PONDICHERRY ENGINEERING COLLEGE
PUDUCHERRY

REGULATIONS FOR POST GRADUATE PROGRAMMES (CBCS)

M.Tech. in Civil Engineering (Advanced Construction Technology)

(w. e. f. July 2011)

1.0 ELIGIBILITY

Candidates seeking admission to the first semester of the four-semester M.Tech Course in Civil Engineering with specialization in Advanced Construction Technology should have passed B.E/B.Tech in Civil/Structural Engineering or B. Arch/B. Arch Engineering through regular course of study from an AICTE approved institution or an examination of any University or Authority accepted by the Pondicherry University as equivalent thereto, with at least 55% marks in the degree examination or equivalent CGPA.

Note: *(1) Candidates belonging to Scheduled Caste / Scheduled Tribe who have a mere pass in qualifying examination are eligible.*
(2) There is no age limit for this programme.

2.0 ADMISSION

The admission policy for various M.Tech programmes shall be decided by the respective institutes offering M.Tech programmes subject to conforming to the relevant regulations of the Pondicherry University.

3.0 STRUCTURE OF PG PROGRAMME

3.1 GENERAL

3.1.1 The M.Tech Programmes are of semester pattern with 16 weeks of instruction in a semester.

3.1.2 The programme of instruction for each stream of specialisation will consist of:

i) Core courses (Compulsory)
ii) Electives
iii) Laboratory
iii) Seminar
iv) Directed Study/Industrial Training
v) Project work

3.1.3 The M.Tech Programmes are of 4 semester duration.

3.1.4 Credits will be assigned to the courses based on the following general pattern:

i) One credit for each lecture period
ii) One credit for each tutorial period
iii) Two credits for practical course
iv) Three credits for Directed study/Industrial training
v) Nine credit for Project Phase-I and Fourteen credits for Project Phase – II

One teaching period shall be of 60 minutes duration including 10 for discussion and movement.

3.1.5 Regulations, curriculum and syllabus of the M.Tech programme shall have the approval of the Board of Studies and other Boards/Committees/Councils, prescribed by the Pondicherry University. The curriculum should be so drawn up that the minimum number of credits and other requirements for the successful completion of the programme will be as given in Table – 1.

Table 1: Minimum Credits and other Requirements of M.Tech (ACT) (Full-Time) Programme

Sl. №	Description	Requirements
1	№ of Semesters	4
2	Min. № of credits of the programme	72
3	Max. №. of credits of the programme	75
4	Min. Cumulative Grade Point Average for pass	5
5	Min. Successful credits needed for registering in the next semester	Sem. I - 10
		Sem. II - 25
		Sem. III - 40
6	Min. period of completion of programme (continuous semesters)	4
7	Max. period of completion of programme (continuous semesters)	8
8	№ of Core and Elective subjects	12
9	Directed Study/Industrial Training	1
10	Laboratories	2
11	Project work (in two semesters)	1

3.1.6 The core course is a course that a student admitted to the M. Tech programme must successfully complete to receive the degree. A student shall register for all the core courses listed in the curriculum. Core courses in a particular specialisation are offered by the Department concerned.

3.1.7 Elective courses are required to be chosen from the courses offered by the department in that particular semester from among the approved courses. A core course of one M.Tech programme/department may be chosen as an elective by a student from other M.Tech programme/department.

3.1.8 **(a)** Directed study is a theory course required to be credited by each student under the close supervision of a faculty member of the department. The title of the course and syllabus are to be formulated by the designated faculty member and approved by the vice-chairperson, taking into account the broad area in which the student proposes to pursue his/her project work.

(b) The intention of training is to develop the intuitive skills of the candidate and to expose them with real time problems faced in the industry. Candidates may opt to undergo industrial training instead of directed study. The candidate(s) who is/are desirous to undergo industrial training may identify a suitable industry in consultation with the Staff Advisor and Vice Chairperson. The training shall be at least for 6 weeks duration. The candidate is required to identify a real time problem in the industry and come up with the possible solution or the strength and weakness of an industry.

3.1.9 Project work is envisaged to train a student to analyze independently any problem posed to him/her. The work may be analytical, experimental, design or combination of both. The student can undertake the project work in the department concerned or in an industry/research laboratory approved by the Chairperson/Vice-Chairperson. The project report is expected to exhibit clarity of thought and expression. The evaluation of project work will be a continuous internal assessment based on two reviews, an internal viva-voce and an external viva-voce examination. *(The permission from industry may be obtained during the second semester and can undergo training immediately after the end semester examinations).*

3.1.10 A student who has acquired the minimum number of total credits for the award of Degree will not be permitted to register for more courses only to improve his /her cumulative grade point average (see Table 1).

3.1.11 The medium of instruction, examination, directed study, project work will be in English.

3.2 GRADING

3.2.1 Based on the performance of each student in a semester, letter grades will be awarded in each course at the end of the semester. The letter grades, the corresponding grade point and the description will be as shown in Table – 2.

TABLE 2: Letter Grade and the Corresponding Grade Point

GRADE	POINTS	DESCRIPTION
S	10	EXCELLENT
A	9	VERY GOOD
B	8	GOOD
C	7	ABOVE AVERAGE
D	6	AVERAGE
E	5	SATISFACTORY
F	0	FAILURE
FA	—	FAILURE DUE TO LACK OF ATTENDANCE/ FAILURE BY ABSENCE

3.2.2 A student is deemed to have completed a course successfully and earned the appropriate credit if and only if, he /she receives a grade of E and above. The student should obtain 40% of marks in end semester examination in a subject to earn a successful grade. A subject successfully completed cannot be repeated at any time.

3.2.3 The letter grades do not correspond to any fixed absolute mark. Each student is awarded a grade depending on his/her performance in relation to the performance of other students taking or have taken the course. For example, S does not mean he/ she has secured 100% or 95%, but, rather that he /she is in the top 5% of all the students who have taken / are taking the course, in the judgment of the teachers. Grades shall be awarded based on the absolute marks in a meeting of the P.G. Programme Committee to be held not later than 10 days after the last day of semester examination. Normally not more than 5% of the students in any written/ laboratory course shall be awarded the grade S and not more than one – third awarded A grade. Average marks in the class shall normally be C grade excepting in the case of practical /project where it may be B grade.

4.0 REGISTRATION

4.1 Each student, on admission, shall be assigned to a Faculty Advisor, who shall advise the student about the academic programme and counsel him/her on the choice of courses depending on his/her academic background and objective.

4.2 With the advice and consent of the Faculty Advisor, the student shall register for courses he/ she plans to take for the semester before the commencement of classes. No student shall be permitted to register for courses exceeding 30 contact hours per week nor shall any student be permitted to register for any course without satisfactorily completing the prerequisites for the course, except with the permission of the teacher concerned in the prescribed format.

4.3 If the student feels that he/she has registered for more courses than he/she can handle, he/she shall have the option of dropping one or more of the courses he/she has registered for, with the consent of his/her Faculty Advisor, before the end of 3rd week of the semester. However, a student to retain his/her status, should register for at least 10 credits/ semester.

4.4 Students, other than newly admitted, shall register for the courses of their choice in the preceding semester by filling in the prescribed forms.

4.5 The College shall prescribe the maximum number of students in each course taking into account the physical facilities available.

4.6 The college shall make available to all students a bulletin, listing all the courses offered in every semester specifying the credits, the prerequisites, a brief description or list of topics the course intends to cover, the faculty offering the course, the time and place of the classes for the course.

4.7 In any Department, preference shall be given to those students for whom the course is a core-course, if, the demand for registration is beyond the maximum permitted member of students.

4.8 Normally no course shall be offered unless a minimum of 3 students are registered.

5.0 EVALUATION

5.1 Evaluation of theory courses shall be based on 40% continuous internal assessment and 60% end-semester examination. Evaluation of laboratory course shall be based on 50% internal assessment and 50% end-semester examination. In each course, there shall be a 3 hour end-semester examination.

5.2 The total marks for the project work will be 400 marks and 100 marks for Directed study/Industrial training. The allotment of marks for external valuation and internal valuation shall be as detailed below:

Project work – (Phase – I): 300 Marks

Internal valuation

Guide	50 marks
First Evaluation	50 marks
Second Evaluation	50 marks
Total	**150 marks**

External valuation

Evaluation (External Examiner Only)		50 marks
Viva voce	Internal Examiner	50 marks
	External Examiner	50 marks
	Total	**150 marks**

Project work – (Phase – II): 400 Marks

Internal valuation

Guide	100 marks
First Evaluation	50 marks
Second Evaluation	50 marks
Total	**200 marks**

External valuation

Evaluation (External Examiner Only)		50 marks
Viva voce	Internal Examiner	75 marks
	External Examiner	75 marks
	Total	**200 marks**

Internal valuation should be done by a committee comprising of not less than 3 faculty members appointed by the Vice-Chairperson.

5.3 **(a)** The directed study shall be evaluated internally and continuously as detailed below:

Test I	: 15 Marks
Test II	: 15 Marks
Assignment	: 10 Marks
Final test covering the whole syllabus	: 60 Marks
Total	**: 100 Marks**

(b) The candidates who undergo industrial training shall submit a report along with a certificate of completion of training obtained from the industry. The duration of the training shall be at least 6 weeks. Internal valuation should be done by a committee comprising of not less than 3 faculty members appointed by the Vice-Chairperson. The marks will be awarded as below:

Training Report	: 60 marks
Viva voce	: 40 Marks
Total	**: 100 Marks**

5.4 The end-semester examination shall be conducted for all the courses offered by the Department. Each teacher shall, in the 4th week of the semester submit to the Vice Chairman, a model question paper for the end-semester examination. The end-semester question paper shall cover the entire course.

5.5 The department shall invite 2 or 3 external experts for evaluating the end-semester examinations and grading. Each expert will be asked to set the question paper(s) for the course(s) he/she is competent to examine for the end-semester examination based on the model question paper submitted by the teacher concerned. The teacher and the expert concerned shall evaluate the answer scripts together and award the marks to the student. If, for any reason, no external expert is available for any paper, then, the teacher concerned shall set the question paper(s) for the end-semester examination, and the teacher himself/herself shall evaluate the papers and award the marks.

5.6 In the department, after the evaluation of the end-semester examination papers, all the teachers who handled the courses and the external experts together shall meet with the M.Tech Programme Committee (see 7.0) and decide the cut-offs for grades in each of the courses and award the final grades to the students.

5.7 Continuous internal assessment mark of 40 for a theory course shall be based on two tests (15 marks each) and one assignment (10 marks). A laboratory course carries an internal assessment mark of 50 distributed as follows: (i) Regular laboratory exercises and records – 20 marks (ii) Internal laboratory test – 20 marks and (iii) Internal viva-voce – 10 marks.

5.8 Every student shall have the right to scrutinize his/her answer scripts, assignments etc. and seek clarifications from the teacher regarding his/her evaluation of the scripts immediately after or within 3 days of receiving the evaluated scripts.

5.9 The department shall send all records of evaluation, including internal assessment for safe-keeping, to the college administration, as soon as all the formalities are completed.

5.10 At the end of the semester, each student shall be assigned a grade based on his/ her performance in each subject, in relation to the performance of other students.

5.11 A student securing **F** grade in a core course must repeat that course in order to obtain the Degree. A student securing F grade in an elective course may be permitted to choose another elective against the failed elective course, as the case may be, in consultation with the Faculty Adviser.

5.12 A student shall not be permitted to repeat any course(s) only for the purpose of improving the grade in a particular course or the cumulative grade point average (CGPA).

5.13 In exceptional cases, with the approval of the Chairperson, PG Programme committee, make–up examination(s) can be conducted to a student who misses end-semester examination(s) due to extreme medical emergency, certified by the college Medical Officer, or due to time-table clash in the end-semester examination between two courses he/she has registered for, in that semester.

5.14 All eligible students shall appear for end-semester examinations.

5.15 No student who has less than 75% attendance in any course will be permitted to attend the end-semester examinations. However, a student who has put in 60-75% attendance in any course and has absented on medical grounds will have to pay a condonation fee of Rs.200/- for each course and produce a medical certificate from a Government Medical Officer not below the rank of R.M.O. or officer of equal grade to become eligible to appear for the examinations. A student with less than 60% attendance shall be given the grade of FA. He/She shall have to repeat that course if it is a core course, when it is offered the next time.

6.0 SUMMER TERM COURSE

6.1 A summer term course (STC) may be offered by the department concerned on the recommendations of M.Tech. Programme Committee. A summer term course is open only to those students who had registered for the course earlier and failed. No student should register for more than two courses during a summer term. Those students who could not appear for examination due to lack of attendance will not be allowed to register for the same course offered in summer, unless, certified by the Vice-Chairperson concerned and the Principal.

6.2 Summer term course will be announced at the end of even semester. A student has to register within the stipulated time by paying the prescribed fees.

6.3 The number of contact hours per week for any summer term course will be twice that of a regular semester course. The assessment procedure in a summer term course will be similar to the procedure for a regular semester course.

6.4 Withdrawal from a summer term course is not permitted.

7.0 PG PROGRAMME COMMITTEE

7.1 Every M.Tech. Programme shall be monitored by a committee constituted for this purpose by the college. Each committee shall consist of all teachers offering the courses for the programme and two student members or 10% of students enrolled whichever is less. The HOD or a senior faculty in the rank of a Professor shall be the Vice-Chairperson, nominated by the Head of the Institution. There shall be a common Chairperson in the Rank of Professor nominated by the Head of the Institution for all the P.G. programmes offered by the institute. There can be a common co-ordinator in the rank of Professor nominated by the Head of the Institution.

7.2 It shall be the duty and responsibility of the committee to review periodically the progress of the courses in the programme, discuss the problems concerning the curriculum and syllabi and conduct of classes. The committee may frame relevant rules for the conduct of evaluation.

7.3 The committee shall have the right to make suggestions to individual teachers on the assessment procedure to be followed for his/her course. It shall be open to the committee to bring to the notice of the Head of the Institution any difficulty encountered in the conduct of the classes or any other pertinent matter.

7.4 The committee shall meet at least twice a semester – first at the beginning of the semester, and second at the end of the semester. In the second meeting, the committee excluding student members but with the external experts invited by the Chairperson PG Programme Committee, shall finalize the grades of the students.

8.0 MINIMUM REQUIREMENTS

8.1 To be eligible towards continuing the Programme, a student must have earned a certain number of successful credits at the end of each semester as given in Table – 1. If he /she fails to satisfy this criterion in any semester, he/she shall be placed on scholastic probation in the succeeding semester. If he/she fails to earn the number of credits by the end of that year (including courses taken in summer), then, he/she shall be asked to discontinue the Programme.

8.2 Students are expected to abide by all the rules of the college and maintain a decorous conduct. Any deviation will be referred to the Head of the Institution for suitable action.

8.3 No student who has any outstanding dues to the college, hostel, library or laboratory or against whom any disciplinary action is contemplated/ pending, will be eligible to receive his/her degree.

9.0 DECLARATION OF RESULTS AND ISSUE OF GRADE CARD

9.1 The PG Programme (CBCS) office shall display the grades as soon as possible after the finalization of the grades. The student shall have the right, for a look at the evaluated examination scripts and represent to the M.Tech. Programme Committee for review if he/she feels aggrieved by the evaluation within a week from the commencement of succeeding semester classes.

9.2 The College shall issue at the beginning of each semester a grade card to the student, containing the grades obtained by the student in the previous semester (s) and his/her Grade Point Average (GPA) and his/her Cumulative Grade Point Average (CGPA).

9.3 The grade card shall list:

a) title of the course(s) taken by the student.
b) credits associated with each course.
c) grade secured by the student.
d) total credits earned by the student in that semester.
e) GPA of the student.
f) total credits earned by the student till that semester and
g) CGPA of the student.

9.4 The GPA shall be calculated as the weighted average of the Grade Points weighted by the credit of the course as follows:

The product of the credit assigned to each course and the grade point associated with the grade obtained in the course is totalled over all the courses and the total is divided by the sum of credits of all the courses and rounded off to two decimal places.

For example, a student securing grade A in a 4 credit course, grade B in a 2 credit course, grade S in a 3 credit course and grade F in a 3 credit course, will have a GPA as:

$(9 \times 4 + 8 \times 2 + 10 \times 3 + 0 \times 3)/ (4+2+3+3) = 82 /12 = 6.83/10$

The sum will cover all the courses the student has taken in that semester, including those in which he/she has secured grade F. Grades FA are to be excluded for calculating GPA and CGPA.

9.5 For computing CGPA, the procedure described in 9.4 is followed, except, that the sum is taken over all the courses the student has studied in all the semesters till then. If a student has repeated any course, the grade secured by him/her in the successful attempt only will be taken into account for calculating CGPA.

9.6 To convert CGPA into percentage marks, the following formula shall be used:

Percentage Mark = (CGPA - 0.5) ×10

9.7 A candidate who satisfies the course requirements for all semesters and passes all the examinations prescribed for all the four semesters within a maximum period of 10 semesters reckoned from the commencement of the first semester to which the candidate was admitted shall be declared to have qualified for the award of degree.

9.8 A candidate who qualifies for the award of the degree shall be declared to have passed the examination in **FIRST CLASS** with **DISTINCTION** upon fulfilling the following requirements:

(i) Should have passed all the subjects pertaining to semesters 1 to 4 in his/her first appearance in four consecutive semesters starting from first semester to which the candidate was admitted.

(ii) Should not have been prevented from writing examinations due to lack of attendance.

(iii) Should have secured a CGPA of 8.50 and above for the semesters 1 to 4.

9.9 A candidate who qualifies for the award of the degree by passing all the subjects relating to semesters 1 to 4 within a maximum period of 6 consecutive semesters after his/her commencement of study in the first semester and securing a CGPA not less than 6.5 shall be declared to have passed the examination in **FIRST CLASS**.

9.10 All other candidates who qualify for the award of degree shall be declared to have passed the examination in **SECOND CLASS**.

9.11 A student with CGPA less than 5.0 is not eligible for the award of degree.

9.12 For the award of University rank and gold medal, the CGPA secured from 1st to 4th semester should be considered and it is mandatory that the candidate should have passed all the subjects from 1st to 4th semester in the first appearance and he/she should not have been prevented from writing the examination due to lack of attendance and should not have withdrawn from writing the end-semester examinations.

10.0 PROVISION FOR WITHDRAWAL

A candidate may, for valid reasons, and on the recommendation of the vice-chairperson and chairperson be granted permission by the Head of the Institution to withdraw from writing the entire semester examination as one unit. The withdrawal application shall be valid only if it is made earlier than the commencement of the last theory examination pertaining to that semester. Withdrawal shall be permitted only once during the entire programme. Other conditions being satisfactory, candidates who withdraw are also eligible to be awarded DISTINCTION whereas they are not eligible to be awarded a rank/ gold medal.

11.0 TEMPORARY DISCONTINUATION FROM THE PROGRAMME

If a candidate wishes to temporarily discontinue the programme for valid reasons, he/she shall apply to the Chairperson, PG Programme committee, through the Head of the department in advance and secure a written permission to that effect. A candidate after temporary discontinuance may rejoin the programme only at the commencement of the semester at which he/she discontinued, provided he/she pays the prescribed fees. The total period of completion of the programme reckoned from the commencement of the first semester to which the candidate was admitted shall not in any case exceed 10 consecutive semesters including the period of discontinuance.

12.0 POWER TO MODIFY

12.1 Notwithstanding anything contained in the foregoing, the Pondicherry University shall have the power to issue directions/ orders to remove any difficulty.

12.2 Nothing in the foregoing may be construed as limiting the power of the Pondicherry University to amend, modify or repeal any or all of the above.

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M. Tech. (ADVANCED CONSTRUCTION TECHNOLOGY)
Curriculum and Scheme of Examination
(Total № of credits required for the completion of the programme: 72)

Semester I

Sl. №	Code	Subject	Hours per Week			Credits	Evaluation (Marks)		
			L	T	P		Internal	External	Total
1	CE 901	Advanced Materials of Construction	3	1	0	4	40	60	100
2	CE 902	Condition Assessment and Rehabilitation of Structures	3	1	0	4	40	60	100
3	CE 903	Design of RC Structures	3	1	0	4	40	60	100
4	CE 904	Construction Methods and Equipments	3	0	0	4	40	60	100
5	—	Elective I	3	0	0	3	40	60	100
6	—	Elective II	3	0	0	3	40	60	100
7	CE 907	Experimental Techniques Laboratory	—	—	3	2	50	50	100
Total						**24**	**290**	**410**	**700**

Semester II

Sl. №	Code	Subject	Hours per Week			Credits	Evaluation (Marks)		
			L	T	P		Internal	External	Total
1	CE 905	Design of Metal Structures	3	1	0	4	40	60	100
2	CE 906	Safety Practices in Construction	3	1	0	4	40	60	100
3	—	Elective III	3	1	0	3	40	60	100
4	—	Elective IV	3	0	0	3	40	60	100
5	—	Elective V	3	0	0	3	40	60	100
6	—	Elective VI	3	0	0	3	40	60	100
7	CE 908	Computing Techniques Laboratory	—	—	3	2	50	50	100
Total						**22**	**290**	**410**	**700**

Semester III

Sl. №	Code	Subject	Hours per Week			Credits	Evaluation (Marks)		
			L	T	P		Internal	External	Total
1	CE 909	Project Phase - I	—	—	24	9	150	150	300
2	CE 971	Directed Study/Industrial Training*	—	—	6/*	3	100	—	100
Total						**12**	**250**	**150**	**400**

*The training period shall at least be 6 weeks duration.

Semester IV

Sl. №	Code	Subject	Hours per Week			Credits	Evaluation (Marks)		
			L	T	P		Internal	External	Total
1	CE 910	Project Phase - II	—	—	36	**14**	200	200	**400**

List of Elective Subjects

Sl. №	Code	Title of Course
1	CE921	Advanced Bridge Construction Engineering
2	CE922	Condition Assessment and Evaluation Engineering
3	CE923	Energy Conservation Techniques in Building Construction
4	CE924	Deterioration Process in Reinforced Concrete
5	CE925	Advanced Structural Analysis
6	CE926	Contract Laws and Regulations
7	CE927	Advanced Foundation Engineering
8	CE928	Resource Management and Control in Construction
9	CE929	Design of Composite Structures
10	CE930	Prefabrication and Construction Techniques
11	CE931	Earthquake Resistant Design of Structures
12	CE932	Wind and Cyclone Effects on Structures
13	CE933	Design of Industrial Structures
14	CE934	Basics of Finite Element Analysis
15	CE935	Acoustics, Lighting and Ventilation Engineering
16	CE936	Stability Analysis of Structures
17	CE937	Theory of Plates and Shells
18	CE938	Plastic Analysis of Structures
19	CE939	Structural Dynamics
20	CE940	Design and Construction of Pavements

CE 901 ADVANCED MATERIALS OF CONSTRUCTION

UNIT – I

Properties and specifications of concrete making material – cement – aggregates. Properties of fresh concrete. Modern techniques in handling- compacting and curing concretes – Properties of hardened concrete- mechanical properties and durability aspects. Additives and admixtures of concrete.

UNIT-II

Materials and methods: Hot and cold weather concreting – underwater concreting - mass concreting - high strength and high performance concretes - Polymer concrete composites- fibre reinforced concrete- GFRC- Ready mixed concrete - light weight concrete – Ferrocement- Self compacting concrete. Engineered cementitious composites.

UNIT-III

Use of waste products and industrial by-products: Fly ash, micro-silica, GGBFS and other mineral products- Geo-textiles and geo-synthetics – applications in Civil Engineering – Concrete under special environment – high density concrete – concrete for nuclear reactors.

UNIT-IV

Thermal insulation and acoustic absorption materials- Water proofing materials and compounds- Flooring materials, Repair materials- Hybrid systems in concrete- smart concrete.

UNIT-V

Concrete mix design- basic consideration-influencing factors. Mix design of concrete by IS, BS and ACI methods, mixes for high performance and high strength concretes.

REFERENCES:

1. Neville, A.M., Properties of Concrete, Pearson Education Asia (P) Ltd, England, 2000.
2. Mehta, P.K and Montevic. P.J., Concrete- Microstructure, Properties and Materials, ICI, 1997.
3. Santhakumar, A.R, Concrete Technology, Oxford University Press, New Delhi, 2007.
4. Jackson, N., Civil Engineering Materials, ELBS, 1983.
5. Diamant, R.M.E., Thermal and Acoustic Insulation, Butterworths, 1986.
6. Vedhikizen Van Zanten, R., (Ed), Gerotextiles and Geomembranes in Civil Engineering.
7. Koerner, R.M., Construction and Geotechnical Methods in Foundation Engineering, McGraw Hill Co., 1985.
8. Rosen, H.J., Construction Materials for Architecture, John Wiley, 1985.
9. Flinn, R.A and Trojan, P.K., Engineering Materials and their Applications, Jaico Publications House, Delhi, 1999.
10. Nawy E , Fundamentals of High Performance Concrete, Second Edition, John Wiley & Sons, New York, 2001.

CE 902 CONDITION ASSESSMENT AND REHABILITATION OF STRUCTURES

UNIT – I

Maintenance, repair and rehabilitation, Facets of maintenance- various aspects of inspection. Assessment procedure for evaluating a damaged structure - causes and agencies causing deterioration- durability of materials - types of problems in components such as foundations, roofs, floors, walls, etc - safety evaluation of existing structures -failure patterns and controls.

UNIT – II

Durability and Deterioration of concrete: Plastic Shrinkage - Plastic Settlement - Drying Shrinkage - Thermal Movement – Freezing and thawing -Weathering - Carbonation - Sulphate Action - Alkali-Aggregate Reaction - Acids - Crazing -Honey Combing - Popouts - Creep - Abrasion - Erosion and Cavitation - Fire - Sub-grade Movement - Formwork Movement - Premature Removal of Forms / Shores - Rebar Corrosion -Poor Design Details - Errors in Design.

UNIT – III

Investigation and Diagnosis: General Considerations - Observation - Questioning - Field and Laboratory Testing - Destructive Testing - Non-Destructive Testing - Rebound Hammer - Ultrasonic Pulse Velocity - Pachometer -Semi-Destructive Testing - Probe Test - Pull-Out Test - Pull-Off Test - Break-Off Test - Core Test - Half-Cell Potential Measurements - Resistivity Measurements - Carbonation Depth Testing - Tests for determining cement content, chloride content and sulphate content.

UNIT – IV

Repair Materials: Patching Materials - Resurfacing Materials - Sealing Materials - Water-Proofing Materials -Admixtures - Substrate Preparation. Corrosion of steel reinforcement: Factors influencing corrosion - corrosion protection of steel structure - masonry deterioration. Construction methods for termite proof in buildings -Biocide treatment and use of preservatives - factors influencing deterioration of wood, timber preservation.

UNIT - V

Refurbishment and Protection Techniques - Routing and Sealing - Stitching - External Stressing - Resin Injection - Grouting - Blanketing -Overlays - Sprayed Concrete - Prepacked Concrete - Dry packing - Jacketing - Plate Bonding -Protective Coatings - Autogenous Healing - Vacuum Impregnation - Chloride Extraction - Cathodic Protection.
Maintenance: Bridge maintenance techniques-factors affecting deterioration of dams, detection methods, remedial measures Maintenance of various buildings and structures – Components of pavement management system – pavement maintenance measures – pavement preservation techniques.

REFERENCES:

1. Peter H. Emmons, Concrete Repair and Maintenance, Galgotia Publishers.
2. S. Champion, Failure and Repair of Concrete Structures, John Wiley & Sons.
3. Ted Kay, Assessment and Renovation of Concrete Structures, Longman Scientific & Technical.
4. R.T.L. Allen and S.C. Edwards, Repair of Concrete Structures, Blackie & Son, 1987.
5. Sidney M. Johnson, Deterioration, Maintenance and Repair of Concrete Structures, McGraw-Hill Book
6. P.H. Perkins, Repair, Protection and Waterproofing of Concrete Structures, E & FN Spon.
7. R.N. Raikar, Diagnosis and Treatment of Structures in Distress, Structwel D & C Pvt. Ltd. Mumbai.
8. Ransem.W.H,, Building Failures, E&F.N, SPON Ltd, 1981.
9. Ralph Haas, Ronald Hudson and Zaneiswki, Modern Pavement Management, Kreiger Publications.

CE 903 DESIGN OF RC STRUCTURES

UNIT I

Stress-strain relationships for concrete-compressive stress behavior-tensile stress behavior-combines stress behavior-biaxial behavior-triaxial compressive stress behavior- creep and shrinkage of concrete-stress strain relationship for steel-monotonic stress behavior-repeated stress behavior-reversed stress behavior-design philosophies-strength and serviceability provisions.

UNIT II

Behaviour of concrete in flexure-stages leading to limit state of collapse-analysis at service loads-analysis at ultimate state- moment curvature relationships.
Behaviour of concrete in shear-shear resistance with and without web reinforcement-interactions of flexure and shear-interaction of flexure, shear and axial forces- effects of repeated and cyclic loading of shear strength.

UNIT III

Behavior of concrete in torsion-equilibrium and compatibility torsion-combined flexure and torsion – torsional stiffness. Bond and anchorage-mechanisms of bond resistance-type of bond-bond failure mechanisms-anchorage requirements-splicing of reinforcement

UNIT IV

Deflection and cracking-factors influencing deflection-short term deflection-control of deflection-deflection calculation. Long term deflection-deflections due to temperature, creep and shrinkage-limits on deflection-causes of cracking-factors influencing crack width in flexure- mechanisms of flexural cracking-control of flexural cracking in design.

UNIT V

Detailing of reinforcement-beams-compression members-brackets and corbels-deep beams-beam-column joints.

REFERENCES:

1. Pillai, S.U & Menon. D, Reinforced Concrete Design, Tata McGraw Hill, New Delhi, 2002.
2. Purushothaman P, Reinforced Concrete Structural Elements, Tata McGraw Hill, New Delhi, 1984.
3. Sinha N C, Roy S K, Fundamentals of Reinforced Concrete, S Chand & Co., New Delhi, 2007
4. Wang C K, Salmon C G, and Pincheira J A, Reinforced Concrete Design, John Wiely & Sons, New York, 2007.
5. Bangash M Y H, Structural Detailing in Concrete, Thomas Telford, London, 2003.
6. Nilson, A H, Darwinn D and Dolan C W, Design of Concrete Structures, 13th Edition, McGraw Hill, New Delhi, 2005.
7. IS:13920-1993, Ductile Detailing of Reinforced Concrete Structures Subjected to Seismic Forces, New Delhi.
8. SP:34 – 1987, Handbook on Concrete Reinforcement and Detailing, BIS, New Delhi.

CE 904 CONSTRUCTION METHODS AND EQUIPMENTS

UNIT-I

Earth Work: Methods: Trenching – Excavations - Braced Excavations – Shafts – Embankments – Dewatering Methods – compaction methods – Stabilising vertical cuts and slopes.
Equipments: Compacting equipments, Scrapers, Dozers, Hydraulic Excavators, Trenching Machines, Graders, Gradalls, Trimmers, Trucks and hauling equipments - Draglines and Cam Shells.

UNIT -II

High Rise Structures: Methods and Equipments for foundations (Raft and pile foundations), well foundations, Shoring, Scaffolding, Formwork, Cranes and hoisting equipment. Slip form technique for tall chimneys and shafts.

UNIT - III

Concreting methods: Methods and Equipments for Concrete: Aggregate preparation, Batching, Mixing, Placing Concrete: Pumps, Ready Mix Plants, Consolidating Concrete, Finishing and Curing methods, Shotcreting and guniting.

UNIT - IV

Construction and Erection Techniques: Concrete Bridges - In-situ and precast construction methods, Balanced cantilever Methods, Span by Span Method, Incremental launching, Steel Bridges, Cable Stayed Bridges and Suspension Bridge.

UNIT-V

Highway Construction: Asphalt Plants, Paving Equipments, Tunnels-stages, methods and lining, Grouting Methods.
Ports: Types, Breakwaters – berthing structures, mooring accessories – dredgers and dredging methods.

References:

1. Antil J.M., Civil Engineering Construction, McGraw Hill Book Co., 1982.
2. Peurifoy, R.L., Ledbette. W.B., Construction Planning, Equipment and Methods, McGraw Hill Co., 2000.
3. Ratay, R.T., Hand Book of Temporary Structures in Construction, McGraw Hill, 1984.
4. Koerner, R.M.,Construction & Geotechnical Methods in Foundation Engineering, McGraw Hill,1984.
5. Varma,M., Construction Equipment and its Planning & Applications, Metropolitan Book Co., 1979.
6. Smith, R.C, Andres, C.K., Principles and Practice of Heavy Construction, Prentice Hall, 1986.

CE 907 EXPERIMENTAL TECHNIQUES LABORATORY

Use of various types of strain gauges - Mechanical and Electrical strain gauges - Casting and testing of R.C. beams and study of their behavior in flexure and shear - Studies on strain and displacement measurements. LVDT's, Load cells and data acquisition systems – software and analysis.

Simple dynamics experiments- determination of natural frequency and damping ratio

CE 905 DESIGN OF METAL STRUCTURES

UNIT I

Design principles of members subjected to lateral loads and axial loads - Principles of analysis and design of Industrial buildings and bents - Crane and gantry girders.

UNIT II

Analysis and design of steel towers, Trestles and Masts- Design of industrial stacks - Self supporting and guyed stacks lined and unlined.

UNIT III

Cold formed sections-types of cross sections- design of cold formed thin walled members- local buckling and post buckling strength-beams-columns and beam columns-connections.

UNIT IV

Introduction to Plastic Analysis of Structures-shape factors, moment redistribution- Static-kinematic and uniqueness theorems-combined mechanisms- analysis of single bay and two bay portal frames- Effect of axial force and shear force on plastic moment.

UNIT V

Pre Engineered buildings- rigid frame end-post and beam end- design of purlin and girders subject to different load conditions-limitations of pre-engineered buildings- advantages and comparison with conventional steel buildings.

References:

1. Subramanian N, Design of Steel Structures, Oxford University Press, New Delhi, 2008.
2. Dayaratnam, P, Design of Steel Structures- Chand & Co, New Delhi, 2008.
3. Horne, M.R and Morris, L. J., Plastic Design of Low Rise Frames, MIT Press, USA, 1982.
4. Wei-Wen Yu, Cold Formed Steel Design, John Wiley & Sons, 2000.
5. Galambos, T V., Stability Design Criteria for Metal Structures, John Wiley & Sons, 1998.
6. IS: 875 (parts 1 to 5) - 1987, Code of Practice for Design Loads for Buildings and Structures, BIS, New Delhi.
7. IS: 1893-2002, Criteria for Earthquake Resistant Design of Structures, BIS, New Delhi.

CE 906 SAFETY PRACTICES IN CONSTRUCTION

UNIT – I

Construction accidents - Construction Safety Management: Importance - causes of accident, safety measures- Environmental issues in construction-Construction industry related laws. Human factors in safety – legal and financial aspects of accidents in construction – occupational and safety hazard assessment.

UNIT – II

Safety Programmes - Construction Safety - Elements of an Effective Safety Programmes - Job-site assessment - Safety Meetings - Safety Incentives. Contractual Obligations - Safety in construction contracts- Substance Abuse - safety Record Keeping.

UNIT – III

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 – IV

Accident prevention-cost of accidents-Safety and productivity-safety provision in the factories act-accident reporting investigation and statistics-total loss control and damage control-Safety sampling- safety audit - critical incident technique- safety equipment - planning and site preparation- safety system of storing construction materials-Excavation - blasting- timbering-scaffolding- safe use of ladders- safety in welding.

UNIT – V

Safety in hand tools- Safety in grinding- Hoisting apparatus and conveyors- Safety in the use of mobile cranes-Manual handling-Safety in demolition work- Trusses, girders and beams- First- aid- Fire hazards and preventing methods-Interesting experiences at the construction site against the fire accidents.

REFERENCES

1. Jimmy W. Hinze, *Construction Safety, Prentice Hall Inc., 1997*
2. Richard J. Coble, Jimmie Hinze and Theo C. Haupt, *Construction Safety and Health Management, Prentice Hall Inc., 2001.*
3. Hand Book on Construction Safety Practices, SP:70, BIS, 2001.

CE 908 COMPUTING TECHNIQUES LABORATORY

Introduction to 3D - DBMS concepts - Civil Eng. Databases – Data entry & Reports. Spreadsheet concepts – Worksheet calculations in Civil Engineering - Regression & Matrix Inversion. Development of C/Matlab programs to solve problems using numerical techniques.

1. Roots of an equation using Newton – Raphson method.
2. Solution of linear simultaneous equations using Gauss elimination.
3. Matrix inversion using GJ method
4. Linear regression analysis.
5. Curve fitting using Polynomial Regression.
6. Eigen value extraction power method
7. Spreadsheets for design of various structural elements- footings, beams, slabs and columns

Computer methods of structural analysis - Finite Element programming – Hands on experience for structural analysis through application packages Staad Pro, SAP, ETABS and Ansys.

CE 921 ADVANCED BRIDGE CONSTRUCTION ENGINEERING

UNIT – I

Construction of Substructure for Bridges: Pile foundations – site investigation – depth of exploration – in-situ testing- soil exploration techniques. Piling methods – pile types – pile driving methods – non-displacement piles – micro piles – durability problems in pile construction – integrity testing – pile testing. Spacing of Piles - size of concrete piles - tolerance in pile alignment - pile cap. Pile concreting under various soil conditions.

UNIT – II

Caissons or well foundations: Caisson construction and sinking methods - construction of well curb (shoe) - towing a floating caisson to sinking site - bed preparation - supporting structures - lowering caissons - sinking open Well caissons - excavation method - de-watering for freeing a 'hanging' caisson. Sand Blow -jetting and lubrication - rectifying tilt in wells - skin friction in caissons - construction details of pneumatic sinking of caissons - construction methods of steining and bottom plugging

UNIT – III

Construction of superstructure - reinforced concrete superstructure- prestressed concrete superstructure - composite and steel superstructure - special superstructures. Geometrical alignment - lighting - Drainage - traffic lane width, road width, footpaths, and clearance for vehicles / boats - road kerb, crash barrier, parapet and handrail - expansion and roadway joints -super-elevation.

UNIT – IV

Slab, T-beam and Box girder deck slab construction: Slab type, T-beam and box-girder bridges Decks Construction methods. Span lengths -deck and stiffening system.

UNIT – V

Segmental Construction, Cantilever Construction and Successive Launching- Precast segmental construction for long-span bridges-cables and their profiling - deck section - soffit surface -deflection and pre-camber - expansion joint - bearings - aesthetics. Cable-stayed bridge construction - Construction methods - cable configuration - towers - multi span cable stayed bridges - stay tendons - aerodynamic stability.

REFERENCES:

1. Chew Yit Lin, Michael, Construction Technology for Tall Buildings (2nd Ed.), Singapore University Press, World Scientific, Hong Kong, 2001.
2. Victor.D.J, Essentials of Bridge Engineering, Oxford IBH, 2001
3. Ponnuswamy.S, Bridge Engineering, Tata McGraw Hill, 1989.
4. Raina V.K. Concrete Bridge practice, Tata McGraw Hill Publishing Co., 1991
5. Derrick Beckett, An Introduction to Structural Design of Concrete Bridges, Surry University Press, Oxford Shire, 1973.
6. Fleming. W. G. K., et al., Piling Engineering, Surrey University Press, London, 1985.

CE 922 CONDITION ASSESSMENT AND EVALUATION ENGINEERING

UNIT – I

Condition Assessment: Introduction – Procedure for the condition assessment of concrete structures – walk over Survey –collation information – Establishment of in-service conditions – field visits – inspection – sampling – structural capacity –load testing – condition assessment of structures and health monitoring.

UNIT –II

Non-Destructive Testing: Strength Tests - Rebound Hammer – Ultrasonic Pulse Velocity Measurement – Pull-out test – Pull-off test – Break-off test –Windsor Probe test –Core cutting.

UNIT –III

Electro-chemical Methods: Half–Cell Potential measurements - Resistivity – Permeability – Cover survey –tests for rebar corrosion assessment – Abrasion resistance test.

UNIT- IV

Chemical Analysis: Chemical analysis for cement content and type – Depth of carbonation –original water content –Chloride content –Sulphate content.

UNIT –V

Performance and Integrity Tests: Radiography –Radar – Resonant Frequency method-Acoustic Emission –Impact echo method – Dynamic Response.

References:

1. Basheer, P. A. M., Proceedings of a Special Technical Session on “Near-surface Testing for Strength and Durability of Concrete”, Fifth CANMET/ACI International Conference on Durability of Concrete, Barcelona, Spain, 4-9 June 2000.
2. R.Holland., Appraisal & Repair of Reinforced Concrete, Thomas Telford
3. Michael Stratton, Structure and Style, E& FN Spon.
4. Recommendations for inspection, maintenance and management of Car Park structure- Institution of Civil Engineers – 2202, Typeset by Gray Publishers, Thomas Telford James Douglas, Building Adaptation, Elsevier.
5. Neville, A.M., Properties of Concrete, Pearson Education Asia (P) Ltd, England, 2000.

CE 923 ENERGY CONSERVATION TECHNIQUES IN BUILDING CONSTRUCTION

UNIT – I

Introduction: 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 -Energy use in buildings - Residential - commercial buildings. Green building concepts.

UNIT - II

Environmental: 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: 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: Energy in building design - Energy efficient and environment friendly building - Thermal phenomena - thermal comfort - Indoor Air quality - Climate, sun and Solar radiations -Psychometrics - passive heating and cooling systems - Energy Analysis - Active HVAC systems -Preliminary Investigation - 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 management programme.

UNIT – V

Energy Management: 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.

REFERENCES

1. Moore F., *Environmental Control System McGraw Hill, Inc., 1994.*
2. Brown, G Z, Sun, *Wind and Light: Architectural design strategies, John Wiley, 1985.*
3. Cook, J, *Award - Winning passive Solar Design, McGraw Hill, 1984.*

CE 924 DETERIORATION PROCESS IN REINFORCED CONCRETE

UNIT-I

Physical Damage: Plastic Settlement –Drying Shrinkage- Thermal Effects – Freeze and Thaw-Abrasion –Creep-Erosion and Cavitation – Fire.

UNIT –II

Rebar Corrosion: Types of Corrosion – Corrosion of reinforcement exposed to atmosphere – Corrosion of reinforcement embedded in concrete –Mechanisms of Corrosion – Factors influencing Corrosion - Protective Coating for concrete surfaces - Protective Coatings for Reinforcement bar – Cathodic Protection.

UNIT- III

Chemical Attack on Concrete: Sulphate attack –Seawater damage –Salt weathering-Carbonation –Acid attack –attack of soft water. Alkali –Silica reaction –Alkali –Carbonate reaction –unsound Cement –Biological attack.

UNIT – IV

Construction and Design Defects: Settlement of Sub-grade –Internal Settlement of Concrete Suspension –Movement of Formwork- Premature removal of forms/shores – Vibrations – Re-entrant Corners – Improper Placement of reinforcing steel bars – Poor Detailing joints – Inadequate – Drainage –Design errors –Deflecti0n –Settlement of foundation.

UNIT – V

Blemishes and Defects in Concrete: Honey Combing –Pop outs –Crazing – Efflorescence –Scaling and Spalling –Cold Joints – Discoloration -Bleeding -Curling.

REFERENCES:

1. Mark Richardson – Technology, Fundamentals of Durable Reinforced Concrete-Spon press (UK)
2. Pietro Pedeferri, Rob.B. Polder, Corrosion of Steel in Concrete Prevention, Diagnosis, Repair, Wiley – VCH
3. G. Jorv, Concrete under severe conditions, Spon Press (UK)
4. R. K. Dhir, Michael, J. Mecarthy, Concrete Durability & Repair Technology, Thomas Telford.
5. R. K. Dhir, Challenges of Concrete Construction, Pt.1, V.4, Thomas Telford, London.
6. SP: 25-1984, Causes and Prevention of Cracks in Buildings, BIS, New Delhi.

CE 925 ADVANCED STRUCTURAL ANALYSIS

Unit – I

Matrix flexibility method – Transformation of forces – Element flexibility to system flexibility. Analysis of statically indeterminate beams and rigid jointed plane -frames – effect of support settlements and elastic supports.

Unit – II

Matrix flexibility method Analysis of pin–jointed frames –effects due to lack of fit and temperature changes. Application to space frames – Direct flexibility approach.

Unit – III

Matrix stiffness method – Transformation of displacements – Elements stiffness to system stiffness – Application to continuous beams – effects of support settlements and elastic supports.

Unit – IV

Matrix stiffness method –– Application to pin-jointed plane frames - support settlements – lack of fit and temperature effect. Analysis of three dimensional pinned frames.

Unit – V

Special analysis techniques – Condensation, Substructuring – reanalysis techniques – transfer matrix method. Analysis of frames with semi rigid connections.

REFERENCES:

1. Pandit, G.S. and Gupta, S.P., Structural Analysis – A Matrix Approach, Tata McGraw Hill Publishing Co., New Delhi, 1997.
2. McGuire, W., and Gallagher, R.H., Matrix Structural Analysis, Lohn Wiley & Sons, New York, 1998.
3. Rajasekaran, S., and Sankarasubramaninan, G., Computational Structural Mechanics, Prentice Hall of India Pvt. Ltd., New Delhi, First Edition 2001.
4. Wang, C.K., “Intermediate Structural Analysis”, McGraw Hill Publishing Co., New York, 1989.
5. Reddy, C.S., “Basic Structural Analysis”, Tata McGraw Hill Publishing Co., New Delhi, 1996.

CE 926 CONTRACT LAWS AND REGULATIONS

UNIT - I

Construction Contracts: Indian Contracts Act - Elements of Contracts - Types of Contracts - Features - Suitability - Design of Contract Documents - International Contract document - Standard Contract Document - law of torts

UNIT – II

Tenders: Prequalification -Bidding - Accepting - Evaluation of tender and Interpretation - Potential Contractual Problems - World Bank Procedures and Guidelines

UNIT - III

Arbitration: Comparison of Actions and Laws -Agreements - Subject Matter - Violations -Appointment of Arbitrators - Conditions of Arbitration - Powers and Duties of Arbitrator - Rules of Evidence -Enforcement of Award – Costs.

UNIT – IV

Legal Requirements: Insurance and Bonding -Laws Governing Sale, Purchase and Use of Urban and Rural Land -Land Revenue Codes - Tax Laws - Income Tax, Sales Tax, Excise and Custom Duties and their Influence on Construction Costs -Legal Requirements for Planning - Property Law - Agency Law -Local Government Laws for Approval - Statutory Regulations

UNIT – V

Labour Regulations: Social Security - welfare Legislation - Laws relating to Wages, Bonus and Industrial disputes, Labour Administration - Insurance and Safety Regulations - Workmen's Compensation Act -other labour Laws.

REFERENCES:

1. Gajaria, G.T., Laws Relating to Building and Engineering Contracts in India, M.M. Tripathi Private Ltd., Bombay , 1982.
2. Jimmie Hinze, Construction Contracts, 2nd Edition , McGraw Hill, 2001.
3. Joseph T. Bockrath, Contracts and the Legal Environment for Engineers and Architects, 6th Edition, McGraw Hill, 2000.

CE 927 ADVANCED FOUNDATION ENGINEERING

UNIT I : Shallow Foundation

Functions and requisites of a foundation - Different types – Bearing capacity determination – Field Tests – Settlement determination – Proportioning of shallow foundation – Design guidelines - Codal recommendations - Construction aspects.

UNIT II: Raft Foundation

Codal Recommendations – Construction aspects – Ground modification for shallow foundations.

UNIT III: Pile Foundation

Function – classification of piles – Factors governing choice of pile foundation – Load transfer principles - load evaluation of piles and pile groups – Static method – Dynamic method –pile load test – Under reamed piles - Pile raft system – Laterally loaded piles - Codal Recommendations – Construction aspects.

UNIT IV: Caisson Foundation

Caissons types – Stability of caissons – Loads - principles of analysis and design - IRC Guidelines- Construction aspects.

UNIT V: Machine Foundation

Types of Machines and Foundations – General requirements –Principles of measuring dynamic properties – Field tests – Factors affecting dynamic properties- Mechanism of Liquefaction–Influencing factors-Evaluation of Liquefaction potential – Design of Block Foundation – Codal Recommendations – Construction aspects - Vibration Isolation.

REFERENCE BOOKS

1. Bowles, J.E., Foundation Analysis and Design, Fifth Edition, McGraw Hill, New York, 1995.
2. Das, B.M., Principles of Foundation Engineering, Design and Construction, Fourth Edition, PWS Publishing, 1999.
3. Vaidyanathan, C.V., and Srinivasalu, P., Handbook of Machine Foundations, McGraw Hill, 1995.
4. Koerner, R.M., Construction & Geotechnical methods in foundation engineering, MGH, New York,1985
5. Hausmann.M.R. Engineering principles of Ground Modification, mcGraw-Hil
6. Peurifoy, R.L., Ledbette. W.B Construction Planning , Equipment and Methods McGraw Hill Co, 2000
7. Ponnusamy S, “Bridge Engineering” Tata McGraw Hill Publishing Co., New Delhi , 2008

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CE 928 RESOURCE MANAGEMENT AND CONTROL IN CONSTRUCTION

UNIT – I

Resource Planning: Resource Planning, Procurement, identification, Personnel, Planning for material, Labour, time schedule and cost control. Types of resources, manpower, Equipment, Material, Money, Time.

UNIT – II

Resources: Systems approach in resource management, characteristics of resources, Resources, Utilization, measurement of actual resources required. Tools for measurement of resources, Labour, classes of Labour, Cost of Labour, Labour Schedule, optimum use of labour.

UNIT - III

Materials: Time of purchase, Quantity of material, sources, Transportation, Delivery and Distribution.
Equipment: Planning and selecting by optimistic choice with respect to cost, Time, Source and handling.

UNIT – IV

Time: Personnel time, Management and planning, Managing time on the project, forecasting the future, Critical path measuring the changes and their effects. Cost control: Cash flow and cost control, objectives of cost, Time and Quality.

UNIT V

Resource allocation and leveling: Time-cost trade of, Computer application in resource leveling examples, resource list, resource allocation graph, Resource loading, Cumulative cost ETC - Value Management.

Introduction to project management software: MS project and Primaveera.

REFERENCES:

1. Andrew, D, Szilagg, Hand Book of Engineering Management, 1982.
2. Glenn, A. Sea's and Reichard, H Clough, Construction Project Management, John Willey and Sons, Inc. 1979.
3. Harvey, A. Levine, Project Management using Micro Computers, Obsome-McGraw Hill C.A. Publishing Co., Inc. 1988,
4. James, A., Adrain, Qauntitative Methods in Construction Management, American Elsevier Publishing Co., Inc. 1973.
5. Oxley Rand Poslcit, Management Techniques applied to the Construction Industry Granda Publishing Ltd., 1980.

CE 929 DESIGN OF COMPOSITE STRUCTURES

UNIT – I

Introduction to steel - concrete composite construction - theory of composite structures –Comparison of composite and non-composite beam action- Introduction to steel - concrete - steel sandwich construction. Materials in composite construction- profiled steel decking-fabricated sections.

UNIT – II

Shear Connectors: types-behaviour-load bearing mechanism-failure mechanism-standard test. Design and strength of shear connectors. Design of Composite members – simply supported slabs – simple and continuous beams.

UNIT – III

Composite columns: Types-Design of concrete encased columns, concrete filled tubular columns. Design of Composite trusses.

UNIT – IV

Connections in Composite construction- flexible and rigid connections- moment resisting connections. Seismic behaviour of composite structures.

UNIT – V

Composite Box Girder Bridges: Introduction - behaviour of box girder bridges - design concepts. Case studies: Case studies on steel-concrete composite construction in buildings and bridges.

REFERENCES:

1. Johnson R.P, Composite structures of steel and concrete, Blackwell Scientific Publications (Second Edition), UK, 1994.
2. Owens, G.W. and Knowels.P, Steel Designers manual (Fifth edition), Steel Concrete Institute (UK), Oxford Blackwell Scientific Publications, 1992.
3. Nethercot, D.A. Composite Construction, Spon Press, London, 2003.
4. Oehlers.O.J, Bradford, M.A. Elementary Behavior of Composite Steel and Concrete structural members, Butterworth-Heineman, London, 1999.

CE 930 PREFABRICATION AND CONSTRUCTION TECHNIQUES

UNIT-I

Materials - Modular co-ordination, standardization and tolerances-system for prefabrication. Pre-cast concrete manufacturing techniques, Moulds –construction design, maintenance and repair.

UNIT-II

Pre-casting techniques - Planning, analysis and design considerations - Handling techniques -Transportation Storage and erection of structures.

UNIT-III

Joints -Curing techniques including accelerated curing such as steam curing, hot air blowing etc., -Test on precast elements - skeletal and large panel constructions - Industrial structures.

UNIT-IV

Pre-cast and pre-fabricating technology for low cost and mass housing schemes. Small pre-cast products like door frames, shutters, Ferro-cement in housing - Water tank service core unit.

UNIT-V

Quality control - Repairs and economical aspects on prefabrication.

REFERENCES:

1. Levitt. M., Precast concrete - Materials, Manufacture Properties and Usage, Applied Science Publs. 1982,
2. Konex.T., Handbook of Pre-cast Construction, Vol.1.2&3.
3. Richardson,J.G., Pre-cast concrete Production, Cement and Concrete Association, London, 1973.
4. Madhava Rao.A-G., Modern Trends in Housing in Developing Countries, Oxford & UBH Publishing co., 1985. -
5. Lewicki.B., Building with Large Pre-fabrications, Elsevier Publishers.
6. Large Panel Prefabricated Constructions, Proc. of Advance Course conducted by SERC, Madras.
7. Bruggeling.A.S.G., & Huyghe.G.F., Prefabrication with Concrete, A.s.A., Balkema Publishers, Netherland, 1991.

CE 931 EARTHQUAKE RESISTANT DESIGN OF STRUCTURES

UNIT I

Engineering seismology – rebound theory – plate tectonics – seismic waves – earthquake size and various scales – local site effects – Indian seismicity – seismic zones of India – theory of vibration – near ground and far ground rotation and their effects.

UNIT II

Seismic design concepts – EQ load on simple buildings – load path – floor and roof diaphragms – seismic resistant building architecture – plan configuration – vertical configuration – pounding effects – mass and stiffness irregularities – torsion in structures.

UNIT III

System Provision of seismic code (IS1893 & IS 13920) – Building systems – frames – shear wall – braced frames – layout design of Moment Resisting Frames (MRF) – ductility of MRF – Infill walls – Non-structural elements

UNIT IV

Calculation of EQ load – 3D modeling of building systems and analysis (theory only) Design and detailing of frames, shear wall, and frame walls – earthquake resistant design of masonry structures.

UNIT V

Cyclic loading behavior of RC steel and masonry structures - modern concepts –base isolation – Adoptive systems – case studies

REFERENCES:

1. Pankaj Agarwal and Manish ShriKhande, Earthquake Resistant Design of Structures, Prentice- Hall of India, 2007, New Delhi
2. Pauley and Priestley, Seismic Design of Reinforced Concrete and Masonry Buildings Structures, John Wiley & Sons, 1992.
3. Duggal, S.K Design of Earthquake Resistant Structures, Oxford IBH, New Delhi, 2007.
4. IS: 1893 – 2002, Criteria for Earthquake Resistant Design of Structures, BIS, New Delhi.
5. IS: 13920 – 1993, Ductile Detailing of Reinforced Concrete Structures Subjected to Seismic Forces, New Delhi.
6. IS: 4326 – 1993, Earthquake Resistant Design and Construction of Buildings – Code of Practice, BIS, New Delhi.
7. IS: 13828 – 1993 Improving Earthquake Resistant of Low Strength Masonry Buildings- Guidelines, BIS, New Delhi.
8. IS: 13935 – 1993, Repair and Seismic Strengthening of Buildings- Guidelines, BIS, New Delhi.

CE 932 WIND AND CYCLONE EFFECTS ON STRUCTURES

UNIT-I

Introduction: Basic wind speed, Design wind speed, Design wind pressure, offshore wind velocity, Wind pressures and forces in buildings/ structures. External pressures coefficients for various roofs, Dynamic effects. Design of Tall Buildings: Analysis of tall building for lateral loads, cantilever method, Portal method, Factor method; Design consideration and plan configurations for wind and cyclone

UNIT-II

Design of shear wall: Introduction, Types of shear walls, behaviour of cantilever walls with rectangular cross section, Flange cantilever shear walls, Moment – Axial load interaction for shear wall section, Interaction of shear walls and Rigid jointed frames, Shear walls with openings, Coupled shear walls.

UNIT-III

Analysis of Steel Towers, Trestles and Masts: Introduction, wind Loads on towers, stresses due to vertical loads and horizontal loads.

UNIT-IV

Analysis of forces in Chimneys Introduction, Wind pressure, Stresses in chimney shaft due to self weight and wind, , Stresses due to temperature effect.

UNIT-V

Design of Glass and Glazing – Control of wind induced vibration on structures – cyclone resistant design of structures – wind tunnel experiments.

REFERENCES:

1. Park, R and Paulay, T., Reinforced Concrete Structures, John Wiley & Sons, 1975, New York.
2. Manohar, S.N, Tall Chimneys- Design and Construction, Tata McGraw Hill, New Delhi, 1985.
3. Teaching Resource for Structural Steel Design – INSDAG, Kolkata.
4. Subramanian N, Design of Steel Structures, Oxford University Press, New Delhi, 2008.
5. Dayaratnam, P, Design of Steel Structures- Chand & Co, New Delhi, 2008.
6. Simiu.E, Scanlan.R.H, Wind Effects on Structures, John wiley & sons, 1996.
7. Melaragno, M.G, Severe Strom Engineering for Structures Design, Gorden and Breach,1996.
8. Agarwal,S.K, Lakshmi P, Wind Effects of Structures, Allied Publishers, Chennai, 1997.
9. Reira J.D and Devanport A.G ,Wind effects on buildings and structures, Belkama.A.A,Netherlands, 1998.

CE 933 DESIGN OF INDUSTRIAL STRUCTURES

UNIT I

Specific requirements for industries, like textile, sugar, cement, chemical etc., site layout and external facilities.

UNIT II

Planning of building work-standards-structural materials including plastics, polymers, fibre glass, pressed cardboards, etc., multi-storey buildings; steel skeletal structures, reinforced concrete frames; workshops; ware houses; single storey buildings; sheds in steel and reinforced concrete; north lights; single span spherical and other special constructions; cooling towers and chimneys; bunkers and silos; prefabrication; construction.

UNIT III

Construction Techniques-Expansion joints-machine foundations; water proofing; roofs and roofing; roof drainage; floors and flooring joists; curtain walling; outer wall facing; sound and shock proof mountings; use of modern hoisting and other construction equipments.

UNIT IV

Circulation, communication and transport; fixed points (central cores); stair cases; grid floor sections; lifts; cranes; continuous conveyors; mobile cranes; transporters; doors; sliding gates

UNIT V

Functional requirements- Lighting: natural lighting; protection from the sun-sky lights; window cleaning installations. Services: layout; wiring; fixtures, cable and pipe bridges; electrical installations; lighting substation; effluent. Ventilation and fire protection: ventilation; air conditioning; fire escapes and chutes; fire alarms; extinguishers and hydrants.

REFERENCES

1. Dunham, C.W ,Planning of industrial structures-Mc Graw Hill book Co. 1948.
2. Subramanian N, Design of Steel Structures, Oxford University Press, New Delhi, 2008.
3. Dayaratnam, P, Design of Steel Structures- Chand & Co, New Delhi, 2008.
4. SP32-1986, Handbook on Functional requirements of industrial buildings, BIS,New Delhi.

CE 934 BASICS OF FINITE ELEMENT ANALYSIS

UNIT – I

Differential equilibrium equations - strain displacement relation - linear constitutive relation - special cases- Principle of stationary potential energy - application to finite element methods.

UNIT – II

Some numerical techniques in finite element Analysis Displacement models - convergence requirements. Natural coordinate systems – Shape function. Interpolation function- Linear and quadratic elements - Lagrange & Serendipity elements- Strain displacement matrix - element stiffness matrix and nodal load vector

UNIT – III

Two dimensional isoparametric elements - Four noded quadrilateral elements – triangular elements- Computation of stiffness matrix for isoparametric elements - numerical integration (Gauss quadrature) -Convergence criteria for isoparametric elements.
Assemblage of elements – Direct stiffness method- Special characteristics of stiffness matrix - Boundary condition & reaction - Gauss elimination and LDT decomposition- Basic steps in finite element analysis.

UNIT – IV

Analysis of framed Structures- 2D truss element - 2D beam element. Analysis of plate bending: - displacement functions - plate bending Elements.

UNIT – V

Introduction to 3 Dimensional elements – Shape functions - Introduction to finite element softwares – Pre and Post processors.

REFERENCES:

1. Krishnamoorthy, C.S, Finite Element Analysis Theory and Programming, McGraw- Hill, 1995.
2. Desai C.S and Abel, J.F., Introduction to the Finite Element Method, Affiliated East West Press Pvt. Ltd. NewDelhi 2000.
3. Ramachandiran,J., Boundary and Finite Elements, Theory and Problems, Narosa Publishing House, Chennai,2000.
4. Logan.D.L, A First Course In The Finite Element Method, Thomson India Edition, New Delhi, 2007.
5. Reddy, J.N., An Introduction To The Finite Element Method, Tata Mc Graw Hill, New Delhi, 2005.
6. Bhatti,M.A, Fundamental Finite Element Analysis and Applications with Mathematica and MatLab computations, John Wiley & Sons, New York, 2005

CE 935 ACOUSTICS, LIGHTING AND VENTILATION ENGINEERING

UNIT – I

Acoustics: Sound - Velocity of sound - frequency and intensity of sound - reflection of sound -reverberation - absorption of sound - Sabin's equation - absorption materials - conditions for good acoustics.

UNIT – II

Acoustical design of an auditorium- defects in an auditorium and their remedies- acoustics of studies -noise and its effects - type of noises-transmission of noise -sound insulation -transmission loss -acceptable noise levels

UNIT – III

Methods of sound insulation – materials used for sound insulation – measurement of acoustical level – methods of acoustical improvement for existing structures.

UNIT – IV

Lighting: Day lighting (or) Natural lighting - design of windows -orientation of buildings - lighting for industrial structures - supplementary illumination - artificial illumination -summary.

UNIT – V

Ventilation: Ventilation due to wind - ventilation due to stack effect -ventilation due to combined effect -infiltration - ventilation of industrial building - calculation of natural ventilation - mechanical ventilation - examples - building regulation -air conditioning - summary

REFERENCES:

1. Marks, Leman,P, Acoustics : A handbook for architects and Engineers, Technical Press. London, 1940.
2. Beranek.L, Concert Halls and Opera Houses – Music, Acoustics and Architecture, Springer, 2003.
3. Merritt,F.S. Standard Handbook for Civil Engineers, McGraw Hill Professional,1995.
4. Hopkinson R.G. and Galbraith R, Architectural Physics:Lighting, HMSO, London,1963.
5. George A.Hool S.B & Nathan, Handbook of Building Construction: Data for Architects, Design and Constructing Engineers and Contractors, Nabu Press, 2010.
6. Andrews F.T., Building Mechanical Systems, Krieger Huntington, N.Y.,1976.
7. CE Hagentoft, Introduction to Building Physics, Student Litteratur, 2001.

CE 936 STABILITY ANALYSIS OF STRUCTURES

UNIT – I

Buckling of columns – introduction – concepts of stability – methods of Neutral Equilibrium – Euler column – Eigen value problem – Axially loaded column – Eccentrically loaded column

UNIT – II

Energy principle – Raleigh Ritz method – Galerkin method – Numerical methods (New mark's difference and matrix methods).

UNIT – III

Beams and Beam columns – introduction – lateral buckling of beams – beam column with concentrated and distributed loads – effect of axial load on bending stiffness

UNIT – IV

Buckling of frames – introduction – modes of buckling – critical load using various methods Neutral equilibrium – slope deflection equations, matrix method.

UNIT – V

Buckling of plates – Differential equation of plate bucklings – critical loan on plates for various boundary conditions – Energy method – Finite difference method.

References

1. Timoshenko and Gere, Theory of elastic stability, McGraw Hill Book Company, 1981
2. Alexandar Chajes, Principles of Structural Stability Theory, Prentice Hall, New Jersey, 1980
3. Iyenger, N.G.R. Structural Stability of columns and plates, Affiliated East west press Pvt Ltd., 1990.
4. Bleich F. Buckling Strength of metal structures, McGraw Hill, 1991.

CE 937 THEORY OF PLATES AND SHELLS

UNIT I

Simple bending of Plates-Assumptions in thin plate theory-Different relationships- Different Boundary Conditions for plates- Plates subjected to lateral loads – Navier's method for simply supported plates – Levy's method for general plates – Example problems with different types of loading.

UNIT II

Circular plates subjected to Axi-symmetrical loads–concentrated load, uniformly distributed load and varying load – Annular circular plate with end moments.

UNIT III

Rayleigh-Ritz method – Application to different problems – Finite difference method – Finite element methodology for plates- Orthotropic Plates.

UNIT IV

Bending of anisotropic plates with emphasis on orthotropic plates – Material Orthotropy – Structural Orthotropy - Plates on elastic foundation.

UNIT V

Shells- Classification of shells - Membrane and bending theory for singly curved and doubly curved shells - Various approximations - Analysis of folded plates.

References

1. Rudolph Szilard, Theory and Analysis of Plates, Prentice Hall, New Jercy 1986.
2. Timoshenko S.P and Woinowsky Krieger, Theory of Plates and Shells, Mc Graw Hill, 1984.
3. G. S. Ramaswamy, "Design and Construction of Concrete Shell Roofs", CBS Publishers. 2005.
4. J N Reddy, Theory and Analysis of Elastic Plates and Shells, CRC Press, 2007.
5. K Chandra Shehara, Theory of Plates, University Press, Hyderabad, 2001.

CE 938 PLASTIC ANALYSIS OF STRUCTURES

UNIT I

The concept of plastic design, ductility of steel, ultimate load as the design criterion- margin of safety-bending of symmetrical sections-plastic hinge-redistribution of moment-mechanisms...

UNIT II

Fundamental principles; statistical method of analysis- mechanism method of analysis-Further methods of analysis-distributed load-members of non-uniform cross sections-calculation of failure loads by computer.

UNIT III

Influence of axial force on the plastic moment-influence of shear force- local buckling of flanges and webs-lateral buckling-column stability-brittle fracture-repeated loading-computer solution for Shakedown analysis.

UNIT IV

Connections-requirements for connections-straight corner connections-Haunched connections-interior beam-column connections-deflection at ultimate load-deflection at working load-rotation capacity.

UNIT V

Design of beams and frames-Design guides- continuous beams-uniform and non-uniform cross sections-single-span frames-procedures for multi storeyed frames-computer solution for elastic-plastic failure loads-simple examples of minimum weight design-minimum weight design by computer.

References:

1. Lynn S Beedle-Plastic design of steel frames, John Wiley, 1978.
2. Michael R Home-Plastic theory of Structures, Thomas Nelson and Sons Limited London, 1976.
3. M. Bill Wong, Plastic Analysis and Design of Steel Structures, Butterworth, 2008.

CE 939 STRUCTURAL DYNAMICS

UNIT I

Introduction to Dynamic analysis - Elements of vibratory systems and simple Harmonic Motion- Mathematical models of SDOF systems - Principle of Virtual displacements - Evaluation of damping resonance.

UNIT II

Fourier series expression for loading - (blast or earthquake) - Duhamel's integral – Numerical methods - Expression for generalised system properties - vibration analysis Rayleigh's method - Rayleigh - Ritz method.

UNIT III

Evaluation of structural property matrices - Natural vibration - Solution of the Eigen value problem - Iteration due to Holzer and Stodola

UNIT IV

Idealisation of multi-storeyed frames - analysis to blast loading - Deterministic analysis of earthquake response - lumped SDOF system

UNIT V

Differential equation of motion - Beam flexure including shear deformation and rotator inertia - Vibration analysis using finite element method for beams and frames

REFERENCES:

1. Mario Paz, and William Leigh, Structural Dynamics, CBS, Publishers, 1987.
2. Roy R Craig, Jr., Structural Dynamics, John Wiley & Sons, 1981.
3. A.K. Chopra, Dynamics of Structures: Theory and Application to Earthquake Engineering, Pearson Education, 2001.

CE 940 DESIGN AND CONSTRUCTION OF PAVEMENTS

UNIT-I

Pavement types, components, highway and airport pavements, complexities in pavement design, subgrade - significance, soil classification, assessment of strength characteristics, Traffic Loads, Climatic factors - variation in moisture content and temperature, frost action, pavement component materials - Environmental factors.

UNIT-II

Stresses and deflections through homogeneous mass, Two-layer and three layer theories and applications, wheel load stresses, wheel load configurations in highway and airport pavements, ESWL, repetition of loads and EWL factors. Stresses due to wheel load and temperature, Westergaard's analysis, IRC design method for highway pavements, design of expansion and longitudinal joint details

UNIT-III

General design approaches, IRC37, IRC 58 ACI-LCN design methods for pavements. stabilometer, Triaxil test, Mcleod and Burmister's two layer theory Problems on above.

UNIT-IV

Highway construction, non bituminous – WBM& WMM-mix design, Bituminous mix design -Bituminous pavements-Cement concrete pavements-RCC pavements-CRC pavements- PSC pavements-construction of joints in CC pavements-Joint filler and sealer compounds and application methods.

UNIT-V

Pavement maintenance methods- Pavements failures, Pavement evaluation methods (flexible & rigid)- Benkelman beam rebound deflection method, strengthening of rigid pavements, pavement surface condition evaluation, highway drainage.

References:

1. Yodern, 'Principles of Pavement Design', John Wiley and Sons, (1st Edition).
2. Sharma,S K., 'Principles Practice and Design of Highway Engineering', S.Chand and Co., New Delhi, 1985.
3. Khanna & Justo, “Highway Engineering”, Chand Publications, New Delhi, 2006.
4. Kadiyalil. R., “Transportation Engineering”, Khanna publications, New Delhi, 2006.
5. Yoder and Witzach, 'Principles of pavement Design', John Wiley and Sons, (2nd Edn.)
6. Huang. Y, “Pavement analysis and Design”, John Wiley and sons.
7. IRC 37 and IRC 58.

INFRASTRUCTURE AND FACULTY REQUIREMENT FOR M.Tech (ACT)

1. Infrastructure

a. Building

Sl. №	*Building Details*	*Area (m^2)*	*№s Required*
1	Class/Tutorial Rooms	33	1
2	Laboratory	75	1
3	Project Lab	50	1

b. Equipment

Sl. №	*Facilities*	*Qty.*
1	Universal Testing Machine (1000 kN)	1 *№*
2	Universal Testing Machine (60 kN)	1 *№*
3	Universal Testing Machine (50 kN)	1 *№*
4	UPV Tester	1 *№*
5	Rebound Hammer	1 *№*
6	Compression Testing Machine (3000 kN)	1 *№*
7	Loading Frame (300 kN)	1 *№*
8	Load and Displacement Measurement Devices	1 Set
9	Accelerated Curing Tank	1 *№*
10	Box Furnace	1 *№*
11	Ball Mill	1 *№*
12	Autoclave	1 *№*

2. Library

Books : 100 №s
Titles : As required by the curriculum
Journals : 5 related International Journals

3. Faculty Requirements

Sl. №	*Cadre*	*№*	*Qualification*	*Specialisation*
1	Professor	1	As per AICTE norms	Civil Engg/ Structural Engg, Geotechnical Engg/Construction Management
2	Associate Professor	1		
3	Assistant Professor	1		

4. Teacher Student Ratio : 1 : 12