



**HINDUSTAN**

INSTITUTE OF TECHNOLOGY & SCIENCE  
(DEEMED TO BE UNIVERSITY)

**DEPARTMENT OF CIVIL ENGINEERING**

**CURRICULUM  
&  
SYLLABUS 2013-14**

M.Tech. - Civil Engineering



**M.Tech.**

**CIVIL WITH SPELIZATION OF  
CONSTRUCTION ENGINEERING &  
MANAGEMENT  
(5 YEAR INTEGRATED COURSE)**

**ACADEMIC REGULATIONS (M.Tech)  
(Full /Part Time) (Effective 2013-14)**

**Vision, Mission and Objectives**

- 1.1** The Vision of the Institute is "To make every man a success and no man a failure".

In order to progress towards the vision, the Institute has identified itself with a mission to provide every individual with a conducive environment suitable to achieve his / her career goals, with a strong emphasis on personality development, and to offer quality education in all spheres of engineering, technology, applied sciences and management, without compromising on the quality and code of ethics.

- 1.2 Further, the Institute always strives**

To train our students with the latest and the best in the rapidly changing fields of Engineering, Technology, Management, Science & Humanities.

To develop the students with a global outlook possessing, state of the art skills, capable of taking up challenging responsibilities in the respective fields.

To mould our students as citizens with moral, ethical and social values so as to fulfill their obligations to the nation and the society.

To promote research in the field of Science, Humanities, Engineering, Technology and allied branches.

- 1.3** Aims and Objectives of the Institute are focused on

Providing world class education in engineering, technology, applied sciences and management.

Keeping pace with the ever changing technological scenario to help the

students to gain proper direction to emerge as competent professionals fully aware of their commitment to the society and nation.

To inculcate a flair for research, development and entrepreneurship.

**Admission**

- 2.1** The admission policy and procedure shall be decided from time to time by the Board of Management (BOM) of the Institute, following guidelines issued by Ministry of Human Resource Development (MHRD), Government of India. The number of seats in each branch of the M.Tech programme will be decided by BOM as per the directives from MHRD, Government of India and taking into account the market demands. Some seats for Non Resident Indians and a few seats for foreign nationals shall be made available.

- 2.2 Eligibility**

At the time of applying for admission, the candidates should have passed / appeared and be awaiting results of the final examination of the 10+2 system or its equivalent with Mathematics, Physics and Chemistry as subjects of study.

- 2.3** The selected candidates will be admitted to the M.Tech. programme after he/she fulfills all the admission requirements set by the Institute and after the payment of the prescribed fees.

- 2.4** In all matters relating to admission to the. M.Tech. programme, the decision of the Institute and its interpretation given by the Chancellor of the Institute shall be final.

**2.5** If at any time after admission, it is found that a candidate has not fulfilled any of the requirements stipulated by the Institute, the Institute may revoke the admission of the candidate with information to the Academic Council.

### **Structure of the programme**

**3.1** The programme of instruction will have the following structure:

A general (common) core programme comprising basic sciences, engineering sciences, humanities, technical arts and mathematics.

An engineering core programme introducing the student to the foundations of engineering in the respective branch.

An elective programme enabling the student to opt and undergo a set of courses of interest to him/ her.

Professional practice including project, seminar and industrial training.

General elective courses, such as, Environmental Studies, Physical Education, Professional ethics, and National Service Scheme.

The distribution of total credits required for the degree programme into the above five categories will nominally be 20%, 50%, 15%, 5%, and 10% respectively.

**3.2. Duration**

The duration of the programme will be a minimum of **10 semesters**. Every branch of the M.Tech. programme will have a curriculum and syllabi for the courses approved by the Academic Council.

**3.3** The academic programmes of the Institute follow the credit system. The general pattern is:

One credit for each lecture hour per week per semester;

One credit for each tutorial hour per week per semester;

Two credit for each laboratory practical of three hours per week per semester.

One credit for 4 weeks of industrial training and

One credit for 4 hours of project per week per semester

**3.4. Credits:**

For the award of degree, a student has to earn certain minimum total number of credits specified in the curriculum of the relevant branch of study. The curriculum of the different programs shall be so designed that the minimum prescribed credits required for the award of the degree shall be within the limits of **230-240**

**3.5** The medium of instruction, examination and the language of the project reports will be English.

### **Faculty Advisor**

**4.1** To help the students in planning their courses of study and for getting general advice on the academic programme, the concerned Department will assign a certain number of students to a Faculty member who will be called their Faculty Advisor.

### **Class Committee**

**5.1** A Class Committee consisting of the following will be constituted by the Head of the Department for each class:

A Chairman, who is not teaching the class.

All subject teachers of the class.

Two students nominated by the department in consultation with the class.

The Class Committee will meet as often as necessary, but not less than three times during a semester.

**The functions of the Class**

**Committee will include:**

Addressing problems experienced by students in the classroom and the laboratories.

Analyzing the performance of the students of the class after each test and finding ways and means of addressing problems, if any.

During the meetings, the student members shall express the opinions and suggestions of the class students to improve the teaching / learning process.

**Grading**

**6.1** A grading system as below will be adhered to.

Range of Marks	Letter Grade	Grade points
95-100	S	10
85 - 94	A	09
75- 84	B	08
65-74	C	07
55-64	D	06
50-54	E	05
< 50	U	00
	I (Incomplete)	--

**6.2 GPA and CGPA**

GPA is the ratio of the sum of the product of the number of credits  $C_i$  of course "i" and the grade points  $P_i$

earned for that course taken over all courses "i" registered by the student to the sum of  $C_i$  for all "i". That is,

$$GPA = \frac{\sum C_i P_i}{\sum C_i}$$

CGPA will be calculated in a similar manner, at any semester, considering all the courses enrolled from the first semester onwards.

**6.3** For the students with letter grade I in certain subjects, the same will not be included in the computation of GPA and CGPA until after those grades are converted to the regular grades.

**6.4** Raw marks will be moderated by a moderation board appointed by the Vice Chancellor of the University. The final marks will be graded using an absolute grading system. The Constitution and composition of the moderation board will be dealt with separately.

**Registration and Enrolment**

**7.1** Except for the first semester, registration and enrollment will be done in the beginning of the semester as per the schedule announced by the University.

**7.2** A student will be eligible for enrollment only if he/she satisfies regulation 10 (maximum duration of the programme) and will be permitted to enroll if (i) he/she has cleared all dues in the Institute, Hostel and Library up to the end of the previous semester and (ii) he/she is not debarred from enrollment by a disciplinary action of the University.

**7.3** Students are required to submit registration form duly filled in.

### **Registration requirement**

- 8.1** A student shall not register for less than 16 credits or more than 30 credits in any given semester.
- 8.2** If a student finds his/her load heavy in any semester, or for any other valid reason, he/she may withdraw from the courses within three weeks of the commencement of the semester with the written approval of his/her Faculty Advisor and HOD. However the student should ensure that the total number of credits registered for in any semester should enable him/her to earn the minimum number of credits per semester for the completed semesters.

### **Continuation of the programme**

- 9.1** For those students who have not earned the minimum required credit prescribed for that particular semester examination, a warning letter to the concerned student and also to his/her parents regarding the shortage of his/her credit will be sent by the HOD after the announcement of the results of the university examinations.

### **Maximum duration of the programme**

#### **10.1 (i) Full - Time**

The normal duration of the programme is ten semesters. However a student may complete the programme at a slower pace by taking more time, but in any case not more than 16 semesters excluding the semesters withdrawn on medical grounds or other valid reasons.

### **Temporary discontinuation**

- 11.1** A student may be permitted by the Director (Academic) to discontinue temporarily from the programme for a semester or a longer period for reasons

of ill health or other valid reasons. Normally a student will be permitted to discontinue from the programme only for a maximum duration of two semesters.

### **Discipline**

- 12.1** Every student is required to observe discipline and decorum both inside and outside the campus and not to indulge in any activity which will tend to bring down the prestige of the University.
- 12.2** Any act of indiscipline of a student reported to the Director (Academic) will be referred to a Discipline Committee so constituted. The Committee will enquire into the charges and decide on a suitable punishment if the charges are substantiated. The committee will also authorize the Director (Academic) to recommend to the Vice Chancellor the implementation of the decision. The student concerned may appeal to the Vice Chancellor whose decision will be final. The Director (Academic) will report the action taken at the next meeting of the Council.
- 12.3** Ragging and harassment of women are strictly prohibited in the University campus and hostels.

### **Attendance**

- 13.1** A student whose attendance is less than 75% in a semester is not eligible to appear for the end - semester examination for that semester. The details of all students who have less than 75% attendance in a course will be announced by the teacher in the class. These details will be sent to the concerned HODs and Director (Academic).
- 13.2** Those who have less than 75% attendance will be considered for

condonation of shortage of attendance. However, a condonation of 10% in attendance will be given on medical reasons. Application for condonation recommended by the Faculty Advisor, concerned faculty member and the HOD is to be submitted to the Director (Academic) who, depending on the merits of the case, may permit the student to appear for the end semester examination. A student will be eligible for this concession at most in two semesters during the entire degree programme. Application for medical leave, supported by medical certificate with endorsement by a Registered Medical Officer, should reach the HOD within seven days after returning from leave or, on or before the last instructional day of the semester, whichever is earlier.

- 13.3** As an incentive to those students who are involved in extra curricular activities such as representing the University in Sports and Games, Cultural Festivals, and Technical Festivals, NCC/ NSS events, a relaxation of up to 10% attendance will be given subject to the condition that these students take prior approval from the officer - in-charge. All such applications should be recommended by the concerned HOD and forwarded to Director (Academic) within seven instructional days after the programme / activity.

**Assessment Procedure**

- 14.1** The Academic Council will decide from time to time the system of tests and examinations in each subject in each semester.
- 14.2** For each theory course, the assessment will be done on a continuous basis as follows:

Test / Exam	Weightage	Duration of Test / Exam
First Periodical Test *	10%	2 Periods
Second Periodical Test	10%	2 Periods
Model Exam	20%	3 Hours
Seminar/ Assignments/Quiz	10%	-
Attendance	10%	-
End - semester examination	50%	3 Hours

\*Best out of the two tests will be considered.

- 14.3** For practical courses, the assessment will be done by the subject teachers as below:

- □ □ □  
 eekly assignment/Observation note book / lab records - weightage 60%.
- □ □ □  
 nd semester examination of 3 hours duration including viva - weightage 40%.

- 14.4** For courses on Physical Education, NSS, etc the assessment will be as satisfactory / not satisfactory only.

**Make up Examination/Periodical Test**

- 15.1** Students who miss the end-semester examinations / model examination for valid reasons are eligible for make-up examination / model examination. Those who miss the end-semester examination / model examination should apply to the Head of the Department concerned within five days after he / she missed examination, giving reasons for absence.
- 15.2** Permission to appear for make-up examination / model exam will be given under exceptional circumstances such as admission to a hospital due to illness. Students should produce a



medical certificate issued by a Registered Medical Practitioner certifying that he/she was admitted to hospital during the period of examination / model exam and the same should be duly endorsed by parent / guardian and also by a medical officer of the University within 5 days.

### Project evaluation

- 16.1** For Project work, the assessment will be done on a continuous basis as follows:

Review / Examination	Weightage
First Review	10%
Second Review	20%
Third Review	20%
End-semester Examination	50%

For end - semester examination, the student will submit a Project Report in a format specified by the Director (Academic). The first three reviews will be conducted by a Committee constituted by the Head of the Department. The end - semester examination will be conducted by a Committee constituted by the Registrar / Controller of examination. This will include an external expert.

### Declaration of results

- 17.1 (i)** A candidate who secures not less than 50% of total marks prescribed for a course with a minimum of 50% of the marks prescribed for the end semester examination shall be declared to have passed the course and earned the specified credits for the course.

To be Eligible to appear for the end semester examinations for a particular course, a candidate will have to secure a minimum of 40% marks in the sessional for that course.

Candidates are required to obtain all credits assigned to the first two semesters of the programme within the first four semesters of the programme. Candidates failing to satisfy this requirement will not be allowed to proceed to the fifth semester until the condition is satisfied. Further, candidates will not be allowed proceeding to seventh semester if they have not cleared all the courses assigned during third & fourth semesters.

- 17.2** After the valuation of the answer scripts, the tabulated results are to be scrutinized by the Result Passing Boards of UG programmes constituted by the Vice-Chancellor. The recommendations of the Result Passing Boards will be placed before the Standing Sub Committee of the Academic Council constituted by the Chancellor for scrutiny. The minutes of the Standing Sub Committee along with the results are to be placed before the Vice-Chancellor for approval. After getting the approval of the Vice-Chancellor, the results will be published by the Controller of Examination/ Registrar.

- 17.3** If a candidate fails to secure a pass in a course due to not satisfying the minimum requirement in the end semester examination, he/she shall register and re-appear for the end semester examination during the following semester. However, the sessional marks secured by the candidate will be retained for all such attempts.

- 17.4** If a candidate fails to secure a pass in a course due to insufficient sessional marks though meeting the minimum requirements of the end semester examination, and wishes to improve on



his/her sessional marks, he/she will have to register for the particular course and attend the course with permission of the HOD concerned and Director (Academic) with a copy marked to the Registrar. The sessional and external marks obtained by the candidate in this case will replace the earlier result.

- 17.5** A candidate can apply for the revaluation of his/her end semester examination answer paper in a theory course within 2 weeks from the declaration of the results, on payment of a prescribed fee through proper application to the Registrar/Controller of Examinations through the Head of the Department. The Registrar/ Controller of Examination will arrange for the revaluation and the results will be intimated to the candidate concerned through the Head of the Department. Revaluation is not permitted for practical courses and for project work.

#### **Grade Card**

- 18.1** After results are declared, grade sheet will be issued to each student which will contain the following details:

Program and branch for which the student has enrolled.

Semester of registration.

List of courses registered during the semester and the grade scored.

Semester Grade Point Average (GPA)

Cumulative Grade Point Average (CGPA).

#### **Class/Division**

- 19.1** Classification is based on CGPA and is as follows:

$CGPA \geq 8.0$  : First Class with distinction

$6.5 \geq CGPA < 8.0$  : First Class

$5.0 \geq CGPA < 6.5$  : Second Class.

- 19.2 (i)** Further, the award of 'First class with distinction' is subject to the candidate becoming eligible for the award of the degree having passed the examination in all the courses in his/her first appearance within the minimum duration of the programme.

The award of 'First Class' is further subject to the candidate becoming eligible for the award of the degree having passed the examination in all the courses within 12 semesters.

(iii)The period of authorized discontinuation of the programme (vide clause 11.1 will not be counted for the purpose of the above classification.

#### **Transfer of credits**

- 20.1** Within the broad framework of these regulations, the Academic Council, based on the recommendation of the transfer of credits committee so consulted by the Chancellor may permit students to earn part of the credit requirement in other approved institutions of repute and status in the country or abroad.

- 20.2** The Academic Council may also approve admission of lateral entry (who hold a diploma in Engineering/ technology) candidates with advance credit based on the recommendation of the transfer of credits committee on a case to case basis.

#### **Eligibility for the award of M.Tech. Degree**

- 21.1** A student will be declared to be eligible for the award of the M.Tech. Degree if he/she has registered and successfully acquired the credits for the core courses; successfully acquired the credits in the different categories as specified in the

curriculum corresponding to the discipline (branch) of his/her study within the stipulated time;

has no dues to all sections of the Institute including Hostels, and

has no disciplinary action pending against him/her.

The award of the degree must be recommended by the Academic Council and approved by the Board of Management of the University.

#### **Change of Branch**

- 22.1** If the number of students in any branch of M.Tech. class as on the last instructional day of the First Semester is less than the sanctioned strength, then the vacancies in the said branches

can be filled by transferring students from other branches. All such transfers will be allowed on the basis of merit of the students. The decision of the Chancellor shall be final while considering such requests.

- 22.2** All students who have successfully completed the first semester of the course will be eligible for consideration for change of branch subject to the availability of vacancies.

#### **Power to modify**

- 23.1** Notwithstanding all that has been stated above, the Academic Council shall modify any of the above regulations from time to time subject to approval by the Board of Management.

**HINDUSTAN UNIVERSITY**  
**DEPARTMENT OF CIVIL ENGINEERING**

**SEMESTER I**  
**(Common to all Branches)**

S.No.	Code No.	Course Title	L	T	P	C	TCH
<b>Theory</b>							
1.	EL 2101	English	3	0	0	3	3
2.	MA 2101	Engineering Mathematics-I	3	1	0	4	4
3.	PH 2001 CY 2001	Engineering Physics / Engineering Chemistry *	3	0	0	3	3
4.	ME 2101	Engineering Graphics	1	0	3	3	4
5.	CS 2101	Computer Programming	3	0	0	3	3
<b>Practical</b>							
6.	CS 2131	Computer Programming Laboratory	0	0	3	2	3
7.	GE 2131	Engineering Practices Laboratory-I	0	0	3	2	3
8.	EL 2131	Communication Skills Laboratory-I	0	0	3	2	3
9.	PH 2031 CY 2031	Physics Laboratory / Chemistry Laboratory *	1	0	3	3	4
		<b>Total</b>				<b>25</b>	<b>30</b>

Note: \* Depending upon the number of batches, it will be alternated between semesters 1 & 2

**SEMESTER II**

S.No.	Code No.	Course Title	L	T	P	C	TCH
<b>Theory</b>							
1	MA 2201	Engineering mathematics-II #	3	1	0	4	4
2	CY 2001/ PH 2001	Engineering Chemistry Engineering Physics * #	3	0	0	3	3
3.	CE 2201	Mechanics of Solids	3	1	0	4	4
4.	CE 2202	Engineering Mechanics	3	1	0	4	4
5.	CE 2203	Construction Materials	3	0	0	3	3
6.	PCM 205	Construction Software Lab	0	0	4	2	4
		<b>Total</b>				<b>24</b>	<b>26</b>

<b>Practical</b>							
6.	CY 2031 PH 2031	Chemistry Laboratory/ Physics Laboratory* #	1	0	3	3	4
7.	GE 2231	Engineering Practices Laboratory-II #	0	0	3	2	3
8.	EL 2231	Communication Skills Laboratory -II #	2	0	2	3	4
9.	CE 2231	Construction Materials Laboratory	0	0	3	2	3
		<b>Total</b>				<b>28</b>	<b>32</b>

**Note:** \* Depending upon the number of batches, it will be alternated between semesters 1 & 2

**# Common to all Branches**

### SEMESTER III

Sl.No	Code No.	Course Title	L	T	P	C	TCH
<b>Theory</b>							
1.	CE 2301	Strength of Materials	3	1	0	4	4
2.	CE 2302	Structural Analysis - I	3	1	0	4	4
3.	CE 2303	Mechanics of Fluids	3	1	0	4	4
4.	CE 2304	Surveying	3	1	0	4	4
5.	CE 2305	Environmental Engineering	3	1	0	4	4
<b>Practical</b>							
6.	CE 2331	Computer Aided Building Drawing	0	0	3	2	3
7.	CE 2332	Computer Aided Structural Analysis Laboratory	0	0	3	2	3
8.	CE 2333	Survey Laboratory	0	0	3	2	3
		<b>Total</b>				<b>26</b>	<b>29</b>

**Semester IV**

Sl.No	Code No.	Course Title	L	T	P	C	TCH
<b>Theory</b>							
1.	MA 2401	Numerical Methods*	3	1	0	4	4
2	CE 2401	Design of Steel Structures - I	3	1	0	4	4
3	CE 2402	Design of Concrete Structures - I	3	1	0	4	4
4	CE 2403	Mechanics of Soils	3	1	0	4	4
5	CE 2404	Construction Techniques Equipments and Practices	3	0	0	3	3
<b>Practical</b>							
6.	CE 2431	Environmental Engineering Laboratory	0	0	3	2	3
7.	CE 2432	Geo Technical Laboratory	0	0	3	2	3
		<b>Total</b>				<b>23</b>	<b>25</b>

\*Common to Civil, Aeronautical, Mechanical Engineering

**SEMESTER V**

Sl.No	Code No.	Course Title	L	T	P	C	TCH
<b>Theory</b>							
1.	CE 2501	Structural Analysis - II	3	1	0	4	4
2.	CE 2502	Design of Steel Structures - II	3	1	0	4	4
3.	CE 2503	Design of Concrete Structures - II	3	1	0	4	4
4.	CE 2504	Irrigation Engineering	3	0	0	3	3
5.	CE 2505	Hydraulic Engineering	3	1	0	4	4
6.	PCM 104	Advanced Concrete Technology	3	0	0	3	3
<b>Practical</b>							
7.	EL 2431	Communication Skills & Personality Development	2	0	2	3	4
8.	CE 2531	Strength of Materials Laboratory	0	0	3	2	3
		<b>Total</b>				<b>27</b>	<b>29</b>

### SEMESTER VI

Sl.No	Code No.	Course Title	L	T	P	C	TCH
<b>Theory</b>							
1.	MG2001	Principles of Management	3	0	0	3	3
2.	PCM 102	Construction Equipment	3	0	0	3	3
3.	CE 2601	Foundation Engineering	3	0	0	3	3
4.	CE 2602	Transportation Engineering-I	3	0	0	3	3
5.	CE 2603	Estimation and Quantity Surveying	3	1	0	4	4
6.	CE 2604	Environmental Science and Engineering	3	0	0	3	3
<b>Practical</b>							
7.	CE 2631	Fluid Mechanics & Machinery Laboratory	0	0	3	2	3
8.	CE 2632	Irrigation & Environmental Engineering Drawing	0	0	3	2	4
		<b>Total</b>				<b>25</b>	<b>27</b>

**\*Common to Civil, Automobile, Mechanical Engineering**

### SEMESTER VII

Sl.No	Code No.	Course Title	L	T	P	C	TCH
<b>Theory</b>							
1.	MG 2002	Total Quality Management*	3	0	0	3	3
2.	PMA103	Probability And Statistics	3	1	0	4	4
3.	PCM 101	Modern Structural Materials And Systems Design	4	0	0	4	4
4.	PCM 103	Computer Applications in Construction Engineering and Planning	3	1	0	4	4
5.	CE2701	Basics of Dynamics and Aseismic Design	3	1	0	4	4
6.	CE 2702	Transportation Engineering-II	3	0	0	3	3
<b>Practical</b>							
7.	CE2731	Computer Aided Design and Drafting	0	0	3	2	3
8.	PCM 205	Construction Software Laboratory	0	0	3	2	3
		<b>Total</b>				<b>26</b>	<b>28</b>

**Common to Civil, Automobile, Aeronautical, Electronics & Instrumentation, Mechanical Engineering.**

### Semester VIII

Sl.No	Code No.	Course Title	L	T	P	C	TC H
Theory							
1	GE 2001	Professional Ethics and Human Values	3	0	0	3	3
2	PCM 201	Construction Planning , Scheduling And control4	0	0	4	4	
3	PCM 202	Advanced Construction Techniques	4	0	0	4	4
4	PCM 204	Shoring, Scaffolding and Framework	4	0	0	4	4
5	-	Elective-I	3	0	0	3	3
6		Elective-II	3	0	0	3	3
<b>Practical</b>							
	CE 2433	Design Project	0	0	6	2	6
		<b>Total</b>				<b>23</b>	<b>27</b>

### SEMESTER IX

Sl.No	Code No.	Course Title	L	T	P	C	TC H
Theory							
1	-	Elective-III	3	0	0	3	3
2	-	Elective-IV	3	0	0	3	3
3	-	Elective-V	3	0	0	3	3
<b>Practical</b>							
4	PCM301	Seminar	0	0	2	1	2
5	PCM302	Practical Training	0	0	0	2	0
6	PCM303	Project Work-Phase1	0	0	12	6	12
		<b>Total</b>				<b>18</b>	<b>23</b>

### SEMESTER X

Sl.No	Code No.	Course Title	L	T	P	C	TC H
<b>Practical</b>							
1	PCM401	Project Work-Phase2	0	0	24	12	24
		<b>Total</b>				<b>12</b>	<b>24</b>

**ELECTIVE SUBJECTS - SEMESTER VIII**

SI.No	Code No.	Course Title	L	T	P	C	TC H
1	CE2551	Electronic Surveying	3	0	0	3	3
2	CE2553	Remote Sensing Techniques and Applications	3	0	0	3	3
3	CE2555	Building Services	3	0	0	3	3
4	CE2651	Housing Planning and Management	3	0	0	3	3
5	CE2653	Environmental Impact Assessment	3	0	0	3	3
6	CE 2655	Air Pollution Management	3	0	0	3	3
7	CE2657	Modern construction materials	3	0	0	3	3
8	CE2752	Prestressed Concrete	3	0	0	3	3
9	CE2753	Finite Element Analysis	3	0	0	3	3
10	CE2755	Pavement Design and Engineering	3	0	0	3	3
11	CE2756	Ground Improvement Techniques	3	0	0	3	3
12	PCM 203	Project Formulation and Appraisal	3	0	0	3	3

**ELECTIVE SUBJECTS - SEMESTER IX**

SI.No	Code No.	Course Title	L	T	P	C	TCH
1	PCM 701	Construction Personnel Management	3	0	0	3	3
2	PCM 105	Construction Project Management	3	0	0	3	3
3	PCM 702	Maintenance and Rehabilitation of Structures	3	0	0	3	3
4	PCM 703	Energy Conservation Techniques in Building Construction	3	0	0	3	3
5	PCM 704	Project Safety Management	3	0	0	3	3
6	PCM 705	Quality Control and Assurance in Construction	3	0	0	3	3
7	PCM 706	System Integration in Construction	3	0	0	3	3
8	PCM 707	Management Information Systems	3	0	0	3	3
9	PCM 708	Quantitative Techniques in Management	3	0	0	3	3
10	PCM 709	Business Economics and Finance Management	3	0	0	3	3
11	PCM 710	Contract Laws and Regulations	3	0	0	3	3
12	CE 2703	Construction Management	3	0	0	3	3

**TOTAL NUMBER OF CREDITS = 233**



**SEMESTER - I**  
**EL 2101 ENGLISH**

**L T P C**  
**3 0 0 3**

**GOAL**

The goal of the programme is to provide a theoretical input towards nurturing accomplished learners who can function effectively in the English language skills; to cultivate in them the ability to indulge in rational thinking, independent decision-making and lifelong learning; to help them become responsible members or leaders of the society in and around their work/living space; to communicate successfully at the individual or group level on multi-disciplinary activities in particular with the community, and in general with the world at large.

**OBJECTIVES**

To widen the capacity of the learners to listen to English language at the basic level and understand its meaning.

To enable learners to communicate in an intelligible English accent and pronunciation.

To assist the learners in reading and grasping a passage in English.

To learn the art of writing simple English with correct spelling, grammar and punctuation.

To cultivate the ability of the learners to think and indulge in divergent and lateral thoughts.

**OUTCOME**

The learners will have the self-confidence to improve upon their informative listening skills by an enhanced acquisition of the English language.

The learners will be able to speak English at the formal and informal levels and use it for daily conversation, presentation, group discussion and debate.

The learners will be able to read, comprehend and answer questions based on literary, scientific and technological texts.

The learners will be able to write instructions, recommendations, checklists, process-description, letter-writing and report writing.

The learners will have the confidence to develop thinking skills and participate in brainstorming, mind-mapping, audiovisual activities, creative thinking and also answer tests in the job-selection processes.

**UNIT I LISTENING SKILL**

**12**

Listening to short and extended dialogues, telephone conversations, discussions, soliloquies -  
Listening to prose & poetry reading -- Listening to sounds, silent letters, stressed syllables in English

Listening to video clips, documentaries, feature films, presentations, interviews -- Listening for the gist of the text, for identifying a topic, general meaning and specific information -- Listening for multiple-choice questions, for positive & negative comments, for interpretation -- Listening for advanced interpretation.

**UNIT II SPEAKING SKILL****12**

Introducing oneself or expressing personal opinion -- Simple oral or casual interaction - Dialogue -- Conversation - Giving and receiving feedback using Johari window - Debates -- Brief presentations -- Differences between disagreeing and being disagreeable -- Participating in group discussions, role plays and interviews -- Generating talks based on visual or written prompts -- Addressing a small group or a large formal gathering - Comparing, contrasting, justifying, agreeing and disagreeing on advanced topics - Speaking about present and past experiences and future plans - Debates, discussions and role plays on advanced topics - Job interviews - Preparing HR questions with possible answers -- Brief presentations - Arguing out a topic without verbal fights -- Power point presentation.

**UNIT III READING SKILL****12**

Reading for skimming and scanning -- Reading for the gist of a text, for specific information, for information transfer and interpretation -- Reading and interpreting anecdotes, short stories, poems, prose passages for intellectual and emotional comments - Reading a Fishbone diagram for strengths and weaknesses, for pros and cons - Reading comprehension exercises for multiple-choice questions, for contextual meaning -- Reading newspapers, magazine articles for critical comments.

**UNIT IV WRITING SKILL****12**

Writing emails, messages, notices, agendas, leaflets, brochures, instructions, recommendations, functional checklists, minutes of a meeting -- Writing paragraphs, comparing, contrasting, presentations with an Introduction, Body and Conclusion -- Arranging appointments, asking for permission, apologizing and offering compensation - Writing formal business letters -- Letter inviting, accepting, declining the invitation - Letter to the editor -- Requesting permission for industrial visits or implant training, enclosing an introduction to the educational institution -- Letter applying for a job, enclosing a CV or Resume - - Writing short reports -- Industrial accident reports -- Writing short proposals.

**UNIT V THINKING SKILL****12**

Developing the acquisition and imparting the knowledge of English using thinking skills -- Eliciting thinking blocks for critical interpretation -- Decoding diagrammatic and pictorial representations into English orthographic version in the form of words, phrases, expressions, idioms, sayings and proverbs.

**TOTAL: 60****REFERENCES:**

- Norman Whitby. Business Benchmark: Pre-Intermediate to Intermediate - BEC Preliminary. New Delhi: Cambridge University Press, 2008 (Latest South Asian edition).
- Devaki Reddy & Shreesh Chaudhary. Technical English. New Delhi: Macmillan, 2009.
- Rutherford, Andrea J. Basic Communication Skills for Technology. 2nd edition. New Delhi: Pearson Education, 2010.

## MA 2101 ENGINEERING MATHEMATICS - I

L T P C  
3 1 0 4

### GOAL

To create the awareness and comprehensive knowledge in engineering mathematics.

### OBJECTIVES

The course should enable the students to:

Find the inverse of the matrix by using Cayley Hamilton Theorem and Diagonalisation of matrix using transformation.

Understand the Evolutes and Envelope of the curve.

Learn the solutions of second order linear differential equations of standard types and Legendre's linear differential equation.

Learn partial differentiations involving two and three variables and expansions of functions using Taylor series.

Learn the expansions of trigonometric, hyperbolic functions and their relations.

### OUTCOME

The students should be able to:

Identify Eigen value problems from practical areas and obtain its solutions and using transformation diagonalising the matrix which would render Eigen values.

Find out effectively the geometrical aspects of curvature and appreciates mathematical skills in constructing evolutes and envelopes in mechanics and engineering drawing.

Recognize and to model mathematically and solving, the differential equations arising in science and engineering.

Understand and model the practical problems and solve it using maxima and minima as elegant applications of partial differentiation.

Acquire skills in using trigonometric and hyperbolic and inverse hyperbolic functions.

Apply their ideas in green house, energy efficient housing projects.

### UNIT I MATRICES

12

**Review:** Basic concepts of matrices-addition, subtraction, multiplication of matrices - adjoint - inverse - solving cubic equations.

Characteristic equation - Properties of Eigen values - Eigen values and Eigen vectors - Cayley Hamilton theorem (without proof) - Verification and inverse using Cayley Hamilton theorem. Diagonalisation of matrices - Orthogonal matrices - Quadratic form - Reduction of symmetric matrices to a Canonical form using orthogonal transformation - Nature of quadratic form.

**UNIT II DIFFERENTIAL CALCULUS** **12**

**Review:** Basic concepts of differentiation - function of function, product and quotient rules.

Methods of differentiation of functions - Cartesian form - Parametric form - Curvature - Radius of curvature - Centre of curvature - Circle of curvature. Evolutes of parabola, circle, ellipse, hyperbola and cycloid - Envelope.

**UNIT III ORDINARY DIFFERENTIAL EQUATIONS** **12**

**Review:** Definition, formation and solutions of differential equations.

Second order differential equations with constant coefficients - Particular integrals -  $e^{ax}\cos bx$ ,  $e^{ax}\sin bx$ . Euler's homogeneous linear differential equations - Legendre's linear differential equation - Variation of parameters.

**UNIT IV PARTIAL DIFFERENTIATION** **12**

Partial differentiation - differentiation involving two and three variables - Total differentiation - Simple problems. Jacobian - verification of properties of Jacobians - Simple problems. Taylor's series - Maxima and minima of functions of two and three variables.

**UNIT V TRIGONOMETRY** **12**

**Review:** Basic results in trigonometry and complex numbers - De Moivre's theorem.

Expansions of  $\sin n$ ,  $\cos n$ ,  $\tan n$  where  $n$  is a positive integer. Expansions of  $\sin^{-1} x$  in terms of sines and cosines of multiples of  $x$  where  $m$  and  $n$  are positive integers. Hyperbolic and inverse hyperbolic functions - Logarithms of complex numbers - Separation of complex functions into real and imaginary parts - Simple problems.

**Note:** Questions need not be asked from review part.

**TOTAL: 60**

**TEXT BOOKS**

Erwin Kreyzig, A Text book of Engineering Mathematics, John Wiley, 1999.

Grewal B.S, Higher Engineering Mathematics, Thirty Eighth Editions, Khanna Publisher, Delhi, 2004.

Chandrasekaran A, A Text book of Engineering Mathematics I, Dhanam Publications, Chennai, 2010.

**REFERENCES**

Venkataraman M.K, Engineering Mathematics, Volume I, The National Publishing Company, Chennai, 1985.

Kandaswamy P, Thilagavathy K and Gunavath K, Engineering Mathematics, Volume I & II, S.Chand and Company, New Delhi, 2005.

Bali N.P, Narayana Iyengar. N.Ch., Engineering Mathematics, Laxmi Publications Pvt. Ltd, New Delhi, 2003.

Veerarajan T, Engineering Mathematics (for first year), Fourth Edition, Tata McGraw - Hill Publishing Company Limited, New Delhi, 2005.

## PH 2001 - ENGINEERING PHYSICS

L T P C  
3 0 0 3

### GOAL

To impart fundamental knowledge in various fields of Physics and its applications.

### OBJECTIVES

- To develop strong fundamentals of properties and behavior of the materials
- To enhance theoretical and modern technological aspects in acoustics and ultrasonics.
- To enable the students to correlate the theoretical principles with application oriented study of optics.
- To provide a strong foundation in the understanding of solids and materials testing.
- To enrich the knowledge of students in modern engineering materials.

### OUTCOMES

The student will

- Be able to understand the properties and behaviour of materials.
- Have a fundamental knowledge of acoustics which would facilitate in acoustical design of buildings and on ultrasonics and be able to employ it as an engineering tool.
- Understand the concept, working and application of lasers and fiber optics.
- Know the fundamentals of crystal physics and non destructive testing methods.
- Have an understanding of the production, characteristics and application of the new engineering materials. This would aid them in the material selection stage.

### UNIT I PROPERTIES OF MATTER

9

Elasticity - types of moduli of elasticity - Stress-Strain diagram - Young's modulus of elasticity - Rigidity modulus - Bulk modulus - Factors affecting elasticity - twisting couple on a wire - Torsional pendulum - determination of rigidity modulus of a wire - depression of a cantilever - Young's modulus by cantilever - uniform and non-uniform bending - viscosity - Ostwald's viscometer - comparison of viscosities.

### UNIT II ACOUSTICS AND ULTRASONICS

9

Classification of sound - characteristics of musical sound - intensity - loudness - Weber Fechner law Decibel - Reverberation - Reverberation time, derivation of Sabine's formula for reverberation time(Jaeger's method) - absorption coefficient and its determination - factors affecting acoustics of building (Optimum reverberation time, loudness, focusing, echo, echelon effect, resonance and noise) and their remedies. Ultrasonics - production - Magnetostriction and Piezoelectric methods - properties applications of ultrasonics with particular reference to detection of flaws in metal ( Non - Destructive testing NDT) - SONAR.

**UNIT III LASER AND FIBRE OPTICS****9**

Principle of lasers - Stimulated absorption - Spontaneous emission, stimulated emission - population inversion - pumping action - active medium - laser characteristics - Nd-Yag laser - CO<sub>2</sub> laser - Semiconductor laser - applications - optical fiber - principle and propagation of light in optical fibers - Numerical aperture and acceptance angle - types of optical fibers - single and multimode, step index and graded index fibers - applications - fiber optic communication system.

**UNIT IV CRYSTAL PHYSICS AND NON- DESTRUCTIVE TESTING****9**

Crystal Physics: Lattice - Unit cell - Bravais lattice - Lattice planes - Miller indices - 'd' spacing in cubic lattice - Calculation of number of atoms per unit cell - Atomic radius - coordination number - Packing factor for SC, BCC, FCC and HCP structures.

Non Destructive Testing: Liquid penetrate method - Ultrasonic flaw detection - ultrasonic flaw detector (block diagram) - X-ray Radiography - Merits and Demerits of each method.

**UNIT V MODERN ENGINEERING MATERIALS AND SUPERCONDUCTING MATERIALS 9**

Modern Engineering Materials: Metallic glasses: Preparation properties and applications. Shape memory alloys (SMA): Characteristics, applications, advantages and disadvantages of SMA. Nano Materials: Synthesis - Properties and applications.

Superconducting Materials: Superconducting phenomena - Properties of superconductors - Meissner effect - Type I and Type II superconductors - High T<sub>c</sub> superconductors (qualitative) - uses of superconductors.

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

Gaur R.K. and Gupta S.L., "Engineering Physics ", 8th edition, Dhanpat rai publications (P) Ltd., New Delhi 2010.

P.Mani, "Engineering Physics ", Vol-I, Dhanam Publications, Chennai 2011.

Rajendran V. an Marikani A., "Applied Physics for engineers" , 3rd edition, Tata Mc Graw - Hill publishing company Ltd., New Delhi,2003.

**REFERENCES:**

Uma Mukherji, "Engineering Physics ", Narosa publishing house, New Delhi, 2003.

Arumugam M., "Engineering Physics ", Anuradha agencies, 2007.

Palanisamy P.K., "Engineering Physics ", SciTech Publications, Chennai 2007.

Arthur Beiser, "Concepts of Modern Physics", Tata Mc Graw -Hill Publications, 2007.

P.Charles, Poole and Frank J. Owens, "Introduction to Nanotechnology", Wiley India, 2007

## CY 2001 ENGINEERING CHEMISTRY

L T P C  
3 0 0 3

### GOAL

To impart basic principles of chemistry for engineers.

### OBJECTIVES

The objective of the course is:

To make the students conversant with the basics of Water Technology and Polymer science.

To provide knowledge on the requirements and properties of a few important engineering materials.

To educate the students on the fundamentals of corrosion and its control.

To give a sound knowledge on the basics of a few significant terminologies and concepts in thermodynamics.

To create an awareness among the present generation about the various conventional energy sources.

### OUTCOME

Upon successful completion of the course, the outcomes are as follows:

The students will gain basic knowledge in water analysis and suitable water treatment method.

The study of polymer chemistry will give an idea on the type of polymers to be used in engineering applications.

Exposure of the students to the common engineering materials will create awareness among the students to search for new materials.

Knowledge on the effects of corrosion and protection methods will help the young minds to choose proper metal / alloys and also to create a design that has good corrosion control.

Students with good exposure on the important aspects of basic thermodynamics will be able to understand the advanced level thermodynamics in engineering applications.

A good background on the various aspects of energy sources will create awareness on the need to utilize the fuel sources effectively and also for exploring new alternate energy resources.

### UNIT I WATER TECHNOLOGY AND POLYMER CHEMISTRY

9

Hardness (Definition, Types, Units) - problems - Estimation of Hardness (EDTA Method) - Water softening - Carbonate conditioning and Calgon conditioning - Demineralization (Ion-Exchange Method) - Water Quality Parameters - Municipal Water Treatment- Desalination - Reverse Osmosis.

Classification of Polymers - PVC, Bakelite - preparation, properties and applications - Effect of Polymer Structure on Properties - Compounding of Plastics- Polymer Blends and Polymer Alloys - Definition, Examples.

**UNIT II ENGINEERING MATERIALS****9**

Properties of Alloys - Heat Treatment of Steel - Polymer Composites - types and applications.- Lubricants - Classification, properties and applications - Mechanism of Lubrication - MoS<sub>2</sub> And Graphite - Adhesives - classification and properties - Epoxy resin (Preparation, properties and applications) - Refractories - Classification, Properties and General Manufacture - Abrasives - Classification , Properties and Uses - Carbon nano tubes - preparation, properties and applications.

**UNIT III ELECTROCHEMISTRY AND CORROSION****9**

Conductometric Titration - HCl vs NaOH and mixture of acids vs NaOH - Electrochemical Series and its applications - Nernst Equation - problems - Polarization, Decomposition Potential, Over-voltage (definitions only) - Galvanic series - Corrosion (Definition, Examples, effects) - Mechanism of Dry Corrosion and Wet Corrosion - Differential aeration Corrosion , examples - Factors Influencing Corrosion

Metal and Environment - Corrosion Control - Design -Cathodic Protection methods - Protective Coatings - Galvanising - Anodising - Electroplating (Cu and Ni) and Electroless plating (Cu and Ni) - Constituents of Paints and varnish.

**UNIT IV CHEMICAL THERMODYNAMICS****9**

Thermodynamic terminology- First Law of Thermodynamics-Internal energy- enthalpy - heat capacity - work done in isothermal expansion of an ideal gas -problems - second law of thermodynamics - entropy change - phase transformations and entropy change - problems - Work Function & Free Energy Function- Maxwell's Relations-Gibbs Helmholtz equation- van't Hoff Isotherm- van't Hoff Isochore - Problems.

**UNIT V FUELS AND ENERGY SOURCES****9**

Fuels - classification - Calorific Value - Dulong's Formula - Problems - Determination of Calorific Value by Bomb Calorimeter - Coal - Proximate Analysis - problems - Octane Number - Cetane Number - Diesel Index (Definitions only) - Bio Gas - Producer Gas -Water Gas - Preparation, Properties and Uses - Batteries - Primary Cells - Leclanche Cell -Secondary Cell - Nickel Cadmium Battery - Fuel Cells - Hydrogen -Oxygen Fuel Cell - Solar Battery - Lead Acid Storage Cell - Nuclear Energy - Light water nuclear power plant.

**TOTAL = 45****TEXT BOOKS**

S. S. Dara, Text Book of Engineering Chemistry, S. Chand & Company Ltd., New Delhi, 2003

Murthy, Agarwal & Naidu, Text Book of Engineering Chemistry, BSP, 2003.

S.Sumathi, Engineering Chemistry, Dhanam Publications, 2008.

S.Sumathi and P.S.Raghavan, Engineering Chemistry II, Dhanam Publications, 2008.

**REFERENCES**

B. K. Sharma, Engineering chemistry, Krishna Prakasam Media (P) Ltd., 2003

A 1. Vogel, A text book of Qualitative Inorganic Analysis, ELBS, London, 2004



A. Gowarikar, Text Book of Polymer Science, 2002

Kuriacose & Rajaram, Vols. 1 & 2, Chemistry in Engineering and Technology, 2004

Puri, Sharma and Pathania, Principles of Physical Chemistry, Vishal Publishing Co. Jalandar, 2004.

## ME 2101 - ENGINEERING GRAPHICS

L T P C  
1 0 3 3

### GOAL

To develop graphical skills for communicating concepts, ideas and designs of engineering products and to give exposure to national standards relating to technical drawings.

### OBJECTIVES

The course should enable the students to:

Introduce drawing standards and use of drawing instruments.

Introduce first angle projection.

Practice of engineering hand sketching and introduce to computer aided drafting

Familiarize the students with different type of projections.

Introduce the process of design from sketching to parametric 3D CAD and 2D orthographic drawings to BIS.

### OUTCOME

The students should be able to:

Develop Parametric design and the conventions of formal engineering drawing

Produce and interpret 2D & 3D drawings

Communicate a design idea/concept graphically

Examine a design critically and with understanding of CAD - The student learn to interpret drawings, and to produce designs using a combination of 2D and 3D software.

Get a Detailed study of an engineering artifact.

**Note: Only first angle projection is to be followed**

### BASICS OF ENGINEERING GRAPHICS

2

Importance of graphics Use of drawing instruments - BIS conventions and specifications - drawing sheet sizes, layout and folding - lettering - Dimensioning - Geometrical constructions - Scales. Construction of curves like ellipse, parabola, cycloids and involutes.

### UNIT I PROJECTION OF POINTS, LINES AND SURFACES

15

General principles of presentation of technical drawings as per BIS - Introduction to Orthographic projection - Naming views as per BIS - First angle projection. Projection of points. Projection of

straight lines located in first quadrant (using rotating line method only). Projection of plane surfaces like polygonal lamina and circular lamina. Drawing views when the surface of the lamina is inclined to one reference plane.

**UNIT II PROJECTION OF SOLIDS 10**

Projections of simple solids like prism, pyramid, cylinder and cone - Drawing views when the axis of the solid is inclined to one reference plane.

**UNIT III DEVELOPMENT OF SURFACES 10**

Introduction to sectioning of solids. Development of lateral surfaces of truncated prisms, pyramids, cylinders and cones.

**UNIT IV ORTHOGRAPHIC PROJECTIONS 10**

Orthographic projections - Conversion of orthographic views from given pictorial views of objects, including dimensioning. Free hand sketching of Orthographic views from Pictorial views.

**UNIT V PICTORIAL PROJECTIONS 10**

Isometric projection - Isometric scale - Isometric views of simple solids like prisms, pyramids, cylinders and cones. Introduction to perspective Projections.

**COMPUTER AIDED DRAFTING (Demonstration Only) 3**

Introduction to computer aided drafting and dimensioning using appropriate software. 2D drawing commands Zoom, Picture editing commands, Dimensioning, Isometric drawing, Iso-Planes and 3D drafting. Plotting of drawing. Practice includes drawing the projection of lines and solids. Prepare isometric view of simple solids like prisms, pyramids, cylinders and cones.

**TOTAL = 60**

**TEXT BOOKS**

Jeyapooan T, "Engineering Drawing and Graphics Using AutoCAD", Vikas Publishing House Pvt. Ltd., New Delhi, 2010.

Warren J. Luzadder and Jon. M.Duff, "Fundamentals of Engineering Drawing", Prentice Hall of India Pvt. Ltd., Eleventh Edition, 2003.

**REFERENCES**

Bhatt N.D and Panchal V.M, "Engineering Drawing: Plane and Solid Geometry", Charotar Publishing House, Anand-3001, 2007.

Thomas E. French, Charles J.Vierck and Robert J.Foster, " Engineering Drawing and Graphic Technology, McGraw- Hill Book company 13th Edition.1987.

Venugopal K., "Engineering Graphics", New Age International (P) Limited, New Delhi, 2008.

## CS 2101 - COMPUTER PROGRAMMING

L T P C  
3 0 0 3

### GOAL

To introduce computers and programming and to produce an awareness of the power of computational techniques that are currently used by engineers and scientists and to develop programming skills to a level such that problems of reasonable complexity can be tackled successfully.

### OBJECTIVES

The course should enable the students to:

Learn the major components of a Computer system.

Learn the problem solving techniques.

Develop skills in programming using C language.

### OUTCOMES

The student should be able to:

Understand the interaction between different components of Computer system and number system.

Devise computational strategies for developing applications.

Develop applications (Simple to Complex) using C programming language.

### UNIT I COMPUTER FUNDAMENTALS 9

Introduction - Evolution of Computers - Generations of Computer - Classification of Computers - Application of Computers - Components of a Computer System - Hardware - Software - Starting a Computer (Booting) - Number Systems.

### UNIT II COMPUTER PROGRAMMING AND LANGUAGES 9

Introduction - Problem-Solving Techniques: Algorithms, Flowchart, Pseudocode - Program Control Structures - Programming Paradigms - Programming languages - Generations of Programming Languages - Language Translators - Features of a Good Programming Languages.

### UNIT III PROGRAMMING WITH C 9

Introduction to C - The C Declaration - Operators and Expressions - Input and Output in C - Decision Statements - Loop Control Statements.

### UNIT IV FUNCTIONS, ARRAYS AND STRINGS 9

Functions - Storage Class - Arrays - Working with strings and standard functions.

### UNIT V POINTERS, STRUCTURES AND UNION 9

Pointers - Dynamic Memory allocation - Structure and Union - Files.

TOTAL = 45

**TEXT BOOK:**

ITL Education Solution Limited, Ashok Kamthane, "Computer Programming", Pearson Education Inc 2007 (Unit: I to V).

**REFERNCES:**

Byron S. Gottfried, "Programming with C", Second Edition, Tata McGraw Hill 2006.

Yashvant Kanetkar, "Let us C", Eighth edition, BPP publication 2007.

Stephen G.Kochan, "Programming in C - A Complete introduction to the C programming language" , Pearson Education, 2008.

T.JeyaPoovan, "Computer Programming Theory and Practice", Vikas Pub, New Delhi.

**CS 2131 COMPUTER PROGRAMMING LABORATORY**

**L T P C**  
**0 0 3 2**

**GOAL**

To provide an awareness to develop the programming skills using computer languages.

**OBJECTIVES**

The course should enable the students to:

To gain knowledge about Microsoft office, Spread Sheet.

To learn a programming concept in C.

**OUTCOME**

The students should be able to

Use MS Word to create document, table, text formatting and Mail merge options.

Use Excel for small calculations using formula editor, creating different types of charts and including pictures etc,

Write and execute the C programs for small applications.

**LIST OF EXPERIMENTS:****a) Word Processing****15**

Document creation, Text manipulation with Scientific notations.

Table creation, Table formatting and Conversion.

Mail merge and Letter preparation.

Drawing - flow Chart

**b) Spread Sheet** **15**

Chart - Line, XY, Bar and Pie.

Formula - formula editor.

Spread sheet - inclusion of object, Picture and graphics, protecting the document

**c) Programming in C :** **15**

To write a C program to prepare the electricity bill.

Functions:

(a) Call by value (b) Call by reference.

To write a C program to print the Fibonacci series for the given number.

To write a C program to find the factorial of number using recursion.

To write a C program to implement the basic arithmetic operations using Switch Case statement.

To write a C program to check whether the given number is an Armstrong number.

To write a C program to check whether the given string is a Palindrome.

To write a C program to create students details using Structures.

To write a C program to demonstrate the Command Line Arguments.

To write a C program to implement the Random Access in Files.

To write C programs to solve some of the Engineering applications.

**TOTAL = 45**

**GE 2131 - ENGINEERING PRACTICES LABORATORY I**

**L T P C**  
**0 0 3 2**

**Goal**

To provide the students with hands on experience on various basic engineering practices in Civil and Mechanical Engineering.

**OBJECTIVES**

The course should enable the students to

Relate theory and practice of basic Civil and Mechanical Engineering

Learn concepts of welding and machining practice

Learn concepts of plumbing and carpentry practice.

## OUTCOMES

The students should be able to

Identify and use of tools, Types of joints used in welding, carpentry and plumbing operations.

Have hands on experience on basic fabrication techniques such as carpentry and plumbing practices.

Have hands on experience on basic fabrication techniques of different types of welding and basic machining practices.

## LIST OF EXPERIMENTS

### 1. Mechanical Engineering

24

1. Welding Arc welding - butt joints, lap joints and T joints.
2. Basic Machining Facing, Turning, Threading and Drilling practice.
3. Machine assembly practice Study of centrifugal pump
4. Study on
  - a. Smithy operations- Production of hexagonal headed bolt.
  - b. Foundry operations - mould preparation for gear and step cone pulley.

### 2. Civil Engineering

21

1. Basic pipe connection using valves, couplings, unions, reducers, elbows in household fitting.
2. Practice in mixed pipe connections: Metal, plastic and flexible pipes used in household appliances.
3. Wood work: Sawing, Planning and making common joints.
4. Study of joints in door panels, wooden furniture.

**TOTAL : 45**

## TEXT BOOK

T. Jeyapooan, M.Saravanapandian and S. Pranitha, "Engineering Practices Lab Manual", 3rd Edition 2006, Vikas Publishing house (P) Ltd., New Delhi.

## EL 2131 COMMUNICATION SKILLS LABORATORY I

L T P C  
0 0 3 2

### GOAL

The goal of the programme is to provide a practical input towards nurturing accomplished learners who can function effectively in the English language skills.

### OBJECTIVES

To extend the ability of the learners to be able to listen to English and comprehend its message.

To enable the learners to have a functional knowledge of spoken English.

To assist the learners to read and grasp the meaning of technical and non-technical passages in English.

To help the learners develop the art of writing without mistakes.

To expand the thinking capability of the learners so that they would learn how to view things from a different angle.

### OUTCOME

The learners will be able to listen to and evaluate English without difficulty and comprehend its message.

The learners would have developed a functional knowledge of spoken English so as to use it in the institution and at job interviews.

The learners will be able to read and comprehend the meaning of technical and non-technical passages in English.

The learners will have developed the art of writing so as to put down their thoughts and feelings in words.

At the end of the course, the learners will be able to think independently and contribute creative ideas.

### UNIT I LISTENING SKILL

9

Listening to conversations and interviews of famous personalities in various fields -- Listening practice related to the TV-- Talk shows - News - Educative programmes -- Watching films for critical comments

Listening for specific information - Listening for summarizing information - Listening to monologues for taking notes - Listening to answer multiple-choice questions.

### UNIT II SPEAKING SKILL

9

Self-introduction -- Group discussion - Persuading and negotiating strategies - Practice in dialogues -- Presentations based on short stories / poems -- Speaking on personal thoughts and feelings -- academic topics - News reading - Acting as a compere -- Speaking about case studies on problems and solutions - Extempore speeches.

**UNIT III READING SKILL****9**

Reading anecdotes to predict the content - Reading for interpretation -- Suggested reading -- Short stories and poems -- Critical reading - Reading for information transfer - Reading newspaper and magazine articles for critical commentary - Reading brochures, advertisements, pamphlets for improved presentation.

**UNIT IV WRITING SKILL****9**

At the beginning of the semester, the students will be informed of a mini dissertation of 2000 words they need to submit individually on any non-technical topic of their choice. The parts of the dissertation will be the assignments carried out during the semester and submitted towards the end of the semester on a date specified by the department. This can be judged as part of the internal assessment.

**UNIT V THINKING SKILL****9**

Practice in preparing thinking blocks to decode diagrammatical representations into English words, expressions, idioms and proverbs - Inculcating interest in English using thinking blocks. Making pictures and improvising diagrams to form English words, phrases and proverbs -- Picture reading.

**Total = 45****REFERENCE**

Raman, Meenakshi, and Sangeetha Sharma. Technical Communication: English Skills for Engineers. 2nd edition. New Delhi: Oxford University Press, 2010. Riordian, Daniel. Technical Communication. New Delhi. Cengage Learning, 2009

**WEBSITES**

**British:** Learn English - British Council (Listen & Watch) <http://Learnenglish.britishcouncil.org>

**American:** Randall's ESL Cyber Listening Lab - <http://www.esl-lab.com/>.

**Intercultural:** English Listening Lesson Library Online <http://www.elllo.org>.



**PH 2031 PHYSICS LABORATORY**

**L T P C**  
**1 0 3 3**

**OBJECTIVE**

To expose the students for practical training through experiments to understand and appreciate the concepts learnt in Physics

**OUTCOME**

Performing the experiments related to the subject will help the students to apply the practical knowledge in industrial applications and for developing or modifying methods

S.No.	List of Experiments	Batch 2 (30)			Batch 1 (30)		
		Week	Periods allotted		Week	Periods allotted	
			L	P		L	P
1	Torsional Pendulum - Determination of rigidity modulus of the material of a wire.	1	1	3	2	1	3
2	Non Uniform Bending - Determination of Young's Modulus.	3	1	3	4	1	3
3	Viscosity -Determination of co-efficient of Viscosity of a liquid by Poiseuille's flow.	5	1	3	6	1	3
4	Lee's Disc - Determination of thermal conductivity of a bad conductor.	7	1	3	8	1	3
5	Air Wedge - Determination of thickness of a thin wire.	9	1	3	10	1	3
6	Spectrometer - Refractive index of a prism.	11	1	3	12	1	3
7	Semiconductor laser - Determination of wavelength of Laser using Grating.	13	1	3	14	1	3
	<b>TOTAL</b>	<b>7</b>	<b>2</b>	<b>1</b>	<b>7</b>	<b>2</b>	<b>1</b>
<b>56 Periods</b>							

**CY 2031 CHEMISTRY LABORATORY**

**L T P C**  
**1 0 3 3**

**OBJECTIVE**

To expose the students for practical training through experiments to understand and appreciate the concepts learnt in Chemistry.

**OUTCOME**

Performing the experiments related to the subject will help the students to apply the practical knowledge in industrial applications and for developing or modifying methods

S.No.	List of Experiments (Any Five)	Batch 2 (30)			Batch 1 (30)		
		Week	Periods allotted		Week	Periods allotted	
			L	P		L	P
1	Estimation of Commercial soda by acid-base titration	1	1	3	2	1	3
2	Determination of Percentage of nickel in an alloy	3		3	4		3
3	Determination of Temporary, permanent and total hardness of water by EDTA method	5	1	3	6	1	3
4	Determination of Chloride content in a water sample	7		3	8		3
5	Potentiometric Estimation of iron	9	1	3	10	1	3
6	Conductometric Titration of a strong acid with a strong base	11	1	3	12	1	3
7	Conductometric Titration of mixture of acids.	13	1	3	14	1	3
8	Determination of Degree of polymerization of a polymer by Viscometry	15	1	3	16	1	3
	<b>TOTAL</b>		<b>6</b>	<b>24</b>		<b>6</b>	<b>24</b>
<b>60 Periods</b>							

**SEMESTER-II**  
**MA 2201 ENGINEERING MATHEMATICS II**

**L T P C**  
**3 1 0 4**

**GOAL**

To create the awareness and comprehensive knowledge in engineering mathematics.

**OBJECTIVES**

The course should enable the students to:

- Understand the evaluation of the double and triple integrals in Cartesian and polar forms.
- Know the basics of Vector calculus.
- Know Cauchy - Riemann equations, Milne - Thomson method and Conformal mapping
- Comprehend the concept of Cauchy's integral formula, Cauchy's residue theorem and contour integration.
- Know Laplace transform and inverse Laplace transform and their properties.

**OUTCOME**

The students should be able to:

- Find area as double integrals and volume as triple integrals in engineering applications.
- Evaluate the gradient, divergence, curl, line, surface and volume integrals along with the verification of classical theorems involving them.
- Applies analytic functions and their interesting properties in science and engineering.
- Evaluate the basics of complex integration and the concept of contour integration which is important for evaluation of certain integrals encountered in practice.
- Have a sound knowledge of Laplace transform and its properties and their applications in solving initial and boundary value problems.

**UNIT I MULTIPLE INTEGRALS**

**12**

**Review:** Basic concepts of integration - Standard results - Substitution methods - Integration by parts - Simple problems.

**Double integrals:** Cartesian and polar co-ordinates - Change of variables - simple problems - Area as a double integral. Triple integrals: Cartesian co ordinates - Volume as a triple integral - simple problems.

**UNIT II VECTOR CALCULUS**

**12**

**Review:** Definition - vector, scalar - basic concepts of vector algebra - dot and cross products-properties. Gradient, Divergence and Curl - Unit normal vector, Directional derivative - angle between surfaces-Irrotational and solenoidal vector fields. Verification and evaluation of Green's theorem - Gauss divergence theorem and Stoke's theorem. Simple applications to regions such as square, rectangle, triangle, cuboids and rectangular parallelepipeds.

**UNIT III ANALYTIC FUNCTIONS****12**

**Review:** Basic results in complex numbers - Cartesian and polar forms - Demoivre's theorem.

Functions of a complex variable - Analytic function - Necessary and sufficient conditions (without proof) - Cauchy - Riemann equations - Properties of analytic function - Harmonic function - Harmonic conjugate - Construction of Analytic functions by Milne - Thomson method. Conformal mapping:  $w = z + a$ ,  $az$ ,  $1/z$  and bilinear transformation.

**UNIT IV COMPLEX INTEGRATION****12**

Statement and application of Cauchy's integral theorem and Integral formula - Evaluation of integrals using the above theorems - Taylor and Laurent series expansions - Singularities - Classification. Residues - Cauchy's residue theorem (without proof) - Contour integration over unit circle and semicircular contours (excluding poles on boundaries).

**UNIT V LAPLACE TRANSFORM****12**

Laplace transform - Conditions of existence - Transform of elementary functions - properties - Transforms of derivatives and integrals - Derivatives and integrals of transforms - Initial and final value theorems - Transforms of unit step function and impulse function - Transform of periodic functions. Inverse Laplace transform - Convolution theorem - Solution of linear ODE of second order with constant coefficients.

**TOTAL = 60**

**Note:** Questions need not be asked from review part.

**TEXT BOOKS**

Venkatraman M.K, Mathematics, Volume - II, National Publishing Company, Chennai, 1985.

Grewal B.S, Higher Engineering Mathematics, Thirty Eighth Editions, Khanna Publisher, Delhi, 2004.

Chandrasekaran A, Engineering Mathematics, Volume - II, Dhanam Publication, 2008.

**REFERENCES**

Kandasamy P, Engineering Mathematics Volume II, S. Chand & Co., New Delhi, 1987.

Grewal B.S, "Engineering Maths - II", Sultan Chand, New Delhi, 1993.

Bali N.P, Manish Goyal, Text book of Engineering Mathematics, 3rd Edition, Lakshmi Publications, 2003.

## CE 2201 MECHANICS OF SOLIDS

3 1 0 4

**PREREQUISITES** MA 2101

### **GOAL**

To introduce the concepts of force, stress, equilibrium, deformation, strain, compatibility, and stress-strain behaviour of materials to the students.

### **OBJECTIVES**

The course should enable the students to :

- Understand the Stress -Strain behaviour of materials.
- Understand the concepts in the analysis of plane trusses and thin cylinders/shells.
- Get knowledge on shear force and bending moment.
- Get knowledge on the deflection and shear stress distribution in the beams.
- Understand the concepts of torsion in shafts.

### **OUTCOME**

The students will be able to:

- Develop knowledge on the different types of stresses acting on rigid bodies. .
- Calculate the reactions and internal forces in simple trusses.
- Draw the Shear force and bending moment diagrams for determinate beams for different loading conditions which is needed for the analysis of structures..
- Find out the deflection of determinate beams and shear stress distribution for different types of sections
- Find out the deflection of springs and torsion in solid and hollow shafts.

### **UNIT I STRESS STRAIN AND DEFORMATION OF SOLIDS, STATES OF STRESS 9**

Rigid bodies and deformable solids - stability, strength, stiffness - tension, compression and shear stresses - strain, elasticity, Hooke's law, limit of proportionately, modulus of elasticity, stress-strain curve, lateral strain - temperature stresses - deformation of simple and compound bars - shear modulus, bulk modulus, relationship between elastic constants - biaxial state of stress - stress at a point - stress on inclined plane - principal stresses and principal planes - Mohr's circle of stresses.

### **UNIT II ANALYSIS OF PLANE TRUSS, THIN CYLINDERS / SHELLS 9**

Stability and equilibrium of plane frames - types of trusses - analysis of forces in truss members method of joints- thin cylinders and shells.

### **UNIT III TRANSVERSE LOADING ON BEAMS 9**

Beams - types of supports - simple and fixed, types of load - concentrated, uniformly distributed, varying distributed load, combination of above loading - relationship between bending moment and

shear force - bending moment, shear force diagram for simply supported, cantilever and over hanging beams - Theory of simple bending - analysis of stresses - load carrying capacity of beams.

**UNIT IV DEFLECTION OF BEAMS AND SHEAR STRESSES 9**

Deflection of beams - double integration method - Macaulay's method -variation of shear stress - shear stress distribution in rectangular, I sections, solid circular sections, hollow circular sections, angle and channel sections- shear centre.

**UNIT V TORSION AND SPRINGS 9**

Stresses and deformation in circular (solid and hollow shafts) - stepped shafts - shafts fixed at both ends- stresses in helical springs - deflection of springs.

**TUTORIAL: 15**

**L = 45, T = 15, TOTAL = 60**

**TEXT BOOKS:**

R K Bansal, Sanjay Bansal " Strength of Materials" , Laxmi Publications, 2009

V. N. Vazirani, M.M. Ratwani, Analysis of Structures, Volume - 1, Khanna Publishers, New Delhi

**REFERENCES:**

Kazimi S.M.A, Solid Mechanics, Tata McGraw-Hill Publishing Co, New Delhi, 2003.

William Nash, Theory and Problems of Strength of Materials, Schaum's Outline Series, McGraw-Hill International Edition.

Srinath L.N, Advanced Mechanics of Solids, Tata McGraw-Hill Publishing Co., New Delhi, 2003.

Egor G. Popov, Engineering Mechanics of Solids, Prentice Hall of India, New Delhi, 2003.

**CE 2202 ENGINEERING MECHANICS**

**3 1 0 4**

**PREREQUISITE** MA 2101, PH 2101

**GOAL**

To impart the students with the knowledge about the Statics and dynamics of rigid bodies.

**OBJECTIVES**

The course should enable the students to :

Study the units and dimensions, laws of mechanics and resolution of forces and equilibrium of particles in space.

Understand the various types of supports and their reactions.

Throw light on friction and frictional force due to belt- friction, wedge friction etc.

Study the methods of determining the centre of gravity and moment of inertia of plane area.  
Understand the basics of velocity, acceleration, displacement and the relation between them.

### **OUTCOME**

The students will be able to:

Apply the proper units and dimensions appropriately and resolve forces and solve various problems.

Analyse the reactions offered by the various supports.

Describe the different types of frictional force and its practical applications..

Workout the centre of gravity and moment of inertia of various plane areas.

Solve problems in dynamics using the various principles like Newtons 2 nd law, Work-energy, Impulse momentum, equations of motions etc.,

### **UNIT I BASICS & STATICS OF PARTICLES 9**

Introduction - Units and Dimensions - Laws of Mechanics - Lamé's theorem, Parallelogram and triangular Law of forces - Vectors - Vectorial representation of forces and moments - Vector operations addition, subtraction, dot product, cross product - Coplanar Forces - Resolution and Compaction of forces - Equilibrium of a particle - Forces in space - Equilibrium of a particle in space - Equivalent systems of forces - Principle of transmissibility - Single equivalent forces.

### **UNIT II EQUILIBRIUM OF RIGID BODIES 9**

Free body diagram -Types of supports and their reactions - Requirements of stable equilibrium - Static determinacy- Moments and Couples - Moment of a force about a point and about an axis - Vectorial representation of moments and couples - Scalar components of a moment - Varignon's theorem - Equilibrium of Rigid bodies in two dimensions - Equilibrium of Rigid bodies in three dimensions - Examples.

### **UNIT III FRICTION 9**

Frictional force - Laws of Coulomb friction - Simple contact friction - Belt friction - Transmission of power through belts - Wedge Friction - Screw Jack - Rolling Resistance.

### **UNIT IV PROPERTIES OF SURFACES AND SOLIDS 9**

Determination of Areas and Volumes - Determination of First moment of area , Centroid of sections, Second and product moments of plane area - Rectangle, circle, triangle, T section, I section, Angle section, Hollow section- Parallel axis theorem and perpendicular axis theorem - Polar moment of inertia -Product moment of inertia.

### **UNIT V DYNAMICS OF PARTICLES 9**

Displacements, Velocity and acceleration, their relationship - Relative motion - Curvilinear motion -

Newton's law - Work Energy Equation of particles - Impulse and Momentum - Impact of elastic bodies.

**TUTORIAL: 15**

**L = 45, T = 15, TOTAL = 60**

**TEXT BOOKS:**

Palanichamy, M.S., Nagan, S., Engineering Mechanics - Statics & Dynamics, Tata McGraw-Hill, 2001.

Rajasekaran, S, Sankarasubramanian, G., Fundamentals of Engineering Mechanics, Vikas Publishing House Pvt., Ltd., 2003.

N.Kottiswaran, "Engineering Mechanics, Statics & Dynamics, Sri Balaji Publications, 2005

**REFERENCES :**

Hibbeler, R.C., Engineering Mechanics, Vol. 1 Statics, Vol. 2 Dynamics, Pearson Education Asia Pvt. Ltd., 2000.

Ashok Gupta, Interactive Engineering Mechanics - Statics - A Virtual Tutor (CDROM), Pearson Education Asia Pvt., Ltd., 2002.

Irving H. Shames, Engineering Mechanics - Statics and Dynamics, IV Edition - Pearson Education Asia Pvt., Ltd., 2003.

Beer, F.P and Johnson Jr. E.R, "Vector Mechanics for Engineers", Vol. 1 Statics and vol. 2 Dynamics, McGraw-Hill International Edition, 1997.

**CE 2203 CONSTRUCTION MATERIALS**

**3 0 0 3**

**PREREQUISITE** Nil

**GOAL**

To introduce the student to various materials that are commonly used in civil engineering construction and their properties.

**OBJECTIVES**

The course should enable the students to :

Be acquainted with the knowledge of manufacture and testing of various conventional materials like stone, bricks and concrete blocks.

Be familiar with the manufacturing process and testing of cement, lime, mortar and aggregates.

Throw light on testing of concrete and mix proportioning.

Be familiar with the properties and applications of construction materials like timber, bitumen, metals and paints.

Gain knowledge of modern materials like glass, ceramics, composites and geosynthetics.



## OUTCOME

The students will be able to :

Make proper choice of material, testing method and aware of various codes available for construction materials.

Develop knowledge of constituents, manufacturing process and testing of cement and lime.

Describe concrete properties and do concrete mix design.

Aware of various market forms of metal, paint, timber and identify suitable material for different civil engineering applications

Gain knowledge of modern materials and its applications.

<b>UNIT I STONES</b>	<b>9</b>
Stone as building material - Criteria for selection - Tests on stones - Deterioration and Preservation of stone work	
<b>UNIT II BRICKS</b>	<b>9</b>
Bricks - Classification - Manufacture of clay bricks - Tests on bricks - Compressive Strength - Water Absorption - Efflorescence - Bricks for special use - Refractory bricks - Cement and Concrete hollow blocks - Light weight concrete blocks.	
<b>UNIT III LIME - CEMENT</b>	<b>9</b>
Lime - Preparation of lime mortar - Cement, Ingredients - Manufacturing process - Types and Grades - Properties of cement and Cement mortar - Hydration - Compressive strength - Tensile strength - Soundness and consistency - Setting time .	
<b>UNIT IV AGGREGATES - MORTAR - CONCRETE</b>	<b>9</b>
Aggregates - Natural stone aggregates - Industrial by products - Crushing strength - Impact strength - Flakiness - Abrasion Resistance - Grading - Sand - Bulking Concrete - Ingredients - Manufacture - Batching plants - Ready Mix Concrete -Hollow concrete blocks.	
<b>UNIT V TIMBER AND OTHER MATERIALS</b>	<b>9</b>
Timber - Industrial timber - Plywood - Veneer - Thermocole -Bitumen -Market forms Panels of laminates	<b>TOTAL = 45</b>

## TEXT BOOKS:

R.K. Rajput, Engineering Materials, S. Chand & Company Ltd., 2000.

M.S. Shetty, Concrete Technology (Theory and Practice), S. Chand & Company Ltd., 2003

## REFERENCES :

1. P. C Varghese, Building Materials, Prentice Hall of India ca-print-prentice\_hall,2005.

## GE 2231 - ENGINEERING PRACTICES LABORATORY II

L T P C  
0 0 3 2

### LIST OF EXPERIMENTS

#### 1. Electrical Engineering

- |    |  |   |
|----|--|---|
| 1. | Wiring for a tube light.                           | 6 |
| 2. | Wiring for a lamp and fan.                         | 6 |
| 3. | Staircase wiring.                                  | 3 |
| 4. | Study of (i) Iron box and (ii) Fan with Regulator. | 6 |

#### 2. Electronics Engineering

- |    |   |   |
|----|---|---|
| 1. | Study of Electronic components and Equipments.  | 3 |
|    | Characteristics of PN junction diode & measurement of Ripple factor or half wave and full wave rectifier. | 9 |
| 3. | Applications of OP-AMP - Inverter, Adder and Subtractor.  | 9 |
| 4. | Study and verification of Logic Gates.  | 3 |

**TOTAL = 45**

### TEXT BOOK

T. Jeyapooan, M.Saravanapandian and S. Pranitha, "Engineering Practices Lab Manual", 3rd Edition 2006, Vikas Publishing house (P) Ltd., New Delhi.

## EL2231 COMMUNICATION SKILLS LABORATORY II

L T P C  
2 0 2 3

### GOAL

The goal of the programme is to provide an advanced practical input towards moulding student-achievers who can use the English language with ease.

### OBJECTIVES

- To extend the power of the learners to listen to English at an advanced level and comment on it.
- To guide the learners to speak English at the formal and informal levels.
- To enable learners to read and grasp the in-depth meaning of technical and non-technical passages in English.
- To help the learners develop the art of writing at the formal and informal levels.
- To expand the thinking capability of the learners so that they would learn how to be original in their thoughts.

## OUTCOME

The learners will be able to listen to and understand English at an advanced level and interpret its meaning.

The learners would have developed English at the formal and informal levels and thus gained the confidence to use it without fear.

The learners will be able to read and grasp the in-depth meaning of technical and non-technical passages in English.

The learners will have developed the art of formal and informal writing.

The learners will be able to think independently and creatively and also verbalize their thoughts fearlessly.

### **UNIT I LISTENING SKILL** **12**

Listening to telephonic conversations -- Listening to native British speakers -- Listening to native American speakers -- Listening to intercultural communication -- Listening to answer questions as one-liners and paragraphs -- Listening practice to identify ideas, situations and people -- Listening to group discussions -- Listening to films of short duration.

### **UNIT II SPEAKING SKILL** **12**

Interview skills - People skills - Job interview - Body language and communication -- How to develop fluency -- Public speaking -- Speaking exercises involving the use of stress and intonation - Speaking on academic topics - Brain storming & discussion - Speaking about case studies on problems and solutions - Extempore speeches - Debating for and against an issue - Mini presentations - Generating talks and discussions based on audiovisual aids.

### **UNIT III READING SKILL** **12**

Reading exercises for grammatical accuracy and correction of errors -- Reading comprehension exercises with critical and analytical questions based on context - Evaluation of contexts - Reading of memos, letters, notices and minutes for reading editing and proof reading -- Extensive reading of parts of relevant novels after giving the gist of the same.

### **UNIT IV WRITING SKILL** **12**

At the beginning of the semester, the students will be informed of a mini dissertation of 3000 words they need to submit individually on any non-technical topic. The parts of the dissertation will be the assignments carried out during the semester and submitted towards the end on a date specified by the department. This can be judged as part of the internal assessment.

### **UNIT V THINKING SKILL** **12**

Practice in preparing thinking blocks to decode pictorial representations into English words, expressions, idioms and proverbs - Eliciting the knowledge of English using thinking blocks -- Picture rereading -- Finding meaning in the meaningless - Interpreting landscapes, simple modern art and verbal and non-verbal communication.

**Total = 60**

## REFERENCE

Ibbotson, Mark. Cambridge English for Engineering. New Delhi: Cambridge University Press, 2009.

Smith-Worthington Jefferson. Technical Writing for Success. New Delhi. Cengage Learning, 2007.

## WEBSITES

British: Learn English -British Council (Business English) - <http://learnenglish.britishcouncil.org/>  
BBC Learning English (General and Business English) - <http://www.bbc.co.uk/worldservice/learningenglish/>. Intercultural: English Listening Lesson Library Online <http://www.ello.org/> \*

## CE 2231 CONSTRUCTION MATERIALS LABORTARY

L T P C  
0 0 3 2

**PREREQUISITES** CE 2203

### GOAL

To introduce the students to various properties of the materials that is commonly used in civil engineering construction.

### OBJECTIVES

To conduct tests on various construction materials.

### OUTCOME

Students will be able to gain knowledge about the mechanical properties of construction materials such as brick, cement, aggregate, concrete and bitumen.

<b>UNIT I TESTS ON BRICK</b>	<b>6</b>
Compressive Strength - Water Absorption - Efflorescence.	
<b>UNIT II TESTS ON CEMENT</b>	<b>9</b>
Specific gravity - Soundness - Consistency and Setting Times - Vicat - Le Chatelier's	
<b>UNIT III TESTS ON AGGREGATES</b>	<b>6</b>
Crushing Strength - Impact Resistance - Flakiness Index.	
<b>UNIT IV TESTS ON CONCRETE</b>	<b>9</b>
Slump cone -Compaction Factor - Cube and Cylinder strength	
<b>UNIT V TESTS ON WOOD</b>	<b>9</b>
Compressive Strength of wood-Perpendicular and Parallel to the grain	

**TEXT BOOKS :**

M.S. Shetty, Concrete Technology (Theory and Practice), S. Chand & Company Ltd., 2003

PC Varghese, Building Materials, Prentice Hall of India ca-print- prentice\_hall,2005

**REFERENCE :**

R.K. Rajput, Engineering Materials, S. Chand & Company Ltd., 2000.

**SEMESTER III**  
**CE 2301 STRENGTH OF MATERIALS**

**L T P C**  
**3 1 0 4**

**PREREQUISITES** CE 2201,CE2202

**GOAL**

To develop a simple inventory to measure fundamental strength of materials (SOM) concepts such as stress, strain and buckling.

**OBJECTIVES**

The course should enable the student to :

Know the concept of strain energy.

Understand the concepts of indeterminate beams such as fixed beam, continuous beam, propped cantilever.

Understand the concept of short column and long column.

Understand the concept of state of stress in 3D and various failure theories.

Understand the concepts of bending of beams.

**OUTCOME**

The students will be able to:

Apply energy theorems and compute deflections in beams and trusses

Calculate the shear force and bending moment for indeterminate beams.

Calculate the critical load acting on the columns for various end conditions.

Calculate the principal stresses and principal strains using different theories of failures.

Analyse the beams with symmetrical, unsymmetrical sections and curved beams.

**UNIT I ENERGY PRINCIPLES**

**9**

Strain energy and strain energy density - strain energy in traction, shear in flexure and torsion - Castigliano's theorems - principle of virtual work - application of energy theorems for computing deflections in beams and trusses - Maxwell's reciprocal theorems

**UNIT II INDETERMINATE BEAMS**

**9**

Propped cantilever and fixed beams-fixed end moments and reactions for concentrated load (central, non central), uniformly distributed load, triangular load (maximum at centre and maximum at end) - theorem of three moments - analysis of continuous beams - shear force and bending moment diagrams for continuous beams.

**UNIT III COLUMNS**

**9**

Eccentrically loaded short columns - middle third rule - core section - columns of unsymmetrical sections - (angle channel sections) - Euler's theory of long columns - critical loads for prismatic

columns with different end conditions; Rankine-Gordon formula for eccentrically loaded columns  
- thick cylinders - compound cylinders.

**UNIT IV STATE OF STRESS IN THREE DIMENSIONS 9**

Spherical and deviatoric components of stress tensor - determination of principal stresses and principal planes - volumetric strain - dilatation and distortion - theories of failure - principal stress - principal strain - shear stress - strain energy and distortion energy theories - application in analysis of stress, load carrying capacity and design of members -residual stresses

**UNIT V ADVANCED TOPICS IN BENDING OF BEAMS 9**

Unsymmetrical bending of beams of symmetrical and unsymmetrical sections - curved beams - Winkler Bach formula - stress concentration

**TUTORIAL: 15**

**L = 45, T = 15, TOTAL = 60**

**TEXT BOOKS:**

Dr.R.K.Bansal, "A Text Book of Strength of materials", Laxmi Publications, Fourth Edition , 2010

V.N. Vazirani, M.M.Ratwani, "Analysis of Structures", Vol-1, Khanna Publishers, New Delhi, (Paper back 2007).

**REFERENCES:**

Kazimi S.M.A, "Solid Mechanics", Tata McGraw-Hill Publishing Co., New Delhi, 2003.

William Nash, "Theory and Problems of Strength of Materials", Schaum's Outline Series, McGraw Hill International Edition.

R.S. Khurmi, "Strength of Materials", S. Chand & Company Ltd, New Delhi, 2003

Egor P Popov, "Engineering Mechanics of Solids", Prentice Hall of India, New Delhi,2003.

**CE 2302 STRUCTURAL ANALYSIS - I**

**L T P C  
3 1 0 4**

**PREREQUISITES** CE 2201,CE 2301

**GOAL**

To introduce the students to basic theory and concepts of Structural analysis and the classical methods as they require in the analysis of buildings.

**OBJECTIVES**

The course should enable the students to :

Understand the principles of analysis of determinate structures

Study the concept of influence lines for the analysis of beams and trusses.

Throw light on the different types of arches.

Impart knowledge in the analysis of the continuous beams and frames using the classical method of analysis.

Understand the concept of analysis of multi storey buildings.

### **OUTCOME**

The students will be able to :

Analyse the trusses and frames using unit load method.

Analyse the structure for moving loads and to get the shear force and bending moment for any complex type of moving loads.

Analyse of Hinged and fixed arches used in the construction industry.

Analyse beams and frames using one slope Deflection Method.

5. Analyse the Multistorey buildings using the Moment Distribution method, which is an iterative method often used in the analysis of indeterminate structures.

### **UNIT I DEFLECTION OF DETERMINATE STRUCTURES 9**

Principles of virtual work for deflections - Deflections of pin-jointed plane frames and rigid plane frames - Williot diagram - Mohr's correction

### **UNIT II MOVING LOADS AND INFLUENCE LINES (DETERMINATE & INDETERMINATE STRUCTURES) 9**

Influence lines for reactions in statically determinate structures - influence lines for members forces in pin-jointed frames - Influence lines for shear force and bending moment in beam sections. Muller Breslau's principle - Influence lines for continuous beams and single storey rigid frames.

### **UNIT III ARCHES 9**

Arches as structural forms - Examples of arch structures - Types of arches - Analysis of three hinged, two hinged and fixed arches, parabolic and circular arches - Settlement and temperature effects.

### **UNIT IV SLOPE DEFLECTION METHOD 9**

Continuous beams and rigid frames (with and without sway) - Simplification for hinged end - Support displacements.

### **UNIT V MOMENT DISTRIBUTION METHOD 9**

Distribution and carry over of moments - Stiffness and carry over factors - Analysis of continuous beams - Plane rigid frames with and without sway.

**TUTORIAL: 15**

**L = 45, T = 15, TOTAL = 60**



## TEXT BOOKS

Vaidyanadhan, R and Perumal, "Comprehensive Structural Analysis - Vol. 1 & Vol. 2", P, Laxmi Publications, New Delhi, 2008

B.C.Punmia, Ashok Kumar Jain, Arun K. Jain, " Theory of Structures", Laxm Publications Pvt. Ltd, 2003.

S.S. Bhavikatti, Structural Analysis, Vol I & II, Vikas Publishing House Pvt. Ltd, 2011

## REFERENCES

C.K. Wang, Tata McGraw-Hill, Analysis of Indeterminate Structures

Devdas Menon, Morgan & Claypool, Structural Analysis -, 2007

L.S. Negi & R.S. Jangid, "Structural Analysis", Tata McGraw-Hill Publications, New Delhi, Sixth Edition, 2003.

## CE 2303 MECHANICS OF FLUIDS

L T P C  
3 1 0 4

**PREREQUISITE** MA 2101

### GOAL

To introduce the students to basic concepts of the properties of fluid and properties of flow. The concept of model analysis is also introduced.

### OBJECTIVES

The course should enable the student to :

Understand the properties of fluid.

Understand the properties of flow.

Understand the principles of Bernoulli's Theorem.

Be acquainted with the losses of flow in pipes.

Be acquainted with the principles of model analysis.

### OUTCOME

The students will be able to:

Relate to the properties of fluid.

Describe how the different flows can be analysed and measured.

Describe the principles and application of Bernoulli's theorem.

Identify the losses in pipes.

Develop models based on dimensional and model analysis.

**UNIT I DEFINITIONS AND FLUID PROPERTIES** **5**

Definitions - Fluid and fluid mechanics - Dimensions and units - Fluid properties.

**UNIT II FLUID STATICS & KINEMATICS** **10**

Hydrostatic equation - Forces on plane surfaces- Pressure measurement .Stream, streak and path lines - Classification of flows - Continuity equation.

**UNIT III FLUID DYNAMICS** **10**

Euler and Bernoulli's equations - Application of Bernoulli's equation - Discharge measurement - Laminar flows through pipes- Turbulent flow - Darcy-Weisbach formula - Moody diagram.

**UNIT IV FLOW THROUGH PIPES** **10**

Major and minor losses of flow in pipes - Pipes in series and in parallel.

**UNIT V SIMILITUDE AND MODEL STUDY** **10**

Dimensional Analysis - Rayleigh's method, Buckingham's Pi-theorem - Similitude and models.

**TUTORIAL: 15**

**L = 45, T = 15, TOTAL = 60**

**TEXT BOOKS :**

Dr. R.K. Bansal "Fluid Mechanics and Hydraulic Machines", Laxmi Publication (P) Publishing House (P) Ltd., 2002.

Rajput, R.K., "A text book of Hydraulic Machines", S. Chand Publications, 3rd Edition, 2006

Garde, R.J. and Mirajgaoker, A.G., "Engineering Fluid Mechanics", Nem Chand Bros., Roorkee

Fox, Robert, W. and Macdonald, Alan, T., "Introduction to Fluid Mechanics", John Wiley & Sons, 1995

**REFERENCES :**

Streeter, Victor, L. and Wylie, Benjamin E., "Fluid Mechanics", McGraw-Hill Ltd., 1998.

E. John Finnemore and Joseph B. Franzini, "Fluid Mechanics with Engineering Applications", McGraw-Hill International Edition.

Pernard Messay, "Mechanics of Fluids" 7th Edition, Nelson Thornes Ltd. U. K. 1998.

**PREREQUISITES** Nil

**GOAL**

To impart the students with the knowledge about the different types of surveying and levelling.

**OBJECTIVES**

The course should enable the students to :

- Understand the principles of surveying.
- Know about compass surveying and plane table surveying.
- Understand the concepts of leveling and its applications.
- Understand the concepts of Theodolite surveying.
- Get exposed to the different Engineering Surveys.

**OUTCOME**

The students will be able to:

- Gain the knowledge about the Survey Instruments, their care and adjustments and the, principles of Chain Surveying.
- Describe the bearing systems and the instruments used in compass surveying and the methods of plane table surveying.
- Use the instruments in leveling, methods of leveling and contouring.
- Do the temporary and permanent adjustments of vernier transit, measurement of horizontal and vertical angles theodolite using theodolite traversing.
- Find the preliminary and final location surveys for engineering projects, route surveys for highways, railways and waterways and the different types of curves.

**UNIT I INTRODUCTION AND CHAIN SURVEYING 9**

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

**UNIT II COMPASS SURVEYING AND PLANE TABLE SURVEYING 9**

Prismatic compass - Surveyor's compass - Bearing - Systems and conversions - Local attraction - Magnetic declination - Dip - Traversing - Plotting - Adjustment of errors. Plane table instruments and accessories - Merits and demerits - Methods - Radiation - Intersection - Resection - Traversing.

**UNIT III LEVELLING AND APPLICATIONS 9**

Level line - Horizontal line - Levels and Staves - Spirit level - Sensitiveness - Bench marks - Temporary and permanent adjustments - Fly and check levelling - Booking - Reduction - Curvature and refraction

Reciprocal levelling - Longitudinal and cross sections - Plotting - Calculation of areas and volumes  
Contouring - Methods - Characteristics and uses of contours - Plotting - Earth work volume -  
Capacity of reservoirs.

#### **UNIT IV ENGINEERING SURVEYS**

**9**

Reconnaissance, preliminary and Final location surveys for engineering projects - Lay out -  
Setting out works - Route Surveys for highways, railways and waterways - Curve ranging -  
Horizontal and vertical curves - Simple curves - Setting with chain and tapes, tangential angles  
by theodolite, double theodolite - Compound and reverse curves - Transition curves - Functions  
and requirements - Setting out by offsets and angles - Vertical curves - Sight distances - Mine  
Surveying - instruments - Tunnels - Correlation of under ground and surface surveys - Shafts

#### **UNIT V TACHEOMETRIC SURVEYING**

**6**

Tachometric systems - Tangential, stadia and sub tense methods - Stadia systems - Horizontal  
and inclined sights - Vertical and normal staffing - Fixed and movable hairs - Stadia constants -  
Anallactic lens - Subtense bar.

**TUTORIAL: 15**

**L = 45, T = 15, TOTAL = 60**

#### **TEXT BOOKS :**

Dr.B.C.punmia,Ashok K Jain, Arun K Jain, Surveying Vol.I, Laxmi Publications, 2009  
Surveying and leveling . S.C.Rangwala and P. S. Rangwala, Charotar Publishing House  
Pvt. Ltd, 2005

#### **REFERENCES:**

Clark D., Plane and Geodetic Surveying, Vols. I and II, C.B.S. Publishers and  
Distributors, Delhi, Sixth Edition, 1971.  
James M.Anderson and Edward M.Mikhail, Introduction to Surveying, McGraw-Hill Book  
Company, 1985.

## CE 2305 ENVIRONMENTAL ENGINEERING

L T P C  
3 1 0 4

**PREREQUISITE** Nil

### **GOAL**

To make the students understand about the water borne diseases, important of water treatment including disinfection of water.

### **OBJECTIVES**

The course should enable the students to :

Learn the population forecasting methods, water demand, source identifications, transportation and treatment of surface water.

Know about the different operations and processes involved in water treatment.

Study about sewerage system for collection and transmission of sanitary sewage.

Understand the design principles sewage and sludge treatment.

Study about the safe disposal sewage.

### **OUTCOME**

The students will be able to:

Design the various water treatment units in the water supply system.

Describe the water treatment processes such as flocculating, sedimentation, filtration, disinfection etc.,

Design sewers for transmission of sanitary sewage and the pumping units.

Design sedimentation tanks, aerator tank, trickling filter, septic tank etc.,

Apply the suitable technique for the disposal sewage.

### **UNIT I WATER SUPPLY SYSTEMS - SOURCE & CONVEYANCE**

**6**

Objectives - Population forecasting - Design period - Water demand characteristics - Sources of water - Source selection - Water quality parameters & significance - Standards - Intake structures - Conveyance - Hydraulics - Laying, jointing & testing of pipes - Pump selection - appurtenances

### **UNIT II DESIGN PRINCIPLES OF WATER TREATMENT**

**10**

Objectives - Selection of unit operations and processes - Principles of flocculation, sedimentation, filtration, disinfection - Design principles of flash mixer, flocculator, clarifiers, filters - Disinfection devices - Softening - Demineralisation - Aeration - Iron removal - Defluoridation - Operation and Maintenance aspects - Residue Management

### **DISTRIBUTION**

Requirements - Components - Service reservoir design - Analysis of distribution network - Hardy Cross method - Equivalent Pipe method - computer application - Leak detection.

<b>UNIT III SEWERAGE SYSTEM : COLLECTION &amp; TRANSMISSION</b>	<b>10</b>
Sources of wastewater - Quantity of sanitary sewage - Storm run off estimation - Wastewater characteristics and significance - Effluent disposal standover - Design of sewers - Computer applications - Laying, jointing and testing of sewers - Sewer appurtenances - Pump selection	
<b>UNIT IV SEWAGE TREATMENT &amp; DESIGN PRINCIPLES</b>	<b>10</b>
Objectives - Selection of unit operation and process - Design principles of primary and secondary treatment, screen chamber, grit chamber, primary sedimentation tanks, activated sludge process - Aeration tank & oxidation ditch - Trickling filter - Stabilisation ponds - Septic tanks with soak pits - Sludge: treatment and disposal - Biogas recovery - Sewage farming	
<b>UNIT V DISPOSAL OF SEWAGE</b>	<b>9</b>
Disposal on land - Disposal into water bodies - Oxygen sag curve - Streeter Phelp's model - Wastewater reclamation techniques	

**TOTAL = 45**

**TEXT BOOKS**

- Garg, S.K., "Environmental Engineering I & II", Khanna Publishers, New Delhi
- Modi, P.N., "Environmental Engineering I & II", Standard Book House, Delhi - 6

**REFERENCES**

- Manual on Water Supply and Treatment, CPHEEO, Government of India, New Delhi, 1999.
- Manual on Sewerage and Sewage Treatment, CPHEEO, Government of India, New Delhi, 1993.
- Hand book on Water Supply and Drainage, SP35, B.I.S., New Delhi, 1987.
- Metcalf and Eddy, M.C., "Wastewater Engineering - Treatment & Reuse", Tata McGraw-Hill Publications, New Delhi, 2003.

## CE 2331 COMPUTER AIDED BUILDING DRAWING

L T P C  
0 0 3 2

**PREREQUISITES** ME 2101

### GOAL

To introduce the students to draft the plan, elevation and sectional views of the buildings using Auto CADD.

### OBJECTIVES

To develop the students to draft building drawings using Auto CADD.

### OUTCOME

The students will be able to draft on computer building drawings Industrial buildings and framed structures (Plan, elevation and sectional views) in accordance with development and control rules satisfying orientation and functional requirements.

### LIST OF EXPERIMENTS

Sl. No.	Description	Hours
1.	Buildings with load bearing walls (Flat and pitched roof) - Including details of doors and windows	12
2.	RCC framed structures	9
3.	Industrial buildings - North light roof structures - Trusses	12
4.	Perspective view of one and two storey buildings	12

### TEXT BOOKS

- Civil Engg. Drawing & House Planning - B.P. Verma, Khanna publishers, Delhi  
Building drawing & detailing - Dr. Balagopal & T.S. Prabhu, Spades Publishers, Calicut.

### REFERENCES

- Shah, Tata McGraw- Hill Building drawing  
Dr. N. Kumaraswamy, A. Kameswara Rao, Charotar Publishing- Building planning & Drawing  
Shah, Kale and Patki, Building Drawing, Tata McGraw-Hill.

### Examination Guideline

30% of the end semester examination paper shall deal with planning, while the rest 70% shall be based on the drafting skill.

### LIST OF EQUIPMENTS

Sl. No.	Description of Equipments	Quantity
1.	Computer system of Pentium IV or equivalent	1 for each student
2.	Licensed version of any reputed Analysis, Design & Drafting software	1 copy for a set of 3 students

**CE 2332 COMPUTER AIDED STRUCTURAL ANALYSIS LABORATORY**

**L T P C**  
**0 0 3 2**

**PREREQUISITES** CE 2301, CE 2201

**GOAL**

To impart knowledge in analyzing the structures using software.

**OBJECTIVES**

To get exposed to the usage of software in the analysis of structures and also testing of structural components through virtual lab.

**OUTCOME**

The students will be able to analyze the structures using software.

**LIST OF EXPERIMENTS**

- |    |   |    |
|----|---|----|
| 1. | Introduction to Structural Engineering virtual lab                              | 9  |
| 2. | Analysis of Continuous beams and Portal Frames                                  | 12 |
| 3. | Analysis of Trusses   | 12 |
| 4. | Analysis of Multi Storied Buildings- Residential Buildings,Commercial Buildings | 12 |

**SOFTWARES REQUIRED**

STAAD PRO - Software

ANSYS Civil.

**Total = 45**



## CE 2333 SURVEY LABORATORY

L T P C  
0 0 3 2

**PREREQUISITES** CE 2304

### **GOAL**

To impart the students with the knowledge about the different types of surveying and leveling field techniques.

### **OBJECTIVE**

To conduct experiments on Surveying and Levelling.

### **OUTCOME**

Students will possess knowledge about chain surveying, compass surveying, plane table surveying, Levelling ,Theodolite survey, Tachometric survey and contouring.

### **LIST OF EXPERIMENTS**

1.	Study of chains and its accessories	3
2.	Aligning, Ranging and Chaining	3
3.	Chain Traversing	3
4.	Compass Traversing	3
5.	Plane Table Surveying	3
6.	Study of levels and levelling staff	6
7.	Fly levelling	6
8.	Check levelling	6
9.	LS and CS	3
10.	Theodolite survey traverse	3
11.	Tachometry - Tangential system - Stadia system - Subtense system.	6

**Total = 45**

**SEMESTER IV**  
**MA 2401 NUMERICAL METHODS**

**L T P C**  
**3 1 0 4**

**GOAL**

To create the awareness and comprehensive knowledge in numerical solutions.

**OBJECTIVES**

The course should enable the students to:

Learn the techniques of solving the algebraic and transcendental equations.

Learn to interpolate using Newton's forward and backward difference formulae for equal and unequal intervals

Understand the use of numerical differentiation and understands to find the approximate area using numerical integration.

Understand solving numerically the initial value problems for ordinary differential equations using single step and multi step method.

Learn the methods of solving second order partial differential equations numerically and use it to solve initial and boundary value problems for partial differential equations.

**OUTCOME**

The students should be able to:

Find out the roots of nonlinear (algebraic or transcendental) equations, solutions of large system of linear equations by direct and indirect methods.

Solve problems where huge amounts of experimental data are involved, the methods discussed on interpolation will be useful in constructing approximate polynomial to represent the data and to find the intermediate values.

Use the numerical differentiation and integration when the function in the analytical form is too complicated or the huge amounts of data are given such as series of measurements, observations or some other empirical information.

Solve engineering problems which are characterized in the form of nonlinear ordinary differential equations, since many physical laws are couched in terms of rate of change of one independent variable

Solve the initial and boundary value problems related heat flow, both one and two dimensional and vibration problems. Understands the numerical techniques of solving the partial differential equation in engineering applications.

**UNIT I SOLUTION OF ALGEBRAIC AND TRANSCENDENTAL EQUATIONS**

**12**

Linear interpolation methods (method of false position) - Newton's method - Statement of Fixed Point Theorem - Fixed point iteration:  $x=g(x)$  method. Solution of linear algebraic system of equations - Direct methods - Gauss-Jordon method and Crout's method - Iterative method: Gauss-Seidel method.

**UNIT II INTERPOLATION AND APPROXIMATION****12**

Interpolation - equal intervals - Newton's forward and backward difference formulae - problems. Interpolation-unequal intervals - Newton's divided difference formula - Lagrange's and inverse interpolation-problems.

**UNIT III NUMERICAL DIFFERENTIATION AND INTEGRATION****12**

Numerical differentiation - Newton's forward and backward difference - Divided differences and finite differences - Numerical integration by trapezoidal and Simpson's 1/3 and 3/8 rules. Two and Three point Gaussian quadrature formulae - Double integrals using trapezoidal and Simpson's rules.

**UNIT IV INITIAL VALUE PROBLEMS FOR ORDINARY DIFFERENTIAL EQUATIONS** **12**

Single step methods: Taylor series method - first order-second order and simultaneous - Euler and Modified Euler methods. Fourth order Runge - Kutta method for solving first and second order equations - Multi-step methods: Milne's and Adam's predictor and corrector methods.

**UNIT V INITIAL AND BOUNDARY VALUE PROBLEMS FOR PARTIAL DIFFERENTIAL EQUATIONS** **12**

Finite difference solution of second order ordinary differential equation - classification of partial differential equations - Finite difference solution of two dimensional heat flow equations Laplace and Poisson equations. One dimensional heat equation by explicit and implicit methods - One dimensional wave equation.

**TOTAL = 60****TEXT BOOKS**

Kandasamy P, Thilagavathy K, Gunavathy K, "Numerical Methods", S.Chand Co. Ltd., New Delhi, 2003.

Chandrasekaran A. and Beena James, "Numerical Methods", Dhanam publications, Chennai, 2011.

**REFERENCES**

Burden R.L, and Faires T.D, "Numerical Analysis", Seventh Edition, Thomson Asia Pvt. Ltd., Singapore, 2002.

Gerald C.F, Wheatley P.O, "Applied Numerical Analysis", Sixth Edition, Pearson Education Asia, New Delhi, 2002.

Balagurusamy E, "Numerical Methods", Tata McGraw-Hill Pub.Co.Ltd, New Delhi, 1999.

## CE 2401 DESIGN OF STEEL STRUCTURES-I

L T P C  
3 1 0 4

**PREREQUISITES** CE 2202

### GOAL

To introduce the students to limit state design of structural components as per current codal provisions.

### OBJECTIVES

The course should enable the students to :

- Throw light on the of limit state design of steel structures and the design of connections.
- Be familiar with the design concepts of steel structural members subjected to tension.
- Understand the design concepts of the structural steel members subjected to compression.
- Be familiar with the design concepts of structural members subjected to bending .
- Be acquainted with the design concepts of the components of roof trusses.

### OUTCOME

The students will be able to :

- 1 Gain knowledge on the bolted and welded connections and the properties of steel.
  - Design the structural members subjected to tension.
  - Design single and compound compression members and the laced and Battened columns.
  - Develop knowledge in designing laterally supported and unsupported beams subjected to axial bending.
  - Design purlins and elements of the roof trusses.

**[Note: Limit State Design Only]**

### UNIT I INTRODUCTION 9

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

### UNIT II TENSION MEMBERS 6

Types of sections - Net area - Net effective sections for angles and Tee in tension - Design of connections in tension members - Use of lug angles - Design of tension splice - Concept of shear lag

### UNIT III COMPRESSION MEMBERS 10

Types of compression members - Theory of columns - Basis of current codal provision for compression member design - Slenderness ratio - Design of single section and compound section compression members - Design of lacing and battening type columns

### UNIT IV BEAMS 10

Design of laterally supported and unsupported beams - Built up beams-Beams subjected to bi-axial bending.

## **UNIT V ROOF TRUSSES AND INDUSTRIAL STRUCTURES**

**10**

Roof trusses - Roof and side coverings - Design loads, design of purlin and elements of truss; end bearing.

**TUTORIAL: 15**

**L = 45, T = 15, TOTAL = 60**

### **TEXT BOOKS :**

N.Subramanian , "Design of Steel Structures" , Oxford University press,2008.

S.K.Duggal, Limit State Design of Steel Structures, Tata McGraw Hill Education Pvt. Ltd, 2010

IS 800 -2007

### **REFERENCES:**

Dr.Ramachandra, Virendra Gehlot, "Limit State Design of Steel Structures", Scientific Publishers, New Delhi, 2010

"Teaching Resources for Structural Steel Design - Vol. I & II", INSDAG, Kolkatta.

Dr. V.L.Shah,S.S.Karve, "Limit State Design of Steel Structures", Structures Publications, 2009.

[www.steel\\_insdag.org](http://www.steel_insdag.org).

## CE 2402 DESIGN OF CONCRETE STRUCTURES - I

L T P C  
3 1 0 4

**PREREQUISITES** CE 2201

### **GOAL**

To introduce the different types of philosophies related to design of Reinforced Concrete Structures and design of basic elements such as slab, beam, column and footing which form part of any structural system.

### **OBJECTIVES**

The course should enable the students to :

- Know the methods of design of concrete structures.
- Understand the limit state design of slab and beam.
- Know the behavior of RC beam in shear and torsion.
- Get the concept of Limit state design of columns.
- Understand the Limit State design of footings and masonry structures.

### **OUTCOME**

The students will be able to:

- Describe the concept of elastic, ultimate, working stress and limit state method of design of concrete structures.
- Design one way, two way, rectangular slab, singly and doubly reinforced rectangular beam and flanged beam by Limit State Method.
- Design RC members for combined bending shear and torsion using Limit State Method.
- Analyse and design short and long columns.
- Design axially and eccentrically loaded rectangular and combined footing.

### **UNIT I METHODS OF DESIGN OF CONCRETE STRUCTURES**

**9**

Concept of elastic method ultimate load method and limit state method- advantages of limit state method over other methods-design codes and specification -Introduction to working stress method-IS 456 - limit state philosophy as detailed in current IS code

### **UNIT II LIMIT STATE DESIGN FOR FLEXURE**

**9**

Analysis and design of one way and two way slabs - rectangular slab subjected to uniformly distributed and concentrated loads - boundary conditions and corner effects - singly and doubly reinforced rectangular and flanged beams - design aids for flexure-deflection and crack width control.

### **UNIT III LIMIT STATE DESIGN FOR SHEAR, TORSION, BOND AND ANCHORAGE**

**9**

Behaviour of RC beams in shear and torsion-shear and torsion reinforcement-limit state design of RC members for combined bending shear and torsion- use of design aids

### **UNIT IV LIMIT STATE DESIGN OF COLUMNS**

**9**

Types of columns-analysis and design of short columns for axial un axial and bi axial bending- design of long columns- use of design aids

## **UNIT V LIMIT STATE DESIGN OF FOOTINGS**

**9**

Design of wall footing-design of axially and eccentrically loaded rectangular footing-design of combined rectangular footing for two columns only.

**TUTORIAL: 15**

**L = 45, T = 15, TOTAL = 60**

### **TEXT BOOKS:**

N. Krishnaraju, and R. N.Pranesh, " Reinforced Concrete Design", New Age International Pvt. Ltd.,2003

Varghese P C, Limit State Design of Reinforced Concrete, Prentice Hall of India, Private, Limited New Delhi, 2nd edition, 2007.

S.Unnikrishna Pillai Menon Devadas, Tata McGraw-Hill, 2003

### **REFERENCES:**

Mallick and Gupta, Reinforced Concrete Design, Oxford and IBH, Delhi, 1997

Design Aides to IS 456-1978 (SP-16)

Code of Practice for Plain and Reinforced Concrete - IS456-2000.

**PREREQUISITES** Nil

**GOAL**

To gain adequate knowledge on Engineering Properties of soil.

**OBJECTIVES**

The course should enable the students to :

Develop an understanding of the index properties of soils and the various methods of soil classification.

Be acquainted with permeability effective stress concepts and seepage through porous media and flow nets.

Understand the stress distribution and types of settlement in soil.

Gain knowledge about the different tests carried to find out the shear strength of soil.

Be acquainted with stability analysis of slopes.

**OUTCOME**

The students will be able to:

Classify the soils based on their properties

Assess the permeability and seepage characteristics of soil.

Find out the settlement of soil based on the stress distribution.

Assess the shear strength of various types of soil.

Analyse the stability of slopes using different methods.

**UNIT I INTRODUCTION**

**10**

Nature of Soil - Problems with soil - phase relation - sieve analysis - sedimentation analysis - Atterberg limits - classification for engineering purposes - BIS Classification system - Soil compaction - factors affecting compaction - field compaction methods and monitoring.

**UNIT II SOIL WATER AND WATER FLOW**

**8**

Soil water - Various forms - Influence of clay minerals - Capillary rise - Suction - Effective stress concepts in soil - Total, neutral and effective stress distribution in soil - Permeability - Darcy's Law-Permeability measurement in the laboratory - quick sand condition - Seepage - Laplace Equation - Introduction to flow nets -properties and uses - Application to simple problems.

**UNIT III STRESS DISTRIBUTION, COMPRESSIBILITY AND SETTLEMENT**

**10**

Stress distribution in soil media - Boussinesque formula - stress due to line load and circular and rectangular loaded area - approximate methods - Use of influence charts - Westergaard equation for point load - Components of settlement - Immediate and consolidation settlement - - laboratory consolidation test - Field consolidation curve - Normal Consolidation and Over Consolidation clays - problems on final and time rate of consolidation



**UNIT IV SHEAR STRENGTH****9**

Shear strength of cohesive and cohesionless soils - Mohr - Coulomb failure theory - Saturated soil and unsaturated soil (basics only) - Strength parameters - Measurement of shear strength, direct shear, Triaxial compression, UCC and Vane shear tests - Drained and undrained behaviour of clay and sand

**UNIT V SLOPE STABILITY****8**

Slope failure mechanisms - Modes - Infinite slopes - Finite slopes - Total and effective stress analysis - Stability analysis for purely cohesive and C- soils - Method of slices - Friction circle method - stability number - problems - Slope protection measures.

**TUTORIAL: 15****L = 45, T = 15, TOTAL = 60****TEXT BOOKS**

Punmia B.C., "Soil Mechanics and Foundations", Laxmi Publications Pvt. Ltd., New Delhi, 16th Edition, (2005).

Gopal Ranjan and Rao A.S.R., "Basic and applied soil mechanics", New Age International Publishers, New Delhi, 2000.

Venkatramaiah, C. "Geotechnical Engineering", New Age International Publishers, New Delhi, 1995

**REFERENCES**

Coduto, D.P., "Geotechnical Engineering Principles and Practices", Prentice Hall of India Private Limited, New Delhi, 2002.

McCarthy D.F., "Essentials of Soil Mechanics and Foundations Basic Geotechniques", Sixth Edition, Prentice-Hall, New Jersey, 2002.

Das, B.M, "Principles of Geotechnical Engineering", (fifth edition), Thomas Books/ cole, 2002

Muni Budhu, "Soil Mechanics and Foundations", John Willey & Sons, Inc, New York, 2000.

## CE 2404 CONSTRUCTION TECHNIQUES, EQUIPMENT AND PRACTICES

L T P C  
3 0 0 3

**PREREQUISITE** CE 2203

### **GOAL**

To make the students aware of the various construction techniques, practices and the equipments needed for different types of construction activities.

### **OBJECTIVES**

The course should enable the students to :

- Be acquainted with different construction practices used in building.
- Understand the various practices in sub structure construction.
- Understand the various practices in super structure construction.
- Understand the techniques in repair and rehabilitation of structures.
- Familiarize the various construction equipments used in the construction industry.

### **OUTCOME**

The students will be able to:

- Develop knowledge in construction of masonry and the various erection techniques.
- Develop knowledge in jacking, piling, dewatering and grouting techniques.
- Be acquainted with launching of girders, bridge decks, construction sequences in cooling towers, silos, chimney, sky scrapers and erection of articulated structures, braced domes and space decks.
- Choose the suitable repair techniques for the damaged building.
- Develop knowledge in various equipment needed for construction of various types of structures from foundation to super structure.

### **UNIT I CONSTRUCTION PRACTICES**

**15**

Specifications, details and sequence of activities and construction co-ordination - Site Clearance - Marking - Earthwork - masonry - stone masonry - concrete hollow block masonry - flooring - damp proof courses - construction joints - movement and expansion joints - pre cast pavements - Building foundations - basements - temporary shed - centering and shuttering sheet piles - slip forms - scaffoldings - de-shuttering forms - Fabrication and erection of steel trusses - laying brick -- weather and water proof - roof finishes - air conditioning - acoustic and fire protection.

### **UNIT II SUB STRUCTURE CONSTRUCTION**

**15**

Techniques of Box jacking - Pipe Jacking -under water construction of diaphragm walls and basement-Tunneling techniques - Piling techniques- driving well and caisson -Dewatering-- well points- sinking cofferdam - cable anchoring and grouting-driving diaphragm walls, sheet piles - shoring for deep cutting

**UNIT III SUPER STRUCTURE CONSTRUCTION****15**

Launching girders, bridge decks, off shore platforms - special forms for shells - techniques for heavy decks -Introduction to pre-stressing and Post tensioning, aerial transporting handling - erection of transmission towers - Construction sequences in cooling towers, silos, chimney, sky scrapers, bow string bridges, cable stayed bridges -Support structure for heavy Equipment and conveyors -Erection of articulated structures, braced domes and space decks

**UNIT IV REPAIR AND REHABILITATION****5**

Study on causes of building damage and deterioration -Methods of repair and restoration - Materials for repair

**UNIT V CONSTRUCTION EQUIPMENT****10**

Selection of equipment for earth work - earth moving operations - types of earthwork equipment - tractors, motor graders, scrapers, earth movers - Equipment for foundation and pile driving. Equipment for compaction, batching and mixing and concreting - Equipment for material handling and erection of structures - Equipment for dredging, trenching, tunneling, drilling, blasting -- dewatering and pumping equipment - Transporters.

**TOTAL = 60****TEXT BOOKS**

Varghese , P.C. Building construction, Prentice Hall of India Pvt. Ltd, New Delhi, 2007.

Shetty, M.S, Concrete Technology, Theory and Practice, S. Chand and Company Ltd, New Delhi, 2005.

Arora S.P. and Bindra S.P., Building Construction, Planning Techniques and Method of Construction, Dhanpat Rai and Sons, 1997.

**REFERENCES**

Gambhir, M.L, Concrete Technology, Tata McGraw-Hill Publishing Company Ltd, New Delhi, 2004

Jha J and Sinha S.K., Construction and Foundation Engineering, Khanna Publishers, 1993.

Sharma S.C. "Construction Equipment and Management", Khanna Publishers New Delhi, 1988.

Deodhar, S.V. "Construction Equipment and Job Planning", Khanna Publishers, New Delhi, 1988.

## CE2431 ENVIRONMENTAL ENGINEERING LABORATORY

L T P C  
0 0 3 2

**PREREQUISITES :** CE 2305

### GOAL

To get exposure about water and sewage analysis.

### OBJECTIVES

To conduct experiments for characterization of water and municipal sewage.

### OUTCOME

The students will be able to analyze the various parameters like pH, Total Solids, Total dissolved solids, iron and manganese, BOD, COD and chlorides , sulphate and dissolved oxygen in water and waste water.

### LIST OF EXPERIMENTS

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

### REFERENCES

Garg, S.K., "Environmental Engineering Vol. I & II", Khanna Publishers, New Delhi  
Modi, P.N., "Environmental Engineering Vol. I & II", Standard Book House, Delhi-6.

## CE 2432 GEO TECHNICAL LABORATORY

L T P C  
0 0 3 2

**PREREQUISITES** CE 2403

### GOAL

To expose the students in testing of different types of soils and to determine its characteristics experimentally.

### OBJECTIVES

To conduct experiments in different types of soils to determine the properties and characteristics.

### OUTCOME

The student acquires the capacity to test the soil and assess its Engineering and Index properties.

### LIST OF EXPERIMENTS

1.	Grain size distribution - Sieve analysis	3
2.	Grain size distribution - Hydrometer analysis	3
3.	Specific gravity of soil grains	3
4.	Relative density of sands	3
5.	Atterberg limits test	3
6.	Determination of moisture - Density relationship using standard Proctor test.	3
7.	Permeability determination (constant head and falling head methods)	3
8.	Determination of shear strength parameters.	3
9.	Direct shear test on cohesionless soil	3
10.	Unconfined compression test on cohesive soil	3
11.	Triaxial compression test	6
	One dimensional consolidation test (Determination of co-efficient of consolidation only)	6
13.	Field density test (Core cutter and sand replacement methods)	3

**Total = 45**

## REFERENCES

Soil Engineering Laboratory Instruction Manual", Published by the Engineering College Co operative Society, Chennai, 2002.

Head, K.H, "Manual of Soil Laboratory Testing (Vol-1 to 3)", John Wiley & Sons, Chichester, 1998.

Lambe T.W., "Soil Testing for Engineers", John Wiley and Sons, New York, 1990.

"I.S.Code of Practice (2720) Relevant Parts", as amended from time to time.

Saibaba Reddy, E. and Rama Sastri, K., "Measurement of Engineering Properties of Soils",

New Age International Publishers, New Delhi, 2002.

**SEMESTER V**  
**CE 2501 STRUCTURAL ANALYSIS - II**

**L T P C**  
**3 1 0 4**

**PREREQUISITES**    CE 2302

**GOAL**

To introduce the students to basic theory and concepts of structural analysis and, the classical methods of analysis of buildings.

**OBJECTIVES**

The course should enable the students to :

- Understand the principles involved in the analysis of determinate structures
- Study the concept of influence lines for the analysis of beams and trusses.
- Understand the concepts involved in the analyses of different types of arches.
- Study the analysis of continuous beams and frames using the classical method of analysis.
- Understand the concept of analysis of multi storey buildings.

**OUTCOME**

The students will be able to:

- Analyse trusses and frames using unit load method.
- Gain knowledge on the analysis procedure for moving loads and to get the shear force and bending moment for any complex type of moving loads.
- Analyse Hinged and fixed arches used in the construction industry.
- Analyse the different types of beams and portal frames using one of the classical methods of Slope Deflection Method.
- Gain knowledge to analyse Multistorey buildings using the Moment Distribution method, which is an iterative method often used in the analysis of indeterminate structures.

**UNIT I FLEXIBILITY METHOD FOR INDETERMINATE FRAMES 9**

Equilibrium and compatibility - Determinate Vs Indeterminate structures - Indeterminacy - Primary structure - Compatibility conditions - Analysis of indeterminate pin-jointed plane frames, continuous beams, rigid jointed plane frames (with redundancy restricted to two).

**UNIT II MATRIX STIFFNESS METHOD 9**

Element and global stiffness matrices - Analysis of continuous beams - Co-ordinate transformations - Rotation matrix - Transformations of stiffness matrices, load vectors and displacements vectors - Analysis of pin-jointed plane frames and rigid frames.

**UNIT III FINITE ELEMENT METHOD 9**

Introduction - Discretisation of a structure - Displacement functions - Truss element - Beam element.

**UNIT IV PLASTIC ANALYSIS OF STRUCTURES****9**

Statically indeterminate axial problems - Beams in pure bending - Plastic moment of resistance - Plastic modulus - Shape factor - Load factor - Plastic hinge and mechanism - Plastic analysis of indeterminate beams and frames - Upper and lower bound theorems

**UNIT V SPACE AND CABLE STRUCTURES****9**

Analysis of Space trusses using method of tension coefficients - Suspension bridges- cables with two and three hinged stiffening girders

**TUTORIAL: 15****L = 45, T = 15, TOTAL = 60****TEXT BOOKS**

- Vaidyantha, R. and Perumal, P., "Comprehensive structural Analysis - Vol.I & II",Laxmi Publications, New Delhi, 2003.
- S.S. Bhavikatti, Structural Analysis, Vol I & II, Vikas Publishing House Pvt.Ltd, 2011
- L.S.Negi & R.S.Jangid," Structural Analysis", Tata McGraw-Hill Publications, New Delhi, 2003.

**REFERENCES**

- Ghali.A, Nebille,A.M. and Brown,T.G. "Structural Analysis" A unified classical and Matrix approach" -5th edition. Spon Press, London and New York, 2003.
- Vazirani V.N, & Ratwani, M.M, "Analysis of Structures", Khanna Publishers, Delhi
- Structural Analysis - A Matrix Approach - G.S. Pandit & S.P. Gupta, Tata McGraw Hill
- Matrix Analysis of Framed Structures - Jr. William Weaver & James M. Gere, CBS Publishers and Distributors,Delhi.



## CE 2502 DESIGN OF STEEL STRUCTURES - II

L T P C  
3 1 0 4

**PREREQUISITES** CE 2401

### **GOAL**

To give exposure to the advanced design of steel structures such as plate girder, gantry girder, columns, light gauge steel sections and design of beams using plastic theory.

### **OBJECTIVES**

The course should enable the students to :

- Understand the design concepts of plate girder.
- Familiar with the design concepts of gantry girder.
- Understand the behavior of columns subjected to axial load and bending moment.
- Know about light gauge sections and its design concepts.
- Familiar with the design concepts of beams using plastic theory.

### **OUTCOME**

The students will be able to:

- Design the plate girder and its components.
- Gain knowledge on the design of gantry girder for moving loads .and fatigue effects.
- Design simple and built up columns subjected to axial load and bending moment.
- Design beams and columns using light gauge steel sections.
- Design the steel and concrete beams using plastic theory.

### **UNIT I PLATE GIRDER 9**

Design of plate girders - web and flange design - curtailment of flange plates - Design of stiffeners and splices.

### **UNIT II GANTRY GIRDERS 9**

Introduction - Loading Considerations - Maximum Loads Effects - Fatigue Effects - Selection of Gantry Girder - Design of Gantry Girder.

### **UNIT III COLUMNS SUBJECTED TO COMBINED BENDING AND AXIAL LOADS 9**

Design of simple and built up columns subject to combined bending and axial loads - design of column base and connection to foundation.

### **UNIT IV LIGHT GAUGE STEEL SECTIONS 9**

Behaviour - Design of flexural and compression members

## UNIT V PLASTIC THEORY

9

Shape factor - plastic hinge - plastic moment - plastic analysis of beams - design of beams.

**TUTORIAL: 15**

**L = 45, T = 15, TOTAL = 60**

### TEXT BOOKS

N.Subramanian, "Design of Steel Structures" , Oxford University press, 2008.

S.K.Duggal, Limit State Design of Steel Structures, Tata McGraw Hill Education Pvt.Ltd, 2010

IS.800 -2007, IS 801- 1975

### REFERENCES

Dr.Ramachandra, Virendra Gehlot, "Limit State Design of Steel Structures", Scientifi Publishers, New Delhi, 2010

"Teaching Resources for Structural Steel Design - Vol. I & II", INSDAG, Kolkatta.

Dr. V.L.Shah, S.S.Karve, "Limit State Design of Steel Structures", Structures Publicatins, 2009.  
[www.steel\\_insdag.org](http://www.steel_insdag.org)

J.Rhodes, "Design of Cold-Formed Steel Members", Elsevier Science Publishers 1991.

## CE 2503 DESIGN OF CONCRETE STRUCTURES - II

L T P C  
3 1 0 4

**PREREQUISITES** CE 2402

### GOAL

To give an exposure to advanced topics in structural design comprising of RCC retaining walls, water tanks, yield line theory and pre stressed concrete structures.

### OBJECTIVES

The course should enable the students to :

Understand the basic principles of designing RCC cantilever and counter fort retaining walls.

Understand the design and detail of different types of water tanks.

Know about the pre stressed concrete materials and systems.

Create an awareness on yield line theory of slabs.

Have a comprehensive design knowledge related to structures that are likely to be encountered in professional practice.

### OUTCOME

The students will be able to:

Design Reinforced Concrete cantilever and counter fort retaining walls.

Design underground and overhead circular and rectangular water tanks.

Gain knowledge on the prestressing methods and the design and analysis of the Pre tensioned and post tensioned concrete beams and losses in pre stress.

Analyse square, rectangular and triangular slabs using yield line theory.

Familiarise the design principles of road bridges and design the flat slabs and staircases.

### UNIT I RETAINING WALLS

9

Design of cantilever and counter fort retaining walls

### UNIT II WATER TANK

9

Underground rectangular tanks - Overhead circular and rectangular tanks - Design of staging and foundations.

### UNIT III PRINCIPLES OF PRESTRESSING

9

Materials for prestressed concrete - Different methods and systems - introduction to prestressing and post tensioning- Uniform and non uniform pre - stressing - Losses in prestress - Analysis of simply supported beams with straight and parabolic tendons.

### UNIT IV YIELD LINE THEORY

9

Application of virtual work method to Square, Rectangular and Triangular slabs.

**UNIT V ADVANCED TOPICS****9**

Design of staircases (ordinary and doglegged) - Design of flat slabs - Principles of design of road bridges for IRC loading.

**TUTORIAL:15****L = 45, T = 15, TOTAL = 60****TEXT BOOKS:**

N. Krishnaraju, R.N.Pranesh, "Design of Reinforced Concrete Design" New Age International (P) Ltd. Publishers, 2003

Jaikrishna and O.P. Jain, Plain and Reinforced Concrete, Vol. I & II, Nem chand & Brothers, 2007.

N. Krishnaraju, "Bridge Engineering", Oxford and IBH publications.

**REFERENCES:**

S.N.Sinha, "Reinforced Concrete Design", Tata Mc Graw Hill, New Delhi, 2002.

A.M. Neville, Properties of Concrete Structures, 4th Edition., - Longman (Pearson Education).

**NOTE:** IS 456:2000, IRC Bridge codes, BIS 3370, IS 1343 are permitted in the Examinations.

**PREREQUISITES** Nil

**GOAL**

To introduce the students to the basic concepts of Irrigation system as they pertain to agriculture and power generation.

**OBJECTIVES**

The course should enable the students to :

- Understand the necessity of irrigation.
- Be familiar with different methods of irrigation.
- Be acquainted with the different hydraulic structures.
- Be familiar with the types of irrigation.
- Be acquainted with integration of management with irrigation systems.

**OUTCOME**

The students will be able to:

- Identify the need for irrigation.
- Describe the different types of irrigation.
- Describe the canal irrigation system.
- Design the hydraulic structures based on hydraulic parameters.
- Describe how the management and irrigation system are integrated.

**UNIT I INTRODUCTION 9**

Irrigation - Need for irrigation - Merits and demerits of irrigation - Crop and crop seasons - consumptive use of water - Duty - Factors affecting duty - Irrigation efficiencies - Planning and Development of irrigation projects.

**UNIT II IRRIGATION METHODS 9**

Canal irrigation - Lift irrigation - Tank irrigation - Flooding methods - Merits and demerits - Sprinkler irrigation - Drip irrigation.

**UNIT III DIVERSION AND IMPOUNDING STRUCTURES 9**

Weirs - elementary profile of a weir - weirs on pervious foundations - Types of impounding structures Tanks, Sluices and Weirs - Gravity dams - Earth dams - Arch dams - Spillways - Factors affecting location and type of dams - Forces on a dam.

**UNIT IV CANAL IRRIGATION 9**

Classification of canals - Alignment of canals- Canal drops -Cross drainage works - Canal Head works - Canal regulators - River Training works.

## **UNIT V IRRIGATION WATER MANAGEMENT**

**9**

Need for optimisation of water use - Minimising irrigation water losses - On farm development works -Participatory irrigation management - Water users associations - Changing paradigms in water management.

**TOTAL = 45**

### **TEXT BOOKS**

- S.K. Garg, "Irrigation Engineering And Hydraulic Structures" , Khanna publishers, 2004  
Sharma R.K., and Sharma T.K., "Irrigation Engineering", S. Chand and company, New Delhi, 2008.  
Gupta, B.L, & Amir Gupta, "Irrigation Engineering", Satya Praheshan, New Delhi

### **REFERENCES**

- A.M.Michael, "Irrigation, Theory and Practices", Vikas Publishing House Pvt.Ltd,Second Edition , 2008  
Dilip Kumar Majumdar, "Irrigation Water Management (Principles & Practices)", Prentice Hall of India (P), Ltd.  
Basak, N.N, "Irrigation Engineering", Tata McGraw-Hill Publishing Co.

## CE 2505 HYDRAULIC ENGINEERING

L T P C  
3 1 0 4

**PREREQUISITES** CE 2303

### **GOAL**

To introduce the students to the basic concepts of open channel flow and to provide the students with skills to design Hydraulic Machines.

### **OBJECTIVES**

The course should enable the student to :

- Understand the principles behind open channel flow.
- Differentiate between uniform and non- uniform flow.
- Throw light on impulse momentum principle.
- Be acquainted with the design the concepts of turbines.
- Be familiar with the design the concepts of pumps.

### **OUTCOME**

The students will be able to:

- Describe the principles of most economical sections.
- Identifying the gradually varied flow profiles.
- Apply the velocity triangle concepts to find out the force & power of hydraulic machines.
- Describe the different types of turbines and their performance.
- Describe the principles of pumps and their applications.

### **UNIT I OPEN CHANNEL FLOW 9**

Open channel flow - Types of flow - Velocity distribution in open channel - Wide open channel - Specific energy - Critical flow and its computation.

### **UNIT II UNIFORM AND NON UNIFORM FLOW 9**

Uniform flow - Velocity measurement - Manning's and Chezy's formula - Determination of roughness coefficients -Most economical rectangular and trapezoidal sections- Hydraulic Jumps.

### **UNIT III IMPULSE MOMENTUM PRINCIPLE 9**

Application of momentum principle - Introduction to impact of jets on vanes - velocity triangles.

### **UNIT IV TURBINES 9**

Turbines - classification - Impulse and Reaction turbines - draft tube and cavitations - performance of turbines.

## UNIT V PUMPS

9

Centrifugal pump - multistage Pumps - Jet and submersible pumps - reciprocating pump - negative slip - flow separation conditions - air vessels -indicator diagram.

**TUTORIAL: 15**

**L = 45, T = 15, TOTAL = 60**

### TEXT BOOKS

Subramanyam K., "Flow in Open channels", Tata McGraw-Hill Publishing Company, 2004.

P.N.Modi,S.M.Seth," Hydraulics and Fluid Mechanics", Standard Book House,15<sup>th</sup> Edition,2005

R.K. Bansal "Fluid Mechanics and Hydraulic Machines", Laxmi Publication (P) Publishing House (P) Ltd., 2002.

Ranga Raju, K.G., "Flow through Open Channels", Tata McGraw-Hill.

### REFERENCES

Ven Te Chow, "Open-Channel Hydraulics", McGraw-H: Q Book company, 1996.

Ramamirtham S., "Fluid Mechanics, Hydraulics and Fluid Machines", Dhanpat Rai & Sons, Delhi, 1998.

John A. Roberson, "Hydraulic Engineering", Jaico Publishing House, 1998.



## PCM 104 ADVANCED CONCRETE TECHNOLOGY

L T P C  
3 0 0 3

### GOAL

To achieve comprehensive knowledge in concrete technology which would help the students to match their skills in materials understanding with the current requirements of the construction industry.

### OBJECTIVES

The course should enable the students to

- To study about the properties of cement
- To get exposure to different types of mineral and chemical admixtures.
- To know about the properties of aggregates.
- To understand the concept of mix proportioning of concrete.
- To study about the durability related properties of concrete.

### OUTCOME

The students will be able to :

- The students will gain knowledge of constituents, manufacturing process and testing of cement.
- Make proper choice of retarders, air entraining agents, plasticizers and other admixtures that should be used in concrete.
- Choose proper testing methods and aware of codes available for aggregates.
- Execute mix proportioning of concrete and become aware of influence of addition of fibre on concrete properties.
- Develop knowledge of durability testing methods of concrete.

### UNIT I CEMENT 12

Composition of OPC-Manufacture-Modified Portland cements-Hydration process of Portland cements-Structure of Hydrated cement Pastes.

### UNIT II ADMIXTURES 12

Mineral admixtures-Slags-Pozolanas and Fillers-Chemical Admixtures-Solutes Retarders-Air Entraining Agents-Water proofing compounds-Plasticizers and Super Plasticizers

### UNIT III AGGREGATES 12

Shape and Mechanical properties-Absorption and Physical durability-Chemical stability and packing Characteristics.

### UNIT IV FRESH CONCRETE 12

Workability-Mix proportioning-Mixes incorporating Fly-Ash Mixes for High performance concrete-Fibre reinforced concrete.

**UNIT 5.PROPERTIES AND DURABILITY OF CONCRETE**

**12**

Interfacial Transition zone-Fracture strength-Mechanical properties-High strength concrete-Shrinkage-Creep- Other properties.Basic consideration-Stability of constituents-Chemical Attack-Corrosion of Reinforcing steel.

**TOTAL = 60**

**TEXT BOOK:**

Neville, A.M., "Properties of concrete ", 4th edition, Longman, In printed.

**REFERENCES:**

Metha P.K. and Montreio P.J.M., "Concrete Structure Properties and Materials ", 2nd edition, Prentice Hall, 1998.

Mindaas and Young, "Concrete ", Prentice Hall, 1998.

## EL 2431 COMMUNICATION SKILLS & PERSONALITY DEVELOPMENT

L T P C  
2 0 2 3

### GOAL

The goal of the programme is to provide the learners with the methods and materials required for becoming accomplished personalities through the medium of English.

### OBJECTIVES

The course is expected to enable students to:

Be aware of self-knowledge by exposure to soft skills, values, behaviour, attitudes, temperamental changes, and a positive attitude to life.

Learn personality traits and undergo personality tests to determine their own personality characteristics and the scope for improvement.

Cultivate the art of speaking fluently making use of proper gestures, tone and voice modulation, adding humour to the speech.

Figure out the need to work in teams, adorn or accept team leadership, and make use of body language to enhance team spirit.

Be familiar with the art of managing self, people, work and time, keeping in mind problems like time-wasters and stress-builders.

### OUTCOME

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

Apply the knowledge gained to improve upon their values, behaviour, attitude, and develop the soft skills required for home, workplace and the society.

Employ the concept of personality traits and build up an accomplished personality that would be pleasing to people around so as to influence them positively.

Develop a personal style and communicate fearlessly and effectively in a convincing manner so as to impress listeners or the audience.

Participate in presentations, group discussions, debates and mock interviews making good use of language skills and interpersonal relationships.

Comprehend stress-management tips to overcome stress-prone habits and develop a career plan with personal, familial and societal goals for success.

### UNIT I

12

Values and attitudes - Value-formation - Values & education - Terminal & Instrumental values - Civic responsibilities - The power of Personal/ Cultural/ Social values -- Behaviour and attitudes -- Features of attitudes - Developing positive attitude - Overcoming negative attitude -- People skills - Soft skills as per the Work Force Profile - The four temperaments - Sanguine - Choleric - Melancholic - Phlegmatic -- Tests for Personal Chemistry.

**UNIT II****12**

What is personality development? - Types of personalities as per (i) Heredity (ii) Environment (iii) Situation - the 16 personality factors - MBTI Tests - Personality types - Increasing self awareness: Assessing one's locus of control, Machiavellianism, self-esteem, self-monitoring, risk-taking, Type A, Type B personality elements - Intellectual and physical abilities for jobs -- Personality tests.

**UNIT III****12**

Developing the art of speaking - How to get rid of stage fright? - Enhancing fluency - Modulating voice Enunciation - Positive and negative gestures - Preparation - How to begin? - How to convince the listeners? - How to wind up the speech? - Adding humour and illustration - Developing one's own style Types of style - How to influence the audience? - How to become an effective speaker? -- Tests for effective speaking.

**UNIT IV****12**

Team work - Team building - Team leadership -- How to face an interview? -- How to participate in a group discussion? - How to argue for or against in a debate? - Body language - Non-verbal communication - Personal appearance - Facial expression - Posture - Gestures - eye contact - Etiquette - Voluntary and involuntary body language - Gender implications -- Tests.

**UNIT V****12**

Managing self, people, work, situations - Time-management - Secrets of time-management - Time-wasters - Stress -- Kinds of stress - Spotting stress - Stress-builders - Stress - management tips - Stress-prone habits -- Goals - Career planning - Interpersonal interaction - Interpersonal relationships -- Tests.

## REFERENCES

- Burlington, V.T. Group Interaction in High Risk Environments. Ashgate Publication, 2004.
- Fisher, Kimball. Leading Self-directed Work Teams: A Guide to Developing New Team Leadership Skills. New York, NY: McGraw Hill, 2000.
- Ted W. Engstrom and R. Alec Mackenzie. Managing Your Time: Practical Guidelines on the Effective Use of Time. 2008.
- Burnard, Philip. Training Games for Interpersonal Skills. McGraw Hill, Inc., New York, 1992.
- Greenwich, Carolyn. The Fun Factor, McGraw Hill, Inc., New York, 1997.

**Study material will be prepared by the Department of Languages.**

**Tests suggested will be prepared by a senior faculty of the department.**

**Movies will be screened to discuss and debate on the topics introduced in each unit.**

## CE 2531 STRENGTH OF MATERIALS LABORATORY

L T P C  
0 0 3 2

**PREREQUISITES** CE 2301

### **GOAL**

To expose the the testing of different materials under the action of various forces and to determine the characteristics experimentally.

### **OBJECTIVES**

To expose the students to different methods available for testing materials under the action of various forces like axial compression axial tension, torsion, flexure, shear etc.

### **OUTCOME**

The students will be able to obtain the strength of the materials and stiffness properties of structural elements experimentally.

### **LIST OF EXPERIMENTS**

- |    |  |   |
|----|--|---|
| 1. | Test involving axial compression to obtain the stress - strain curve                   | 6 |
| 2. | Test involving axial tension to obtain the stress - strain curve and the strength      | 6 |
| 3. | Test involving torsion to obtain the torque vs. angle of twist and hence the stiffness | 6 |
| 4. | Test involving flexure to obtain the load deflection curve and hence the stiffness     | 6 |
| 5. | Tests on springs   | 3 |
| 6. | Hardness tests   | 3 |
| 7. | Shear test   | 6 |
| 8. | Test for impact resistance   | 3 |

**Total = 45**

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

**SEMESTER VI**  
**MG 2001 PRINCIPLES OF MANAGEMENT**

**L T P C**  
**3 0 0 3**

**PREREQUISITES** Nil

**GOAL**

To make the students to understand the different managerial functions like planning, organizing, staffing, leading and controlling .

**OBJECTIVES**

The course should enable the students to :

- Be familiar with the historical development of organizations.
- Understand the various steps involved in planning.
- Understand the Structure and Process involved in formal and informal organization.
- Impart knowledge on the principles of leadership and human factors.
- Impart knowledge on System and process of Controlling.

**OUTCOME**

The students will be able to:

- Visualize the development of various business organizations.
- Be acquainted with steps involved in planning.
- Gain knowledge in departmentation by different strategies.
- Be acquainted with different motivation techniques.
- Describe the various issues on process control.

**UNIT I HISTORICAL DEVELOPMENT** **9**

Definition of Management - Science or Art - Management and Administration - Development of Management Thought - Contribution of Taylor and Fayol - Functions of Management - Types of Business Organisation.

**UNIT II PLANNING** **9**

Nature & Purpose - Steps involved in Planning - Objectives - Setting Objectives - Process of Managing by Objectives - Strategies, Policies & Planning Premises- Forecasting - Decision-making.

**UNIT III ORGANISING** **9**

Nature and Purpose - Formal and informal organization - Organization Chart - Structure and Process - Departmentation by difference strategies - Line and Staff authority - Benefits and Limitations - De-Centralization and Delegation of Authority - Staffing - Selection Process - Techniques - HRD - Managerial Effectiveness.

**UNIT IV DIRECTING****9**

Scope - Human Factors - Creativity and Innovation - Harmonizing Objectives - Leadership - Types of Leadership Motivation - Hierarchy of needs - Motivation theories - Motivational Techniques - Job Enrichment - Communication - Process of Communication - Barriers and Breakdown - Effective Communication - Electronic media in Communication.

**UNIT V CONTROLLING****9**

System and process of Controlling - Requirements for effective control - The Budget as Control Technique - Information Technology in Controlling - Use of computers in handling the information - Productivity - Problems and Management - Control of Overall Performance - Direct and Preventive Control - Reporting - The Global Environment - Globalization and Liberalization - International Management and Global theory of Management.

**TOTAL = 45****TEXT BOOKS**

- G.K. Vijaya Raghavan, M.Sivakumar, Principles of Management, Lakshmi Publications, Jan 2010.
- M. Govindarajan, S. Natarajan, Principles Of Management, Prentice Hall of India Learning Pvt. Ltd 2005
- Harold Kooritz & Heinz Weihrich "Essentials of Management", Tata McGraw-Hill, 1998
- Joseph L Massie "Essentials of Management", Prentice Hall of India,(Pearson) Fourth Edition, 2003.

**REFERENCES**

- Tripathy PC And Reddy PN, "Principles of Management", Tata McGraw-Hill, 1999.
- Decenzo David, Robbin Stephen A, "Personnel and Human Reasons Management", Prentice Hall of India, 1996
- JAF Stomer, Freeman R. E and Daniel R Gilbert Management, Pearson Education, Sixth Edition, 2004.
- Fraidoon Mazda, "Engineering Management", Addison Wesley, 2000.



## PCM 102 CONSTRUCTION EQUIPMENT

L T P C  
3 0 0 3

### GOAL

To study the latest construction equipments used in the industry .It also helps to understand the basics of equipment management which includes cost control, maintenance and safety in equipment handling.

### OBJECTIVES

The course should enable the students to:

Study the management of construction.

Be familiar with the Earthwork Equipments.

Be acquainted with the knowledge of other Construction Equipment.

Be familiar in the Materials Handling Equipment.

Be familiar with the Equipment for production of Aggregate and Concreting.

### OUTCOMES

The students will be able to :

Implement the management methods in the project in terms of control of cost, Maintenance and safety.

Make use of the different types of Earthwork equipments like tractors, motor graders, scrapers, front end waders and earth movers.

Select the particular equipments for Trenching, Tunneling, Drilling, Blasting, Compaction, Dewatering, Pumps and the Pile Driving.

Develop Awareness on Material Handling Equipment like Forklift, Portable Material Bins, Conveyors and Hauling Equipment

Gain Knowledge and use of Equipment in the Production of aggregate using crushers, accessories, and concrete batching and mixing plant.

### UNIT I CONSTRUCTION EQUIPMENT MANAGEMENT 12

Identification-Planning-Equipment management in projects -Maintenance management-S Replacement-Cost control of equipment-Depreciation Analysis-Safety Management

### UNIT II EQUIPMENT OF EARTHWORK 12

Fundamentals of earthwork operations-Earth moving operations-Types of Earthwork Equipment-Tractors, Motor Graders, Scrapers, Front end waders, Earth Movers.

### UNIT III OTHER CONSTRUCTION EQUIPMENT 12

Equipment for Dredging, Trenching, Tunneling, Drilling, Blasting-Equipment for compaction-Erection Equipment-Types of pumps used in construction-Equipment for Dewatering and Grouting-Foundation and Pile Driving Equipment

**UNIT IV MATERIALS HANDLING EQUIPMENT** **12**

Forklifts and Related Equipment-Portable Material Bins-Conveyors-Hauling Equipment

**UNIT V EQUIPMENT FOR PRODUCTION OF AGGREGATE AND CONCRETING** **12**

Crushers-Feeders-Screening Equipment-Handling Equipment-Batching and Mixing Equipment -  
Hauling, Pouring and Pumping Equipment-Transporters

**TOTAL = 60**

**TEXT BOOKS**

Peurifoy, R.L., Ledbetter, W.B.and Schexnayder, C., " Construction Planning, Equipment and Methods ", 7th Edition, McGraw Hill, Singapore, 2001.

Sharma S.C. "Construction Equipment and Management ", Khanna Publishers New Delhi, 1988

**REFERENCES**

Deodhar, S.V. "Construction Equipment and Job Planning ", Khanna Publishers, New Delhi, 3rd Edition, 2007.

Dr. Mahesh Varma, "Construction Equipment and its Planning and Application ", Metro-politan Book Company, New Delhi - 1997.

## CE 2601 FOUNDATION ENGINEERING

L T P C  
3 0 0 3

**PREREQUISITES** CE 2403

### GOAL

To make the students understand the need of soil investigation, its importance in the choice of foundation and the design of suitable foundation.

### OBJECTIVES

The course should enable the students to :

- Get a basic understanding of the geotechnical site investigation.
- Understand the types of foundation and the design concepts of shallow foundation.
- Get exposed to footings and rafts.
- Get the concepts of pile foundation.
- Know about Retaining walls.

### OUTCOME

The students will be able to:

- Describe different soil exploration techniques.
- Gain knowledge on the factors affecting bearing capacity of shallow foundation, various tests to find the bearing capacity and the components of settlement of foundation.
- Know the contact pressure distribution below footings and rafts, types and proportioning of isolated and combined footings and mat foundation.
- Describe the types of piles, their functions, factors influencing the selection of pile, load carrying capacity of pile and pile group and the settlement of pile groups.
- Calculate the plastic equilibrium in soils, earth pressure on retaining walls and the pressure on the wall due to line loads.

### UNIT I SITE INVESTIGATION AND SELECTION OF FOUNDATION

9

Scope and objectives - Methods of exploration-averaging and boring - Wash boring and rotary drilling - Depth of boring - Spacing of bore hole - Sampling - Representative and undisturbed sampling - sampling techniques - Split spoon sampler, Thin tube sampler, Stationary piston sampler - Bore log report - Penetration tests (SPT and SCPT)

### UNIT II SHALLOW FOUNDATION

9

Introduction - Location and depth of foundation - codal provisions - bearing capacity of shallow foundation on homogeneous deposits - Terzaghi's formula and BIS formula - factors affecting bearing capacity - problems - Bearing Capacity from insitu tests (SPT, plate load) - Allowable bearing pressure, Settlement Components of settlement -Allowable settlements- Methods of minimising settlement, differential settlement.



### **UNIT III FOOTINGS AND RAFTS**

**9**

Types of foundation - Contact pressure distribution below footings & raft - Isolated and combined footings - types - proportioning - mat foundation - types - use - proportioning

### **UNIT IV PILES**

**9**

Types of piles and their function - Factors influencing the selection of pile - Carrying capacity of single pile in granular and cohesive soil - Static formula - dynamic formulae (Engineering news and Hiley's)-Negative skin friction - uplift capacity - Group capacity by different methods (Feld's rule, Converse Labarra formula) - Settlement of pile groups - Interpretation of pile load test -- under reamed piles

### **UNIT V RETAINING WALLS**

**9**

Plastic equilibrium in soils - active and passive states - Rankine's theory - cohesionless and cohesive soil - Coloumb's wedge theory - condition for critical failure plane - Earth pressure on retaining walls of simple configurations - Graphical methods (Rebhann and Culmann) - pressure on the wall due to line load.

**TUTORIAL: 15**

**L = 45, T = 15, TOTAL = 60**

### **TEXT BOOKS**

- Arora K.P, " Soil Mechanics and Foundation Engineering" , Standard Publishers, 2009
- Gopal Ranjan and Rao, A.S.R. "Basic and Applied Soil Mechanics", Wiley Eastern Ltd., New Delhi (India), 2003.
- Murthy, V.N.S, "Soil Mechanics and Foundation Engineering", CBS Publishers Distribution Ltd, New Delhi, 2008.

### **REFERENCES**

- Das, B.M. "Principles of Foundation Engineering (Fifth edition), Thomson Books/COLE, 2003.
- Swamisaran, "Analysis and Design of Structures - Limit state Design", Oxford IBH Publishing Co-Pvt. Ltd., New Delhi, 1998
- Kaniraj, S.R, "Design aids in Soil Mechanics and Foundation Engineering", Tata McGraw Hill publishing company Ltd., New Delhi, 2002
- Bowles J.E, "Foundation analysis and design", McGraw-Hill, 1994
- Punmia,B.C., "Soil Mechanics and Foundations", Laxmi publications pvt. Ltd., New Delhi, 1995.
- Venkatramaiah,C."Geotechnical Engineering",New Age International Publishers,New Delhi, 1995
- N.N. Som and S.C. Das, "Theory and Practice of Foundation Design", Prentice Hall of India Pvt. Ltd., New Delhi, 2003.

## CE2602 TRANSPORTATION ENGINEERING -I

L T P C  
3 0 0 3

**PREREQUISITES** CE 2203

### **GOAL**

To introduce the various components of Highway Engineering, their geometric elements, the geometric design of pavements and the various highway materials, their properties and the practices adopted for highway construction and maintenance.

### **OBJECTIVES**

The course should enable the students to :

- Familiarize about Highway Planning and alignment and the Engineering surveys for highway alignment.
- Understand the geometric design of highways.
- Understand the design principles of Pavements.
- Get exposed to the various highway materials and their testing.
- Know about highway maintenance and pavement evaluation techniques.

### **OUTCOME**

The students will be able to:

- Familiarize with the different methods of road construction, highway development in India, ongoing Highway Development Programmes and the institutions for Highway development at national level, Highway Cross sectional elements etc.
- Design the horizontal and vertical alignments, sight distances and to understand the IRC recommendations for the geometric design of hill roads.
- Design the flexible and rigid pavements by IRC method.
- Describe how the laboratory tests can be conducted on aggregates and bitumen..
- Identify the defects in flexible and rigid pavements and suggest their remedies, do the evaluation of pavement failure and strengthening.

### **UNIT I HIGHWAY PLANNING AND ALIGNMENT**

**9**

Tresaguet and Macadam's method of Road Construction, Highway Development in India - Jayakar Committee Recommendations and Realisations, Twenty-year Road Development Plans, Concepts of On-going Highway Development Programmes at National Level, Institutions for Highway Development at National level - Indian Roads Congress, Highway Research Board, National Highway Authority of India, Ministry of Road Transport and Highways (MORTH) and Central Road Research Institute. Requirements of Ideal Alignment, Factors Controlling Highway Alignment Engineering Surveys for Alignment - Conventional Methods and Modern Methods (Remote Sensing, GIS and GPS techniques) Classification and Cross Section of Urban and Rural Roads (IRC), Highway Cross Sectional Elements - Right of Way, Carriage Way, Camber, Kerbs, Shoulders and Footpaths [IRC Standards], Cross sections of different Class of Roads.

**UNIT II GEOMETRIC DESIGN OF HIGHWAYS****9**

Design of Horizontal Alignments - Superelevation, Widening of Pavements on Horizontal Curves and Transition Curves [Derivation of Formulae and Problems] Design of Vertical Alignments - Rolling, Limiting, Exceptional and Minimum Gradients, Summit and Valley Curves Sight Distances - Factors affecting Sight Distances, PIEV theory, Stopping Sight Distance (SSD), Overtaking Sight Distance (OSD), Sight Distance at Intersections, Intermediate Sight Distance and Illumination Sight Distance [Derivations and Problems in SSD and OSD]

Geometric Design of Hill Roads [IRC Standards Only]

**UNIT III DESIGN OF RIGID AND FLEXIBLE PAVEMENTS****9**

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

**UNIT IV HIGHWAY MATERIALS AND CONSTRUCTION PRACTICE****9**

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

**UNIT V HIGHWAY MAINTENANCE****9**

Types of defects in Flexible pavements - Surface defects, Cracks, Deformation, Disintegration - Symptoms, Causes and Treatments. Types of Pavement, Failures in Rigid Pavements - Scaling, Shrinkage, Warping, Structural Cracks Spalling of Joints and Mud Pumping - and Special Repairs.

Pavement Evaluation - Pavement Surface Conditions and Structural Evaluation, Evaluation of pavement Failure and strengthening - Overlay design by Benkelman Beam Method [Procedure only], Principles of Highway Financing.

**TOTAL = 45****TEXT BOOKS**

Khanna K and Justo C E G Justo, Highway Engineering, Khanna Publishers, Roorkee, 2001.

Kadiyali L R, Principles and Practice of Highway Engineering, Khanna Technical Publications, Delhi, 2000.

**REFERENCES**

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

Bureau of Indian Standards (BIS) Publications on Highway Materials

Specifications for Road and Bridges, MORTH (India)

## CE 2603 ESTIMATION AND QUANTITY SURVEYING

L T P C  
3 1 0 4

**PREREQUISITES** CE 2331, CE 2402, CE 2404, CE 2503

### **GOAL**

To provide the student with the ability to estimate the quantities of item of works involved in buildings, water supply and sanitary works, road works and irrigation works, and also to equip the student with the ability to do rate analysis, valuation of properties and preparation of reports for estimation of various items.

### **OBJECTIVES**

The course should enable the students to :

Know about various methods of estimates.

Be familiar with the estimated of load bearing & framed structures.

Be familiar with the estimate of irrigation system.



Understand the procedures involved in valuation of structure.

Acquire knowledge in detailed report preparation of estimates.

### **OUTCOME**

The students will be able to :

Produce site estimation report considering building plan, water supply, sanitary works, road works and irrigation works.

Make a detailed estimate of buildings.

Do a detailed estimation of irrigation systems and water supply systems.

Gain knowledge on the schedule of rates, analysis of rates, detailed and general specifications.

Prepare report on estimate of residential building, Culverts, Roads, Water supply and sanitary installations.

### **UNIT I INTRODUCTION 3**

Types of estimates - Units of measurements - Methods of estimates - Advantages

### **UNIT II ESTIMATE OF BUILDINGS 12**

Load bearing and framed structures - Calculation of quantities of brick work, RCC, PCC, Plastering, white washing, colour washing and painting / varnishing for shops, rooms, residential building with flat and pitched roof - Various types of arches - Calculation of brick work and RCC works in arches - Estimate of joineries for panelled and glazed doors, windows, ventilators, handrails etc.

### **UNIT III ESTIMATE OF OTHER STRUCTURES 12**

Estimating of septic tank, soak pit - sanitary and water supply installations - water supply pipe line sewer line - tube well - open well - estimate of bituminous and cement concrete roads - estimate of retaining walls - culverts - estimating of irrigation works - aqueduct, syphon, fall.

### **UNIT IV SPECIFICATION 6**

Data - Schedule of rates - Analysis of rates - Specifications - sources - Detailed and general specifications - Arbitration and legal requirements.

### **UNIT IV VALUATION 6**

Necessity - Basics of value engineering - Capitalized value - Depreciation - Escalation - Value of building - Calculation of Standard rent - Mortgage - Lease

### **UNIT V REPORT PREPARATION 6**

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

**TUTORIAL: 15**

**L = 45, T = 15, TOTAL = 60**

**TEXT BOOKS:**

- Dutta, B.N., "Estimating and Costing in Civil Engineering", UBS Publishers & Distributors Pvt. Ltd., 2003
- Kohli, D.D and Kohli, R.C., "A Text Book of Estimating and Costing (Civil)", S.Chand & Company Ltd., 2004.

**CE 2604 ENVIRONMENTAL SCIENCE AND ENGINEERING****L T P C**  
**3 0 0 3****PREREQUISITES** CE 2305, CY 2101**GOAL**

To create the awareness and comprehensive knowledge in environmental science.

**OBJECTIVES**

The course should enable the students to

- Understand the various components of the environment.
- Study the science of water, air and land - to environment.
- Get awareness about the importance of current environmental issues.
- Get exposure on different Environmental techniques to reduce environmental stresses.
- Become familiar with the tools for better environmental management.

**OUTCOME**

The students will be able to:

- Describe the environmental components, eco system and the sustainable development.
- Gain knowledge on the environmental objectives, goals and policies on development projects and their impacts.
- Describe the current environmental issues ,bio diversity, ozone depletion etc.
- Gain knowledge in handling the environmental problems independently with new techniques
- Prepare report on environmental issues of at least one environmentally sensitive site and describe the different tools for environmental management.

**UNIT I COMPONENTS OF ENVIRONMENT****9**

Components - Water, air and land - Inter-relationship between components - Subcomponents; Ecosystem - Structure and functional components of ecosystem - Development and evolution of ecosystem - Energy flow and material cycling in ecosystem - Natural and man made impacts on water, air and land; Environment and development - Concept of sustainable development.

**UNIT II SCIENCE OF ENVIRONMENT****9**

Chemistry, Physics and biology of water, air and land; Stress on the Chemistry, Physics and Biology of water, air and land owing to the impacts; Environmental quality objectives and goals - Policies on development projects and their impacts, with emphasis on the branch of engineering of the student.

**UNIT III CURRENT ENVIRONMENTAL ISSUES****9**

Current Environmental issues at Country level - management of municipal sewage, municipal solid waste, Hazardous waste and Bio-medical waste - Air pollution due to industries and vehicles; Global issues - Biodiversity, Climatic change, Ozone layer depletion.

**UNIT IV ENGINEERING INTERVENTIONS TO REDUCE THE ENVIRONMENTAL STRESSES****9**

Minimisation of Stress - Principles of Physics, chemistry and biology in engineering interventions such as waste treatment - Flow sheets of engineering interventions relevant to the Engineering discipline of the student - Waste minimization techniques - Clean technology options - Standards of performance of the interventions.

**UNIT V (A) TOOLS FOR ENVIRONMENTAL MANAGEMENT****9**

Environmental impact assessment; Precautionary Principle and Polluter Pays Principle; Constitutional provisions, Legal and economic instruments in Environmental Management; Role of Non-government organizations - Community participation in environmental management works; International conventions and protocols; Pollution Control Boards and Pollution Control Acts.

**(B) FIELD STUDY**

In-depth study of environmental issues of at least one environmentally sensitive site related to the students and preparation of a report thereupon.

**TOTAL = 45****TEXT BOOKS**

- Gilbert M. Masters, "Introduction to Environmental Engineering and Science", Prentice-Hall of India Pvt. Ltd, New Delhi, 2004.
- J. Glynn Henry and Gary W. Heinke, "Environmental Science and Engineering", 2nd edition, Prentice-Hall of India Pvt. Ltd., New Delhi, 2004.

**REFERENCES**

- R. Pannirselvam and S. Karthikeyan, "Environmental Impact Assessment", SPGS Publishers, Chennai - 600 088, 2005.
- David H. F. Liu and Bela G. Liptak "Environmental Engineers' Handbook", 2nd edition, Lewis Publishers, Newyork, 1997.

## CE 2631 FLUID MECHANICS & MACHINERY LABORATORY

L T P C  
0 0 3 2

**PREREQUISITES** CE 2303, CE 2505

### GOAL

To get exposed to the functions of various hydraulic devices and machines.

### OBJECTIVES

To get exposed to the working of various hydraulic devices such as orifice meter, Venturimeter and notches.

To get exposed to the working of various hydraulic machines such as pumps and turbines.

### OUTCOME

The students will be able to describe the performance characteristics of turbines and pumps

The students will be able to describe the performance characteristics of turbines and pumps.

### LIST OF EXPERIMENTS

- |     |  |   |
|-----|--|---|
| 1.  | Determination of co-efficient of discharge for orifice   | 3 |
| 2.  | Determination of co-efficient of discharge for notches   | 3 |
| 3.  | Determination of co-efficient of discharge for venturimeter                                    | 3 |
| 4.  | Determination of co-efficient of discharge for orifice meter                                   | 3 |
| 5.  | Study of impact of jet on flat plate (normal / inclined)                                       | 3 |
| 6.  | Study of friction losses in pipes  | 3 |
| 7.  | Study of minor losses in pipes   | 3 |
| 8.  | Study on performance characteristics of Pelton turbine.  | 6 |
| 9.  | Study on performance characteristics of Francis turbine  | 6 |
|     | Study on performance characteristics of Centrifugal pumps<br>(Constant speed / variable speed) | 6 |
| 11. | Study on performance characteristics of reciprocating pump.                                    | 6 |

**Total = 45**

## CE 2632 IRRIGATION AND ENVIRONMENTAL ENGINEERING DRAWING

L T P C  
0 0 3 2

**PREREQUISITES** CE 2305, CE 2504

### GOAL

The student shall be able to conceive, design and draw all types of irrigation and environmental structures in detail showing plan, elevation sections.

### OBJECTIVES

To understand the concepts of hydraulic design and to draw detailed drawings of hydraulic Structures.

To introduce the design concepts of major units associated with water and sewage treatment

### OUTCOME

To design and draw plan, elevation and sections of irrigation structures in detail.

The students will be able to design the sewage treatment plant units and draw the general arrangement.

### PART A

#### 1. TANK IRRIGATION STRUCTURES 9

Tank surplus weirs - Tank sluices weirs on pervious foundations - Detailed drawings showing foundation details, plan and elevation - gravity dams - earth dams

#### 2. CANAL TRANSMISSION STRUCTURES 9

Canal head works - Canal regulator Aqueducts - Canal drops - Notch type - Drawing showing plan, elevation, foundation details

### TEXT BOOKS :

Garg, S.K, "Irrigation Engineering and Design of Structures"

Satyanarayana Murthy, "Irrigation Design and Drawing", Published by Mrs. L. Banumathi, Tuni, East Godavari District, A.P. 1998

Sharma R.K, "Irrigation Engineering and Hydraulic Structures", Oxford and IBH Publishing Co., New Delhi, 2002

### PART B

General layout of water treatment of plant - Design & drawing Slow sand filter - Rapid sand filter - Pressure filter - Chlorinator - Bleaching powder doser - Softeners - Demineralisation plant 6

2. Design and drawing of infiltration gallery. 3

General layout of wastewater treatment plant - Sludge digester - Sludge drying beds - Waste stabilisation ponds 6

Drawing of raw water - Intake towers - Manholes - Sewer lines - Pumping stations for water and sewage	6
Design and drawing of: Water supply and drainage for buildings - Septic tanks and disposal arrangements - House service connection for water supply and drainage - Appurtenances in water supply and drainage	6
	<b>Total = 45</b>

## REFERENCES

- Manual on Water Supply and Treatment, CPHEEO, Government of India, New Delhi, 1999
- Manual of Sewerage and Sewage Treatment, CPHEEO, Government of India, New Delhi, 1993
- Hand book on Water Supply and Drainage, SP35, B.I.S., New Delhi, 1987
- Peary, H.S., Rowe, D.R., and Tchobanoglous, G., "Environmental Engineering", McGraw-Hill Book Co., New Delhi, 1995
- Metcalf & Eddy, "Wastewater Engineering (Treatment and Reuse)", 4th Edition, Tata McGraw-Hill, New Delhi, 2003.

**SEMESTER VII**  
**MG 2002 TOTAL QUALITY MANAGEMENT**

**L T P C**  
**3 0 0 3**

**PREREQUISITES** Nil

**GOAL**

To understand the Total Quality Management concepts and principles and the various tools available to achieve Total Quality Management and also to understand the statistical approach for quality control.

**OBJECTIVES**

The course should enable the students to :

Understand the basic concepts of Total Quality Management.

Be familiar with the total quality management principles.

Know about the various process control tools available to achieve Total Quality Management.

Study about quality function deployment and total productive maintenance.

Get awareness about the ISO certification process and their need in various industries.

**OUTCOME**

The students will be able to :

Apply the concepts of quality planning, quality control etc., in the appropriate places.

Apply the total quality management principles in issues like customer complaints, customer retention, relationship development etc.,

Describe the tools of quality, management tools, process capability etc.,

Describe quality function deployment and total productive maintenance.

Implement the quality systems for various industries.

**UNIT I INTRODUCTION**

**9**

Definition of Quality, Dimensions of Quality, Quality Planning, Quality costs - Analysis Techniques for Quality Costs, Basic concepts of Total Quality Management, Historical Review, Principles of TQM, Leadership - Concepts, Role of Senior Management, Quality Council, Quality Statements, Strategic Planning, Deming Philosophy, Barriers to TQM Implementation.

**UNIT II TQM PRINCIPLES**

**9**

Customer satisfaction - Customer Perception of Quality, Customer Complaints, Service Quality, Customer Retention, Employee Involvement - Motivation, Empowerment, Teams, Recognition and Reward, Performance Appraisal, Benefits, Continuous Process Improvement - Juran Trilogy, PDSA Cycle, 5S, Kaizen, Supplier Partnership - Partnering, sourcing, Supplier Selection, Supplier Rating, Relationship Development, Performance Measures - Basic Concepts, Strategy, Performance Measure.

**UNIT III STATISTICAL PROCESS CONTROL (SPC) 9**

The seven tools of quality, Statistical Fundamentals - Measures of central Tendency and Dispersion, Population and Sample, Normal Curve, Control Charts for variables and attributes, Process capability, Concept of six sigma, New seven Management tools.

**UNIT IV TQM TOOLS 9**

Benchmarking - Reasons to Benchmark, Benchmarking Process, Quality Function Deployment (QFD) - House of Quality, QFD Process, Benefits, Taguchi Quality Loss Function, Total Productive Maintenance (TPM) - Concept, Improvement Needs, FMEA - Stages of FMEA.

**UNIT V QUALITY SYSTEMS 9**

Need for ISO 9000 and Other Quality Systems, ISO 9000:2000 Quality System - Elements, Implementation of Quality System, Documentation, Quality Auditing, TS 16949, ISO 14000 - Concept, Requirements and Benefits.

**TOTAL = 45**

**TEXT BOOK**

Dale H.Besterfield, et al., Total Quality Management, Pearson Education, Inc. 2003. (Indian reprint 2004). ISBN 81-297-0260-6.

**REFERENCES**

James R.Evans & William M.Lindsay, The Management and Control of Quality, (5th Edition), South-Western (Thomson Learning), 2002 (ISBN 0-324-06680-5).

Feigenbaum.A.V. "Total Quality Management, McGraw Hill, 1991.

Oakland.J.S. "Total Quality Management Butterworth - Heinemann Ltd., Oxford. 1989.

Narayana V. and Sreenivasan, N.S. Quality Management - Concepts and Tasks, New Age International 1996.



## PMA 103 PROBABILITY AND STATISTICS

Common to M.Tech (AME/CM/EE)

L T P C  
3 1 0 4

### GOAL

The course will help the students to understand the concepts of probability and statistics and its applications in the field of construction management.

### OBJECTIVES

The course should enable the students to

Understand the basic concepts of sampling distributions and estimation.

Learn about the testing of hypothesis.

Gain the knowledge in Analysis of variance.

Know the probability functions and the Random variables.

Learn about the basic concepts of linear programming.

### OUTCOME

The students should be able to:

Use the sampling principles in the field of construction management.

Find the significance of large samples by using hypothesis testing.

Implement the variance design principles in sampling.

Interpolate data by using probability theories.

Explain linear programming in the field of construction management.

### UNIT I SAMPLING DISTRIBUTIONS AND ESTIMATION 12

Sampling distributions - Point and interval estimates for population proportions, mean and variance - Maximum likelihood estimate method - Method of moments.

### UNIT II TESTING OF HYPOTHESIS 12

Basic definitions of statistical hypothesis - Tests of significance for large samples - single proportion, difference of proportion, single mean and difference of mean - Small samples - t, Chi-square and F distributions.

### UNIT III DESIGN OF EXPERIMENTS 12

Analysis of variance - One way and Two way Classifications. Completely randomized design - Randomized block design - Latin square design.

### UNIT IV PROBABILITY AND RANDOM VARIABLES 12

Discrete and Continuous random variables - Moments - Moment generating functions - Standard distributions - Binomial, Poisson, Geometric, Negative Binomial, Uniform, Normal, Exponential,

Gamma and Weibull distributions - Two dimensional random variables - Joint, Marginal and Conditional distributions. Multiple and partial correlation and Regression.

**UNIT V LINEAR PROGRAMMING**

**12**

Basic concepts - Graphical and Simplex method - Transportation problem - Assignment problem

**TOTAL: 60**

**REFERENCES**

Taha, H.A., "Operations Research - An Introduction ", Prentice Hall of India Ltd., 6th Edition, New Delhi, 1997.

Dr.A.Singaravelu, Dr.S.Siva Subramanian and Dr.C.Ramachandran, "Probability and Queuing Theory", Meenakshi agency, 20th edition, January 2013.

Kapur, J.N. and Saxena, H.C. "Mathematical Statistics ", S. Chand and Co. Ltd., New Delhi, 1997.

T.Veerarajan, "Probability, Statistics and Random Processes", Tata McGraw-Hill, second edition, 2006.

**PCM 101 MODERN STRUCTURAL MATERIALS AND SYSTEMS DESIGN**

**L T P C**  
**4 0 0 4**

**GOAL**

Knowledge about modern and innovative structural materials and concepts of smart /intelligent home systems would help students to enhance their standards to the current requirements in the construction domain in par with international standards.

**OBJECTIVES**

The course should enable the students to:

- Gain knowledge about special concrete.
- Aware of the different metals.
- Have a wide knowledge of composites.
- Familiarizing with specialized materials.
- Create innovative ideas in respect of smart and intelligent materials.

**OUTCOME**

The students should be able to:

- Make use of the high strength and high performance concrete according to the need.
- Select the respective alloy steel, aluminum and use the components in the respective construction methods.
- Use wide variety of polymer and composites for building components.

Understand numerous materials such as water proofing, admixtures from different manufacturers and select the best choice to the end application.

Apply their ideas in green house, energy efficient housing projects.

**UNIT I CONCRETES** **12**

High strength and High performance concrete-Fiber Reinforced concrete

**UNIT II METALS** **12**

New Alloy steels-Aluminum and its products-Other alloys

**UNIT III COMPOSITES** **12**

Plastics-Reinforced polymers-FRP-Cellular cores

**UNIT IV OTHER MATERIALS** **12**

Water proofing compounds-Non -weathering Materials-Flooring and Facade Materials.

**UNIT V SMART AND INTELLIGENT MATERIALS** **12**

Brief outline and uses

**TOTAL = 60**

**TEXT BOOK:**

Shan Somayaji, "Civil Engineering Materials ", 2nd Edition, Prentice Hall Inc., 2001

**REFERENCES:**

Mamlouk, M.S. and Zaniewski, J.P., " Materials for Civil and Construction Engineers ", 2nd Edition, Prentice Hall Inc., 1999.

Derucher, K.Korfiatis. G. and Ezeldin, S., " Materials for Civil and Highway Engineers ", 4th Edition, Prentice Hall Inc., 1999.

Aitkens, "High Performance Concrete ", McGraw Hill, 1999.

**PCM 103 COMPUTER APPLICATIONS IN CONSTRUCTION ENGINEERING AND PLANNING**

**L T P C**

**3 1 0 4**

**GOAL**

To attain knowledge in the field of Construction Engineering, Planning, Scheduling, Estimation, Inventory and Equipment handling, Execution and Successful Completion with in the time frame and budget allocated.

**OBJECTIVES**

The course should enable the students to:

Understand the various Parameters of Software Package in the Construction Management.

Study the Optimization techniques.  
Be familiar with Inventory problems.  
Practice the Scheduling Applications.  
Find out the Problems in Simulation and Decision making.

### **OUTCOMES**

The students will be able to :

Apply the Knowledge in Data base Management, Spread Sheets in Construction.  
Make decision in application to protection scheduling, equipment replacement, material transportation and work assignment problems.  
Gain knowledge of Inventory Problems in Construction Engineering and software development.  
Utilize the Knowledge in tools of Construction Management like PERT and CPM and PRIMAVERA.  
Take Decision in the Construction Engineering Projects.

### **UNIT I INTRODUCTION 5**

Introduction to System Hardware-Languages-Database Management-Spread Sheets-Applications

### **UNIT II OPTIMIZATION TECHNIQUES 15**

Linear, Dynamic and Integer Programming-Branch and Bound Techniques-Application to Production Scheduling, Equipment Replacement, Material Transportation and Work Assignment Problems-Software Development

### **UNIT III INVENTORY PROBLEMS 15**

Deterministic and Probabilistic Inventory Models-Software Development

### **UNIT IV SCHEDULING APPLICATIONS 15**

PERT and CPM-Software Development - Use of PRIMAVERA

### **UNIT V OTHER PROBLEMS 10**

Decision Making-Bayes Theory-Simulation-Models

**TOTAL = 60**

### **TEXT BOOK:**

Bily E. Gillet., "Introduction to Operation Research" - A Computer Oriented Algorithmic Approach, Tata McGraw Hill, 1990

### **REFERENCES:**

Paulson, B.R., "Computer Applications in Construction ", McGraw Hill, 1995.

Feigenbaum. L., "Construction Scheduling With Primavera Project Planner ", Prentice Hall Inc., 2003.

## CE 2701 BASICS OF DYNAMICS AND ASEISMIC DESIGN OF STRUCTURES

L T P C  
3 1 0 4

**PREREQUISITES** MA 2101, MA 2201, CE 2501

### GOAL

To introduce the students the phenomena of earthquakes, the process, measurements and the factors that affects the design of structures in seismic areas.

### OBJECTIVES

The course should enable the students to :

Understand the concepts involved in finding the response of Structures for Dynamic forces.

Know about the mode shapes of the structures under dynamic loading.

Get exposure on the causes of earthquake and its characteristics.

Have knowledge about the response of structures under earthquake loading.

Be familiarize with the codal provisions and the aseismic design methodology.

### OUTCOME

The students will be able to:

Analyze the structures with single degree of freedom for dynamic loading conditions.

Find out the natural frequencies and the mode shapes of structures under dynamic loading.

Gain knowledge on the causes of earthquake and the damage on the structures caused by earthquake.

Find out the response, of the structures, such as acceleration and displacement, for earthquake loading.

Design earthquake resistant structures and adopt appropriate vibration control techniques.

### UNIT I THEORY OF VIBRATIONS 9

Concept of inertia and damping - Types of Damping - Difference between static forces and dynamic excitation - Degrees of freedom - SDOF idealization - Equations of motion of SDOF system for mass as well as base excitation - Free vibration of SDOF system - Response to harmonic excitation - Impulse and response to unit impulse - Duhamel integral

### UNIT II MULTIPLE DEGREE OF FREEDOM SYSTEM 9

Two degree of freedom system - Normal modes of vibration - Natural frequencies - Mode shapes - Introduction to MDOF systems - Decoupling of equations of motion - Concept of mode superposition (No derivations).

### UNIT III ELEMENTS OF SEISMOLOGY 9

Causes of Earthquake - Geological faults - Tectonic plate theory - Elastic rebound - Epicentre -

Hypocentre - Primary, shear and Raleigh waves - Seismogram - Magnitude and intensity of earthquakes - Magnitude and Intensity scales - Spectral Acceleration - Information on some disastrous earthquakes

**UNIT IV RESPONSE OF STRUCTURES TO EARTHQUAKE 9**

Response and design spectra - Design earthquake - concept of peak acceleration - Site specific response spectrum - Effect of soil properties and damping - Liquefaction of soils - Importance of ductility - Methods of introducing ductility into RC structures.

**UNIT V DESIGN METHODOLOGY 9**

IS 1893, IS 13920 and IS 4326 - Codal provisions - Design as per the codes - Base isolation techniques Vibration control measures - Important points in mitigating effects of earthquake on structures.

**TUTORIAL: 15**

**L = 45, T = 15, TOTAL = 60**

**TEXT BOOKS**

S.R.Damodarasamy, S.Kavitha "Basics of Structural dynamics and Aseismic Design", PHI Learning Private Limited., 2009.

Pankaj Agarwal, "Earthquake Resistant Design of Structures", Prentice Hall of India, 2007.

**REFERENCES**

Mario Paz,William Leigh, " Structural Dynamics Theory and Computation", Springer- 2004.

Madhujit Mukhopdhyay, " Structural Dynamics, Vibrations and Systems", Anne Books India, 2006.

**CE2702 TRANSPORTATION ENGINEERING-II**

**L T P C  
3 0 0 3**

**PREREQUISITES** CE 2203

**GOAL**

To impart the students with the knowledge of planning, design, construction and maintenance of railway tracks, airport and harbours.

**OBJECTIVES**

The course should enable the students to :

Get exposed to Railway Planning and design.

Know about Railway track and its operation.

Know the concepts of airport planning and design.

Know about different types of airport layouts and the navigational aids for air traffic control.

Acquire knowledge about Harbour Engineering

## OUTCOME

The students will be able to:

Gain knowledge about the Engineering surveys for track alignment, Permanent way, its components and their functions.

Design turnouts, points and crossings and signaling and interlocking.

Identify the components of airports and execute the design.

Gain knowledge about different airport layouts airport buildings, runway taxiway markings and lightings for air traffic control.

5. Describe the classification of harbours, their planning and layouts, coastal structures and the navigational aids.

### UNIT I RAILWAY PLANNING AND DESIGN

12

Role of Indian Railways in National Development - Engineering Surveys for Track Alignment - Obligatory points - Conventional and Modern methods (Remote Sensing, GIS & GPS, EDM and other equipments) Permanent Way, its Components and Functions of each Component:

Rails - Types of Rails, Rail Fastenings, Concept of Gauges, Coning of Wheels, Creeps and kinks Sleepers - Functions, Materials, Density Ballasts - Functions, Materials, Ballastless Tracks

Geometric Design of Railway Tracks - Gradients and Grade Compensation, Super-Elevation, Widening of Gauges in Curves, Transition Curves, Horizontal and Vertical Curves (Derivations of Formulae and Problems)

### UNIT II RAILWAY TRACK CONSTRUCTION, MAINTENANCE AND OPERATION

12

Points and Crossings - Design of Turnouts, Working Principle Signalling, Interlocking and Track Circuiting Construction & Maintenance - Conventional, Modern methods and Materials, Track Drainage Track Modernisation- Automated maintenance and upgrading, Technologies, Re-laying of Track, Lay outs of Railway Stations and Yards, Rolling Stock, Tractive Power, Track Resistance, Level Crossings

### UNIT III AIRPORT PLANNING AND DESIGN

12

Advantages and Limitations of Air Transport, Components of Airports Airport Planning - Air traffic potential, Site Selection, Design of Components, Cost Estimates, Evaluation and Institutional arrangements Runway Design- Orientation, Cross wind Component, Wind rose Diagram (Problems), Geometric Design and Corrections for Gradients (Problems), Drainage

Taxiway Design - Geometric Design Elements, Minimum Separation Distances, Design Speed, Airport Drainage Airport Zoning - Clearance over Highways and Railways

### UNIT IV AIRPORT LAYOUTS, VISUAL AIDS, AND AIR TRAFFIC CONTROL

12

Airport Layouts - Apron, Terminal Building, Hangers, Motor Vehicle Parking Area and Circulation Pattern, Case studies of Airport Layouts Airport Buildings - Primary functions, Planning Concept,

Principles of Passenger Flow, Passenger Facilities Visual Aids - Runway and Taxiway Markings, Wind Direction Indicators, Runway and Taxiway Lightings Air Traffic Control - Basic Actions, Air Traffic Control Network Helipads, Hangars, Service Equipments.

**UNIT V HARBOUR ENGINEERING & OTHER MODES OF TRANSPORT 12**

Definition of Terms - Harbours, Ports, Docks, Tides and Waves, Littoral Drift, Sounding, Area, Depth, Satellite Ports Requirements and Classification of Harbours Site Selection & Selection Investigation  
Speed of water, Dredging, Range of Tides, Waves and Tidal Currents, Littoral Transport with Erosion and Deposition, Soundings, Anchoring Grounds, Geological Characteristics, Winds & Storms, Position and Size of Shoals Shore Considerations- Proximity to Towns/Cities, Utilities, Construction Materials, Coast Lines Dry and Wet Docks,, Planning and Layouts Entrance, Position of Light Houses, Navigating Terminal Facilities - Port Buildings, Warehouse, Transit Sheds, Inter-modal Transfer Facilities, Mooring Accessories, Navigational Aids Coastal Structures- Piers, Breakwaters, Wharves, Jetties, Quays, Spring Fenders Coastal Shipping, Inland Water Transport and Container Transportation. Pipe Ways, Rope Ways.

**TOTAL = 60**

**TEXT BOOKS**

- Saxena Subhash C and Satyapal Arora, A Course in Railway Engineering, Dhanpat Rai and Sons, Delhi, 1998.
- Khanna S K, Arora M G and Jain S S, Airport Planning and Design, Nemchand and Brothers, Roorkee, 1994.
- S P Bindra, A Course in Docks and Harbour Engineering, Dhanpat Rai and Sons, New Delhi, 1993.

**REFERENCES**

- S.C Rangwala, "Railway Engineering" , Charotar Publishing House, 1995.
- S.C. Rangwala, "Airport Engineering" , Charotar Publishing House, 1996.
- Oza and Oza, "A course in Docks & Harbour Engineering".
- J.S. Mundrey, "A course in Railway Track Engineering".



## CE 2731 COMPUTER AIDED DESIGN AND DRAFTING

L T P C  
0 0 3 2

**PREREQUISITES** CE2331, CE2402, CE2503

### GOAL

To acquire hands on experience in design and preparation of structural drawings for concrete / steel structures normally encountered in Civil Engineering practice.

### OBJECTIVES

To understand the design principles of various types of Retaining walls, Bridges, Water tanks and Plate Girder Bridges and to draw the structural drawings using Auto CADD.

### OUTCOME

The students will be able to

Design and prepare structural drawings for concrete / steel structures normally encountered in Civil Engineering practice.

### LIST OF EXPERIMENTS

Design and drawing of RCC cantilever and counter fort type retaining walls with reinforcement details	9
Design of solid slab and RCC Tee beam bridges for IRC loading and reinforcement details	9
Design of pressed, rectangular and hemispherical bottom steel tank - Staging - Detailed drawings	9
Design and drafting of Intz type water tank, Detailing of circular and rectangular water tanks	9
Design of plate Girder Bridge - Truss Girder bridges - Detailed Drawings including connections	9
<b>Total = 45</b>	

### TEXT BOOKS

Krishna Raju, "Structural Design & Drawing (Concrete & Steel)", CBS Publishers

Punmia, B.C., Ashok Kumar Jain, Arun Kumar Jain, "Design of steel structures", Lakshmi publications Pvt. Ltd.

### REFERENCES

Krishnamurthy, D., "Structural Design & Drawing - Vol. II", CBS Publishers & Distributors, Delhi

Krishnamurthy, D., "Structural Design & Drawing - Vol. III Steel Structures", CBS Publishers & Distributors, New Delhi

## PCM 205 CONSTRUCTION SOFTWARE LABORATORY

L T P C  
0 0 3 2

**PREREQUISITES** CE 2703

### **GOAL**

To gain knowledge in software applications in the field of construction engineering and planning which helps the students as an effective tool to manage huge construction projects.

### **OBJECTIVES**

To gain knowledge in software applications in the field of construction engineering and planning.

### **OUTCOME**

The student will be able to use an effective tool to manage huge construction projects which includes planning, scheduling, estimation, inventory and equipment handling, execution and successful completion with in the time frame and budget allocated.

### **LIST OF EXPERIMENTS**

<b>1. ESTIMATION OF BUILDINGS</b>	<b>24</b>
Estimation and costing of building structures	
<b>2. ESTIMATION OF BRIDGES</b>	<b>21</b>
Estimation and costing of bridge structures	
	<b>Total = 45</b>

### **Software required**

PRIMAVERA Software

**SEMESTER VIII**  
**GE 2001 PROFESSIONAL ETHICS AND HUMAN VALUES**

**L T P C**  
**3 0 0 3**

**PREREQUISITES** Nil

**GOAL**

To introduce the students to basic concepts of Engineering Ethics and Human Values.

**OBJECTIVES**

The course should enable the students to :

To create an awareness on Human Values.

To be familiar with the various theories on Engineering Ethics.

Throw light on moral social values and Loyalty of professional.

To create an awareness about the safety aspects responsibilities and various rights of professionals.

**OUTCOME**

The students will be able to:

Gain knowledge in Human values.

Use the senses of Engineering Ethics and ethical theories..

Be acquainted with the Global issues on Environmental Ethics and Computer Ethics.

Get awareness on the Ethics and responsibilities of a professional.

Get awareness on Engineering Ethics and Human Values.

**UNIT I HUMAN VALUES**

**10**

Morals, Values and Ethics - Integrity - Work Ethic - Service Learning - Civic Virtue - Respect for Others - Living Peacefully - caring - Sharing - Honesty - Courage - Valuing Time - Co-operation - Commitment - Empathy - Self-Confidence - Character - Spirituality

**UNIT II ENGINEERING ETHICS**

**9**

Senses of 'Engineering Ethics' - variety of moral issued - types of inquiry - moral dilemmas - moral autonomy - Kohlberg's theory - Gilligan's theory - consensus and controversy - Models of Professional Roles - theories about right action - Self-interest - customs and religion - uses of ethical theories.

**UNIT III ENGINEERING AS SOCIAL EXPERIMENTATION**

**9**

Engineering as experimentation - engineers as responsible experimenters - codes of ethics - a balanced outlook on law - the challenger case study

**UNIT IV SAFETY, RESPONSIBILITIES AND RIGHTS****9**

Safety and risk - assessment of safety and risk - risk benefit analysis and reducing risk - the three mile island and chernobyl case studies. 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 GLOBAL ISSUES****8**

Multinational corporations - Environmental ethics - computer ethics - weapons development - engineers as managers-consulting engineers-engineers as expert witnesses and advisors - moral leadership-sample code of Ethics like ASME, ASCE, IEEE, Institution of Engineers (India), Indian Institute of Materials Management, Institution of electronics and telecommunication engineers (IETE), India, etc.

**TOTAL = 45****TEXT BOOKS**

Mike Martin and Roland Schinzinger, "Ethics in engineering", McGraw-Hill, New York 1996.

Govindarajan M, Natarajan S, Senthil Kumar V. S, "Engineering Ethics", Prentice Hall of India, New Delhi, 2004.

**REFERENCES**

Charles D. Fleddermann, "Engineering Ethics", Pearson Education/ Prentice Hall, New Jersey, 2004 (Indian Reprint)

Charles E Harris, Michael S. Protchard and Michael J Rabins, "Engineering Ethics - Concepts and Cases", Wadsworth Thompson Learning, United States, 2000 (Indian Reprint now available)

John R Boatright, "Ethics and the Conduct of Business", Pearson Education, New Delhi, 2003.

Edmund G Seebauer and Robert L Barry, "Fundamentals of Ethics for Scientists and Engineers", Oxford University Press, Oxford, 2001.

## PCM 201 CONSTRUCTION PLANNING, SCHEDULING AND CONTROL

L T P C  
4 0 0 4

### GOAL

To achieve comprehensive knowledge in planning, scheduling, estimation, inventory and equipment handling, cost monitoring, accounting, quality control and safety in construction projects.

### OBJECTIVES

The course should enable the students to:

Understand the basic concepts in construction planning.

Be able to familiarize the different methods of scheduling procedures.

Learn the cost control monitoring methods and according.

Be acquainted with the knowledge of methods of quality control and about safety concern in construction.

Study the types of project information, its use and organization in databases.

### OUTCOME

The students should be able to:

Apply the concepts of Planning for construction projects.

Make use of network scheduling techniques like CPM, PERT, PNA for Civil Engineering projects.

Apply the methods of cost control and avoid cost overrun for civil engineering projects.

Apply the techniques of quality control for the projects.

Gain knowledge on organization of project information in databases.

### UNIT I CONSTRUCTION PLANNING

12

Basic concepts in the development of construction plans-choice of Technology and Construction method-Defining Work Tasks-Definition-Defining Precedence relationships among activities-Estimating Activity Durations-Estimating Resource Requirements for work activities-coding systems

### UNIT II SCHEDULING PROCEDURES AND TECHNIQUES

12

Relevance of construction schedules-The critical path method-Calculations for critical path scheduling-Activity float and schedules-Presenting project schedules-Critical path scheduling for Activity-on-node and with leads, Lags and Windows-Calculations for scheduling with leads, lags and windows-Resource oriented scheduling-Scheduling with resource constraints and Precedence's-Use of Advanced Scheduling Techniques-Scheduling with uncertain durations-Calculations for Monte Carlo Schedule simulations-crashing and time/cost trade offs-scheduling in poorly structured problems-Improving the Scheduling process

**UNIT III COST CONTROL MONITORING AND ACCOUNTING** **12**

The cost control problem-The project Budget-Forecasting for Activity cost control financial accounting systems and cost accounts-Control of project cash flows-Schedule control-Schedule and Budget updates-Relating cost and schedule information

**UNIT IV QUALITY CONTROL AND SAFETY DURING CONSTRUCTION** **12**

Quality and safety Concerns in Construction-Organizing for Quality and Safety-Work and Material Specifications-Total Quality control-Quality control by statistical methods -Statistical Quality control with sampling by Attributes-Statistical Quality control by Sampling and Variables-Safety.

**UNIT V ORGANIZATION AND USE OF PROJECT INFORMATION** **12**

Types of project information-Accuracy and Use of Information-Computerized organization and use of information-Organizing information in databases-relational model of Data bases-Other conceptual Models of Databases-Centralized databases Management systems-Databases and application programs-Information transfer and Flow

**TOTAL = 60**

**TEXT BOOKS**

Chitkara, K.K. "Construction Project Management Planning ", Scheduling and Control, Tata McGraw Hill Publishing Co., New Delhi, 1998.

Calin M. Popescu, Chotchai Charoenngam, "Project planning, Scheduling and Control in Construction: An Encyclopedia of Terms and Applications ", Wiley, New York, 1995.

**REFERENCES**

Chris Hendrickson and Tung Au, "Project Management for Construction - Fundamentals Concepts for Owners ", Engineers, Architects and Builders, Prentice Hall, Pittsburgh, 2000.

Moder.J., C.Phillips and Davis, " Project Management with CPM ", PERT and Precedence Diagramming, Van Nostrand Reinhold Co., Third Edition, 1983.

Willis., E.M., " Scheduling Construction projects ", John Wiley and Sons 1986.

Halpin,D.W., " Financial and cost concepts for construction Management ", John Wiley and Sons, New York, 1985.

## PCM 202 ADVANCED CONSTRUCTION TECHNIQUES

L T P C  
4 0 0 4

**PREREQUISITE** Nil

### **GOAL**

To introduce the student to various advanced construction techniques and activities which includes underwater construction, concrete paving, bridges, tall structures, domes, tower transmission line etc.

### **OBJECTIVES**

The course should enable the students to :

- Gain knowledge of tunneling, piling and jacking techniques.
- Be familiar with various underwater construction techniques.
- Be acquainted with knowledge of construction techniques in tall structures.
- Gain knowledge of construction techniques in special structures.
- Be familiar with the repairing work techniques.

### **OUTCOME**

The students will be able to :

- Develop knowledge of various techniques involved in piling.
- Aware of various construction activities involve in underground and under water.
- Describe various types of concreting operation in tall structures, techniques involved in erection of large span structures and transmission line structures.
- Aware of various market forms of construction sequences in some of the special structures like chimney, silos, sky scrapers etc.
- Gain knowledge of repair and maintenances of foundation and dismantling techniques.

### **UNIT I SUB STRUCTURE CONSTRUCTION- TUNNELING AND PILING 12**

Tunneling techniques-piling techniques- Box jacking -Pipe Jacking- driving diaphragm walls, sheet piles-laying operations for built up offshore system-shoring for deep cutting-Large reservoir construction with membranes and Earth system.

### **UNIT II SUB STRUCTURE CONSTRUCTION-UNDER WATER CONSTRUCTION 12**

Under Water Construction of diaphragm walls and basement- -driving well and caisson-sinking cofferdam-cable anchoring and grouting- -well points-Dewatering and stand by Plant equipment for underground open excavation

### **UNIT III SUPER STRUCTURE CONSTRUCTION- TALL STRUCTURES 12**

Techniques of construction for continuous concreting operation in Tall buildings of various shapes and Varying sections-Launching Techniques-Suspended from work-erection techniques of tall

structures, Large span structures-Launching techniques for heavy decks-insitu prestressing in high rise structures, areial transporting handling erecting light weight components on tall structures-erection of lattice towers and rigging of transmission line structures-Vacuum Dewatering of concrete flooring-Concrete paving technology.

**UNIT IV SUPER STRUCTURE CONSTRUCTION- SPECIAL STRUCTURES 12**

Construction sequences in cooling towers, Silos Chimney, Sky scrapers, bow string bridges, cable stayed bridges-Launching and pushing of box decks-Advanced construction Techniques in Offshore construction practice-construction sequence and methods in domes and prestress domes-Support structure for heavy Equipment and conveyor and machinery in heavy industries-erection of articulated structures, braced domes and space decks.

**UNIT V REPAIR CONSTRUCTION 12**

Mud jacking grout through slab foundation-micro piling for strengthening floor and shallow profile-pipeline laying-protecting sheet piles, screw anchors-sub grade water proofing under pining advanced techniques and sequence in demolition and dismantling.

**TOTAL = 60**

**TEXT BOOK**

Robertwade Brown, "Practical foundation engineering hand book ", McGraw Hill Publications, 2nd Edition, 2000.

**REFERENCES**

Patrick Powers. J., " Construction Dewatering: New Methods and Applications ", John Wiley and Sons, 3rd Edition, 2007.

Jerry Irvine, "Advanced Construction Techniques ", CA Rocketr, 1984.

**PCM 204 SHORING, SCAFFOLDING AND FORMWORK**

**L T P C  
4 0 0 4**

**GOAL**

This subject help the students to understand the appropriate shoring scaffolding and formwork components in respect of structural elements. While handling scaffolds, the students also get exposed to safety practices.

**OBJECTIVES**

The course should enable the students to

Be familiar with the planning and detailing the forms.

Be aware of shores

Have a wide knowledge of slip form and safety practices for scaffolds



Create knowledge of formwork design and causes of its failure

Be acquainted with the knowledge of materials and site equipments.

### **OUTCOME**

The students should be able to:

To make proper planning comparing the need and specification of various elements requirements and measurements during the projects.

Gain knowledge of different types of shores, site preparation, load distribution for different types of construction activities.

To use the slip form in the building according to code provisions with safety requirements

Apply the techniques to all structural components of substructures and super structures in specialized constructions in respect to load distribution design, quality of work and safety factors in the actual field .

Be aware of new material and fasteners to use these wooden boards in respective building components while doing construction practices.

### **UNIT I PLANNING**

**10**

Overall planning-Detailed Planning-Standard units-Corner units - Schedule for column form work-Formwork Elements-Planning at tender stage-Development of basic system-Planning for maximum reuse-Economical form construction-Planning examples-crane size, effecting scheduling Estimate-Recheck plan details-Detailing the forms.

### **UNIT II SHORES**

**10**

Simple wood stresses-Slenderness ratio-Allowable load-Tubular steel shores patented shores-Site preparation, Size and spacing-Steel Tower Frames-Safety practices-Horizontal shores shoring for multistories-More concentrated shore loads T-heads-Tow Tier Wood shores-Ellis Shores-Dayton sure grip and baker Ross shores-Safeway Symons shores-Beaver-advanced shores dead shore-Raking and Flying shores

### **UNIT III SLIP FORMS AND SAFETY PRACTICES FOR SCAFFOLDS**

**10**

Principles-Types-Advantages-Functions of Various components-Planning-Desirable Characteristics of concrete-common problems faced-Safety in slip forms special structures built with slip form technique-Codal provisions- Types of Scaffolds-Putlog and independent Scaffold-Single pole scaffolds-Fixing ties-Spacing of ties plan-Bracing-Knots-Safety net-General safety requirements-precautions against particular hazards-Truss suspended-Gantry and system scaffolds.

### **UNIT IV FORMWORK DESIGN AND CAUSES OF ITS FAILURE**

**20**

Basic simplification-Beam formulae-Allowable stress-Deflection bending-Lateral stability-Shear, Bearing-Examples in wall forms-Slab forms-Beam forms-Ties, Anchors and Hangers-Column forms-Building and Erecting framework-Footings-Wall footings slopped footing forms-slab on grade and paving work-Highway and airport paving-curb and gutter forms-Wall forms -Giant forms curved wall forms-Wall openings joints-Tolerance for walls-Column heads-Beam forms- Suspended forms- Concrete

joint construction-Flying system forms- Domes Forms- Hemispherical, Parabolic, Translational typical barrel vaults, Hyperbolic Folded plates-Shell form Design Consideration loads- Tunnel forming components-Curb forms invert forms-Arch forms-Concrete placement methods- Cut and cover construction-General design considerations- Pressure on Form-Concrete density-Height of discharge-Temperature-Rates of placing-consistency of concrete-Live loads and wind pressure-Vibration hydrostatic pressure and pressure distribution- Causes of failures-Inadequate shoring inadequate bracing of members-Improper vibration-Premature stripping-Errors in design-Failure to follow codes-How formwork affects concrete quality-Safety factors.

#### **UNIT V MATERIALS AND SITE EQUIPMENT**

**10**

Lumber-Types-Finish-Sheathing boards working stresses-Repetitive member stress-Plywood-Types and grades- Textured surfaces and strength-Reconstituted wood-Steel-aluminum form lining materials-Hardware and fasteners-Nails in plywood-Bolts lag screws and connectors-Bolt loads- Crane arrangements-site layout plan-Transporting plant-Formwork beams-Formwork ties-Wales and ties-Scaffold frames from accessories-Vertical transport table form work.

**TOTAL = 60**

#### **TEXT BOOKS**

Robert L.Peurifoy and Garold D.Oberlander, "Formwork For concrete Structures ", McGraw-Hill, 1996.

Hurd.M.K., "Formwork for concrete ", Special Publication 7th Edition, American Concrete Institute, Detroit, 2005.

#### **REFERENCES**

Michael P. Hurst, "Construction Press ", London & NewYork, 1997.

Austin, C.K., "Formwork for concrete ", Cleaver - Hume Press Ltd., London, 1996.

Tudor Dinescu and Constantin Radulescu, "Slip Form Techniques ", Abacus Press, Turn Bridge Wells, Kent, 1992.

Guide for concrete formwork, American concrete institute, Detroit, Michigan, 1996.

Safety Requirements for Scaffolding, "American National Standards Institute ", New York, 10018, 1994.

## CE 2433 DESIGN PROJECT

L T P C  
0 0 6 2

### PREREQUISITES

CE 2301, CE 2401, CE 2402, CE 2331, CE 2332, CE 2305, CE 2403, CE2303.

### GOAL

To impart and improve the design capability of the students in any one of the disciplines of Civil Engineering.

### OBJECTIVES

To enable the students to work on a project involving theoretical and experimental studies related to Civil Engineering.

### OUTCOME

The students will be able to widen their knowledge based on the experimental or theoretical studies carried out in any one of the Civil Engineering areas such as Structural Engineering, Environmental Engineering, Water Resources Engineering, Transportation Engineering, Soil Mechanics and Remote sensing.

Students shall work in convenient groups of not more than six members in a group. Every Project Work shall have a Guide who is a member of the faculty of the University. Twenty four periods per week shall be allotted in the Time Table for this important activity and this time shall be utilized by the students to receive directions from the Guide, on library reading, laboratory work, computer analysis or field work as assigned by the Guide and also to present in periodical seminars the progress made in the project.

Each student shall finally produce a comprehensive report covering background information, literature survey, problem statement, Project work details and conclusions. This final report shall be typewritten form as specified in the guidelines.

**ELECTIVE SUBJECTS  
SEMESTER VIII  
CE 2551 ELECTRONIC SURVEYING**

**L T P C  
3 0 0 3**

**PREREQUISITES** CE 2304

**GOAL**

To equip the students with knowledge about advance surveying techniques, Electronic Distance Measurement and Electronic Surveying.

**OBJECTIVES**

The course should enable the students to :

Know about electronic devices which are used in electronic surveying.

To throw light on various conductors and equipment used.

Provide students with the fundamental technical knowledge about electromagnetic waves.

Understand the various techniques of micro waves

Understand the principles of Electronic Distance Measurement (EDM)

**OUTCOME**

The students will be able to :

Use different conductors for surveying.

Gain knowledge about different propagation of electromagnetic waves.

Use the techniques, skills, and modern surveying engineering tools necessary for surveying engineering practice

Gain knowledge about different propagation of micro waves.

Conduct survey using the EDM for measurement of distances, traversing and base line measurement.

**UNIT I BASICS** **7**

Methods of measuring distance, historical development, basic principles, classifications, applications and comparison with conventional surveying.

**UNIT II CONDUCTORS** **8**

Fundamentals of electronics, resonant circuits, semiconductors, Lasers, Cathode ray tube, photo multiplier tube, transducers, oscillators, frequency mixing, modulation and demodulation, Kerrcell modulator, measurement of phase difference, reflectors and power sources.

**UNIT III ELECTROMAGNETIC WAVES** **8**

Definition, classification, applications, propagation properties, wave propagation at lower and higher frequencies. Refractive index, factors affecting, computation of group refractive index for light and

near infrared waves at standard conditions and ambient conditions, reference refractive index, first velocity correction.

#### **UNIT IV MICRO WAVES**

**7**

Definition, classification, applications, propagation properties, wave propagation at lower and higher frequencies, computation of refractive index for microwaves, measurement of atmospheric parameters, mean refractive index, real time application of first velocity correction, second velocity correction and total atmospheric correction.

#### **UNIT V ELECTROMAGNETIC DISTANCE MEASURING SYSTEM**

**15**

Electro-optical system, measuring principle, working principle, sources of error, infrared EDM instruments, Laser EDM instruments and total station. Microwave system, measuring principle, working principle, sources of error, microwave EDM instruments, comparison with Electro-optical system, care and maintenance of EDM instruments, Modern Positioning Systems, EDM traversing, trilateration and base line measurement using EDM.

**TOTAL = 45**

#### **TEXT BOOKS**

Burnside, C.D. Electromagnetic distance measurement 3rd edition, Blackwell Science, 1991.

Rueger, J.M. Electronic Distance Measurement, Springer-Verlag, Berlin, 1996.

#### **REFERENCES**

Laurila, S.H. Electronic Surveying in Practice, John Wiley and Sons Inc, 1983.

Soastamoinen, J.J. Surveyor's guide to electro-magnetic Distance Measurement, Adam Hilger Ltd., 1967.

### **CE 2553 REMOTE SENSING TECHNIQUES AND APPLICATIONS**

**L T P C**  
**3 0 0 3**

**PREREQUISITES** CE 2304

#### **GOAL**

To equip the students with knowledge about remote sensing techniques and its application in natural resource management.

#### **OBJECTIVES**

The course should enable the students to :

Understand the concepts of Electromagnetic radiance.

Learn the various types of land use/ land cover.

Get acquainted with the principles of mapping flood risk zone.

Understand the concepts behind agriculture, forest and soil.

Understand the concepts of earth science.

## **OUTCOME**

The students will be able to:

Describe the various components of electromagnetic radiation

Analyse the basic data for urban land use planning

Identify ground water potential zones, recharge area and assess drought.

Prepare crop inventory mapping and can produce estimation.

Describe the principles of lithological and structural mapping.

### **UNIT I INTRODUCTION**

**9**

Definition - Physics of remote sensing - electromagnetic radiation (EMR) - remote sensing windows interaction of EMR with atmosphere, earth surface, soils, water and vegetation - platform and sensors - image interpretations.

### **UNIT II LAND USE STUDIES**

**9**

Definition of land use - land use / land cover classification - schemes and levels of classification systems with RS data - land use mapping - change detection - urban land use planning, site suitability analysis, transportation planning.

### **UNIT III WATER RESOURCES**

**9**

Aerial assessment of surface water bodies - Capacity survey of water bodies - mapping of snow - covered areas - flood risk zone mapping - identification of groundwater potential zones, recharge areas - droughts, definition, drought assessment and management.

### **UNIT IV AGRICULTURE, SOIL AND FORESTRY**

**9**

Crop inventory mapping - production estimation - command area monitoring - soil mapping - crop stress detection - estimation of soil erosion - forest types and density mapping - forest fire risk zone mapping.

### **UNIT V EARTH SCIENCE**

**9**

Lithology - lithological mapping - structural mapping - Geomorphology - nature and type of landforms identification - use of remote sensing data for land slides - targeting mineral resource - Engineering geology and Environmental geology.

**TOTAL = 45**

## **TEXT BOOK**

Michael Hord, R. Remote Sensing Methods and Application, John Wiley and Sons, New York, 1986.

## REFERECNES

- Lillesand, T.M and Kicter R.W. Remote Sensing and Image Interpretation, John Willey and Sons, inc, new York, 2002.
- Steven, M.D, and Cllark, J.A. Application of Remote Sensing in Agriculture, Butterworths, London, 1990.
- Space Applications Centre, Manual for Forest Mapping and Damage Detection Using Satellite Data, Report No. IRS-UP/SAC/FMDD/TN/16/90, 1990, pp - 253.
- Sabins, F.F. Jr. Remote Sensing Principles and Interpretation, W.H. Freeman & Co., 1978.
- Manual of Remote Sensing Vol. II. American Society of Photogrammetry.

## CE 2555 BUILDING SERVICES

L T P C  
3 0 0 3

**PREREQUISITES** Nil

### GOAL

To impart the students with the various aspects of pumps and machinery involved in Civil Engineering practice and the principles of electrical and air conditioning facilities involved.

### OBJECTIVES

The course should enable the students to :

- Study about machineries used in the Civil Engineering field.
- Acquire knowledge about electrical systems in the buildings.
- Impart knowledge on the principles of Lighting and Illumination in the buildings.
- Familiarize with refrigeration principles and its applications.
- Create an awareness of the fire safety aspects in the buildings.

### OUTCOME

The students will be able to:

- Describe the different machineries used in the construction.
- Plan the electrical wiring for the buildings.
- Design the lighting system required for different types buildings.
- Choose suitable refrigeration and air conditioning systems for different types of buildings.
- Describe the fire safety aspects of building services.

**UNIT I MACHINERIES****8**

Hot Water Boilers - Lifts and Escalators - Special features required for physically handicapped and elderly - Conveyors - Vibrators - Concrete mixers - DC/AC motors - Generators - Laboratory services - Gas, water, air and electricity

**UNIT II ELECTRICAL SYSTEMS IN BUILDINGS****10**

Basics of electricity - Single / Three phase supply - Protective devices in electrical installations - Earthing for safety - Types of earthing - ISI specifications - Types of wires, wiring systems and their choice - Planning electrical wiring for building - Main and distribution boards - Transformers and switch gears - Layout of substations.

**UNIT III PRINCIPLES OF ILLUMINATION & DESIGN****8**

Visual tasks - Factors affecting visual tasks - Modern theory of light and colour - Synthesis of light - Additive and subtractive synthesis of colour - Luminous flux - Candela - Solid angle illumination - Utilisation factor - Depreciation factor - MSCP - MHCP - Laws of illumination - Classification of lighting - Artificial light sources - Spectral energy distribution - Luminous efficiency - Colour temperature - Colour rendering.

Design of modern lighting - Lighting for stores, offices, schools, hospitals and house lighting. Elementary idea of special features required and minimum level of illumination required for physically handicapped and elderly in building types.

**UNIT IV REFRIGERATION PRINCIPLES & APPLICATIONS****10**

Thermodynamics - Heat - Temperature, measurement transfer - Change of state - Sensible heat - Latent heat of fusion, evaporation, sublimation - saturation temperature - Super heated vapour - Subcooled liquid - Pressure temperature relationship for liquids - Refrigerants - Vapour compression cycle - Compressors - Evaporators - Refrigerant control devices - Electric motors - Starters - Air handling units - Cooling towers - Window type and packaged air-conditioners - Chilled water plant - Fan coil systems - Water piping - Cooling load - Air conditioning systems for different types of buildings - Protection against fire to be caused by A.C. Systems

**UNIT V FIRE SAFETY INSTALLATION****9**

Causes of fire in buildings - Safety regulations - NBC - Planning considerations in buildings like non-combustible materials, construction, staircases and lift lobbies, fire escapes and A.C. systems. Special features required for physically handicapped and elderly in building types - Heat and smoke detectors - Fire alarm system, snorkel ladder - Fire lighting pump and water storage - Dry and wet risers - Automatic sprinklers.

**TOTAL = 45****TEXT BOOKS**

Udayakumar, R, "A Text Book of Building Services", Eswar Press (2007 R.G.Hopkinson and J.D. Kay, "The Lighting of buildings", Faber and Faber, London, 1969.

William H.Severns and Julian R.Fellows, "Air-conditioning and Refrigeration", John Wiley and Sons, London, 1988.



## REFERENCES

- E.R.Ambrose, "Heat Pumps and Electric Heating", John and Wiley and Sons, Inc., New York, 1968.
- Handbook for Building Engineers in Metric systems, NBC, New Delhi, 1968.
- Philips Lighting in Architectural Design, McGraw-Hill, New York, 1964.
- A.F.C. Sherratt, "Air-conditioning and Energy Conservation", The Architectural Press, London, 1980.
- National Building Code.

## CE 2651 HOUSING PLANNING AND MANAGEMENT

L T P C  
3 0 0 3

**PREREQUISITES** CE 2331

### GOAL

To enable the students to develop skills on Housing Policies, Housing Laws at State level, Bye-laws at Urban and Rural Local Bodies and to decide appropriate New Constructions Techniques.

### OBJECTIVES

The course should enable the students to :

- Understand the principles of sustainable housing and strategies of National housing policies.
- Gain knowledge on the standards for different housing programmes.
- Understand the concepts involved in the planning and design of housing projects.
- Familiarise with the construction techniques and different materials for construction.
- Know about Housing Finance.

### OUTCOME

The students will be able to :

- Gain knowledge about the housing laws at state level at urbans and rural local bodies.
- Describe the standards for apartments, rental housing, slum housing etc.
- Make site analysis and execute the layout design and housing unit design.
- Choose the suitable techniques and materials for constructions.
- Make cash flow analysis and pricing of housing units.

## UNIT I INTRODUCTION TO HOUSING

9

Definition of Basic Terms - House, Home, Household, Apartments, Multi storied Buildings, Special

Buildings, Objectives and Strategies of National Housing Policies, Principle of Sustainable Housing, Housing Laws at State level, Bye-laws at Urban and Rural Local Bodies - levels - Development Control Regulations, Institutions for Housing at National, State and Local levels.

**UNIT II HOUSING PROGRAMMES 9**

Basic Concepts, Contents and Standards for Housing Programmes - Sites and Services, Neighbourhoods, Open Development Plots, Apartments, Rental Housing, Co-operative Housing, Slum Housing Programmes, Role of Public, Private and Non-Government Organisations.

**UNIT III PLANNING AND DESIGN OF HOUSING PROJECTS 9**

Formulation of Housing Projects - Site Analysis, Layout Design, Design of Housing Units (Design Problems).

**UNIT IV CONSTRUCTION TECHNIQUES AND COST-EFFECTIVE MATERIALS 9**

New Construction Techniques - Cost Effective Modern Construction Materials, Building Centres - Concept, Functions and Performance Evaluation.

**UNIT V HOUSING FINANCE AND PROJECT APPRAISAL 9**

Appraisal of Housing Projects - Housing Finance, Cost Recovery - Cash FloW Analysis, Subsidy and Cross Subsidy, Pricing of Housing Units, Rents, Recovery Pattern (Problems).

**TOTAL = 45**

**TEXT BOOKS**

Meera Mehta and Dinesh Mehta, Metropolitan Housing Markets, Sage Publications Pvt. Ltd., New Delhi. 1999.

Francis Cherunilam and Odeyar D Heggade, Housing in India, Himalaya Publishing House, Bombay, 1997.

**REFERENCES**

Development Control Rules for Chennai Metropolitan Aera, CMA, Chennai, 2002

UNCHS, National Experiences with Shelter Delivery for the Poorest Groups, UNCHS (Habitat), Nairobi, 1994.

National Housing Policy, 1994, Government of India.

## CE 2653 ENVIRONMENTAL IMPACT ASSESSMENT

L T P C  
3 0 0 3

**PREREQUISITES** CE 2305, CE 2604

### **GOAL**

To introduce the student the basic theory and concepts of various impact assessment procedures to protect the Environment.

### **OBJECTIVES**

The course should enable the students to:

Know about the basics of Environmental Impact Assessment(EIA) and the legal provisional in EIA.

Study about the various methods involved in EIA.

Predict and assess the impact of various developmental activities on environment.

Get knowledge about the environmental management plan to take care of adverse impacts.

Study the impact due to highway projects, airport projects and other infrastructure projects.

### **OUTCOME**

The students will be able to:

Describe the importance of EIA studies.

Apply the various methods for carrying out EIA studies.

Apply the various techniques for predicting and assessing the impact.

Mitigate the adverse impacts arising out of development projects.

Carry out EIA studies and prepare EIA report for various infrastructure and development projects.

### **UNIT I INTRODUCTION 5**

Impact of development projects under Civil Engineering on environment - Environmental Impact Assessment (EIA) - Environmental Impact Statement (EIS) - EIA capability and limitations - Legal provisions on EIA.

### **UNIT II METHODOLOGIES 5**

Methods of EIA -Check lists - Matrices - Networks - Cost-benefit analysis - Analysis of alternatives - Case studies.

### **UNIT III PREDICTION AND ASSESSMENT 10**

Assessment of Impact on land, water and air, noise, social, cultural flora and fauna; Mathematical models; public participation - Rapid EIA.

**UNIT IV ENVIRONMENTAL MANAGEMENT PLAN 10**

Plan for mitigation of adverse impact on environment - options for mitigation of impact on water, air and land, flora and fauna; Addressing the issues related to the Project Affected People - ISO 14000

**UNIT V CASE STUDIES 15**

EIA for infrastructure projects - Bridges - Stadium - Highways - Dams - Multi-storey Buildings - Water Supply and Drainage Projects.

**TOTAL = 45**

**TEXT BOOKS**

R. Pannirselvam and S. Karthikeyan, "Environmental Impact Assessment", SPGS Publishers, Chennai - 600 088, 2005.

Canter, R.L., "Environmental Impact Assessment", McGraw-Hill Inc., New Delhi, 1996.

Shukla, S.K. and Srivastava, P.R., "Concepts in Environmental Impact Analysis", Common Wealth Publishers, New Delhi, 1992.

**REFERENCES**

John G. Rau and David C Hooten (Ed)., "Environmental Impact Analysis Handbook", McGraw-Hill Book Company, 1990.

"Environmental Assessment Source book", Vol. I, II & III. The World Bank, Washington, D.C., 1991.

Judith Petts, "Handbook of Environmental Impact Assessment Vol. I & II", Blackwell Science, 1999.

**CE 2655 AIR POLLUTION MANAGEMENT**

**L T P C  
3 0 0 3**

**PREREQUISITES** CE 2305

**GOAL**

To make the students familiar with various types of Air Pollutants, their effects and control methods, and to expose the students to the various Air Pollution dispersion models.

**OBJECTIVES**

The course should enable the students to :

Understand the various types of Air Pollutants and their effects of human beings, materials, vegetations and animals.

Understand the meteorological factor responsible for dispersion of pollutants.

Know about the measurement of the Air Pollutants in the ambient air using high volume air samplers.

Study about the control methods adopted for different types of Air Pollutants coming out from different types of industries.

Study about the noise pollution problems and the noise standards.

### **OUTCOME**

The students will be able to:

Categorise the various type of Air Pollutants coming out from different sources.

Gain knowledge in the dispersion of pollution, meteorological factors and dispersion models.

Sample and analyse the major air pollutants present in the ambient air.

Select appropriate control equipment to minimize the air pollution problems in industries.

Measure noise levels in industries and compare with standards and to suggest appropriate measures to noise pollution problems.

### **UNIT I SOURCES AND EFFECTS OF AIR POLLUTANTS 9**

Classification of air pollutants - Particulates and gaseous pollutants - Sources of air pollution - Source inventory - Effects of air pollution on human beings, materials, vegetation, animals - global warming-ozone layer depletion, Sampling and Analysis - Basic Principles of Sampling - Source and ambient sampling - Analysis of pollutants - Principles.

### **UNIT II DISPERSION OF POLLUTANTS 9**

Elements of atmosphere - Meteorological factors - Wind roses - Lapse rate - Atmospheric stability and turbulence - Plume rise - Dispersion of pollutants - Dispersion models - Applications.

### **UNIT III AIR POLLUTION CONTROL 15**

Concepts of control - Principles and design of control measures - Particulates control by gravitational, centrifugal, filtration, scrubbing, electrostatic precipitation - Selection criteria for equipment - gaseous pollutant control by adsorption, absorption, condensation, combustion - Pollution control for specific major industries.

### **UNIT IV AIR QUALITY MANAGEMENT 7**

Air quality standards - Air quality monitoring - Preventive measures - Air pollution control efforts - Zoning - Town planning regulation of new industries - Legislation and enforcement - Environmental Impact Assessment and Air quality

### **UNIT V NOISE POLLUTION 5**

Sources of noise pollution - Effects - Assessment - Standards - Control methods - Prevention

**TOTAL = 45**

### **TEXT BOOKS**

Anjaneyulu, D., "Air Pollution and Control Technologies", Allied Publishers, Mumbai, 2002.

Rao, C.S. Environmental Pollution Control Engineering, Wiley Eastern Ltd., New Delhi, 1996.

Rao M.N., and Rao H. V. N., Air Pollution Control, Tata-McGraw-Hill, New Delhi, 1996.

## REFERENCES

- W.L.Heumann, Industrial Air Pollution Control Systems, McGraw-Hill, New York, 1997
- Mahajan S.P., Pollution Control in Process Industries, Tata McGraw-Hill Publishing Company, New Delhi, 1991.
- Peavy S.W., Rowe D.R. and Tchobanoglous G. Environmental Engineering, McGraw Hill, New Delhi, 1985.
- Garg, S.K., "Environmental Engineering Vol. II", Khanna Publishers, New Delhi
- Mahajan, S.P., "Pollution Control in Process Industries", Tata McGraw-Hill, New Delhi, 1991.

## CE 2657 MODERN CONSTRUCTION MATERIALS

L T P C  
3 0 0 3

**PREREQUISITES** Nil

### GOAL

To educate students on protective, preventive and corrective actions, to be taken in a building with regards to various materials, details and stages in construction, for comprehensive understanding of practices to cover water proofing, types of insulation, covering, paints and enamels.

### OBJECTIVES

The course should enable the students to :

- Understand the various materials and membranes for water- proofing their method of application depending on the context like basements, floors and terraces, through detail drawing.
- Study the heat transfer into buildings by various materials, their properties, uses and methods of application in floors, walls and roofs, through detail drawing.
- Enable the students understand the importance acoustical or sound treatment in building through use of various boards, quilts, and mats available in the market, their properties and uses for contextual applications.
- Understand the various floor and wall finishing materials, their properties, method of laying and making them to adopt for barrier free environment, through detail drawing.
- Understand the properties, uses and applications of various paints, enamels, emulsions, varnishes and their varieties for contextual application in buildings.

### OUTCOME

The students will be able to:

- Able to make proper choice of material for water proofing for different applications.
- Aware of process of heat transfer; in various materials & can make proper choice of thermal constructive material.

Gain knowledge in various acoustic insulation materials & its importance.

Make proper choice of floor & wall finishing materials & aware of proper method of laying.

Gain knowledge of paint, enamels, and varnishes & make proper choice for contextual application in buildings.

**UNIT I DAMP AND WATER PROOFING 9**

Damp proofing- hot applied and cold applied- Emulsified asphalt, Bentonite clays, butyl rubber, silicon, vinyl's Epoxy resins and metallic water proofing materials properties, uses.(Water proofing membranes such as rag, asbestos, glass, felt- plastic and synthetic rubber- vinyl, butyl rubber, neoprene polyvinyl chloride (PVC)- Application of the above under various situations- basement floors, swimming pool, terraces, etc.

**UNIT II THERMAL INSULATION 9**

Heat transfer and heat gain by materials- vapor barriers and rigid insulation- properties and uses of spun glass, foamed glass, cork, vegetable fibers, mineral fibers, foamed plastics, and vermiculite and glass fibers. Gypsum- manufacture, properties and uses, plaster of paris and hydride gypsum.

**UNIT III ACOUSTIC INSULATION 9**

Porous, Baffle and perforated materials such as acoustic plastic, acoustic tiles, wood, partial board, fiber board, cork, quilts and muts- Brief study on properties and uses of the above-current developments.

**UNIT IV FLOOR AND WALL COVERINGS 9**

Floor coverings- flooring- softwood, hardwood- Resilient flooring- terrazzo- properties, uses and laying. Wall coverings - Porcelain, enameled metal, wood veneer, Vinyl, plastic surfaced paneling - properties uses and lying. Wall and floor tiles- Ceramic glazed mosaic, quarry and cement files- properties uses and lying. Market study of current developments.

**UNIT V PROTECTIVE AND DECORATIVE COATINGS 9**

Paints - Enamels, distempers, plastic emulsions, cement based paints- properties, uses and applications- defects in painting, varnishes, special purpose paints- luminous & fire retardant paints, properties, uses & application.

**TOTAL = 45**

**TEXT BOOKS**

S.C.Rangwala, "Building Construction" , Charotar Publishing House, Anand, India, 2008.

B.C.Punmia, "Building Construction", Laxmi Publications Pvt. Ltd., New Delhi, 1993.

Francis. D. K. Ching, "A Visual Dictionary of Architecture", Van Nostrand Reinhold - 1997.

Arora S.P. and Bindra S.P., Building Construction Planning Techniques and Method of Construction, Dhanpat Rai Sons, 1997.

## REFERENCES

- Jack M.Launders, "Construction Materials, Methods", Careers pub, J.Holland, Illinois Wileox Co., Inc. 1983.
2. Arthur R.Llons, "Materials for architects and builders An introduction", Holder Headline group, Great Britain, 1997.
- Don.A.Watson, "Construction Materials and Processes", McGraw-Hill Book Co.,1972.

## CE 2752 PRESTRESSED CONCRETE

L T P C  
3 0 0 3

**PREREQUISITES** CE 2402, CE 2503

### GOAL

To possess the students with knowledge about behaviour, analysis and design requirements for prestressed concrete members according to Indian design code requirements.

### OBJECTIVES

The course should enable the students to :

- Understand the basic concepts of prestressing.
- Be acquainted with the codal provision for the design of prestressed concrete elements.
- Understand the principles involved in the design of tensioned bridge decks.
- Have comprehensive design knowledge about circular prestressing.
- Understand the design concepts of pressure composite constructions.

### OUTCOME

The students will be able to:

- Describe the systems and methods of prestressing and find the deflection of prestressed elements.
- Design the prestressed concrete elements as per the codal provisions.
- Design prestressed concrete tanks, poles and sleepers.
- Find the flexural and shear strength of prestressed concrete composite members.
- Design pretensioned and post tensioned concrete bridge decks.

### UNIT I INTRODUCTION - THEORY AND BEHAVIOUR

9

Basic concepts - Advantages - Materials required - Systems and methods of prestressing - Analysis of sections - Stress concept - Strength concept - Load balancing concept - Effect of loading on the tensile stresses in tendons - Effect on tendon profile on deflections - Factors influencing deflections



Calculation of deflections - Short term and long term deflections - Losses of prestress -  
Estimation of crack width

**UNIT II DESIGN 9**

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

**UNIT III CIRCULAR PRESTRESSING 9**

Design of prestressed concrete tanks - Poles and sleepers

**UNIT IV COMPOSITE CONSTRUCTION 9**

Analysis for stresses - Estimate for deflections - Flexural and shear strength of composite members

**UNIT V PRE-STRESSED CONCRETE BRIDGES 9**

General aspects - pretension prestressed bridge decks - Post tensioned prestressed bridge decks - Advantages over R.C. bridges - Principles of design only

**TOTAL = 45**

**TEXT BOOKS**

Krishna Raju N., Prestressed concrete, Tata McGraw Hill Company, New Delhi 2011

Mallik S.K. and Gupta A.P., Prestressed concrete, Oxford and IBH publishing Co.Pvt. Ltd. 1997.

**REFERENCES**

Ramaswamy G.S., Modern prestressed concrete design, Arnold Heinimen, New Delhi, 1990

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

David A.Sheppard, William R. and Philips, Plant Cast precast and prestressed concrete - A design guide, McGraw Hill, New Delhi 1992.

**CE 2753 FINITE ELEMENT ANALYSIS**

**3 0 0 3**

**PREREQUISITES** CE 2501

**GOAL**

To posses the students with knowledge about basic finite-element theory, computer implementation of this theory, and its practical applications.

**OBJECTIVES**

The course should enable the students to :

Understand finite-element analysis modeling and various methods involved in it.

Understand the concepts of finite element analysis of one dimensional problem.

Get knowledge on finite element formulation of two dimensional elements through generalized coordinates approach.

Study about Isoparametric elements and formulation of element equations.

Study about finite element analysis of problems related to field applications.

## **OUTCOME**

The students will be able to:

Solve simple problems using Ritz method and weighted residuals method.

Discretize one dimensional elements, formulate the element equation and find the solution of equation using cholesky method.

Discretize the two dimensional elements using triangular and quadrilateral elements, assemble element matrices and find solution for different boundary conditions.

Describe the Isoparametric elements and formulate element equations in one and two dimensions.

Apply finite element analysis for field applications such as Heat - transfer, Fluid flow etc.,

## **UNIT I INTRODUCTION - VARIATIONAL FORMULATION 9**

General field problems in Engineering - Modelling - Discrete and Continuous models - Characteristics Difficulties involved in solution - The relevance and place of the finite element method - Historical comments - Basic concept of FEM, Boundary and initial value problems - Gradient and divergence theorems - Functionals - Variational calculus - Variational formulation of VBPS. The method of weighted residuals - The Ritz method.

## **UNIT II FINITE ELEMENT ANALYSIS OF ONE DIMENSIONAL PROBLEMS 9**

One dimensional second order equations - discretization of domain into elements - Generalised coordinates approach - derivation of elements equations - assembly of elements equations - imposition of boundary conditions - solution of equations - Cholesky method - Post processing - Extension of the method to fourth order equations and their solutions - time dependant problems and their solutions - example from heat transfer, fluid flow and solid mechanics.

## **UNIT III FINITE ELEMENT ANALYSIS OF TWO DIMENSIONAL PROBLEMS 9**

Second order equation involving a scalar-valued function - model equation - Variational formulation - Finite element formulation through generalised coordinates approach - Triangular elements and quadrilateral elements - convergence criteria for chosen models - Interpolation functions - Elements matrices and vectors - Assembly of element matrices - boundary conditions - solution techniques.

## **UNIT IV ISOPARAMETRIC ELEMENTS AND FORMULATION 9**

Natural coordinates in 1, 2 and 3 dimensions - use of area coordinates for triangular elements in - 2 dimensional problems - Isoparametric elements in 1,2 and 3 dimensional - Lagrangean and serendipity elements - Formulations of elements equations in one and two dimensions - Numerical integration.

## **UNIT V APPLICATIONS TO FIELD PROBLEMS IN TWO DIMENSIONALS**

**9**

Equations of elasticity - plane elasticity problems - axisymmetric problems in elasticity - Bending of elastic plates - Time dependent problems in elasticity - Heat - transfer in two dimensions - incompressible fluid flow.

**TOTAL = 45**

### **TEXT BOOK**

Chandrupatla, T.R., and Belegundu, A.D., "Introduction to Finite Element in Engineering", Third Edition, Prentice Hall, India, 2003

### **REFERENCES**

J.N.Reddy, "An Introduction to Finite Element Method", McGraw-Hill, Intl. Student Edition, 1985.

Zienkiewics, "The finite element method, Basic formulation and linear problems", Vol.1, 4/e, McGraw-Hill, Book Co.

S.S.Rao, "The Finite Element Method in Engineering", Pergaman Press, 2003.

C.S.Desai and J.F.Abel, "Introduction to the Finite Element Method", Affiliated East West Press, 1972.

## **CE 2755 PAVEMENT DESIGN AND ENGINEERING**

**L T P C**  
**3 0 0 3**

**PREREQUISITES** CE 2602, CE 2702

### **GOAL**

To introduce the students on various IRC guidelines for designing rigid and flexible pavements.

### **OBJECTIVES**

The course should enable the students to :

Understand the types of pavements and the stress distribution in them.

Understand the methods of design of flexible pavements.

Familiarize with the various methods of design of rigid pavements.

Understand the pavement evaluation techniques and their maintenance.

Get exposed to the pavement stabilization techniques.

### **OUTCOME**

The students will be able to:

Describe the various types of pavements, stress and deflections in pavements under repeated loading.

Design the flexible pavement as per IRC.

Design the rigid pavement as per IRC.

Perform pavement evaluation by surface appearance and by deflection measurement.

Choose the suitable soil stabilisers and Geo-synthetics for rural roads.

**UNIT I TYPE OF PAVEMENT AND STRESS DISTRIBUTION ON LAYERED SYSTEM 9**

Introduction - Pavement as layered structure - Pavement types - rigid and flexible -Stress and deflections in pavements under repeated loading

**UNIT II DESIGN OF FLEXIBLE PAVEMENTS 9**

Flexible pavement design - Empirical - Semi empirical and theoretical Methods - Design procedure as per latest IRC guidelines - Design and specification of rural roads

**UNIT III DESIGN OF RIGID PAVEMENTS 9**

Cement concrete pavements - Modified Westergaurd approach - Design procedure as per latest IRC guidelines - Concrete roads and their scope in India.

**UNIT IV PERFORMANCE EVALUATION AND MAINTENANCE 9**

Pavement Evaluation [Condition and evaluation surveys (Surface Appearance, Cracks, Patches And Pot Holes, Undulations, Ravelling, Roughness, Skid Resistance), Structural Evaluation By Deflection Measurements, Present Serviceability Index] Pavement maintenance. [IRC Recommendations Only]

**UNIT V STABILISATION OF PAVEMENTS 8**

Stabilisation with special reference to highway pavements - Choice of stabilisers -Testing and field control -Stabilisation for rural roads in India -use of Geo-synthetics (geo-textiles & geo-grids) in roads.

**TOTAL = 45**

**TEXT BOOKS**

Kadiyali, L.R., "Principles and Practice of Highway Engineering", Khanna tech. Publications, New Delhi, 2000.

A. T. Papagiannakis, E. A. Masad , " Pavement Design and Materials "

Wright, P.H., "Highway Engineers", John Wiley & Sons, Inc., New York, 1996

Design and Specification of Rural Roads (Manual), Ministry of rural roads, Government of India, New Delhi, 2001

**REFERENCES**

Yoder R.J and Witczak M.W., "Principles of Pavement Design", John Wiley, 1975.

Guidelines for the Design of Flexible Pavements, IRC:37 - 2001, The Indian roads Congress, New Delhi.

Guideline for the Design of Rigid Pavements for Highways, IRC:58-1998, The Indian Roads Congress, New Delhi.

## CE 2756 GROUND IMPROVEMENT TECHNIQUES

3 0 0 3

**PREREQUISITES** Nil

### **GOAL**

To equip the students with latest available ground improvement techniques for Civil Engineering Structures.

### **OBJECTIVES**

The course should enable the students to:

- Understand the geotechnical problems in various types of soils and the suitable ground improvement techniques.
- Be familiar with the various dewatering techniques that can be used in the soils with higher ground water level.
- To know the various techniques and procedures adopted for ground improvement..
- Understand the concept, types and applications of earth reinforcement.
- Gain knowledge about the various types, materials and techniques used for grouting.

### **OUTCOME**

The students will be able to :

- Assess the geotechnical problems in various types of soils and suggest suitable ground improvement techniques.
- Choose the suitable dewatering techniques for construction sites where the ground water table is at a higher level.
- Identify the apt ground improvement technique for various types of soils and site conditions.
- Apply the earth reinforcement techniques for retaining walls and slopes.
- Use the various types of grouting materials and techniques to strengthen the soil.

### **UNIT I INTRODUCTION**

9

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

### **UNIT II DRAINAGE AND DEWATERING**

9

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

### **UNIT III IN-SITU TREATMENT OF COHESIONLESS AND COHESIVE SOILS**

9

In-situ densification of cohesionless and consolidation of cohesive soils -Dynamic compaction and consolidation - Vibrofloation - Sand pile compaction - Preloading with sand drains and fabric drains - Stone columns - Lime piles - Installation techniques only - relative merits of various methods and their limitations.

**UNIT IV EARTH REINFORCEMENT****9**

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

**UNIT V GROUT TECHNIQUES****9**

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

**TOTAL = 45****TEXT BOOK**

Purushothama Raj, P. "Ground Improvement Techniques", Tata McGraw-Hill Publishing Company, New Delhi, 1999.

**REFERENCES**

Jones J.E.P., Earth Reinforcement and Soil Structure, Butterworths, 1995.

Koerner, R.M., "Design with Geosynthetics", (3rd Edition) Prentice Hall, New Jersey, 2002

Jewell, R.A., "Soil Reinforcement with Geotextiles", CIRIA special publication, London, 1996

Das, B.M., "Principles of Foundation Engineering", Thomson Books / Cole, 2003.

**PCM 203 PROJECT FORMULATION AND APPRAISAL****L T P C  
3 0 0 3****GOAL**

This subject helps the students to understand the complete project formulation, appraisal process from project identification, to project clearance. It also give better exposure to the students in the area of appraisal ,finance and PSP process.

**OBJECTIVES**

The course should enable the students to:

Have the idea of project formulation and preparation of detailed project report.

Aware of the project costing

Gain knowledge of project appraisal

Be acquainted with the knowledge of project financing.

Be familiar with the private sector participation.

**OUTCOME**

The students should be able to:

Have wide knowledge in respect of the projects particularly infrastructure, World Bank projects, feasibility report, project clearances required.

Follow the method of cash flow in the projects and also have an idea of the investment and its value.

Understand the project appraisal and implement it in every stages of ongoing work and make decisions accordingly and to achieve the ultimate aim of profit.

Know about the requirement and source of finance to carry out the project and financial institutions.

Develop knowledge in respect of execution of infrastructure development project - BOT,BOLT,BOOT- technology transfer and foreign collaboration, scope of technology transfer.

**UNIT I PROJECT FORMULATION 12**

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

**UNIT II PROJECT COSTING 12**

Project cash flows-Time value of Money-Cost of Capital

**UNIT III PROJECT APPRAISAL 12**

NPV-BCR-IRR-ARR-Urgency-pay back period-Assessment of Various Methods-Indian Practice of Investment Appraisals-International practice of Appraisal-Analysis of Risk-Different Methods-Selection of a Project and Risk Analysis in Practice

**UNIT IV PROJECT FINANCING 12**

Project Financing-Means of Finance-Financial Institutions-Special schemes-Key Financial Indicators

**UNIT V PRIVATE SECTOR PARTICIPATION 12**

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

**TOTAL = 60**

**TEXT BOOKS**

Prasanna Chandra, " Projects-Planning Analysis Selection Implementation & Review 6th Edition ",Tata Mc Graw Hill Publishing Co., Ltd., New Delhi., 2006.

Joy.P.K., " Total Project Management - The Indian Context (Chapters 3- 7) ", New Delhi , Macmillan India Ltd., 2006.

**REFERENCES**

United Nations Industrial Development Organisation (UNIDO) "Manual for the preparation of Industrial Feasibility Studies ", (IDBI Reproduction) Bombay, 1987.

Barcus,S.W. and Wilkinson J.W., " Handbook of Management Consulting Services ", McGraw Hill, New York, 1986.

**ELECTIVE SUBJECTS**  
**SEMESTER IX**  
**PCM 701 CONSTRUCTION PERSONNEL MANAGEMENT**

**L T P C**  
**3 0 0 3**

**GOAL**

In construction industry labour force is the main source of activity which is to be monitored effectively. So that the output is maximum. In Human Resource management, students will be able to manages the challenges in handling manpower in the construction industry.

**OBJECTIVES**

The course should enable the students to:

Create the knowledge of manpower planning

Understand the various types of Organization

Be Familiar with the human behaviors

Create Awareness of welfare measures.

Be acquainted with the knowledge of management and development methods.

**OUTCOME**

The students should be able to:

Understand the manpower planning, organizing, controlling in human resource management.

Make use of the knowledge in respect of charts, staffing, plan and development, placement and training in actual field

To implement the basic psychology, motivation, performance, managing groups, behavioral aspects of decision making in real situations

As a project manager, he can become aware of his duty to ensure safety and health in addition to individual benefits in terms of compensation, GPF, laws related to welfare measures.

Apply these methods in managing the special human resource problems, employee appraisal and assessment in the construction industry.

**UNIT I MANPOWER PLANNING** **6**

Manpower Planning, Organizing, Staffing, directing and Controlling-Personnel Principles.

**UNIT II ORGANISATION** **10**

Organization-Span of control-Organization charts-Staffing plan-Development and Operation of Human resources-Managerial Staffing-Recruitment-Selection-Placement, Training and Development

**UNIT III HUMAN BEHAVIOUR** **12**

Introduction to the field of management-basic individual psychology-motivation-job design and performance management-Managing groups at work-self managing work teams-Inter group behaviour



and conflict in organizations-Leadership- Behavioral aspects of decision-making; and communication for people management

**UNIT IV WELFARE MEASURES** **5**

Compensation - Safety and Health- GPF- EPF- Group- Insurance- Housing- Pension- Laws-related to welfare measures.

**UNIT V MANAGEMENT AND DEVELOPMENT METHODS** **12**

Compensation-Wages and Salary, Employee Benefits ,employee appraisal and assessment-Employee services-Safety and Health-Discipline and Discharge-Special human resource problems, Performance appraisal-Employee hand book and personnel manual-Job descriptions and organization structure and Human relations-Productivity of Human resources

**TOTAL = 45**

**TEXT BOOKS**

Carleton Counter II and Jill Justice Coulter, "The Complete Standard Hand Book of Construction Personnel Management", Prentice Hall, Inc., New Jersey, 1989.

Memoria, C.B., "Personnel Management ", Himalaya Publishing Co., 1999.

**REFERENCES**

Josy.J Familaro, "Handbook of Human Resources Administration", McGraw Hill International Edition, 1987.

Pringle Charles, "Management Longnecker " Emerricle Publishing Co., 1981.

R.S.Dwivedi, "Human Relations and Organisational Behaviour ",5th Edition, BH -2005

**PCM 105 CONSTRUCTION PROJECT MANAGEMENT**

**L T P C**  
**4 0 0 4**

**GOAL**

To achieve comprehensive knowledge in Construction Project management which includes the concepts of Planning, Scheduling, Design, Construction, Material and Equipment Utilization Process.

**OBJECTIVES**

The course should enable the students to:

Understand the Perspective of owner's.

Study the Project management of Organizing.

Become familiar with the Design and Construction Process.

Understand the Labour, Material and equipment utilization.

Get Awareness about the Cost Estimation in the Construction Project.

## OUTCOMES

The students will be able to :

Develop knowledge of Construction Professional Services, Finance facilities, Legal and regulatory requirements, Role of contractors and Project Managers.

Gain knowledge on Professional Construction Management and interpersonal behavior in Project Organization, leadership and motivation.

Apply knowledge on Construction Planning , Computer Aided Engineering and Value Engineering, Feasibility Studies.

Analysis the labour productivity materials, Management, Materials Procurement, and delivery, Inventory control, Tradeoffs cost in material management, Choice of equipments and standard production rates.

Type of construction cost estimates, Unit-cost method of estimation, application of cost indices to estimating, allocation of construction cost overtime and estimation of operating costs.

### UNIT I THE OWNER'S PERSPECTIVE

9

Introduction-The project life cycle-Major Types of Construction-Selection of Professional Services-Construction contractors-Financing of constructed facilities-Legal and regulatory Requirements-The changing Environment of the construction Industry-The Role Project Managers.

### UNIT II ORGANIZING FOR PROJECT MANAGEMENT

9

Project management-Trends in Modern Management-Strategic planning and project programming-Effects of project risks on organization-Organization of Project Participants-Traditional designer-Constructor sequence-Professional construction management-Owner-Builder-Operation-Turnkey operation-Leadership and Motivation for the Project team-Interpersonal behavior in project organization-perceptions of Owners and Contractors

### UNIT III THE DESIGN AND CONSTRUCTION PROCESS

9

Design and construction as an integrated system-Innovation and technological Feasibility-Innovation and technological feasibility-Design Methodology-Functional Design-Physical Structures-Geo-Technical Engineering Investigation-Construction Site Environment-Value engineering-Construction Planning-Industrialized Construction and Prefabrication-Computer -Aided Engineering.

### UNIT IV LABOUR, MATERIAL AND EQUIPMENT UTILIZATION

9

Historical Perspective-Labour Productivity-Factors Affecting Job-Site Productivity-Labor Relations in construction-Problems in collective bargaining-Materials Management-Materials Procurement and Delivery- Inventory control-Tradeoffs of cost in Material Management-Construction Equipment-Choice of Equipment and Standard production Rates-Construction Processes Queues and Resource Bottlenecks

## UNIT V COST ESTIMATION

9

Costs Associated with Construction Facilities-Approaches to cost estimation-Type of construction cost estimates-Effects of scale on construction cost-Unit cost-Method of estimation-Methods for allocation of joint costs-Historical cost data-Cost indices-Applications of cost Indices to Estimating-Estimate based on Engineers List of Quantities-Allocation of Construction costs over time-Computer Aided cost Estimation-Estimation of operating costs

**TOTAL = 45**

### TEXT BOOKS

- Chris Hendrickson and Tung Au, "Project management for Construction - Fundamental Concepts for owners ", Engineers, Architects and Builders, Prentice Hall, Pittsburgh, 2000.
- Chitkara, K.K. "Construction Project Management Planning ", Scheduling and Control, Tata McGraw Hill Publishing Co., New Delhi, 1998.

### REFERENCES

- Frederick E.Gould, "Construction Project Management ", Wentworth Institute of Technology, Vary E.Joyce, Massachusetts Institute of Technology, 2001.
- Choudhury, S., "Project Management ", Tata McGraw Hill Publishing Co., New Delhi, 2008.
- Ernest E. Ludwig, "Applied project Engineering and Management ", Gulf Publishing Co., Houston, Texas, 1988.
- Harold Kerzner, "Project Management - A systems Approach to Planning ", Scheduling and Controlling, CBS Publishers & Distributors, Delhi, 9th Edition, 2006.
- Joy P.K., "Total Project Management ", The Indian Context, Macmillan, India Ltd., New Delhi, 1994.

## PCM 702 MAINTENANCE AND REHABILITATION OF STRUCTURES

L T P C  
4 0 0 4

**PREREQUISITE** Nil

### GOAL

To introduce the student to concrete quality, durability aspects, causes of deterioration and demolition procedure.

### OBJECTIVES

The course should enable the students to :

- Able to introduce to quality assurance for concrete construction.
- Be familiar with serviceability and durability of concrete structures.
- Gain knowledge of maintenance and repair strategies.
- Be familiar with the properties of materials & repair techniques.
- Throw light on engineered demolition techniques.

## OUTCOME

The students will be able to :

- Develop knowledge of concrete quality and various properties of concrete.
- Gain knowledge of various mechanics involved in serviceability and durability of structures.
- Aware of various procedure and techniques in repair and rehabilitation.
- Gain knowledge of material and techniques in repair work.
- Describe case studies involved in dilapidated structures.

### UNIT I GENERAL

12

Quality assurance for concrete construction as built concrete properties strength, permeability, thermal properties and cracking.

### UNIT II INFLUENCE ON SERVICEABILITY AND DURABILITY

12

Effects due to climate, temperature, chemicals, wear and erosion, Design and construction errors, corrosion mechanism, Effects of cover thickness and cracking, methods of corrosion protection, corrosion inhibitors, corrosion resistant steels, coatings, cathodic protection.

### UNIT III MAINTENANCE AND REPAIR STRATEGIES

12

Definitions : Maintenance, repair and rehabilitation, Facets of Maintenance importance of Maintenance Preventive measures on various aspects Inspection, Assessment procedure for evaluating a damaged structure causes of deterioration - testing techniques.

### UNIT IV MATERIALS AND TECHNIQUES FOR REPAIR

12

Special concretes and mortar, concrete chemicals, special elements for accelerated strength gain, Expansive cement, polymer concrete, sulphur infiltrated concrete, ferro cement, Fibre reinforced concrete. Rust eliminators and polymers coating for rebars during repair foamed concrete, mortar and dry pack, vacuum concrete, Guniting and Shotcrete Epoxy injection, Mortar repair for cracks, shoring and underpinning. Repairs to overcome low member strength, Deflection, Cracking, Chemical disruption, weathering wear, fire, leakage, marine exposure..

### UNIT V ENGINEERED DEMOLITION TECHNIQUES

12

Engineered Demolition techniques for dilapidated structures - Case studies.

**TOTAL = 60**

## TEXT BOOKS

Denison Campbell, Allen and Harold Roper, "Concrete Structures ", Materials, Maintenance and Repair, Longman Scientific and Technical UK, 1991.

R.T.Allen and S.C.Edwards, "Repair of Concrete Structures ", Taylor & Francis, 1993.

## REFERENCES

M.S.Shetty, "Concrete Technology - Theory and Practice ", S.Chand and Company, New Delhi, 6th Edition, 2005.

Santhakumar, A.R., "Training Course notes on Damage Assessment and repair in Low Cost Housing ", "RHDC-NBO "Anna University, July, 1992.

Raikar, R.N., "Learning from failures - Deficiencies in Design ", Construction and Service - R & D Centre (SDCPL), Raikar Bhavan, Bombay, 1987.

N.Palaniappan, "Estate Management, Anna Institute of Management ", Chennai, 1992.

Lakshmi pathy, Metal Lecture notes of Workshop on "Repairs and Rehabilitation of Structures", 29 - 30th October 1999.

## PCM 703 ENERGY CONSERVATION TECHNIQUES IN BUILDING CONSTRUCTION

L T P C  
3 0 0 3

### GOAL

Enable the students to know about energy conservation techniques in building construction which includes smart utilization of alternate sources of energy for buildings, green building concepts and energy management concepts which is the need of the day.

### OBJECTIVES

The course should enable the students to:

Introduce to energy usage in buildings, and energy production systems.

Know the design of green buildings and various waste management methods.

To study energy efficient design strategies

Gain ideas of various conservative measures

To study about different methods of energy methods of energy management.

### OUTCOME

The students should be able to:

Know the importance of energy conservation especially in commercial and industrial units.

Get an idea about the importance of waste management techniques to be used.

Use advanced technologies in building construction which are eco-friendly.

Know the methods of energy management which are highly required in construction industry.

Handle energy savings in lighting systems which is a main constitute to the total power use.

### UNIT I INTRODUCTION

6

Fundamentals of Energy-Energy production systems-Heating, Ventilating and Air conditioning-  
Solar Energy and conservation-Energy Economic Analysis-Energy conservation and audits-  
Domestic energy consumption-Savings-Challenges-Primary energy use in buildings-  
Residential-commercial-Institutional and public buildings

**UNIT II ENVIRONMENTAL****7**

Energy and resource conservation-Design of green buildings-Evaluation tools for building energy-Embodied and operating energy-Peak demand-Comfort and indoor air quality-Visual and acoustical quality-Land, water and materials-Airborne emissions and Waste management

**UNIT III DESIGN****8**

Natural building design consideration-Energy efficient design strategies-Contextual factors-Longevity and process assessment-Renewable energy sources and design-Advanced building technologies-Smart buildings-Economies and cost analysis

**UNIT IV SERVICES****12**

Energy in building design-Energy efficient and environmental friendly building-Thermal phenomena-Thermal comfort-Indoor air quality-Climate, Sun and solar radiation-Psychometrics-Passive heating and cooling systems- Energy analysis -Active HVAC systems-Preliminary investigations-Goals and policies-Energy audit-Types of Energy audit-Analysis of results-Energy flow diagram-Energy consumption/Unit production-Identification of wastage-Priority of conservative measures-Maintenance of energy management program.

**UNIT V ENERGY MANAGEMENT****12**

Energy management of electrical equipment-Improvement of power factor-Management of maximum demand-Energy savings in pumps-Fans-Compressed air systems-Energy savings in lighting systems-Air conditioning systems-Applications-Facility operation and maintenance-Facility modifications-Energy recovery dehumidifier-Waster heat recovery-Steam plants and distribution systems-Improvement of boiler efficiency-Frequency of blow down-Steam leakage-Steam flash and condense return

**TOTAL = 45****TEXT BOOK**

Moore F., " Environmental control systems ", McGraw Hill, Inc., 1994

**REFERENCES**

Brown, G.Z, Sun, " Wind and Light: Architectural design Strategies ", John Wiley & Sons, 1985.

Cook, J, "Award - Winning Passive Solar Design ", McGraw Hill, 1984.

## PCM 704 PROJECT SAFETY MANAGEMENT

L T P C  
3 0 0 3

### GOAL

This subject gives exposure to the students about various construction accidents, their causes and preventive measures to be taken. Safety programmes and contractual obligations for safety in construction contracts are highlights of this subject.

### OBJECTIVES

The course should enable the students to :

- Be familiar with construction accidents.
- Understand the elements of safety program.
- Be acquainted with the knowledge of safety in construction contracts.
- Understands the design for safety.
- Be familiar with the role of owner & designer in construction safety.

### OUTCOMES

The student will be able to :

- Be able to describe the importance of safety and know the legal implications if safety is not followed at site.
- Execute a proper safety program for construction project.
- Apply safety parameter in construction contract documents.
- Describe the responsibilities of different level of workers with regard to safety for a construction project.
- Gain knowledge on selection of safe contractors and designer who will pay more attention to safety.

### UNIT I CONSTRUCTION ACCIDENTS 10

Accidents and their causes-Human factors in construction safety-cost of construction injuries-Occupational and Safety hazard assessment-Legal implications

### UNIT II SAFETY PROGRAMMES 10

Problem areas in construction safety-Elements of an Effective an safety program-Job site Safety assessment-safety meetings-safety incentives

### UNIT III CONTRACTUAL OBLIGATIONS 5

Safety in construction contracts-Substance Abuse-Safety record keeping

### UNIT IV DESIGNING FOR SAFETY 15

Safety culture-Safe workers-Safety and first line supervisors-Safety and Middle Managers-Top

Management Practices, Company Activities and Safety-Safety Personnel-Sub contractual obligation Project Coordination and Safety Procedures-Workers Compensation

**UNIT V OWNERS AND DESIGNERS OUTLOOK**

5

Owner involvement in construction safety, selecting safe contractors, Designer selection, Owners attitudes about designing for safety, Design decisions that affect safety.

**TOTAL = 45**

**TEXT BOOK**

Jimmy W.Hinze, "Construction Safety ", Prentice Hall Inc., 1997.

**REFERENCES**

Richard J. Coble, Jimmie Hinze and Theo C.Haupt, "Construction Safety and Health Management", Prentice Hall Inc., 2001.

Tamilnadu Factory Act.

**PCM 705 QUALITY CONTROL AND ASSURANCE IN CONSTRUCTION**

**L T P C**  
**3 0 0 3**

**GOAL**

This subject gives complete awareness of quality control and quality assurance in construction activities.

**OBJECTIVES**

The course should enable the students to:

Create basic knowledge about quality management.

Aware of the ISO quality system.

Have a wide knowledge of quality planning

Familiar with quality assurance and control

Have a knowledge of how to improve the quality.

**OUTCOME**

The students should be able to:

Make use of this knowledge for the organization and formulate the system responsibilities and construction teams

Implement the standards and preparation of documents in real situation.

Use all the relevant codes and standards, codes of quality, quality policy, methods in construction industry, based on the above to attain highest level of customer satisfaction in projects.



Wide knowledge in this will help to solve numerous problems on the way and able to take early decisions to achieve the ultimate aim of the organization.

With the help of the knowledge students will be able to formulate the details, specification and drawings.

**UNIT I QUALITY MANAGEMENT 9**

Quality - Introduction, Definitions, Objectives and Management functions, Types of Quality organizational Structure- Responsibilities and authorities, Total Quality System, Inspection, Control and Improvement- Quality circles and Improvement Teams- Construction Team- Owner, engineers, Architect, Contractors.

**UNIT II QUALITY SYSTEMS 9**

Introduction - Quality system Standard- ISO family of standards and structure Requirement- Preparing quality systems Documents- Quality related training - Implementing Quality system- Third party certification.

**UNIT III QUALITY PLANNING 9**

Quality Policy, Objectives and methods in construction Industry - Consumers Satisfaction- Ergonomics-Time of completion - Statistical tolerance - Taguch's concept of quality - Codes and Standards-Contract Documents and Construction Programming - Factors influencing construction Quality - Inspection procedures for construction processes and products - Total QA/QC programme- Cost of Quality.

**UNIT IV QUALITY ASSURANCE AND CONTROL 9**

Definitions and Objectives - Techniques and needs of QA/QC- Regulatory agent, Contract and Construction oriented objectives and methods- Technical Control and Financial Control - Different aspects of quality - Appraisals- Critical, major failure aspects and failure mode analysis- Stability methods and tools, optimum design reliability testing, reliability coefficient and reliability prediction.

**UNIT V QUALITY IMPROVEMENT 9**

Selection of Construction materials -Influence of drawings, detailing, specification, Standardization- Bid preparation-Construction activity-Environmental safety, Social and Environmental factors - Natural cause and speed of construction- Life cycle costing- Value Engineering and value analysis.

**TOTAL = 45**

**TEXT BOOKS**

James, J.O Brian, "Construction Inspection Handbook - Quality Assurance and Quality Control", Van Nostrand, New York, 1989.

Kwaku A., Tenah and Jose M.Guevera, "Fundamental of Construction Management and Organization ", Prentice Hall of India, 1995.

**REFERENCES**

Juran Frank, J.M. and Gryna, F.M. " Quality planning and Analysis ", Tata McGraw Hill, 1982.

Hutchins. G., "ISO 9000 ", Viva Books, NewDelhi, 1993.

Clarkson H. Oglesby, "Productivity Improvement in Construction ", McGraw Hill, digitized on 2007.

John L.Ashford, "The Management of Quality in Construction ", E & F.N Spon, New York, 1992.

Steven McCabe, "Quality Improvement Techniques in Construction ", Addison Wesley Longman Ltd., England, 1998.

## **PCM 706 SYSTEM INTEGRATION IN CONSTRUCTION**

**L T P C**  
**3 0 0 3**

### **GOAL**

Understand the Structural and Functional aesthetic system requirements for Buildings.  
Environmental issues and Service requirement of Plumbing, Electricity, etc in Buildings.

### **OBJECTIVES**

The course should enable the students to

Study the Structural systems in construction.

Be familiar with the Environmental system in Construction.

Be acquainted with the knowledge of Services in construction.

Be familiar with the Maintenance of Construction.

Be clear in the Safety of fire, Fire escape system design, Pollution free and Hazard free in Construction execution process.

### **OUTCOMES**

The students will be able to :

Apply the knowledge of materials selection and specification.

Use relevant Environmental system integration with Structural system.

Guide the system of plumbing, Electricity, Arrangements.

Develop the Knowledge in the Maintenance and replacement of damage components, maintenance free exposed and finished surfaces.

Aware of the safety, Fire, escape system, planning free construction environmental and Hazard free construction execution.

### **UNIT I STRUCTURAL**

**9**

Structural system, Systems for enclosing buildings, Functional aesthetic system, Materials selection and Specification.

<b>UNIT II ENVIRONMENTAL</b>	<b>9</b>
Qualities of enclosure necessary to maintain a specified level of interior environmental quality- Weather resistance-Thermal infiltration-Acoustic control-Transmission reduction-Air quality- Illumination-Relevant systems integration with structural systems	
<b>UNIT III SERVICES</b>	<b>9</b>
Plumbing-Electricity-Vertical circulation and their interaction	
<b>UNIT IV MAINTENANCE</b>	<b>9</b>
Component Longevity in terms of operation performance and resistance to deleterious forces- Planning systems for least maintenance-Feasibility for replacement of damaged components equal life elemental design- Maintenance free exposed and finished surfaces	
<b>UNIT V SAFETY</b>	<b>9</b>
Ability of systems to protect fire-Preventive systems-Fire escape system design-Planning for pollution free construction environmental-Hazard free Construction execution.	
<b>TOTAL = 45</b>	

**TEXT BOOKS**

- E.C.Butcher and A.C.Parnell, "Designing for fire safety", John wiley and Sons, 1993.  
William T.Mayer, "Energy Economics and Build Design", McGraw Hill Book Co., 1983

**REFERENCES**

- Peter R.Smith and Warren G.Jullian, "Building services", Applied Science Publishers Ltd.,  
London.  
A.J.Elder and Martiz Vinden Barg, "Handbook of Buildings and Enclosure", Mc Graw-Hill Book  
Co., 1983, digitized on 2007.  
Jane Taylor and Gordin Cooke, "The Fire Precautions Act in Practices", 1987.

**PCM 707 MANAGEMENT INFORMATION SYSTEMS**

**L T P C**  
**3 0 0 3**

**Goal**

To understand the importance of Management information systems in managing huge projects  
in construction Industry.

**Objectives**

- The course should enable the students to  
Introducing the information system in Architecture.  
Be familiar with the System development.

Develop the Knowledge of Information Systems in Construction Management.

Be familiar with the Implementation and control.

Develop the Knowledge of system audit.

### **OUTCOMES**

The students will be able to :

Develop the framework and evaluation of Information system.

Gain the knowledge of System development in Structural methodologies and designing the Structural programs.

Apply the knowledge of the information systems in functional areas, Finance, Marketing, and Production.

Implement the control in Testing Security, Coding Techniques, Cost benefit analysis, Assessing the value and risk of information system.

Utilize the Knowledge to develop Engineering qualities, Software specification, Software quality assurance, Software life cycle models.

### **UNIT I INTRODUCTION**

**7**

Information systems-Establishing the frame work-Business Models-Information System Architecture-Evolution of Information Systems

### **UNIT II SYSTEM DEVELOPMENT**

**8**

Modern Information system-System Development Life cycle-Structured Methodologies-Designing computer based Methods, Procedures, Control-Designing structured programs

### **UNIT III INFORMATION SYSTEMS**

**10**

Integrated construction Management Information System-Project Management Information System-Functional Areas, Finance, Marketing, Production, Personnel-Levels, DSS, EIS, ES-Comparison, Concepts and Knowledge Representation-Managing International Information System

### **UNIT IV IMPLEMENTATION AND CONTROL**

**10**

Control-Testing security-coding Techniques-Defection of error-Validating-Cost Benefit Analysis-Assessing the value and risk of Information System.

### **UNIT V SYSTEM AUDIT**

**10**

Software Engineering Qualities-Design-Production,Service,Software Specification, Software metrics, Software Quality assurance-Systems Methodology-Objectives-Time and Logic, Knowledge and Human Dimension-Software life cycle models-Verification and Validation

**TOTAL = 45**

### **TEXT BOOKS**

Kenneth C Laudon and Jane Price Laudon, "Management Information Systems - Organization and Technology", Prentice Hall, 1996.

Gordon B. Davis, " Management Information System: Conceptual Foundations", Structure and Development, McGraw Hill, 1985, digitized on 2007.

## **REFERENCES**

Joyce J Elam, "Case Series for Management Information Systems", Simon and Schuster, Custom Publishing, 1996.

Ralph H Sprague and Huge J Watson, "Decision Support for managers", Prentice Hall, 1996.

Michael W Evans and John J Marciniah, "Software Quality assurance and Management", John Wiley and Sons, 1987, digitized on 2007.

Card and Glass, "Measuring Software Design Quality ", Prentice Hall, 1990, digitized on 2007.

## **PCM 708 QUANTITATIVE TECHNIQUES IN MANAGEMENT**

**3 0 0 3**

### **GOAL**

This subject provides a comprehensive knowledge in operation research and linear programming techniques and also help them to learn the concepts of production management and financial management.

### **OBJECTIVES**

The course should enable the students to:

- Be acquainted with the knowledge of operations research.
- Study various production management systems.
- Understand the concepts of financial management.
- Study models for decision making.
- Understand the concepts of managerial economics.

### **OUTCOME**

The students should be able to:

- Make logical approach to problem and arrive at best solution to problem.
- Gain knowledge on material management, various network planning techniques and apply this methods to manage the civil engineering projects.
- Make important financial decisions which would affect the firms profitability.
- Determine optimal strategies when faced with several decision alternatives.
- Gain knowledge on interrelations between cost, revenue, volume and profit and can make proper decisions by applying game theory.

<b>UNIT I OPERATIONS RESEARCH</b>	<b>9</b>
Introduction to Operations research-Linear programming-Graphical and Simplex Methods, Duality and Post- Optimality Analysis-Transportation and Assignment Problems	
<b>UNIT II PRODUCTION MANAGEMENT</b>	<b>9</b>
Inventory control, EOQ, Quantity Discounts, Safety Stock-Replacement Theory-PERT and CPM-Simulation Models-Quality Control	
<b>UNIT III FINANCIAL MANAGEMENT</b>	<b>9</b>
Working Capital Management-Compound Interest and Present Value methods-Discounted Cash Flow Techniques-Capital Budgeting	
<b>UNIT IV DECISION THEORY</b>	<b>9</b>
Decision Theory-Decision Rules-Decision making under conditions of certainty, risk and uncertainty-Decision trees-Utility Theory	
<b>UNIT V MANAGERIAL ECONOMICS</b>	<b>9</b>
Cost concepts-Break-even -Analysis-Pricing techniques-Game Theory applications	
<b>TOTAL = 45</b>	

#### TEXT BOOKS

- Vohra, N.D. "Quantitative Techniques in Management", Tata McGraw Hill Co., Ltd, New Delhi, 1990.
- Seehroeder, R.G., "Operations Management", McGraw Hill, USA, 1982.

#### REFERENCES

- Levin, R.I, Rubin, D.S.,and Stinsonm J., "Quantitative Approaches to Management", McGraw Hill Book Co.,1988.
- Frank Harrison,E., "The Managerial Decision Making Process ",Houghton Mifflin Co. Boston, 1975.
- Varshney, R.L. and Maheswari, K.L., "Managerial Economics",Sultan Chand, 1975.

## PCM 709 BUSINESS ECONOMICS AND FINANCE MANAGEMENT

L T P C  
3 0 0 3

### GOAL

This subjects give wide scope of understanding the basics of construction economics and financial management in construction projects.

### OBJECTIVES

The course should enable the students to:

- Have a knowledge of economics
- Familiar with construction economics.
- Understand the financial management
- Aware of accounting method.
- Have a wide knowledge of lending to contractors.

### OUTCOME

The students should be able to:

- Understand the economics in relation to civil engineering, market demand and supply choice of technology
- Make use of this knowledge in housing, transport and other infrastructure.
- Apply in practical situations, ie borrowing, generation of funds, budgeting, analysis of financial statement, balance sheet, Investment and financing decision.
- Analyze the stages of completion of projects during the execution of project and also tax reporting
- Know about the loans, interim construction financing, security and risk aspects.

### UNIT I ECONOMICS

10

Role of Civil Engineering in Industrial Development-Advances in Civil Engineering and engineering economics-Support matters of Economy as related top Engineering-Market demand and supply-Choice of technology- Quality control and Quality Production-Audit in economic law of returns governing production

### UNIT II CONSTRUCTION ECONOMICS

10

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

18

The need for financial management-Types of financing-Short term borrowing-Long term borrowing-Leasing -Equity financing-Internal generation of funds-External commercial borrowings-Assistance

from Government Budgeting support and International finance corporations-Analysis of financial statements-Balance sheet-Profit and loss account-Cash flow and fund flow analysis-Ratio analysis-Investment and financing decision-Financial control-Job control and Centralized management

**UNIT IV ACCOUNTING METHOD** **5**

General Overview-Cash basis of a accounting-Accrual basis of accounting-Percentage completion method-Completed contract method-Accounting for Tax reporting purposes and Financial reporting purposes

**UNIT V LENDING TO CONTRACTORS** **2**

Loans to Contractors-Interim construction financing-Security and risk aspects

**TOTAL = 45**

**TEXT BOOKS**

Warner Z Hirsch, "Urban Economics", Macmillan, NewYork, 1993.

Prasanna Chandra, "Projects - Planning Analysis Selection Implementation & Review", Fourth Edition, Tata McGraw Hill Publishing Co., Ltd, New Delhi, 1995.

**REFERENCES:**

Kwaku A., Tenah and Jose M. Guevera, "Fundamental of Construction Management and Organization", Prentice Hall of India, 1995.

Halpin, D.W., " Financial and cost concepts for construction Management", John Wiley and Sons New York, 1985.

Madura J. and Veit, E.T., "Introduction to Financial Management", West Publishing Co., St.Paul, 1988.

**PCM 710 CONTRACT LAWS AND REGULATIONS**

**L T P C**  
**3 0 0 3**

**PREREQUISITE** Nil

**GOAL**

To introduce the student to construction laws and regulations in construction industry which includes different Indian and International contracts, tenders, arbitrations and legal requirements.

**OBJECTIVES**

The course should enable the students to :

- Be acquainted with the knowledge of construction contracts.
- Be familiar with the bidding system.
- Throw light on laws, agreements and arbitrations.
- Gain knowledge of legal requirement and statutory regulations.
- Be familiar with the labour regulation.



## **OUTCOME**

The students will be able to :

Develop knowledge of Indian contracts and International contracts.

Develop knowledge of tenders, prequalification, evaluation based on world bank guidelines.

Make use of the laws, arbitration, and enforcement during execution of projects.

Aware of various taxes, legal requirement, exercise and customs duties and property laws.

Develop knowledge of labour laws, labour administration welfare legislation, Insurance and safety regulations.

### **UNIT I CONSTRUCTION CONTRACTS 10**

Indian Contracts Act-Elements of Contracts-Types of contracts-Features-Suitability-Design of Contract Documents-International contract document-Standard contract Document-Law of Torts.

### **UNIT II TENDERS 10**

Prequalification-Bidding-Accepting-Evaluation of Tender from Technical, Contractual and commercial points of view-contract formation and interpretation-Potential contractual problems-World Bank Procedures and Guidelines.

### **UNIT III ARBITRATION 5**

Comparison of Actions and Laws-Agreements ,subject matter-Violations-Appointment of Arbitrators-Conditions of Arbitrations-Powers and duties of Arbitrator-Rules of Evidence-Enforcement of Award-costs

### **UNIT IV LEGAL REQUIREMENTS 10**

Insurance and Bonding-Laws Governing Sale, Purchase and use of Urban and Rural land-Land Revenue codes-Tax Laws-Income Tax, Sales Tax, Excise and customs duties and their influence on construction costs-Legal requirements for planning-Property Law-Agency Law-Local Government Laws for Approval-Statutory Regulations.

### **UNIT V LABOUR REGULATION 10**

Social Security-Welfare Legislation-Laws relating to wages, Bonus and Industrial Disputes, Labour Administration-Insurance and Safety Regulations-Workmen's Compensation Act-Other Labour laws

**TOTAL = 45**

## **TEXT BOOK**

Gajaria G.T., "Laws Relating to Building and Engineering Contracts in India ", M.M.Tripathi Private Ltd., Bombay, 1982.

## **REFERENCES**

Tamilnadu PWD Code, 1986.

Jimmie Hinze, "Construction Contracts ", 2nd Edition, McGraw Hill, 2001.

Joseph T. Bockrath, "Contracts and the Legal Environment for Engineers and Architects ", 6th Edition, McGraw Hill, 2000.

## CE 2703 CONSTRUCTION MANAGEMENT

L T P C  
3 0 0 3

**PREREQUISITES** MG2001

### **GOAL**

To introduce to students the functions of management, network planning techniques, contract system accounting procedures in government organization & groom them to match to the requirement of employer expectation in construction industry.

### **OBJECTIVES**

The course should enable the students to :

Understand the functions of management and various organizational structures.

Throw light on construction planning, resource planning and various labour legislations

Understand the concept of network planning methods and principles of cost control

Study the concept of tender and contracts and impart idea about quality control and safety requirements

Throw light on various accounting procedures adopted in government organizations.

### **OUTCOME**

The students will be able to:

Describe the importance of management and know the merits and demerits of various organizational structures

Gain knowledge on resource planning for civil engineering projects and know the labour requirements

Make use of network planning techniques like CPM and PERT and apply methods of cost control for civil engineering projects.

Execute the project works by inviting tenders and document and interpret project work progress.

Document and Communicate Schedule and Cost Impacts.

### **UNIT I PRINCIPLES OF MANAGEMENT**

**9**

Definition - importance - function of management - relevance to Government and Quasi Government departments - private contractors and contracting firms - organisational structure.

### **UNIT II CIVIL ENGINEERING MANAGEMENT**

**9**

Construction Planning : Collection of field data - preliminary estimates - approval and sanction of estimates - budget provision - construction stages - scheduling methods - progress reports and charts

Resource Planning: Planning for materials, machines, men and organisation - resource allocation.

Labour and Labour Welfare Relationship between management and labour - problems - labour Legislations - Minimum Wages Act - settlement of disputes - industrial psychology.

**UNIT III MANAGEMENT METHODS 9**

Concepts of network - network planning methods CPM/PERT - management by network analysis and control - principles of cost control - control by graphical representation, by bill of quantities and by network analysis.

**UNIT IV EXECUTION OF WORK 9**

Departmental Works : Procedure - departmental labour - quality control, inspection and duties of personnel - safety requirements.

Contracts: Contract system - types of contracts - specifications, documents, procedures, condition, taxes, law of contractors and legal implications are penalties.

Tender and Tender Documents: Definition - calling for tenders - tender documents - submission of tenders - processing of tenders - negotiations and settlement of contracts- agreement between the owner and the contractor

Quality Control: Quality of materials - role of site engineer- workmanship

**UNIT V ACCOUNTS AND STORES 9**

Measurements of work - recording - checking - types of bills - mode of payment - budget estimate - revised estimates - completion of reports and certificates - claims - banking settlement - types of accounts - drawal and transfer classifications of transactions - ledger accounts - interest account - cash book.

Suspense classification - storing - maintenance inspection - inventories - transfer of surplus and accounting of shortage stores - procedures adopted in P.W.D. and C.P.W.D.

**TUTORIAL:15**

**L = 45, T = 15, TOTAL = 60**

**TEXT BOOKS**

Sanga Reddy and Meyyappan - Construction management - Kumaran Publications.

Joseph L. Massie, Essentials of Management, Prentice Hall of India

Cholt and Dhir - Construction Management

**REFERENCES**

C.P.W.D. Manuals

Public Works Accounts Code, PWD, Tamilnadu