PROGRAM STRUCTURE

AND

DETAILED SYLLABUS

R20 REGULATIONS

M.Tech (STRUCTURAL ENGINEERING)

FOR

MASTER OF TECHNOLOGY TWO YEAR POST GRADUATE COURSE

(Applicable for the batches admitted from 2020-2021)

ANURAG UNIVERSITY

Venkatapur, Ghatkesar, Hyderabad-500088.

www.anurag.edu.in

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Academic Regulations for M.Tech.(Regular) with effect from the Academic Year 2020-21.

1. Eligibility for Admissions

1. Admission to the M.Tech. program shall be made subject to eligibility, qualification and specialization as prescribed by the Anurag University (AU) from time to time.
2. Admissions shall be made on the basis of merit / rank obtained by the candidates at the qualifying Entrance Test conducted by the University or on the basis of any other order of merit as approved by the University, subject to reservations as prescribed by the Telangana State Private Universities Act (Establishment and Regulations) No.11 of2018.

2. Courses of Study

The following specializations are offered for the M.Tech program of study:

1. Computer Science and Engineering
2. Electrical Power Systems
3. Embedded Systems
4. Machine Design
5. Power Electronics and Electrical Drives
6. Structural Engineering
7. VLSI System Design

3. Course Registration

3.1 Every student is required to be present and register online at the commencement of each semester on the day fixed for and notified in the academic calendar. The students will choose the courses for registration in consultation with the Faculty Advisor. The students may also consult the Head of the Department / Dean of the School.

3.2 The registration will be organized departmentally under the supervision of the Head of the Department in coordination with Faculty Advisor.

3.3 A student, who does not register on the day announced, may be permitted to register, in consideration of any compelling reason, within the first week. Similarly, a student may be permitted to change the registration for a course within the first week only in consultation with respective faculty advisor. No late registration/change of registration shall be permitted after the first week

from the scheduled date.

3.4 Only those students will be permitted to register who have: (a) cleared all University and Hostel dues of the previous semesters (b) paid all required fees for the current semester, and (c) not been debarred from registering for a specified period on disciplinary action or any other ground.

3.5 A candidate shall be given one chance to re-register and attend the classes for a maximum of two courses, if the CIE marks secured by a candidate are less than 50% and failed in those subjects but fulfilled the attendance requirement. A candidate must re-register for failed courses within four weeks of commencement of the class work and secure the required minimum attendance to appear for SEE. In the event of the student taking this chance, his CIE marks and SEE marks obtained in the previous attempt stand cancelled.

3.6 Dropping of courses: Within four weeks after the commencement of the semester, the student may, in consultation with the faculty advisor, drop one or more courses. The dropped courses shall be registered in the subsequent semesters as and when it is offered.

4. Attendance

4.1 Attendance in all classes (lectures/tutorials, laboratories etc.) is compulsory. A student will not be permitted to appear in the semester end examination on grounds of unsatisfactory attendance. Minimum required attendance in each theory / laboratory course is 75% (including the days of attendance in sports, games, and NCC and NSS activities) for appearing in the semester end examination. Students are advised to monitor the status of their attendance in the online system from time to time. Absence without obtaining sanction of leave will be considered as an act of indiscipline.

4.2 Condonation of shortage of attendance in each course up to 10% (65% and above and below 75%) in each semester shall be granted on genuine medical grounds and valid reasons on representation by the candidate with supporting documentary evidence.

4.3 Shortage of attendance below 65% in each course shall not be condoned.

4.4 Students whose shortage of attendance is not condoned in any course are not

eligible to appear for their semester end examination of that course and their registration shall stand cancelled.

4.5 However, in respect of women candidates who seek condonation of attendance due to pregnancy, the Vice-Chancellor may condone the deficiency in attendance to the extent of 15% (as against 10% condonation for others) on medical grounds subject to submission of medical certificate to this effect. Such condonation shall be availed only twice during the program of study.

4.6 A prescribed fee shall be payable towards condonation of shortage of attendance.

4.7 A candidate shall get minimum required attendance at least in three (3) theory courses in the present semester to get promoted to the next semester.

4.8 Promotion Rules:

4.8.1 A student shall be promoted from I Year to II Year only if he/she fulfills the academic requirements of securing 50% of average credits up to I Year II Semester, from all the examinations, whether or not the candidate takes the examinations.

4.8.2 A student shall register and put up required attendance in all 88 credits and earn all 88 credits for the award of degree.

4.8.3 Students, who fail to earn 88 credits as indicated in the course structure within four academic years from the year of their admission, shall forfeit their admission.

4.9 When a student is detained due to shortage of attendance in any semester, no grade allotments or SGPA/CGPA calculations will be done for that entire semester in which he/she got detained.

4.10 When a student is detained due to lack of credits in any year, he / she may be readmitted after fulfillment of the academic requirements, with the academic regulations of the batch into which he / she gets readmitted.

4.11 For readmitted candidates, if there are any professional electives / open electives, the same may also be re-registered if offered. However, if those electives are not offered in later semesters, then alternate electives may be chosen from the set of elective courses offered under that category.

5. Assessment of Academic Performance

5.1 The performance of a student in a semester shall be evaluated course-wise for a maximum of 100 marks in each theory and practical course. In addition, Seminars, Comprehensive Viva-Voce, Technical Paper writing, Project Work Reviews and Project Work shall be evaluated for 100 marks each. The distribution of marks for Continuous Internal Evaluation (CIE) and the Semester End Examination (SEE) along with the minimum pass percentage shall be as follows:

Course	Continuous Internal Evaluation (CIE)	Semester End Examination (SEE)	Minimum Requirements to	academic Pass a Course
			*Minimum Pass Percentage (SEE)	*Minimum Pass Percentage (CIE+SEE)
Theory	40	60	40	50
Laboratory / Practicals	50	50	40	50
Seminars	100	0	-	50
Comprehensive Viva-Voce	-	100	50	**50**
Technical Paper Writing	100	-	-	50
Project Reviews	100	-	-	50

*Provided a relaxation of 10% of maximum marks shall be given to physically challenged students.

5.2 Each theory course in a semester is evaluated for 100 marks, with the following weightages:

5.2.1 Continuous Internal Evaluation(CIE)

The CIE for Theory Courses has the following three components, comprising of 40 marks:

a. Midterm Examinations for 20marks
b. Quizzes for 10marks
c. Assignment / Seminars / Projects / Group Activities for10 marks
d. Mid-term Examinations

There shall be two midterm examinations of 20 marks each. The average of the two examinations shall be taken as the marks secured by each candidate. Each midterm examination shall be conducted for the duration of 90 minutes and the question paper consists of Part-A (Short Answers for 5 marks) consists of 5 questions carrying 1 mark each, and Part-B (Long Answers for 15 marks) containing 5 questions of which student has to answer 3 questions; each question carrying 5 marks.

The First midterm examination shall be conducted for 2.5 units of syllabus at the end of 8 weeks of instruction and Second midterm examination shall be conducted for remaining 2.5 units at the end of 16 weeks of instruction.

In case any student has missed one of the two examinations, or wants to improve in one of the examinations, an optional third midterm examination will be conducted. This optional third midterm examination will be conducted during the preparation cum external practical examinations period subject to the following conditions:

1. Interested students have to register for the third mid examination by paying the prescribed registration fee.
2. Third midterm examination covers entire semester syllabus carrying 20marks

a. Quizzes:

There shall be a total of five quizzes of 10 marks each. The quiz is to be conducted at the end of each of the five units of instruction. The average of the five quizzes shall be taken as the final marks secured by each candidate.

5.2.2 Assignment / Seminars / Projects / Group Activities:

The faculty will evaluate the students for 10 marks by conducting any of the following in two phases covering at least two units in each phase: Assignments / Seminars / Projects / Group Activities. This should be completed before the conduct of second mid-term examination.

5.2.3 Semester End Examination

a. The semester end examination will be conducted for 60 marks. The question paper will consist of two parts viz.,i) Part-A for 20marks, ii) Part –B for 40 marks.

b. Part-A is compulsory, which consists of ten questions (numbered from 1 to 10), two questions from each unit carrying 2 marks each.

c. Part-B consists of five questions (numbered from 11 to 15) shall be set by covering one question (may contain sub-questions) from each unit of the syllabus carrying 8 marks each. For each question there will be an“either”“or”choice (that means there will be two questions from each unit and the student shall have to answer any one of them).

5.3 Each laboratory course in a semester is evaluated for 100 marks, with the following weightages:

a. Throughout the semester the student will be evaluated for 50 marks under CIE as follows**:**

i. Preparation for Lab – 10 marks.
ii. Observation – 10 marks.
iii. Completion of Experiment – 5 marks.
iv. Record –5 marks.
v. Skill Test – 20 Marks

Before the end of instruction a Skill Test will be conducted for 20 marks. The practical SEE shall be conducted for 50 marks with an examiner along with the lab faculty. The examiner shall be appointed by the Dean (Examinations) of the University.

5.4 There shall be two seminar presentations during I Year I Semester and I Year II Semester. For each Seminar there will be only internal evaluation of 100 marks. Students shall present a seminar before the faculty members assigned for the purpose.

5.5 There shall be a Comprehensive Viva-Voce in II year I Semester. The Comprehensive Viva-Voce is intended to assess the students' understanding of various courses he has studied during the program. Comprehensive viva-voce will be taken by the faculty members assigned for the purpose.

5.6 There shall be a Technical Paper Writing that covers concepts of abstract, introduction, material and methods, conclusion, references, acknowledgement etc. The report shall be presented as a printed document for evaluation. Evaluation shall done by the faculty member assigned for the purpose

5.7 There shall be a project work review I and II in 2nd Year first and second semester respectively. For the Project work Reviews there is an internal marks of 100, the evaluation should be done by the Project Review Committee (PRC) for 50 marks and Supervisor will evaluate for 50 marks.

5.8 A candidate shall be given one chance to re-register for the courses if the internal marks secured by a candidate is less than 50% and failed in that course for maximum of two times. In the event of the student taking another chance, his / her CIE and SEE marks obtained in the previous attempt stands cancelled.

5.9 If there is a complaint in awarding the CIE marks, the University shall nominate a committee to look into the matter.

5.10 Candidates shall be permitted to apply for recounting/revaluation of SEE theory-scripts within the stipulated period with payment of prescribed fee.

5.11 Recounting: The totaling of the marks awarded shall be verified in the answer script and corrected if there is any mistake.

5.12 Revaluation

a) The answer scripts of the candidate who applied for revaluation are evaluated by two subject experts independently other than the original evaluator.

b) If the difference of marks between these two valuations is 15% or more, it will be sent for third valuation to another subject expert.

c) Nearest of two valuations out of three will be considered and the average of these two will be taken as the final marks obtained.

d) If the difference of the final marks and original marks after revaluation is 15% or more of maximum marks, then the revaluation marks are considered for declaring the result.

e) If the revaluation marks are less than the original marks, the original marks are retained and there is no change in the result.

5.13 Challenge Valuation:

The candidates who have applied for revaluation and are not satisfied with the result are only eligible to apply for challenge valuation by paying the prescribed fee in the form of DD payable to the Registrar, AU.

a) On receipt of the DD, a photocopy of the answer booklet shall be given to the student.

b) The paper will be evaluated in the presence of the student by a senior faculty member appointed by the University.

c) If there is any change in the marks >= 15% of the maximum marks, the new marks will be awarded to the student. Otherwise, there will be no change in original secured marks.

d) If the change in marks (equal or above 15% of the maximum marks) occurs, the amount paid towards challenge valuation will be refunded.Otherwise, the student will forfeit the total amount which he/she has paid.

6. The Grading System

6.1 As a measure of the student's performance, a 10-point Absolute Grading System using the following Letter Grades (UGC Guidelines) and Corresponding percentage of marks shall be followed:

% of Marks Secured (Class Intervals)	Letter Grade (as per UGC Guidelines)	Grade Points
90% and above (≥ 90%, ≤ 100%)	O (Outstanding)	10
Below 90% but not less than 80% (≥ 80%, < 90%)	**A**$^{+}$(Excellent)	9
Below 80% but not less than 70% (≥ 70%, < 80%)	**A** (Very Good)	8
Below 70% but not less than 60% (≥ 60%, < 70%)	**B**$^{+}$(Good)	7
Below 60% but not less than 50% (≥ 50%, < 60%)	**B** (Above Average)	6
Below 50% (< 50%)	F (Fail)	0
Absent	Ab	0

6.2 In general, a student shall not be permitted to repeat any course(s) only for the sake of 'Grade Improvement' or 'SGPA/ CGPA improvement'.

6.3 The 'Credit Points' (CP) for a course, is computed by multiplying the Grade Point with Credits for that particular course.

Credit Points (CP) = Grade Point (GP) x Credits

6.4 The Student passes the course only when he/she gets GP ≥ 6 (B Grade or above).

6.5 The Semester Grade Point Average (SGPA) is calculated as follows

$$SGPA = \frac{\{\sum_{i=1}^{N} C_i G_i\}}{\{\sum_{i=1}^{N} C_i\}}$$

where 'i' is the course indicator index (takes into account all courses in a semester), 'N' is the no. of courses registered for the Semester (as specifically required and listed under the Course Structure of the parent Department), C is the no. of Credits allotted to the ith course, and G represents the Grade Points (GP) corresponding to the Letter Grade awarded for that course.

6.6 The Cumulative Grade Point Average (CGPA) is a measure of the overall cumulative performance of a student over all semesters considered for registration. The CGPA is calculated as follows:

$$CGPA = \frac{\{\sum_{j=1}^{M} C_j G_j\}}{\{\sum_{j=1}^{M} C_j\}}$$

Where 'M' is the total no. of courses (as specifically required and listed under the course Structure of the parent Department) the Student has registered from the 1st Semester onwards up to and inclusive of the Semester S (obviously M > N), 'j' is the course indicator index (takes into account all courses from 1 to S Semesters), C is the no. of credits allotted to the j^{th} course, and G represents the Grade Points (GP) corresponding to the Letter Grade awarded for that j^{th} course. After registration and completion of I Year I Semester however, the SGPA of that semester itself may be taken as the CGPA, as there are no cumulative effects.

6.7 For CGPA and SGPA calculations performance in failed courses (securing F Grade) will also be taken into account, and the Credits of such courses will also be included in the multiplications and summations.

7. Passing Standards

7.1 A student shall be declared successful or 'passed' in a Semester, only when he/she gets a SGPA ≥ 6.00 (at the end of that particular Semester); and a student shall be declared successful or 'passed' in the entire UGP, only when he/she gets a CGPA ≥ 6.00; subject to the condition that he/she secures a GP ≥ 6 (B Grade or above) in every registered course in each Semester.

7.2 After the completion of each semester, a grade card or grade sheet (or transcript) shall be issued to all the registered students of that semester, indicating the letter grades and credits earned. It will show the details of the courses registered (course code, title, No. of credits, grade earned etc.), credits earned, SGPA and CGPA.

8. Evaluation of Project/Dissertation Work

Every candidate shall be required to submit a thesis or dissertation on a topic approved by the Project Review Committee.

8.1 A Project Review Committee (PRC) shall be constituted with Head of the Department as Chairman, Project Supervisor and two senior faculty members.

8.2 Registration of Project Work: A candidate is permitted to register for the project work after satisfying the attendance requirement of all the courses, both theory and practical.

8.3 After satisfying 8.2, a candidate has to submit, in consultation with his Project Supervisor, the title, objective and plan of action of his project work to the PRC for approval. Only after obtaining the approval of the PRC the student can initiate the Project work.

8.4 If a candidate wishes to change his supervisor or topic of the project, he/she can do so with the approval of the PRC. However, the PRC shall examine whether or not the change of topic/supervisor leads to a major change of his initial plans of project proposal. If yes, his date of registration for the project work starts from the date of change of Supervisor or topic as the case may be.

8.5 A candidate shall submit his project status report in two stages at least with a gap of 3 months between them.

8.6 The work on the project shall be initiated at the beginning of the II year and the duration of the project is two semesters. A candidate is permitted to submit Project Thesis only after successful completion of all theory and practical courses with the approval of PRC not earlier than 40 weeks from the date of registration of the project work. For the approval of PRC the candidate shall submit the draft copy of thesis to the Head of the Department and make an oral presentation before the PRC.

8.7 Three copies of the Project Thesis certified by the supervisor shall be submitted to the University.

8.8 After approval from the PRC, a soft copy of the thesis should be submitted for PLAGIARISM check and the plagiarism report should be submitted to the examination branch and be included in the final thesis. The thesis will be accepted for submission, if the similarity index is less than 30%. If the similarity index has more than the required percentage, the student is advised to modify accordingly and re-submit the soft copy of the thesis after one month. The maximum number of re-submissions of thesis after plagiarism check is limited to TWO. The candidate has to register for the project work and work for two semesters. After two attempts, the admission is liable to be cancelled.

8.9 For Project Evaluation (Viva Voce) in II Year II Sem. there is an external mark of 100 and the same evaluated by the External examiner appointed by the Institution. The candidate has to secure minimum of 50% marks in Project Evaluation (Viva-Voce) examination.

8.10 If he/she fails to fulfill the condition as specified in 8.9, he/she shall reappear for the Viva-Voce examination only after three months. In the reappeared examination also, fails to fulfill the above said condition, he/she will not be eligible for the award of the degree.

8.11 The thesis shall be adjudicated by one examiner appointed by the Dean-Examinations from the list of panel of examiners approved by the Vice-Chancellor. For this, Chairman, Board of Studies of the respective departments shall submit a panel of 3 examiners, who are eminent in that field with the help of the concerned guide and senior faculty of the department.

8.12 If the report of the examiner is unfavorable, the candidate shall revise and resubmit the Thesis. If the report of the examiner is unfavorable again, the thesis shall be summarily rejected.

8.13 If the report of the examiner is favorable, Project Viva-Voce examination shall be conducted by a board consisting of the Supervisor, Head of the Department and the external examiner who adjudicated the Thesis.

8.14 The Head of the Department shall coordinate and make arrangements for the conduct of Project Viva-Voce examination.

9 Award of Degree and Class

9.1 A Student who registers for all the specified courses as listed in the Course Structure, satisfies all the Course Requirements, and passes the examinations prescribed in the entire PG Program (PGP), and secures the required number of Credits 88 (with CGPA $\geq$ 6.0), shall be declared to have 'QUALIFIED' for the award of the M.Tech Degree in the chosen Branch of Engineering and Technology with specialization as he/she admitted.

9.2 Award of Class

After a student has satisfied the requirements prescribed for the completion of the program and is eligible for the award of M.Tech Degree, he/she shall be placed in one of the following three classes based on the CGPA:

CGPA	Class	Condition
≥8.00	First Class with Distinction	• Should have passed all the courses in 'first appearance' in a semester examinations and should complete the program in 2 years of time. • Should not have been detained or prevented from writing the end semester examinations in any semester due to shortage of attendance or any other reason.
≥6.75 - <8.00	First Class	• The Students who secure CGPA≥8.00, but not fulfilling above conditions for "First Class with Distinction" shall be awarded "First Class"
≥ 6.00 -< 6.75	Second class	

9.3 A student with final CGPA (at the end of the PGP) < 6.00 will not be eligible for the Award of Degree.

10 Withholding of Results

If the student has not paid the dues, if any, to the institution or if any case of indiscipline is pending against him/her, the result of the student will be withheld and he/she will not be allowed into the next semester. His/her degree will be withheld in such cases.

11 Transitory Regulations

11.1 Discontinued, detained or failed candidates are eligible for readmission / re-registration as and when offered next as per the University admission procedure.

11.2 The candidate who fails in any course has to complete the same course / equivalent course in the maximum stipulated time as per the Regulations in vogue.

12 Convocation

12.1 The University shall conduct convocation to confer the degree(s).

12.2 The University shall institute Prizes and Awards to meritorious students during convocation.

13 Amendments

The regulations hereunder are subject to amendments as may be made by Academic Council from time to time. Any or all such amendments will be effective from such date and to such batches of candidates (including those already undergoing the program).

ANNEXURE – I: Disciplinary Action against Students – Provisions

A. Student's behavior and discipline will be assessed and will receive the same attention as the academic work. Discipline includes the observance of good conduct and orderly behavior by the students of the University;

B. All students pursuing a Program at the University shall observe code of conduct and maintain discipline and must consider it as a duty to behave decently at all places;

C. Every student shall always carry the Identity card issued by the university. Every student shall have to produce or surrender the identity card, as and when required by the proctorial staff, teaching and library staff and the officials of the university. The loss of the identity card, whenever it occurs, shall immediately be reported in writing to the Registrar.

D. Any violation of the code of conduct or breach of any rules and regulations of the university is construed as an act of indiscipline and shall make him/her liable for disciplinary action;

E. The following acts are treated as gross indiscipline;

   a) Disobeying the teacher/officials or misbehaving in the class;
   b) Quarrelling or fighting in the University campus, hostels amongst themselves, indulging in any activity which amounts to ragging or Harassment of other students;
   c) Quarrelling or fighting with a University employee(s) or any other public utility functionaries in the campus;
   d) Indecent behavior in the University campus or outside causing inconvenience to others;
   e) Visiting socially unacceptable websites, smoking or consuming liquor or banned substances like drugs etc. ;
   f) Damage to the University property;
   g) Indulging in acts of theft, forgery, stealing and misappropriating;
   h) Any other activity that defames the University;
      i. Use of mobile in the class/academic area.
      ii. irregularity in attending classes, persistent idleness, negligence or indifference towards the work assigned;
      iii. Any other conduct which is considered to be unbecoming of a student.

F. Rules for Students Conduct & Behavior in Campus and Outside;

G. The rules and regulations, academic calendar shall be provided to all the students

H. In general, Dean, Student Affairs will deal with the welfare and discipline of all students in the campus including Hostel and also outside the campus and will ensure maintenance of good conduct. He/ She will be assisted by other members of faculty/ staff/ wardens as nominated;

I. Conduct and Behavior:

a) Students should attend all their classes and strictly observe class timings. They should likewise carry out other out-door and extracurricular duties assigned to them. Their attendance and leave is governed by the regulations pertaining to them;

b) Students must give their undivided attention to their academic work and must be respectful to their teachers and supervisors;

c) Students must conduct themselves with due decorum in the classes, laboratories, Library etc. and move in an orderly and disciplined manner in the campus;

d) Students should not indulge in abusive behavior/ violence of any kind with fellow students, teaching faculty and employees of the University within or outside the University. Violence by any student or group of students will lead to severe disciplinary action;

e) No meeting of the students other than those organized under the aegis of the various recognized students' activities shall be called without the prior permission in writing from the Dean, Student Affairs;

f) Neither meetings/functions within the University campus shall be organized nor any outsider address the students without the prior permission in writing from the Registrar;

g) No students shall use unfair means at any of the examinations and tests or attempt or threaten the staff to get undue advantage;

h) Students must pay all fees and other dues on specified dates. If they do not do so, they render themselves liable to penalties as in force from time to time;

i) Students must take good care of all University property. Any damage to University property shall be viewed as indiscipline. Such student(s), in addition to facing the disciplinary action, shall have to replace the damaged property and make good the losses caused due to their action. Students must

use the furniture and fittings with due care and must not deface buildings, roads, furniture and fittings etc. in any manner;

j) Students must handle the laboratory equipment, instruments and machinery with great care. Any damage or breakage of such equipment etc., due to improper use are negligent handling will have to be made good by the students concerned;

k) Ragging in any form is unlawful and strictly prohibited. If a student found ragging shall be punished as per the Anti-Ragging Act;

l) The University shall have a zero-tolerance policy towards Ragging and shall lay down strict guidelines on the same as per policies of the UGC in vogue and in compliance to directions of Hon'ble Supreme Court;

m) Mobile cellular phone may be carried by the students. However, they shall be kept in silent mode during the classes. Violation will lead to confiscation of the mobile phone;

n) All the students are required to observe the decorum in the dress code as prescribed by the University. Students not adhering to the prescribed dress code may be denied entry to the University campus;

o) Smoking, consumption/possession of liquor, intoxicants, drugs, cigarettes, hookah etc., inside or outside the Campus is strictly prohibited. Any violation will invoke severe penalty including rustication from the Hostel/ University.

J. Policy to prevent Sexual Harassment:

a) The University shall be committed to treating every employee and student with dignity and respect. It shall seek to create a work environment that is free from sexual harassment of any kind, whether verbal, physical or visual;

b) A policy shall be prescribed by the University to provide guidelines for prompt redressal of complaints related to sexual harassment which should be in full compliance with "The Sexual Harassment of Women at Workplace (Prevention, Prohibition & Redressal)" Act, 2013;

c) All references / complaints and redressal mechanism pertaining to any matter will be handled within the ambit of the said Act and the Rules framed thereunder. The policy so prescribed shall be communicated to all employees and students.

K. Grievance and Redressal Mechanisms:

The University shall constitute various Grievance and Redressal committees and its guidelines as specified by the statutory authorities of the University.

ANNEXURE – II: Malpractices Rules

S.No	Nature of Malpractice Improper conduct during examinations	Punishment
	***If the candidate*:**	
1. (a)	Possesses or keeps accessible in examination hall, any paper, note book, programmable calculators, Cell phones, pager, palm computers or any other form of material concerned with or related to the subject of the examination (theory or practical) in which he/she is appearing but has not made use of (material shall include any marks on the body of the candidate which can be used as an aid in the subject of the examination)	Expulsion from the examination hall and cancellation of the performance in that subject only.
(b)	Gives assistance or guidance or receives it from any other candidate orally or by any other body language methods or communicates through cell phones with any candidate or persons in or outside the exam hall in respect of any matter.	Expulsion from the examination hall and cancellation of the performance in that subject only of all the candidates involved. In case of an outsider, he/she will be handed over to the police and a case is registered against him/her.
2.	Has copied in the examination hall from any paper, book, programmable calculators, palm computers or any other form of material relevant to the subject of the examination (theory or practical) in which the candidate disappearing.	Expulsion from the examination hall and cancellation of the performance in that subject and all other subjects the candidate has already appeared including practical examinations and project work and shall not be permitted to appear for the remaining examinations of the subjects of that Semester/year. The hall ticket of the candidate is to be cancelled.
3.	Impersonates any other candidate in connection with the examination.	The candidate who has impersonated shall be expelled from examination hall. The candidate is also debarred and forfeits the seat. The performance of the original candidate, who has been impersonated, shall be cancelled in all the subjects of the examination (including practicals and project work) already appeared and shall not be allowed to appear for examinations of the remaining subjects of that semester/year. The candidate is also debarred for two consecutive semesters from class work and all Semester end examinations. The continuation of the course by the candidate is subject to the academic regulations in connection with forfeiture of seat. If the imposter is an outsider, he/she will be handed over to the police and a case is registered against him/her.

4.	Smuggles in the Answer book or additional sheet or takes out or arranges to send out the question paper during the examination. Takes away answer book or additional sheet, during or after the examination.	Expulsion from the examination hall and cancellation of performance in that subject and all the other subjects the candidate has already appeared including practical examinations and project work and shall not be permitted for the remaining examinations of the subjects of that semester/year. The candidate is also debarred for two consecutive semesters from class work and all SEEs. The continuation of the course by the candidate is subject to the academic regulations in connection with forfeiture of seat.
5	Uses objectionable, abusive or offensive language in the answer paper or in letters to the examiners or writes to the examiner requesting him to award pass marks	Cancellation of the performance in that subject.
6	Refuses to obey the orders of the Chief Superintendent / Assistant Superintendent / any officer on duty or misbehaves or creates disturbance of any kind in and around the examination hall or organizes a walk out or instigates others to walk out, or threatens the officer-in charge or any person on duty inside or outside the examination hall or causing any injury to himself / herself or to any others or threatens whether by words, either spoken or written or by signs or by visible representation, assaults the officer in-charge, or any person on duty in or outside the examination hall or any others, or indulges in any other act of misconduct or mischief which result in damage to or destruction of property in the examination hall or any part of the college campus or engages in any other act which in the opinion of the officer on duty amounts to use of unfair means or misconduct or has the tendency to disrupt the orderly conduct of the examination.	They shall be expelled from examination halls and cancellation of their performance in that subject and all other subjects the candidate(s) has (have) already appeared and shall not be permitted to appear for the remaining examinations of the subjects of that semester/year. The candidates also are debarred and forfeit their seats. In case of outsiders, they will be handed over to the police and a police case will be registered against them.
7.	Leaves the exam hall taking away answer script or intentionally tears the script or any part-thereof inside or outside the examination hall.	Expulsion from the examination hall and cancellation of performance in that subject and all the other subjects the candidate has already appeared including practical examinations and project work & shall not be permitted for the remaining examinations of the subjects of that semester/year. The candidate is also debarred for two consecutive semesters from class work and all Semester examinations. The continuation of the course by the candidate is subject to the academic regulations in connection with forfeiture of seat.

8.	Possess any lethal weapon or firearm in the examination hall.	Expulsion from the examination hall and cancellation of the performance in that subject and all other subjects the candidate has already appeared including practical examinations and project work and shall not be permitted for the remaining examinations of the subjects of that semester/year. The candidate is also debarred and forfeits these at.
9.	Who is not a candidate for the particular examination or any person not connected with the University indulges in any malpractice or improper conduct mentioned in clause 6 to 8.	Expulsion from the examination hall and cancellation of the performance in that subject and all other subjects the candidate has already appeared including practical examinations and project work and shall not be permitted for the remaining examinations of the subjects of that semester/year. The candidate is also debarred and forfeits the seat. Person(s) who do not belong to the University will be handed over to police and, a police case will be registered against them.
10.	Comes in a drunken condition to the examination hall.	Expulsion from the examination hall and cancellation of the performance in that subject and all other subjects the candidate has already appeared including practical examinations and project work and shall not be permitted for the remaining examinations of the subjects of that semester/year.
11.	Found copying,on the basis of internal evidence, such as, during valuation or during special scrutiny.	Cancellation of the performance in that subject and all other subjects the candidate has appeared including practical examinations and project work of that semester/year examinations.
12.	If any malpractice is detected which is not covered in the above clauses 1 to 11 shall be reported to the malpractice committee for further action on suitable punishment as per rules.	

ANNEXURE –III: Definitions

In these Regulations, unless the context otherwise requires:

a. Academic Year: Two consecutive (one odd + one even) semesters constitute one academic year

b. Choice Based Credit System (CBCS): The CBCS provides choice for students to select from the prescribed courses (core, elective or minor or soft skill courses)

c. Course: Usually referred to, as a 'course' is a component of a program. All courses neednot carry the same weightage. The courses should define learning objectives and learning outcomes. A course may be designed to comprise lectures/tutorials/laboratory work/field work/outreach activities/ project work/vocational training/viva/seminars/term papers/assignments/ presentations/self- study etc., or a combination of some of these

d. Credit Based Semester System (CBSS): Under the CBSS, the requirement for awarding a degree or diploma or certificate is prescribed in terms of number of credits to be completed by the students

e. Credit: A unit by which the course work is measured. It determines the numberof hours of instructions required per week. One credit is equivalent to one hour of teaching (lecture or tutorial) or two hours of practical work/field work per week

f. Grade Point: It is a numerical weight allotted to each letter grade on a 10-point scale

g. Credit Point: It is the product of grade point and number of credits for a course

h. Letter Grade: It is an index of the performance of students in a said course. Grades are denoted by letters i.e., O, A+, A, B+, B, C and F

i. Semester Grade Point Average (SGPA): It is a measure of academic performance in a semester. It is the ratio of total credit points secured by a student in various courses registered in a semester and the total course credits taken during that semester. It shall be expressed up to two decimal places

j. Cumulative Grade Point Average (CGPA): It is a measure of overall cumulative performance of a student. The CGPA is the ratio of total credit points secured by a student in all semesters and the sum of the total credits. It shall be expressed up to two decimal places

k. Program: An academic program of the University

l. Semester: Each semester shall consist of 16 weeks of instruction.

m. Transcript or Grade Card or Certificate: Based on the grades earned, a grade certificate shall be issued to all the registered students after every semester. The grade certificate will display the course details (code, title, number of credits, grade secured) along with SGPA of that semester and CGPA earned till that semester

n. Types of courses: The courses in a program may be of three kinds: Core, Elective and Foundation

o. Core course: This is the course which is to be compulsorily studied by a student as a core requirement of a program in a branch of study

p. Elective course: This is the course to be chosen from a pool of courses. Elective course may be (a) Supportive to the branch of study (b) Providing an expanded scope (c) Enabling an exposure to some other branch/domain (d) Nurturing student's proficiency/skill

q. Foundation course:This course may be of two kinds, compulsory foundation and elective foundation

r. Compulsory Foundation courses: These are the courses based upon the content that leads to knowledge enhancement. They are mandatory for all disciplines

s. Elective Foundation courses: These are value-based and are aimed at man-making education

t. The academic regulations should be read as a whole for the purpose of any interpretation.

u. In case of any doubt or ambiguity in the interpretation of the above rules, the decision of the Chancellor is final.

ANURAG UNIVERSITY

M. Tech (STRUCTURAL ENGINEERING)

SEMESTER-I **COURSE STRUCTURE**

CODE	Course Title	L	T	P	C
A31038	Theory of Elasticity	4	0	0	4
A31039	Structural Dynamics	4	0	0	4
A31040	Advanced Structural Analysis	4	0	0	4
A31041 A31042 A31043	Advanced Concrete Technology Design of High Rise Structures Advanced Foundation Engineering	3	0	0	3
A31044 A31045 A31046	Advanced R.C. Design Soil Dynamic and Foundation Engineering Plastic Analysis and Design	3	0	0	3
A31047 A31048 A31049 A31050	*Open Elective –I	3	0	0	3
A31211	Advanced Concrete Technology Laboratory	0	0	3	2
A31212	Seminar-I	0	0	3	2
Total		**21**	**0**	**6**	**25**

SEMESTER-II **COURSE STRUCTURE**

CODE	Course Title	L	T	P	C
A32034	Advanced Steel Design	4	0	0	4
A32035	Theory of Plates	4	0	0	4
A32036	Finite Element Method	4	0	0	4
A32037 A32038 A32039	Pre-stressed Concrete Bridge Engineering Design of Sub Structures	3	0	0	3
A32040 A32041 A32042	Earthquake Resistant Design of Buildings Repair and Rehabilitation of Buildings Stability of Structures	3	0	0	3
A32043 A32044 A32045 A32046	*Open Elective – II	3	0	0	3
A32212	CAD Lab	0	0	3	2
A32213	Seminar-II	0	0	3	2
Total		**21**	**0**	**6**	**25**

SEMESTER-III **COURSE STRUCTURE**

CODE	Course Title	L	T	P	C
A33210	Technical Paper Writing	0	4	0	2
A33211	Comprehensive Viva-Voce	0	0	0	4
A33212	Project work Review I	0	0	22	8
Total		**0**	**4**	**22**	**14**

SEMESTER-IV **COURSE STRUCTURE**

Category	Course Title	L	T	P	C
A34207	Project work Review II	0	0	24	8
A34208	Project Evaluation (Viva-Voce)	0	0	0	16
Total		**0**	**0**	**24**	**24**

***Open Elective subjects must be chosen from the list of open electives offered by OTHER Departments.**

Open Elective-I

S.No	Department	Course Title	Subject Code
1	Computer Science and Engineering	*Introduction of Artificial Intelligence*	
2	Department of Mathematics	Computer Oriented Numerical Methods	
3	Mechanical Engineering	Operations Research	
4	Electrical and Electronics Engineering	Reliability Engineering	

Open Elective-II

S.No	Department	Course Title	Subject Code
1	Computer Science and Engineering	Machine Learning	
2	Electronics and CommunicationEngineering	Principles of Electronic Communications	
3	Mechanical Engineering	Composite Materials	
4	Electrical and Electronics Engineering	Energy From Waste	

ANURAG UNIVERSITY

M. Tech – I Year – I Sem. (Structural Engg.)

THEORY OF ELASTICITY (PC-I)

Course Objectives: To impart knowledge on the basic concepts of theory of elasticity, and solve the Structural Engineering problems

Course outcomes: The learner will be able to solve problems of elasticity and be able to apply numerical methods to solve continuum problems.

Pre-requisite: Strength of Materials, Mathematics, Mechanics of solids

UNIT-I

Introduction: Elasticity - notation for forces and stress - components of stresses - components of strain - Hooks law. Plane stress and plane strain analysis – Two dimensional co-ordinate system-differential equations of equilibrium - boundary conditions – Strain Displacement Relations - compatibility equations –Airy's stress function

UNIT - II

Two dimensional problems in rectangular coordinates - solution by polynomials - Saint-Venants principle - determination of displacements - bending of simple beams – Simple Supported and Cantilever Beam.

UNIT - III

Two dimensional problems in polar coordinates - stress distribution symmetrical about an axis - pure bending of curved bars - strain components in polar coordinates - displacements for symmetrical stress distributions Edge Dislocation - general solution of two-dimensional problem in polar coordinates - application to Plates with Circular Holes-solid and hollow – Rotating Disk. Bending of Prismatic Bars: Stress function - bending of cantilever - circular cross section - elliptical cross section - rectangular cross section.

UNIT - IV

Analysis of stress and strain in three dimensions - principal stress - stress ellipsoid - director surface- determination of principal stresses Stress Invariants - max shear stresses Stress Tensor – Strain Tensor- Homogeneous deformation - principal axes of strain-rotation.

General Theorems: Differential equations of equilibrium - conditions of compatibility - determination of displacement - equations of equilibrium in terms of displacements - principle of super position - uniqueness of solution - the reciprocal theorem Strain Energy.

UNIT - V

Torsion of Circular Shafts - Torsion of Straight Prismatic Bars– Saint Venant's Method - torsion of prismatic bars - bars with circular and elliptical cross sections – thin walled sections-Prandtl's membrane analogy - torsion of a bar of narrow rectangular bars - solution of torsional problems by energy method - torsion of shafts, tubes , bars etc. – Introduction and Applications of Elastic Solutions in Geomechanics.

TEXT BOOKS

1. Timoshenko Theory of Elasticity, Mc-Graw hill Publications, 2017.
2. L. S. Srinath Advanced Mechanics of solids, Tata Mc-Graw Hill, 2017.

REFERENCES:

1. Y.C. Fung Theory of Elasticity, Dover publications, New York, 2008.
2. Arthur P. Boresi Advanced Mechanics of Materials, John Willey publishers, 2010
3. P.N. Chandra Mouli Continuum Mechanics, Yes Dee Publishers, 2004
4. Sadhu singh, Theory of Elasticity Khanna Publishers, 2018.

ANURAG UNIVERSITY

M. Tech – I Year – I Sem. (Structural Engg.)

STRUCTURAL DYNAMICS (PC-II)

Course Objectives: To impart knowledge on the fundamental of structural dynamics and their applications.

Course Outcomes: The learner will be able to understand the equation of motion, dynamics response of single, and multi degree-of freedom systems.

UNIT - I:

Theory of vibrations: Introduction - Elements of vibratory system - Degrees of Freedom - Continuous System - Lumped mass idealization - Oscillatory motion - Simple Harmonic motion - Vectorial representation of S.H.M. - Free vibrations of single degree of freedom system - undamped and damped vibrations - critical damping - Logarithmic decrement - Forced vibration of SDOF systems - Harmonic excitation -Dynamic magnification factor – Phase angle – Bandwidth

UNIT - II

Introduction to Structural Dynamics: Fundamental objectives of dynamic analysis -Types of prescribed loading - Methods of discretization - Formulation of equations of motion by different methods – Direct equilibration using Newton's law of motion / D'Alembert's principle, Principle of virtual work and Hamilton principle.

Single Degree of Freedom Systems: Formulation and solution of the equation of motion - Free vibration response - Response to Harmonic, Periodic, Impulsive and general dynamic loadings - Duhamel integral, Numerical evaluation of dynamic response- Central Difference Method and Newmark's Method, Concept of response spectrum.

UNIT - III

Multi Degree of Freedom Systems: Selection of the degrees of Freedom - Evaluation of structural property matrices - Formulation of the MDOF equations of motion -Undamped free vibrations - Solutions of Eigen value problem for natural frequencies and mode shapes - Analysis of Dynamic response – Normal co-ordinates - Uncoupled equations of motion - Orthogonal properties of normal modes – Modal Analysis- Mode super position procedure for damped forced vibrations

UNIT - IV

Practical Vibration Analysis: Introduction - Stodola method - Fundamental mode analysis - Analysis of second and higher modes - Holzer method - Basicprocedure.

Continuous Systems: Introduction - Flexural vibrations of beams - Elementary case – Derivation of governing differential equation of motion - Analysis of undamped free vibrations of beams in flexure - Natural frequencies and mode-shapes of simple beams with different end conditions - Principles of application to continuous beams.

UNIT - V

Deterministic Earthquake Response of Systems – Rigid Foundation, Types of Earthquake Excitation – Response to Rigid – Soil Excitation, Lumped SDOF elastic systems – Lumped SDOF elastic system – Distributed Parameter Elastic Systems – SRSS, CQC combination of modal responses.

TEXT BOOKS:

1. Anil. K. Chopra, Dynamics of Structures, Pearson Education India, 2007.
2. PankajAgarwal and Manish Shrikhande," Earthquake Resistant Design of Structures", PHI, 2006.

REFERENCES:

1. Ray W. Clough, Joseph Penzin, Dynamics of Structures, CBS Publishing, 2015.
2. Mario Paz,"Structural Dynamics: Theory and Computation", CBS Publishing, 2004.
3. W.T. Thomson, Theory of vibrations, CBS Publishers And Distributors Pvt Ltd, 2002.
4. MadhujitMukhopadhyay, Vibrations, Dynamics and Structural systems, CRC press, 2000

ANURAG UNIVERSITY

M. Tech – I Year – I Sem. (Structural Engg.)

ADVANCED STRUCTURAL ANALYSIS (PC-III)

Course Objectives: To impart knowledge on the analysis of indeterminate Structures like continuous beams, trusses and portal frames.

Course Outcomes: The learner will be able to analyse different indeterminate structures using Matrix methods.

UNIT - I

Introduction to matrix methods of structural analysis: Static and kinematic indeterminacies, Matrix formulations by force and displacement methods, Transformation of coordinates - element stiffness matrix - and load vector - local and global coordinates, Analysis of continuous beams and redundant trusses by force and displacement methods with degree redundancy and freedom not exceeding three. Initial and thermal stresses of truss

UNIT - II

Analysis of rigid jointed plane frames and grids: by Flexibility approach with degree of redundancy not exceeding three.

UNIT - III

Analysis of rigid jointed plane frames and grids: by Stiffness approach with degree of freedom not exceeding three.

UNIT - IV

Beams on elastic foundation: Introduction - Modulus of foundation and basic equation - Beams of length under concentrated and uniformly distributed loads - Analysis of semi-infinite beams making use of functions for infinite beams

Unit-V

Introduction to Nonlinear Analysis: Geometric and material nonlinearity, P-Δ effect, Effects of axial force on flexural stiffness – buckling of ideal columns, buckling behaviour of real columns, flexural behaviour of beam columns, flexural stiffness measures for braced prismatic beam columns, effect of axial tension, flexural stiffness measures for unbraced prismatic beam columns. Slope-deflection method of analysis – slope deflection equations for prismatic beam-columns, fixed end moments in beam-columns.

Shear walls- Necessity - structural behaviour of large frames with and without shear walls - approximate methods of analysis of shear walls.

TEXT BOOKS:

1. William Weaver J.R and James M. Gere Matrix Analysis of Frames structures CBS publications, 2nd edition, 2004
2. Ashok. K. Jain Advanced Structural Analysis, NemChandBrothers, 3rd edition, 2015

REFERENCE:

1. DevadasMenon Advanced Structural Analysis,Narosa, 2009.
2. K. Jain Advanced Structural Analysis,Nem Chand & Bros. 2015.
3. R. C. Hibbler Structural Analysis, Pearson, 2015.
4. P. Seshu Text Book of Finite Element Analysis, PHI, 2003.
5. C.S. Reddy Basic Structural Analysis, Tata Mc-Grawhill
6. S.A Pandit& Gupta Matrix method of analysis

ANURAG UNIVERSITY

M. Tech – I Year – I Sem. (Structural Engg.)

ADVANCED CONCRETE TECHNOLOGY (PE-I)

Course Objectives: Study the different types of admixtures, mix design, properties and applications of special concretes.

Course Outcomes: Design concrete mixes by various methods. Familiarize with the types of admixtures, and applications of special concretes.

UNIT – I

Cement chemistry-Portland cement and its constituent phases-High temperature chemistry-The chemistry of Portland cement manufacture-Hydration of calcium silicate phases-Hydrated aluminates, ferrite and sulphate phases- Hydration of cement.

Admixtures: Classification of admixtures - Chemical and mineral admixtures - Influence of various admixtures on properties of concrete and their applications

UNIT –II

Mix Design of Concrete as per IS 10262-2019, ACI Method and DOE Method

Durability Properties - Permeability – chemical attack – Sulphate attack – Carbonation - Quality of water – marine conditions – Thermal properties of concrete – fire resistance – methods of making durable concrete

UNIT –III

High Strength Concrete – Micro structure – Manufacturing and Properties- Design of HSC Using ErintroyShaklok Method- Ultra High Strength Concrete. High Performance Concrete-Requirements and properties of High-Performance Concrete- DesignConsiderations.

UNIT –IV

Concrete - Understanding the quasi-brittle nature of concrete - Failure of concrete under low stress - Micro— cracking, crack propagation - stress concentration at openings –Destructive, semi-destructive & Non-destructive testing methodology - Rebound hammer test – Ultrasonic Pulse Velocity (UPV) Test - Penetration resistance test - Pull-out Test - Pull-off Method - Break-off test - Cover Measurement

UNIT - V

Special Concrete: Self Compacting concrete – Polymer concrete – Fiber reinforced concrete – Reactive Powder concrete – Blended Concrete-RMC-Requirements and Guidelines – Advantages and Applications. Light weight concrete. Concrete mix design: Quality Control – Quality assurance – Quality audit.

TEXTBOOKS

1. A.M. Neville Properties of Concrete, ELBS publications, Fifth edition, 2012.
2. Shetty M.S., “Concrete Technology”, S.Chand and Company Ltd. Delhi, Seventh edition, 2013.

REFERNCES

1. Gambhir.M.L., “Concrete Technology”, Tata McGraw Hill, Publishing Co. Ltd NewDelhi, 2013.
2. Santhakumar .A.R.,” Concrete Technology”, Oxford University Press, NewDelhi2006.
3. RajatSiddique Special Structural concretes,Galgotia Publications.
4. N.KrishnaRaju Design of Concrete Mixes, CBS Publications, 5/e edition, 2018
5. P.K. Mehta Concrete: Micro Structure, Properties and Materials, Tata Mc-Graw Hill Publishing House Pvt. Ltd, fourth edition.

ANURAG UNIVERSITY

M. Tech – I Year – I Sem. (Structural Engg.)

DESIGN OF HIGH RISE STRUCTURES (PE-I)

Course Objective: To impart knowledge on analysis of tall buildings.

Course Outcomes: The learner will be able to analyse and chose an appropriate systems for tall buildings.

Unit-I

Introduction : Evolution of tall buildings - Classification of Buildings – Low-rise, medium-rise, high- rise — Ordinary framed buildings & Shear-wall buildings –Behaviour of buildings under lateral loads like Wind loads, Earthquake loads & Blast loads – Basic structural & functional design requirements– Strength, Stiffness & Stability.

Unit-II

Lateral load resisting elements: Frames, Shear walls & Tubes – Shear, Bending & combined modes of deformation – Structural behavior of Rigid frames – Simplified methods of analysis – Substitute frame method, Portal method, Cantilever method, Equivalent frame method –Structural behaviour of Shear walls – Approaches of analysis – Elastic continuum approach & Discrete approach -- Structural behavior of Tubes –Actions.

Unit-III

Choice of System for a Building: Frame building, Shear wall building, Shear walls acting with frames, Single framed tubes – Other structural forms – Staggered Wall-beam system, Tube-in-tube system, Base isolation technique for earthquake resistance. Load distribution in a tall building – Load resisted by different shear walls & frames – Determinate & Indeterminate problems – Equivalent Stiffness method, Design of shear wall as per IS code, Design of Pile Foundation.

Unit-IV

Methods of Analysis: Shear walls without Openings – Estimation of Stiffness by simple Cantilever theory & Deep beam theory – Shear walls with Openings – Equivalent frame for large openings – Muto's method for small openings –Elastic Continuum approach – Coull&Chowdhry's method – Design Charts – Limitations of Continuum approach. Shear wall- Frame Interaction: Sharing of loads between wall & frame - Different methods – comparison -- Khan &Sbrounis' method – Design charts- - Mac Leod's method - Advantages & limitations -- Cooperation of Floor slabs – Equivalent width.

Unit-V

Modern Methods: Analysis of Tall buildings by Stiffness method – Available Software for analysis of tall buildings.

TEXTBOOKS:

1. Design of Tall Buildings by Taranath B., McGraw Hill.

REFERENCES

1. Reinforced Concrete Design of Tall Buildings by Bungales. Taranath, CRCPress.
2. Analysis of Shear Walled Buildings by S. M. A. Kazimi& R. Chandra, Tor-steel Research Foundation, Calcutta,India.
3. Analysis of Framed Structures by Gere &Weaver
4. Design of Building Structures by Wolfgang Schuller, PrenticeHall

ANURAG UNIVERSITY

M. Tech – I Year – I Sem. (Structural Engg.)

ADVANCED FOUNDATION ENGINEERING (PE-I)

Course Objective: To determine the bearing capacity of shallow and deep foundations and to estimate settlements of structures subjected to external loads, leading to design of foundations resting on soils.

Course Outcome: Students should be in a position to design foundations for varieties of structures resting on soil deposits, and appreciate the importance of reliability based design in geotechnical engineering.

Unit-I

Soil Exploration: Exploration Methods; Planning the Exploration Program; Boring and Sampling; In Situ Tests: Standard & Cone Penetration Tests, Field Vane, Dilatometer, Pressure meter; Rock Sampling, Core Recovery, RQD; Geophysical Exploration; Preparation of Soil Report, Case Studies.

Unit-II

Shallow Foundations: Bearing Capacity:- Shear Failure; Effect of Water Table; Footings with Eccentric or Inclined Loads, Footings on Layered Soils, Slopes on finite layer with a Rigid Base at Shallow Depth, effect of compressibility of soil, on soils with strength increasing with depth, Plate Load tests, Presumptive bearing capacity.

Unit-III

Settlement: Components – Immediate, Primary and Secondary Settlements, Consolidation, Stresses and Displacements in Homogeneous, Layered and Anisotropic Soils; Bearing Pressure using SPT, CPT, Dilatometer and Pressure meter; Settlement of foundations on Sands- Schmertmann and Burland&Burbridge methods; Structure Tolerance to Settlement and Differential Settlements, Rotation, CodalProvisions.

Unit-IV

Deep Foundations: Single Pile: Vertically loaded piles, Static capacity- α, β and λ Methods, Dynamic formulae; Wave Equation Analyses; Point Bearing Resistance with SPT and CPT Results; Bearing Resistance of Piles on Rock; Settlement; Pile Load Test; Uplift Resistance; Laterally Loaded Piles -Ultimate Lateral Resistance; Negative Skin Friction; Batter Piles; Under Reamed Piles; Ultimate Capacity of Pile Groups in Compression, Pullout & Lateral Load; Efficiency; Settlements of Pile Groups; Interaction of Axially & Laterally Loaded Pile Groups, Codal Provisions, Analysis of foundation on soft soil.

Unit-V

Special Topics of Foundation Engineering:

Foundations on Collapsible Soils: Origin and occurrence, Identification, Sampling and Testing, Preventive and Remedial measures.

Foundations on Expansive Soils: The nature, origin and occurrence, Identifying, testing and evaluating expansive soils, typical structural distress patterns and Preventive design & construction measures.

***Introduction to Reliability-Based Design:** Brief introduction of probability and statistics, LRFD for structural strength requirements, LRFD for geotechnical strength requirements, Serviceability requirements

TEXT BOOKS

1. Das, B. M. - Principles of Foundation Engineering 5^{th}Edition Nelson Engineering(2004)
2. Donald P Coduto – Foundation Design Principles and Practices, 2^{nd}edition, Pearson, Indian edition, 2012. Phi Learning(2008)

REFERENCE BOOKS:

1. Bowles, J. E. - Foundation Analysis & Design 5^{th}Edition McGraw-Hill Companies, Inc.(1996)
2. Poulos, H. G. & Davis, E. H. - Pile Foundation Analysis and Design john Wiley & sons inc(1980-08)
3. Tomlinson, M. J. - Foundation Design and Construction - Prentice Hall(2003).
4. Baecher, G.B. & Christian, J.T. – Reliability and Statistics in Geotechnical Engineering,Wiley Publications (2003).

ANURAG UNIVERSITY

M. Tech – I Year – I Sem. (Structural Engg.)

ADVANCED REINFORCED CONCRETE DESIGN (PE-II)

Course Objectives: To impart knowledge on the behavior and design on various reinforced concrete structural elements.

Course Outcome: The learner will be able to design the reinforced concrete elements like continues beams, irregular slabs, flat slabs Deep beams corbels, and footings.

Pre requisites: Design of Reinforced Concrete Structures

UNIT I

Limit Analysis of R. C. Structures: Rotation of a plastic hinge, Redistribution of moments, moment rotation characteristics of RC member, I.S. code provisions, loading pattern, Bending Moment Envelop, Application for Fixed Beams and Continuous Beams. Inelastic Analysis of Slabs, Moment Redistribution in Columns, Limit Analysis with Torsional Hinges.

UNIT II

Yield line analysis for slabs: Yield line criterion – Virtual work and equilibrium methods of analysis – For square circular, Rectangular, Triangular and Hexagonal with simple and continuous end conditions.

UNIT III

Flat slabs: Direct design method – Distribution of moments in column strips and middle strip-moment and shear transfer from slabs to columns – Shear in Flat slabs-Check for one way and two way shears-Introduction to Equivalent frame method. Limitations of Direct design method, Distribution of moments in column strips and middle strip sketch showing reinforcement details.

UNIT IV

Design of Reinforced Concrete Deep Beams & Corbels: Steps of Designing Deep Beams, Design by IS 456. Checking for Local Failures, Detailing of Deep Beams, Analysis of Forces in a Corbels, Design of Procedure of Corbels.

UNIT V

Design of Shear Walls: Design and Detailing of Shear Walls considering shear wall-frame interaction in a tall RC structure subjected to seismic loading.

Design of Foundations – Types of combined footings; Design of combined beam and slab footing for two columns, Raft Foundations: Flat Slab Rafts for Framed Buildings for Design of the Beam and Slab Raft under uniform Pressure.

TEXT BOOKS:

1. S. UnnikrishnaPillai&DevdasMenon Reinforced Concrete Design; Tata Mc. Graw-Hill Publishing Company Ltd. New Delhi 2010
2. P.C. Varghese Advanced Reinforced Concrete Prentice Hall of INDIA Private Ltd. 2008.

REFERENCES:

1. Dr. S. R. Karve and V.L Shah Limit State Theory and Design of Reinforced Concrete. Standard Publishers,PUNE 2004.
2. N.Subramanian Design of Reinforced Concrete Structures, Oxford University Press.
3. P. Purushotham Reinforced concrete structural elements – behaviour, Analysis and design, Tata Mc.Graw-Hill, 1994.
4. Arthus H. Nilson, David Darwin, and Chorles W. Dolar Design of concrete structures –, Tata Mc.Graw-Hill, 3rd Edition, 2005.
5. KennathLeet Reinforced Concrete design, Tata Mc. Graw-Hill International, editions, 2nd edition, 1991.
6. P.C. Varghese Design Reinforced Concrete Foundations Prentice Hall of INDIA Private Ltd.

ANURAG UNIVERSITY

M. Tech – I Year – I Sem. (Structural Engg.)

SOIL DYNAMICS AND FOUNDATIONS ENGINEERING (PE-II)

Course Objective: To understand the wave propagation in soils, determine dynamic properties of soil for analyzing and designing foundations subjected to vibratory loading.

Course Outcome: Able to understand the fundamentals of wave propagation in soil media, evaluate the dynamic properties of soil, and design foundations for centrifugal and reciprocating machines.

Unit-I

Fundamentals of Vibration: Definitions, Simple harmonic motion, Response of SDOF systems of Free and Forced vibrations with and without viscous damping, Frequency dependent excitation, Systems under transient loads, Rayleigh's method of fundamental frequency, Logarithmic decrement, Determination of viscous damping, Transmissibility, Systems with Two and Multiple degrees of freedom, Vibration measuringinstruments.

Unit-II

Wave Propagation and Dynamic Soil Properties: Propagation of seismic waves in soil deposits - Attenuation of stress waves, Stress-strain behaviour of soils under cyclic loads, Strength of cyclically loaded soils, Dynamic soil properties - Laboratory and field testing techniques, Elastic constants of soils, Correlations for shear modulus and damping ratio in sand, gravels, clays and lightly cemented sand. Liquefaction of soils and its evaluation using simple methods.

Unit-III

Vibration Analyses: Types, General Requirements, Permissible amplitude, Allowable soil pressure, Modes of vibration of a rigid foundation block, Methods of analysis, Lumped Mass models, elastic half space method, elasto-dynamics, effect of footing shape on vibratory response, dynamic response of embedded block foundation, Vibrationisolation.

Unit-IV

Design of Machine Foundations: Analysis and design of block foundations for reciprocating engines, Dynamic analysis and design procedure for a hammer foundation, IS code of practice design procedure for foundations of reciprocating and impact type machines. Vibration isolation and absorption techniques.

Unit-V

Machine Foundations on Piles: Introduction, Analysis of piles under vertical vibrations, Analysis of piles under translation and rocking, Analysis of piles under torsion, Design procedure for a pile supported machine foundation.

TEXT BOOKS:

1. Swami Saran - Soil Dynamics and Machine Foundation, Galgotia Publications Pvt. Ltd.(2010)
2. Prakash, S. - Soil Dynamics, McGraw Hill Book Company(1981)

REFERENCES:

1. Prakash, S. and Puri, V. K. - Foundation for Machines: Analysis and Design, JohnWiley & Sons,1998.
2. Kameswara Rao, N. S. V. - Vibration Analysis and Foundation Dynamics, Wheeler Publication Ltd.,1998.
3. Das, B. M. &Ramana, G.V. - Principles of Soil Dynamics, 2nd Edition, CL Engineering Publishers,2010.
4. P Srinivasulu and C V Vaidyanathan, Handbook of Machine Foundation, SERC

ANURAG UNIVERSITY

M. Tech – I Year – I Sem. (Structural Engg.)

PLASTIC ANALYSIS AND DESIGN (PE-II)

Course Objectives: To impart knowledge on the analysis of steel structures like continuous beams, steel frames and connection, using Plastic Analysis.

Course Outcomes: The learner will be able to design continuous beams and steel frames

UNIT – I

Analysis of Structures for Ultimate Load: Fundamental Principles – statical method of Analysis – Mechanism method of analysis – Method of analysis, Moment check – Carry over factor – Moment Balancing Method.

UNIT – II

Design of Continuous Beams: Continuous Beams of uniform section throughout – Continuous Beams with differentcross-sections.

UNIT – III

Secondary Design Problems: Introduction – Influence of Axial force on the plastic moment – influence of shear force – local buckling of flanges and webs – lateral buckling – columnstability.

UNIT – IV

Design of Connections: Introduction – requirement for connections – straight corner connections – Haunched connection – Interior Beam-Column connections.

UNIT – V

Design of Steel Frames: Introduction – Single bay, single storey frames – simplified procedures for Single span frames – Design of Gable frames with Haunched Connection. Ultimate Deflections:

Introduction – Deflection at ultimate load – Deflection at working load – Deflections of Beams and Single span frames.

TEXT BOOKS:

1. L.S. Beedle Plastic Design of Steel Frames, John Willey &Sons.
2. B.G.Neal Plastic Analysis, SponPres

REFERENCES

1. N. Subramanian Design of Steel Structures, Oxford University Press

ANURAG UNIVERSITY

M. Tech – I Year – I Sem. (Structural Engg.)

ADVANCED CONCRETE TECHNOLOGY LAB

Course Objective:to understand the test procedure and behavior of the concrete and RC beams

Course Outcome:the student will be able to design concrete mix which will satisfy the fresh and hardened concrete properties, and study the behavior of structural elements.

Experiments to be conducted:

1. Workability of fresh concrete
   a) slump core
   b) Compaction Factor
   c) Vee Bee Test
2. To design the mix for High Strength Concrete and determine fresh and hardened properties of High Strength Concrete.
3. Mix proportion on fly-ash based concrete for compressive strength.
4. Mix proportion on Geo-polymer concrete for compressive strength.
5. Cube compressive strength of fly-ash and geo polymer concrete. Split tensile strength and modulus of rupture for fly-ash concrete/geo-polymer concrete.
6. Marsh cone test.
7. Permeability and Air entrainment of concrete
8. NDT tests on hardened concrete
   a) Rebound hammer
   b) UPV hammer
9. Accelerated curing of concrete
10. Design and Testing of self-compacting concrete of standard grade (M30 or M40)
    a) V- Funnel
    b) L -Box
    c) U -Box
    d) J -Ring

ANURAG UNIVERSITY

M. Tech – I Year – II Sem. (Structural Engg.)

ADVANCED STEEL DESIGN (PC -IV)

Course Objectives: To impart knowledge on behavior and design of various connections, industrial and steel girders.

Course Outcomes: The learner will be able to design different steel structures

UNIT - I:

Simple connections – Bolted, Pinned and Welded Connections: Bolted Connections- Load Transfer Mechanism – Failure of Bolted Joints – Specifications for Bolted Joints – Bearing – Type Connections – Tensile Strength of Plate – Strength and Efficiency of the Joint – Combined Shear and Tension – Slip – Critical Connections – Praying Action – Combined Shear and Tension for Slip- Critical Connections. Design of Groove welds- Design of Fillet Welds- Design of Intermittent fillet welds- Failure of Welds.

UNIT – II

Eccentric and Moment Connections: Introduction – Beams – Column Connections- Connections Subjected to Eccentric Shear – Bolted Framed Connections- Bolted Seat Connections – Bolted Bracket Connections. Bolted Moment Connections – Welded Framed Connections – Welded Bracket Connections - Moment Resistant Connections.

UNIT - III

Analysis and Design of Industrial Buildings: Dead loads, live loads and wind loads on roofs. Design wind speed and pressure, wind pressure on roofs; wind effect on cladding and louvers; Design of angular roof truss, tubular truss, truss for a railway platform. Design of purlins for roofs, design of built up purlins, and design of knee braced trusses and stanchions. Design of bracings.

UNIT - IV:

Design of Steel Truss Girder Bridges: Types of truss bridges, component parts of a truss bridge, economic proportions of trusses, self-weight of truss girders, design of bridge compression members, tension members; wind load on truss girder bridges; wind effect on top lateral bracing; bottom lateral bracing; portal Bracing; swaybracing.

UNIT - V:

Design of Steel Bunkers and Silos: Introduction– Janseen's Theory – Airy's Theory – Design of Parameters – Design Criteria – Analysis of Bins – Hopper Bottom –Design of Bins.

TEXT BOOKS:

1. S. K. Duggal Limit State Design of Steel Structures, McGraw Hill Education Private Ltd. NewDelhi.
2. K. S. Sairam Design of Steel Structures, PearsonEducation.

REFERENCES:

1. N. Subramanian Design of Steel Structures, Oxford UniversityPress.
2. Dr. Ramachandra&VivendraGehlot Design Steel Structures Volume – II, Scientific Publishers JournalsDepartment.
3. Gaylord & Gaylord Design of Steel Structures, Publisher; Tata McGraw Hill, Education. Edition2012.
4. Indian Standard Code – IS – 800-2007 General Construction in Steel- Code of Practice, Steel Tables

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M. Tech – I Year – II Sem. (Structural Engg.)

THEORY OF PLATES (PC - V)

Course Objectives: To impart knowledge on the behavior of plates and to analyse the problems pertaining to beams on elastic foundation.

Course Outcomes: The learner will be able to understand the behavior of plates for loadings and boundary conditions.

Prequiste: Mechanics of Solids, Mathematics.

UNIT - I

Cylindrical Bending: Different kind of plates – Assumptions – Derivation of differential equation for cylindrical bending of long rectangular plates - Analysis of uniformly loaded rectangular plates with edges simply supported and fixed subjected to uniform load.

Pure Bending of Plates: Slope and curvature of slightly bent plates – Relations between moments and curvature - Particular cases of pure bending –Moment in any direction-Principal moments-Strain energy in pure bending –Energy methods like Ritz and Galerkin Methods to rectangular plates subjected to simple loadings.

UNIT - II

Small Deflection Theory of Thin Rectangular Plates: Assumptions – Derivation of governing differential equation for thin plates – Boundary conditions – simply supported plate under sinusoidal load – Navier's solution – Application to different loading cases – Levy's solution for various boundary conditions subjected to different loadings like uniform and hydrostatic pressure.

UNIT - III

Circular Plates: Symmetrical loading – Relations between slope, deflection, moments and curvature–Governing differential equation – Uniformly loaded plates with clamped and simply supported edges–Central hole – bending by moment's andshearing forces uniformlydistributed.

Orthotropic Plates: Introduction – Bending of anisotropic plates - Derivation of governing differential equation – Determination of Rigidities in various cases like R.C. slabs, corrugated sheet – Application to the theory of grid works.

UNIT - IV

Plates on Elastic Foundations: Governing differential equation – deflection of uniformly loaded simply supported rectangular plate – Navier and Levy type solutions – Large plate loaded at equidistant points by concentrated forces P.

UNIT - V

Buckling of Plates: Governing equation for Bending of plate under the combined action of in-plane loading and lateral loads – Buckling of rectangular plates by compressive forces acting in one and two directions in the middle plane of plate

Finite Difference Methods: Introduction - Application to rectangular plates subjected to simple loading for various boundary conditions. Problems

TEXT BOOKS

1. Timoshenko Theory of Plates and Shells, McGraw Hill Book Co., New York. 2017.
2. Bhavikatti SS. Theory of plates and shells. New Age International; 2012.

REFERENCES:

1. P. Szilard Theory and Analysis of Plates, Prentice Hall.2014.
2. Reddy JN. Theory and analysis of elastic plates and shells. CRC press; 2006.
3. N. K. Bairagi Plate Analysis, Khanna Publishers. New Delhi.2010.

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M. Tech – I Year – II Sem. (Structural Engg.)

FINITE ELEMENT METHOD (PC –VI)

Course Objectives: To impart knowledge about various finite element techniques and development of finite element code.

Course Outcome: The learner will be able to solve continuum problems using finite element analysis.

UNIT - I

Introduction: Concepts of FEM - steps involved - merits and demerits - energy principles Discretization - Raleigh - Ritz method of functional approximation.

Principles of Elasticity: Stress equations - strain displacement relationships in matrix form plane stress, plane strain and axi-symmetric bodies of revolution with axi-symmetric loading.

UNIT - II

One dimensional FEM: Stiffness matrix for beam and bar elements - shape functions for 1-D elements. Two dimensional FEM: Different types of elements for plane stress and plane strain analysis - displacement models - generalized coordinates - shape functions - convergent and compatibility requirements - geometric invariance - natural coordinate system - area and volume coordinates - generation of element stiffness and nodal load matrices

UNIT - III

Isoparametric formulation: Concept - different isoparametric elements for 2D analysis - formulation of 4-noded and 8-noded isoparametric quadrilateral elements - Lagrange elements - serendipity elements.

Axi Symmetric Analysis: bodies of revolution - axi symmetric modeling - strain displacement relationship - formulation of axi symmetric elements.

Three dimensional FEM: Different 3-D elements-strain-displacement relationship – formulation of hexahedral and isoparametric solid element.

UNIT - IV

Introduction to Finite Element Analysis of Plates: Basic theory of plate bending - thin plate theory - stress resultants - Mindlin's approximations - formulation of 4-noded isoperimetric quadrilateral plate element – Shell Element.

UNIT - V

Heat Transfer- Introduction:, Steady state Heat Transfer, and 1D Steady state Condition - 2D steady state condition-Triangular element.

Dynamic Analysis-Introduction, Formulation-Element Mass matrices of bar element, truss element, CST element, Axi-symetric element, Evaluation of Eigen value-Eigen Vector.

Non– linearfinite analysis –Introduction- Types – Analysis of Material and Geometric Nonlinearity.

TEXT BOOKS:

1. T. R. Chandrupatla and A. D. Belegundu, Introduction to Finite Elements in Engineering, Prentice –Hall of India Private Limited,New Delhi, 2009.
2. David V. Hutton, Fundamentals of Finite Element Analysis, McGraw Hill Education (India) Private Limited, Delhi, 2014.

REFERENCE

1. Daryl L, Logan, "A first course in the Finite Element Method", Third Edition, Thomson Brook, Canada Limited, 2007.
2. R. D. Cook, R.D" Concepts and Applications of Finite Element Analysis", John Wiley and sons, 1981.
3. O. C. Zienkiewicz. And R. L. Taylor, "The Finite Element Method", Vol.1, McGraw Hill Company Limited, London, 1989.
4. Reddy, J. N, An Introduction to the Finite Element Method, McGraw Hill, New York, 1993.
5. Bathe, K. J, (2006). Finite Element Procedures, Prentice Hall of India, New Delhi.

ANURAG UNIVERSITY

M. Tech – I Year – II Sem. (Structural Engg.)

PRE-STRESSED CONCRETE (PE - III)

Course Objectives: Learn the concept of pre-stressed concrete, methods and systems of pre-stressing, losses of pre-stress. Study the analysis and design of statically indeterminate beams

Course Outcomes: After completing this course, the student will be able to Analyse and design the sections for flexure, shear bond and anchorages.

UNIT - I

General Principles of Prestressed Concrete: Pre–tensioning and post – tensioning – Prestressing by straight, concentric, eccentric, bent and parabolic tendons – Different methods and systems of prestressing like Hoyer system, Freyssinet system, MagnelBlaton system – Lee-Mc call system. Losses of Prestress: Loss of prestress in pre-tensioned and post-tensioned members due to various causes like elastic shortening of concrete, shrinkage of concrete, creep of concrete, relaxation of steel, slip in anchorage, bending of member and frictional loss – Analysis of sections for flexure.

UNIT - II

Design of Section for Flexure: Allowable stresses – Elastic design of simple beams having rectangular and I-section for flexure – kern lines – cable profile and cable layout.

Design of Sections for Shear: Shear and Principal Stresses – Improving shear resistance by different prestressing techniques – horizontal, sloping and vertical prestressing – Analysis of rectangular and I–beam – Design of shear reinforcement – IS: 1343: 2012provisions.

Deflections of Prestressed Concrete Beams: Short term deflections of un cracked members– Prediction of long-time deflections – load – deflection curve for a PSC beam – IS code requirements for max. Deflections.

UNIT – III

Transfer of Prestress in Pretensioned Members: Transmission of prestressing force by bond – Transmission length – Flexural bond stresses – IS: 1343 : 2012 provisions – Anchorage zone stresses in post tensioned members – stress distribution in End block – Analysis by approximate, Guyon and Magnel methods – Anchorage zone reinforcement.

Statically Indeterminate Structures: Advantages & disadvantages of continuous PSC beams -Primary and secondary moments – P and C lines – Linear transformation concordant and non- concordant cable profiles – Analysis and design of two span continuous beams.

UNIT – IV

Tension Members: Introduction, Ties, Circular pre-stressing – Design of PSC pipes.

Compression Members: Introduction – Design of PSC columns.

UNIT – V

Slabs: Introduction –Types – rectangular and flat slabs – Codal provisions – Design of PSC floor slabs - one way and two way slabs, and simple flat slabs. Grid Floors: Introduction.

TEXT BOOKS:

1. N. Krishna Raju Prestressed Concrete, Tata McGraw Hill Book – Co., New Delhi, sixth edition, 2018.
2. S. Ramamrutham Prestressed Concrete, DhanpatRai& Sons, Delhi.

REFERENCES:

1. T.Y. Lin and Burn Design of Prestressed Concrete Structures , John Wiley, NewYork, third edition, 2010
2. N. Rajagopalan Prestressed Concrete, Alpha ScienceInternational, second edition, 2005.
3. IS 1343 -2012 Prestressed Concrete – Code of Practice, Bureau of IndianStandards.

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M. Tech – I Year – II Sem. (Structural Engg.)

BRIDGE ENGINEERING (PE - III)

Course Objectives: To impart knowledge about different types of bridges, their analysis and design for combination of different loading condition as per codal provisions.

Course Outcomes: The learner will be in a position to understand and design different types of bridges.

Prerequisites: Structural Analysis I &II, Reinforced Concrete Design

UNIT I

Concrete Bridges: Introduction-Types of Bridges-Economic span length-Types of loading-Dead Load-live load-Impact Effect-Centrifugal force-wind loads-Lateral loads-Longitudinal forces-Seismic loads- Frictional resistance of expansion bearings-Secondary Stresses-Temperature Effect-Erection Forces and effects-Widthof roadway and footway-General Design Requirements.

Solid slab Bridges: Introduction-Method of Analysis and Design.

UNIT II

Girder Bridges: Introduction-Method of Analysis and Design-Courbon's Theory, Grillage analogy

UNIT III

Box Culvert: - Single Cell Box Culvert – Design Loads, Design Moments, Shears and Thrusts.

Design of Critical sections.

UNIT IV

Pre-Stressed Concrete Bridges: Basic principles-General Design requirements-Mild steel rein for cement in prestressed concrete member-Concrete cover and spacing of pre-stressing steel-Slender beams-Composite Section-Propped-Design of Propped Composite Section-Unproped Composite section-Two-stage Prestressing-Shrinking stresses-General Design requirements for Road Bridges.

UNIT V

Sub-structure of bridges: Substructure- Beds block-Piers- Pier Dimensions- Design loads for piers-Abutments- Design loads for Abutments. Health Monitoring of Bridge structures.

TEXT BOOKS:

N. Krishna Raju Design of Bridges, Oxford & IBH

Johnson Victor Essentials of Bridge Engineering, Oxford & IBH

REFERENCES

M.G.Aswani, V.N.Vazirani and M.M.Ratwani Design of Concrete Bridges.

E.C.Hambly Bridge Deck Behaviour.

V.K.Raina. Concrete Bridge Design and Practice

V.V.sastry Design of Bridges, DhanpatRai& Co.

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M. Tech – I Year – II Sem. (Structural Engg.)

DESIGN OF SUB STRUCTURES (PE - III)

Course Objectives: To impart knowledge on geotechnical and structural design of different types of foundation appropriate to the type of soil for different structures.

Course Outcome: The learner will be able to design shallow and deep foundations from both geotechnical and structural considerations.

UNIT – I

Shallow Foundations: Basic requirements of foundation –Types and selection of foundations. Bearing capacity of foundations, structural design of isolated, combined, eccentric, strip, and strap footings, Detailing of rein for cement.

UNIT – II

Raft Foundations: Types of rafts, SBC of raft foundation and structural design of different raft foundations, Detailing of reinforcement.

UNIT – III

Pile Foundations: Types of piles Load carrying capacity of single and pile groups, structural design of piles, pile caps and pile-raft foundation, Detailing of reinforcement.

UNIT – IV

Design of Retaining walls: Stability Checks and structural design of gravity, Cantilever retaining walls, Detailing of reinforcement, Design of Strut, Brace Excavation.

UNIT – V

Machine Foundations: Vibration analysis of machine foundation - Design of foundation for Reciprocating machines and Impact machines - as per l S Codes, Detailing of reinforcement.

TEXT BOOKS:

1. Varghese P.C. Design of RC foundations, PHI Learning Pvt.Ltd.
2. UnnikrishnanaPillai&DevadasMenon, Reinforces Concrete Design, McGraw Hill Publishing Pvt.Ltd.

REFERENCE:

1. Bowles .J.E., "Foundation Analysis and Design", McGraw Hill Publishing co., New York,1986
2. Tomlinson.M.J,"FoundationDesignandConstruction",Longman,SixthEdition,NewDelhi, 1995.
3. Das, B.M., Principles of Foundation Engineering, Design and Construction, Fourth Edition, PWS Publishing, 1999.
4. Narayan V. Nayak, Foundation design manual, DhanpatRai& Sons,2006.
5. PrakashShamsherandPuriVijayK,FoundationsforMachines,AnalysisandDesign"John Wiley and Sons, USA,1988.
6. IS 2911: Part 1: Sec 1: 1979 Code of practice for design and construction of pilefoundations: Part 1 Concrete piles, Section 1 Driven cast in-situ concretepiles.

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M. Tech – I Year – II Sem. (Structural Engg.)

EARTHQUAKE RESISTANT DESIGN OF BUILDINGS (PE - IV)

Course Objectives: To impart knowledge on the seismology and behavior of buildings during earthquakes.

Course Outcomes: The learner will be able to analyse and design buildings to resist seismic forces

UNIT-I

Earthquake Ground Motion: Engineering seismology, Seismic zoning map of India, Strong motion studies in India, Strong motion characteristics, Evaluation of seismic design parameters, Theory of seismic pickup.

UNIT-II

Concepts of Earthquake Resistant Design of RCC Structures: Basic elements of earthquake resistant design, Identification of seismic damages in RCC buildings, Effect of structural irregularities on performance of RCC buildings during earthquakes, earthquake resistant building architecture.

UNIT-III

Seismic Analysis and Modelling of RCC Structures: Code based procedure for determination of design lateral loads, Infill walls, Seismic analysis procedure as per IS 1893 code, Equivalent static force method, Response spectrum method, Time history analysis, Mathematical modelling of multi-storey RCC buildings.

UNIT-IV

Earthquake Resistant Design of RCC Structures: Ductility considerations, Earthquake resistant design of multi-storey RCC buildings and shear walls based on IS 13920 code, Capacity based design.

UNIT-V

Earthquake Resistant Design of Masonry Structures: Identification of damages and non-damages in masonry buildings, Elastic properties of structural masonry, Lateral load analysis of masonry buildings, Seismic analysis and design of one-storey and two-storey masonry buildings. Case studies of past earthquakes in India.

TEXT BOOKS:

1. PankajAgarwal and Manish Shrikhande, Earthquake Resistant Design of Structures, Prentice Hall of India, 2009.
2. S K Duggal, Earthquake Resistant Design of Structures, Oxford University Press, 2007.

REFERENCE

1. Bruce A Bolt, Earthquakes, W H Freeman and Company, New York, 2004.
2. C. A. Brebbia, Earthquake Resistant Engineering Structures, WIT Press, 2011.
3. Mohiuddin Ali Khan, Earthquake-Resistant Structures: Design, Build and Retrofit, Elsevier Science & Technology, 2012.
4. Paulay, T and Priestley, M.J.N., Seismic Design of Reinforced Concrete and Masonry buildings, John Wiley

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M. Tech – I Year – II Sem. (Structural Engg.)

REPAIR AND REHABILITATION OF BUILDINGS (PE - IV)

Course Objectives: To impart knowledge on the distress in structures.

Course Outcomes: The learner will be able to understand the reasons for distress in structures and will be able to suggest suitable solutions

UNIT – I

Introduction – Deterioration of Structures – Distress in Structures – Causes and Prevention. Mechanism of Damage – Types of Damage.

UNIT – II

Corrosion of Steel Reinforcement – Causes – Mechanism and Prevention.Damage of Structures due to Fire – Fire Rating of Structures – Phenomena ofDesiccation.

UNIT – III

Inspection and Testing – Symptoms and Diagnosis of Distress - Damage assessment – NDT.

UNIT – IV

Repair of Structure – Common Types of Repairs – Repair in Concrete Structures – Repairs in Under Water Structures – Guniting – Shotcreting – Underpinning –Strengthening of Structures – Strengthening Methods – Retrofitting – Jacketing, FRP method, Composite Method.

UNIT – V

Health Monitoring of Structures – Use of Sensors – Building Instrumentation

TEXTBOOKS

1. Concrete Technology by A. R. Santhakumar, Oxford Universitypress
2. Non-Destructive Evaluation of Concrete Structures by Bungey - Surrey UniversityPress

REFERENCES

1. Defects and Deterioration in Buildings, E F & N Spon,London
2. Maintenance, Repair & Rehabilitation and Minor Works of Buildings by P. C. Varghese,PHI.
3. Maintenance and Repair of Civil Structures, B.L. Gupta and Amit Gupta,Standard Publications.
4. Concrete Repair and Maintenance Illustrated, RS Means Company Inc W. H. Ranso,(1981)
5. Building Failures: Diagnosis and Avoidance, EF & N Spon, London, B. A. Richardson,(1991).

ANURAG UNIVERSITY

M. Tech – I Year – II Sem. (Structural Engg.)

STABILITY OF STRUCTURES (PE - IV)

Course Objectives: To impart knowledge on the elastic, inelastic buckling and torsional buckling of structures.

Course Outcomes: The learner will be able to understand buckling of bars and frames.

UNIT – I

Beam Columns: Differential equations for beam columns- beam columns with concentrated loads – continuous lateral loads-couples- beam columns with built in ends – continuous beams with axial load

Application of trigonometrically series – Effects of initial curvature on deflections – Determination of allowablestresses.

UNIT - II

Elastic Buckling of bars and frames: Elastic Buckling of straight columns – Effect of shear stress on buckling – Eccentrically and laterally loaded columns- Buckling of frames-large deflections of buckled bars-Energy methods- Buckling of bars on elastic foundations- Buckle line of bar with intermediate compressive forces - Buckling of bars with change in cross-section – Effect of shear force on critical load- built upcolumns.

UNIT - III

In Elastic Buckling: Buckle line of straight bar- Double modulus theory – Tangent modulus theory, Inelastic lateral Buckling. Experiments and design formulae: Experiments on columns – Critical stress diagram – Empirical formulae for design –various end conditions

UNIT - IV

Torsion Buckling: Pure torsion of thin walled bars of open cross section – Non-uniform torsion of thin walled bars of open cross section- Torsional buckling – Buckling by torsion and flexure.

UNIT – V

Lateral buckling of simply supported Beams: Beams of Rectangular cross-section subjected to pure bending. Buckling of simply supported Rectangular plates: Derivation of equation of plate subjected to constant compression in one and two directions.

TEXT BOOKS

1. Theory of elastic Stability by Timshenko& Gere -McGraw Hill

REFERENCES

2. Stability of metallic structures by Blunch- McGrawHill
3. Theory of Beam- Columns Vol. I by Chem. &Atste McGrawHill
4. Stability Theory of Structures by Ashwini Kumar, AlliedPublishers

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M. Tech – I Year – II Sem. (Structural Engg.)

CAD LABORATORY

Course Objective: To impart knowledge on the use of various Software's

Course Outcome: the student will be able to analyze and design structural elements of abuilding

1. Design of beam using Excel for flexural shear and with deflectioncheck
   a) Singly and doubly reinforced RCBeam
   b) Design of Steel Beam using Excel for flexural shear and with deflectioncheck
2. Design of RC slab one-way and two-way usingExcel
3. Design of RC short & long columns subjected to biaxialbending.
4. Design of isolated footings usingExcel
5. Analysis & design of 2-D steeltruss
6. Analysis & Design of 2-D buildingframe
7. Analysis & Design of Multi-storey space frame (for mid-rise) subjected to lateralloads
8. Plate bending usingFEM
9. Modal analysis of a high risebuilding

Note: Exercises from 6-10 may be carried out using any relevant commercial software package.