1. Veerarajan T, "Engineering Mathematics", 3 [rd] edition, Tata McGraw Hill Pub., 2005.
2. Singaravelu A, "Engineering Mathematics", Meenakshi Publications, Chennai, 2004.

Course Outcomes:

At the end of the course the students will be able to acquire knowledge on
1. Partial differential equations.
2. Fourier series.
3. Fourier transform.
4. Z-transforms and the methods of solving them.
5. Solving boundary value problems.

MAPPING PROGRAMME OUTCOMES WITH COURSE OUTCOMES												
COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	✓	✓						✓				
CO2	✓	✓	✓		✓			✓		✓	✓	
CO3	✓	✓		✓	✓			✓	✓			
CO4	✓	✓				✓	✓	✓				
CO5	✓	✓	✓	✓				✓				✓

01ES303	ENGINEERING MECHANICS	L	T	P
		4	**0**	**0**

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 Inertias of Rectangular, Triangular, Circular and Semi-circular- Moment of Inertias of structural Steel Sections of Standard 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 Thin Rectangular Plate, Thin Circular Disc, Solid Cylinder, Prism, Sphere and Cone from 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. Palanichamy, M.S and Nagan, S, "Engineering Mechanics (Statics and Dynamics*)"*, Tata McGraw Hill Publishing Company, Ltd., New Delhi, 2010.
2. Beer, F.P and Johnson, R, "Vector Mechanics for Engineers (Statics)", McGraw- Hill Book company, New Delhi, 2004.
3. Natesan,S.C, "Engineering Mechanics (Statics and Dynamics)", first edition, Umesh Publications, New Delhi, 2002.

Reference books:

1. S.S.Bhavikatti and K.G.Rajasekarappa, " Engineering Mechanics", New Agent International (P) Ltd, 1999.
2. Sadhu Sing, "Engineering Mechanics"*,* Oxford & IBH Publishing Co., New Delhi, 2000.
3. Irving H. Shames, "Engineering Mechanics"*,* prentice Hall of India ltd., New Delhi, 2006
4. Hibbeller, R.C and Ashok Gupta, "Engineering Mechanics: Statics and Dynamics"*,* Edition, Pearson Education, 2010.

Course Outcomes:

At the end, Students can able to

1. Have knowledge on forces and its related laws of mechanics in static and dynamic conditions.
2. Analyze the forces and its motions on particles, rigid bodies and structures.
3. Solve the moment of inertia of any sections and masses for the structural members.
4. Understand the kinematics, impulse momentum principle and law of conservation of energy
5. Acquire knowledge on frictional forces and equilibrium analysis on solid components

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
Mapping of COs with Pos												
CO1	✓	✓									✓	✓
CO2		✓	✓	✓						✓		
CO3					✓		✓		✓			
CO4						✓			✓		✓	
CO5						✓			✓			

01ES304	CONSTRUCTION ENGINEERING	L	T	P	C
		2	0	0	2

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 types 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 slabs, Sunshades, Roof Beams and Roof Slabs – Fabrication of Steel – Bar Bending as per IS Standards (SP 34: 1987) – Cover Blocks – Placing of Bars in Formwork – 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 – Formwork (Shuttering or Scaffolding) – Types of Formwork – 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. Arora.S.P, "Building Construction Technology" (Including Engineering Materials), 2010.
2. Rangwala.S.C, "Building Construction", Charotar Publishing House Pvt. Limited, 2009.

Reference Books:

1. Sharma and Kaul, "Building Construction", S.Chand & Company, New Delhi, 1987.
2. Rajput.R.K, "Engineering Materials", S.Chand & Company, New Delhi. 2008.
3. Dr.Punmia.B.C, "Construction Engineering", Laxmi Publishers Private Limited, New Delhi, 1993.

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 end of the course students will be able to

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

Cos	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
MAPPING PROGRAMME OUTCOMES WITH COURSE OUTCOMES												
CO1		✓									✓	
CO2	✓	✓		✓		✓		✓				
CO3							✓					
CO4			✓		✓					✓		
CO5									✓			✓

02PC305	CONCRETE TECHNOLOGY	L	T	P
		4	0	0

Objectives:

- To develop systematic knowledge about the nature and basic properties of the ingredients of concrete.
- To familiarize testing procedures 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 IS Code 269-1989 – 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 – Importance of aggregates in concrete – Specifications as per IS Code 2386 (Part I to VIII) – 1963– Specifications as per IS Code 383-1970 – Water Testing – Specifications.

Unit III

Concrete ingredients – Manufacturing process – Storing – Batching – Mixing – Transporting – Placing – Finishing – Curing – Properties of fresh concrete – Workability measurements – Testing methods – Seggregation – 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 Code 516-1959 – Compressive strength of concrete and its 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 – IS Code 10262-2009 and ACI Committee 211.1.91 method – Fly ash based mix design – Effect of replacement materials in mix design.

Text Books:

1. Mehta, P.K. and Monteiro, P.J.M., "Concrete, Microstructure, Properties and Materials", Indian Concrete Institute, 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", Tata McGraw Hill Co., New Delhi, 2004.
3. Neville, A.M. and Brooks J.J., "Concrete Technology", Pearson Education, Indian Reprint, 2002.

Standards:

1. IS: 269 – 1989, Specification for Ordinary Portland cement 33 Grade (Fourth Revision), 1998.
2. IS: 2386 (Part I to VIII) – 1963, Method of Tests for Aggregate for Concrete, Bureau of Indian Standards, New Delhi.
3. IS: 383 – 1970, Specification for Coarse and Fine Aggregates from Natural Sources for Concrete, Bureau of Indian Standards, New Delhi.
4. IS: 516 – 1959, Method of Tests for Strength of Concrete, Bureau of Indian Standards, New Delhi.
5. IS: 10262 – 2009, Recommended Guidelines for Concrete Mix Design, Bureau of Indian Standards, New Delhi.
6. ACI Committee 211.1,91 Standard Practice for Selecting Proportions for Normal, Heavy weight and Mass Concrete, ACI Manual of Concrete Practice Part 1, 1991, American Concrete Institute, Detroit.
7. SP 23:1982, Handbook on Concrete Mixes.

Course Outcomes:

At the end of the course students will be able to

1. Identify the properties of cement, aggregate and concrete.
2. Acquire knowledge of testing of cement, aggregate and concrete and their strength requirements.
3. Understand the importance of manufacturing process of concrete.
4. Recognize the functions of different concrete admixtures and its types.
5. Realize the significance of mechanical properties in hardened concrete and concrete mix proportioning.

MAPPING PROGRAMME OUTCOMES WITH COURSE OUTCOMES												
Cos	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	✓	✓				✓					✓	✓
CO2		✓	✓		✓			✓				
CO3			✓		✓					✓		✓
CO4							✓					
CO5		✓									✓	

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

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 which 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 fluid particle rotational and irrotational motion – circulation and velocity – velocity potential and stream function – streamline, equipotential line and flownet – use and limitations of low net.

Euler's equation of motion in different 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 Cc, Cv and Cd – 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 weirand notch – calibration – ventilation of weirs – flow over a V – notch, trapezoidal notch – broad – crested weirs – submerged weirs – spillways.

Other flow measurement devices – rotameter – elbowment and pilot 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 – hydro dynamically smooth and rough boundaries – velocity distribution for turbulent flow pipes.

Text Books:

1. Modi, P.N., and Seth, S.M., Hydraulics, Fluid mechanics and Hydraulic Machines, Standard Book Home, Newq 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 4 th 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.

Cos	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	✓	✓									✓	✓
CO2		✓	✓									
CO3				✓	✓		✓		✓			✓
CO4						✓	✓		✓		✓	
CO5						✓			✓	✓		

MAPPING PROGRAMME OUTCOMES WITH COURSE OUTCOMES

01SP307	**BUILDING DRAWING**	L	T	P
		0	**0**	**3**

Objectives:

- To introduce the student to basic principles of Building drawing.
- To learn to draft plan, elevation and sectional views of buildings in accordance with development and control rules satisfying orientation and functional requirements as per National Building Code.

Unit I

Objectives of bye laws – importance of bye laws – function of local authorities – setback – plot coverage – number of floors – height of the building – built up area – carpet area – working drawings – approval drawings – details about the plan, section, elevation and site plan.

Unit II

Site plan – key plan – orientation of building – scale – drainage lines – line diagrams for indicating well / sump / septic tanks with orientation of buildings – guidelines for building drawings.

Unit III

Types of residential buildings – usual requirements and different space units – minimum size requirements for each type of rooms – furniture arrangements – circulatory elements – position of stairs – position of doors / windows / ventilators and sanitary fittings.

Unit IV

Types of public buildings – Commercial – Health – Institutional – Government – Entertainment structures.

Unit V

Planning aspects – requirements of industrial units – roofing systems and roof coverage –rolling shutters – ramps – ventilation – lighting arrangements – basic needs – Preparation of plan, section and elevation of buildings with specifications for the given line drawing to scale.

Exercises:

1. Conventional symbols.
2. Paneled and flush doors.
3. Paneled and glazed windows.
4. Lean to roof and small sheds.
5. Residential buildings with fully tiled roof with hips & valleys.
6. R.C.C. flat roofed single roomed building.
7. Residential building with single bedroom (load bearing structure).
8. Residential building with double bedroom (framed structure).
9. Residential building with R.C.C. roofed hips & valleys.
10. Residential double storied building with R.C.C. roof.
11. Library building with R.C.C. flat roof.
12. Primary health centre for rural areas with R.C.C. flat roof.
13. Single storied school building with R.C.C. flat roof.
14. Bank building with R.C.C. flat roof.
15. Mini shopping mall building.

Text Books:

1. Shah. M.G., Kal.C.M. and Patki. S.Y., "Building drawing with an integrated approach to Built Environment", Fourth Edition, 1996.
2. Kaleem. S., Zaidi. A. and Suhail Siddiqui, "Drawing and Design of Residential and commercial buildings", Standard Publications, 2001.

Reference Books:

1. Venugopal. K. and Praburaja. V., " Building Drawing", New Age International Publishers, 1996.
2. Rangwala. S.C., "Civil Engineering Drawing,"
3. Verma. B.P., "Civil Engineering Drawing and House planning"

Course Outcomes:

At the end of the course students will be able to

1. Understand conventional symbols used in drawing.
2. Draft plan, elevation and sectional views of doors & windows, lean to roof and different types of buildings.
3. Understand the regulations as per National Building Code.
4. Identify the functional requirements and building rules.
5. Acquire knowledge on planning aspects of industrial buildings

MAPPING PROGRAMME OUTCOMES WITH COURSE OUTCOMES												
Cos	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	✓	✓		✓		✓			✓			
CO2		✓			✓			✓			✓	✓
CO3			✓	✓			✓			✓		
CO4		✓			✓			✓			✓	
CO5			✓				✓			✓		✓

02CP308	CONSTRUCTION ENGINEERING LABORATORY	L	T	P
		0	0	3

Objectives:

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

List of Experiments:

1. Standard tests on cement
2. Standard tests on fine and coarse aggregates
3. Workability tests on fresh concrete
4. Tests on hardened concrete, bricks and tiles
5. Concrete mix design as per IS 10262: 2009 and SP 23:1982
6. Study on Reinforcement Detailing for different structural components as per SP34: 1987

Reference Books:

1. Mehta, P.K. and Monteiro, P.J.M., "Concrete, Microstructure, Properties and Materials", Indian Concrete Institute, 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, 2002.
6. IS 10262: 2009, Recommended Guidelines for Concrete Mix Design, Bureau of Indian Standards, New Delhi.SP 23:1982, Handbook on Concrete Mixes, Bureau of Indian Standards, New Delhi.

Course Outcomes:

At the end of the course students will be able to

1. Understand the concrete properties.
2. Gain knowledge on the workability, durability, creep, shrinkage, temperature effects etc.

3. Compute the compression value for different materials
4. Gain knowledge on different mix proportion of concrete
5. Prepare the reinforcement detailing for structures

MAPPING PROGRAMME OUTCOMES WITH COURSE OUTCOMES												
Cos	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	✓	✓				✓			✓			✓
CO2		✓	✓	✓						✓	✓	
CO3					✓		✓		✓			✓
CO4	✓					✓			✓			
CO5						✓			✓		✓	

FOURTH SEMESTER

01BS401	PROBABLITY, RANDOM PROCESSES AND NUMERICAL METHODS	L	T	P
		43	0	0

Objectives

- 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 rule.

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.
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 - 20031.
2. Lipschutz..S and Schiller. J, Schaums"s outlines – introduction to probability and statistics McGraw Hill, New Delhi, 1998.
3. Kandasamy.P, Thilagavathy.K, and Gunavathy.K, Numerical Methods, S.Chand & Co. Ltd., , New Delhi. 2004.

Course Outcomes:

At the end of the course, the students able to
1. Acquire skills in handling situations involving random variables, random processes
2. Solve problems for engineers in using numerical methods.
3. Understand the hypothesis testing for small and large samples
4. Understand the interpolation techniques
5. Give solution for ODE by different methods

**MAPPING PROGRAMME OUTCOMES WITH COURSE OUTCOMES**
COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	✓	✓				✓		✓				✓
CO2			✓	✓				✓	✓		✓	
CO3	✓	✓		✓								
CO4		✓	✓									✓
CO5	✓	✓		✓								

01ES402	SOLID MECHANICS	L	T	P
		4	0	0

Objectives:

- To understand the concepts of stress and strain
- To determine the internal forces in beams
- To formulate the expressions for deflection
- To identify the behaviour of columns, struts and cylindrical shells

Unit I

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

Unit II

Shear force and Bending moment – Types of beams – Types of loads – Relation between B.M. and S.F. – B.M.D and S.F.D. for Cantilever, Simply Supportedand Overhanging beams subjected to various types of loading – Bending Stresses in beams – Shearing Stresses in beams**.**

Unit III

Deflection of beams– Estimation of slope and deflection for Cantilever, Simply Supported and Overhanging beams by Macaulay's method, Strain energy and Moment area methods subjected to various types of loading.

Torsion of shafts – Assumptions – horse power transmitted by a shaft – Strength of a shaft – Torsional resistance of Solid and Hollow shafts – Combined bending and torsion.

Unit IV

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

Unit V

Columns and Struts – Types – Failure modes – Euler's formula – Rankine's formula – I.S. code formula – Practical end conditions and Effective length factors – Built-up columns –

Thin Cylindrical shells – Assumptions – Internal pressure – Change in volume – Minimum thickness of wall plates – Thick Cylindrical Shells – Assumptions – Lame's theory – Compound cylinders.

Text Books:

1. Sadhu Singh, "Strength of Materials", Khanna Publishers, New Delhi, 2000.
2. Vaidyanathan. R., Perumal.P. and Lingeswari.S., "Mechanics of Solids and Structures", Volume I, Scitech Publications Private Limited, Chennai, 2006.

Reference Books:

1. Rajput. R.K., "Strength of Materials", S. Chand & Company, New Delhi, 2007.
2. Prasad. I.B., "Strength of Materials", Khanna Publishers, New Delhi, 1998.
3. James M. Gere, "Mechanics of Materials", Thomson India, Brooks/Cole, 2006.
4. Robert L. Mott, "Applied Strength of Materials", PHI Learning Private Limited, New Delhi, 2009.
5. Timoshenko. S.B. and Gere. J.M., "Mechanics of Materials", Van NosReinbhold, New Delhi, 1995.
6. Jhunarkar. S.B. and Shah. H.J., "Mechanics of Structures", Volume I, Charotar Publishing House, New Delhi, 1997.
7. Kazimi, "Solid Mechanics", Tata McGraw Hill Publishers, New Delhi, 1999.
8. Punmia. B.C., Jain Ashok and Jain Arun., "Strength of Materials and Theory of structures – Volume 1", Laxmi Publications Private Limited, New Delhi, 2000.

Course Outcomes:

At the end of the course students will be able to

1. Compute stress and strain for various loads.
2. Arrive Shear force and bending moment in beams.
3. Estimate slope and deflection of types of beams.
4. Analyse statically determinate frames.
5. Assess behavior of columns and struts and failure of materials.

MAPPING PROGRAMME OUTCOMES WITH COURSE OUTCOMES												
Cos	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	✓	✓										
CO2		✓	✓								✓	✓
CO3					✓		✓		✓	✓		
CO4						✓			✓			
CO5						✓			✓			

01PC403	SURVEYING I	L	T	P
		4	0	0

Objectives:

- To introduce the principles of various surveying methods and survey instruments.
- To expose students to Levelling by several methods.
- To learn to handle survey instruments and Area and Volume computations.
- To solve problems and understand applications of surveying to civil engineering projects.

Unit I

Surveying – Levelling – Classification – Division principle and uses of surveying – Fundamental of measurement – drawing to scale – symbols used in surveying – Linear measurement – Chain Surveying – accessories in chain surveying – triangulation by chain – technical terms used in chain surveying – field book – use.

Unit II

Cross- staff – offset – measurement of area by chain traversing – error – obstacles in chain surveying – problems.

Horizontal angles – Bearing – compass – prismatic – Meridian and its types – declination – Fore and back bearing – Whole Circle Bearing and Reduced Bearing – closed and open traverse – applications – area calculation – Local attraction and its correction – detection – methods – corrected bearing and angles – problems.

Unit III

Levelling – MSL – Datum – Technical terms – level and its types – staffs and its types Temporary adjustment – principles of levelling – Reduction of levels – methods – HI/HC methods – Rise and fall method – missing data – problems.

Unit IV

Differential levelling – Fly levelling – application – reciprocal levelling – correction for curvature – refraction – gradient of a line – problems.

Contouring – types – characteristics – methods – interpolation – uses of contour maps.

Unit V

Computation of area – field notes – plan – mid-ordinate – Trapezoidal method – Simpson's method – Computation of volume – methods – L/S, C/S – Earth work excavation – storage capacity of reservoir – Setting out buildings – positioning of structure – foundation setting out.

Text Books:

1. Agor. R, "A text book on Advanced Surveying ", Khanna Publishers, 4th Edition, New Delhi, 2007.
2. Arora. K.R., "A text book on Surveying Volume I and II", Standard Publishers, New Delhi, 2006.

Reference Books:

1. Punmia, B.C., Ashok K.Jain and Arun K.Jain, "Surveying Volume I & II", Laxmi Publications, 2005.
2. Kanetkar, T.P. and Kulkarni, S.V., "Surveying and Levelling", Pune Vidyarthi Griha Prakashan, 1988.

Course Outcomes:

At the end of the course students will be able to

1. Possess knowledge about chain surveying, compass surveying, plane table surveying and Levelling.
2. Gain knowledge about Survey Instruments, their care and adjustments.

3. Use all surveying equipments, arrive LS & CS,
4. Prepare contour maps and carryout surveying works related to land and civil engineering projects.
5. Compute the area and volume by different method

MAPPING PROGRAMME OUTCOMES WITH COURSE OUTCOMES												
COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	✓	✓										
CO2		✓	✓					✓			✓	✓
CO3				✓	✓	✓			✓	✓		
CO4			✓	✓							✓	✓
CO5					✓	✓		✓		✓		

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

Objectives:

- To introduce the different types of philosophies related to design of basic structural elements such as slabs, beams and columns with reference to Indian standard code of practice.
- To learn to design footings.

Unit I

Objectives of 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 alone: 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 stress distribution in flanged beams – Shear stresses distribution in rectangular beams due to torsion – Design shear strength of concrete – Flexural shear code recommendations for rectangular and flanged sections – Problems. Bond – Factors affecting bond resistance as per IS 456:2000 – Check for development length – Check for crack width – Deflection computations – short term and long term.

Design of one and two way concrete slabs – Circular slabs – Cantilever slabs – Dog legged staircase as per IS 456:2000 standards – Reinforcement detailing as per SP 34: 1987 and IS 13920: 1993.

Unit IV

Design of Short and Slender Columns as per IS 456:2000 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 –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 Publications, 1988.
2. Krishnaraju.N, "Advanced R.C.Design", Tata McGraw Hill Publications, 1995.

Reference Books:

1. Shah. V.L and Karve, "Illustrated R.C. Design", Structures Publications, 2010.
2. Ramamrutham. S and Narayan. R, "Design of R.C. Structures", Dhanpat Rai & Sons, 1993.
3. Mallick. S.K and Gupta. A.P, "Reinforced Concrete", Oxford I B H, 1987.
4. Punmia.B.C, et al, "R.C.Structures - Vol.I & II", Laxmi Publications, 1992.

Standards:

1. IS 456: 2000, Code of Practice for Plain and Reinforced Concrete, Bureau of Indian Standards, New Delhi.
2. IS 13920: 1993, Code of Practice for 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.

Course Outcomes:

At the end of the course students will be able to

1. Understand the behaviour of Reinforced Concrete and its design philosophies.
2. Gain knowledge about the rudimentary principles of designing reinforced concrete structural elements as per the existing codes.
3. Learn the stress distribution and flextural shear for different elements
4. Develop the knowledge on desigining the columns
5. Learn the desigining the footing for various structures

MAPPING PROGRAMME OUTCOMES WITH COURSE OUTCOMES												
COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1		✓	✓					✓				
CO2			✓	✓		✓	✓					✓
CO3	✓				✓				✓			
CO4			✓				✓			✓		
CO5		✓		✓				✓				

01PC405	APPLIED HYDRAULICS ENGINEERING	L	T	P
		4	0	0

Objectives:

- To introduce the students to various hydraulic engineering problems like open channel flows and their computations.
- To understand the methods of dimensional analysis.
- To impart knowledge on characteristics and working principles of hydraulic machines.

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:

At the end of the course students will be able to

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.
5. Understand the working principle of turbines.

MAPPING PROGRAMME OUTCOMES WITH COURSE OUTCOMES												
Cos	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	✓		✓			✓						
CO2		✓						✓		✓		
CO3				✓			✓					
CO4		✓			✓			✓				
CO5	✓					✓				✓		

01PC406	ENGINEERING GEOLOGY	L	T	P
		4	0	0

Objectives:

- To learn the importance of geology in civil engineering field during earthquake, volcanic activity and the action of various geological agencies.

- To impart knowledge of geology essential in projects such as dams, tunnels, bridges, roads, airports and harbours.

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 Earthquakes – 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, KVGK, "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.

Course Outcomes:

At the end of the course students will be able to

1. Gain knowledge on projects such as dams, tunnels, bridges.
2. Realize the importance of Earthquakes, volcanoes and the action of various geological agencies.
3. Understand the classification and properties of rocks.
4. Know the geological formations with respect to civil engineering aspects.
5. Understand the basic knowledge regarding application of remote sensing in selection of site for civil engineering projects

MAPPING PROGRAMME OUTCOMES WITH COURSE OUTCOMES												
Cos	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	✓		✓			✓						
CO2			✓					✓				
CO3		✓				✓		✓				
CO4	✓			✓						✓		
CO5				✓			✓		✓			

01CP407	SURVEYING LABORATORY I	L	T	P
		0	0	3

Objectives:

- To conduct experiments on Surveying and Levelling.
- Understand the principles of surveying.
- Know about compass surveying and plane table surveying.
- Understand the concepts of leveling and its applications.

List of experiments:

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. Open Traversing and Closed Traversing
4. Determination of distance of two inaccessible points

III Plane Table Surveying
1. Study of Plane Table Accessories
2. Determination of Area of an extent by radiation method
3. Determination of distances using Intersection method
4. Determination of a point using resection – Three point problem

IV Levelling

1. Study of Dumpy level and Telescopic Levelling staff
2. Simple Leveling – Determination of Reduced levels using Height of Collimation Method
3. Simple Leveling – Determination of Reduced levels using Rise & Fall Method
4. Differential Leveling – Determination of Reduced levels using Height of Collimation Method
5. Differential Leveling – Determination of Reduced levels using Rise & Fall Method

Text Books:

1. Agor. R, "A text book on Advanced Surveying", Khanna Publishers, 4th Edition, New Delhi, 2007.
2. Arora. K.R., "A text book on Surveying Volume I and II", Standard Publishers – New Delhi, 2006.

Reference Books:

1. Punmia, B.C., Ashok K. Jain and Arun K. Jain "Surveying Volume I & II" Laxmi Publications, 2005.
2. Kanetkar, T.P. and Kulkarni, S.V., "Surveying and Levelling", Pune Vidyarthi Griha Prakashan, 1988.

Course Outcomes:

At the end of the course students will be able to

1. Possess knowledge about chain surveying, compass surveying, plane table surveying and Leveling.
2. Gain knowledge about Survey Instruments, their care and adjustments and principles.
3. Use leveling surveying equipments and prepare LS and CS and contour maps
4. Compute the areas by traversing methods
5. Understand the different methods of computing reduced level.

MAPPING PROGRAMME OUTCOMES WITH COURSE OUTCOMES											
Cos	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	✓		✓					✓				
CO2			✓		✓			✓	✓			
CO3	✓			✓		✓						
CO4		✓					✓					
CO5				✓		✓				✓		

01CP408	STRENGTH OF MATERIAL LABORATORY	L	T	P
		0	0	3

Objectives:

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

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 specimens
5. Impact test
6. Hardness tests on different metals
7. Test on helical springs
8. Torsion test

Reference Books:

1. Rajput. R.K, "Strength of Materials", S.Chand & Co., September 2000.
2. Dr. Punmia. B.C, et al, "Strength of Materials and Theory of Structures - Vol.1", Laxmi Publications, 2000.
3. Sadhu Singh, "Strength of Materials", Khanna Publishers, New Delhi, 1988.
4. Ramamrutham. S, "Strength of Materials", Dhanpat Rai sons, New Delhi, 1992.
5. Hiraskar. G.K, "Strength of Materials", Khanna Publishers, New Delhi, 1984.

Course Outcomes:

At the end of the course students will be able to

1. Understand the different material properties.
2. Gain knowledge between the stress and strain,

3. Develop the Young's modulus and Poisson's ratio
4. Understand the diffetent loading conditions such as traverse and axial
5. Determine the hardness of different metals

MAPPING PROGRAMME OUTCOMES WITH COURSE OUTCOMES												
COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	✔		✔					✔				
CO2		✔		✔				✔			✔	
CO3						✔				✔		
CO4			✔				✔					
CO5		✔			✔					✔		

FIFTH SEMESTER

02PC501	STRUCTURAL MECHANICS I	L	T	P
		4	**1**	**0**

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 should 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 simple supported beams - ILD for single over hang beams - ILD for Propped cantilever beams with flexural hinges- simply simple 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 - ILD for Simple Plane truss problems.

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 sample support level and different support levels. ILD for moving loads over suspension bridges.

Analysis 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, 1992.

Reference Books:

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

Course Outcomes:

At the end Students will be able to

1. Analyze the indeterminate structures like beams and frames with different end conditions.
2. Explain the concepts of influence lines and its effects.
3. Solve the structural problems with different methods of analysis.
4. Analyze the arch structures
5. Analyze the bridges and suspension cable bridges.

MAPPING PROGRAMME OUTCOMES WITH COURSE OUTCOMES												
COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	✓	✓						✓				✓
CO2		✓						✓				
CO3		✓		✓								✓
CO4				✓					✓			✓
CO5			✓				✓				✓	

01PC502	SURVEYING II	L	T	P
		4	0	0

Objectives:

- To expose students to geodetic measurements and control survey methodology and its adjustments.
- To introduce the concepts of modern surveying.

Unit I

Theodolite – classification – part of transit theodolite – adjustments – measurement of horizontal and vertical angles – traversing – methods.
Trigonometric Survey – heights and distances – base accessible – base inaccessible – single and double plane methods – numerical problems.

Unit II

Tachometer principle – stadia – tangential – methods – derivation of formula – determination of constants – analytics lens – uses – staff held vertical – normal – line of sight inclined – numeric problems.
Sub-tense bar – principle – use – problems.

Unit III

Curves – classification – necessity – elements of simple curve – calculation – degree of simple curve – setting out a simple curve – various methods – difficulties in setting out simple curve – numerical problems related to simple curves only.

Introduction to compound, reverse, transition and vertical curves.

Unit IV

Horizontal and vertical control – triangulation – principle – purpose – classification – field work – triangulation station marking – signals – intervisibility of stations – numeric problems – baseline measurements – methods.
Errors in surveying – types – accidental errors – laws of weights –standard error – methods – methods of correlates – normal equation method – least squares.

Unit V

Field astronomy – geometry of sphere – spherical triangle – solution – Napier's rule – various co-ordinate systems – shortest distance between two points – earth surface – Equation of time.
Electromagnetic Distance Measurement (EDM): Introduction – electromagnetic waves – modulation – types of EDM measurements – distomat – total station – Satellite systems: GPS, Differential GPS – GPS surveys – software modules – applications of GPS.

Text Books:

1. Agor, R., "A text book on Advanced Surveying ", Khanna Publishers, IV Edition, New Delhi, 2007.
2. Arora, K.R. "A text book on Surveying Volume I and II", Standard Publishers New Delhi, 2006.

Reference Books:

1. Punmia, B.C., Ashok K. Jain and Arun K. Jain, "Surveying Volume I & II", Laxmi Publications, 2005.
2. Kanetkar, T.P. and Kulkarni, S.V., "Surveying and Levelling", Pune Vidyarthi Griha Prakashan, 1988.

Course Outcomes:

At the end of the course students will be able to

1. Understand and application of theodolite surveying.
2. Apply the principle of tacheometric surveying.
3. Solve the components of curves and curve setting
4. Have knowledge on rectifying the errors and adjustment of errors in surveying.

5. Gain knowledge on the working principle of GPS, its components, and signal structure and error sources.

MAPPING PROGRAMME OUTCOMES WITH COURSE OUTCOMES												
Cos	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	✓	✓		✓				✓				
CO2	✓					✓		✓				
CO3								✓	✓			
CO4		✓			✓		✓					
CO5			✓			✓				✓		

02PC503	SOIL MECHANICS	L	T	P
		4	0	0

Objectives:

- To understand the nature, properties and behavioral response of soils is essential for a safe and stable design of foundations.
- To understand the behavior of soils as a supporting medium for structures.
- To develop knowledge required for successful structural engineering practice

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. Dr. Punmia.B.C, "Soil Mechanics & Foundation Engineering", Lakshmi Publications, 2005.
2. Moorthy, V.N.S., "Soil Mechanics & Foundation Engineering", CRS Press, 2002.

Reference Books:

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

Course Outcomes:

At the end of the course students will be able to

1. Understand the different types of soil based on their formation mechanism and relationships of the soil
2. Understand the behaviour of soils based on their moisture contents and classify any soils based on their particle size distribution and index properties;

3. Understand the physical significance of effective stress and its relation with pore pressure.
4. Effect of capillary action and seepage flow direction on the effective stress at a point in the soil mass.
5. Understand the soil characters such as shear strength and stress distribution.

MAPPING PROGRAMME OUTCOMES WITH COURSE OUTCOMES											
Cos	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	✓	✓										✓
CO2				✓		✓						✓
CO3					✓			✓				
CO4			✓				✓			✓		
CO5				✓				✓	✓			

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

Objectives:

- To learn 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 storeyed 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.

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

Reference Books:

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

Standards:

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

Course Outcomes:

At the end of the course students will be able to

1. Understand the behaviour of Reinforced Concrete and its design philosophies.
2. Learn the designing the footing for various structures
3. Develop the knowledge on designing the columns
4. Gain knowledge about the rudimentary principles of designing reinforced concrete structural elements such as different shape of water tanks as per the existing codes.
5. Gain knowledge about the designing of reinforced concrete structural elements such as retaining walls as per the existing codes.

MAPPING PROGRAMME OUTCOMES WITH COURSE OUTCOMES												
Cos	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1		✓	✓		✓			✓				
CO2			✓	✓		✓	✓			✓		✓
CO3						✓						✓
CO4				✓				✓			✓	
CO5		✓		✓					✓			✓

01CP507	SURVEYING LABORATORY II	L	T	P
		0	0	3

Objectives

- To conduct experiments on Surveying and Levelling.
- Understand the principles of surveying.
- Understand the concepts of Theodolite surveying.

List of Experiments:

I   Theodolite and Trigonometric Surveying

1. Study of Transit theodolite, fundamentals of various axes
2. Measurement of horizontal angle by repetition method
3. Measurement of horizontal angle by reiteration method
4. Trigonometric levelling – Single plane method – Base accessible
5. Trigonometric levelling – Single plane method – Base inaccessible
6. Trigonometric levelling – Double plane method – Base inaccessible

II   Tacheometric Surveying

1. Determination of tacheometric constants
2. Determination of Distance and elevation by stadia hair method
3. Determination of Distance and elevation by tangential method
4. Determination of Gradient of a line using stadia hair and tangential method
5. Determination of distances and heights using Subtense bar.

III   Demonstration

1. Study of GPS
2. Study of Total Station

IV   Survey Camp (One Week Mandatory)
1. Longitudinal Section and Cross Section of Canal / Bund
2. Block Contouring
3. Hill Contouring
4. Setting out work – Simple Curves
5. Building Marking

Text Books:
3. Agor, R., "A text book on Advanced Surveying ", Khanna Publishers, 4th Edition, New Delhi, 2007.
4. Arora, K.R. "A text book on Surveying Volume I and II", Standard Publishers New Delhi, 2006.

Reference Books:
3. Punmia, B.C., Ashok K. Jain and Arun K. Jain, "Surveying Volume I & II", Laxmi Publications, 2005.
4. Kanetkar, T.P. and Kulkarni, S.V., " Surveying and Levelling", Pune Vidyarthi Griha Prakashan, 1988.

Course Outcomes: At the end of the course students will be able to
1. Possess the knowledge to find the horizontal and vertical angle by theodolite surveying
2. To find out the inaccessible distance by theodolite surveying
3. To find out the difference in elevation by tacheometric surveying
4. To find out the gradient between the points
5. Possesses the knowledge of GPS and Total Station

MAPPING PROGRAMME OUTCOMES WITH COURSE OUTCOMES												
Cos	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	✔	✔		✔				✔		✔		✔
CO2			✔		✔				✔			
CO3		✔					✔		✔			
CO4					✔					✔		
CO5		✔			✔				✔			✔

01CP508	SOIL MECHANICS LABORATORY	L	T	P
		0	0	3

Objectives

- To train the students in various aspects of soil investigation.
- To learn the determination of basic soil properties, strength, deformation and permeability characteristics of soils

List of Experiments:

1. Sieve analysis
2. Hydrometer analysis
3. Atterberg limits
4. Permeability determination (constant head and falling head methods)
5. Optimum Moisture content determination(Proctor compaction, CBR value test)
6. Shear strength determination (Direct shear test , Unconfined compression test, Triaxial compression test)
7. One-dimensional consolidation test.

Reference Books:

1. Punmia.B.C, Soil Mechanics & Foundation Engineering, Lakshmi Publications, 2005.
2. Moothy.V.N.S , Soil Mechanics & Foundation Engineering, *CRS Press,* 2002.
3. Arora, Soil Mechanics & Foundation Engineering, *Standard Publishers Distributors,* 2005.
4. Venkataramaiah.C, Geotechnical Engineering, *New Age International Publishers,* 2006.
5. Shamsher Prakash, Problems in Soil Mechanics, *Asia Publishing House,* 1972.
6. Terzaghi.K and Peck.R.B, Soil Mechanics in Engineering Practice, *John Wiley & Sons,* 1996.
7. SP 36 – 1 (1987): Compendium of Indian Standards on Soil Engineering: Part-1 Laboratory Testing of Soils for Civil.

Course Outcomes:

At the end of the course students will be able to

1. Understand the soil properties.
2. Gain knowledge about the soil characters.
3. Compute the Permeability of soils

4. Compute the moisture content and bearing value of different soils.
5. Gain knowledge on shear strength of soils.

MAPPING PROGRAMME OUTCOMES WITH COURSE OUTCOMES											
COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	✓		✓					✓			✓	✓
CO2				✓		✓		✓	✓			
CO3		✓			✓				✓	✓		
CO4	✓		✓				✓			✓		
CO5		✓			✓						✓	

SIXTH SEMESTER

02PC601	STRUCTURAL MECHANICS II	L	T	P
		4	0	0

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

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 - Neylor's Simplification method.

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 stagging.

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

Course Outcomes:

At the end Students will be able to

1. Analyze the indeterminate structures like beams and frames with different end conditions through various advanced and modern methods.
2. Solve the structural problems with matrix approach.
3. Do the flexural analysis for different structural members.
4. Analyze the beam member with matrix approach
5. Do the analysis of beams with different approach.

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12

MAPPING PROGRAMME OUTCOMES WITH COURSE OUTCOMES												
COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	✓										✓	✓
CO2		✓	✓							✓		
CO3				✓			✓		✓			✓
CO4						✓					✓	
CO5						✓			✓	✓		

01PC602	**ESTIMATION AND VALUATION**	L	T	P
		4	**0**	**0**

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, 2005.
2. Chakraborthi M., "Estimating and Costing Specifications in Civil Engineering", Kolkatta.

Reference Books:

1. Rangwala S.C., "Elements of Estimating and Costing in Civil Engineering", Charotar Publishing House, India.
2. Kohli D.D. and Kohli R.C., "A Text Book of Estimating and Costing" (Civil).
3. Banerjee D.N., "Principles and Practices of Valuation", Eastern Law House, V Edition, 1998.
4. Vazirani, V.N. and Chandola S.P., "Estimating and Costing", Khanna Publishers, New Delhi.
5. Rangwala S.C., "Valuations of Real Properties"
6. Kanagasabapathy B., "Practical Valuations"
7. "Hand book of Consolidated Data – 8/2000, Volume I", TNPWD.
8. "TamilNadu Transparencies in Tender Act, 2000".

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

1. Prepare a detailed estimate for different types of structures.
2. Prepare valuation reports.
3. Understand and execute rate analysis of various works in construction.
4. Estimate the total construction cost of the structure.
5. Understand the valuation techniques and guidence

Cos	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	✓	✓		✓					✓		✓	
CO2			✓		✓		✓		✓			
CO3						✓		✓	✓			✓
CO4											✓	
CO5						✓		✓	✓		✓	

MAPPING PROGRAMME OUTCOMES WITH COURSE OUTCOMES

01CP607	HYDRAULICS LABORATORY	L	T	P
		0	0	3

Objectives:

- To understand the practical methods for determination of co-efficient of discharge.
- To study characteristic features of pumps and turbines by carrying out experiments.
- 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 **Mouthpiece**

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 Pipes**

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)

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 end of the course students will be able to

1. Determine discharge using various devices.
2. Measure flow in pipes and determine frictional losses.
3. Compute forces and coefficient of impact on jets.
4. Study the performance of pumps and turbines.
5. Develop the Characteristics curves of pumps and turbines.

MAPPING PROGRAMME OUTCOMES WITH COURSE OUTCOMES												
Cos	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	✓		✓							✓	✓	
CO2		✓		✓		✓			✓			✓
CO3			✓	✓		✓						
CO4					✓				✓		✓	✓
CO5	✓		✓						✓			✓

01CP608	TRANSPORTATION ENGINEERING LABORATORY	L	T	P
		0	0	3

Objectives:

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

List of Experiments:

1. Determination of Crushing value of Coarse Aggregates.

2. Determination of Impact value of Coarse Aggregates.

3. Determination of Flakiness Index and Elongation Index of Coarse Aggregates.

4. Determination of Abrasion value of Coarse Aggregates.

5. Determination of Fineness modulus and grading curve of coarse aggregates.

6. Determination of Flash and Fire point of Bitumen.

7. Determination of Viscosity of Bitumen.

8. Determination of Penetration value of Bitumen.

9. Determination of softening point of Bitumen.

10. Determination of Ductility value of Bitumen.

11. Determination of Marshal Stability Value of Bituminous mixture.

Reference Books:

1. Khanna S. K., Justo C.E.G, and Veeraragavan A., "Highway Materials and Pavement Testing", Nem Chand and Bros., Roorkee.

2. Gambhir, M.L. and Jamwal Neha, "Lab Manual: Building and construction materials, Testing and Quality Control", McGraw Hill Education (India), Pvt. Ltd., Noida.

3. Duggal, Ajay K. Puri and Vijay P., "Laboratory Manual in Highway Engineering", New Age Publishers, New Delhi.

4. Sood Hemant, Mittal, L.N. and 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. Understand the properties and test procedures of aggregate, bituminous materials, composites and recycled waste products.
2. Know the different types of bituminous pavement construction and its principles
3. Learn the properties of various aggregate used as pavement materials through relevant tests.
4. Know the principles and procedures of testing Concrete.
5. Arrive the stability value of bituminous mix.

MAPPING PROGRAMME OUTCOMES WITH COURSE OUTCOMES												
COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	✓	✓								✓		
CO2				✓		✓				✓	✓	
CO3	✓					✓					✓	
CO4			✓	✓								
CO5			✓	✓	✓				✓		✓	

SEVENTH SEMESTER

00HS701	ENGINEERING ETHICS	L	T	P
		4	0	0

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 Senthilkuma, 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.
3.

Reference Books:

1. Charles E Harris, Michael S Pritchard and Michael J Rabins, "Engineering Ethics – Concepts and Cases", Thompson Learning, 2000.
2. Charles D Fleddermann, "Engineering Ethics", Prentice Hall, New Mexico, 1999. John R Boatright, "Ethics and the Conduct of Business", Pearson Education, 2003.
3. Edmund G Seebauer and Robert L Barry, "Fundamentals of Ethics for Scientists and Engineers", Oxford University Press, 2001.
4. David Ermann and Michele S Shauf, "Computers, Ethics and Society", Oxford University Press, (2003).

Course Outcomes:

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.
4. To procreate awareness of professional rights and responsibilities of an engineer
5. To create an engineer to have ability to act as managers consultant and leadership role in their professional activities.

MAPPING PROGRAMME OUTCOMES WITH COURSE OUTCOMES											
COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	✓	✓						✓	✓		✓	✓
CO2			✓		✓	✓		✓	✓			
CO3				✓				✓	✓	✓	✓	
CO4		✓					✓				✓	
CO4			✓				✓	✓			✓	
CO5		✓		✓						✓		

02PC702	STRUCTURAL STEEL DESIGN	L	T	P
		4	0	0

Objectives:

- To design simple steel elements and the corresponding fasting systems are dealt with the course.
- To learn the design of steel structural elements along with advanced design concepts to enhance their design concepts with the relevant codal standards.

Unit I

Introduction to Structural steel and their types- Advantages of structural steel- Design mythology- Limit State Design – Stress-strain curve of structural steels- Partial safety factors for loads and Materials – Deflection Limits. Bolted connections –shear capacity – Tension capacity – Bearing Capacity – Bolts subjected to combined shear and tension– Design of connections as per IS 800 – 2007 provisions. Welded connections – Butt joint – Lap joint – weld subjected to combination of normal and shear stress – combination of bearing bending and shear – Design of connections as per IS 800 – 2007 provisions.

Wind on Industrial steel Buildings - Design wind speed and pressure – Internal and external wind pressure coefficients form codes – 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.

Unit II

Tension members – Types – Design strength duo 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.

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 III

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. Tubular Trusses, joint details, tubular scaffoldings. Analysis and design of hoarding structures under dead live and wind load conditions (SP 64 (2001).

Unit IV

Beams – Effective span of Beams – Design strength in Bending Torsional Buckling – Effective Length for simply supported beams – Shear – Beams of unsymmetrical sections – Plate girders – Elements of a plate girder Design of beams and plate girders as per IS 800 – 2007 provisions. Design of gantry girder – Braced industrial buildings – Un-braced industrial frames–Base plate with anchor bolt details - detailing as per IS standards

Unit V

Plastic analysis and design – Advantages and disadvantages – Plastic bending of beams – 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 frames

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

Text Books:

1. Duggal.S.K , Limit state Design of Steel Structures, Tata McGraw Hill Education Private Ltd,2000.
2. Sairam.K.S, Design Of Steel Structures, Pearson Publications, 2013.

Reference Books:

1. Shiyekar, Limit state Design of Steel Structures, Phi Learning Pvt Ltd,2010
2. Design of Steel Structures, Subramanian.N, Oxford University Press,2008
3. Design of Steel Structures Textbook, Bhavikatti.S.S, I.K. International Publishing House Pvt. Ltd, 2012.

Standards:

1. IS: 800 – 2007, General Construction in Steel – Code of Practice.
2. IS: 875(Part3): Wind Loads on Buildings and Structures.Teaching resource materials by INSDAG, Kolkatta.
3. IS: 802(Part 1 to part 3):1995 Code of practice for use of cold formed light gauge steel structural members in general building construction.
4. IS: 806- 1968 Code of practice for use of steel tubes in general building construction.

5. IS: 4014- 1967(Part I and II) Code of practice for steel tubular scaffolding.
6. SP: 6 (2) - 1962 Steel beams and plate girders.
7. SP: 6 (5) - 1980 Structural use of light gauge steel.
8. IS codes for Aluminium Structures, IS:3908, 3909, 3921, 5384, 6445, 6476, 6475, 6449, 8147, Bureau of Indian Standards.
9. SP 64 (2001): Explanatory Handbook on Indian Standard Code of Practice for Design Loads (other than Earthquake).
10.

Course Outcomes:

At the end of the course students will be able to

1. Get the fundamental knowledge about the different types of Steel sections available in the market.
2. Know the design of Connections and Different types of members which subjected to Various load conditions
3. Have knowledge on designing of steel structures on industrial buildings
4. Solve the design problem of girders
5. Acquire a overall knowledge on design of steel structures such as roofs, beams, trusses and scaffoldings etc.

MAPPING PROGRAMME OUTCOMES WITH COURSE OUTCOMES											
Cos	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	✓	✓	✓	✓			✓		✓	✓	✓	✓
CO2			✓	✓	✓	✓		✓			✓	✓
CO3									✓			
CO4			✓	✓					✓		✓	
CO5		✓	✓	✓							✓	

01CP706	ENVIRONMENTAL ENGINEERING LABORATORY	L	T	P
		0	0	3

Objectives:

- To quantify water and wastewater pollutants.

- To determine concentration of air pollutants.

- To analyze the characteristics of water, wastewater and ambient air.

- To study the growth of microorganisms and its quantification.

List of Experiments:

1. Determination of **Chloride** content in water sample.
2. Determination of **Dissolved Oxygen** in water sample.
3. Determination of **pH** in water sample.
4. Determination of **Hardness** in water sample.
5. Determination of **Total Solids (TDS, TSS)** in water sample.
6. Determination of **Turbidity** of various water and wastewater samples using Nephelo Turbidity meter.
7. Determination of **Electrical Conductivity** of water samples.
8. Determination of **Sulphates** in water sample.
9. Determination of **Chemical Oxygen Demand** for water sample.
10. Determination of **Bio-Chemical Oxygen Demand** for water sample.
11. Determination of **Residual Chlorine** in water sample.
12. Determination of **Chlorine Demand** for water sample.
13. Determination of optimum dosage of coagulant using Jar test apparatus.
14. Determination of infiltration capacity using Double ring infiltrometer.

Reference Books:

1. AWWA, WEF, "Standard Methods for the Examination of Water and Wastewater", APHA, 2005.
2. Sawyer, C.N., McCarty, P.L., and Parkin, G.F., "Chemistry for Environmental Engineering", 4th Edition, Tata McGraw-Hill Publishing Company Limited, 2000.

Course Outcomes:

At the end of the course students will be able to:
1. Quantify the pollutant concentration in water, wastewater and ambient air.
2. Recommend the degree of treatment required for water and wastewater.
3. Analyze the survival conditions for the microorganisms and their growth rate.
4. Recommend the quantity of chemicals required for water treatment
5. Give suggestion and remedy for water treatment.

MAPPING PROGRAMME OUTCOMES WITH COURSE OUTCOMES											
Cos	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	✓	✓		✓			✓			✓	✓	✓
CO2		✓	✓		✓	✓		✓	✓			
CO3						✓					✓	
CO4	✓						✓				✓	✓
CO5		✓				✓	✓					✓

CEPV803	PROJECT WORK AND DESERTATION	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 construction planning, water resource planning & management and environmental acpects
3. Understand the modelling, analysis and design concepts related to civil engineering applications.

Mapping of COs with POs											
Cos	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	✓	✓	✓						✓			
CO2				✓	✓	✓			✓	✓	✓	
CO3						✓	✓	✓		✓	✓	

SYLLABUS OF PROFESSIONAL ELECTIVES

01PExxx	HYDROLOGY	L	T	P
		4	0	0

Objectives

- To introduce the student to principles of Hydrologic cycle and preciptation.
- To impart knowledge on characteristics of aquifers and well hydraulics.
- To understand the techniques of development and management of Rainfall and Runoff.
- To expose students to investigation, artificial recharge of groundwater , Flood management and Drought assessment.

Unit I

Introduction - Hydrologic cycle - Hydrologic equation - The Global water budget- Indian Scenario - Scope and applications of hydrology – Hydrometeorology - Constituents and Structure of atmosphere - The General circulation - Triple cell model - Transistory system -Meteorological observations - Climate and weather seasons of India

Unit II

Precipitation – Formation – Forms – Types - Measurement - Optimum Rain Gauge Network - Analysis and Interpretation of Rainfall Data - Rainfall Intensity - Rainfall Hyetograph – Duration – Frequency - Areal Distribution - Average Depth of Precipitation - Estimation of Missing Rainfall Data

Unit III

Hydrologic Abstractions – Evaporation - Factors Affecting – Measurement – Estimation - Reducing Evaporation – Evapotranspiration - Methods of Estimation - Penman Method – Infiltration -Factors Influencing – Measurement – Equations - Infiltration Indices - Effective Rainfall

Unit IV

Runoff – Components - Factors Influencing - Catchment Characterisation - Stream Order and Drainage Density - Basin Yield - Rainfall - Runoff Relationship - Strange Tables and Curves - Flow Duration Curve - Flow Mass Curve - Stream Flow Measurement – Stage – Discharge – Relationship - Velocity Distribution - Stream Gauge Site Selection – Hydrograph – Features – Hydrograph – Separation – DRH - Unit Hydrograph – Derivation - Application - Synthetic Unit Hydrograph

Unit V

Flood - Design Flood – Methods of Estimation of IDF - MPF – SPF – Flood Frequency analysis – Return Period – Flood Routing –Reservoir Routing- Channel Routing – Muskingham Routing – Drought – types of drought – drought indices

Text books

1. Jayarami Reddy, "Hydrology", Tata McGraw Hill, 2008.
2. S.P. Garg, "Groundwater and Tube Wells", Oxford & IBH Publishing Co., 1993

Reference Books:

1. Raghunath H.M., "Ground Water Hydrology", New Age International (P) Limited, New Delhi, 2010
2. R.Subramanya, "Engineering hydrology"- New age international, 2005
3. Chow, V.T. and Maidment D.R. , "Hydrology for Engineers", McGraw-Hill Inc., Ltd., 2000

Course Outcomes:

At the end of the course students will be able to

1. Understand Hydrologic cycle and precipitation.
2. Acquire knowledge of Flood Management.
3. Realize the importance of rainfall and Runoff.
4. Understand the concept of Drought Assessment.
5. Gain overall knowledge on flood and drought management

MAPPING PROGRAMEE OUTCOMES WITH COURSE OUTCOMES											
Cos	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	✓	✓										
CO2		✓	✓					✓				
CO3					✓			✓				
CO4								✓				
CO5		✓			✓					✓		

01PExxx	CONSTRUCTION MANAGEMENT	L	T	P
		4	**0**	**0**

Objectives:
- To introduce the practices of various stages of construction.
- To learn elements of management, project planning and cost analysis.
- To acquire knowledge on PERT and CPM.

Unit I
Introduction – Classification of Construction work – Stages in Construction – Construction Team – Resources for construction – Objectives and Functions of Construction Management and its Applications.

Unit II
Types of organisation – principles – site organization – Scrutiny of site documents – Job layout – principles of storing materials – Organisation of labour – Construction labour –Organization of PWD and related departments – Functions – Method of executing work – Miscellaneous Topics.

Unit III
Project planning – Contract Planning, Scheduling and Control – Material Handling – Constructional practices – Contract – types of contract – contract document – specification – important conditions of contract – tender and tender document – Deposits by the contractor – Arbitration – Negotiation – M.Book – Muster roll – stores – Lab components: Introduction to Microsoft projects and Primavera – Preparation of schedule for a project by using Microsoft projects and Primavera.

Unit IV
Project management – Bar charts and Milestone charts – Network methods – PERT – CPM – Comparison of PERT and CPM – Cost and Time optimization – development and elements of network – Activity time – estimate events times – concept of floats – critical activities and critical path – Cost analysis – direct and indirect cost– normal and crash duration– cost slope – cost optimisation – updating – resources smoothing – resources levelling.

Unit V
Construction quality – inspection, quality control and quality assurance – total quality management and their techniques – cost of quality – ISO standards – audit – evaluation of safety – accident causation theories – foundation of a major injury – health and safety act and regulations – cost of accidents – principles of safety – safety and health management systems.

Text Books:
1. Harpal Singh, "Construction Management and Accounts", Tata McGraw Hill Publishing Company Ltd., New Delhi, 2007.

2. Vazirani, V.N. and Chandola, S.P., "Construction Management and Accounts", Khanna Publishers, New Delhi, 2011.

Reference Books:

1. Subramanya, K., "Construction Management", Tata McGraw Hill Publishing Company Ltd., New Delhi, 1989.
2. Punmia, B.C. and Khandelwal, K.K., "Project Planning and Control with PERT and CPM", Laxmi Publications (P) Ltd., New Delhi, 2009.
3. Sharma, S.C., "Construction Engineering and Management", Khanna Publishers, New Delhi, 2008.
4. Murugesan .G, "Total Quality Management", Laxmi Publications, New Delhi, 2013.
5. CADD Centre Manual, "Project planning and management by using MS Project", CADD Centre Training Services Pvt. Ltd., 2010.
6. CADD Centre Manual, "Primavera Training Manual", CADD Centre Training Services Pvt. Ltd., 2010.

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

1. Develop the ability to influence project design and to manage pre-construction activities.

2. Understand method of control of project schedule, cost, quality and risks.

3. Realize ethics of project management.

4. Acquire knowledge on Tenders and related procedures.

5. Recognize the significance of safety and health management.

Cos	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1						✓					✓	✓
CO2	✓	✓					✓	✓				
CO3		✓		✓		✓	✓	✓				
CO4			✓				✓	✓		✓		
CO5					✓			✓	✓	✓		✓

MAPPING PROGRAMEE OUTCOMES WITH COURSE OUTCOMES

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

Objectives:

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

Unit I

Objectives of public water supply schemes; Health acceptability, adequacy, conveyance 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 – Sanitary protection of wells – Estimating the yield of wells under steady state conditions – Duipit's Equation – Sea & Back water sources – Intake Structures.

Unit III

Pipes 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, New 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", 2001.
2. Arcadio P.Sincero, Gregoria A.Sincero, "Environmental Engineering – A Design Approach", Prentice Hall, 2002.
3. Glynn Henry, J. & Gary W Heinke, "Environmental Science and Engineering", Prentice Hall of India, 2004.
4. Metcalf, L. and Eddy, H.P., "Waste Water Engineering, Collection, Treatment, and Disposal" by McGraw Hill Publishers, 4th Edition, 2003.

Course Outcomes:

At the end of the course students will be able to

1. Apply procedures to forecast population and compute future water demand.
2. Develop on Environmental Management Systems for characteristics of water.
3. Explain different methodologies for collection and conveyance systems.
4. Design the various water treatment units
5. Examine layout and analyze water distribution systems.

MAPPING PROGRAMEE OUTCOMES WITH COURSE OUTCOMES												
COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1			✓	✓		✓		✓				
CO2							✓	✓	✓			
CO3							✓		✓			
CO4							✓	✓				
CO5		✓				✓				✓		

01PExxx	**FOUNDATION ENGINEERING**	L	T	P
		4	**0**	**0**

Objectives:

- To impart basic knowledge on design of foundations and its behaviours under different soil conditions to carry out proper foundation design.
- To draw shear force and Bending moment diagram for foundations.
- To get exposed to settlement of foundations.
- To learn concept of pile foundations.

Unit I

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 – 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. Murthy, 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. Purushothama Raj. P., "Soil Mechanics and Foundation Engineering", 2nd Edition, Pearson Education, 2013.
2. Varghese, P.C.,"Foundation Engineering", Prentice Hall of India Private Limited, NewDelhi, 2005.
3. Das, B.M. "Principles of Foundation Engineering" 5th edition, Thompson Asia Pvt. Ltd., Singapore, 2003.
4. Kaniraj, S.R. "Design aids in Soil Mechanics and Foundation engineering", Tata McGraw Hill Publishing Company Ltd., New Delhi, 2002.
5. Punmia, B.C. "Soil Mechanics and Foundations", Laxmi Publications Pvt.Ltd., New Delhi, 2005.

6. Venkatramaiah, C. "Geotechnical Engineering", New Age International Publishers, New Delhi, 2007 (Reprint).
7. Arora K.R, "Soil Mechanics and Foundation engineering", Standard Publishers and Distributors, New Delhi, 2005.

Standards:
1. IS: 6403: 1981 (Reaffirmed 1997) "Breaking capacity of shallow foundation", Bureau of Indian Standards, New Delhi, 1998
2. IS:8009 (Part1):1976 (Reaffirmed 1998) "Shallow foundations subjected to symmetrical static vertical loads", Bureau of Indian Standards, New Delhi, 1999
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, 1994
5. IS: 2911(Part2):1979 (Reaffirmed 1997) "Timber Piles", Bureau of Indian Standards, New Delhi, 2007
6. IS: 2911(Part 3):1979 (Reaffirmed 1997) "Under Reamed Piles", Bureau of Indian Standards, New Delhi, 1998
7. IS: 2911 (Part 4):1979 (Reaffirmed 1997) "Load Test on Piles", Bureau of Indian Standards, New Delhi, 1997

Course Outcomes:

At the end of the course students will be able to

1. Select type of foundation required for the soil at a appropriate place
2. Assesses the bearing capacity of different soil stratum
3. Design shallow, foundations and deep foundations
4. Have knowledge on laying pile foundation
5. Design a foundation for retaining structures.

MAPPING PROGRAMEE OUTCOMES WITH COURSE OUTCOMES											
Cos	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1		✓	✓					✓			✓	✓
CO2					✓	✓						
CO3		✓		✓	✓							
CO4								✓	✓			
CO5			✓	✓			✓					

01PExxx	**TRANSPORTATION ENGINEERING**	L	T	P
		4	**0**	**0**

Objectives

- To give an overview of highway engineering with respect to the development, planning, design, construction of highways.
- To impart knowledge on the elements of traffic engineering and associated studies.
- To expose students to the basics of railways, geometric design, construction, maintenance, operation and control of railways.

Unit I

Introduction – Highway development in India - Classification of roads – Highway alignment and surveys - Geometric Design of Highway – Cross sectional elements – Sight distances – stopping and Overtaking sight distances – over taking zone requirements – Design of horizontal alignment – speed – radius – super elevation – extra widening of pavements – extra widening at curves – Vertical alignment – gradients – summit curves and valley curves – worked out problems .

Unit II

Introduction – Road user – vehicle and traffic characteristics – Speed and volume studies – Parking and accident studies – Principles of design of intersections – Simple layouts – Objectives – classification – uses and advancement of traffic signs – markings and signals – Design of isolated signals.

Unit III

Highway Materials – Aggregates and Bituminous Materials – Selection and testing – Construction methods for Earth roads – gravel W.B.M roads – bituminous pavements – cement concrete pavements – Design of flexible and rigid pavements as per IRC guidelines.

Unit IV

Introduction – Typical cross-sections – Route alignment surveys – conventional and modern methods – Various gauges – Coning of wheels – tilting of rails – Functions and requirements of component parts of a railway track – Creep of rails – Geometrical design of railway track –

Horizontal curves – radius – super elevation – cant deficiency – transition curves – safe speed on curves – different types of gradients – grade compensation – Modern Track based system.

Unit V

Construction of railway track – earthwork – plate laying and packing – Maintenance of track – alignment – gauge – renewal of component parts – drainage – modern methods of track maintenance.

Railway Operation and Control: Points and crossings and their design – Track junctions – simple track layouts – Details of different types of stations and yards – passenger amenities – Signaling and interlocking – Train movement control systems – Urban rail – Infrastructure for Metro, Mono and underground railways.

Text Books:

1. Khanna.S.K. and Justo. C.E.G., "Highway Engineering", NemChand & Brothers, Roorkee, 2005
2. Bindra.S.P., "Basic Highway Engineering", Dhanpat Rai & Sons, New Delhi,1977

Reference Books:

1. Kadiyali.L.R., "Traffic Engineering and Transport Planning", Khanna Publishers, New Delhi, 2013
2. Saxena Subhash.C and Satyapal Arora, "A Course in Railway Engineering", Dhanpat Rai and Sons, New Delhi, 2003
3. Rangwala. S.C. and . Rangwala. K.S., "Principles of Railway Engineering", Charotar Publishing House, 2013
4. Vazirani. V.N. and Chandola.S.P., "Transportation Engineering Volume I & II", Khanna Publishers, New Delhi, 2000
5. Kadiyali. L. R. and Lal. N. B., "Principles and Practices of Highway Engineering", Khanna Publishers, New Delhi, 2008.
6. Paul K Wright and Karen K. Dixon, "Highway Engineering", Replica Press Limited, Kundli, Seventh Edition.Indian Roads Congress (IRC) Specifications, "Guidelines and Special Publications on Traffic Planning and Management", 1994
7. Papacostas. C.S. and Prevedouros. P.D., "Transportation Engineering & Planning", Prentice Hall of India, Third Edition, 2001
8. Mundrey, J. S., "Railway Track Engineering", TataMcGraw Hill Company, 2003
9. Rao. G.V., "Principles of Transportation and Highway Engineering", TataMcGraw Hill Company, 2004

10. Chakraborthy and Das, "Principles of Transportation Engineering", Prentice Hall of India, 2005
11. Narasimha Murthy. A.S. and Henry R. Mohle, "Transportation Engineering Basics", ASCE Press, 2000

Course Outcomes:

At the end of the course students will be able to

1. Classify the different types of transportation systems.
2. Plan various public transportation systems.
3. Classify and Design highways according to IRC standards.
4. Design pavements as per IRC recommendations.
5. Demonstrate various test methods for highway materials.
6.

MAPPING PROGRAMEE OUTCOMES WITH COURSE OUTCOMES												
Cos	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	✓	✓						✓				
CO2				✓				✓			✓	
CO3			✓					✓			✓	✓
CO4			✓					✓				✓
CO5		✓						✓			✓	✓

01PExxx	WASTE WATER ENGINEERING	L	T	P
		4	0	0

Objectives:
- To make the students conversant with basic principles of wastewater engineering.
- To learn about collection, conveyance, characterization, treatment and disposal of domestic wastewater.

Unit I

Definitions: Sewage, Sewer and Sewerage – Collection & Conveyance of sewage – Classification of sewerage systems – 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 II

Materials for sewers – Joints in sewers – Laying & testing of sewers –Ventilation – Cleaning of sewers – Sewer appurtenances – Pumps – Types of pumps – Pumping station.
Principles and layout of house drainage systems – Sanitary fixtures and fittings – one pipe systems and two pipe systems.

Unit III

Characteristics and composition of wastewater – Analysis of physical, chemical and biological characteristics – B.O.D. and its significance – Population Equivalent – Domestic, Municipal and Industrial wastewater – Objectives of wastewater disposal – Methods of disposal – discharge into bodies of water – Hydraulic of sewers: Self cleansing velocity, Decomposition cycles.

Unit IV

Septic tanks and disposal arrangements – Imhoff tank – Intermittent sand filters – Oxidation Pond & Ditch – Aerobic, Anaerobic and combinations of processes – Primary & Secondary Treatment – Unit operation & processes in wastewater treatment: Screens, Grit chamber, Skimming tank and Settling tanks.

Unit V

Aerobic Methods: Activated Sludge Process – Methods of Aeration – Trickling Filters –Anaerobic Methods: Digesters – Disinfection for reuse – Sludge treatment – Sludge digesters – Methods of sludge disposal – Operation and maintenance aspects.

Text Books:

1. Punmia, B.C., Ashok Kumar Jain and Arun Kumar Jain, "Environmental Engineering – 2: Wastewater Engineering", Laxmi Publications, 2004.
2. Rangwala, S.C., "Water Supply and Sanitary Engineering", Charotar Publication House Pvt. Ltd., Gujarat, 2013.

Reference Books:

1. Garg, S.K., "Sanitary Engineering", Khanna Publishers, 2005.
2. Duggal, K.N., "Environmental Engineering", S.Chand & Company, 2004.
3. Metcalf, L. and Eddy, H.P., "Wastewater Engineering, Collection, Treatment, and Disposal", McGraw Hill Publishers, 4th Edition, 2003.
4. Davis & Corwell, "Environmental Engineering", McGraw-Hill Series in Civil and Environmental Engineering, 2012.
5. Gerald Kiely, "Environmental Engineering", Tata McGraw-Hill Education, 2007.

Course Outcomes:

At the end of the course students will be able to
1. Apply the main procedures and methods of treatment for wastewater.
2. Develop on Environmental Management Systems.
3. Explain different methodologies for collection and conveyance of wastewater.
4. Examine the physical, chemical and biological characteristics of wastewater.
5. Suggest suitable methods for treatment and disposal.

MAPPING PROGRAMEE OUTCOMES WITH COURSE OUTCOMES											
COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	✓	✓	✓					✓				
CO2		✓	✓						✓			
CO3				✓		✓		✓				
CO4			✓						✓			
CO5	✓				✓					✓		

01PExxx	**PRESTRESSED CONCRETE**	L	T	P
		4	**0**	**0**

Objectives:

- To inculcate the basics of pre-stressing techniques.
- To design prestressed beams as per IS code specifications.
- To understand the concepts adopted for design of bridge structures.

Unit I

Pre-stress 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 – Effect of tendon profile on deflections – Factors influencing deflections – Calculation of deflections – Short term and long term deflections - Losses of pre-stress – Estimation of crack width.

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 IS1343-2012

Unit III

Analysis for stresses for composite sections – Estimation of deflections – Flexural and shear strength of composite members – Shear key.

Unit IV

Factors influencing 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.

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

Unit V

Design of concrete pipes – Circular tanks – poles – Railway sleepers – Stress distribution in end blocks – Design of anchorage zone reinforcement – Partial pre-stressing – Applications.

Text Books:

1. Krishna Raju, N., "Pre-stressed concrete", 5th Edition, Tata McGraw Hill Company, New Delhi, 2012.
2. Pandit, G.S. and Gupta, S.P. "Pre-stressed Concrete", CBS Publishers and Distributors Pvt. Ltd., 2012.

Reference Books:

1. Rajagopalan, N., "Pre-stressed Concrete", Narosa Publishing House, 2002.
2. Dayaratnam, P., "Pre-stressed Concrete Structures", Oxford and IBH, 2013.
3. Lin, T.Y. and Ned H.Burns, "Design of pre-stressed Concrete Structures", Third Edition, Wiley India Pvt. Ltd., New Delhi, 2013.
4. IS 1343:1980, Code of Practice for Pre-stressed Concrete, Bureau of Indian Standards, New Delhi, 2012.
5. IS 3370-1(2009) Code of practice for Concrete structures for storage of Liquids, Bureau of Indian Standards, New Delhi.

Course Outcomes

At the end of the course students will be able to

1. Gain knowledge on concepts and methods of pre-stressing.
2. Design various Pre-stressed concrete structural elements.
3. Calculate deflections and analyse stresses in prestressed beams.
4. Estimate and assess the composite prestressed section
5. Design of various structural elements using prestressed conctrete.

MAPPING PROGRAMEE OUTCOMES WITH COURSE OUTCOMES											
Cos	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	✓	✓	✓					✓				
CO2			✓	✓						✓	✓	✓
CO3				✓				✓		✓	✓	✓
CO4		✓			✓	✓						
CO5			✓	✓			✓					

01PExxx	**SAFETY IN CIVIL ENGINEERING PRACTICES**	L	T	P
		4	**0**	**0**

Objectives:

- To get familiar with the various terminology in accident prevention and its theories.
- To assess the safety performance as per Indian Standards.
- To know the principles involved in the design of industrial buildings.

Unit I

Accidents – Injury – unsafe act – unsafe condition – Reportable accidents. History of safety movement: ILO – UNDP – NSC – BSC – ROSPA – CIS- NSC – LPA (India) – Construction safety – Elements of an effective safety Programme – Job – site assessment.

Unit II

Safety aspects of buildings and plants – layout **–** Introduction to treatment and disposal of Industrial wastes & effluents – Planning and safe operations: Planning & site preparation – safe system of storing construction materials – excavation – Demolition – Hoisting apparatus – manual handling – safe use of Ladder – safety in Hand tools.

Unit III

Accidents and Hazard control – Accident causes and their control – Cost of accidents – Accident reports – Accident reporting investigation and statistics – Identification of the VCI factors – Safety organization – Types – Safety committees.

Unit IV

Safety policy – safety meeting – Planning for safety and Productivity – Safety Management techniques: Safety sampling – Safety Audit – Job safety analysis – accident recall technique – Safety and health provision in the Factories Act.

Unit V

Reasons for maintaining interest – Staff functions – Safety meeting – Posters and display – other promotional methods – safety publicity by various means.
Involvement in safety: Role on treatment and voluntary agencies – safety officers – Five hazards and Prevention methods – Interesting experiences at the construction site against fire accidents.

Reference Books:

1. Jimmy W. Hinze, Construction safety, Prentice Hall Inc., 1997.
2. Einrich, H.W., Industrial Accident Prevention, McGraw Hill Company, New York, 1980.

Course Outcomes:

At the end of the course students will be able to

1. Know modern construction safety techniques to be adopted in the construction of buildings and special structures
2. Aware of maintenance of rehabilitation and strengthening techniques and demolition.
3. Realize the significance of alertness against accidents and safety management.
4. Acquire knowledge in different safety management techniques
5. Make the civil engineer to create awareness regarding safety during practices.

MAPPING PROGRAMEE OUTCOMES WITH COURSE OUTCOMES											
Cos	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	✓	✓						✓				
CO2			✓				✓			✓		
CO3		✓			✓							
CO4			✓		✓			✓				
CO5	✓					✓			✓			

01PExxx	**GROUNDWATER ENGINEERING**	L	T	P
		4	**0**	**0**

Objectives
- To introduce the student to principles of groundwater governing equations.
- To impart knowledge on characteristics of aquifers and well hydraulics.
- To understand the techniques of development and management of groundwater.
- To expose students to investigation, artificial recharge of groundwater and seawater intrusion.

Unit I

Origin and age of groundwater – Scope and place of groundwater in Hydrologic cycle – vertical distribution of groundwater – rock properties affecting ground water - types of aquifers- water level fluctuations – Groundwater in India

Unit II

Storage coefficient- specific yield – Darcy's law– coefficient of permeability –laboratory measurement of permeability – field measurement of permeability – general flow equation – steady unidirectional flow – steady radial flow to a well both in confined and unconfined aquifer – steady flow with uniform recharge – unsteady radial flow to a well in confined aquifer – Non equilibrium equation for pumping tests by Theis method and Cooper -Jacob method.

Unit III

Construction of wells – methods for constructing shallow wells and for drilling deep wells – well completion - perforation screens and gravel packing – rigs for vertical and radial drilling – collector wells – infiltration galleries.

Unit IV

Surface and sub – surface investigations of ground water – geophysical exploration – electrical methods – seismic refractions methods – subsurface investigation –test drilling and resistivity.

Unit V

Artificial recharge of groundwater - sea water intrusion - Ghyben–Herzberg relation between fresh and saline water- remediation for seawater intrusion.

Text Books:

1. Jayarami Reddy P., "Hydrology", Laxmi Publications, Third Edition, Chennai, 2016.
2. David Keith Todd, "Groundwater Hydrology", John Wiley and Sons, 2000.

Reference Books:

1. Raghunath H.M., "Groundwater Hydrology", Wiley Eastern Limited, New Delhi, 2000.
2. Walton C., "Groundwater Resource Evaluation", McGraw-Hill Publications, 2000.
3. Fitts R Charles, "Groundwater Science", Elsevier Academic Press, 2002.
4. Ramakrishnan S., "Groundwater", K.J. Graph arts, Chennai, 1998.

Course Outcomes:

At the end of the course students will be able to

1. Understand aquifer properties and its dynamics.
2. Acquire knowledge of well construction and maintenance.
3. Realize the importance of artificial recharge of groundwater.
4. Understand the concept of seawater intrusion.
5. Assess and suggest the remediation techniques for sea water intrusion.

MAPPING PROGRAMEE OUTCOMES WITH COURSE OUTCOMES												
Cos	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	✓	✓	✓									
CO2		✓	✓			✓		✓				
CO3			✓			✓		✓				
CO4	✓	✓						✓				
CO5					✓	✓	✓					

01PExxx	**NUMERICAL METHODS APPLIED TO CIVIL ENGINEERING**	L	T	P
		4	**0**	**0**

Objectives:

- To provide mathematical foundation of numerical techniques for solving equations in engineering problems.
- To impart knowledge on finite difference techniques and power series methods of solution.
- To demonstrate the utility of numerical methods in obtaining solution to ordinary differential and partial differential equations describing various civil engineering problems, where analytical solutions are not readily available.

Unit I

Method of finite difference: Finite Difference Operators – E, Δ, Solution of First and Second Order Linear Difference Equations with Constant Coefficients – Non Homogeneous Linear Difference Equations with Constant Coefficients.

Unit II

Interpolation – Newton-Gregory Forward and Backward, Interpolation – Newton's Divided Difference Formula – Lagrange's Interpolation Formula for Unequal Intervals – Gauss Interpolation Formula – Sterling Interpolation Formula – Numerical Differentiation –Numerical Integration – Trapezoidal Rule – Simpsons1/3 and 3/8 Rule.
Curve Fitting – Linear and Non Linear Regression – Direct Methods – Indirect Methods.

Unit III

Numerical solution of Algebraic and Transcendental Equations – Balzano's Bisection Method – Successive Approximation Method – Regular – Falsi Method – Newton-Raphson Method – Graffies Root Squaring Method.
Numerical solution of simultaneous Linear Algebraic Equations – Gauss Elimination method – Gauss Jordan Elimination Method – Gauss Siedel Iteration Method – Crout's method.

Unit IV

Numerical Solution of Ordinary Differential Equation of First, Second Order and Simultaneous Equations – Taylor's Series Method – Euler's Method – Improved Euler's Method – Modified Euler's Method.
Runge Kutta Method of Fourth Order – Milne's-Predictor Corrector Method – Picard's Method.

Unit V

Numerical Solution of Partial Differential Equations – Elliptic Equation – Poisson's Equation – Laplace Equation – Lieberman's Iterative Method – Relaxation Method – Hyperbolic Equations – One Dimensional Heat Equation – Bender–Schmidt Recurrence Relation – Crank Nicholson's Implicit Method.

Text books:

1. Venkatraman, M. K., "Numerical Methods in Science and Engineering", National Publishing Company, 2005.
2. Krishna Raju, N. and Muthu, K. U., "Numerical Methods for Engineering Problems", Macmillan Publishing Company, 2000.

Reference books:

1. Kandasamy, P., Thilagavathy, K. and Gunavathy, K., "Numerical Methods", S.Chand & Company, 2007.
2. Jain, M. K., Iyengar, S. R. K. & Jain, R. K., "Numerical Methods for Science and Engineering Computations", New Age   International Publishers Ltd., 2007.
3. Rajasekaran, S., "Numerical Methods in Science and Engineering", S.Chand (G/L) & Company Ltd., 2003.
4. Sankara Rao, K., "Numerical Methods for Scientists and Engineers", Prentice Hall of India Pvt. Ltd., New Delhi, 3 rd Edition, 2007.
5. Gereals, C.F and Wheatley, P.O., "Applied Numerical Analysis", Addition Wesley Publishing Company, 1998.
6. John H. Mathews, "Numerical Methods for Mathematics", Science & Engineering, Prentice Hall of India Pvt. Ltd., New Delhi, 1994.
7. Smith, G.D., "Numerical solution of Partial Differential Equations: Finite Difference Method", Clarendon Press, Oxford, 2004.
8. Chapra,S. C. and Canale, R. P., "Numerical Methods for Engineers", 7th Edition, Mc Graw Hill Publishers, 2015.

Course Outcomes:

At the end of the course students will be able to

1. Perceive the power of numerical techniques.
2. Demonstrate the applications of these techniques to problems drawn from industry, management and civil engineering fields.
3. Apply numerical methods to get close approximate solutions to complex Engineering problems.

4. Apply ODE to make simultaneous equations in various civil engineering problems.
5. Find the numerical solution of partial differential equation.

MAPPING PROGRAMEE OUTCOMES WITH COURSE OUTCOMES												
Cos	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	✓	✓						✓				
CO2		✓	✓					✓				
CO3				✓				✓	✓			
CO4			✓	✓		✓						
CO5	✓	✓								✓		

01PExxx	CIVIL ENGINEERING SYSTEMS ANALYSIS	L	T	P
		4	0	0

Objectives:

- To introduce the engineering systems concept and methodology.
- To learn methods of Linear programming, formulation and solution of problems by LP.
- To learn concepts of Non-linear programming, Dynamic Programming and applications.
- To understand the economic aspects of engineering systems.

Unit I

Introduction to systems engineering - four distinct phases of civil engineering projects: planning, design, construction and operation - design methodology - the notion of a system - functions of the systems engineer - Mathematical decision - making models - statement of mathematical model - classification - methods of finding an optimal solution.

Unit II

Linear programming - general form of an LP problem - solution techniques - graphical method - simplex method - solution procedures for minimization problem, maximization problem- excess and artificial variables - Degeneracy - Duality.
Special forms of LP problems - transportation problems - obtaining initial feasible solution - assignment problems - integer programming.

Unit III

Non-linear programming - introduction and scope - optimum - seeking strategies - gradient methods - direct search methods - unconstrained function - constrained functions.

Unit IV

Dynamic programming - DP terminology - the principle of optimality - allocation process.

Unit V
Economic aspects of systems engineering - cash flow - interest and equivalence of time - compound interest factors - non-uniform series cash flows - depreciation and salvage value - project appraisal techniques.

Text Books:

1. Alan A. Smith, Ernest Hinton and Roland W. Lewis, "Civil Engineering systems analysis and Design", John Wiley & Sons, 1983.
2. Andrew B. Templeman, "Civil Engineering systems", The Macmillan Press Ltd.1982.

Reference Books:

1. Charles S. Revelle, E. Earl Whitlach and Jeff. R. Wright, "Civil and Environmental Systems Engineering", Pearson Prentice Hall Inc., New Jersey, 2004.

Course Outcomes:

At the end of the course students will be able to

1. Perceive the concept of civil engineering systems.
2. Apply Linear Programming and Dynamic Programming to solve Engineering problems.
3. Demonstrate the applications of system engineering to real systems.
4. Apply methods related to economic aspects of engineering systems
5. Acquire knowledge on economic aspects of civil engineering systems

MAPPING PROGRAMEE OUTCOMES WITH COURSE OUTCOMES												
COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	✓	✓						✓				
CO2			✓	✓						✓		
CO3								✓		✓		
CO4		✓				✓				✓		
CO5	✓						✓		✓			

01PExxx	**BRIDGE ENGINEERING**	L	T	P
		4	**0**	**0**

Objectives:

- To learn the IRC loading standards and analysis
- To design the 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).

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Text Books:

1. Krishna Raju, N., "Design of Bridges", Oxford & IBH, 2010.
2. Ponnuswamy, S., "Bridge Engineering", Tata McGraw-Hill, 1986.

Reference Books:

1. Johnson Victor, D., "Essentials of Bridge Engineering", Oxford & IBH Publishing Co., 2001.
2. Rajagopalan, N., "Bridge Super Structures", Narosa Publishing House Pvt. Ltd., First Edition, 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, Bureau of Indian Standards, New Delhi.
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 II)-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 to

1. Understand the behaviour of bridge structures.
2. Gain knowledge about the rudimentary principles of designing the bridges as per the existing codes.

3. Understand the advantages and general features of designing of girder bridges
4. Gain knowledge on designing the prestressed bridges by applying various load patterns.
5. Have knowledge on plates, bearings and rollers placed in bridges.

MAPPING PROGRAMEE OUTCOMES WITH COURSE OUTCOMES												
COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	✓	✓	✓					✓				
CO2				✓				✓			✓	✓
CO3												
CO4			✓				✓				✓	
CO5		✓		✓				✓				

01PExxx	ARCHITECTURE	L	T	P
		4	0	0

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 and 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 Playway / 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 Centers, 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.
5. Understand the architectural planning concept of various types of buildings.

MAPPING PROGRAMEE OUTCOMES WITH COURSE OUTCOMES											
COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	✓	✓	✓									
CO2		✓	✓			✓	✓	✓				
CO3							✓	✓				
CO4						✓	✓	✓				
CO5				✓						✓		✓

01PExxx	**SERVICES IN HIGH RISE BUILDINGS**	L	T	P
		4	**0**	**0**

Objectives

- To introduce the student to various services in high rise buildings.
- To impart knowledge on the integration of services into an Intelligent and energy efficient system.
- To learn about water supply, sanitation, light, ventilation and security systems.
- To get an exposure to air conditioning and fire safety arrangement.

Unit I

Standards of high rise buildings – Aspects and Integration of services – Relative costs – Concepts of Intelligent Architecture and Building Automation – Zoning for high rise constructions – Environmental Impacts on high rise buildings.

Unit II

Water supply and waste water collection systems – water storage and distribution systems – Planning and Design – Selection of Pumps – Rainwater harvesting – Sewage collection Systems and recycling of water – solid waste disposal methods.

Unit III

Natural and Mechanical Ventilation systems – Air conditioning systems and load estimation – Planning and design for efficiency – Automation and Energy Management Natural lighting systems – Energy efficiency in lighting systems – load and distribution – Planning and design for energy efficiency – Automation – Types of elevators, systems and services – Lobby design – Escalators – safety principles.

Unit IV

Security systems – Access Control and Perimeter Protection – CCTV Intruder alarms – Passive fire safety – Fire Detection and Fire Alarms Systems – Planning and Design – NBC.

Unit V

Case Studies of High Rise Buildings and skyscrapers through appropriate examples –
Norman Foster; Ove Arup; Ken Yeang, etc.

Text Books:

1. William J. Mcguinness, Benjamin Stein and John S. Reynolds, "Mechanical and Electrical Equipment for Buildings", John Wiley & Sons, Inc. 1980.
2. Donald Watson, Michael J. Crosbie and John Hancock Callender, "Time-Saver Standards for Architectural Design Data", McGraw-Hill International Editions, 2001.

Reference Books:

1. Arceivala. S.J., "Wastewater Treatment for Pollution Control", Tata McGraw-Hill, 3 rd Edition, 2006.
2. Bajwa. G.S., "Practical Handbook on Public Health Engineering", Deep Publishers, Shimla, 2003.
3. National Building Code - Part VIII "Building Services – Section 4, Acoustics, Sound Insulation and Noise Control" – Bureau of Indian Standards, New Delhi, 2005.
4. Shengwei Wang, "Intelligent Buildings and Building Automation", Spon Press, London, 2009.

Course Outcomes:

At the end of the course students will be able to

1. Understand the concepts of energy efficient design of buildings.
2. Explain different services essential for living in buildings.
3. Acquire knowledge of effective management of services.
4. Plan Electrical, Sanitation and Mechanical systems for buildings.
5. Emphasize the need for building automation, fire safety and security.

MAPPING PROGRAMEE OUTCOMES WITH COURSE OUTCOMES											
Cos	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	✓	✓	✓									
CO2		✓	✓					✓				
CO3		✓	✓			✓		✓				
CO4						✓		✓			✓	
CO5						✓		✓			✓	

01PExxx	CONSTRUCTION TECHNIQUES	L	T	P
		4	**0**	**0**

Objectives:

- To study and understand the latest construction techniques applied to engineering construction for sub structures, super structures and special structures .
- To learn about rehabilitation and strengthening techniques and demolition techniques.

Unit I

Box jacking - Pipe jacking - Under water construction of diaphragm walls and basement - Tunneling techniques - Piling techniques - Driving well and caisson - sinking cofferdam - cable anchoring and grouting - Driving diaphragm walls, Sheet piles - Laying operations for built up offshore system - Shoring for deep cutting - Large reservoir construction - well points - Dewatering for underground open excavation.

Unit II

Vacuum dewatering of concrete flooring – Concrete paving technology – Techniques of construction for continuous concreting operation in tall buildings of various shapes and varying sections – Erection techniques of tall structures, Large span structures – launching techniques for heavy decks – in-situ pre-stressing in high rise structures, Post tensioning of slab- aerial transporting – Handling and erecting lightweight components on tall structures.

Unit III

Erection of lattice towers - Rigging of transmission line structures – Construction sequence in cooling towers, Silos, chimney, sky scrapers - Bow string bridges, Cable stayed bridges – Launching and pushing of box decks – Construction of jetties and break water structures – Construction sequence and methods in domes – Support structure for heavy equipment and machinery in heavy industries – Erection of articulated structures and space decks.

Unit IV

Seismic retrofitting - Strengthening of beams - Strengthening of columns - Strengthening of slab - Strengthening of masonry wall, Protection methods of structures, Mud jacking and grouting for foundation – Micro piling and underpinning for strengthening floor and shallow profile - Sub grade water proofing, Soil Stabilization techniques.

Unit V

Demolition Techniques, Demolition by Machines, Demolition by Explosives(implosion), Advanced techniques using Robotic Machines, Demolition Sequence, Dismantling Techniques, Safety precautions in Demolition and Dismantling.

Text Books:
1. Jerry Irvine, "Advanced Construction Techniques", CA Rocketr, 1984.
2. Patrick Powers. J., "Construction Dewatering: New Methods and Applications", John Wiley & Sons, 1992.

Refrence Books:

1. Peter H. Emmons, "Concrete repair and maintenance illustrated", Galgotia Publications Pvt. Ltd., 2001.
2. Robertwade Brown, "Practical foundation engineering hand book", McGraw Hill Publications, 1995.
3. Sankar, S.K. and Saraswati, S., "Construction Technology", Oxford University Press, New Delhi, 2008.

Course Outcomes: At the end of the course students will be able to
1. Know the modern construction techniques to be used in the construction of buildings and special structures
2. Understand rehabilitation and strengthening techniques and demolition.
3. Aware of safety precautions in Demolition and Dismantling.
4. Gain a knowledge on retrofitting of structural elements and sub grade water proofing and soil stabilization
5. Understand the demolition techniques by using advanced demolition machines and explosion

Cos	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	✓	✓	✓					✓				
CO2								✓		✓	✓	
CO3							✓	✓			✓	✓
CO4			✓			✓				✓		
CO5	✓			✓								✓

MAPPING PROGRAMEE OUTCOMES WITH COURSE OUTCOMES

01PExxx	GROUND IMPROVEMENT TECHNIQUES	L	T	P
		4	0	0

Objectives:

- To learn the advancement in the subsoil stabilization with a modern approach.
- To get exposed to the real problem, methods of improvement over such problems and the methodology involved.

Unit I

Introduction - Methods of ground improvement - Geotechnical problems in alluvial, lateritic and Black 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, 1984.
2. Mike Moseley, Klaus Kirsch, "Ground Improvement", Spon, 2003.

Reference Books:

1. Colin J F P Jones, "Earth Reinforcement and Soil Structures", London; Boston: Butterworths, 1985.
2. R F Craig, "Soil Mechanics", Fifth edition, Chapman & Hall, 1992.

Course Outcomes:

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

1. Understand the behaviour of ground improvement techniques.
2. Gain knowledge the rudimentary principles of designing ground piles as per the existing codes.
3. Analyze and select materials and techniques suitable for ground improvement.
4. Gain knowledge on provision of reinforcement materials to curtail the seepage
5. Apply different grouting techniques on soils

Cos	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	✓	✓	✓					✓				
CO2			✓					✓		✓	✓	
CO3								✓		✓	✓	
CO4		✓						✓				✓
CO5				✓			✓				✓	

MAPPING PROGRAMEE OUTCOMES WITH COURSE OUTCOMES

01PExxx	REPAIR AND REHABILITATION OS STRUCTURES	L	T	P
		4	0	0

Objectives:

- To understand the mechanism of deterioration of concrete and damage assessment.
- To get exposed to 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, 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, 1992.
2. Allen, R.T.L. and S.C. Edwards, "The Repair of Concrete Structures", Blackie & Sons Ltd., V.K, 1987.

Course Outcomes:

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

1. Understand and assess damages.
2. Select suitable repair materials and techniques for rehabilitation of concrete structures.
3. Analyze the damage by testing methods, and give suggestions and recommendations for different rehabilitation techniques.
4. Gain knowledge on applying grouting and epoxy coating.
5. Gain overall knowledge on replacement techniques on mortar and concrete

MAPPING PROGRAMEE OUTCOMES WITH COURSE OUTCOMES											
Cos	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	✓	✓	✓					✓				
CO2						✓		✓			✓	✓
CO3								✓			✓	✓
CO4			✓						✓			✓
CO5		✓				✓				✓		

01PExxx	RIVER ENGINEERING	L	T	P
		4	0	0

Objectives

- To introduce the student to processes related to streamflow and forces involved.
- To impart knowledge on regimes of flow and their importance.
- To understand the land use changes in basin morphology.
- To discuss on sediment control and related measures.

Unit I

Incipient motion of sediment particles – Critical tractive force – Regimes of flow: Ripple and dune regime – antidune regime – importance of regimes of flow – Bed load transport: Bed load equations – Suspended load transport : General equation of diffusion – integration of sediment distribution equation – method of integrating curves of concentration X velocity – simple relations for suspended load.

Unit II

Bed level variation in alluvial streams: Continuity equation for sediment – equilibrium depth of scour in long channel contractions – general mathematical models – silting of reservoirs – local scour.

Unit III

Variation in plan form of streams: secondary currents – flow in rigid boundary open channel bends – scour and deposition at alluvial bends – sediment distribution at channel bifurcations – meandering – lateral migration of alluvial streams cutoffs – delta formation.
Impact: Impact of land use changes in basin morphology – Impact of droughts and floods – Watershed changes on quantity and quality of water.

Unit IV

Sediment control in canals: Methods of sediment control – river training: objective of river training – river training for flood control – navigation – guiding the flow – sediment control – stabilization of rivers – alluvial river models – debris flows – density currents.

Unit V

Unsteady flow: Governing equations for one – dimensional flow – channel routing – kinematic routing – diffusion routing – Muskingum–Cunge routing.

Text books:

1. Gupta. K.D., "River Engineering", Vayu Education of India Publications, First Edition 2014
2. Jansen, P.Ph., L. van Bendegom, J. van den Berg, M. de Vries & A. Zanen., "Principles of River Engineering: The Non-Tidal Alluvial River", Pitman Publishing Limited, 1979

Reference Books:

1. Garde. R.J. and Ranga Raju. K.G., "Mechanics of sediment transportation and alluvial stream problems", Wiley Eastern Limited, 1977
2. M.Hanif Chaudhry, "Open channel flow", Prentice Hall of India Private Limited, 1994

Course Outcomes:

At the end of the course students will be able to

1. Understand concept of sediment transport and river morphology.
2. Explain watershed changes due to streamflow.
3. Recognize the significance of river training works and their role in flood control.
4. Acquire knowledge on flood routing and equations governing unsteady flow.
5. Understand the different river routing techniques.

Cos	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
MAPPING PROGRAMEE OUTCOMES WITH COURSE OUTCOMES												
CO1		✓	✓					✓				
CO2						✓		✓				✓
CO3			✓					✓			✓	
CO4		✓						✓				✓
CO5				✓						✓	✓	

01PExxx	TALL BUILDING	L	T	P
		4	0	0

Objectives:

- To introduce design aspects and analysis methodologies of tall buildings.
- To learn to analyze the stability analysis of tall buildings.

Unit I

Development of High Rise Structures - General Planning Considerations - Design philosophies - Materials used for Construction - High Strength Concrete - High Performance Concrete - Self Compacting Concrete - Glass - High Strength Steel

Unit II

Gravity Loading - Dead Load - Live Load - Live load reduction technique - Impact Load - Construction Load -   Sequential Loading. Lateral Loading - Wind load - Earthquake Load. Combination of Loads.

Unit III

Factors affecting growth, Height and Structural form. High rise behaviour of Various structural systems - Rigid frames, braced frames, Infilled frames, shear walls, coupled shear walls, wall-frames, tubular structures, cores, outrigger - braced and hybrid mega systems.+

Unit IV

Modeling for approximate analysis, Accurate analysis and reduction techniques, Analysis of buildings as total structural system considering overall integrity and major subsystem interaction, Analysis for member forces, drift and twist, computerised general three dimensional analysis.

Unit V

Overall buckling analysis of frames, wall-frames, Approximate methods, second order effects of gravity of loading, P-Delta analysis, simultaneous first-order and P-Delta analysis, Translational, Torsional instability, out of plumb effects, stiffness of member in stability, effect of foundation rotation.

Text Books:

1. Bryan Stafford Smith, Alex coull, "Tall Building Structures, Analysis and Design", John Wiley and Sons, Inc., 1991.
2. Taranath, B. S., "Structural Analysis and Design of Tall Buildings", McGraw Hill, 2011.

Reference Books:

1. Lin, T.Y and Stotes Burry, D., "Structural Concepts and systems for Architects and Engineers", John Wiley, 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.

Course Outcomes: At the end of this course the student will be able to

1. Understand the behavior of tall buildings subjected to lateral loading.
2. Gain knowledge about the rudimentary principles of designing tall buildings as per the existing IS Codes.
3. Analyze different types of frames.
4. Assess the modeling for approximate analysis for total structural system.
5. Asses the overall buckling analysis of frames

MAPPING PROGRAMEE OUTCOMES WITH COURSE OUTCOMES											
Cos	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	✓	✓						✓				
CO2		✓	✓					✓				✓
CO3			✓	✓				✓				✓
CO4			✓		✓					✓		
CO5		✓					✓					✓

01PExxx	EARTHQUAKE ENGINEERING	L	T	P
		4	0	0

Objectives:

- To realize that Earthquake and Wind excitations are two major dynamic loadings to be considered for many modern civil engineering structures.
- To understand that these loadings will enable design engineers 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 Resistant design- Strength and Stiffness, Ductility Design and Detailing (15:13920), 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, 1998.
2. Clough, R.W. and Penzien, J., "Dynamics of Structures", Second Edition, McGraw-Hill International Edition, 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 of Advances in Earthquake Engineering", Computational Mechanics Inc, 1997.
5. Hiroshi Akiyama, "Earthquake Resistant Limit State Design for Buildings", University of Tokyo Press, 1985.
6. Paz, M. and Leigh.W. "Structural Dynamics – Theory & Computations", 4th Edition, CBS Publishers & Distributors, New Delhi, 2006.

List of Codes:

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 Seismic Forces — Code of Practice, Bureau of Indian Standards, New Delhi.

4. Explanatory Handbook on Codes for Earthquake Engineering, Special Publication SP 22, Bureau of Indian Standards, New Delhi.
5. IS 13827: 1993, Indian Standard Guidelines for Improving Earthquake Resistance of Earthen Buildings.
6. IS 13828: 1993, Indian Standard Guidelines for Improving Earthquake Resistance of Low Strength Masonry Buildings.
7. IS 13935: 1993, Indian Standard Guidelines for Repair and Seismic Strengthening of Buildings.
8. IS 456: 2000, Explanatory Handbook on Indian Standard Code of Practice for Plain and Reinforced Concrete, Special Publication SP: 24, Bureau of Indian Standards, New Delhi.

Course Outcomes:

At the end of the course students will be able to

1. Design the earthquake resistant structures.
2. Understand the behaviour of structures during earthquakes.
3. Explain the Philosophy and Principles of Earthquake Resistant design.
4. Understand the loadings will enable design engineers to ensure the safety and serviceability of structures.
5. Understand the technological principles of planning, analysis, design of buildings according to earthquake design.

MAPPING PROGRAMEE OUTCOMES WITH COURSE OUTCOMES												
Cos	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1		✓	✓	✓				✓				
CO2			✓	✓				✓				✓
CO3			✓	✓				✓				
CO4		✓						✓				✓
CO5		✓				✓				✓		

01PExxx	WATERSHED CONSERVATION AND MANAGEMENT	L	T	P
		4	**0**	**0**

Objective
- To introduce the student to the concept of dynamic process of a watershed resulting in soil erosion.
- To emphasize the need for water conservation.

Unit I
Watershed - concept - classification - characteristics History of erosion - Erosion problems of India - Approaches to soil and water conservation.

Unit II
Soil erosion - Types of soil erosion - Controlling soil erosion - Soil erosion by wind and water - soil conservation practices - vegetative practices - mechanical practices - erosion control in torrents and gullies - soil loss estimation models.

Unit III
Need for water conservation - water conservation measures - water harvesting - principles and techniques - flood water harvesting.

Unit IV
Watershed programmes - factors affecting watershed management - planning of watershed works - watershed water resources - watershed management practices.

Unit V
Joint forest management - Grass land farming and management - Range and pastures - Grazing practices - Wasteland development.

Text Books:
1. Suresh, R., "Soil and Water Conservation Engineering", Standard Publishers & Distributors, New Delhi, 2000.
2. Ghanshyam Das, "Hydrology and Soil conservation Engineering", Prentice-Hall India, New Delhi, 2000.

Reference Books:
1. Tideman, E. M., "Watershed Management - Guidelines for Indian Conditions", Omega Scientific Publishers, New Delhi, 1996.

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

1. Understand the appropriate Conservation measures to be adopted for remediation of a watershed.
2. Suggest measures for control of soil erosion.
3. Explain principles and techniques to be adopted for water conservation.
4. Plan watershed management programmes.
5. Interpret runoff data and quantify erosion by using various modelling methods

Cos	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
MAPPING PROGRAMEE OUTCOMES WITH COURSE OUTCOMES												
CO1	✓	✓				✓		✓				
CO2			✓						✓			✓
CO3	✓									✓		✓
CO4		✓				✓		✓				
CO5	✓		✓								✓	

01PExxx	SPECIAL CONCRETE STRUCTURES	L	T	P
		4	0	0

Objectives:

- To expose the students to the design practices of complicated RCC structures like Deep beams, R.C.poles, storage containers and elevated water tanks.
- To understand the significance of various code specifications in design of special concrete structures.

Unit I

Analysis and Design of Building frames - Analysis for vertical and horizontal loads - Method of substitute frames – Portal method - Cantilever method - Factor method. Design of portal frames with vertical loads – Design of gable frames with vertical loads - Design of deep beams using strut and tie concept – Design of Concrete Corbels for crane loads – Design of Grid floors - Detailing of reinforcement as per relevant standards.

Unit II

Design of Concrete Poles as per IS 785: 1965 – Design of Concrete Hume Pipes as per IS 458:1971 – Design of R.C. Chimneys as per IS 4998 (Part I): 1992 – Design of Portal frames as per SP 43: 1987 – Detailing of reinforcement as per relevant standards.

Unit III

Design of Concrete Bunkers as per IS 4995 (Part I,II): 1974 – Design of Concrete Silos as per IS 5503 (Part I) :1969 - Detailing of reinforcement as per relevant standards.

Unit IV

Design of Elevated Concrete water tanks - Circular tanks - Rectangular tanks - Intze type tanks - Design of stagging – Design of Underground Rectangular and Circular Water tanks - Design of Domes – Detailing of reinforcement as per IS 11992: 1995, IS 3370 (Part IV): 1967 and IS 3370 (Part I): 2009.

Unit V

Design of Bridge deck Slab - I.R.C.loadings - Design of solid slab bridges – Pigeaud's curves – General design requirements as per IRC: 6-2014 and IRC 21: 2000.

Text Books:

1. Krishnaraju, N., "Advanced R.C.Design", CBS Publishers & Distributors Pvt. Ltd., 2012.
2. Punmia, B.C., Ashok Kumar Jain and Arun Kumar Jain, "R.C.Structures - Vol. I & II", Laxmi Publications (P) Ltd., 1992.

Reference Books:

1. Mallick, S.K. & Gupta, A.P., "Reinforced Concrete", Oxford I B H, 1987.
2. Park and Paulay, T., "R.C.Structures", Tata McGraw Hill Publications, 1975.

3. Ramamrutham, S. and Narayan, R., "Design of R.C. Structures", Dhanpat Rai and Sons, 1992.
4. Dayaratnam, P., "Design of RC Structures", Oxford & IBH Publishing Co., 2000.
5. Punmia, B. C., "R.C.Structures – Vol. II", Standard Publishers, 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
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. IS 2974 (Part I):1982, Code of Practice for Design and Construction of Machine Foundations (Foundation for Reciprocating Type Machines).
8. IS 2974 (Part II):1980, Code of Practice for Design and Construction of Machine Foundations [Foundations for Impact Type Machines (Hammer Foundations)].
9. IS 2974 (Part III): 1992, Design and Construction of Machine Foundations - Code of Practice [Foundations for Rotary Type Machines (Medium and High Frequency)].
10. IS 2974 (Part IV):1979, Code of Practice for Design and Construction of Machine Foundations (Foundations for Rotary Type Machines of Low Frequency).
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).
12. IS 4995 (Part II):1974, Criteria for Design of Reinforced Concrete Bins for Storage of Granular and Powdery Materials (Design Criteria).
13. IS 9178 (Part II):1979, Criteria for Design of Steel Bins for Storage of Bulk Materials (Design Criteria).

14. IS 5503 (Part I) :1969, General Requirements for Silos for grain storage (Construction requirements)
15. IS 4998 (Part I): 1992, Criteria for Design of Reinforced (Assessment of Loads).
16. IS 3370 (Part IV): 1967, Code Of Practice for Concrete Structures for the Storage of Liquids.
17. IS 11992: 1995, Criteria for Design Of RCC Staging For Overhead Water Tanks.
18. IS 3370 (PART I): 2009, Concrete Structures for Storage of Liquids - Code of Practice.
19. IRC: 6-2014, Standard Specifications and Code of Practice for Road Bridges Section: II (Loads And Stresses).
20. IRC 21: 2000, Standard Specifications and Code of Practice for Road Bridges Section III [Cement Concrete (Plain And Reinforced)].

Course Outcomes: At the end of this course the student will be able to

1. Understand the advanced structural elements and its design procedure.
2. Acquire knowledge about the rudimentary principles of designing deep beams, R.C. Poles etc. as per the existing codes.
3. Analyze building frames for vertical and horizontal loads.
4. Design special concrete structures as per the existing code provision
5. Understand the design concept of bunkers, water tanks and bridge decks.

MAPPING PROGRAMEE OUTCOMES WITH COURSE OUTCOMES												
Cos	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	✓	✓						✓				
CO2			✓	✓								✓
CO3									✓		✓	
CO4			✓			✓		✓				✓
CO5		✓					✓		✓			

01PExxx	**PREFABRICATED STRUCTURES**	L	T	P
		4	**0**	**0**

Objectives:

- To impart knowledge to students on modular construction, industrialized construction.
- To learn to design prefabricated elements and their construction methods.

Unit I

Need for prefabrication – Principles – Materials – Modular coordination – Modules/Units – Standardization of Systems – Production – Transportation – Erection Equipments – Erection Techniques.

Unit II

Structural Systems: Skeletal Frame System – Large Panel System – Cell System. Systems for Lateral Load Resistance: Low-rise Portals and Frames – Multi-Storied Frames – Wall System. Roof and Floor Systems: Roof System – Floor System. Precast Concrete Components: Beams – Columns – Roof Units – Floor Units – Wall Units – Foundation Units – Units for Miscellaneous Applications.

Unit III

Introduction – Materials – Loads: Dead Load – Live Load – Wind Load – Seismic Load – Equivalent Seismic Load Method – Response Spectrum Method – Time History – Abnormal Loads – Fire Resistance. Load Factor: Load Combinations. Analysis of Precast Frames: Skeletal Frames – Inverted U Shaped Frame – L Shaped Frame – H-Shaped Frame. Analysis of Frames with Stability Elements: Shear Walls to Resist Lateral Loads – Details of Typical Example Building – Seismic Parameters of Analysis – Modelling and Analysis. Analysis of Voided Slab Floor Elements: Method of Analysis – Analysis of Typical Voided Slab using Grillage Analogy – Calculation of Member Properties – Loading – Longitudinal Analysis – Transverse Analysis.

Unit IV

Design Consideration: Moment Resistance of Slabs - Moment Resistance of Rectangular Beams - Moment Resistance of T Beams - Moment Resistance of Inverted T Beams - Moment Resistance of L Beams – Axial Load Capacities of Short and Slender Columns.

Joints and Connections in Precast Buildings: Introduction – Scope – Details of Connections: Column to Foundation Connections – Wall to Foundation Connection – Beam to Column Connection – Column to Column Connection – Floor to Beam Connection – Wall Panel to Wall Panel Connection. Tolerances. Connection Materials – Mechanical Couplers – Dowels – Welded Head Studs – Bolted and Threaded Connections – Inserts – Expansion Inserts – Bearing Pads – Connecting Elements – Other Load Transfer Materials.

Unit V

Production, Handling and Erection of Precast Elements: Production, Planning and Set up. Types of Precast Concrete Products: Foundations – Structural Elements. Moulds – Column Mould – Beam Mould – Wall Mould – Slab Mould – Other Moulds. Mould Tolerances, Production,Demoulding Techniques, Concrete and Vibrations, Precast Concrete Products Tolerances, Curing and Storage, Transportation, Handling Equipments for Precast Components, Handling Devices for Lifting, Erection Schemes and Supports, Other Accessories for Erection Works, Safety, Installation of Precast Element: Installation of vertical Members – Installation of Beams – Installation of Slabs – Installation of Special element. Common Defects and Acceptance Criteria: Hollow Core Slabs-Pre-stressed Planks/Slabs - RCC Products – Non- Conforming Products – Quality Assessment.

Text Books:

1. Indian Concrete Institute (ICI), "Handbook on Precast Concrete for Buildings", 1st Edition, 2016.
2. CBRI, "Building materials and components", India, 1990.
3. Gerostiza, C. Z., Hendrikson, C. and Rehat, D. R., "Knowledge based process planning for construction and manufacturing", Academic Press Inc., 1994.

Reference Books:

1. Koncz, T., "Manual of precast concrete construction", Vol. I, II and III, Bauverlag, GMBH, 1976.
2. Society for the studies in the use of precast concrete, "Structural design manual", Precast concrete connection details, Netherland Betor Verlag, 2009.

Course Outcomes:

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

1. Realize the need for prefabrication in construction.
2. Design some of the prefabricated elements
3. Understand the construction techniques involved in building framed structures.
4. Insist on Quality in precast construction.
5. Gain knowledge of production, handling and erection of precast elements

MAPPING PROGRAMEE OUTCOMES WITH COURSE OUTCOMES												
Cos	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1		✓		✓				✓				
CO2	✓					✓				✓		
CO3			✓	✓				✓				✓
CO4											✓	✓
CO5	✓				✓					✓		

01PExxx	**HYDROPOWER ENGINEERING**	L	T	P
		4	**0**	**0**

Objectives
- To introduce the student to various forms of energy resources.
- To learn in detail about hydroelectric power plants and their components.
- To impart knowledge on load assessment and operation.
- To study about economics of hydroelectric power.

Unit I

Power resources – Conventional and Nonconventional, Need & advantages, Hydrological analysis, Hydropower development in India, Hydropower potential.

Unit II

Classification of hydropower plants - Run of river plants, Storage or Valley dam plants, Pumped storage plants, Introduction to micro hydro, Base load and Peak load plants, advantages & disadvantages, Components of hydropower plants.

Unit III

Estimation of electrical load on turbines, Load factor, Plant factor, peak demand and utilization factor, load duration curve, Prediction of load.

Unit IV

Types of Powerhouses, Typical layout of powerhouse, Components, Power plant equipments, Instrumentation and control, Selection, Classification, Principles and design of impulse & reaction turbines, Governing of turbines, Water hammer, Surge tanks, Draft tubes, Cavitation.

Unit V
Economic considerations, pricing of electricity, laws and regulatory aspects, Policies, Electricity Act 2003, Investment in the power sector, Carbon credits, Participation of private sector.

Text Books:

1. Dandekar M. M. and Sharma K. N., "Water Power Engineering".
2. Sharma R.K. and Sharma T.K., "A textbook of Water Power Engineering", S.Chand Publishers, 2003.

Reference Books:

1. P.N. Modi, Irrigation, "Water Resources and Water Power Engineering", Standard Book House, New Delhi, 2006.
2. Gilbert Gedeon P.E., "Planning and Design of Hydroelectric power plants", CECW-ED Engineer Manual No. 1110 – 2 – 3001, 1995.
3. Nigam P.S., "Handbook of Hydroelectric Engineering", Nem Chand, Roorke, 1985.
4. Wang.X., "Modern Power System Planning", McGraw-Hill, Signapore, 1994

Course Outcomes:

At the end of the course students will be able to

1. Understand the layout, functional aspects and principles involved in the selection of different types of power plants.
2. Acquire thorough knowledge of operation of hydropower plants and design components.
3. Explain pricing of Electricity.
4. Learn the principles and design concept of different turbines
5. Understand the economic concept of power sector and private sector

MAPPING PROGRAMEE OUTCOMES WITH COURSE OUTCOMES												
Cos	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	✓				✓						✓	
CO2		✓	✓					✓				
CO3						✓		✓				
CO4	✓				✓							✓
CO5		✓						✓		✓		

01PExxx	TRAFFIC ENGINEERING AND MANAGEMENT	L	T	P
		4	0	0

Objectives

- To give an overview of traffic engineering characteristics, traffic control and design.
- To understand the techniques of traffic survey and traffic regulation.
- To expose students to traffic management and traffic safety with integrated approach in traffic planning.
- To learn the environmental impact of traffic.

Unit I

Introduction - Objectives and scope of traffic engineering - Components of road traffic: vehicle, driver and road - Road user and vehicle characteristics and their effect on road traffic - Fundamentals of Traffic Flow – Urban Traffic problems in India and Sustainable approach.

Unit II

Traffic Surveys – Speed, journey time and delay surveys – Vehicles Volume Survey including non-motorized transports – Methods and interpretation – Origin Destination Survey – Methods and presentation – Parking Survey – Accident analyses -Methods, interpretation and presentation – Statistical applications in traffic studies and traffic forecasting – Level of service – Concept, applications and significance.

Unit III

Control of traffic movements through time sharing and space sharing concepts - Intersection Design – channelization – Rotary intersection design – Signal design – Coordination of signals – Grade separation – Traffic signs including VMS and road markings – Significant roles of traffic control personnel – Bus stop location and bus bay design – Road lighting – Regulations on vehicles – drivers and traffic.

Unit IV

Concept and significance of traffic safety **-** Road accidents – Causes, effect, prevention, and cost – Road traffic accidents scenario in India - Engineering measures of traffic safety– Traffic and

environment hazards – Air and Noise Pollution, causes, abatement measures – Promotion and integration of public transportation – Promotion of non-motorized transport.

Unit V

Nature of traffic problems in cities – Area Traffic Management System – Traffic System Management (TSM) with IRC standards – Traffic Regulatory Measures – Travel Demand Management (TDM) – Direct and indirect methods – Congestion and parking pricing – All segregation methods – Coordination among different agencies – Intelligent Transportation Systems: applications in traffic management and control.

Textbooks:

1. Kadiyali.L.R. ,"Traffic Engineering and Transport Planning", Khanna Publishers, Delhi, 2013
2. Indian Roads Congress (IRC) Specifications: "Guidelines and Special Publications on Traffic Planning and Management"

Reference Books:

1. Pignataro.L., "Traffic Engineering - Theory and Practice", John Wiley, 1973
2. Salter. R.I and Hounsell.N.B., " Highway Traffic Analysis and Design", Macmillan Press Limited, 1996.
3. Fred L. Mannering, Scott S. Washburn and Walter P.Kilareski, "Principles of Highway Engineering and Traffic Analysis", Wiley India Private Limited, New Delhi, 2011.
4. Garber and Hoel, "Principles of Traffic and Highway Engineering", Cengage Learning, New Delhi, 2010
5. SP: 43-1994, "Guidelines on Low-cost Traffic Management Techniques for Urban Areas", IRC Specifications, 1994.
6. Institute of Transportation Engineers, "Transportation and Traffic Engineering Hand Book", Prentice Hall, 1982
7. John E. Tyworth, "Traffic Management Planning - Operations and Control", Addison Wesly Publishing Company, 1997.
8. Hobbs.F.D. , "Traffic Planning and Engineering", University of Birmingham, Peragamon Press Limited, 2005.
9. Taylor.M.A.P. and Young.W., "Traffic Analysis – New Technology and New Solutions", Hargreen Publishing Company, 1998.

Course Outcomes:

At the end of the course students will be able to

1. Understand the concepts of traffic engineering and its characteristics.
2. Perform traffic studies.
3. Explain traffic control and design.

4. Realize the importance of traffic management.
5. Identify the specification of traffic facilities.

Cos	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
MAPPING PROGRAMEE OUTCOMES WITH COURSE OUTCOMES												
CO1		✓					✓		✓			
CO2			✓			✓				✓		
CO3		✓			✓			✓				✓
CO4	✓			✓		✓						
CO5								✓			✓	

Syllabus of Professional Electives Laboratories

01EPxxx	**DESIGN & DRAWING LABORATORY I**	L	T	P
		0	0	3

Objectives:

- Train students to use latest software available to solve structural engineering problems.
- Learn documentations procedures.

List of Experiments:

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 beams: 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 sections and reinforcement details as per IS: 2911 (Part 1/Sec 1) - 2010, IS 2911 (Part III): 1980 and SP 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

Plate 11. Analysis of Symmetrical and Un-Symmetrical Building Frames(Gravity, Wind and Earthquake Loads) using STADD PRO and Etabs Softwares.

Reference Books:

1. Krishnaraju. N, "Structural Design and Drawing", Oscar Publications, 2005.
2. Punmia, B.C; ""Reinforced Concrete Structure Vol I"", Standard Publishers Distributors, New Delhi, 2007.
3. STADD PRO and Etabs Software Working Manuals.

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.

Course Outcomes:

At the end of the course students will be able to

1. Gain Structural Engineering knowledge on Reinforced concrete structural elements for practical applications.
2. Acquire experience to use Modern Software in Civil engineering.
3. Understand the design and development of Shop drawing for practical purposes.
4. Understand the design and drawing of reinforcement details in various sections
5. Analyze the frame structures using computer tool

MAPPING PROGRAMEE OUTCOMES WITH COURSE OUTCOMES											
COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1		✓		✓				✓			✓	
CO2					✓				✓	✓		
CO3	✓			✓				✓				
CO4			✓			✓						
CO5	✓					✓						✓

01EPxxx	CIVIL ENGINEERING SOFTWARE LABORATORY	L	T	P
		0	0	3

Objective:

- To enable the students to be conversant with the use of software packages like STAAD PRO, 3D Home Architecture, ERDAS, GIS and Water quality softwares

List of Experiments

1. Structural Engineering Software packages like STAAD PRO
2. 3D Home Architecture to solve simple problems.
3. Quantity and Cost estimation software
4. PRIMAVERA & MS Project to solve simple problems.
5. Water distributing network softwares
6. Watershed Planning Softwares.
7. GIS and water quality softwares - Q.GIS, Arc GIS, MapInfo, etc.,
8. GRAMM++

References

1. STAAD Pro Manual
2. PRIMAVERA Manual
3. ERDAS Manual
4. ARC VIEW Manual
5. SMS, GMS and WMS Manual

Course Outcomes:

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

1. Implement ideas of Computer aided design in Civil Engineering Projects
2. Use various software for Quantity and Cost estimation
3. Apply soft computing to water resource distribution problems.
4. Do the analysis for framed structures using software tool
5. Gain knowledge on mapping techniques using geographical information system

MAPPING PROGRAMEE OUTCOMES WITH COURSE OUTCOMES												
Cos	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1		✓		✓		✓				✓		
CO2		✓		✓				✓	✓			
CO3						✓		✓			✓	✓
CO4			✓		✓							
CO5	✓		✓		✓					✓		

		L	T	P
01EPxxx	**DESIGN & DRAWING LABORATORY II**	**0**	**0**	**3**

Objectives:

- To understand principles of design of Irrigation and Public Health structures.
- To prepare the drawings using AutoCAD for various systems.

List of Experiments:

A - Design of the following Irrigation Structures and Drawing using AutoCAD
  a. Tank Sluice with Tower Head.
  b. A tank surplus weir.
  c. A canal drop (Notch type).
  d. A canal regulator cum Bridge.
  e. Cross drainage work: Super passage only.

B - Design of the following Items and Drawing using AutoCAD

  a. River or canal intake.
  b. Slow sand filter.
  c. Rapid sand filter.
  d. Clari-flocculator.
  e. Septic tank.
  f. Trickling Filter (Conventional type).
  g. Activate Sludge Process.
  h. Layout of Water Supply System for a Town.
  i. Layout of Sewerage System for a Town.

Reference Books:

1. CPHEEO, "Manual on Water Supply and Treatment", Govt. of India, 3rd Edition, 2010.
2. CPHEEO, "Manual on Sewage and Sewerage treatment", Part-C Govt. of India, 3rd Edition, 2013.

Course Outcomes:

At the end of the course students will be able to

1. Understand conventional systems of Irrigation and Public health drawings.
2. Draft plan, elevation and sectional views of Public health structures.
3. Identify the functional requirements of the structures.
4. Design the various irrigation structures and water and sewage treatment units
5. Understand and prepare the computer aided drawings as per the design standards

MAPPING PROGRAMEE OUTCOMES WITH COURSE OUTCOMES												
COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	✓		✓				✓			✓		
CO2		✓		✓				✓	✓			
CO3	✓				✓			✓			✓	✓
CO4												
CO5	✓					✓			✓		✓	

Syllabus of Open Electives

01OExxx	**URBAN AND RURAL PLANNING**	L	T	P
		4	0	0

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

Objects of town planning – Economic justification – Principles of Town Planning – Necessity of Town Planning – Growth of Towns – Natural and planned growth – stages in Town Development – Distribution of Landuse – Forms of planning – Development of Town Planning in Ancient India – Concepts of Modern Town Planning and 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 neighborhood 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 Bye laws – 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 Rural planning – 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. Rangwala. S.C., "Town Planning", Charotar Publications House Pvt. Ltd., Gujarat, 26th Edition, 2013
2. Thooyavan. K.R., "Human Settlements – A Planning Guide to Beginners", M.A. Publications, Chennai, 2005

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, 1971.
3. Goel. S.L.,"Urban Development and Management", Deep and Deep Publications, New Delhi, 2002

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.
5. Understand the concept of rural planning and sanitation.

MAPPING PROGRAMEE OUTCOMES WITH COURSE OUTCOMES											
COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	✓		✓		✓			✓				
CO2				✓		✓				✓	✓	
CO3		✓				✓		✓				✓
CO4		✓	✓					✓		✓		
CO5				✓		✓						✓

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01OExxx	SOLID WASTE MANAGEMENT	L	T	P
		4	0	0

Objective

- To gain an insight regarding sources, characteristics and composition of solid waste.
- To understand the rate of generation of solid waste and its present status in india.
- To know the method of collection, transfer, and transport of municipal solid waste.
- To Understand the role and applicability of physical, chemical, thermal and biological processing techniques.
- To acquire substantial knowledge in the field of resource recovery, waste-to-energy and on composting facility.

Unit I

Introduction - goals and objectives of solid waste management - social aspects – legal aspects health factors - generation of solid wastes – sampling – characterization - method of disposal as a factor dependent upon the quality of refuse.

Unit II

Storage system - dust bins at the streets - collection facility - frequency of collection - method of transport – transfer stations – types – design requirements.

Volume reduction - methods - compaction and balling - grinding of garbage - disposal methods. Incinerators - design and operation - dust and air pollution problems - use -cost considerations.

Unit III

Sanitary land fill - methods - machineries involved - site selection – Geoenvironmental investigations - Design and operation - liners and covers - phases of waste digestion - leachate control and treatment, gas recovery and control, landfill post closure monitoring - cost consideration - environmental factors such as odours, flies and vectors and leachate and groundwater pollution.

Unit IV

Recovery and Reuse – ocean disposal - impact assessment - precautions required for the operation of the project - cost considerations.

Unit V

Composting – types - methods – factors influencing composting - recommended procedures - impact assessment - cost consideration - disposal of industrial solid waste and hazardous refuse – - types - sources - characteristics - precautions needs – treatment and disposal.

Text Books:

1. George Tchobanoglous, Hilary Theisen and Samuel A, Vigil, Integrated Solid Waste Management, McGraw- Hill, New York, 1993.
2. CPHEEO, Manual on Municipal Solid waste management, Central Public Health and Environmental Engineering Organization, Government of India, New Delhi, 2000.

Reference books:
1. Handbook of Solid Waste Management by Frank Kreith , George Tchobanoglous McGraw Hill Publication.
2. Solid Waste Management - Haggerty, D.J., Von Nostrand Renihold company, New York, 1973.
3. Municipal Refuse Disposal - NY American Public Works Association, 1966.
4. Refuse Collection Practice - by American Public Works Association, 1967.
5. Management of Solid Wastes in Developing Countries - Flintoff, F., WHO Publication, 1972.

Course Outcomes:

At the end of the course students will be able to

1. Apply the procedures and methods for MSW Collection, segregation, processing and disposal
2. Develop an Environmental Management System.
3. Explain different methodologies for Environmentally sound solutions
4. Examine the process by which legal systems are adopted and enforced.
5. Gain knowledge on composting methods of municipal solid waste.

MAPPING PROGRAMEE OUTCOMES WITH COURSE OUTCOMES											
COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1		✓		✓		✓			✓			
CO2	✓					✓					✓	
CO3			✓					✓				
CO4						✓			✓			
CO5	✓									✓		✓

01OExxx	AIRPORT, HARBOUR AND DOCK	L	T	P
		4	**0**	**0**

Objectives
- To expose the students to Airport Planning, Harbours and Docks

Unit I
Air transport characteristics-airport classification-air port planning: objectives, components, layout characteristics, socio-economic characteristics of the Catchment area, criteria for airport site selection and ICAO stipulations, Typical airport layouts, Case studies, Parking and circulation area.

Unit II
Runway Design: Orientation, Wind Rose Diagram - Runway length - Problems on basic and Actual Length, Geometric design of runways, Configuration and Pavement Design Principles – Elements of Taxiway Design – Airport Zones – Passenger Facilities and Services – Runway and Taxiway Markings and lighting.

Unit III
Definition of Basic Terms: Harbor, Port, Satellite Port, Docks, Waves and Tides – Planning and Design of Harbours: Requirements, Classification, Location and Design Principles – Harbour Layout and Terminal Facilities – Coastal Structures: Piers, Break waters, Wharves, Jetties, Quays, Spring Fenders, Dolphins and Floating Landing Stage – Inland Water Transport – Wave action on Coastal Structures and Coastal Protection Works – Environmental concern of Port Operations – Coastal Regulation Zone, 2011.

Unit IV
Berthing structures – Types – Loads – Selection of berthing structures – Design principles of diaphragm walls, dolphins and piles. Selection and Design principles of Dock fenders and Mooring accessories.

Unit V
Design principles of dock structures - Graving dry dock – Slip way – floating dry dock - Monitoring and repair of harbour structures - Dredging - Navigational aids – Light house.

Text Books:

1. Khanna S K, Arora M G and Jain S S, "Airport Planning and Design", Nemchand and Brothers, Roorkee, 2012.
2. Bindra S P, "A Course in Docks and Harbour Engineering", Dhanpat Rai and Sons, New Delhi, 2013

Reference books:

1. Rangwala, "Airport Engineering", Charotar Publishing House, 2013.
2. Rangwala, "Harbor Engineering", Charotar Publishing House, 2013.
3. Oza.H.P. and Oza.G.H., "A course in Docks & Harbour Engineering". Charotar Publishing Co., 2013
4. Srinivasan R. Harbour, "Dock and Tunnel Engineering", 26th Edition 2013

Course Outcomes: At the end students will be able to

1. Plan the various civil Engineering aspects of Airports, Harbour and Docks.
2. Design various aspects of civil Engineering of Airports, Harbour and Docks.
3. Gain an insight on the planning and site selection of Airport Planning and design.
4. Analyze and design the elements for orientation of runways and passenger facility systems.
5. Understand the various features in Harbours and Ports, their construction, coastal protection works and coastal Regulations to be adopted.

MAPPING PROGRAMEE OUTCOMES WITH COURSE OUTCOMES											
Cos	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	✓	✓	✓									
CO2		✓				✓		✓			✓	
CO3				✓								
CO4							✓		✓			
CO5					✓					✓		✓

01OExxx	REMOTE SENSING AND GEOGRAPHIC INFORMATION SYSTEMS	L	T	P
		4	0	0

Objectives

- To introduce the basic concepts of remote sensing.
- To learn the fundamentals of photogrammetric 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

IS 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, 2009

Reference Books:

5. Basudeb Bhatta, "Remote Sensing and GIS", Second Edition, Oxford University Press, 2011.
6. Agarwal. C.S. and Garg. P.K., "Remote Sensing in Natural Resources Monitoring and Management", Wheeler Publishing Company, 2000.
7. Peter A. Burrough and Rachael A. McDonnell, "Principles of Geographical Information systems for land resource assessment", Clarendon Press,Oxford University Press, 2004.
8. Anji Reddy. M., "Textbook of Remote Sensing and Geographical Information System", 2nd Edition, BS Publications, Hyderabad, 2001.
9. Ian Heywood, Sarah Cornelius, Steve Carver and Srinivasa Raju, "An Introduction to Geographical Information Systems", Pearson Education, 2 nd Edition, 2007.
10. Wolf Paul, "Elements of Photogrammetry", McGraw-Hill Edition, New Delhi, 1998.
11. Clarke Parks and Crane, "Geographical Information Systems and Environmental Modelling", Prentice Hall of India, 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.
5. Apply GIS and LIS techniques to highway alignment, watershed management, Water quality mapping and surface & groundwater resources.

Cos	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
MAPPING PROGRAMEE OUTCOMES WITH COURSE OUTCOMES												
CO1	✓	✓				✓						
CO2			✓					✓			✓	
CO3					✓				✓			✓
CO4				✓				✓		✓		
CO5			✓				✓			✓		

01OExxx	ECONOMICS AND FINANCES FOR CIVIL ENGINEERS	L	T	P
		4	0	0

Objectives

- To impart Business acumen and a deep insight in economics imminent to be successful in civil engineering practice.
- To learn 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 corporations - Analysis of financial statements - Balance sheet - Profit and loss account - Funds flow statement - Ratio analysis - Investment and Financing decision - Financial control - Job control - Centralized 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

Cost estimating of Civil Engineering equipment – Depreciation and Interest – Maintenance and Repair costs – Degree of utilization – equivalent annual cost – operating cost standards – exercises. Project Benefit Cost analysis – least cost – Net Present Value (NPV) – equivalent annual cost method – Internal Rate of Return method (IRR) – Benefit – Cost Ratio – exercises.

Text Books:

1. Joy, P. K. "Total Project Management-the Indian context"
2. Tenah K. A. & J., M.Guevara, "Fundamentals of Construction Management and Organisation"

Reference Books:
1. Warner Z.Hirsch, "Urban Economics" Telford Publishers, London, UK, 1997.
2. Mitchel, Robert L., "Engineering Economics", John Wiley & Sons, UK, 1980.
3. Alan A.Smith, Ernest Hinton and Roland W. Lewis "Civil Engineering Systems Analysis and Design", John Wiley and Sons, UK, 1983.
4. Charles S.Revelle, E.Earl Whitlach and Jeff.R.Wright, " Civil and Environmental Systems Engineering", Pearson Prentice Hall Inc., New Jersey, USA, 2004.

Course Outcomes:

At the end of the course students will be able to

1. Perceive the power of economics techniques and finance.
2. Demonstrate the applications of these techniques to problems drawn from industry, management and other engineering fields.
3. Apply cost estimation methods to get close approximate solutions to complex Engineering problems.
4. Understand the financial concept and analysis.
5. Perceive knowledge on accounting methods applied in Civil Engineering.

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	✓		✓	✓		✓		✓			✓	
CO2				✓	✓		✓		✓	✓	✓	✓
CO3	✓											
CO4		✓		✓			✓		✓		✓	
CO5					✓						✓	

Mapping of COs with POs

01OExxx	ENVIRONMENTAL IMPACT ASSESSMENT	L	T	P
		4	**0**	**0**

Objectives:

- To understand the evolution, role, application and the general procedure for EIA
- To impart the concept of Environmental Management Systems (EMS).
- To impart / inculcate the knowledge of Environmental Auditing, Life cycle Assessment (LCA).
- To introduce the concept and role of Cleaner Production, Sustainable Development and ISO 14000 series.
- To understand the rules and regulations governing EIA and EIA case studies.

Unit I

Evolution of EIA – Concepts – Methodologies – Screening – Scoping – Base line Studies – mitigation – Matrices – Checklist.

Unit II

Rapid EIA – Comprehensive EIA – Legislative and Environmental Clearance procedure in India – prediction tools for EIA.

Unit III

Assessment of Impact on Air – Soil – Water – Noise – Biological – Socio–Cultural Environment. Public participation – Resettlement and Rehabilitation procedures – Sustainable Development.

Unit IV

Documentation of EIA – EMP – Post project Monitoring – EIA case studies. Environmental Auditing – Various types of Audit – Philosophy - concepts – rules and relevant methodologies.

Unit V

Concept of Cleaner production - Role of ISO and ISO 14000 in Environmental Management.

Text Books:

1. Canter R.L., "Environmental Impact Assessment", McGraw Hill Inc., New Delhi, 1997.
2. Anjaneyalu Y., "Environmental Impact Assessment Methodologies", B.S. Publications, Hyderabad, 2002.

Reference Books:

1. Lohani B., Evans J.W., Ludwig H., Everitt R.R., Richard A. Carpenter and Tu S.L., "Environmental Impact Assessment for Developing countries in Asia", Volume 1 – Overview, Asian Development Bank, 1997.
2. Peter Morris and Riki Therivel, "Methods of Environmental Impact Assessment", Routledge Publishers, 2009.
3. Barry Sadler and Mary McCabe, "Environmental Impact Assessment Training Resource Manual", United Nations Environment Programme, 2002.
4. Judith Petts, "Handbook of Environmental Impact Assessment Volume I and II", Blackwell Science, New York, 1999.
5. Ministry of Environment and Forests, "EIA Notification and Sectoral Guides", Government of India, New Delhi, 2010.
6. The World Bank, "Environmental Impact Assessment Source book, Volume I, II and III", Washington D.C., 2011.

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

1. Apply the main procedures and methods which are adopted at different stages in EIA process.
2. Develop on Environmental Management Systems.
3. Explain different methodologies for Environmental Impact prediction and assessment.
4. Evaluate EIA reports
5. Examine the process by which legal systems are adopted and enforced.

MAPPING PROGRAMEE OUTCOMES WITH COURSE OUTCOMES											
Cos	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	✓		✓						✓v			
CO2						✓					✓	
CO3			✓		✓			✓				
CO4						✓		✓		✓		
CO5	✓									✓		

01OExxx	**AIR AND NOISE POLLUTION**	L	T	P
		4	**0**	**0**

Objective

- To make the students conversant with basic principles of Air and Noise Pollution,

- To analyse the sources, conveyance, treatment and effects of air & Noise Pollution.

Unit I

Introduction: Definition of clean air - air pollutants - Sources and classification - Effects of air pollution on man, animal, vegetation and properties -Ambient Air Quality Standards, Air pollution control legislation.

Unit II

Meteorology and Air pollution – Atmospheric stability – Inversions – Mixing height – plume behaviour – Plume rise estimation – Effluent dispersion theories –Air pollutants Modelling.

Unit III

Control of Air pollutants: particulates – Filters – Gravitational settling chambers – Centrifugal-multiple type cyclones – Collection efficiency - Electrostatic precipitators – Wet collectors - Centrifugal spray scrubbers - Venturi scrubbers.

Unit IV

Gaseous pollution control – Absorption - Principles – Description of equipment, Adsorption – Principal adsorbents – Equipment descriptions – Condensation – Contact condensers Incineration – Equipment description.

Unit V

Sound and noise - Source of noise pollution - Environmental and industrial noise -Effects of noise pollution - Fundamentals of sound - generation, propagation, etc., Sound measurement, sound level meters – Measures for prevention and control of noise -Environmental and industrial noise - Noise control legislation.

Text Books

1. Rao.M.N., "Air Pollution", Tata Mc.Graw Hill, 1998.
2. C.S. Rao, "Environmental Pollution Control Engineering", New Age International Publishers, 2006.

Reference Books

1. Noel de Nevers, "Air Pollution Control Engineering", Mc.Graw Hill, New York. 1995.
2. Stern, A.C., "Air Pollution", Vol.I, II and III, Academic Press, 1962.
3. Cunniff, P.F., "Environmental Noise Pollution", John Wiley and Sons, New York, 1981.

Course Outcomes:

At the end of the course students will be able to

1. Understand the basics of Air and Noise Pollution.
2. Develop on Environmental Management Systems for air and noise
3. Emphasize the importance of control of air and noise pollution.
4. Differentiate between absorption and adsorption process.
5. Understand noise generation propagation and control legislation.

MAPPING PROGRAMEE OUTCOMES WITH COURSE OUTCOMES											
Cos	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	✓	✓						✓				
CO2				✓		✓						
CO3								✓		✓		
CO4			✓								✓	
CO5					✓							✓

01OExxx	OPERATIONS RESEARCH IN CIVIL ENGINEERING	L	T	P
		4	0	0

Objectives

- To assess the real condition of a project so that loss can be avoided
- To solve the linear programming problems for minimizing the project cost and maximizing its profit

Unit I
Introduction: Definition and Scope of Operations Research- Linear Programming: Introduction, Formulation of linear programming problems, graphical method of solving LP problem, simplex method, maximization and minimization, Degeneracy in LPP, Unbounded and, Infeasible solutions.

Unit II
Duality : Definition, Relationship between primal and dual solutions, Economic Interpretation, Post optimal of sensitivity analysis, Dual Simplex Method.

Unit Ill
Transportation Models: Finding an initial feasible solution - North West corner method, Least cost method, Vogel's Approximation method, Finding the optimal solution, optimal solution by stepping stone and MODI methods, Special cases in Transportation problems - Unbalanced Transportation problem.

Assignment Problems: Hungarian method of Assignment problem, Maximization in Assignment problem, unbalanced problem, problems with restrictions, travelling salesman problems.

Unit IV
Replacement Models : Introduction, replacement of items that deteriorate igoring change in money value, replacement of items that deteriorate considering change in money value with time, replacement of items that fail suddenly - Individual replacement policy, Group replacement policy.
Game Theory: Introduction, 2 person zero sum games, Maximi - Minimax principle, Principle of Dominance, Solution for mixed strategy problems, Graphical method for 2 x n and m x 2 games.

Unit V
Sequencing Models: Introduction, General assumptions, processing n jobs through 2 machines, processing 'n' jobs through m machines, Processing 2 jobs through m machines.
Queuing Theory: Introduction, single channel - poission arrivals - exponential service times with infinite population & finite population, Multi channel - poisson arrivals - Exponential service times with infinite population.

Introduction to optimization Techniques: Single objective & Multi objective optimization Techniques like G.A, NSGA, P.Q.O. & MPSO Techniques.

Text Books:

1. Hamdy, A. Taha, "Operations Research-An Introduction", Sixth Edition, Prentice Hall of India Pvt. Ltd., 1997.
2. Sharma S.D., "Operations Research", Kedarnath, Ramnath & Co., Meerut, 2009.

Reference Books

1. Harvey M. Wagner, "Principles of Operations Research", Second Edition, Prentice Hall of India Ltd., 1980.
2. Kapoor V.K., "Operations Research", S. Chand Publishers,New Delhi, 2004.
3. Paneer Selvam R., "Operations Research", Second Edition, PHI Learning Pvt. Ltd., New Delhi, 2008.

Course Outcomes:

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

1. Solve the optimization problems
2. Apply LPP to Transportations problems which is essential for a Civil Engineer
3. Solve assignment problems in an easy way
4. Assess the real conditions of a project so that loss can be avoided
5. Solve the Linear programming problems for minimizing the project cost and maximizing its profit

MAPPING PROGRAMEE OUTCOMES WITH COURSE OUTCOMES											
Cos	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1		✓	✓					✓				
CO2				✓		✓						
CO3								✓		✓		
CO4			✓								✓	
CO5					✓							✓

01OExxx	SOIL & WATER CONSERVATION ENGINEERING	L	T	P
		4	0	0

Objectives

- To introduce the student to various soil and water conservation measures for creating an awareness of problems of soil erosion.
- To impart knowledge on the appropriate conservation measures to be adopted for remediation of watershed.

Unit I

Measurements of distances and area – Chain surveying – Methods of traversing – Measurement of angles and bearing – Plane table surveying – Types of leveling – contouring – Instruments for surveying and levelling.

Unit II

Problems of soil erosion – Geological and Accelerated erosion – Factors affecting water erosion – Types of water erosion – Splash – Sheet and rill – Gully – Stream bank – road erosion – ravines – Universal soil loss equation (USLE) – soil loss tolerances – Rainfall erosion index – soil erodibility index – slope – slope length – topographical factors – Crop management for soil – erosion factor – measurement of runoff and soil loss – wind erosion mechanics – methods of estimation of wind erosion – Desertification – deforestation – shifting cultivation.

Unit III

Erosion control measures – Contour bunds and graded bunds – Broad beds and furrows – wide based terraces and dykes – Random tie ridging – basin listing and mulching – Bench terraces – stone walls – contour trenches – contour cultivation – strip cropping– mixed cropping – mixed farming – crop rotation for erosion control– Afforestation – Diversion drains– vegetative water ways – Gully control – control of landslides – Gully control measures – wind erosion control – wind breaks – shelter belts.

Unit IV

Watershed – Concept – planning – principles – components of watershed development – watershed management plan – Biological watershed management plan – Water harvesting methods – techniques for improving crop production.

Unit V

Meteorological parameters and their managements – analysis of precipitation data – observation from precipitation, – Runoff – hydrograph analysis – stream flow measurements – flood routing – hydrological reservoir and channel routing – ground water occurrence – confined and unconfined aquifers – properties – wells – hydraulics – ground recharges.

Text books:
1. Suresh. R., "Soil and Water Conservation Engineering", Standard Publishers & Distributors, New Delhi , 1997
2. Tideman, "Soil and Water conservation"

Reference books:
1. Gurmel Singh et al., "Manual of soil and water conservation practice", Oxford & IBH publishing Company, New Delhi, 1996
2. Michael, A.M. and Ojha. T. P., "Principles of Agricultural Engineering Volume II", Jain Brothers, New Delhi, 1980

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

1. Understand soil erosion in depth and carryout computation of parameters measuring erosion.
2. Recognize different types of soil erosion and their impact.
3. Acquire knowledge of various soil erosion control measures.
4. Devise watershed management plans.
5. Understand the meteorological parameters and their management techniques.

**MAPPING PROGRAMEE OUTCOMES WITH COURSE OUTCOMES**
COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	✔		✔					✔			✔	
CO2						✔				✔		
CO3			✔					✔		✔		
CO4		✔		✔								
CO5					✔							✔

01OExxx	ENGINEERING THERMODYNAMICS	L	T	P
		4	0	0

Objectives

- To understand the principles and analysis of Thermodynamic and bulk behavior of simple physical systems.
- To make the students to understand the gas cycle and vapour cycle

Unit I

Fundamental concepts and definitions - Thermodynamic system - State, property of system - Thermodynamic   equilibrium - Zeroth law - temperature scales - path, process, cycle - work and heat.

First law of Thermodynamics - Mechanical equivalent of heat - Corollaries of the First law - Internal energy - steady flow energy equation. Second law of Thermodynamics - Limitations to the First law - heat engine and reversed heat engines - Kelvin Planck and Clausius statements -   corollaries - reversibility - Car not cycle -   Thermodynamic temperature scale - Entropy - Clausius inequality.

Unit II

Properties of pure substance- Tables of properties - Diagrams of properties - representation on p-V, T-s and h-s diagrams.

Non-flow   processes - Constant volume - constant   pressure - isothermal - isentropic and polytrophic processes for gas and vapor - Representation on p-V and T-s diagrams - Flow processes - Constant pressure - isentropic - polytrophic - throttling using gas and vapor - work and heat exchange - representation on p-V and T-s diagrams

Unit III

Gas cycles - Carnot, Otto, Diesel, Dual and Brayton cycles - representation on p-V and T-s diagrams - Air standard efficiency - mean effective pressure.

Unit IV

Vapour cycle: Carnot cycle with steam as working substance - Rankine cycle - Efficiency of these cycles - representation on T-s and h-s diagrams - Reheat cycle - specific steam consumption and work ratio-Regeneration(Concept only)

Unit V

Gas and gas-vapour mixtures - Dalton's law – Amagat's law - properties of air and water vapour mixtures - Psychrometric chart - Psychrometric calculations.

Text Books:
1. Ballaney P.L., "Thermal Engineering", Khanna Publishers, New Delhi,24th edition,2003.
2. Nag P.K., "Engineering Thermodynamics", Tata McGraw-Hill, New Delhi, 4th edition, 2008

Reference Books:
1. Gorden J., Van Wylen & Richars E. Sonntag, "Fundamentals of Classical Thermodynamics", John Wiley & Sons, 1985.

Course Outcomes:

At the end students will be able to

1. Understand the principles Thermodynamic system.
2. Analyze the bulk behavior of simple physical system
3. Gain knowledge on gas cycle
4. Gain knowledge on representation on TS and HS diagram
5. Do the calculations of psychometric.

Mapping of COs with POs												
COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1		✓		✓		✓	✓	✓			✓	
CO2			✓	✓	✓				✓			✓
CO3	✓											
CO4		✓	✓	✓			✓				✓	
CO5		✓										

01OExxx	**REFRIGERATION AND AIR CONDITIONING**	L	T	P
		4	**0**	**0**

Objectives

- To provide in-depth study of the basics of refrigeration and air-conditioning
- To study the various refrigeration systems and their thermodynamic cycles.
- To study the basics of psychrometry and cooling load calculations of air-conditioning systems.

Unit I

Introduction - Unit of refrigeration - Refrigeration systems - Refrigeration cycles and concepts - Coefficient of Performance - Reversed Carnot cycle - Refrigeration system as heat pump - Air Refrigeration - types – simple problems.

Unit II

Introduction to Steam Jet Refrigeration, vapour absorption refrigeration and Solar refrigeration - Theory only - Performance Analysis of vapour Compression cycle - Ideal and actual conditions - simple problems - Representation of cycle on p-h and T-s diagrams - Properties of refrigerants and their choice for different applications – Eco friendly refrigerant.

Unit III

Refrigeration equipment - Description only with sketches - Compressors - Reciprocating, centrifugal and screw - open, hermetic and semi-hermetic units - condensers - air and water cooled condensers, evaporative condensers - Evaporators - Double tube, Shell and Tube, Dry and flooded types - Expansion devices - Protection devices - High and Low pressure cut out Thermostat - solenoid valve.

Unit IV

Psychometric of Air conditioning Processes - Adiabatic mixing, sensible cooling and heating, latent heat process, total heat process, sensible heat factor - By-pass factor - Cooling and Dehumidifying coil, heat coils, air washer, adiabatic dehumidifiers, water and steam injection - Problems on psychrometric processes.

Unit V

Air conditioning system - classification - Unitary, packaged and central type summer and winter air-conditioning systems - Description with sketches - merits and demerits - Comfort indices - Air purification - Airconditioning - Heat gain and load calculations - RSHF, GSHF and ESHF - Need for reheating.

Text Books:

1. Arora S.C. & Domkundwar S., Refrigeration and Air-conditioning, Dhanpat Rai & Sons, New Delhi, 1995.
2. Ballaney P.L., Refrigeration and Air-conditioning, Khanna Publisher, New Delhi 13th edition, 2003.

Reference Books:

1. R.S Khurmi& J.K.Guptha, Refrigeration and Air-conditioning, S.Chand & company ltd New Delhi, 3rd edition, 2005.
2. Harris, Modern Air-conditioning, McGraw-Hill Book Co, New Delhi, 2000.
3. Roy J. Dossat, Principles of Refrigeration, Pearson education, Asia, 2001.
4. V.K Jain, Refrigeration and Air-conditioning, S.Chand & company ltd , New Delhi

Course Outcomes:

At the end students will be able to

1. Understand the basics of refrigeration and air conditioning.
2. Know the various refrigeration system and thermodynamics cycles.
3. Gain knowledge on refrigeration equipments
4. Differentiate between Adiabatic mixing and dehumidifiers
5. Do load calculations of air conditioning

Mapping of COs with POs											
COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	✓			✓							✓	
CO2			✓		✓				✓			✓
CO3						✓		✓				
CO4			✓				✓				✓	
CO5		✓										

01OExxx	**BIOLIGY FOR ENGINEERS**	L	T	P
		4	**0**	**0**

Course Objective

- 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.

Mapping of COs with POs											
COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1		✓		✓			✓					
CO2			✓		✓						✓	✓
CO3	✓		✓				✓					
CO4				✓		✓			✓			✓
CO5	✓			✓								

01OExxx	DISASTER MANAGEMENT	L	T	P
		4	**0**	**0**

Objectives

- To help in providing the basic concepts of disasters and also gives a thorough knowledge and experience to reduce disaster risks.
- To find the possible risk reduction measures of disaster.

Unit 1

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 2

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 3

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 4

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 5

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 Disater Setting. (Paperback – June 1985) Publisher: John Wiley & Sons ISBN:047191505X
3. Sinha, P.C. Technological Disasters , 1997, 516 pp Anmol Publications Trivedi,

Course Outcomes: At the end students able to

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
3. Understand causes of tsunamis and landslides.

4. Take precautionary measures during and before cyclones.
5. Differentiate between coastal flood, environmental hazard and biological hazards

Cos	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	✓		✓					✓				
CO2		✓						✓			✓	✓
CO3	✓			✓					✓			
CO4				✓		✓					✓	
CO5	✓		✓						✓			

Mapping of COs with POs

01OExxx	ENTREPRENEURSHIP	L	T	P
		4	0	0

Objective

- 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; "Innovation and entrepreneurship", Butterworth – Heinemann,   London, 1985.

Reference Books:

1   Alan Barrell **"**Creativity, innovation, entrepreneurship and enterprise in construction and development", University of Reading, Entrepreneur in Residence Entrepreneur in Residence, University of Xiamen, Xiamen 2012.

2   "Entrepreneurship Studies", National University Commission (Nigerian University
    System), 2010.

Course Outcomes:

 At the end of the course students will be able to

   1. Understand the concept of entrepreneurship.
   2. Identify business opportunities within an organization or independently

00OExxx	**NATIONAL SERVICE SCHEME**	L	T	P
		4	0	0

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) Advisory committee and their functions with special reference to college principal, 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:

    1. National Service Scheme Manual, Government of India, 2006.
    2. Training Programme on National Programme scheme, TISS.
    3. Orientation Courses for N.S.S. Programme officers, TISS.
    4. Case material as Training Aid for field workers, Gurmeet Hans.
    5. Social service opportunities in Hospitals, KapilK.Krishan,TISS.
    6. Social Problems in India, Ram Ahuja.