# COURSE STRUCTURE

## B. TECH.

## CIVIL ENGINEERING

## 2021-22

# Rama University Uttar Pradesh, Kanpur

**Ref:RU/FET/CED/BOS/2021** **Dated: 14/06/2021**

Faculty of Engineering & Technology

Department of Civil Engineering

Minutes of Meeting

Boards of Studies

A meeting of Boards of Studies of Civil Engineering, FET was held on 14/06/2021 (Monday) at 2:30 P.M. in conference room of FET. The following members were present:

1. Mr.Satish Parihar - Chairperson
2. Dr.Deeksha Ranjan - Member
3. Mr.Vaibhav Yadav - Member
4. Prof. Pradeep Kumar - External Member

**Agenda:**

1. **Action Taken Report (ATR) on Minutes of Previous Meeting.**

   The BOS committee reviewed and confirmed the minutes of the BOS meeting held on 02/05/2020.

2. To consider and approve new Evaluation Scheme and Syllabus.

| S. No. | Item No. | Existing | Recommendation /Action Taken |
|---|---|---|---|
| 1 | To consider and approve the proposed changes in CBCS based curriculum along with its Evaluation Scheme and Syllabus for B.Tech. students to be admitted in the Academic Session 2021-22 | The existing Evaluation Scheme and Syllabus was reviewed for B.Tech. students | The BOS considered suggestions for the Evaluation Scheme and Syllabus and thereafter discussion, recommended the same for final approval |

3. **To review the existing Short term Courses and CBCS based M.Tech.(Full Time & Part Time) along with their Evaluation Scheme and Syllabus**

   The board approved the review committee for considering **introduction of the new Short term Courses and the proposed change, if any, in CBCS based M.Tech.(Full Time & Part Time) along with its Evaluation Scheme and Syllabus**

   A committee under the chairmanship of Mr. Vaibhav Yadav, who has been authorized to select two more Internal members, was constituted in this connection.

The meeting concluded with a vote of thanks to the chair.

Date of the Next Meeting: to be decided and intimated thereafter

(Chairman)

***Encl.: Recommended Curricula attached for consideration and approval.***

CC:
1. Dean, FET
2. Registrar Office

***Encl.: Recommended Curricula attached for consideration and approval.***

**Program Educational Objectives**

At Rama University Computer Science and Engineering program will prepare its graduates to:

**PEO 1:**Work productively as successful Computer professionals in diverse career paths including supportive and leadership roles on multidisciplinary teams or be active in higher studies,

**PEO 2:**Communicate effectively, recognize and incorporate societal needs and constraints in their professional endeavors, and practice their profession with high regard to ethical responsibilities,

**PEO 3:** Engage in life-long learning and to remain current in their profession to foster personal and organizational growth.

**Program Specific Outcomes**

- Apply standard Software Engineering practices and strategies in real-time software project development using open-source programming environment or commercial environment to deliver a quality product for the organization success
- Design and develop computer programs/computer-based systems in the areas related to algorithms, networking, web design, cloud computing, IoT, AI and data analytics of varying complexity
- Acquaint with the contemporary trends in industrial/research settings and thereby innovate novel solutions to existing problems

**Program Outcomes:**

**PO1** - Engineering knowledge: Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.

**PO2** - Problem analysis: Identity, formulates, review research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.

**PO3** - Design/development of solutions: Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.

**PO4** - Conduct investigations of complex problems: Use research-based knowledge and research methods including design of experiments, analysis, and interpretation of data, and synthesis of the information to provide valid conclusions.

**PO5** - Modern tool usage: Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modeling to complex engineering activities with an understanding of the limitations.

**PO6** - The engineer and society: Apply to reason informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional engineering practice.

**PO7** - Environment and sustainability: Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.

**PO8** - Ethics: Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.

**PO9** - Individual and teamwork: Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.

**PO10** - Communication: Communicate effectively on complex engineering activities with the engineering community and with society at large, such as being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.

**PO11** - Project management and finance: Demonstrate knowledge and understanding of the engineering and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.

**PO12** - Life-long learning: Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in thebroadestcontext of technological change.

# ORDINANCE, RULES, REGULATIONS

For

# Bachelor of Technology Programmes

**1. Title**

This ordinance shall be called as "The Rama University Uttar Pradesh, Faculty of Engineering &Technology Ordinance Governing Four Years B.Tech. Degree Course"

**2. Duration of the Course**

i. The Course shall consist of regular study for a minimum period of 8 semesters in four academic years, after +2 and 6 semesters in three academic years, after Diploma.
ii. The course of study shall be by regularly attending the requisite number of lectures, tutorials and practical training.
iii. The 3rd, 5th, and 7th semesters shall ordinarily be from 1st July to 31stDecember; however, the First semester shall ordinarily begin from 1st August. The remaining semesters shall be from 1st January to till 30th June subject to change, if any notified by the Vice Chancellor and other competent authorities; from time to time. The periods are inclusive of the time for examinations.
iv. Total duration of the B.Tech. Course shall be 4 years, each year comprising of two semesters. Each semester shall normally have teaching for the 90 working days or as prescribed by UGC from time to time.
v. A candidate, who has failed twice in first year due to any reason (either due to his/her non-appearance or he/she being not permitted to appear in semester examinations) shall not be allowed to continue his/her studies further subject to clause 9.
vi. The maximum time allowed for a candidate admitted in I /III semester (for diploma holders) for completing the B.Tech. Course shall be 7 (seven) / 5 (five) years respectively, failing which he/she shall not be allowed to continue for his/her B.Tech. Degree.

**3. Medium of Instruction**

The medium of instruction and examination shall be in English only.

**4. Number of seats**

Number of students to be admitted each year and the number of batches shall be decided and notified by the University from time to time; based upon the Rules, instructions and Notifications issued by UGC.

**5. Admission**

5.1. Admission to B.Tech. First year in Isemester and lateral admission in B.Tech. Second year in III semester (for diploma holder candidates only) will be made as per the rules prescribed by the Academic Council of the Rama University, Kanpur.

5.2. Admission on migration of a candidate from any other University to the University is permitted.

**6. Eligibility for Admissions:**

**6.1. Admission to B. Tech. First Year:**

Candidates who have passed 10+2 from CBSE/ISC/Any state board/NIOS (with minimum 50% marks in PCM or PCB) standard from other board with Physics and Mathematics along with any one of Chemistry/Bio-Technology/Computer Science/ Biology are eligible for admission to first year of 4 yearsB.Tech. Courses offered by Faculty of Engineering &Technology affiliated to Rama University, Kanpur.

**6.2. Admission to B.Tech. Second Year through Lateral Entry Scheme:**

Candidates who have passed 3/ 4 Year Diploma (with minimum 50% marks) from institutions recognized by the Board of Technical Education or University in any branch of Engineering/Technology except Agriculture Engineering. are eligible for admission to Second year in any branch of Engineering /Technology except Agriculture Engineering.

**7. Procedure for Admission**

At the relevant time admission to the course shall be governed by The Acts, Statutes and Ordinances in force and issued by the University. Admission to the Course shall be made strictly on the basis of the merit of the Entrance Test.

Provided that while making admission to the course reservation policy of the Government of Uttar Pradesh governing admission to higher educational Institutions issued from time to time shall be applied

**8. Fee**

A student shall pay the fee prescribed by the University from time to time

**9. Attendance**

9.1 Every student is required to attend all the lectures, tutorials, practicals and other prescribed curricular and co-curricular activities. The attendance can be condoned up to 25% on medical grounds or for other genuine reasons beyond the control of students.

**12. Teaching**

The objective of classroom education is to awaken the curiosity of the student, generate habits of rational thinking in him, gear his mind to face the unfamiliar and train him to stand on his own. Classroom instruction helps the student in the organization and correlation of facts, comprehension of ideas and the creative use of knowledge.

The teacher also has the additional responsibility to make the student search for knowledge on his own and induce him to use additional facilities like the library, laboratory and the environment, to optimize his learning process. Self-study by the student would therefore form an important factor in the planning of teaching and evaluation. The student is required to cooperate and respond to this challenge.

Every course whether single-section or multi-section is conducted by a member of the faculty called instructor-in-charge, with the assistance, wherever necessary, of the required number of instructors who will be partners with him in meeting the full academic perceptions and organizational needs of teaching the course and evaluating the students. Wherever the instructor-in-charge is mentioned hereafter, it connotes the team of instructors, acting as one entity under his captainship.

The instructor-in-charge should make a comprehensive plan in respect of conducting the course even before the semester begins. In a multi-section course, all instructors must remain in continuous interaction in order to ensure a smooth operation of the course. While recognizing variations due to personal attitudes and styles, it is important that these are smoothened out so that the operation and grading in different sections in a course, indeed between courses across the faculty, are free from any seeming arbitrariness.

At the beginning of class work, the instructor, in-charge/instructor must announce to his class/ section through a Course Handout/Lesson Plan, the necessary information in respect of (i) the operations of the course (its pace, coverage and level of treatment, textbooks and other reading assignments, home tasks etc); (ii) various components of evaluation, such as tutorials, laboratory exercises, home assignment, several quizzes/tests/examinations (announced or unannounced, open book or closed book), regularity of attendance, etc. (iii) the frequency, duration, tentative schedule, relative weightage etc., of these various components; (iv) the broad policy which governs decisions about make-up; (v) mid-semester grading; (vi) grading procedure (overall basis, review of border line cases, effect of class average etc.) vii) Chamber consultation hours and (viii) other matters found desirable and relevant.

**13. Examination:**

13.1 The performance of a student in a semester shall be evaluated through continuous evaluation and end semester examination. The continuous evaluation shall be based on Mid Term Examination, assignments/tutorials, quizzes/viva-voce and attendance. The marks for continuous evaluation (Sessional marks) shall be awarded at the end of the semester. The end semester examination shall be comprised of written papers, practicals and viva-voce, inspection of certified course work in classes and laboratories, project work, design reports or by means of any combination of these methods.

13.2 The distribution of marks for sessional, end semester theory papers, practicals and other examinations, seminar, project, industrial training shall be as prescribed.

13.3 The marks obtained in a subject shall consist of marks allotted in end semester theory paper, practical examination and sessional work.

9.2 A further relaxation of attendance up to 10% for a student can be given by Dean provided that he/she has been absent with prior permission of the Head of Department for the reasons acceptable to him. Vice Chancellor may further condone attendance shortage up to 5% on genuine grounds. However, under no circumstances, a student with an attendance of less than 60% in a subject shall be allowed to appear in the semester-end examination of that subject. Provided that the late admitted students in the first semester of any course maintain at least 75% attendance (including medical and other reasons) from the date of their admission.

9.3 No student will be allowed to appear in the end semester examination if he / she do not satisfy the overall average attendance requirements of Clause Nos. 9.1, and 9.2 and such candidate(s) shall be treated as having failed and will be further governed by clause no. 2.5 & 2.6.

9.4 The attendance shall be counted from the date of admission in the college or start of academic session whichever is later.

**10. Curriculum:**

10.1 The 4 Year curriculum has been divided into 8 Semesters and shall include lectures, tutorials, practicals, seminars and projects etc. in addition to industrial training and educational tour etc. as defined in the scheme and executive instructions issued by the University from time to time.

10.2 The curriculum will also include such other curricular, co-curricular and extra- curricular activities as may be prescribed by the University from time to time.

**11. Change of Branch:**

11.1 Change of branch may be allowed against the vacant seats in the following two stages, provided criteria at following sub clauses is satisfied:

(i) In first year, after the last date of admission to the B.Tech. I semester, on the basis of merit of (10+2) examination marks on vacant seat subject to clause 11.2.

(ii) In the second year, on the basis of merit at the B.Tech. First year examination for those who are pass without any carry over paper.

11.2 After change of branch, number of students in branch(s) shall neither increase over the intake approved by UGC or A.I.C.T.E. nor it will decrease below 75% of intake approved by UGC or A.I.C.T.E.

11.3 Change of branch facility is not applicable to following:

Candidates admitted in second year of B.Tech. Courses as per clauses 6.2.

11.4 The change of branch if allowed will become effective from B.Tech. III semester.

11.5 Further change of branch shall not be permitted.

15.3 A candidate shall not be promoted to third year unless he/she passes all the subjects of first year. Similarly, a candidate shall not be promoted to fourth year unless he/she passes all the examinations of second year.

15.4 All other candidates who do not satisfy conditions laid down in clause 8 shall be declared fail and shall be required to repeat the whole academic year after taking re- admission. This facility is, however, subject to the time limits stipulated in clause-2.

**16. Carryover System:**

16.1 (a) A candidate who satisfies the requirements of clause 16.2 (a) will be required to appear in those theory papers / practicals in which he/she failed. However, a candidate of first year will be allowed to appear in the second semester examination in those theory/ practical subjects in which he/she failed in the first semester examination, provided examination of those theory/practical subjects are held in second semester.

(b) A candidate satisfying clause 16.2 (b) shall be required to exercise his/her choice up to a maximum of Six theory papers in which he/she desires to appear in the examination to fulfill the requirements of clause 14.6. He/she shall inform the college about his/her choice within 15 days after the start of new session.

16.2 The highest marks secured in any subject in various attempts (end semester and carryover examinations) shall be considered.

**17. Ex-studentship:**

17.1 A candidate opting for ex-studentship shall be required to appear in all the theory & practical subjects in the end semester examinations of both semesters of the same academic year. However, the marks pertaining to Sessional, Industrial Training, and Seminar shall remain the same as those secured earlier.

17.2 A candidate opting for ex-studentship shall be required to apply to the FET by paying only examination fee within 15 days from the start of new session.

**18. Re-admission:**

A candidate may be allowed for re-admission provided he/she satisfies one of the following conditions:

18.1 A candidate is declared fail.

18.2 A candidate did not appear in a semester examination / or he/she was not granted permission to appear in the examination.

18.3 A candidate has been detained by the department and subsequently has been permitted to take re-admission.

18.4 A candidate as an ex-student passed the examination of the academic year or qualified for carryover system.

18.5 A candidate promoted with carry over subjects and he/she opted for re- admission.

**19. Results:**

19.1 The result of a candidate shall be declared on the basis of performance of both semesters of the same academic year. However, a final year student, who is not permitted in any one of the final year semester examinations due to shortage of attendance, will be permitted in that particular semester of the next academic session to study as a regular student and appear at that semester examination.

19.2 Result of the final year shall be declared on the basis of working out Grand Total by adding marks of all the years of study in the following ways:

(a) For candidates admitted to B.Tech. Course as per clause 6.1

I Year 100% of aggregate marks

II Year 100% of aggregate marks

III Year 100% of aggregate marks

IV Year 100% of aggregate marks

(b) Candidates admitted in III semester of B.Tech. Course as per clause 6.2

II Year 100% of aggregate marks

III Year 100% of aggregate marks

IV Year 100% of aggregate marks

**20. Award of Division:** The division shall be awarded on the basis of final year result.

## 20.1 Calculation of Grade Point and Grade Point Average

Relative grading shall be adopted at the Faculty of Engineering & Technology, Rama University. The list of letter grades, the grade points associated with them are given below:

| Grade | Grade Point |
|---|---|
| **O** | **10** |
| **A** | **9** |
| **B** | **8** |
| **C** | **7** |
| **D** | **6** |
| **E** | **5** |
| **F** | **0** |

In order to arrive at alphabet grades, the total marks in a particular course for all the students pursuing the course are tabulated in the descending order (equivalently a histogram).
The performance of the course is analyzed in terms of the highest, lowest and the average marks and the dividing lines between the clusters of students. Gaps and dips between the clusters and the nature of the clusters guide in drawing the dividing lines between the grades. In a normal class of large size, the C grade usually covers the average performance. This is, however not a hard and fast rule and exceptions may arise in case of small classes, skewed histogram etc. Borderline cases may be considered individually on the basis of regularity and the attendance, class room discussions, progressive good performance throughout the semester, etc.

## 20.2 Calculation System of Semester Grade Point Average:

- Computation of the Semester Grade Point Average (SGPA) and Cumulative Performance Index (CPI):

  The SGPA is an indicator of the overall academic performance of a student in all the courses he/she has registered during a given semester. It is computed as follows: If the grades awarded to a student are $G_1$, $G_2$ etc in courses with corresponding credits $C_1$, $C_2$ etc, the SGPA is given by:

$$SGPA = \frac{C_1 \times G_1 + C_2 \times G_2 + \cdots + C_n \times G_n}{C_1 + C_2 + \cdots + C_n}$$

- The CPI indicates the overall academic performance of a student in all the courses registered upto and including the latest completed semester/summer term. It is computed in the same manner as the SGPA, considering all the courses (say, n) and is given by:

13.4 To qualify a subject a student is required to secure a minimum of 30% marks in both internal as well as external separately and grand total required for a subject is minimum 40%. A student who secure less than 50% of marks in aggregate in a semester shall be deemed to have failed in that semester.

13.5 The minimum pass marks in a project/practical subject (including sessional marks if any) shall be 50% (internal 50%, External 50% and aggregate 50%).

13.6 A candidate, in order to pass, must secure 50% marks in the aggregate in a particular academic year inclusive of each semesters of the academic year.

13.7 The minimum pass marks in Seminar, Industrial Training and Educational Tour, Viva-Voice etc shall be 50%.

13.8In Non Credit Courses (Non grading courses) a student's must secure 40% marks to qualify the courses.

**14. Evaluation Feedback**

Just as evaluation is done in continuous manner, feedback should also be available in a continuous manner. Thus, the answer scripts must be promptly evaluated, shown to the students for them to obtain any clarification on their performance and returned to the students whenever practical. The performance of the students in the examination should be discussed in the class giving as much details as possible like the highest, lowest and average performances. Solutions with marking schemes are displayed soon after a test.

**15. Promotion:**

15.1 A candidate satisfying all the requirements under clause 13 shall be promoted to the next academic year of study.

15.2. (a) A candidate shall be eligible for provisional promotion to the next academic year of study provided:

(i) He/ She should either completely clear all the subject of any of the semester of an academic year or earn the credit greater than or equal to the minimum credits of either of the semester of that academic year.

(ii) In yearly result, A student shall be declared PASS only of he/ she secures above grades in all the subjects and minimum Semester Grade Point Average (SGPA) of 5.0, in each semester of an academic year.

(b) If a candidate satisfies the requirement of clauses 13.4, 13.5 & 13.7 but fails to satisfy the requirement of clause 14.6, he/she shall be eligible for provisional promotion with carry over. He/she may choose up to a maximum of any four theory papers of that particular academic year as per his/her choice to pass the examination of that year.

$$CPI = \frac{\sum_{i=1}^{n} C_i \times G_i}{\sum_{i=1}^{n} C_i}$$

- Percentage conversion of CPI:

$$Percentage\ of\ marks = \left(\frac{SGPA}{CGPA} \times 10\right) - 4.5$$

- Students should get a minimum grade E in each subject with 5CPI to clear the semester.

- CPI conversion

| | |
|---|---|
| **≥8 CPI** | **I Division with Honours** |
| **≥6 CPI** | **I Division** |
| **≥5 CPI** | **II Division** |
| **<5 CPI** | **Fail** |

**21. Award of Rank:**

On the basis of final year result, the top ten candidates in each branch shall be awarded rank according to their merit provided they pass all the examinations in first attempt.

**22. Reports**

At the end of the course, in certain situations, the instructor-in-charge may report certain events/facts in suitable words, in place of grades discussed earlier. These reports are not to be construed as grades. The various reports listed below are elaborated in the subsequent clauses.

- Incomplete (I)
- Grade Awaited (GA)
- Withdrawn (W)
- Registration Cancelled (RC), Required to Register (RR), Discontinued from the Program (DP)
- Not Cleared (NC)

**Incomplete (I)**

If the instructor-in-charge finds a student having not fulfilled some of the requirements of a course before the final deadline for transmitting the grade, and he is satisfied that he is able to transmit some grade or a report with or without this particular fulfillment, but at his discretion wishes to give the student an

opportunity, he may, within the deadline, send a report 'I' (Incomplete) and also inform the student of the same. It shall be the responsibility of the student to contact the instructor-in-charge in time for replacement of the 'I' report within two weeks after the end of the semester (and within one week after the end of summer term, for a summer term course) which the instructor-in-charge will communicate whatever grade/report is possible for the situation. Whenever such relaxation is made, the Dean/Director will specify at his discretion, with the consent of the instructor-in-charge, the date by which 'I' report has to be converted.

The requirement envisaged in the above clause must be completed within the time allowed. If the extra time given goes beyond the registration in the next semester/term, registration in the next semester/term is not possible. The student in such a situation should seek permission to stay away as per the above clause

**Grade Awaited (GA)**

There are many situations where operational and practical difficulties may cause a delay in the communication of a grade. Certain situations which are visualized in this connection are: (i) where a case of unfair means is pending; (ii) where a case of indiscipline is pending, and (iii) where the courses are being conducted at an off campus centre for IP students, where precise co-ordination between the Institute and these centers may not work in a timely manner. In these circumstances the Dean may authorize the instructor-in-charge to report GA (Grades Awaited).

A student may also get a "GA" report if he has, due to a genuine reason not been able to appear for an examination on the scheduled date and his request for make-up has been granted. In such a case, the student should ensure by the end of the term that either:

- He takes the make-up examination and convert the "GA" report onto a letter grade or
- He makes an application to the Dean/Director, through Instructor in Charge to convert "GA" report into a "NC" report.

Whenever the report GA appears in the grade sheet, a student will not be allowed to register for the subsequent semester, until the student takes steps to convert "GA" report into a letter grade or "NC" report.

**Withdrawn (W)**

A student may seek withdrawal from the course(s) in a semester for any of the following reasons:

- The student is unable to register for the course(s) for a genuine reason.
- The student is unable to cope up with the normal load and withdraws from the course(s) to reduce his academic load for a particular semester.

The request for withdrawal should be made to the Dean of the faculty, within two weeks of the commencement of the semester in case of (i) above and within the stipulated duration as specified in the academic calendar in the case of (ii) In such cases the grade sheet/transcript of the student will indicate 'W' (Withdrawn against the course(s) from which the student has withdrawn his registration. The student will have to register for the course(s) when it is offered next and obtain a valid letter grade. If the course with 'W' report is a prerequisite course for another course, the registration to the course is possible only on obtaining a valid letter grade in the prerequisite course with 'W' report. If the withdrawal is made after the due date, the event will be reported as "RC" or "DP" as the case may be.

**Registration Cancelled (RC) or Required to Register (RR) or Discontinued from the Programme (DP)**

If a student's registration for a course has to be cancelled, this fact will be reported in the grade sheet as RC (Registration Cancelled). Registration would be cancelled and an RC is issued in the following cases:

- Cancellation is recommended as a part of disciplinary action for resorting to unfair means during examination or other unprofessional behaviour.
- Cancellation is recommended due to less than the minimum required percentage of attendance.
- Cancellation is recommended if a provisionally admitted student fails to submit the proof of necessary documents required for registration and/or does not satisfy the minimum eligibility requirements for the admission within the prescribed time limit.
- Cancellation is recommended when a student persistently and/or deliberately does not pay his dues.

RC itself has many meanings and may be reported as the following:

- When it is clearly known that the student will be required to register again in the same course, the event will be reported as RRA (Required to Register Again).
- If RC amounts to discontinuation from the program it will be reported as DP (Discontinued from the Program)
- If the cancellation of registration is not reported either as RRA or as DP but is reported as RC, it does not necessarily mean that it is free from any constraint. The meaning of the constraint has to be construed from the context in which the RC is reported.

**Not Cleared (NC)**

If a student continued to remain registered in a course but gave the instructor inadequate opportunity to evaluate him by absenting himself from quizzes/tests/examinations/other components of evaluation, or by appearing in the same for the sake of appearance without applying himself to the task in hand or by submitting a blank script (answer book), these events would be reported as NC (Not Cleared).

Whenever a student gets a NC report in a course irrespective of whether he has a grade in the course or not earlier to this event, the following will govern further action. It is to be noted that a NC cannot be ignored, except under the situations described below:

- Whenever a student gets a NC report in a course which is in the compulsory package of his program, he is required to register again in the some course and get a valid grade therein.
- If a student has a NC report in a course taken as elective, he can either repeat the course to get a valid grade or ignore it to choose another course. However, a student must get valid grades in at least the prescribed number of electives in his program.
- Whenever a student's record has an NC in a course which remains unaccounted after a process of transfer has been completed it will not be possible for him to wipe out the NC report in such a course because this course is not a part of his program anymore; and he can graduate with this NC.
- If a student is reported NC in a project course, it will be administratively converted to RC by the Dean and future registration in project courses will be done only if the Dean is satisfied with the genuineness of the candidate's interest in the course.

- If a student is reported NC in Thesis or Seminar, he will be required to register in the same for one more semester. Operationally, this is to be achieved by requiring him to register once again in as many units of Thesis or Seminar in which he had registered when he was awarded NC. If these two courses get separated due to NC in one of them, there is no need to register in the other.

**23. Grade Sheet**

A student's grades, reports, CGPA, etc., at the end of every semester/term will be recorded on a grade sheet, a copy of which will be issued to him. The grade sheet will be withheld when a student has not paid his dues or when there is a case of breach of discipline or unfair means pending against him.

While registration with approval of appropriate authority consistent with these regulations is a token of permission to pursue studies, the grade sheet is a complete record of the outcome of what was intended in the original/amended/ revised registration. The various grades and reports discussed above would be appropriately used to tally the grade sheet with original/ amended/revised registration. It would be evident that this tally between what was registered for and what was obtained in terms of grades and reports will apply to all courses except the course, which was originally registered for, but subsequently replaced by another course through substitution.

The tally is made on a course basis at the end of semester/term to determine which of the courses have been cleared. A course is deemed to have been cleared if the student obtains a grade in the course. However, mere clearing of the prescribed courses does not tantamount to fulfilling the requirements of graduation.

While all the grades secured and other pertinent information for semesters are given in a grade sheet, the chronologically organized information from the grade sheets of a student with the necessary explanation constitutes his transcript which is issued at the time he leaves the Institute or at an intermediate point on request.

**24. Scrutiny and Revaluation:**

26.1Scrutiny shall be allowed in maximum three theory papers only as University norms.

26.2Revaluation shall be allowed in maximum three theory papers only as University norms.

**25. Unfair means:**

Cases of unfair means shall be dealt as per the rules of the University and The U.P. Public Examination (Prevention of Unfair means) Act if any in prevalence.

**26. Award of Sessional Marks:**

Sessional marks for theory subjects, practicals and project shall be awarded as will be prescribed and at present the break-up of sessional marks shall be as follows:

**Evaluation Scheme:**

- **Course without practical components**

For Continuous Evaluation (CE) is such as: 20 Marks

1. Attendance: 10 Marks
2. Assignments/Quiz / Seminar/Term paper:10Marks

MTE - Mid Term Examination: 20 Marks
a. First Mid Term Examination: 10 marks
b. Second Mid Term Examination: 10 marks
c. Pre University Test: 10 marks

*** Best of Two will be selected from First Mid Term Examination, Second Mid Term Examination and Pre University Test**

ETE - End Term Examination: 60 Marks

- **Course with practical components only**

For Continuous Evaluation (CE) is such as: 30 Marks
Conduct / Perform/Execution /Practical File/ Viva-Voice

MTE - Mid Term Examination: 20 Marks
a. First Mid Term Examination: 10 marks
b. Second Mid Term Examination: 10 marks
c. Pre University Test: 10 marks

*** Best of Two will be selected from First Mid Term Examination, Second Mid Term Examination and Pre University Test**

ETE - End Term Examination: 50 Marks

Make-up test may be held only for those students who could not appear in any one of mid-term class tests due to genuine reasons for which the prior permission from the Head of Department was taken. Make up test shall ordinarily be held about two weeks before the semester examination. The syllabus for the make-up test shall be the whole syllabus covered by the subject teacher up to that time.

**27. Award of Seminar, Industrial Training, Educational Tour Marks at Department level:**

27.1 The marks of Seminar, Industrial Training, Educational tour marks shall be awarded on the following basis:

| Criteria | Internal | External | |
|---|---|---|---|
| Project Report | 20 | - | |
| Viva Voce | 20 | 50 | |
| Attendance | 10 | | |
| **Total** | 50 | 50 | 100 |

27.2 The marks in Seminar, Industrial Training and Educational Tour shall be awarded by a committee consisting of following members:

(i) Head of the Department or his/her nominee.

(ii) Concerned Officer – In charge.

(iii) Senior Faculty Member of the department nominated by the Head of Department.

**28. Cancellation of Admission:**

The admission of a student at any stage of study shall be cancelled if:

(i) He / She is not found qualified as per UGC/AICTE / State Government norms and guidelines or the eligibility criteria prescribed by the University.

or

(ii) He / She is found unable to complete the course within the stipulated time as prescribed in clause 2.vi

or

(iii) He / She are found involved in creating indiscipline in the FET or in the University.

29. The Academic Council shall have the power to relax any provision provided in the ordinance in any specific matter/situation subject to the approval of Executive Council of the University & such decision(s) shall be reported to the Chancellor of the University.

# Assessment Criteria

All courses of B. Tech. shall be evaluated by 100 marks. The subject shall be evaluated by 100 marks, out of which 40 marks shall be internal assessment and 60 marks for external assessment. Internal Assessment for 40 marks shall be as per the criteria given below:

| Criteria | Marks |
|---|---|
| Mid Term Examination (Best of two out of MID-1, MID-2 and PUT) | 20 |
| Assignments/ Quiz / Seminar/Term paper | 10 |
| Attendance | 10 |
| **Total Internal Assessment** | **40** |

Marks for Attendance shall be awarded as per the criteria given below:

| Attendance Percentage | Marks |
|---|---|
| 75% to 100% | 10 |
| 71% to 74% | 9 |
| 66% to 70% | 8 |
| 61% to 65% | 7 |
| 56% to 60% | 6 |
| 11% to 55% | 5 |
| 0% to 10% | 0 |

All students should have a minimum of 75% attendance in all subjects, in order to appear in the end term examination / viva voce. The 75% criterion includes all leaves of absence – whether approved or not approved.

Students failing to obtain 75% attendance shall be required to repeat the course in the subsequent year, along with the next batch, to make up for the shortage of attendance.

Under extraordinary circumstances, a student with attendance below 75% shall be allowed to appear in the term exams / viva voce. This will be at the discretion of the Vice Chancellor of the University. Circumstances when such leniency shall be shown include:

a. Death of a blood relative – father, mother, grandfather, grandmother, brother or sister.
b. Extreme cases of health adversity requiring hospitalization of the student.

In such cases, the student shall be required to give a written application to the Vice Chancellor of the University, along with appropriate proof. In case of death of blood relative, an application from the parent(s) shall be considered.

***All faculty members shall maintain appropriate records and make them available to the University's examination centre at the end of the semester.***

**Credit System:**

The B. Tech. Program has a total of 184 credits (164 Credit Course curriculum and 20 MOOCs Course) and students are required to complete all courses. On completion of all courses, the students shall earn 200 credits and would be eligible for award of the B. Tech. Degree.

***Seminar(B. Tech.)***

Each student shall select on one recent or hot topic for seminar. The students are required to prepare three copies of their seminar reports of which two have to be submitted to the Faculty. The reports shall be submitted within two weeks of commencement of the seventh semester. The report shall carry 30 marks, out of which 50 shall be evaluated by an External Examiner appointed by the University while the remaining 20 marks shall be evaluated by a Board of Internal Examiners (minimum two) appointed by the Dean, Faculty of Engineering & Technology. The Seminar shall be evaluated in the following manner:

| Criteria | Internal | External | |
|---|---|---|---|
| Project Report | 20 | - | |
| Viva Voce | 20 | 50 | |
| Attendance | 10 | | |
| **Total** | 50 | 50 | 100 |

External evaluation will be conducted during seventh end semester practical exam.

***Summer Industrial Training (B. Tech.)***

Each student shall undergo practical training of six to eight weeks during the vacations after the sixth semester. The students are required to prepare three copies of their project reports of which two have to be submitted to the Faculty. The reports shall be submitted within two weeks of commencement of the seventh semester. The report shall carry 30 marks, out of which 50 shall be evaluated by an External Examiner appointed by the University while the remaining 20 marks shall be evaluated by a Board of Internal Examiners (minimum two) appointed by the Dean, Faculty of Engineering & Technology. The summer training Project shall be evaluated in the following manner:

| Criteria | Internal | External | |
|---|---|---|---|
| Project Report | 30 | - | |
| Viva Voce | 20 | 50 | |
| **Total** | 50 | 50 | 100 |

External evaluation will be conducted during seventh end semester practical exam.

***Final Year Mini Project Report (B. Tech. 7th semester)***

During the seventh semester, each student shall undertake a project to be pursued by him/her under the supervision of a faculty guide/supervisor. The guide/ supervisor shall be appointed by the Dean, Faculty of Engineering & Technology. Minimum four copies of project report along with one soft copy in a CD shall be submitted at least two weeks prior to the commencement of the 7th End Term Examination. The mini project report shall carry 50 marks, out of which 25 shall be evaluated by an External Examiner appointed by the University while the remaining 25 marks shall be evaluated by a Internal Examiner appointed by the Dean, Faculty of Engineering & Technology. The mini project report shall be evaluated in the following manner:

| **Criteria** | **Internal** | **External** | |
|---|---|---|---|
| Project Report | 40 | 100 | |
| Viva Voce | 40 | 100 | |
| Attendance | 20 | | |
| **Total** | 100 | 200 | 300 |

***Final Year Major Project Report (B. Tech.)***

The final year major project may be extension of seventh semester mini project. During the eight semesters, each student shall undertake a project to be pursued by him / her under the supervision of a guide/supervisor. The guide/supervisor shall be appointed by the Dean, Faculty of Engineering & Technology. Minimum four copies of project report along with one soft copy in a CD shall be submitted at least two weeks prior to the commencement of the 8th End Term Examination. The major project report of 650 marks and shall be evaluated by a Board of Internal & External Examiners. The Board shall consist of a minimum of two Internal Faculty Members supervisor shall be appointed by the Dean, Faculty of Engineering & Technology and External Examiner shall be appointed by the University. The major project report shall be evaluated in the following manner:

| Criteria | Internal | External | |
|---|---|---|---|
| Project Report | 75 | 100 | |
| Viva Voce | 75 | 300 | |
| Attendance | 50 | | |
| **Total** | 200 | 400 | 600 |

**Note:**

From 2nd year onwards, students will take up **(Human Values &Scientific Reading and Writing)** as an audit subject. The student shall have to clear this audit subject with minimum E grade during 2nd Year to 4th year but its grade shall not be considered in SGPA/CGPA.

However, a student may opt more than two audits subject (with approval of Dean) for which shall not be compulsion to clear the subject, and the grade of these subjects shall not be considered in SGPA/ CGPA.

**Calculation of Grade Point and Grade Point Average**

Relative grading shall be adopted at the Faculty of Engineering & Technology, Rama University. The list of letter grades, the grade points associated with them are given below:

| Grade | Grade Point |
|---|---|
| **O** | **10** |
| **A** | **9** |
| **B** | **8** |
| **C** | **7** |
| **D** | **6** |
| **E** | **5** |
| **F** | **0** |

In order to arrive at alphabet grades, the total marks in a particular course for all the students pursuing the course are tabulated in the descending order (equivalently a histogram).

The performance of the course is analyzed in terms of the highest, lowest and the average marks and the dividing lines between the clusters of students. Gaps and dips between the clusters and the nature of the clusters guide in drawing the dividing lines between the grades. In a normal class of large size, the C grade usually covers the average performance. This is, however not a hard and fast rule and exceptions may arise in case of small classes, skewed histogram etc. Borderline cases may be considered individually on the basis of regularity and the attendance, class room discussions, progressive good performance throughout the semester, etc.

**Calculation System of Semester Grade Point Average:**

- Computation of the Semester Grade Point Average (SGPA) and Cumulative Performance Index (CPI):

  The SGPA is an indicator of the overall academic performance of a student in all the courses he/she has registered during a given semester. It is computed as follows: If the grades awarded to a student are $G_1$, $G_2$ etc in courses with corresponding credits $C_1$, $C_2$ etc, the SGPA is given by:

$$SGPA = \frac{C_1 \times G_1 + C_2 \times G_2 + \cdots + C_n \times G_n}{C_1 + C_2 + \cdots + C_n}$$

- The CPI indicates the overall academic performance of a student in all the courses registered upto and including the latest completed semester/summer term. It is computed in the same manner as the SGPA, considering all the courses (say, n) and is given by:

$$CPI = \frac{\sum_{i=1}^{n} C_i \times G_i}{\sum_{i=1}^{n} C_i}$$

- Percentage conversion of CPI:

$$Percentage\ of\ marks = \left(\frac{SGPA}{CGPA} \times 10\right) - 4.5$$

- Students should get a minimum grade E in each subject with 5CPI to clear the semester.

- CPI conversion

| | |
|---|---|
| **≥8 CPI** | **I Division with Honours** |
| **≥6 CPI** | **I Division** |
| **≥5 CPI** | **II Division** |
| **<5 CPI** | **Fail** |

- In case a student gets a F grade in more than one subject, he / she has to repeat one or more of the subjects by registering for "Guided Study" in that semester. Registration for Guided Study shall be made on the payment of Rs. 500 per subject as well as registering for the examination with a payment of Rs. 1000 per subject.
- If the students get F grade in six theory subjects in an academic session, then he/ she will repeat the year.
- Whenever a student is permitted to repeat, the new grade with star will replace the old grade and computation of the SGPA will done by considering the new grade.

B. Tech. Course should be completed within seven years. If a student does not complete the B. Tech. program in Seven years, he / she will have to appear in the program as a fresh.

**Chairperson**

Signature: .....

Name: Mr. Satish Parihar

Date:

**Internal Members**

Signature: 1.....

Name: Dr. Deeksha Ranjan

Date:

2.....

Mr. Vaibhav Yadav

**External Members**

Signature: 1.....

Name: Dr. Pradeep Kumar

Date:

# Rama University Uttar Pradesh, Kanpur

(vide U.P. Act No. 1 of 2014 as passed by State Legislature and recognized by UGC U/s 2(f))

## Faculty of Engineering & Technology,

B.Tech. Civil Engineering

(From 2021-22)

## I Semester

| S. No | Course Code | Course Name | Category | L | T | P | Cr | CA | MTE | ETE | Total |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | THEORY | | | | | | | | |
| 1 | BSC-101 | Engineering Physics | BSC | 3 | 0 | 0 | 3 | 20 | 20 | 60 | 100 |
| 2 | BSC-102 | Engineering Mathematics-I | BSC | 3 | 1 | 0 | 4 | 20 | 20 | 60 | 100 |
| 3 | BSC-103 | Environment and Ecology | BSC | 3 | 0 | 0 | 3 | 20 | 20 | 60 | 100 |
| 4 | ESC-101 | Basic Electrical Engineering | ESC | 3 | 0 | 0 | 3 | 20 | 20 | 60 | 100 |
| 5 | ESC-102 | Mechanics of Rigid Bodies | ESC | 3 | 0 | 0 | 3 | 20 | 20 | 60 | 100 |
| 6 | HSC-101 | Communication Skill-I | HSC | 2 | 0 | 0 | 2 | 20 | 20 | 60 | 100 |
| | | | LABORATORIES | | | | | | | | |
| 7 | BSC-151 | Engineering Physics Lab | BSC | 0 | 0 | 2 | 1 | 30 | 20 | 50 | 100 |
| 8 | ESC-151 | Engineering Workshop Lab | ESC | 0 | 0 | 2 | 1 | 30 | 20 | 50 | 100 |
| 9 | ESC-152 | Engineering Graphics & Design Lab | ESC | 0 | 0 | 2 | 1 | 30 | 20 | 50 | 100 |
| 10 | HSC-151 | Communication Skill Lab | HSC | 0 | 0 | 2 | 1 | 30 | 20 | 50 | 100 |
| | | **TOTAL** | | **17** | **1** | **8** | **22** | **240** | **200** | **560** | **1000** |

# Rama University Uttar Pradesh, Kanpur

(vide U.P. Act No. 1 of 2014 as passed by State Legislature and recognized by UGC U/s 2(f))

## Faculty of Engineering &Technology,

B.Tech. Civil Engineering

## II Semester

| S. No | Course Code | Course Name | Category | L | T | P | Cr | CA | MTE | ETE | Total |
|---|---|---|---|---|---|---|---|---|---|---|---|
| **THEORY** | | | | | | | | | | | |
| 1 | BSC-201 | Engineering Chemistry | BSC | 3 | 0 | 0 | 3 | 20 | 20 | 60 | 100 |
| 2 | BSC-202 | Engineering Mathematics-II | BSC | 3 | 1 | 0 | 4 | 20 | 20 | 60 | 100 |
| 3 | ESC-203 | Engineering Geology | ESC | 3 | 0 | 0 | 3 | 20 | 20 | 60 | 100 |
| 4 | ESC-202 | Engineering Thermodynamics | ESC | 3 | 0 | 0 | 3 | 20 | 20 | 60 | 100 |
| 5 | ESC-204 | Basic Electronics Engineering | ESC | 3 | 0 | 0 | 3 | 20 | 20 | 60 | 100 |
| 6 | HSC-201 | Communication Skill - II | HSC | 2 | 0 | 0 | 2 | 20 | 20 | 60 | 100 |
| 7 | HSC-202 | Universal Human Values & Professional Ethics | HSC | 2 | 0 | 0 | 0 | 20 | 20 | 60 | 100 |
| **LABORATORIES** | | | | | | | | | | | |
| 8 | ESC 251 | Basic Electrical & Electronics Engineering Lab | ESC | 0 | 0 | 2 | 1 | 30 | 20 | 50 | 100 |
| 9 | BSC 251 | Engineering Chemistry Lab | BSC | 0 | 0 | 2 | 1 | 30 | 20 | 50 | 100 |
| 10 | ESC-257 | "Wastes as Wealth" Lab | ESC | 0 | 0 | 2 | 1 | 30 | 20 | 50 | 100 |
| 11 | ESC-254 | Engineering Thermodynamics Lab | ESC | 0 | 0 | 2 | 1 | 30 | 20 | 50 | 100 |
| **TOTAL** | | | | **17** | **1** | **8** | **22** | **240** | **200** | **560** | **1000** |

# Rama University Uttar Pradesh, Kanpur

(vide U.P. Act No. 1 of 2014 as passed by State Legislature and recognized by UGC U/s 2(f))

## Faculty of Engineering & Technology,

B.Tech. Civil Engineering

[illegible] applicable w.e.f. from Session 2021-22)

## III Semester

| S. No | Course Code | Course Name | Category | L | T | P | Cr | CA | MTE | ETE | Total |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | **THEORY** | | | | | | | | |
| 1 | PME-301 | Fluid Mechanics and Machinery | PCC | 3 | 0 | 0 | 3 | 20 | 20 | 60 | 100 |
| 2 | PME-302 | Mechanics of Deformable Bodies | PCC | 3 | 1 | 0 | 4 | 20 | 20 | 60 | 100 |
| 3 | PCE-301 | Building Materials & Construction | PCC | 3 | 0 | 0 | 3 | 20 | 20 | 60 | 100 |
| 4 | PCE-302 | Engineering Survey | PCC | 3 | 0 | 0 | 3 | 20 | 20 | 60 | 100 |
| 5 | ESC-302 | Basic Computer Engineering | ESC | 3 | 0 | 0 | 3 | 20 | 20 | 60 | 100 |
| 6 | HSC-301 | Verbal Ability–I | HSMC | 2 | 0 | 0 | 2 | 20 | 20 | 60 | 100 |
| | | | **LABORATORIES** | | | | | | | | |
| 7 | PCE-351 | Building Materials Laboratory | PCC | 0 | 0 | 2 | 1 | 30 | 20 | 50 | 100 |
| 8 | PCE-352 | Engineering Survey Laboratory | PCC | 0 | 0 | 2 | 1 | 30 | 20 | 50 | 100 |
| 9 | PCE-353 | Building Planning & Drawing Lab | PCC | 0 | 0 | 2 | 1 | 30 | 20 | 50 | 100 |
| 10 | ESC-351 | Basic Computer Engineering Lab | ESC | 0 | 0 | 2 | 1 | 30 | 20 | 50 | 100 |
| | | **TOTAL** | | **17** | **1** | **8** | **22** | **240** | **200** | **560** | **1000** |

# Rama University Uttar Pradesh, Kanpur

(vide U.P. Act No. 1 of 2014 as passed by State Legislature and recognized by UGC U/s 2(f))

## Faculty of Engineering &Technology,

**B.Tech. Civil Engineering**

**Course Curriculum (effective from Session 2021-22)**

## IV Semester

| S. No | Course Code | Course Name | Category | L | T | P | Cr | CA | MTE | ETE | Total |
|---|---|---|---|---|---|---|---|---|---|---|---|
| **THEORY** | | | | | | | | | | | |
| 1 | PCE-401 | Structural Analysis | PCC | 3 | 1 | 0 | 4 | 20 | 20 | 60 | 100 |
| 2 | PCE-402 | Open Channel Flow | PCC | 3 | 0 | 0 | 3 | 20 | 20 | 60 | 100 |
| 3 | PCE-403 | Concrete Technology | PCC | 3 | 0 | 0 | 3 | 20 | 20 | 60 | 100 |
| 4 | PCE-404 | Highway Engineering | PCC | 3 | 0 | 0 | 3 | 20 | 20 | 60 | 100 |
| 5 | PCE-405 | Water Resources Engineering | PCC | 3 | 0 | 0 | 3 | 20 | 20 | 60 | 100 |
| 6 | HSC-401 | Verbal Ability–I | HSMC | 2 | 0 | 0 | 2 | 20 | 20 | 60 | 100 |
| **LABORATORIES** | | | | | | | | | | | |
| 7 | PME-451 | Fluid Mechanics & Machinery Lab | PCC | 0 | 0 | 2 | 1 | 30 | 20 | 50 | 100 |
| 8 | PCE-451 | Structural Analysis Lab | PCC | 0 | 0 | 2 | 1 | 30 | 20 | 50 | 100 |
| 9 | PCE-452 | Concrete Technology Lab | PCC | 0 | 0 | 2 | 1 | 30 | 20 | 50 | 100 |
| 10 | PCE-453 | Survey Camp | PCC | 0 | 0 | 2 | 1 | 30 | 20 | 50 | 100 |
| **TOTAL** | | | | **17** | **1** | **8** | **22** | **240** | **200** | **560** | **1000** |

# Rama University Uttar Pradesh, Kanpur

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Faculty of Engineering &Technology,

B.Tech. Civil Engineering

## V Semester

| S. No | Course Code | Course Name | Category | L | T | P | Cr | CA | MTE | ETE | Total |
|---|---|---|---|---|---|---|---|---|---|---|---|
| **THEORY** | | | | | | | | | | | |
| 1 | PCE-501 | Geotechnical Engineering | PCC | 3 | 0 | 0 | 3 | 20 | 20 | 60 | 100 |
| 2 | PCE-502 | Environmental Engineering | PCC | 3 | 1 | 0 | 4 | 20 | 20 | 60 | 100 |
| 3 | ECE-501-506 | Engineering Minor Elective-I | PCC | 3 | 0 | 0 | 3 | 20 | 20 | 60 | 100 |
| 4 | PCC-511-513 | Pathway Elective-I | PCC | 3 | 0 | 0 | 3 | 20 | 20 | 60 | 100 |
| 5 | HSC-501 | Reasoning Ability–I | HSMC | 2 | 0 | 0 | 2 | 20 | 20 | 60 | 100 |
| 6 | | Open Minor/Open Elective-I | OEC | 3 | 0 | 0 | 3 | 20 | 20 | 60 | 100 |
| 7 | ESC-501 | Scientific Reading & Writing | ESC | 2. | 0 | 0 | 0 | 30 | 20 | 60 | 100 |
| **LABORATORIES** | | | | | | | | | | | |
| 8 | PCE-551 | Highway Engineering Lab | PCC | 0 | 0 | 2 | 1 | 30 | 20 | 50 | 100 |
| 9 | PCE-552 | Geotechnical Engineering Lab | PCC | 0 | 0 | 2 | 1 | 30 | 20 | 50 | 100 |
| 10 | PCE-553 | Environmental Engineering Lab | PCC | 0 | 0 | 2 | 1 | 30 | 20 | 50 | 100 |
| 11 | LCE-551 | Mini Project-I | LC | 0 | 0 | 2 | 1 | 30 | 20 | 50 | 100 |
| **TOTAL** | | | | **17** | **1** | **8** | **22** | **240** | **200** | **560** | **1000** |

| **Engineering Minor Elective** | **Specialization** | | | | | |
|---|---|---|---|---|---|---|
| | **Structural Engineering** | **Geotechnical Engineering** | **Transportation Engineering** | **Construction Technology & Management** | **Water Resources Engineering** | **Environmental Engineering** |
| **I(ECE-501-506)** | *Plastic Analysis of Structure* | *Ground Improvement Engineering* | *Railway & Airport Engineering* | *Elementary Architectural Science* | *Ground Water Management* | *Rural Water Supply & Sanitation* |

| **Pathway Elective** | **Pathway** | | |
|---|---|---|---|
| | **Corporate Job** | **Government Jobs** | **Higher Studies** |
| I | *Concepts of Civil Engineering* | *Concepts of Civil Engineering* | *Concepts of Civil Engineering* |

# Rama University Uttar Pradesh, Kanpur

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Faculty of Engineering &Technology,

B.Tech. Civil Engineering

Course Curriculum (effective from Session 2021-22)

## VI Semester

| S. No | Course Code | Course Name | Category | L | T | P | Cr | CA | MTE | ETE | Total |
|---|---|---|---|---|---|---|---|---|---|---|---|
| **THEORY** | | | | | | | | | | | |
| 1 | PCE-601 | Reinforced Cement Concrete Design | PCC | 3 | 1 | 0 | 4 | 20 | 20 | 60 | 100 |
| 2 | ECE-601-604 | Engineering Minor Elective-II | PCC | 3 | 0 | 0 | 3 | 20 | 20 | 60 | 100 |
| 3 | PCE-611-613 | Pathway Elective-II | PEC | 3 | 0 | 0 | 3 | 20 | 20 | 60 | 100 |
| 4 | HSC-601 | Reasoning Ability–II | HSMC | 2 | 0 | 0 | 2 | 20 | 20 | 60 | 100 |
| 5 | | Open Minor/Open Elective-II | OEC | 3 | 0 | 0 | 3 | 20 | 20 | 60 | 100 |
| **LABORATORIES** | | | | | | | | | | | |
| 6 | PCE-651 | STAAD Pro Lab | PCC | 0 | 0 | 2 | 1 | 30 | 20 | 50 | 100 |
| 7 | LCE-652 | Departmental Seminar | LC | 0 | 0 | 2 | 1 | 30 | 20 | 50 | 100 |
| 8 | LCE-651 | Mini Project-II | LC | 0 | 0 | 2 | 1 | 30 | 20 | 50 | 100 |
| **TOTAL** | | | | **14** | **1** | **6** | **18** | **190** | **160** | **450** | **800** |

| **Engineering Minor Elective** | **Specialization** | | | | | |
|---|---|---|---|---|---|---|
| | **Structural Engineering** | **Geotechnical Engineering** | **Transportation Engineering** | **Construction Technology & Management** | **Water Resources Engineering** | **Environmental Engineering** |
| **II(ECE-601-606)** | *Advanced Design of Concrete Structures* | *Geo-synthesis & Reinforced Soil Structures* | *Pavement Designs* | *Sustainable Construction* | *Ground Water Hydrology* | *Integrated Waste Management for a Smart City* |

| **Pathway Elective** | **Pathway** | | |
|---|---|---|---|
| | **Corporate Job** | **Government Jobs** | **Higher Studies** |
| II | *Applications of Softwares* | *Applications of Softwares* | *Applications of Softwares* |

# Rama University Uttar Pradesh, Kanpur

(U/s U.P. Act No. 1 of 2014 as passed by State Legislature and recognized by UGC U/s 2(f))

Faculty of Engineering & Technology,

B.Tech. Civil Engineering

Course Curriculum (effective from session 2021-22)

## VI Semester

| S. No | Course Code | Course Name | Category | L | T | P | Cr | CA | MTE | ETE | Total |
|---|---|---|---|---|---|---|---|---|---|---|---|
| **THEORY** | | | | | | | | | | | |
| 1 | PCE-601 | Reinforced Cement Concrete Design | PCC | 3 | 1 | 0 | 4 | 20 | 20 | 60 | 100 |
| 2 | ECE-601-606 | Engineering Minor Elective-II | PCC | 3 | 0 | 0 | 3 | 20 | 20 | 60 | 100 |
| 3 | PCE-611-613 | Pathway Elective-II | PEC | 3 | 0 | 0 | 3 | 20 | 20 | 60 | 100 |
| 4 | HSC-601 | Reasoning Ability–II | HSMC | 2 | 0 | 0 | 2 | 20 | 20 | 60 | 100 |
| 5 | | Open Minor/Open Elective-II | OEC | 3 | 0 | 0 | 3 | 20 | 20 | 60 | 100 |
| **LABORATORIES** | | | | | | | | | | | |
| 6 | PCE-651 | STAAD Pro Lab | PCC | 0 | 0 | 2 | 1 | 30 | 20 | 50 | 100 |
| 7 | LCE-652 | Departmental Seminar | LC | 0 | 0 | 2 | 1 | 30 | 20 | 50 | 100 |
| 8 | LCE-651 | Mini Project-II | LC | 0 | 0 | 2 | 1 | 30 | 20 | 50 | 100 |
| **TOTAL** | | | | **14** | **1** | **6** | **18** | **190** | **160** | **450** | **800** |

| **Engineering Minor Elective** | **Specialization** | | | | | |
|---|---|---|---|---|---|---|
| | **Structural Engineering** | **Geotechnical Engineering** | **Transportation Engineering** | **Construction Technology & Management** | **Water Resources Engineering** | **Environmental Engineering** |
| **II(ECE-601-606)** | *Advanced Design of Concrete Structures* | *Geo-synthesis & Reinforced Soil Structures* | *Pavement Designs* | *Sustainable Construction* | *Ground Water Hydrology* | *Integrated Waste Management for a Smart City* |
| **Pathway Elective** | **Pathway** | | | | | |
| | **Corporate Job** | | **Government Jobs** | | **Higher Studies** | |
| II | *Applications of Softwares* | | *Applications of Softwares* | | *Applications of Softwares* | |

# Rama University Uttar Pradesh, Kanpur

(vide U.P. Act No. 1 of 2014 as passed by State Legislature and recognized by UGC U/s 2(f))

Faculty of Engineering & Technology,

B.Tech. Civil Engineering

Course Curriculum (effective from Session 2021-22)

## VII Semester

| S. No | Course Code | Course Name | Category | L | T | P | Cr | CA | MTE | ETE | Total |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | THEORY | | | | | | | | |
| 1 | PCE-701 | Design of Steel Structures | PCC | 3 | 0 | 0 | 3 | 20 | 20 | 60 | 100 |
| 2 | PCE-702 | Quantity Survey & Estimation | PCC | 3 | 0 | 0 | 3 | 20 | 20 | 60 | 100 |
| 3 | ECE-701-706 | Engineering Minor Elective –III | PEC | 3 | 0 | 0 | 3 | 20 | 20 | 60 | 100 |
| 4 | PCE-711-713 | Pathway Elective-III | PEC | 3 | 0 | 0 | 3 | 20 | 20 | 60 | 100 |
| 5 | | Open Minor/Open Elective –III | OEC | 3 | 0 | 0 | 3 | 20 | 20 | 60 | 100 |
| | | | LABORATORIES | | | | | | | | |
| 6 | PCE-751 | Construction Management Laboratory | PCC | 0 | 0 | 2 | 1 | 30 | 20 | 50 | 100 |
| 7 | LCE-751 | Presentation on Industrial Training | LC | 0 | 0 | 2 | 1 | 0 | 50 | 50 | 100 |
| 8 | LCE-752 | Capstone Project Phase-I | LC | 0 | 0 | 4 | 2 | 0 | 50 | 50 | 100 |
| | | **TOTAL** | | **15** | **0** | **6** | **19** | **190** | **160** | **450** | **800** |

| Engineering Minor Elective | Specialization | | | | | |
|---|---|---|---|---|---|---|
| | Structural Engineering | Geotechnical Engineering | Transportation Engineering | Construction Technology & Management | Water Resources Engineering | Environmental Engineering |
| III(ECE-701-706) | *Seismic Design of Structures* | *Earth & Earth Retaining Structures* | *Traffic Engineering & Management* | *Remote Sensing & GIS* | *Water Resource Systems* | *Industrial Waste Treatment* |

| Pathway Elective | Pathway | | |
|---|---|---|---|
| | Corporate Job | Government Jobs | Higher Studies |
| III | *Measurement, Reliability and Quality Control* | *Measurement, Reliability and Quality Control* | *Modern Research Methodology* |

# VIII Semester

| S. No | Course Code | Course Name | Category | L | T | P | Cr | CA | MTE | ETE | Total |
|---|---|---|---|---|---|---|---|---|---|---|---|
| THEORY | | | | | | | | | | | |
| 1 | PCE-801 | Construction Project Management | PEC | 3 | 0 | 0 | 3 | 20 | 20 | 60 | 100 |
| 2 | ECE-801-806 | Engineering Minor Elective-IV | PEC | 3 | 0 | 0 | 3 | 20 | 20 | 60 | 100 |
| 3 | | Open Minor/Open Elective-IV | OEC | 3 | 0 | 0 | 3 | 20 | 20 | 60 | 100 |
| LABORATORIES | | | | | | | | | | | |
| 4 | LCE-851 | Capstone Project Phase-II | LC | 0 | 0 | 16 | 8 | 0 | 200 | 400 | 600 |
| TOTAL | | | | 9 | 0 | 16 | 17 | 60 | 260 | 580 | 900 |

| Engineering Minor Elective | Specialization | | | | | |
|---|---|---|---|---|---|---|
| | Structural Engineering | Geotechnical Engineering | Transportation Engineering | Construction Technology & Management | Water Resources Engineering | Environmental Engineering |
| IV(ECE-801-806) | *Advanced Design of Steel Structures* | *Advanced Foundation Engineering* | *Urban Transportation Planning* | *Alternate Building Materials & Techniques* | *Irrigation Engineering* | *Advanced Environmental Engineering* |

L-Lecture, T-Tutorial, P- Practical, CA- Continuous Assessment, MTE-Mid Term Examination, ETE-End Term Examination

**Evaluation Scheme:**

**Course with theory components only**

For Continuous Assessment (CA) is such as: 20 Marks

a) Attendance: 10 Marks
b) Assignments: 5 Marks
c) Class Tests: 5 Marks

MTE - Mid Term Examination: 20 Marks

ETE - End Term Examination: 60 Marks

**Course with practical components only**

For Continuous Assessment (CA) is such as: 30 Marks

a) Attendance : 10 Marks
b) Perform : 10 Marks
c) Practical File : 10 Marks

MTE - Mid Term Examination: 20 Marks

a) Execution : 10 Marks
b) Viva-Voce : 10 Marks

ETE - End Term Examination: 50 Marks

# Rama University Uttar Pradesh, Kanpur

(vide U.P. Act No. 1 of 2014 as passed by State Legislature and recognized by UGC U/s 2(f))

Faculty of Engineering & Technology,

B.Tech. Civil Engineering

Course Curriculum (effective from Session 2021-22)

## Summary of Elective Courses

| Engineering Minor Elective | Specialization | | | | | |
|---|---|---|---|---|---|---|
| | Structural Engineering | Geo-technical Engineering | Transportation Engineering | Construction Technology & Management | Water Resources Engineering | Environmental Engineering |
| I(ECE-501-506) | *Plastic Analysis of Structure* | *Ground Improvement Engineering* | *Railway & Airport Engineering* | *Elementary Architectural Science* | *Ground Water Management* | *Rural Water Supply & Sanitation* |
| II(ECE-601-606) | *Advanced Design of Concrete Structures* | *Geo-synthesis & Reinforced Soil Structures* | *Pavement Designs* | *Sustainable Construction* | *Ground Water Hydrology* | *Integrated Waste Management for a Smart City* |
| III(ECE-701-706) | *Seismic Design of Structures* | *Earth & Earth Retaining Structures* | *Traffic Planning & Management* | *Remote Sensing & GIS* | *Water Resource Systems* | *Industrial Wastes Treatment* |
| IV(ECE-801-806) | *Advanced Design of Steel Structures* | *Advanced Foundation Engineering* | *Urban Transportation Planning* | *Alternate Building Materials & Techniques* | *Irrigation Engineering* | *Advanced Environmental Engineering* |

| Pathway Elective | Pathway | | |
|---|---|---|---|
| | **Corporate Job** | **Government Jobs** | **Higher Studies** |
| I | *Concepts of Civil Engineering* | *Concepts of Civil Engineering* | *Concepts of Civil Engineering* |
| II | *Applications of Softwares* | *Applications of Softwares* | *Applications of Softwares* |
| III | *Measurement, Reliability and Quality Control* | *Measurement, Reliability and Quality Control* | *Modern Research Methodology* |

# Rama University Uttar Pradesh, Kanpur

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**Faculty of Engineering &Technology,**

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**Course Curriculum (effective from Session 2021-22)**

## SEMESTER-I (FIRST YEAR)

## BSC-101: Engineering Physics

| L | T | P | Credit |
|---|---|---|---|
| 3 | 0 | 0 | 3 |

**Pre-requisite: 1.** Intermediate

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

| | |
|---|---|
| BSC-101.1 | ***calculate [III]*** To solve the classical and wave mechanics problems., ***identify [III]*** basic mechanism of Relativistic Mechanics and ***construct [III]*** Calculate the variation of mass with velocity |
| BSC-101.2 | ***Sketch [III]*** cam profile &***compute [III]*** To develop the understanding of laws of electrodynamics and their application in various parameters. |
| BSC-101.3 | ***Perform [III]*** To formulate and solve the engineering problems on Quamtum mechanics and its applications. |
| BSC-101.4 | ***Analyze [III]*** To aware of limits of classical physics & to apply the ideas in solving the problems in their parent streams. |
| BSC-101.5 | ***Understand [II]*** basic behind optical fiber and lasers |

**Mapping of course outcomes with program outcomes**

| CO | PO1: Engineering knowledge | PO2 Problem analysis | PO3:Design/devel opment of solutions | PO4:Conduct investigations of complex problems | PO5:Modern tool usage | PO6: The engineer and society | PO7:Environment and sustainability | PO8:Ethics | PO9:Individual and team work | PO10:Communication | PO11:Project management and finance | PO12:Life-long learning |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| BSC-101.1 | 2 | 3 | 2 | 3 | - | - | - | - | - | 1 | - | 1 |
| BSC-101.2 | 1 | 2 | 1 | - | 2 | - | - | - | - | - | - | 1 |
| BSC-101.3 | 3 | 3 | 2 | 3 | 3 | - | - | - | 1 | - | - | 2 |
| BSC-101.4 | 3 | 3 | 2 | 3 | 3 | - | - | - | 1 | - | - | 2 |
| BSC-101.5 | 3 | 3 | 2 | 3 | 3 | - | - | - | 1 | - | - | 2 |

**Unit-I:Relativistic Mechanics:**

1.1 Frame of reference, Inertial & non-inertial frames, Galilean transformations.
1.2 Michelson- Morley experiment,
1.3 Postulates of special theory of relativity, Lorentz transformations, Length contraction,
1.4 Time dilation, Velocity addition theorem
1.5 Variation of mass with velocity.
1.6 Einstein's mass energy relation
1.7 Relativistic relation between energy and momentum,
1.8 Massless particle

**Unit-II: Electromagnetic Field Theory:**

2.1 Continuity equation for current density, Displacement current,
2.2 Maxwell's equations in vacuum
2.3 Maxwell's equations in non conducting medium,
2.4 Energy in an electromagnetic field, Poynting vector,
2.5 Poynting theorem,
2.6 Plane electromagnetic waves in vacuum and their transverse nature
2.7 Relation between electric and magnetic fields of an electromagnetic wave,
2.8 Energy and momentum carried by electromagnetic waves, Resultant pressure, Skin depth.

**Unit-III: Quantum Mechanics:**

**3.1** Introduction of Quantum Mechanics
**3.2** Wave particle duality, Matter waves,
**3.3** Time-dependent
**3.4** Time-Independent Schrodinger Wave Equation.
**3.5** Born interpretation of wave function
**3.6** Solution to stationary state Schrodinger wave
**3.7** Equations for One-Dimensional Particle in a box.

**Unit-IV: Wave Optics:**

**4.1** Coherent sources, Interference in uniform and wedge shaped thin films,
**4.2** Necessity of extended sources,
**4.3** Newton's Rings and its applications,
**4.4** Fraunhoffer diffraction at single slit,
**4.5** Fraunhoffer diffraction at double slit,
**4.6** Absent spectra, Diffraction grating, Spectra with grating,

4.7 Dispersive power, resolving power of grating,
4.8 Rayleigh's criterion of resolution, resolving power of grating.

**Unit-V: Fibre Optics & Laser Optics:**

**5.1** Introduction to fibre optics, Acceptance angle,
**5.2** Numerical aperture, Normalized frequency,
**5.3** Classification of fibre, Attenuation and Dispersion in optical fibres
**5.4** Laser: Absorption of radiation,
**5.5** Spontaneous and stimulated emission of radiation, Einstein's coefficients, Population inversion
**5.6** Various levels of Laser, Ruby Laser,
**5.7** He-Ne Laser, Laser applications.

**Text/Reference Books:**

1. Concepts of Modern Physics – Aurthur Beiser (McGraw Hill)
2. Introduction to Special Theory of Relativity- Robert Resnick (Wiley)
3. Optics – Brijlal & Subramanian (S. Chand )
4. Engineering Physics: Theory and Practical- Katiyar and Pandey (Wiley India)
5. Applied Physics for Engineers- Neeraj Mehta (PHI Learning, New) 6. Engineering Physics-Malik HK and Singh AK (McGrawHill)

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## Faculty of Engineering &Technology,

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**Course Curriculum (effective from Session 2021-22)**

## BSC-151: Engineering Physics Lab

| L | T | P | Credit |
|---|---|---|---|
| 0 | 0 | 2 | 1 |

**Pre-requisite: 1.** Intermediate

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

| | |
|---|---|
| BSC-151.1 | ***calculate [III]***The wavelength of sodium light by Newton"s ring experiment,***identify [III]*** basic mechanism of machine and ***construct [III]*** its inversions also draw their velocity and acceleration image |
| BSC-151.2 | ***sketch [III]***wavelength of sodium light with the help of Fresnel"s bi-prism &***compute [III]*** various parameters involved in gear system. |
| BSC-151.3 | ***Perform [III]***the variation of magnetic field with the distance along the axis of a current carrying coil |
| BSC-151.4 | ***Analyze [III]***estimate the radius of the coil. |
| BSC-151.5 | ***Understand [II]*** basic behind brakes and dynamometer |

**Mapping of course outcomes with program outcomes**

| CO | PO1: Engineering knowledge | PO2 Problem analysis | PO3:Design/development of solutions | PO4:Conduct investigations of complex problems | PO5:Modern tool usage | PO6: The engineer and society | PO7:Environment and sustainability | PO8:Ethics | PO9:Individual and team work | PO10:Communication | PO11:Project management and finance | PO12:Life-long learning |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| BSC-151.1 | 2 | 3 | 2 | 3 | - | - | - | - | - | 1 | - | 1 |
| BSC-151.2 | 1 | 2 | 1 | - | 2 | - | - | - | - | - | - | 1 |
| BSC-151.3 | 3 | 3 | 2 | 3 | 3 | - | - | - | 1 | - | - | 2 |
| BSC-151.4 | 3 | 3 | 2 | 3 | 3 | - | - | - | 1 | - | - | 2 |
| BSC-151.5 | 3 | 3 | 2 | 3 | 3 | - | - | - | 1 | - | - | 2 |

**List of Experiments:**

**Any ten experiments (at least four from each group).**

**Group A**

1. To determine the wavelength of sodium light by Newton's ring experiment.
2. To determine the wavelength of different spectral lines of mercury light using plane transmission grating.
3. To determine the specific rotation of cane sugar solution using polar-meter.
4. To determine the focal length of the combination of two lenses separated by a distance and verify the formula for the
5. Focal length of combination of lenses.
6. To measure attenuation in an optical fiber.
7. To determine the wavelength of He-Ne laser light using single slit diffraction.
8. To study the polarization of light using He-Ne laser light.
9. To determine the wavelength of sodium light with the help of Fresnel's bi-prism.
10. To determine the coefficient of viscosity of a given liquid.
11. To determine the value of acceleration due to gravity (g) using compound pendulum.

**Group B**

1. To determine the energy band gap of a given semiconductor material.
2. 2.To study Hall effect and determine Hall coefficient, carrier density and mobility of a given semiconductor material using Hall effect set up
3. To determine the variation of magnetic field with the distance along the axis of a current carrying coil and estimate the radius of the coil.
4. To verify Stefan's law by electric method.
5. To determine resistance per unit length and specific resistance of a given resistance using Carey Foster's Bridge.
6. To study the resonance condition of a series LCR circuit.
7. To determine the electrochemical equivalent (ECE) of copper.
8. To calibrate the given ammeter and voltmeter by potentiometer.
9. To draw hysteresis (B-H curve) of a specimen in the form of a transformer and to determine its Hysteresis loss.
10. To measure high resistance by leakage method.

**Text/Reference Books:**

1. Practical Physics- K. K. Dey& B. N. Dutta (Kalyani Publishers New Delhi)
2. Engineering Physics-Theory and Practical- Katiyar& Pandey (Wiley India)
3. Engineering Physics Practical- S K Gupta ( KrishnaPrakashan Meerut)

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## BSC-102: Engineering Mathematics-I

| L | T | P | Credit |
|---|---|---|---|
| 3 | 0 | 0 | 3 |

**Pre-requisite: 1.** Intermediate Mathematics

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

| | |
|---|---|
| BSC-102.1 | ***calculate [III]***solve the consistent system of linear equations,***identify [III]***Able to solve qualitative problems based on vector analysis and matrix analysis such as linear independence and dependence of vectors, rank etc. ***construct [III]*** its inversions also draw their velocity and acceleration image***Analyze: II]***analyze the methods in matrices, complex numbers, and differential calculus. ***compute [III]*** various parameters involved in gear system. |
| BSC-102.2 | ***sketch [III]***analyze the methods in matrices, complex numbers, and differential calculus. ***compute [III]*** various parameters involved in gear system. |
| BSC-102.3 | ***Perform [III]***evaluate multiple integrals in various coordinate systems, ***Analyze [III]***convert line integrals into area integrals and surface integrals into volume integrals |
| BSC-102.4 | ***Analyze [III]*** apply the concepts in solving physical problems arising in engineering |
| BSC-102.5 | ***Understand [II]***apply qualitative applications of the concepts of gradient, divergence and curl to formulate engineering problems |

**Mapping of course outcomes with program outcomes**

| CO | PO1: Engineering knowledge | PO2 Problem analysis | PO3:Design/development of solutions | PO4:Conduct investigations of complex problems | PO5:Modern tool usage | PO6: The engineer and society | PO7:Environment and sustainability | PO8:Ethics | PO9:Individual and team work | PO10:Communication | PO11:Project management and finance | PO12:Life-long learning |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| BSC-102.1 | 3 | 3 | 2 | 2 | 1 | 1 | - | - | 3 | 3 | 2 | 2 |
| BSC-102.2 | 2 | 2 | 1 | - | 2 | - | - | - | - | - | - | 1 |
| BSC-102.3 | 3 | 3 | 2 | 3 | 1 | - | - | - | 1 | - | - | 2 |
| BSC-102.4 | 2 | 2 | 3 | 1 | 1 | - | - | - | 3 | - | - | 2 |
| BSC-102.5 | 2 | 2 | 3 | 2 | 1 | - | - | - | 3 | - | - | 2 |

**Unit-I: Matrix Algebra:**

1.1 Elementary operations and their use in getting the Rank
1.2 Inverse of a matrix,
1.3 solution of linear simultaneous equations,
1.4 Orthogonal, Symmetric, Skew-symmetric, Hermitian, Skew-Hermitian, Normal & Unitary matrices and their elementary properties
1.5 Eigen-values and Eigenvectors of a matrix
1.6 CayleyHamilton theorem, Diagonalization of a matrix

**Unit-II: Differential Calculus-I**

2.1 Successive Differentiation (nth order derivatives)
2.2 Leibnitz's theorem
2.3 Partial derivatives
2.4 Euler's theorem for homogeneous functions
2.5 Total derivatives,
2.6 Change of variables
2.7 Curve tracing: Cartesian and Polar coordinates

**Unit-III: 3Differential Calculus-II**

3.1 Taylor's and McLaurin's Theorems
3.2 Expansion of function of several variables
3.3 Jacobian
3.4 Lagrange's method of multipliers ( Simple applications)

**Unit-IV: Integral Calculus**

4.1 Double and triple integrals
4.2 Change of order of integration, Change of variables
4.3 Beta and Gamma functions
4.4 Application of integration to lengths, Volumes and Surface areas-- Cartesian and Polar coordinates

**Unit-V: Vector Calculi**

**5.1** Unit Vector
**5.2** Components of a Vector
**5.3** Velocity & Acceleration

5.4 Gradient, Divergence and Curl with their Physical Interpretations
5.5 Line, Surface and Volume Integrals,
5.6 Applications Of Green's, Stoke's and Gauss Divergence Theorems (Without Proof)

**Text/Reference Books:**

1. E. Kreyszig :Advanced Engineering Mathematics-Volume-I,JohnWiley& Sons.
2. B. V. Ramana, Higher Engineering Mathematics, Tata McGraw- Hill Publishing Company Ltd.
3. R.K.Jain& S.R.K. Iyenger, Advance Engineering Mathematics, Narosa Publishing House.
4. Peter V. O' Neil, Advanced Engineering Mathematics, Thomas ( Cengage) Learning.
5. Thomas & Finley, Calculus, Narosa Publishing House
6. Rukmangadachari, Engineering Mathematics – I, Pearson Education

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**Faculty of Engineering &Technology,**

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## BSC-103: Environment & Ecology

| L | T | P | Credit |
|---|---|---|---|
| 3 | 0 | 0 | 3 |

**Pre-requisite: 1. None**

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

| | |
|---|---|
| **BSC-103.1** | ***Understand [II]*** integrated role of environment with other disciplines and intrinsic values of the natural resources |
| **BSC-103.2** | ***Understand[II]*** ecological process and need for ecological balance |
| **BSC-103.3** | ***Understand [II]*** importance of biodiversity and their sustainable utilization |
| **BSC-103.4** | ***Understand [II]*** and develop critical thinking skills in relation to environmental pollution and its abatement |
| **BSC-103.5** | ***Understand [II]*** the need for sustainable development and role of individual and government in Environment protection. |

**Mapping of course outcomes with program outcomes**

| CO | PO1: Engineering knowledge | PO2 Problem analysis | PO3:Design/development of solutions | PO4:Conduct investigations of complex problems | PO5:Modern tool usage | PO6: The engineer and society | PO7:Environment and sustainability | PO8:Ethics | PO9:Individual and team work | PO10:Communication | PO11:Project management and finance | PO12:Life-long learning |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| BSC-103.1 | - | - | - | - | - | - | 2 | 2 | 2 | - | - | 2 |
| BSC-103.2 | - | - | - | - | - | - | 2 | 2 | 2 | - | - | 2 |
| BSC-103.3 | - | - | - | - | - | - | 2 | 2 | 2 | - | - | 2 |
| BSC-103.4 | - | - | - | - | - | - | 2 | 2 | 2 | - | - | 2 |
| BSC-103.5 | - | - | - | - | - | - | 2 | 2 | 2 | - | - | 2 |

**Unit-I: Multidisciplinary nature of environmental studies and Natural resources**

1.1 Definition, scope and importance

1.2 Need for public awareness
1.3 Renewable and non-renewable resources: Natural resources and associated problems.
(a) Forest resources: Use and over-exploitation, deforestation, case studies. Timber extraction, mining, dams and their effects on forest and tribal people.
(b) Water resources: Use and over-utilization of surface and ground water, floods, drought, conflicts over water, dams-benefits and problems.
(c) Mineral resources: Use and exploitation, environmental effects of extracting and using mineral resources, case studies
(d) Food resources: World food problems, changes caused by agriculture and overgrazing, effects of modern agriculture, fertilizer-pesticide problems, water logging, salinity, case studies.
(e) Energy resources: Growing energy needs, renewable and non renewable energy sources, use of alternate energy sources. Case studies.
(f) Land resources : Land as a resource, land degradation, man induced landslides, soil erosion and desertification
1.4 Role of an individual in conservation of natural resources.
1.5 Equitable use of resources for sustainable lifestyles.

**Unit-II: Ecosystems**

2.1 Concept of an ecosystem
2.2 Structure and function of an ecosystem
2.3 Producers, consumers and decomposers.
2.4 Energy flow in the ecosystem.
2.5 Ecological succession.
2.6 Food chains, food webs and ecological pyramids.
2.7 Introduction, types, characteristic features, structure and function of the following ecosystem:
(a) Forest ecosystem
(b) Grassland ecosystem
(c) Desert ecosystem
(d) Aquatic ecosystems (ponds, streams, lakes, rivers, oceans, estuaries)
2.8 Field work- Study of common plants, insects, birds.

**Unit-III: Biodiversity and its conservation**

3.1 Introduction — Definition: genetic, species and ecosystem diversity.
3.2 Biogeographical classification of India
3.3 Value of biodiversity : consumptive use, productive use, social, ethical, aesthetic and option values
3.4 Biodiversity at global, National and local levels.
3.5 India as a mega-diversity nation
3.6 Hot-spots of biodiversity.
3.7 Threats to biodiversity: habitat loss, poaching of wildlife, man-wildlife conflicts.

3.8 Endangered and endemic species of India
3.9 Conservation of biodiversity: In-situ and Ex-situ conservation of biodiversity.
3.10 Field work-Visit to a local area to document environmental assets river, forest, grassland, hill, mountain.

**Unit-IV: Environmental Pollution**

4.1 Definition
4.2 Causes, effects and control measures of:
(a) Air pollution
(b) Water pollution
(c) Soil pollution
(d) Marine pollution
(e) Noise pollution
(f) Thermal pollution
(g) Nuclear hazards
4.3 Solid waste Management: Causes, effects and control measures of urban and industrial wastes.
4.4 Role of an individual in prevention of pollution.
4.5 Pollution case studies.
4.6 Disaster management: floods, earthquake, cyclone and landslides.
4.7 Field work-Visit to a local polluted site — Urban / Rural / Industrial / Agricultural

**Unit-V: Social Issues and the Environment and Human Population and the Environment**

5.1 From Unsustainable to Sustainable development
5.2 Urban problems related to energy
5.3 Water conservation. rain water harvesting, watershed management
5.4 Resettlement and rehabilitation of people: its problems and concerns. Case studies.
5.5 Environmental ethics: issues and possible solutions.
5.6 Climate change. global warming, acid rain, ozone layer depiction, nuclear accidents and holocaust, Case studies.
5.7 Wasteland reclamation.
5.8 Consumerism and waste products.
5.9 Environmental Protection Act
5.10 Air ( Prevention and Control of Pollution) Act.
5.11 Water (Prevention and control of Pollution) Act
5.12 Wildlife Protection Act
5.13 Forest Conservation Act
5.14 Issues involved in enforcement of environmental legislation.

5.15 Public awareness.
5.16 Population growth, variation among nations.
5.17 Population explosion — Family Welfare Programme.
5.18 Environment and human health.
5.19 Human Rights.
5.20 Value Education.
5.21 HIV / AIDS.
5.22 Women and Child Welfare.
5.23 Role of Information Technology in Environment and human health
5.24 Case Studies.
5.25 Field work-Study of simple ecosystems-pond, river, hill slopes, etc.

**Text/Reference Books:**

1. Environmental Science: S. C. Santra, 3rd edition, New Central Book Agency (P) Ltd.
2. Ecology and Environment: P. D. Sharma, 13th Edition Rastogi Publication.
3. Fundamentals of Environmental Studies Mahua Basu and X. Savarimuthu, 1st Edition, Cambridge University Press
4. Environmental Chemistry: A.K. De, 8th Edition, New Age International (P) Ltd

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## Faculty of Engineering &Technology,

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**Course Curriculum (effective from Session 2021-22)**

## ESC-101: Basic Electrical Engineering

| L | T | P | Credit |
|---|---|---|---|
| 3 | 0 | 0 | 3 |

**Pre-requisite: 1.**

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

| | |
|---|---|
| ESC 101.1 | Apply the concepts of KVL/KCL and network theorems in solving DC circuits. |
| ESC 101.2 | Analyze the steady state behavior of single phase and three phase AC electrical circuits. |
| ESC 101.3 | Identify the application areas of a single phase two winding transformer as well as an auto transformer and calculate their efficiency. Also identify the connections of a three phase transformer. |
| ESC 101.4 | Illustrate the working principles of induction motor, synchronous machine as well as DC machine and employ them in different area of applications. |
| ESC 101.5 | Describe the components of low voltage electrical installations and perform elementary calculations for energy consumption. |

**Mapping of course outcomes with program outcomes**

| CO | PO1: Engineering knowledge | PO2 Problem analysis | PO3:Design/development of solutions | PO4:Conduct investigations of complex problems | PO5:Modern tool usage | PO6: The engineer and society | PO7:Environment and sustainability | PO8:Ethics | PO9:Individual and team work | PO10:Communication | PO11:Project management and finance | PO12:Life-long learning |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| ESC 101.1 | 3 | 3 | 1 | 2 | - | - | - | - | - | 1 | - | 1 |
| ESC 101.2 | 3 | 3 | 1 | - | - | - | - | - | - | - | - | 2 |
| ESC 101.3 | 3 | 3 | 2 | 3 | 3 | - | - | - | 1 | 1 | - | 2 |
| ESC 101.4 | 3 | 2 | - | - | - | - | - | - | 1 | 1 | - | 2 |
| ESC 101.5 | 3 | 2 | 1 | - | - | - | - | - | 1 | 1 | - | 2 |

**Unit-I: DC Circuits**

1.1 Electrical circuit elements (R, L and C),
1.2 Concept of active and passive elements, voltage and current sources,
1.3 Concept of linearity and linear network, unilateral and bilateral elements,
1.4 Kirchhoff's laws,
1.5 Loop and nodal methods of analysis,
1.6 Star-delta transformation,
1.7 Superposition theorem, Thevenin theorem, Norton theorem.

**Unit-II: Steady- State Analysis of Single Phase AC Circuits**

2.1 Representation of Sinusoidal waveforms – Average and effective values, Form and peak factors,
2.2 Concept of phasors, phasor representation of sinusoidally varying voltage and current.
2.3 Analysis of single phase AC Circuits consisting of R, L, C, RL, RC, RLC combinations (Series and Parallel),
2.4 Apparent, active & reactive power,
2.5 Power factor, Power factor improvement.
2.6 Concept of Resonance in series & parallel circuits, bandwidth and quality factor.
2.7 Three phase balanced circuits, voltage and current relations in star and delta connections.

**Unit-III: Transformers**

3.1 Magnetic materials,
3.2 BH characteristics,
3.3 Ideal and Practical Transformer,
3.4 Equivalent Circuit,
3.5 Losses in Transformers,
3.6 Regulation and Efficiency.
3.7 Auto-Transformer and Three-Phase Transformer Connections.

**Unit-IV: Electrical Machines**

**DC machines:**

4.1 Principle & Construction, Types,
4.2 EMF equation of generator and torque equation of motor,
4.3 Applications of DC motors (simple numerical problems)

**Three Phase Induction Motor:**

4.4 Principle & Construction, Types,
4.5 Slip-torque characteristics,
4.6 Applications (Numerical problems related to slip only)

**Single Phase Induction motor:**

4.7 Principle of Operation and Introduction to Methods of Starting,

4.8 Applications.

**Three Phase Synchronous Machines:**

4.9 Principle of operation of alternator and synchronous motor and

4.10 Their applications.

**Unit-V: Electrical Installations**

5.1 Components of LT Switchgear: Switch Fuse Unit (SFU), MCB, ELCB, MCCB,

5.2 Types of Wires and Cables,

5.3 Importance of earthing.

5.4 Types of Batteries, Important characteristics for Batteries.

5.5 Elementary calculations for energy consumption and savings, battery backup.

**Text/Reference Books:**

1. Ritu Sahdev, "Basic Electrical Engineering", Khanna Publishing House.
2. S. Singh, P.V. Prasad, "Electrical Engineering: Concepts and Applications" Cengage.
3. D. P. Kothari and I. J. Nagrath, "Basic Electrical Engineering", Tata McGraw Hill.
4. D. C. Kulshreshtha, "Basic Electrical Engineering", McGraw Hill.
5. E. Hughes, "Electrical and Electronics Technology", Pearson, 2010.
6. L. S. Bobrow, "Fundamentals of Electrical Engineering", Oxford University Press.
7. V. D. Toro, "Electrical Engineering Fundamentals", Pearson India.

# Rama University Uttar Pradesh, Kanpur

(vide U.P. Act No. 1 of 2014 as passed by State Legislature and recognized by UGC U/s 2(f))

**Faculty of Engineering &Technology,**

**B.Tech. Civil Engineering**

**Course Curriculum (effective from Session 2021-22)**

## HSC-101: Communication Skills-I

| L | T | P | Credit |
|---|---|---|---|
| 2 | 0 | 0 | 2 |

**Pre-requisite: Basic Knowledge of Grammar & Composition**

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

| | |
|---|---|
| **HSC-101.1** | **(Remember)**To frame correct sentences with illustrations |
| **HSC-101.2** | **(Understand)**To comprehend the language correctly |
| **HSC-101.3** | **(Apply)**To develop listening and writing skills |
| **HSC-101.4** | **(Analyze)**To inculcate descriptive and explanatory skills |
| **HSC-101.5** | **(Evaluate and create)** To Communicate effectively in English with appropriate body language making use of correct and appropriate vocabulary and grammar in an organized context |

**Mapping of course outcomes with program outcomes**

| CO | PO1: Engineering knowledge | PO2 Problem analysis | PO3:Design/development of solutions | PO4:Conduct investigations of complex problems | PO5:Modern tool usage | PO6: The engineer and society | PO7:Environment and sustainability | PO8:Ethics | PO9:Individual and team work | PO10:Communication | PO11:Project management and finance | PO12:Life-long learning |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **HSC-101.1** | 2 | 2 | 2 | - | - | 2 | - | - | 2 | 2 | - | 2 |
| **HSC-101.2** | 1 | 2 | 2 | - | - | 2 | - | - | 2 | 2 | - | 2 |
| **HSC-101.3** | 3 | 2 | 2 | - | - | 2 | - | - | 2 | 2 | - | 2 |
| **HSC-101.4** | 3 | 2 | 2 | - | - | 2 | - | - | 2 | 2 | - | 2 |
| **HSC-101.5** | 3 | 2 | 2 | - | - | 2 | - | - | 2 | 2 | - | 2 |

**Unit-I: Essentials of Grammar & Composition- Syntax**

1.1 Words formation and parts of speech
1.2 Usage of foreign words, idioms and phrases in correspondence
1.3 Vocabulary including antonyms,synonyms, homophones and common prefixes and suffixes
1.4 Subject-verb agreement, punctuation and error detection

**Unit-II: Reading and Comprehension**

2.1 Employing different reading skills,
2.2 Comprehension passage – Understanding the author's point of View
2.3 The art of condensation- Summarization, paraphrasing, précis and abstract writing
2.4 Reading short stories(Rabindranath Tagore, MunsiPremchand, Mulk Raj Anand and James Joyce)
2.5 Writing business letters and reports

**Unit-III: Communication- concept, styles and its types**

3.1 Process and principles of effective business communication
3.2 Types of Communication-(Verbal Communication, Non-verbal Communication, Interpersonal Communication, Extra personal Communication, Intrapersonal Communication, Mass Communication and Media Communication etc.
3.3 Barriers to communication
3.4 Remedies to overcome from the barriers of Communication

**Unit-IV: Listening and Speaking**

4.1 Listening vs. hearing and poor listening vs. effective listening
4.2 Advantages of good listening
4.3 Five steps to active listening
4.4 Conduction of job interviews and meetings
4.5 Public Speaking

**Text/Reference Books:**

1. Remedial English Grammar. F.T. Wood. Macmillan.2007
2. Communication Skills. Sanjay Kumar and Pushp-Lata. Oxford University Press. 2011.
3. Oxford Guide to Effective Writing and Speaking. John Seely. Oxford University Press, 2013.
4. English for Engineers. NP Sudharshana, C. Savitha.CUP.2018
5. Dubliners (Modern Classics), James Joyce, Penguin, 2000.
6. The Home-Coming, Rabindranath Tagore, CI Publisher, 2014.

7. The Lost Child and Other Stories, Mulk Raj Anand, Orient, 2004. Optional Materials:
8. English Vocabulary in Use (Intermediate) Michael McCarthy & Felicity O'Dell, 2002.
9. A Comprehensive Grammar of the English Language.R.Quirk, Pearson Education India, 2010

## HSC-151: Communication Skills Lab

| L | T | P | Credit |
|---|---|---|---|
| 0 | 0 | 2 | 1 |

**Pre requisite: 1.**

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

| | |
|---|---|
| HSC 151.1 | **(Remember)**To frame correct sentences with illustrations |
| HSC 151.2 | **(Understand)**To comprehend the language correctly |
| HSC 151.3 | **(Apply)**To develop listening and writing skills |
| HSC 151.4 | **(Analyze)**To inculcate descriptive and explanatory skills |
| HSC 151.5 | **(Evaluate and create)** To Communicate effectively in English with appropriate body language making use of correct and appropriate vocabulary and grammar in an organized context |

**Mapping of course outcomes with program outcomes**

| CO | PO1: Engineering knowledge | PO2 Problem analysis | PO3:Design/development of solutions | PO4:Conduct investigations of complex problems | PO5:Modern tool usage | PO6: The engineer and society | PO7:Environment and sustainability | PO8:Ethics | PO9:Individual and team work | PO10:Communication | PO11:Project management and finance | PO12:Life-long learning |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| HSC 151.1 | 2 | 1 | - | 2 | - | 2 | - | - | 3 | 3 | - | 2 |
| HSC 151.2 | 1 | 1 | - | 1 | 2 | 2 | - | - | 3 | 3 | - | 2 |
| HSC 151.3 | 3 | 2 | - | 1 | 3 | 2 | - | - | 3 | 3 | - | 2 |
| HSC 151.4 | 3 | 1 | - | 1 | 3 | 2 | - | - | 1 | 3 | - | 2 |
| HSC 151.5 | 3 | 1 | - | 1 | 3 | 2 | - | - | 1 | 3 | - | 2 |

**List of Practicals:**

1. Group Discussion, Conversations and dialogue- Practical based on relevant Grammatical Patterns.
2. Practice of Communication Skills for Seminars/Conferences/Workshops with emphasis on Paralinguistic /Kinesics.
3. Presentation Skills for Technical Paper/Project Reports/ Professional Reports based on proper Stress and Intonation Mechanics
4. Public Speaking practice by conducting elocution, extempore, debate and speech competition
5. Theme Presentation/ Keynote Presentation based on correct methodologies
6. Individual Speech Delivery/Conferencing with skills to defend Interjections/Quizzes
7. Argumentative Skills/Role Play Presentation with Stress and Intonation.
8. Comprehension Skills based on Reading and Listening Practical's on a model Audio

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**Faculty of Engineering & Technology,**

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**Course Curriculum (effective from Session 2021-22)**

## ESC-151: Engineering Workshop

| L | T | P | Credit |
|---|---|---|---|
| 0 | 0 | 2 | 1 |

**Pre-requisite: 1.**

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

| | |
|---|---|
| ESC-151.1 | Understand (II) different tools & operations for work shop practice |
| ESC-151.2 | Produce (III) Carpentry joints ,Fitting jobs, sheet metal jobs, black smithy jobs, welding and machine jobs. |

**Mapping of course outcomes with program outcomes**

| CO | PO1: Engineering knowledge | PO2 Problem analysis | PO3:Design/development of solutions | PO4:Conduct investigations of complex problems | PO5:Modern tool usage | PO6: The engineer and society | PO7:Environment and sustainability | PO8:Ethics | PO9:Individual and team work | PO10:Communication | PO11:Project management and finance | PO12:Life-long learning |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| ESC-151.1 | 2 | | | | | 2 | | | 2 | 2 | | 2 |
| ESC-151.2 | 2 | | | | | 2 | | | 2 | 2 | | 2 |

**List of Experiments:**

1. **Introduction to Mechanical workshop material, tools and machines**
   To study layout, safety measures and different engineering materials (mild
   Steel, medium carbon steel, high carbon steel, high speed steel and cast iron etc) used in workshop.
   To study and use of different types of tools, equipments, devices & machines
   Used in fitting, sheet metal and welding section.
   To determine the least count of vernier caliper, vernier height gauge, micrometer (Screw gauge) and take different reading over given metallic pieces using these instruments.
2. **Machine shop**
   Demonstration of working, construction and accessories for Lathe machine

Perform operations on Lathe - Facing, Plane Turning, step turning, taper turning, threading, knurling and parting.

**3, Fitting shop**

Practice marking operations.

Preparation of U or V -Shape Male Female Work piece which contains: Filing, Sawing, Drilling,Grinding.

**4. Carpentry Shop**

Study of Carpentry Tools, Equipment and different joints.

Making of Cross Half lap joint, Half lap Dovetail joint and Mortise Tenon Joint

**5. Welding Shop**

Introduction to BI standards and reading of welding drawings.

**Text/Reference Books:**

1. Colvin, F. H. and Haas, L. L., Jigs and Fixtures – A Reference Book, McGraw Hill (1938).
2. Joshi, P. H., Jigs and Fixtures, McGraw Hill (1988).
3. Basu, Mukherjee, Mishra, Fundamentals of Tool Engg. Design, Oxford & IBH Publishing (1996).
4. Pandey and Shan, Modern Machining Processes, McGraw Hill..

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**Course Curriculum (effective from Session 2021-22)**

## ESC-152: Engineering Graphics & Design Lab

| L | T | P | Credit |
|---|---|---|---|
| 0 | 0 | 2 | 1 |

**Pre-requisite: 1.**

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

| | |
|---|---|
| **ESC 152.1** | Understanding of the visual aspects of engineering design |
| **ESC 152.2** | Understanding of engineering graphics standard. |
| **ESC 152.3** | Applying modern engineering tool for engineering drawing |
| **ESC 152.4** | Appling computer-aided geometry drawing |
| **ESC 152.5** | At Analysis of Isometric views |

**Mapping of course outcomes with program outcomes**

| CO | PO1: Engineering knowledge | PO2 Problem analysis | PO3:Design/development of solutions | PO4:Conduct investigations of complex problems | PO5:Modern tool usage | PO6: The engineer and society | PO7:Environment and sustainability | PO8:Ethics | PO9:Individual and team work | PO10:Communication | PO11:Project management and finance | PO12:Life-long learning |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **ESC 152.1** | 2 | 1 | 1 | 1 | 1 | - | - | - | - | | - | |
| **ESC 152.2** | 1 | 1 | 1 | - | 1 | 1 | - | - | - | | - | |
| **ESC 152.3** | 1 | 2 | 1 | 2 | 1 | 1 | - | - | - | | - | |
| **ESC 152.4** | 2 | 2 | 2 | 1 | 2 | 1 | - | - | - | - | 1 | |
| **ESC 152.5** | 2 | 3 | 1 | 2 | 2 | 1 | - | - | 1 | - | 1 | 2 |

**Unit-I:**
1.1 Introduction to Drawing.
1.2 Principles of Engineering.
1.3 Graphics and their significance,
1.4 Usage of drawing instruments, lettering, Scales.
1.5 Plain and Diagonal Scales, Orthographic projections.
1.6 Conventions – Projections of Points.

**Unit-II:**
2.1 Projections and Sections of Regular Solids.
2.2 Sections in lined to both the Planes .
2.3 Auxiliary Views; Simple annotation, dimensioning and scale.
2.3 Floor plans they include: windows, doors.
2.4 Development of surfaces of Right Regular Solids.
2.5 Cylinder and Cone.

**Unit-III:**
3.1 Computer Graphics.
3.2 Drawing Area (Background, Crosshairs, Coordinate System), Dialog boxes.
3.3 The Command Line (where applicable), The Status Bar.
3.4 Isometric Views of lines.
3.5 Simple and compound Solid, Set up of the drawing page.
3.6 ISO and ANSI standards for coordinate dimensioning.
3.7 Orthographic constraints.

**Unit-IV:**
4.1 Demonstration of a simple team design project Geometry.
4.2 Project Geometry and topology of engineered components
4.3 Engineering models and their presentation in standard 2D blueprint form and as 3D wire-frame.
4.4 Geometric dimensioning and tolerancing.
4.5 Use of solid-modelling software for creating associative models at the component.
4.6 Applying colour coding according to building drawing practice.

**Unit-V:**
5.1 Isometric Projections: Principles of Isometric projection.
5.2 Isometric Scale, Isometric Views, Conventions.

5.3 Views of lines, Planes Simple and compound Solids.
5.4 Conversion of Isometric.
5.5 Isometric Views to Orthographic Views and Vice- versa, Conversions.

**Text/Reference Books:**

1. Bhatt N.D., Paschal V.M. & Ingle P.R. (2014), Engineering Drawing, Charotar Publishing House.
2. Shah, M.B. & Rana B.C. (2008), Engineering Drawing and Computer Graphics, Pearson Education
3. Agrawal B. & Agrawal C.M. (2012), Engineering Graphics, McGraw Publication

# Rama University Uttar Pradesh, Kanpur

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## Faculty of Engineering &Technology,

**B.Tech. Civil Engineering**

**Course Curriculum (effective from Session 2021-22)**

**SEMESTER-II (FIRST YEAR)**

## BSC-201: Engineering Chemistry

| L | T | P | Credit |
|---|---|---|---|
| 3 | 0 | 0 | 3 |

**Pre-requisite: 1. Intermediate passed**

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

| | |
|---|---|
| BSC-201.1 | *Understand [II]* the concepts in molecular interactions and nanomaterials |
| BSC-201.2 | *Understand [II]* the synthesis and applications of polymer science. *Identify [II], apply [III] and analyze [IV]* the structure of organic molecules using chemical spectroscopy |
| BSC-201.3 | *Understand [II]* and *apply [III]* the concepts and mechanism of organic chemistry for synthesis |
| BSC-201.4 | *Understand [II], apply [III]* and *analyze [IV]* the quality of water and fuels |
| BSC-201.5 | *Understand [II]* and *apply [III]* the concepts of chemical kinetics, electrochemistry |

**Mapping of course outcomes with program outcomes**

| CO | PO1: Engineering knowledge | PO2 Problem analysis | PO3:Design/development of solutions | PO4:Conduct investigations of complex problems | PO5:Modern tool usage | PO6: The engineer and society | PO7:Environment and sustainability | PO8:Ethics | PO9:Individual and team work | PO10:Communication | PO11:Project management and finance | PO12:Life-long learning |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| BSC-201.1 | 2 | 2 | 1 | 2 | - | - | - | - | - | - | - | 2 |
| BSC-201.2 | 2 | 3 | 2 | 3 | 2 | - | - | - | - | - | - | 2 |
| BSC-201.3 | 2 | 2 | 2 | 2 | 1 | - | - | - | - | - | - | 2 |
| BSC-201.4 | 3 | 3 | 2 | 3 | 1 | 2 | - | - | - | - | - | 2 |
| BSC-201.5 | 3 | 3 | 2 | 3 | 1 | 2 | - | - | - | - | - | 2 |

**Unit-I: Atomic and Molecular Structure**

1.1 Molecular orbital theory and its applications in diatomic molecules.
1.2 Band theory of solids.
1.3 Liquid crystal and its applications.
1.4 Point defects in solids.
1.5 Structure and applications of Graphite and Fullerenes.
1.6 Concepts of Nanomaterials and its application.

**Unit-II: Polymer, Spectroscopic techniques and Applications**

2.1 Polymerization and its classification.
2.2 Basic concepts of polymer-Blend and composites.
2.3 Conducting and biodegradable polymers.
2.4 Preparation and application of some industrially important polymers (Polyethylene, Teflon, PVC, Nylon, Phenol formaldehyde & Urea Formaldehyde).
2.5 General methods of synthesis of organ-o-metallic compounds (Grignard reagent) and their applications.
2.6 Elementary idea and simple applications of Rotational, Vibration, Ultraviolet & Visible, $^1$HNMR and Raman spectroscopy.

**Unit-III: Stereochemistry and Organic Reactions**

3.1 Stereochemistry with special reference to chirality,
3.2 E - Z and R - S nomenclature.
3.3 Reaction intermediate (carbocations, carbanions and free radicals).
3.4 Types of organic reactions with special reference of nucleophilic substitution reaction.
3.5 Mechanism of Name reactions:
(a) Aldol condensation
(b) Cannizzaro reaction
(c) Beckmann rearrangement
(d) Hofmann rearrangement and
(e) Diels-Alder reaction.

**Unit-IV: Water Analysis and Fuels**

4.1 Standards for drinking water.
4.2 Municipality waste water treatment.
4.3 Hardness of water.
4.4 Disadvantage of hard water.
4.5 Techniques for water softening; Zeolite, Lime-Soda, Ion exchange resin, Reverse osmosis.
4.6 Fuels; Classification of fuels.

4.7 Analysis of Coal.
4.8 Determination of Calorific values (Bomb calorimeter and Dulong's method)

**Unit-V: Chemical Kinetics, Corrosion, Phase rule**

5.1 Rate, order and molecularity of reaction,
5.2 Integrated rate equation of zero order, first order and second order reactions.
5.3 Activation energy.
5.4 Galvanic cell.
5.5 Corrosion: Electrochemical theory of corrosion and its protection.
5.6 Phase Rule and its application to one component system (water and sulfur).

**Text/Reference Books:**

1. University Chemistry. Bruce M. Mahan, Rollie J Meyers. 4th Edition.
2. University General Chemistry An Introduction To Chemical Science. C.N.R. Rao. Macmillan India Limited. 1st Edition.
3. Organic Chemistry. I.L. Finar. Pearson Education. 6th Edition.
4. Textbook of Physical Chemistry. Samuel Glasstone. D. Van Nostrand Company, Inc.
5. Textbook of Polymer Science. Fred W. Billmeyer. John Wiley & Sons Inc. 3rd Edition.
6. Comprehensive Engineering Chemistry. Dr. Sunita Rattan. S.K. Kataria and Sons. 3rd Edition.
7. Engineering Chemistry. R. K. Agrawal. Krishna Prakashan Media (P) Ltd. 16th Edition.

# Rama University Uttar Pradesh, Kanpur

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**Faculty of Engineering &Technology,**

**B.Tech. Civil Engineering**

**Course Curriculum (effective from Session 2021-22)**

## BSC-251: Engineering Chemistry Lab

| L | T | P | Credit |
|---|---|---|---|
| 0 | 0 | 4 | 2 |

**Pre-requisite: 1. Intermediate**

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

| | |
|---|---|
| BSC-251.1 | Standardize solutions using titrations and understand basic working of pH meter and UV-Visible spectrophotometer |
| BSC-251.2 | Analyze ores and bleaching powder |
| BSC-251.3 | Estimate the Hardness of water in terms of Calcium and Magnesium ions |
| BSC-251.4 | Determine the solubility, surface tension and viscosity of solutions |
| BSC-201.5 | Identify the elements and functional groups present in organic compounds |
| BSC-251.6 | Estimate the rate constant of reaction |

**Mapping of course outcomes with program outcomes**

| CO | PO1: Engineering knowledge | PO2 Problem analysis | PO3:Design/development of solutions | PO4:Conduct investigations of complex problems | PO5:Modern tool usage | PO6: The engineer and society | PO7:Environment and sustainability | PO8:Ethics | PO9:Individual and team work | PO10:Communication | PO11:Project management and finance | PO12:Life-long learning |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| BSC-251.1 | 3 | 3 | 2 | 2 | 3 | 2 | - | - | 1 | - | - | 2 |
| BSC-251.2 | 3 | 2 | 2 | 2 | - | 1 | - | - | - | - | - | 1 |
| BSC-251.3 | 3 | 3 | 2 | 2 | - | 3 | 1 | - | 1 | - | - | 2 |
| BSC-251.4 | 3 | 3 | 2 | 2 | 1 | 2 | - | - | - | - | - | 2 |
| BSC-201.5 | 3 | 2 | 2 | 2 | - | 1 | - | - | - | - | - | 1 |
| BSC-251.6 | 3 | 3 | 2 | 2 | - | 1 | - | - | - | - | - | 1 |

**List of Experiments (any ten experiments):**

1. Determination of alkalinity in the given water sample.
2. Determination of Temporary and Permanent hardness in water sample using EDTA as standard solution.
3. Determination of available chlorine in bleaching powder.
4. Determination of chloride content in the given water sample by Mohr's method.
5. Determination of Iron content in the given Iron ore sample by using $[K_3Fe(CN)_6]$ as an external indicator.
6. Determination of solubility of salt (NaCl) at room temperature.
7. Determine the viscosity of a given solution.
8. Element detection and Functional group identification in organic compounds.
9. Preparation of Bakelite& Urea Formaldehyde resin.
10. Verification of Beer's law.
11. Determination of surface tension of given liquid.
12. Determination of rate constant of hydrolysis of esters.

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## BSC-202: Engineering Mathematics-II

| L | T | P | Credit |
|---|---|---|---|
| 3 | 0 | 0 | 3 |

**Pre-requisite: 1.** Intermediate Mathematics

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

| | |
|---|---|
| BSC-202.1 | ***calculate [III]***Demonstrate solutions to first order differential equations by various methods and.***identify [III]***identify, analyze and subsequently solve physical situations whose behavior can be described by ordinary differential equations ***construct [III]*** structure and procedure of solving a higher order differential equations with constant coefficients and variable coefficients***Analyze: II]compute [III]***apply for solving differential equations. |
| BSC-202.2 | ***Knowledge and Understanding [II]*** Learn the theory of Riemann-Stieltjes integrals, to be aquainted with the ideas of the total variation and to be able to deal with functions of bounded variation. ***Analyze [IV]***Intellectual Skills Develop a reasoned argument in handling problems about functions, especially those that are of bounded variation |
| BSC-202.3 | ***Understand [II]***Understand Laplace transforms and its properties and finding the solution of ordinary differential equations, ***Apply[III]*** Apply the Laplace and inverse Laplace transformations for different types of functions ***Analyze [IV]***enhance and develop the ability of using the language of mathematics in analyzing the real-world problems of sciences and engineering. |
| BSC-202.4 | ***knowledge[I]***knowledge in Fourier transforms. ***Perform [III]***evaluating Fourier series., |
| BSC-202.5 | ***Analyze [IV]*** apply the concepts in solving physical problems arising in engineering***Apply[III]*** apply partial derivative equation techniques to predict the behaviour of certain phenomena |

## Mapping of course outcomes with program outcomes

| CO | PO1: Engineering knowledge | PO2 Problem analysis | PO3:Design/development of solutions | PO4:Conduct investigations of complex problems | PO5:Modern tool usage | PO6: The engineer and society | PO7:Environment and sustainability | PO8:Ethics | PO9:Individual and team work | PO10:Communication | PO11:Project management and finance | PO12:Life-long learning |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| BSC-202.1 | 3 | 2 | 2 | 1 | 1 | 1 | - | - | - | - | 2 | 2 |
| BSC-202.2 | 3 | 2 | 1 | - | 2 | - | - | - | - | - | - | 1 |
| BSC-202.3 | 3 | 2 | 2 | 1 | 1 | - | - | - | - | - | - | 2 |
| BSC-202.4 | 3 | 2 | 1 | 1 | 1 | - | - | - | - | - | 1 | 1 |
| BSC-202.5 | 3 | 2 | 1 | 2 | 1 | - | - | - | - | - | 1 | 1 |

**Unit-I: Differential Equations:**

1.1 Linear differential equations of nth order with constant coefficients
1.2 Complementary function
1.3 Particular integral
1.4 Simultaneous linear differential equations
1.5 Solution of second order differential equations by changing dependent & independent variables
1.6 Method of variation of parameters
1.7 Applications to engineering problems (without derivation)

**Unit-II: Sequences of Functions :**

2.1 Pointwise convergence
2.2 Uniform Convergence
2.2 Uniform convergence and boundedness
2.3 Uniform convergence and continuity
2.4 Uniform convergence and Riemann integration
2.5 Uniform convergence and differentiation
2.6 Subsequences and the Bolzano-Weiertrass Theorem (without proof)
2.7 Cauchy's Convergence Criterion

**Unit-III: Laplace Transform:**

3.1 Existence theorem
3.2 Laplace transform of derivatives and integrals
3.3 Laplace transform of periodic functions
3.4 Unit step function
3.5 Inverse Laplace transform
3.6 Convolution theorem
3.7 Applications to solve simple linear and simultaneous differential equations.

**Unit-III: Fourier Series**

4.1 Periodic functions
4.2 trigonometric series
4.3 Fourier series of period 2 π
4.4 Euler's formulae, functions having arbitrary period
4.5 change of interval
4.6 Even and odd functions
4.7 Half range sine and cosine series

**Unit-V: Partial Differential Equations :**

5.1 Introduction of partial differential equations
5.2 Formation of PDE
5.3 Genesis of first order PDEs.
5.4 Method of separation of variables for solving first order PDEs
5.5 Cauchy's problem for first order PDEs.
5.6 Second order PDEs with constant coefficients
5.7 Simple techniques to solve second order PDEs with variable coefficients

**Text/Reference Books:**

1. E. Kreyszig :Advanced Engineering Mathematics-Volume-I,JohnWiley& Sons.
2. B. V. Ramana, Higher Engineering Mathematics, Tata McGraw- Hill Publishing Company Ltd.
3. R.K.Jain& S.R.K. Iyenger, Advance Engineering Mathematics, Narosa Publishing House.
4. Peter V. O' Neil, Advanced Engineering Mathematics, Thomas ( Cengage) Learning.
5. Thomas & Finley, Calculus, Narosa Publishing House
6. Rukmangadachari, Engineering Mathematics – I, Pearson Education

7. S.C. Malik and Savita Arora, Mathematical Analysis, New Age International (P) Ltd. Publishers.
8. S.K. Mapa, Introduction to Real Analysis, Sarat Book Distributors.
9. R.R. Goldberg, Method of Real analysis, Oxford and IBH Publishing Co.
10. D. Soma Sundaram and B. Choudhury, A first Course in Mathematical Analysis, Norosa Publishing House

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## ESC-202: Engineering Thermodynamics

| L | T | P | Credit |
|---|---|---|---|
| 3 | 0 | 0 | 3 |

**Pre-requisite: NA**

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

| | |
|---|---|
| ESC-202.1 | ***calculate [III]*** Apply various laws of thermodynamics to various processes and real systems. |
| ESC-202.2 | ***calculate [III]*** Apply the concept of Entropy, Calculate heat, work and other important thermodynamic properties. |
| ESC-202.3 | ***find [III]*** Estimate performance of various Thermodynamic gas power cycles |

**Mapping of course outcomes with program outcomes**

| CO | PO1: Engineering knowledge | PO2 Problem analysis | PO3:Design/development of solutions | PO4:Conduct investigations of complex problems | PO5:Modern tool usage | PO6: The engineer and society | PO7:Environment and sustainability | PO8:Ethics | PO9:Individual and team work | PO10:Communication | PO11:Project management and finance | PO12:Life-long learning |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| ESC-202.1 | 3 | 2 | 2 | 1 | - | - | - | | | | | |
| ESC-202.2 | 3 | 2 | 2 | 1 | - | - | - | | | | | |
| ESC-202.3 | 2 | 1 | 2 | 1 | - | - | - | | | | | |

**Unit-1: Fundamental Concepts and Definitions:**

1.1 Introduction and definition of thermodynamics,

1.2 Systems, surroundings and universe,

1.3 Microscopic and Macroscopic approaches,

1.4 Concept of continuum, Control system boundary,

1.5 Properties and state, Thermodynamic properties,

1.6 Thermodynamic path, process and cycle, Thermodynamic equilibrium,

1.7 Reversibility and irreversibility, Quasi static process
1.8 Energy and its forms, Work and heat
1.9 Gas laws, Ideal gas, Real gas, Law of corresponding states,
1.10 Property of mixture of gases
1.11 Zeroth law of thermodynamics,
1.12 Temperature and its' measurement, Temperature scales

**Unit-II: First law of Thermodynamics:**

2.1 Thermodynamic definition of work,
2.2 Thermodynamic processes,
2.3 Calculation of work in various processes and sign convention
2.4 Non-flow work and flow work
2.5 Joules' experiment, First law of thermodynamics
2.6 Internal energy and enthalpy, First law of thermodynamics applied to open systems
2.7 Steady flow systems and their analysis,
2.8 Steady flow energy equation, Boilers, Condensers, Turbine, Throttling process, Pumps etc
2.9 First law analysis for closed system (non flow processes),
2.10 Analysis of unsteady processes such as filling and evacuation of vessels with and without heat transfer
2.11 Limitations of first law of thermodynamics, PMM-I.

**Unit-III: Second law**

3.1 Devices converting heat to work
3.2 Thermal reservoir, Heat engines, Efficiency
3.3 Devices converting work to heat, Heat pump, refrigerator, Coefficient of Performance
3.4 Reversed heat engine,
3.5 Kelvin Planck statement of second law of thermodynamics
3.6 Clausius statement of second law of thermodynamics
3.7 Equivalence of two statements of second law of thermodynamics
3.8 Reversible and irreversible processes, Carnot cycle and Carnot engine
3.9 Carnot theorem and it's corollaries, thermodynamic temperature scale, PMM-II.

**Unit-IV: Entropy, Availability and Irreversibility**

4.1 Clausius inequality

4.2 Concept of Entropy,
4.3 Entropy change in different thermodynamic processes
4.4 Tds equation, Principle of entropy increase
4.5 T-S diagram, Statement of the third law of thermodynamics.
4.6 Available and unavailable energy
4.7 Availability and Irreversibility,
4.8 Second law efficiency, Helmholtz & Gibb's function.

**Unit-V: Properties of Steam and Thermodynamics Cycles**

5.1 Pure substance, Property of steam
5.2 Triple point, Critical point, Sub-cooled liquid
5.3 Saturation states, Superheated states, Phase transformation process of water
5.4 Graphical representation of pressure, volume and temperature, P-T & P-V diagrams
5.5 T-S and H-S diagrams, use of property diagram, Steam-Tables &Mollier charts
5.6 Dryness factor and it's measurement,
5.7 processes involving steam in closed and open systems
5.8 Simple Rankine cycle

**Text/ Reference Books:**

1. Engineering Thermodynamics by Jones and Dugans, PHI Learning Pvt. Ltd.
2. Fundamentals of Thermodynamics by Sonntag, Wiley India Pvt. Ltd.
3. Engineering Thermodynamics by Onkar Singh, New Age International Pub
4. Thermodynamics by J.P. Holman, McGraw Hill.
5. Engineering Thermodynamics by P.K.Nag, Tata McGraw Hill Pub.

# Rama University Uttar Pradesh, Kanpur

(vide U.P. Act No. 1 of 2014 as passed by State Legislature and recognized by UGC U/s 2(f))

## Faculty of Engineering & Technology,

**B.Tech. Civil Engineering**

**Course Curriculum (effective from Session 2021-22)**

## ESC-203: Engineering Geology

| L | T | P | Credit |
|---|---|---|---|
| 3 | 0 | 0 | 3 |

**Pre-requisite: NA**

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

| | |
|---|---|
| **ESC-203.1** | Understand weathering process and mass movement. |
| **ESC-203.2** | Distinguish geological formations |
| **ESC-203.3** | Identify geological structures and processes for rock mass quality |
| **ESC-203.4** | Identify subsurface information and groundwater potential sites through geophysical investigations |
| **ESC-203.5** | Apply geological principles for mitigation of natural hazards and select sites for dams and tunnels |

**Mapping of course outcomes with program outcomes**

| CO | PO1: Engineering knowledge | PO2 Problem analysis | PO3:Design/development of solutions | PO4:Conduct investigations of complex problems | PO5:Modern tool usage | PO6: The engineer and society | PO7:Environment and sustainability | PO8:Ethics | PO9:Individual and team work | PO10:Communication | PO11:Project management and finance | PO12:Life-long learning |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **ESC-203.1** | 3 | 2 | 3 | | 3 | 1 | | 2 | 1 | | 3 | |
| **ESC-203.2** | 3 | 2 | 3 | | 3 | 2 | | 2 | 1 | | 3 | |
| **ESC-203.3** | 3 | 2 | 3 | | 3 | 3 | | 2 | 1 | | 3 | |
| **ESC-203.4** | 3 | 2 | 3 | | 3 | 3 | | 2 | 1 | | 3 | |
| **ESC-203.5** | 3 | 2 | 3 | | 3 | 2 | | 2 | 1 | | 3 | |

**Unit-I: Introduction:**

1.1 Branches of geology useful to civil engineering

1.2 scope of geological studies in various civil engineering projects

1.3 Physical properties of minerals

1.4 susceptibility of minerals to alteration
1.5 Rock forming minerals
1.6 Mega-scopic identification of common primary and secondary minerals.

**Unit-II: Physical Geology**
2.1 Weathering, Erosion and Denudation
2.2 Factors affecting weathering
2.3 Engineering consideration
2.4 Geological work natural agencies like wind, river, glacier, underground water.

**Unit-III: Petrology-Rock forming processes:**
**Igneous Rocks**
3.1 Volcanic Phenomenon and different materials ejected by volcanoes. Characteristics of different types of magma
3.2 Division of rock on the basis of depth of formation, and their characteristics.
3.3 Chemical and Mineralogical Composition.Texture and its types. Structures.
3.4 Classification of Igneous rocks.
3.5 Detailed study of Acidic Igneous rocks like Granite, Rhyolite or Tuff, Pegmatite. Engineering aspect to granite.
3.6 Basic Igneous rocks Like Gabbro, Dolerite,
3.7 Basalt. Engineering aspect to Basalt.

**Sedimentary Rocks**
3.8 Mode of formation, Mineralogical Composition.Texture and its types. Structures
3.9 Gradation of Clastic rocks. Classification of sedimentary rocks and their characteristics.
3.10 Detailed study of Conglomerate, Breccia, Sandstone, Mudstone and Shale, Limestone.

**Metamorphic Rocks**
3.11 Agents and types of metamorphism, metamorphic grades
3.12 Mineralogical composition, structures and textures in metamorphic rocks
3.13 Important Distinguishing features of rocks as Rock cleavage, Schistosity, Foliation, Classification..
3.14 Detailed study of Gneiss, Schist, Slate with engineering consideration.

**Unit-IV:**
4.1 Concept of Rock Deformation and Tectonics, Dip and Strike

4.2 Fold- Types and nomenclature, Criteria for their recognition in field.
4.3 Faults: Classification, recognition in field, effects on outcrops
4.4 Joints and Unconformity
4.5 Importance of structural elements in engineering operations

**Unit-V:** Geological Consideration for Site of
5.1 Dam,
5.2 Tunnel,
5.3 Reservoir And
5.4 Bridge

**Text/ Reference Books:**

1. Tony Waltham : Fundamentals of Engineering Geology ,SPON Press
2. J.M. Treteth : Geology of Engineers, Princeton, Von. Nostrand.
3. K V G K Gokhale , Text Book of Engineering Geology , B S Publication
4. Prabin Singh : Engineering and General Geology, Katson Publishing House.
5. Blyth F.G.M. : A Geology for Engineers, Arnold, London.
6. D.S. Arora : Geology for Engineers, Mohindra Capital Publishers, Chandigarh.
7. F G Bell : Funamentals of Engineering Geology , B S Publication
8. Leggot, R.F. : Geology and Engineering, McGraw Hill, New York.
9. P.K. Mukerjee : A text Book of Geology, Calcutta Word Publishers.
10. Kesavalu , Text Book of Engineering Geology, MacMillan India.
11. Duggal, S.K., Pandey, H.K. &Rawal, N. - Engineering Geology, McGraw Hill.

# Rama University Uttar Pradesh, Kanpur

(vide U.P. Act No. 1 of 2014 as passed by State Legislature and recognized by UGC U/s 2(f))

**Faculty of Engineering &Technology,**

**B.Tech. Civil Engineering**

**Course Curriculum (effective from Session 2021-22)**

## ESC-204: Basic Electronics Engineering

| L | T | P | Credit |
|---|---|---|---|
| 3 | 0 | 0 | 3 |

**Pre-requisite: 1.** None

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

| | |
|---|---|
| **ESC-202.1** | know about Introduction of Semiconductor Materials and, diode and its application |
| **ESC-202.2** | know about Bipolar Junction Transistors and Field Effect Transistor and its application |
| **ESC-202.3** | know Operational Amplifiers and its characteristics |

**Mapping of course outcomes with program outcomes**

| CO | PO1: Engineering knowledge | PO2 Problem analysis | PO3:Design/development of solutions | PO4:Conduct investigations of complex problems | PO5:Modern tool usage | PO6: The engineer and society | PO7:Environment and sustainability | PO8:Ethics | PO9:Individual and team work | PO10:Communication | PO11:Project management and finance | PO12:Life-long learning |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| ESC-202.1 | 3 | 3 | 2 | 3 | 2 | - | - | 1 | - | 2 | - | 2 |
| ESC-202.2 | 2 | 2 | 2 | 2 | - | - | - | 1 | - | 2 | - | 2 |
| ESC-202.3 | 2 | 2 | 2 | 3 | 2 | - | - | 1 | - | 2 | - | 1 |

**Unit-I: Semiconductor materials and properties&Diode Applications**

1.1 Group-IV materials, Covalent bond, electron-hole concepts

1.2 Basic concepts of energy bands in materials, concept of forbidden gap

1.3 Intrinsic and extrinsic semiconductors, donors and acceptors impurities

1.4 Junction diode, p-n junction, depletion layer, V-I characteristics,

1.5 Diode resistance, capacitance diode ratings (average current, repetitive peak current, non-repetitive current, peak-inverse voltage), Hall effect.

1.6 rectifiers (half wave and full wave) calculation of transformer utilization factor and diode ratings,

# Rama University Uttar Pradesh, Kanpur

(vide U.P. Act No. 1 of 2014 as passed by State Legislature and recognized by UGC U/s 2(f))

**Faculty of Engineering &Technology,**

**B.Tech. Civil Engineering**

**Course Curriculum (effective from Session 2021-22)**

## ESC-251: Basic Electrical & Electronic Engineering Lab

| L | T | P | Credit |
|---|---|---|---|
| 0 | 0 | 2 | 1 |

**Pre-requisite: 1.**

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

| | |
|---|---|
| ESC 251.1 | Conduct experiments illustrating the application of KVL/KCL and network theorems to DC electrical circuits. |
| ESC 251.2 | Demonstrate the behavior of AC circuits connected to single phase AC supply and measure power in single phase as well as three phase electrical circuits. |
| ESC 251.3 | Perform experiment illustrating BH curve of magnetic materials. |
| ESC 251.4 | Calculate efficiency of a DC machine. |
| ESC 251.5 | Demonstrate the behavior of Diode, BJT, and JFET. |

**Mapping of course outcomes with program outcomes**

| CO | PO1: Engineering knowledge | PO2 Problem analysis | PO3:Design/development of solutions | PO4:Conduct investigations of complex problems | PO5:Modern tool usage | PO6: The engineer and society | PO7:Environment and sustainability | PO8:Ethics | PO9:Individual and team work | PO10:Communication | PO11:Project management and finance | PO12:Life-long learning |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| ESC 101.1 | 3 | 3 | 2 | 1 | 2 | - | - | - | - | - | - | 1 |
| ESC 101.2 | 3 | 3 | 2 | 1 | 2 | - | - | - | - | - | - | 2 |
| ESC 101.3 | 3 | 3 | - | 1 | - | - | - | - | - | - | - | 2 |
| ESC 101.4 | 3 | 3 | - | 1 | - | - | - | - | - | - | - | 2 |
| ESC 101.5 | 3 | 2 | - | - | - | - | - | - | - | - | - | 2 |

**List of Experiments:**

**Note:** A minimum of sevenexperiments **(four from group A & Three from group B)** from the following should be performed.

**Group-A**

1. Verification of Kirchhoff's laws
2. Verification of Superposition and Thevenin Theorem.
3. Measurement of power and power factor in a single phase ac series inductive circuit and study improvement of power factor using capacitor
4. Study of phenomenon of resonance in RLC series circuit and obtain resonant frequency.
5. Measurement of power in 3- phase circuit by two wattmeter method and determination of its power factor for star as well as delta connected load.
6. To observe the B-H loop of a ferromagnetic material in CRO.
7. Determination of efficiency of a dc shunt motor by load test
8. To study running and speed reversal of a three phase induction motor and record speed in both directions.

**Group-B**

1. V-I Characteristics of Silicon & Germanium PN Junction diodes.
2. V-I Characteristics of Zener Diode.
3. Characteristics of BJT in Common Emitter Configuration.
4. Characteristics of JFET in Common Source Configuration.
5. Common Emitter BJT Amplifier.
6. Half Wave and Full Wave Rectifier without Filter.

## HSC-201: Communication Skills-II

| L | T | P | Credit |
|---|---|---|---|
| 2 | 0 | 0 | 2 |

**Pre-requisite: Basic knowledge of Grammar & Composition**

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

| | |
|---|---|
| HSC-201.1 | **(Remember)**Frame correct sentences with illustrations |
| HSC-201.2 | **(Understand)**Comprehend the language correctly |
| HSC-201.3 | **(Apply)**Interpret the language correctly |
| HSC-201.4 | **(Analyze)**Use given material in new situations |
| HSC-201.5 | **(Evaluate)**Correspond effectively using various types of writing like letters, memos etc. |
| HSC-201.6 | **(Create)**Communicate effectively in English with appropriate body language making use of correct and appropriate vocabulary and grammar in an organized context |

**Mapping of course outcomes with program outcomes**

| CO | PO1: Engineering knowledge | PO2 Problem analysis | PO3:Design/development of solutions | PO4:Conduct investigations of complex problems | PO5:Modern tool usage | PO6: The engineer and society | PO7:Environment and sustainability | PO8:Ethics | PO9:Individual and team work | PO10:Communication | PO11:Project management and finance | PO12:Life-long learning |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| HSC-201.1 | 2 | 2 | 1 | - | 2 | 3 | - | - | 2 | 2 | - | 2 |
| HSC-201.2 | 2 | 2 | 1 | - | 2 | 3 | - | - | 2 | 2 | - | 2 |
| HSC-201.3 | 3 | 2 | 1 | - | 2 | 3 | - | - | 2 | 3 | - | 2 |
| HSC-201.4 | 3 | 2 | 1 | - | 2 | 3 | - | - | 2 | 3 | - | 2 |
| HSC-201.5 | 3 | 2 | 1 | - | 2 | 3 | - | - | 2 | 3 | - | 2 |
| HSC-201.6 | 3 | 2 | 1s | - | 2 | 3 | - | - | 2 | 2 | - | 2 |

5.5 Public Speaking-Speeches, Conversations, dialogues and debates

**Text/Reference Books:**

1. Improve Your Writing ed. V.N. Arora and Laxmi Chandra, Oxford Univ. Press, 2001, New Delhi.
2. Technical Communication: A Practical Approach: Madhu Rani and Seema Verma- Acme Learning, New Delhi-2011
3. Technical Communication- Principles and Practices by Meenakshi Raman &Sangeeta Sharma, Oxford Univ. Press,2007, New Delhi. Reference Books .
4. Communication Skills for Engineers and Scientists, Sangeeta Sharma et.al. PHI Learning Pvt.Ltd,2011, New Delhi.
5. Business Correspondence and Report Writing by Prof. R.C.Sharma& Krishna Mohan, Tata McGraw Hill & Co.Ltd.,2001, New Delhi.
6. Word Power Made Easy by Norman Lewis, W.R.Goyal Pub. &Distributors, 2009,Delhi
7. Communication Skills, by Sanjay Kumar and Pushp Lata Oxford Publications, Oxford Univ. Press, 20011, 2015, New Delhi.

**Unit-I: Essentials of Communication Skills:**

1.1 Communication Skills: Types: Verbal; Non-Verbal;
1.2 Process of Communication; Levels of Communication;
1.3 Intrapersonal; Interpersonal; Mass Communication
1.4 Barriers of Communication
1.5 Remedies to overcome from the barriers of communication
1.6 Essential Elements; Nuances of Delivery;
1.7 Listening: Active; Passive

**Unit-II: Constituents of Technical Written Communication:**

2.1 Basic review of Grammar and Composition,
2.2 Transformation of sentences, Synonyms, Antonyms and homophones etc.
2.3 The art of condensation- Summarization, paraphrasing, précis and abstract writing
2.4 Requisites of Techniques and Method, Inductive Method, Deductive, spatial, linear, Chronological etc
2.5 Vocabulary of about 1000 words.

**Unit-III: Forms of Technical Communication**

3.1 Business letters: Sales letter, acknowledgement letters, Letter of Enquiry, letter of quotation, order, Claim and adjustment letters etc.
3.2 Job application and Resumes. Official letters: D.O letters, Govt.letters, letters of Authorities etc
3.3 Reports: Types, Significance, structure, style & writing of Reports
3.4 Proposals: parts, types, writing of Proposal, significance Technical paper, project,,
3.5 Dissertation and Thesis Writing, Features, Methods & Writing

**Unit-IV: Presentation Strategies:**

4.1 Defining purpose, audience & locale ,Organizing Contents,
4.2 Preparing Outlines, Audio-Visual Aids, Nuances of delivery
4.3 Body language, space, Setting, Nuances of voice Dynamics, Time Dimension

**Unit-V: Writing & Speaking Skills**

5.1 Paragraph Writing
5.2 Drafting essay, reports, official letters and CV writing
5.3 Group Discussion
5.4 Job Interview

# Rama University Uttar Pradesh, Kanpur

(vide U.P. Act No. 1 of 2014 as passed by State Legislature and recognized by UGC U/s 2(f))

**Faculty of Engineering &Technology,**

**B.Tech. Civil Engineering**

**Course Curriculum (effective from Session 2021-22)**

**SEMESTER-III (SECOND YEAR)**

## PME-301: Fluid Mechanics and Machinery

| L | T | P | Credit |
|---|---|---|---|
| 3 | 0 | 0 | 3 |

**Pre-requisite: 1. Mechanics**

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

| | |
|---|---|
| **PME-301.1** | After studying this unit student will know the UNDERSTAND[II]of fluid and its properties, manometer, hydrostatic forces acting on different surfaces and also problem solving techniques. |
| **PME-301.2** | In this unit student will be UNDERSTAND[II] to the basic laws of fluids, flow patterns, viscous flow through ducts and their corresponding problems. |
| **PME-301.3** | At the end of this unit student will be ABLE TO CALCULCATE[III]related to boundary layer theory, flow separation, basic concepts of velocity profiles, dimensionless numbers and dimensional analysis. |
| **PME-301.4** | In this unit student will ANALYZE [IV] the hydrodynamic forces acting on vanes and their performance evaluation. the importance, function and performance of hydro machinery |
| **PME-301.5** | After studying this unit student will be in a position to evaluate[V] the performance characteristics of hydraulic turbines. Also a little knowledge on hydraulic systems and fluidics is imparted to the student. |

**Mapping of course outcomes with program outcomes**

| CO | PO1: Engineering knowledge | PO2 Problem analysis | PO3:Design/development of solutions | PO4:Conduct investigations of complex problems | PO5:Modern tool usage | PO6: The engineer and society | PO7:Environment and sustainability | PO8:Ethics | PO9:Individual and team work | PO10:Communication | PO11:Project management and finance | PO12:Life-long learning |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **PME-301.1** | 3 | 3 | 1 | 1 | - | - | - | | | | | 1 |
| **PME-301.2** | 3 | 3 | 1 | 1 | - | - | - | | | | | 1 |
| **PME-301.3** | 3 | 3 | 1 | 1 | - | - | - | | | | | 1 |
| **PME-301.4** | 3 | 3 | 1 | 1 | | | | | | | | 1 |
| **PME-301.5** | 3 | 3 | 1 | 1 | | | | | | | | 1 |

1.7 filter, calculation of ripple factor and load regulation clipping circuits,
1.8 clamping circuits, voltage multipliers,
1.9 Breakdown diodes breakdown mechanisms (zener and avalanche) breakdown characteristics,
1.10 Zener Resistance, Zener Diode Ratings Zener Diode Application as Shunt Regulator.

**Unit-II: Operational Amplifiers & Instrumentation**

2.1 Concept of ideal operational amplifiers,
2.2 Ideal op-amp parameters, inverting,
2.3 Non-Inverting and Unity Gain Amplifiers, Adders, Difference Amplifiers, Integrators Etc.
2.4 Instrumentation: Digital Voltmeter, Digital Multimeter,
2.5 **Oscilloscope:** Introduction, Basic Principle,
2.6 CRT, Block Diagram of Oscilloscope,
2.7 Simple CRO, Measurement of voltage , current phase and frequency.

**Unit-III: Bipolar Junction Transistor:**

3.1 Basic construction, transistor action CB, CE and CC configurations, input/output characteristics
3.2 Biasing of transistors-fixed bias, emitter bias,
3.3 Potential Divider Bias, Comparison Of Biasing Circuits Transistor

**Unit-IV: Field Effect Transistor**

4.1 Basic construction, transistor action, concept of pinch off,
4.2 Maximum Drain Saturation Current, Input And Transfer Characteristics,
4.3 Characteristic Equation Cg, Cs And Cd Configurations, Fixed, Self-Biasing.
4.4 **MOSFET:** depletion and enhancement type MOSFET-construction, operation and characteristics.

**Unit-V: Switching theory and logic design:**

5.1 Number systems, conversion of bases Boolean algebra,
5.2 Logic Gates, Concept Of Universal Gate, Canonical Forms.
5.3 Minimization using K-map, Combinational Circuits, Basic of Flip flops .

**Text/Reference Books:**

1. Boylestad and Nashelsky, "Electronic Devices and circuits" PHI, 6e.
2. Morris Mano, "Digital Computer Design", PHI.
3. Millman J. and HalkiasC.,Jit Satybrat, "Integrated Electronics ", Tata McGraw-Hill.

**Unit- I:**

1.1. Fluid Statics: Dimensions and Units:
1.2. Physical Properties of Fluids- Specific Gravity,
1.3. Viscosity And Its Significance, Surface Tension,
1.4. Capillarity, Vapor Pressure.
1.5. Atmospheric Gauge and Vacuum Pressure –Measurement Of Pressure.
1.6. Manometers Piezometer, U-tube,
1.7. Inverted and Differential Manometers.
1.8. Pascal's law, hydrostatic law. Buoyancy and floatation:
1.9. Meta Center, Stability of Floating Body. Submerged Bodies.
1.10. Calculation of Metacentric height. Stability analysis and applications.

**Unit- II:**

2.1. Fluid Kinematics: Introduction, Flow Types.
2.2. Equation Of Continuity For One Dimensional Flow,
2.3. Circulation And Vorticity, Stream Line, Path Line And Streak Lines And Stream Tube.
2.4. Stream Function And Velocity Potential Function, Differences And Relation Between Them. Condition For Irrotational Flow, Flow Net, Source And Sink, Doublet And Vortex Flow.
2.5. Fluid Dynamics: Surface and Body Forces –Euler's And
2.6. Bernoulli's equations for flow along a stream line, Momentum Equation and Its Applications,
2.7. force on pipe bend. Closed conduit flow: Reynold's experiment-
2.8. Darcy Weisbach equation- Minor losses in pipes- pipes in series and pipes in parallel-
2.9. Total Energy Line-Hydraulic Gradient Line.

**Unit-III:**

3.1. boundary Layer Theory: Introduction,
3.2. Momentum Integral Equation, Displacement,
3.3. Momentum and Energy Thickness, Separation of Boundary Layer,
3.4. Control of Flow Separation, Stream Lined Body,
3.5. Bluff Body and Its Applications, Basic Concepts Of Velocity Profiles.
3.6. Dimensional Analysis: Similitude And Modeling – Dimensionless Numbers

**Unit- IV:**

4.1. Basics of Turbo Machinery: Hydrodynamic Force Of Jets On Stationary and Moving Flat,
4.2. Inclined and Curved Vanes, Jet Striking Centrally and at Tip,
4.3. Velocity Diagrams, Work Done And Efficiency,
4.4. Flow over Radial Vanes. Of Turbo Machinery:
4.5. Hydrodynamic Force of Jets on Stationary and Moving Flat, Inclined and Curved Vanes,
4.6. Jet Striking Centrally and at Tip, Velocity Diagrams,
4.7. Work Done and Efficiency, Flow over Radial Vanes.
4.8. Centrifugal Pumps: Classification, Working, Work Done – Manometric Head- Losses And Efficiencies-
4.9. Specific Speed- Pumps In Series And Parallel-Performance Characteristic Curves, Cavitations &
4.10. NPSH. Reciprocating Pumps: Working, Discharge, Slip, Indicator Diagrams.

**UNIT-V:**

5.1. Hydraulic Turbines: Classification of Turbines, Impulse and Reaction Turbines,
5.2. Pelton wheel,
5.3. Francis turbine and Kaplan turbine-working proportions,
5.4. Work Done, Efficiencies, Hydraulic Design –
5.5. Draft Tube- Theory Functions and Efficiency.
5.6. Performance Of Hydraulic Turbines: Geometric Similarity,
5.7. Unit And Specific Quantities, Characteristic Curves, Governing Of Turbines, Selection Of Type Of Turbine,
5.8. Cavitation, Surge Tank, Water Hammer.
5.9. Hydraulic Systems Hydraulic Ram, Hydraulic Lift,
5.10. Hydraulic Coupling. Fluidics – Amplifiers, Sensors and Oscillators.
5.11. Advantages, Limitations and Applications.

**Text /Reference Books :**

1. Hydraulics, fluid mechanics and Hydraulic machinery MODI and SETH.
2. Fluid Mechanics and Hydraulic Machines by Rajput.
3. Fluid Mechanics and Hydraulic Machines/ RK Bansal/Laxmi Publications (P) Ltd.
4. Fluid Mechanics and Fluid Power Engineering by D.S. Kumar, Kataria & Sons.
5. Fluid Mechanics and Machinery by D. Rama Durgaiah, New Age International.
6. Hydraulic Machines by Banga& Sharma, Khanna Publishers.
7. Instrumentation for Engineering Measurements by James W. Dally, William E.Riley ,John Wiley & Sons Inc. 2004

8. Fluid Mechanics and Hydraulic Machines by Domkundwar&Domkundwar, Dhanpatrai&Co.

# Rama University Uttar Pradesh, Kanpur

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**Faculty of Engineering &Technology,**

**B.Tech. Civil Engineering**

**Course Curriculum (effective from Session 2021-22)**

## PME-302: Mechanics of Deformable Bodies

| L | T | P | Credit |
|---|---|---|---|
| 3 | 1 | 0 | 4 |

**Pre-requisite:** 1. ESC-102 Mechanics of Rigid Bodies

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

| | |
|---|---|
| **PME-302.1** | **understand [II]** the concept of "stress' and 'strain' will **apply [III]** to structural member subjected to loading and also able to sketch [III] Mohr's Circle. |
| **PME-302.2** | **compute [III]** the deflection of beam. |
| **PME-302.3** | **understand [II]** the concept of torsion of shafts. |
| **PME-302.4** | **solve [II]** deflection of spring and to compute [III] buckling of column & Struts |
| **PME-302.5** | **determine [II]** the various stresses induced in Thin & Thick Cylinders. |
| **PME-302.6** | **understand [II]** the concept of stress and unsymmetrical bending will apply[III] to Curved bars |

**Mapping of course outcomes with program outcomes**

| CO | PO1: Engineering knowledge | PO2 Problem analysis | PO3:Design/ development of solutions | t investigations of complex | PO5:Modern tool usage | PO6: The engineer and society | PO7:Environment and sustainability | PO8:Ethics | PO9:Individual and team work | PO10:Communication | PO11:Project management and finance | PO12:Life-long learning |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **PME-302.1** | 3 | 3 | 3 | - | - | - | - | - | - | - | - | - |
| **PME-302.2** | 3 | 2 | 1 | - | - | - | - | - | - | 1 | - | - |
| **PME-302.3** | 3 | 3 | 1 | - | - | - | - | - | - | 1 | - | - |
| **PME-302.4** | 3 | 3 | 1 | - | - | - | - | - | - | 1 | - | - |
| **PME-302.5** | 3 | 3 | 2 | - | - | - | - | - | - | 1 | - | - |
| **PME-302.6** | 3 | 3 | 2 | - | - | - | - | - | - | 1 | - | - |

**Unit- I: Tension-Compression-Torsion**

1.1 Revision of Stress and Strain Stress-Strain Diagrams
1.2 Hooks' Law,
1.3 Elasticity, Plasticity, Creep,Relaxation, Resilience, Proof resilience
1.4 Shear Stress & Shear Strain
1.5 Elastic constants, Thermal Effects, Misfit and Pre-strain
1.6 Torsion and Hooke's Law in shear
1.7 The Torsion Formula, Non-uniform torsion, Stresses and strains in pure shear

**Unit-II: Mohr's Circle for Plane Stress and Plane Strain& Pressure Vessels**

2.1 State of Plane stress, Stresses on Inclined Sections,
2.2 Transformation Equations for Plane Stress
2.3 Principal Stresses and Maximum Shear Stresses
2.4 Mohr's Circle for Plane Stress
2.5 State of Plane Strain Transformation Equations for Plane Strain
2.6 Principal Strain and Maximum Shear Strain
2.7 Mohr's Circle for Plane Strain,
2.8 Strain rosette
2.9 Spherical Pressure Vessels Cylindrical Pressure Vessels

**Unit-III: Beams-Shear Force and Bending Moment Diagram and Associated Stresses**

3.1 Introduction to beam, Shear Force and Bending Moment
3.2 Relationships between loads, shear forces, and bending moments
3.3 Rule for drawing shear force and bending moment diagram
3.4 Shear force and bending moment diagram for Pure bending
3.5 Strain curvature relation
3.6 Normal Stresses in Beams, Neutral axis, Moment-Curvature Relationship, Flexure Formula
3.7 Shear stresses in beams with axial loads, Combined torsion and bending

**Unit- IV: Deflection of Beam & Columns**

4.1 Differential equation of the deflection curve
4.2 Deflections by integration, Moment area method,
4.3 First Moment-Area Theorem, Second Moment-Area Theorem
4.4 Introduction to columns,
4.5 Buckling and stability Differential Equation for Column Buckling,

4.6 Pinned-pinned column
4.7 Columns with other support conditions
4.8 Column with eccentric load
4.9 Ranking formula for Column

**Unit- V: Energy Methods and Theories of Failure**

1.1 Strain Energy in axially loaded prismatic bar
1.2 Strain Energy in other loading conditions
1.3 Castigliano's Theorem
1.4 Helical Springs
1.5 Theory of Failure-I
1.6 Material Testing

**Text /Reference Books :**

1. Mechanics of Materials by Pytel
2. Strength of Materials by Ryder
3. Strength of Materials by Timoshenko and &Young
4. Mechanics of Materials by Bear Johonson

# Rama University Uttar Pradesh, Kanpur

(vide U.P. Act No. 1 of 2014 as passed by State Legislature and recognized by UGC U/s 2(f))

**Faculty of Engineering &Technology,**

**B.Tech. Civil Engineering**

**Course Curriculum (effective from Session 2021-22)**

## PCE-301: Building Materials & Construction

| L | T | P | Credit |
|---|---|---|---|
| 3 | 0 | 0 | 3 |

**Pre-requisite: None**

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

| | |
|---|---|
| PCE-301.1 | understand the properties of stones, bricks and aggregates suitable for construction and testing procedure |
| PCE-301.2 | understand the properties of cement and admixtures suitable for construction and testing procedure |
| PCE-301.3 | Understand role of building regulations and technology in construction |
| PCE-301.4 | understand about the properties and application of timber and metals |

**Mapping of course outcomes with program outcomes**

| CO | PO1: Engineering knowledge | PO2 Problem analysis | PO3:Design/development of solutions | PO4:Conduct investigations of complex problems | PO5:Modern tool usage | PO6: The engineer and society | PO7:Environment and sustainability | PO8:Ethics | PO9:Individual and team work | PO10:Communication | PO11:Project management and finance | PO12:Life-long learning |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| PCE-301.1 | 3 | 3 | 3 | 3 | 3 | 1 | 3 | 2 | | | 3 | |
| PCE-301.2 | 3 | 3 | 2 | 2 | 3 | 1 | 3 | 2 | | 3 | 3 | |
| PCE-301.3 | 3 | 3 | | | | 2 | | 1 | | | | |
| PCE-301.4 | 3 | 2 | 3 | 1 | 3 | 1 | 3 | 2 | | 3 | 3 | |

**Unit-I: Stones, Bricks & Aggregates:**

1.1 Properties of building stones- relation to their structural requirements.
1.2 Classification of stones,
1.3 Stone Quarrying, Precautions in Blasting, Dressing of Stone,
1.4 Composition of Good Brick Earth

1.5 Various Methods of Manufacture of Bricks,
1.6 Comparison between Clamp Burning and Kiln Burning;
1.7 Fine aggregate: Natural And Manufactured: Sieve Analysis, Zoning, Specify Gravity, Bulking, Moisture Content, Deleterious Materials;
1.8 Coarse aggregate: Natural And Manufactured: Importance Of Size, Shape And Texture.

**Unit-II: Cement & Admixtures:**

1.1 Various types of cement and their properties;
1.2 Various field and laboratory tests for cement;
1.3 Various ingredients of cement concrete and their importance,
1.4 Various tests for concrete; Field and Laboratory Tests
1.5 Admixtures: Mineral and Chemical Admixture.

**Unit-III: Building Components and Foundations:**

3.1 Lintels, arches,
3.2 Floors: concrete, mosaic, terrazzo floors,
3.3 Roofs: pitched, flat and curved roofs, lean-to-roof, coupled roofs, trussed roofs, king and queen post trusses; RCC roofs, madras terrace/shell roofs.
3.4 Foundations: Shallow foundations, spread, combined, strap and mat footings.

**Unit-IV: Wood, Metals & Masonry:**

4.1 Timber: Structure, Properties, Seasoning of Timber; Classification of Various Types of Woods Used in Buildings, Defects in Timber; Alternative Materials For Wood,
4.2 Metals: Galvanized Iron, Fibre-Reinforced Plastics, Steel, Aluminium;
4.3 Masonry: Types of Masonry, English and Flemish Bonds, Rubble and Ashlars Masonry, Cavity and Partition Walls.

**Unit-V: Stairs and Building Planning:**

1.7 Stairs: Definitions, Technical Terms, Types of Stairs, Requirements of Good Stairs; Geometrical Design of RCC Doglegged and Open-Well Stairs;
1.8 Principles of building planning, classification building and planning and building by laws.

**Text Books/ Reference Books:**

1. S. K. Duggal, "Building Materials", New Age International Publishers.
2. Sushil Kumar "Building Materials and construction", Standard Publishers, 20th edition, reprint, 2015.
3. Dr.B. C. Punmia, Ashok kumar Jain, Arun Kumar Jain, "Building Construction", Laxmi Publications (P) ltd., New Delhi.
4. Rangawala S. C. "Engineering Materials||", Charter Publishing House, Anand, India
5. PC Verghese, "Building Construction", PHI.
6. R. Chuddy, "Construction Technology", Vol 1&2, Longman UK.
7. Subhash Chander, "Basic Civil Engineering", Jain Brothers.

# Rama University Uttar Pradesh, Kanpur

(vide U.P. Act No. 1 of 2014 as passed by State Legislature and recognized by UGC U/s 2(f))

## Faculty of Engineering &Technology,

**B.Tech. Civil Engineering**

**Course Curriculum (effective from Session 2021-22)**

## PCE-351: Materials Laboratory

| L | T | P | Credit |
|---|---|---|---|
| 0 | 0 | 2 | 1 |

**Pre-requisite:**

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

| | |
|---|---|
| **PCE-351.1** | understand the basic tests for materials and cement. |
| **PCE-351.2** | understand various tests of sand and concrete. |
| **PCE-351.3** | understand the basic tests for workability of the concrete. |
| **PCE-351.4** | understand of the basic test for fine and coarse aggregates. |

**Mapping of course outcomes with program outcomes**

| CO | PO1: Engineering knowledge | PO2 Problem analysis | PO3:Design/development of solutions | PO4:Conduct investigations of complex problems | PO5:Modern tool usage | PO6: The engineer and society | PO7:Environment and sustainability | PO8:Ethics | PO9:Individual and team work | PO10:Communication | PO11:Project management and finance | PO12:Life-long learning |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **PCE-351.1** | 3 | | 2 | | 3 | 1 | | 2 | | | 3 | |
| **PCE-351.2** | 3 | | 2 | | 3 | 1 | | 2 | | | 3 | |
| **PCE-351.3** | 3 | | 2 | | 3 | 1 | | 2 | | | 3 | |
| **PCE-351.4** | 3 | | 2 | | 3 | 1 | | 2 | | | 3 | |

List of Experiments:

**Cement (Two turns only)**

1. Normal Consistency of cement.
2. Initial & final setting time of cement
3. Compressive strength of cement
4. Fineness of cement by air permeability and Le-chatalier's apparatus.

5. Soundness of cement.
6. Tensile strength

**Coarse Aggregate ( Two turns only )**

1. Crushing value of aggregate
2. Impact value of aggregate
3. water absorption of aggregate
4. Sieve Analysis of Aggregate
5. Specific gravity & bulk density
6. Grading of aggregates.
7. Fine Aggregate : (one turn only )
8. Sieve analysis of sand
9. Silt content of sand
10. Bulking of sand

**Concrete Tests :**

1. Workability of concrete
2. Effect of w/c ratio on compressive strength of concrete
3. Relation between cube and cylinder tests
4. Physical and mechanical properties of reinforcing steel.

**Bricks Testing:**

1. Water absorption.
2. Dimension Tolerances
3. Compressive Strength
4. Efflorescence

# Rama University Uttar Pradesh, Kanpur

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**Faculty of Engineering &Technology,**

**B.Tech. Civil Engineering**

**Course Curriculum (effective from Session 2021-22)**

## PCE-302: Engineering Survey

| L | T | P | Credit |
|---|---|---|---|
| 3 | 0 | 0 | 3 |

**Pre-requisite: None**

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

| | |
|---|---|
| PCE-302.1 | Understand the principles, types and methods of surveying, to apply them in practice with minimum or no error. |
| PCE-302.2 | Analyse and rectify the errors in the horizontal-linear and horizontal-angular measurements to calculate area. |
| PCE-302.3 | Analyse and evaluate the measurements in leveling to obtain reduced levels, contour lines and earthwork estimation. |
| PCE-302.4 | Analyse and evaluate the horizontal and vertical coordinates using a theodolite. |
| PCE-302.5 | Understand and use modern instruments and advanced technologies in surveying. |

**Mapping of course outcomes with program outcomes**

| CO | PO1: Engineering knowledge | PO2 Problem analysis | PO3:Design/development of solutions | PO4:Conduct investigations of complex problems | PO5:Modern tool usage | PO6: The engineer and society | PO7:Environment and sustainability | PO8:Ethics | PO9:Individual and team work | PO10:Communication | PO11:Project management and finance | PO12:Life-long learning |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| PCE-302.1 | 2 | 2 | | | 1 | 1 | 1 | | 1 | | | |
| PCE-302.2 | 3 | 3 | | | | | 1 | | 1 | | | |
| PCE-302.3 | 3 | 3 | | | | | 1 | | 1 | | | |
| PCE-302.4 | 3 | 3 | | | 1 | | 1 | | 1 | | | |
| PCE-302.5 | 3 | 2 | | | 1 | | 1 | | 1 | | | |

**Unit-I: Introduction to Surveying & Leveling:**

1.1 Introduction to Surveying: Definition, Classification, Principles, Survey stations and Survey lines;

1.2 Introduction to measurement of distance, direction and elevation; Ranging and it methods,
1.3 Meridians and Bearings,
1.4 Methods of leveling, Booking and reducing levels, Reciprocal leveling, distance of visible horizon, Profile leveling and cross sectioning, Errors in leveling;
1.5 Contouring: Contouring: Characteristics, methods, uses, computation of areas and volumes

**Unit-II: Plane Table, Theodolite and Triangulation Survey:**
2.1 Introduction to methods of Plane Table Surveying: Instruments, Two Point and Three Point Problem
2.2 Theodolite survey: Instruments, Measurement of Horizontal and Vertical Angle; Methods of Horizontal and Vertical Control,
2.3 Triangulation: Figures or systems, Signals, Satellite station,
2.4 Baseline and its importance, corrections,
2.5 Trigonometric leveling: Accessible and inaccessible objects.

**Unit-III: Curves:**
3.1 Curves: Elements of simple circular curves,
3.2 Theory and methods of setting out simple circular curves,
3.3 Transition curves- types, characteristics and equations of various transition curves;
3.4 Introduction to vertical curves.

**Unit-IV: Modern Field Survey Systems:**
4.1 Modern Field Survey Systems: Principle and types of Electronic Distance Measurement systems and instruments,
4.2 Total Station- its advantages and applications;
4.3 Global Positioning Systems- Segments, working principle, errors and biases.
4.4 Geographic Information System: Concepts and data types, Data Models, Data Acquisition.
4.5 GIS applications in Civil Engineering.

**Unit-V: Photogrammetric Survey & Remote Sensing (Only Introductory):**
5.1 Photogrammetric Survey: basic principles, aerial camera, scale of a vertical photograph,
5.2 Relief Displacement of a Vertical Photograph, Height of Object from Relief Displacement,
5.3 Flight Planning For Aerial Photography,
5.4 Selection Of Altitude, Interval Between Exposures, Crab and Drift,
5.5 Stereoscope And Stereoscopic Views, Parallax Equations.
5.6 Introduction to Digital Photogrammetric Survey
5.7 Remote Sensing: Concepts and physical basis of Remote Sensing,
5.8 Electromagnetic spectrum, atmospheric effects, image characteristics.
5.9 Remote sensing systems, spectral signatures and characteristics spectral reflectance curves.

5.10 Salient features of some of Remote Sensing satellites missions. Digital image processing:
5.11 Introduction to image rectification and restoration, image.

**Text / Reference Books:**

1. Madhu, N, Sathikumar, R and Satheesh Gobi, Advanced Surveying: Total Station, GIS and Remote Sensing, Pearson India, 2006.
2. Manoj, K. Arora and Badjatia, Geomatics Engineering, Nem Chand & Bros, 2011
3. Bhavikatti, S.S., Surveying and Levelling, Vol. I and II, I.K. International, 2010
4. Chandra, A.M., Higher Surveying, Third Edition, New Age International (P) Limited, 2002.
5. Anji Reddy, M., Remote sensing and Geographical information system, B.S. Publications, 2001.
6. Arora, K.R., Surveying, Vol-I, II and III, Standard Book House.
7. Punmia BC et al: Surveying Vol. I, II, Laxmi Publication
8. Chandra AM and Ghosh SK: Remote Sensing and Geographical Information System, Alpha Science
9. Ghosh SK: Digital Image Processing, Alpha Science
10. Lillesand T M et al: Remote Sensing & Image Interpretation, John Wiley & Sons
11. Bhatta B: Remote Sensing and GIS, Oxford University Press, 2008

# Rama University Uttar Pradesh, Kanpur

(vide U.P. Act No. 1 of 2014 as passed by State Legislature and recognized by UGC U/s 2(f))

**Faculty of Engineering &Technology,**

**B.Tech. Civil Engineering**

**Course Curriculum (effective from Session 2021-22)**

## ESC-301: Basic Computer Engineering

| L | T | P | Credit |
|---|---|---|---|
| 3 | 0 | 0 | 3 |

**Pre-requisite:** None

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

| | |
|---|---|
| ESC-301.1 | *Understanding [II]* a functional hierarchical code organization |
| ESC-301.2 | *Ability [III]* to define and manage data structures based on problem subject domain |
| ESC-301.3 | *Ability [III]* to work with textual information, characters and strings |
| ESC-301.4 | *Ability [III]* to work with arrays of complex objects. |
| ESC-301.5 | *Understanding [II]* a defensive programming concept. Ability to handle possible errors during program execution |

**Mapping of course outcomes with Program Outcomes**

| CO | PO1: Engineering knowledge | PO2 Problem analysis | PO3:Design/development of solutions | PO4:Conduct investigations of complex problems | PO5:Modern tool usage | PO6: The engineer and society | PO7:Environment and sustainability | PO8:Ethics | PO9:Individual and team work | PO10:Communication | PO11:Project management and finance | PO12:Life-long learning |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| ESC-301.1 | 2 | 2 | 1 | 3 | 2 | - | 1 | 1 | - | 2 | 1 | 2 |
| ESC-301.2 | 2 | 2 | 2 | 3 | - | - | 1 | 1 | - | 1 | 1 | 2 |
| ESC-301.3 | 3 | 3 | 2 | 2 | 1 | - | 2 | 2 | - | 1 | - | 2 |
| ESC-301.4 | - | 2 | 2 | 2 | 2 | 1 | 2 | 1 | 1 | 2 | 2 | 3 |
| ESC-301.5 | 2 | 2 | 2 | 3 | 3 | 2 | 3 | 1 | 1 | 2 | 2 | 2 |

**Unit-I: Introduction to Number System and Programming Concepts:**

1.1 Computer basics

1.2 Classification of computers
1.3 Operations of computer
1.4 Components of a computer
1.5 Operating system concepts
1.6 Binary, Octal and hexadecimal number systems
1.7 Binary arithmeticApproaches of problem solving, computer algorithms and flow charts.
1.8 Introduction of computer languages - machine language, assembly language and high level language.
1.9 Information storage: data sizes, addressing
1.10 Error handling, program execution time

**Unit-II: Programming Structure, Execution and Concepts in C**

2.1 Integer representation and arithmetic
2.2 Boolean algebra, logical, shift and bit level operations
2.3 Standard input and output in C
2.4 Fundamental data types and sizes: character, integer,
2.5 Short, long, unsigned, single and double floating point.
2.6 Storage classes: automatic, register, static and external. Operators and expressions: arithmetic
2.7 Relational and logical operators
2.8 Operator precedence and order of evaluation.

**Unit-III: Control Flow and Functions**

3.1 Statements and blocks,
3.2 'If-Else', 'Else-If', 'Switch', nesting 'If-Else'
3.2 loops 'While', 'Do-while' and 'For', use of 'Break' and 'Continue'
3.3 'Goto' and 'Labels'.
3.4 Basics of functions
3.5 Types of functions
3.6 Functions with array
3.7 Passing values to functions 3
3.8 Recursive functions

**Unit-IV: Arrays, Structureand Pointers**

4.1 Introduction to Array
4.2 2-D and 3-D array
4.3 Introduction Structures
4.4 Structures of functions

4.5 Pointers and addresses
4.6 Pointers and functions arguments,
4.7 Pointers and arrays, Address arithmetic,
4.8 Pointers arrays, multidimensional arrays,
4.9 Pointers to functions
4.10 Pointers of structures

**Unit-V: File Handling and Introduction of Android**

5.1 Standard C preprocessors
5.2 File access, defining
5.3 Calling macros and standard libraries
5.4 Introduction of Android
5.5 History and Version, Installing software's
5.6 Basic Android concepts
5.7 Using more Android capabilities.

# Rama University Uttar Pradesh, Kanpur

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**Faculty of Engineering &Technology,**

**B.Tech. Civil Engineering**

**Course Curriculum (effective from Session 2021-22)**

## ESC-351: Basic Computer Engineering Lab

| L | T | P | Credit |
|---|---|---|---|
| 0 | 0 | 2 | 1 |

**Pre-requisite:** None

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

| | |
|---|---|
| ESC-351.1 | write simple programs. |
| ESC-351.2 | write branching and looping based programs. |
| ESC-351.3 | write little complex programs like digit based, prime nos, etc |
| ESC-351.4 | write array based programs including searching and sorting. |
| ESC-351.5 | write file, structure macros based programs. |

**Mapping of course outcomes with Program Outcomes**

| CO | PO1: Engineering knowledge | PO2 Problem analysis | PO3:Design/development of solutions | PO4:Conduct investigations of complex problems | PO5:Modern tool usage | PO6: The engineer and society | PO7:Environment and sustainability | PO8:Ethics | PO9:Individual and team work | PO10:Communication | PO11:Project management and finance | PO12:Life-long learning |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| ESC-351.1 | 1 | 2 | 1 | 2 | 1 | - | - | 1 | 1 | 1 | - | 1 |
| ESC-351.2 | 1 | 1 | 1 | 1 | - | 3 | 1 | 1 | 1 | 1 | 2 | 1 |
| ESC-351.3 | 1 | 1 | 1 | 2 | 1 | 3 | - | 1 | 3 | 1 | 1 | 2 |
| ESC-351.4 | 2 | 2 | 1 | 2 | 2 | - | - | 1 | 3 | 1 | 1 | 1 |
| ESC-351.5 | 1 | 1 | 1 | 2 | 3 | - | - | 1 | 1 | 1 | 2 | 2 |

Part A

Brief Introduction of MS-Word which includes formatting, editing of a document.

Brief Introduction of MS-Excel which includes formulate, and basic arithmetic calculation in a datasheet.
Brief Introduction of MS-Power point which includes animated presentation for a seminar/report.
Part B
Printing the reverse of an integer.
Printing the odd and even series of N numbers.
Input a string and find the number of each of the vowels appear in the string.
Accept N words and make it as a sentence by inserting blank spaces and a full stop at the end.
Printing the reverse of a string.
Searching an element in an array using pointers.
Checking whether the given matrix is an identity matrix or not.
Finding the first N terms of Fibonacci series.
Declare 3 pointer variables to store a character, a character string and an integer respectively. Input values into these variables. Display the address and the contents of each variable.
Define a structure with three members and display the same.
Declare a union with three members of type integer, char, string and illustrate the use of union.
Recursive program to find the factorial of an integer.
Finding the maximum of 4 numbers by defining a macro for the maximum of two numbers.
Arranging N numbers in ascending and in descending order using bubble sort.
Addition and subtraction of two matrices.
Multiplication of two matrices.
Converting a hexadecimal number into its binary equivalent.

Check whether the given string is a palindrome or not.
Demonstration of bitwise operations.
Applying binary search to a set of N numbers by using a function.

**Text / Reference Books:**

1. R.S. Salaria, Computer Concepts and Programming in C, Khanna Publishing House
2. E Balaguruswami,, Computer Concepts and Programming in C, McGraw Hill
3. Vikas Gupta, Computer Concepts and Programming in C,, Wiley India Publication
4. Reema Thareja, Computer Fundamentals and Programming in C., Oxford Publication

## HSC-301: Verbal Ability–I

| L | T | P | Credit |
|---|---|---|---|
| 2 | 0 | 0 | 2 |

# Rama University Uttar Pradesh, Kanpur

(vide U.P. Act No. 1 of 2014 as passed by State Legislature and recognized by UGC U/s 2(f))

**Faculty of Engineering &Technology,**

**B.Tech. Civil Engineering**

**Course Curriculum (effective from Session 2021-22)**

**SEMESTER-IV (SECOND YEAR)**

## PCE-401: Structural Analysis

| L | T | P | Credit |
|---|---|---|---|
| 3 | 1 | 0 | 4 |

**Pre-requisite:** ESC-102: Mechanics of Rigid Bodies
PME-302: Mechanics of Deformable Bodies

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

| | |
|---|---|
| **PCE-401.1** | Analyze the determinate and indeterminate structures by applying the energy principles |
| **PCE-401.2** | Categorize the structures and analyze the structural elements using force and displacement method of analysis |
| **PCE-401.3** | Analyze the response in structural elements for the moving loads using method of influence line diagram. |
| **PCE-401.4** | dtermine the internal forces in arch and cable structures by applying the basic engineering knowledge. |
| **PCE-401.5** | Form stiffness and flexibility matrix for elements and structures |

**Mapping of course outcomes with Program Outcomes**

| CO | PO1: Engineering knowledge | PO2 Problem analysis | PO3:Design/development of solutions | PO4:Conduct investigations of complex problems | PO5:Modern tool usage | PO6: The engineer and society | PO7:Environment and sustainability | PO8:Ethics | PO9:Individual and team work | PO10:Communication | PO11:Project management and finance | PO12:Life-long learning |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **PCE-401.1** | 3 | 3 | 1 | 1 | | | | | | | | 3 |
| **PCE-401.2** | 3 | 3 | 1 | 1 | | | | | | | | 3 |
| **PCE-401.3** | 3 | 3 | 1 | 1 | | | | | | | | 3 |
| **PCE-401.4** | 3 | 3 | 1 | 1 | | | | | | | | 3 |
| **PCE-401.5** | 3 | 3 | 1 | 1 | | | | | | | | 3 |

**Unit-I: Statically Indeterminate Structures:**

1.1 Degree of static and kinematic indeterminacies.
1.2 Introduction to Force and Displacement Methods of Analysis.
1.3 Energy principles – Castigliano's theorems - Engessor's theorem - Maxwell Betti's theorem
1.4 Principle of least work – Method of virtual work (unit load method) –
1.5 Applications in statically determinate and indeterminate structures (analysis of Propped cantilever and fixed beams).

**Unit-II: Three Moments Theorem & Slope Deflection Method:**

2.1 Introduction to theorem of three moments for continuous beams,
2.2 Slope Deflection Method: Analysis of Statically Indeterminate Beams with and without settlement of supports
2.3 Slope Deflection Method: Rigid Jointed Plane Frames with and without side sway.

**Unit-III: Moment Distribution Method:**

3.1 Moment Distribution Method: Analysis of Statically Indeterminate Beams with and without settlement of supports
3.2 Moment Distribution Method: Rigid Jointed Plane Frames with and without side sway.

**Unit-IV: Three Hinged and Two Hinged Arches:**

4.1 Analysis of Three Hinged Arches
4.2 Analysis of Two Hinged Arches,

**Unit-V:** Moving loads Matrix and Methods of Structural Analysis:

5.1 Moving loads and influence lines – influence lines (IL) for statically determinate and indeterminate beams for reaction, SF and BM.
5.2 Matrix Methods of Structural Analysis - Formation of Stiffness and Flexibility Matrices for Elements and Structure.

**Text / Reference Books:**

1. Hibbeler, R.C.(2008), Structural Analysis, Pearson Publishers, New Delhi.
2. Jain, A.K. (2009), Theory and Analysis of Structures, Vol. I and II, Nem Chand & Bros, Roorkee.
3. Norris, C.H. and Wilbur, J.B. (2007), Elementary Structural Analysis, Tata McGraw Hill, New Delhi
4. Devdas Menon, "Structural Analysis", Narosa Book Distributers Pvt Ltd, 2010.
5. S P Gupta and G S Pundit, "Theory of Structures", Vol I & II, Tata McGraw Hill, 2017
6. Sujit Kumar Roy and Subrata Chakrabarty, "Fundamentals of Structural Analysis",S.Chand& Co., 2010.
7. S. B. Junnarkar and H. J. Shah, "Mechanics of Structures Vol. II", 20th Edition, Charotar Publishing House, 2008.
8. *L.S.Negi and R.S.Jangid, Structural Analysis, Tata McGraw Hill, 2004.*
9. *D S PrakashRao, "Structural Analysis - A Unified Approach", Universities Press (India) Ltd.*
10. Reddy, C.S. (2005), Basic Structure Analysis, Tata McGraw-Hill, New Delhi.
11. Thandavamoorthy, T.S. (2005), Analysis of Structures: Strength and Behaviour, Oxford University Press, New Delhi.

12. Vazirani, V.N., Ratwani, M.M., and Duggal, S.K. (2010), Structural Analysis of Structures, Vol. 1 and 2, 17th edition, Khanna Publishers, New Delhi.
13. Kukreja, C.B. (2000), *Indeterminate Structural Analysis*, Standard Publishers Distributors, New Delhi.
14. Jain, O.P. and Jain, B.K. (2009), *Theory and Analysis of Structures, Vol. I and II*", Nem Chand and Bros, Roorkee.

# Rama University Uttar Pradesh, Kanpur

(vide U.P. Act No. 1 of 2014 as passed by State Legislature and recognized by UGC U/s 2(f))

**Faculty of Engineering & Technology,**

**B.Tech. Civil Engineering**

**Course Curriculum (effective from Session 2021-22)**

## PCE-402: Concrete Technology

| L | T | P | Credit |
|---|---|---|---|
| 3 | 0 | 0 | 3 |

**Pre-requisite:** PCE-301: Building Materials & Construction

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

| | |
|---|---|
| PCE-403.1 | Select the suitable ingredients for concrete and suggest suitable laboratory test to check its property. |
| PCE-403.2 | Evaluate the properties of ordinary concrete and special concrete based on the destructive and non-destructive tests. |
| PCE-403.3 | Evaluate durability related issues in concrete and suggest preventive measures. |
| PCE-403.4 | Apply the modern methods in concrete manufacturing |
| PCE-403.5 | Proportion the concrete mixtures to meet performance requirements |

**Mapping of course outcomes with Program Outcomes**

| CO | PO1: Engineering knowledge | PO2 Problem analysis | PO3:Design/development of solutions | PO4:Conduct investigations of complex problems | PO5:Modern tool usage | PO6: The engineer and society | PO7:Environment and sustainability | PO8:Ethics | PO9:Individual and team work | PO10:Communication | PO11:Project management and finance | PO12:Life-long learning |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| PCE-403.1 | 2 | 1 | 2 | | | 1 | 2 | | | | | 1 |
| PCE-403.2 | 1 | 1 | 1 | | | 1 | 1 | | | | | 1 |
| PCE-403.3 | 2 | 1 | 2 | | | 1 | 1 | | | | | 1 |
| PCE-403.4 | | 1 | 1 | | | 1 | 2 | | | | | 1 |
| PCE-403.5 | 2 | 2 | 2 | | | 1 | 2 | | | | | 2 |

# Rama University Uttar Pradesh, Kanpur

(vide U.P. Act No. 1 of 2014 as passed by State Legislature and recognized by UGC U/s 2(f))

## Faculty of Engineering &Technology,

### B.Tech. Civil Engineering

### Course Curriculum (effective from Session 2021-22)

## PCE-451: Structural Analysis Laboratory

| L | T | P | Credit |
|---|---|---|---|
| 0 | 0 | 2 | 1 |

**Pre-requisite:** None

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

| | |
|---|---|
| PCE-451.1 | Correlate concept of theory in experiments to analyze and design structures for field works. |
| PCE-451.2 | Analyze the determinate and indeterminate structures to overcome critical conditions |

**Mapping of course outcomes with Program Outcomes**

| CO | PO1: Engineering knowledge | PO2 Problem analysis | PO3:Design/development of solutions | PO4:Conduct investigations of complex problems | PO5:Modern tool usage | PO6: The engineer and society | PO7:Environment and sustainability | PO8:Ethics | PO9:Individual and team work | PO10:Communication | PO11:Project management and finance | PO12:Life-long learning |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| PCE-451.1 | 1 | 2 | 1 | 2 | 1 | - | - | 1 | 1 | 1 | - | 1 |
| PCE-451.2 | 1 | 1 | 1 | 1 | - | 3 | 1 | 1 | 1 | 1 | 2 | 1 |

**List of Experiments:**

1. To determine Flexural Rigidity (EI) of a given beam
2. To verify Maxwell's Reciprocal theorem.
3. To find horizontal thrust in a three-hinged arch and to draw influence line diagrams for Horizontal Thrust end Bending moment.
4. To find horizontal thrust in a two hinged arch and to draw influence line diagrams for horizontal Thrust and bending moment.
5. To find deflection of curved members.
6. To find bar forces in a three members structural frames with pin jointed bar
7. To find Critical load in Struts with different end conditions.
8. To find deflections in Beam having unsymmetrical bending

**Unit-I: Materials:**

1.1 Cement: different types - chemical composition and physical properties - tests on cement - I.S. specifications
1.2 Aggregates: classification - mechanical properties and tests as per I.S. – alkali-aggregate reaction, grading requirements - heavy weight - light weight - normal weight - aggregate - sampling of aggregate,
1.3 Water: quality of water,
1.4 Admixtures: Accelerators - Retarders - Water Reducing Agents – Super Plasticizers- Use Of Silica Fumes

**Unit-II: Properties of Fresh Concrete:**

2.1 Workability - factors affecting workability
2.2 Tests for workability
2.3 Rheology of Concrete
2.4 Segregation and Bleeding – causes and remedies

**Unit-III: Properties of Hardened Concrete:**

3.1 Strength: factors affecting strength of concrete - strength of concrete in compression, tension and flexure
3.2 Stress- strain characteristics and elastic properties
3.3 Shrinkage and Creep
3.4 Durability of concrete
3.5 Permeability
3.6 Chemical Attack and Sulphate Attack
3.7 Resistance to Abrasion and Cavitation
3.8 Resistance to freezing and thawing
3.9 Resistance to fire and Marine atmosphere
3.10 Quality control - frequency of sampling - test specimens - statistical analysis of test results - standard deviation - acceptance criteria

**Unit-IV: Production of Concrete:**

4.1 Measurement of Materials: Storage And Handling
4.2 Batching Plant and Equipments
4.3 Mixing : Types of Mixers –
4.4 Transportation Of Concrete - Pumping Of Concrete –
4.5 Placing Of Concrete
4.6 Under Water Concreting
4.7 Compaction Of Concrete
4.8 Curing Of Concrete
4.9 Ready Mixed Concrete

**Text / Reference Books:**

1. Neville, A.M. and Brooks, J.J.," Concrete Technology", ELBS.
2. Shetty, M.S, "Concrete Technology, Theory and Practice", S. Chand and Company Ltd, New Delhi, 2008.
3. Gambhir, M.L, "Concrete Technology", Tata McGraw Hill Publishing Company Ltd, New Delhi, 2004.
4. Santha Kumar, A.R; "Concrete Technology" , Oxford University Press, New Delhi, 2007.
5. Gupta B.L., Amit Gupta, "Concrete Technology", Jain Book Agency, 2010.
6. P.K. Mehta and Paulo J.M. Monteiro, "Concrete: microstructure, properties and materials", The Mc Graw Hill Companies.
7. Jayant D. Bapat (2013), Mineral admixtures in cement and concrete, Taylor and Francis group.
8. IS-10262-1982 Recommended Guidelines for Concrete Mix Design, Bureau of Indian Standards, New Delhi, 1998.
9. IS-456-2000 Plain and Reinforced Concrete- Code of Practice, Bureau of Indian Standards, New Delhi, 2000.

## PCE-452: Concrete Technology Laboratory

| L | T | P | Credit |
|---|---|---|---|
| 0 | 0 | 2 | 1 |

Pre-requisite: **PCE-402: Concrete Technology Laboratory**

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

| | |
|---|---|
| **PCE-452.1** | Understand and apply provisions in IS Codes for different ingredients of concrete. |
| **PCE-452.2** | Adopt procedure in IS Codes and other methods of concrete mix design |
| **PCE-452.3** | Understand quality standards of various tests conducted on concrete. |
| **PCE-452.4** | Understand effects of Admixtures |

**Mapping of course outcomes with Program Outcomes**

| CO | PO1: Engineering knowledge | PO2 Problem analysis | PO3:Design/development of solutions | PO4:Conduct investigations of complex problems | PO5:Modern tool usage | PO6: The engineer and society | PO7:Environment and sustainability | PO8:Ethics | PO9:Individual and team work | PO10:Communication | PO11:Project management and finance | PO12:Life-long learning |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **PCE-452.1** | 2 | 1 | 2 | | | 1 | 2 | | | | | 1 |
| **PCE-452.2** | 1 | 1 | 1 | | | 1 | 1 | | | | | 1 |
| **PCE-452.3** | 2 | 1 | 2 | | | 1 | 1 | | | | | 1 |
| **PCE-452.4** | 1 | 1 | 1 | | | 1 | 2 | | | | | 1 |

**List of Experiments:**

1. Study of IS codes for (i) Aggregates (ii) Cements (iii) Admixtures (iv) Fly ash

2. Concrete Mix design computation by ACI 211.1-91 method, IS code method as per 10262- 2007 & 456-2000, DOE method for given sample.
3. Preparation and testing of samples as per any one of the above mentioned computations (Minimum grade of concrete is M30)
4. Tests on Concrete- (a) Workability tests - Slump cone test, compaction factor test, Vee-bee consistometer test, flow table test. (b) Strength tests- compressive strength, flexural strength, split tensile strength.
5. Effects of Admixture - Accelerator, Retarder, Super Plasticizer.

# Rama University Uttar Pradesh, Kanpur

(vide U.P. Act No. 1 of 2014 as passed by State Legislature and recognized by UGC U/s 2(f))

## Faculty of Engineering &Technology,

**B.Tech. Civil Engineering**

**Course Curriculum (effective from Session 2021-22)**

## PCE-403: Open Channel Flow

| L | T | P | Credit |
|---|---|---|---|
| 3 | 0 | 0 | 3 |

**Pre-requisite:** PME-301: Fluid Mechanics & Machinery

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

| | |
|---|---|
| PCE-402.1 | Select most economical channel section. |
| PCE-402.2 | Apply the principles of energy to analyze uniform flow conditions in open channel. |
| PCE-402.3 | Apply the principles of energy to analyze non-uniform flow conditions in open channel. |
| PCE-402.4 | Understand and apply the general concepts of hydraulic jump and its significance. |
| PCE-402.5 | Understand and apply the general concepts of Spatially-Varied Flow |

**Mapping of course outcomes with Program Outcomes**

| CO | PO1: Engineering knowledge | PO2 Problem analysis | PO3:Design/development of solutions | PO4:Conduct investigations of complex problems | PO5:Modern tool usage | PO6: The engineer and society | PO7:Environment and sustainability | PO8:Ethics | PO9:Individual and team work | PO10:Communication | PO11:Project management and finance | PO12:Life-long learning |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| PCE-402.1 | 3 | 3 | 1 | 1 | | | | | | | | 3 |
| PCE-402.2 | 3 | 3 | 1 | 1 | | | | | | | | 3 |
| PCE-402.3 | 3 | 3 | 1 | 1 | | | | | | | | 3 |
| PCE-402.4 | 3 | 3 | 1 | 1 | | | | | | | | 3 |
| PCE-402.5 | 3 | 3 | 1 | 1 | | | | | | | | 3 |

**Unit-I: Open Channel Flow:**

1.1 Introduction Difference Between Open Channel Flow And Pipe Flow,
1.2 Geometrical Parameters Of A Channel,
1.3 Continuity Equation.
1.4 Uniform Flow : Chezy's And Manning's Equations For Uniform Flow In Open Channel,
**1.5** Velocity Distribution,
**1.6** Most Efficient Channel Section.

**Unit-II: Energy and Momentum Principles:**

2.1 Energy and Momentum Principles
2.2 Critical Depth,
2.3 Concepts of Specific Energy and Specific Force,
2.4 Application of Specific Energy Principle for Interpretation of Open Channel Phenomena,
2.5 Flow through Vertical and Horizontal Contractions.

**Unit-III: Non-Uniform Flow in Open Channel:**

3.1 Non-Uniform Flow in Open Channel
3.2 Equation of Gradually Varied Flow and its Limitations,
3.3 Flow Classification and Surface Profiles,
3.4 Integration of Varied Flow Equation by Analytical, Graphical and Numerical Methods,
3.5 Flow in Curved Channels.

**Unit-IV: Hydraulic Jump:**

4.1 Hydraulic Jump, Surges, Water Waves
4.2 Classical Hydraulic Jump, Evaluation of the Jump Elements in Rectangular and Non-Rectangular Channels on Horizontal and Sloping Beds,
4.3 Equation of Motion for Unsteady Flow,
4.4 Open Channel Surge, Celerity of the Gravity Wave, Deep and Shallow Water Waves.

**Unit-V: Spatially-Varied Flow:**

5.1 Spatially-Varied Flow: Introduction,
5.2 SVF with Increasing Discharge, Differential Equation of SVF with Increasing Discharges,
5.3 Control Point, Classification and Solutions, Profile Computation,
5.4 SVF with Decreasing Discharge, Differential Equation For SVF With Decreasing Discharge, Computations.

**Reference Books / Text Books/ Case Studies:**

1. Asawa, G.L. (2009), "Fluid Flow in Pipes and Channels", CBS Publishers and Distributors, New Delhi.
2. French, R.H. (1994), "Open-Channel Hydraulics", McGraw-Hill Book Company, Singapore.

3. Ojha, C.S.P., Berndtsson, R., and Chandramouli, P.N. (2010), "Fluid Mechanics and Machinery", Oxford University Press, New Delhi.
4. Ranga Raju, K.G. (1993), "Flow through Open Channels", Tata McGraw-Hill, Publishing Company Ltd., New Delhi.
5. Subramanya, K. (1996), "Flow in Open Channels", Tata McGraw-Hill, Publishing Company Ltd., New Delhi.
6. Modi P.N. and Seth S.M., "Hydraulics and Fluid Mechanics including Fluid Machines", Standard Book House, 2017.
7. Garg, S. K., "Irrigation Engineering and Hydraulic Structures", Khanna Publishers, 2006.
8. Chow V.T., "Open Channel Hydraulics", McGraw Hill, Inc.. 2009.
9. Rajput R K ,"Fluid Mechanics and Hydraulic Machines", S Chand Publishers, 2016.
10. N.N.Pillai, "Fluid Mechanics & Fluid Machines", Universities Press, Third Edition, 2009.
11. K.Subramanya, "Flow in Open Channels", Tata McGraw Hill, 1997.
12. M. Hanif Chaudhry, "Open Channel Flow", Prentice Hall of India, 2007.
13. G. Rangaraju, "Flow Through Open Channels", Tata McGraw Hill, 2001.
14. Jagdish Lal, "Hydraulic Machines including Fluidics", Metropolitan Book Co, 2016.
15. P.N.Modi, "Irrigation, Water Resources, and Water power Engineering", Standard Publishers Distributors, 2014.

# Rama University Uttar Pradesh, Kanpur

(vide U.P. Act No. 1 of 2014 as passed by State Legislature and recognized by UGC U/s 2(f))

**Faculty of Engineering &Technology,**

**B.Tech. Civil Engineering**

**Course Curriculum (effective from Session 2021-22)**

## PCE-404: Highway Engineering

| L | T | P | Credit |
|---|---|---|---|
| 3 | 0 | 0 | 3 |

**Pre-requisite:** PCE-301: Building Materials & Construction

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

| | |
|---|---|
| **PCE-404.1** | Explain the history of road development in India. |
| **PCE-404.2** | Carry out geometric deign of highways. |
| **PCE-404.3** | Analyse the suitability of materials for construction of pavements |
| **PCE-404.4** | Design of Flexible and Rigid Pavements |
| **PCE-404.5** | Explain the principles of Traffic Engineering and conduct surveys. |
| **PCE-404.6** | Perform analysis and design of intersections |

**Mapping of course outcomes with Program Outcomes**

| CO | PO1: Engineering knowledge | PO2 Problem analysis | PO3:Design/development of solutions | PO4:Conduct investigations of complex problems | PO5:Modern tool usage | PO6: The engineer and society | PO7:Environment and sustainability | PO8:Ethics | PO9:Individual and team work | PO10:Communication | PO11:Project management and finance | PO12:Life-long learning |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **PCE-404.1** | 1 | | 1 | | | 2 | 1 | | | | | |
| **PCE-404.2** | 3 | 2 | 3 | 2 | | 2 | | | | | | 3 |
| **PCE-404.3** | 3 | 2 | 1 | 1 | | | | 1 | | | | 3 |
| **PCE-404.4** | 3 | 2 | 3 | 3 | | | | 1 | | | | 3 |
| **PCE-404.5** | 3 | 2 | 3 | 3 | | | | | | | | 3 |
| **PCE-404.6** | 3 | 2 | 3 | 3 | | | | | | | | 3 |

**Unit-I: Highway Development and Planning:**

1.1 Classification of roads.

1.2 Road development in India - Salient features of first, second, third and fourth road development plans in India.
1.3 Current road projects in India - NHDP, PMGSY and Bharatmala project.
1.4 Highway Alignment and Project Preparation.

**Unit-II: Geometrical Design:**
2.1 Highway Cross Section Elements,
2.2 Sight distances
2.3 Horizontal curves, Super elevation,
2.4 Transition Curves, Widening at Curves
2.5 Vertical curves – Gradients,
2.6 Special consideration for hill roads – Hairpin bends
2.7 Lateral and vertical clearance at underpasses.

**Unit-III: Pavement Materials:**
3.1 Aggregate and Bitumen - desirable properties, tests, requirements for different types of pavements.
3.2 Bituminous Mix Design-Marshall Mix Design.

**Unit-IV: Pavement Design:**
4.1 Pavement Design Introduction – types of pavements and their use.
4.2 Flexible pavements: factors affecting design and performance;
4.3 Stresses in Flexible Pavements;
4.4 Design of Flexible Pavements as per IRC ,
4.5 Rigid pavements- components and functions;
4.6 Factors Affecting Design and Performance of Rigid Pavements;
4.7 Stresses in Rigid Pavements;
4.8 Design of Rigid Pavements as per IRC

**Unit-V: Traffic Engineering and Control:**
5.1 Introduction - Road user, vehicle and traffic characteristics.
5.2 Speed and Volume Studies.
5.3 Design of at-grade intersections – roundabouts and signalized intersections.
5.4 Traffic regulation and control traffic signs and road markings
5.5 Parking Facilities -Multimodal transportation
5.6 ITS and Automated Highways:

**Reference Books/ Text Books / Cases:**

1. Chakroborty, P. and Das, A. (2009), "*Principles of Transportation Engineering*", PHI Learning Publications, New Delhi.
2. Kadiyali, L.R. and Lall, N.B. (2009), "*Highway Engineering*", Khanna Publishers, New Delhi.
3. Kadiyali, L.R. (2011), '*Traffic Engineering and Transportation Planning*", Khanna Publishers, New Delhi.
4. Khanna, S.K. and Justo, C.E.G. (2011), "*Highway Engineering*", Nem Chand and Brothers, Roorkee.
5. Khisty, C.J. and Lall, B.K. (2009), "*Transportation Engineering: An Introduction*", PHI Learning Publications, New Delhi.
6. Papacostas, C.S. and Prevedouros, P.D. (2009), "*Transportation Engineering and Planning*", PHI Learning Publications, New Delhi

## PCE-405: Water Resources Engineering

| L | T | P | Credit |
|---|---|---|---|
| 3 | 0 | 0 | 3 |

**Pre-requisite:** PME-301: Fluid Mechanics & Machinery
PCE-402: Open Channel Flow

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

| | |
|---|---|
| **PCE-405.1** | Understand and quantify the hydrological processes |
| **PCE-405.2** | Apply basics of storm hydrology to estimate the catchment rainfall and runoff for various hydrological applications. |
| **PCE-405.3** | Understand and apply the reservoir planning characteristics and operational practices for various purposes. |
| **PCE-405.4** | Comprehend the channel flow theories and apply in design of irrigation water distribution systems |

**Mapping of course outcomes with Program Outcomes**

| CO | PO1: Engineering knowledge | PO2 Problem analysis | PO3:Design/development of solutions | PO4:Conduct investigations of complex problems | PO5:Modern tool usage | PO6: The engineer and society | PO7:Environment and sustainability | PO8:Ethics | PO9:Individual and team work | PO10:Communication | PO11:Project management and finance | PO12:Life-long learning |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **PCE-405.1** | 2 | 2 | | | | | | | | | | |
| **PCE-405.2** | 3 | 3 | 2 | 2 | | | | | | | | |
| **PCE-405.3** | 3 | 3 | 2 | | | | | | | | | |
| **PCE-405.4** | 2 | 2 | | | | | | | | | | |

**Unit-I: Introduction to Hydrology:**

1.1 Hydrologic cycle – hydrologic processes – water balance equation - global water balance – applications.

1.2 Precipitation – forms of precipitation – monsoons in India – precipitation measurement – rain gauge network – areal precipitation – rainfall intensity-duration-frequency (IDF) relationships – depth-area-duration (DAD) relationships.

1.3 Evaporation – evaporation process - measurement methods – evaporimeters - analytical methods – mass transfer method – energy budget method – combination method. Evapo-transpiration – measurement methods – empirical equations – potential and actual evapo-transpiration.

1.4 Infiltration – rainfall hyetograph - measurement – infiltration capacity – infiltration indices.

**Unit-II:**

2.1 Runoff – runoff volume – SCS-CN method – hydrographs – factors affecting runoff hydrograph – components of hydrograph – base flow separation – effective rainfall – unit hydrograph – flow duration curve – floods – rational method – flood frequency – design flood – design storm – risk, reliability and safety factor.

2.2 Flow measurement – methods – velocity area method – dilution method – stage-discharge curve.

2.3 Groundwater and well hydrology – types of aquifers - aquifer properties – Darcy's law – well hydraulics – determination of hydraulic conductivity – steady state flow in wells – steady state equations for confined and unconfined aquifers – aquifer test.

**Unit-III: Irrigation:**

3.1 Water Requirement of Crops: duty and delta – soil-water relationship – root zone soil water

3.2 Irrigation requirement – types of irrigation.

3.3 Water distribution system – canal systems

3.4 Design of irrigation channels – Kennedy's and Lacey's theory of regime channels.

3.5 Canal drops – regulators – canal escapes.

**Unit-IV: Dams:**

4.1 Classification

4.2 Design Considerations.

4.3 Gravity dam – forces on gravity dam – stress analysis.

4.4 Spillways– components – types – hydraulic jump.

4.5 Reservoirs – capacity estimation methods – mass curve – sequent peak algorithm – performance indices – storage- yield-performance function – reservoir operation for irrigation,

4.6 Hydropower and Flood Control.

**Text/ Reference Books:**

1. Basak, N. N. - Irrigation Engineering and, McGraw Hill Education Publication.
2. Arora, K.R. - Irrigation Water Power and Water Resource Engineering, Standard Publisher
3. Asawa, G.L. - Irrigation Engineering, Wiley Eastern
4. Garg, S.K. - Irrigation Engineering & Hydraulic Structures, Khanna Publishers
5. Modi, P.N. - Irrigation Engineering & Hydraulic Structures
6. Zimmerman, J.D. - Irrigation, John Wiley & Sons
7. Varshney, Gupta & Gupta - Theory and Design of Irrigation Structures, Nem Chand & Bros.
8. Subramanya K, 'Engineering Hydrology', 4th Edition, McGraw Hill Education (India), New Delhi, 2013
9. Ragunath, H M, 'Hydrology-Principles, Analysis and Design, Wiley Eastern Ltd., 2006
10. Todd, D K, 'Groundwater Hydrololgy' John Wiley & Sons, 2006.
11. Chow V T, Maidment D R, Mays L W, 'Applied Hydrology', Tata-McGraw Hill Education, New Delhi, 2010.
12. Linsley R K, Franzini J B, Freyberg D L, Tchobanoglous G, 'Water Resources Engineering', 4th Edition, McGraw Hill, 1992
13. Singh V.P, Elementary hydrology, Prentice Hall, Englewood Cliffs, New Jersey, 1992.

# Rama University Uttar Pradesh, Kanpur

(vide U.P. Act No. 1 of 2014 as passed by State Legislature and recognized by UGC U/s 2(f))

**Faculty of Engineering &Technology,**

**B.Tech. Civil Engineering**

**Course Curriculum (effective from Session 2021-22)**

**PME-451: Fluid Mechanics and Machinery Lab**

| L | T | P | Credit |
|---|---|---|---|
| 0 | 0 | 2 | 1 |

**Pre-requisite: 1.** PME 301 Fluid Mechanics and Machinery

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

| | |
|---|---|
| **PME-451.1** | ***Compute [III]*** COD for orifice, venturi meters and rate of flow etc. |
| **PME-451.2** | ***calculate [III]*** friction factor for pipes |
| **PME-451.3** | ***Experiment[III]*** various pump and water turbines. |

**Mapping of course outcomes with program outcomes**

| CO | PO1: Engineering knowledge | PO2 Problem analysis | PO3:Design/development of solutions | PO4:Conduct investigations of complex problems | PO5:Modern tool usage | PO6: The engineer and society | PO7:Environment and sustainability | PO8:Ethics | PO9:Individual and team work | PO10:Communication | PO11:Project management and finance | PO12:Life-long learning |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **PME-451.1** | 3 | 2 | 2 | - | - | - | - | | | | | 2 |
| **PME-451.2** | 3 | 2 | 2 | - | - | - | - | | | | | 2 |
| **PME-451.3** | 3 | 2 | 2 | - | - | - | - | | | | | 2 |

**List of Experiments:**

1. Determination of the Coefficient of discharge of given Orifice meter.
2. Determination of the Coefficient of discharge of given Venturi meter.
3. Calculation of the rate of flow using Rota meter.
4. Determination of friction factor for a given set of pipes.
5. Conducting experiments and drawing the characteristic curves of centrifugal pump/ submergible pump
6. Conducting experiments and drawing the characteristic curves of reciprocating pump.
7. Conducting experiments and drawing the characteristic curves of Gear pump.

8. Conducting experiments and drawing the characteristic curves of Pelton wheel.
9. Conducting experiments and drawing the characteristics curves of Francis turbine.
10. Conducting experiments and drawing the characteristic curves of Kaplan turbine.

**Text/ Reference Books:**

1. Modi P.N. and Seth, S.M. "Hydraulics and Fluid Mechanics", Standard Book House, New Delhi 2013.
2. Graebel. W.P, "Engineering Fluid Mechanics", Taylor & Francis, Indian Reprint, 2011
3. Kumar K. L., "Engineering Fluid Mechanics", Eurasia Publishing House(p) Ltd., New Delhi 2016
4. Robert W.Fox, Alan T. McDonald, Philip J.Pritchard, "Fluid Mechanics and Machinery", 2011.
5. Streeter, V. L. and Wylie E. B., "Fluid Mechanics", McGraw Hill Publishing Co. 2010

# Rama University Uttar Pradesh, Kanpur

(vide U.P. Act No. 1 of 2014 as passed by State Legislature and recognized by UGC U/s 2(f))

**Faculty of Engineering &Technology,**

**B.Tech. Civil Engineering**

**Course Curriculum (effective from Session 2021-22)**

## PCE-453: Survey Camp

| L | T | P | Credit |
|---|---|---|---|
| 0 | 0 | 2 | 1 |

Pre-requisite: **PCE-302: Engineering Survey**

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

| | |
|---|---|
| **PCE-453.1** | Interpret the contours. |
| **PCE-453.2** | Mark a road alignment of (L-section, Cross-section) a given gradient connecting any two stations on the map. |
| **PCE-453.3** | Calculate the earth work. |
| **PCE-453.4** | Prepare a topographical plan of a given area. |

**Mapping of course outcomes with Program Outcomes**

| CO | PO1: Engineering knowledge | PO2 Problem analysis | PO3:Design/development of solutions | PO4:Conduct investigations of complex problems | PO5:Modern tool usage | PO6: The engineer and society | PO7:Environment and sustainability | PO8:Ethics | PO9:Individual and team work | PO10:Communication | PO11:Project management and finance | PO12:Life-long learning |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **PCE-453.1** | 3 | 1 | 3 | | 2 | | | 2 | 3 | | 2 | |
| **PCE-453.2** | 3 | 3 | | 2 | 3 | | | 2 | 3 | 1 | 3 | |
| **PCE-453.3** | 3 | 1 | 3 | | 2 | | | 2 | 3 | | 2 | |
| **PCE-453.4** | 3 | 3 | | 2 | 3 | | | 2 | 3 | 1 | 3 | |

**List of Experiments:**

Preparation of topographical plan of a given area on Auto Cad. The survey camp will be organized for a duration of 10 days time span. The students may be assigned an undulated area of about 1.5 to 2.00 sq.km. with level difference of 15m consisting of good number of

physical features such as buildings, roads, bridges, culverts, railway tracks, electric lines etc. They are required to prepare the topographic map of above areas showing various features along with contours using a suitable contour intervals. They will mark a road alignment of given gradient connecting any two stations on the map consisting some horizontal and vertical curves and will prepare estimate of earthwork and submit the detailed technical report indicating therein practical difficulties faced during surveying for the features like ridge, line, valley lines, saddle cliffs etc.

The students should be divided in the groups consisting of 10-15 in numbers. They are required to submit the Report of work done, during survey camp, which will be dully examined, while awarding the internal assessment.

## HSC-401: Verbal Ability–II

| L | T | P | Credit |
|---|---|---|---|
| 2 | 0 | 0 | 2 |

# Rama University Uttar Pradesh, Kanpur

(vide U.P. Act No. 1 of 2014 as passed by State Legislature and recognized by UGC U/s 2(f))

## Faculty of Engineering & Technology,

**B.Tech. Civil Engineering**

**Course Curriculum (effective from Session 2021-22)**

**SEMESTER-V (THIRD YEAR)**

### PCE-501: Geotechnical Engineering

| L | T | P | Credit |
|---|---|---|---|
| 3 | 0 | 0 | 3 |

**Pre-requisite:** None

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

| | |
|---|---|
| **PCE-501.1** | Develop a basic understanding of the engineering properties of soil, and the use of such properties in the analysis of selected geotechnical engineering problems. |
| **PCE-501.2** | Understand the fundamental behavior of soil and its relevance to civil engineering operations and applications, behavior of soil in field conditions. |
| **PCE-501.3** | Understand mineralogy of soil mass, its impacts on soil behavior and permeability of soil in context of stability. |
| **PCE-501.4** | Estimation and analysis of developed stress in soil mass and impacts and determination of seepage pressure. |
| **PCE-501.5** | Develop a concept to adopt the best suitable technique for soil strength improvement techniques (Compaction Techniques) and compaction. |

**Mapping of course outcomes with Program Outcomes**

| CO | PO1: Engineering knowledge | PO2 Problem analysis | PO3:Design/development of solutions | PO4:Conduct investigations of complex problems | PO5:Modern tool usage | PO6: The engineer and society | PO7:Environment and sustainability | PO8:Ethics | PO9:Individual and team work | PO10:Communication | PO11:Project management and finance | PO12:Life-long learning |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **PCE-501.1** | 3 | 3 | 3 | 1 | 3 | 3 | 3 | 3 | 3 | 2 | 3 | |
| **PCE-501.2** | 3 | 3 | 3 | 1 | 3 | 3 | 3 | 3 | 3 | 2 | 3 | |
| **PCE-501.3** | 3 | 3 | 3 | 1 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | |
| **PCE-501.4** | 3 | 3 | 3 | 1 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | |
| **PCE-501.5** | 3 | 3 | 3 | 1 | 3 | 3 | 3 | 3 | 3 | 2 | 3 | |

**Unit-I: Introduction:**

**1.1** Soil Formation, Transport and Deposit of Soil,
1.2 Soil Composition, Basic Definitions, Phase Relationships, Index Properties,
1.3 Particle Size Analysis, Shape and Size, Grain Size Distribution Curves, Relative Density, Consistency of Soils,
1.4 Determination of Important Physical and Index Properties of Soils,
1.5 Soil Classification Systems with Specific Reference to Unified Soil Classification and IS Soil Classification Systems,
1.6 Field IdentificationTests.
1.7 **Soil Structure:** Soil Structure, Single Grained Structure, Honeycomb Structure, Flocculent and Dispersed Structures, Structure of Composite Soils. Role of Soil Structure on the Behavior ofSoils.

**Unit-II: Soil-Water Relations:**

2.1 Soil-Water Systems, Capillarity,
2.2 Geostatic Stresses, Effective and Neutral Stress,
2.3 Capillary Flow, Darcy's Law,
2.4 Permeability, Factors Affecting Permeability,
2.5 Determination of Permeability in the Laboratory and in the Field,
2.6 Piping, Quick Sand Condition, Seepage, Governing Differential Equation forFlow through Soils.
2.7 Different Kinds of Flow: Steady State and Transient Flow,
2.8 Graphical Method of Solving Steady State Flow Equation (Laplace Equation): Flow Nets and their Uses,
2.9 Flow through Homogeneous Earth Dams: Two Dimensional Cases,
2.10Design of Drainage Filters

**Unit-III: Shear Strength of Soil:**

2.11Mohr-Coulomb Failure Criterion, Direct Shear Test, Unconfined Compression Test, Triaxial Tests: Unconsolidated Undrained, Consolidated Drained and Consolidated Undrained Tests, Vane Shear Test,Shear Strength Of Clays, Critical Void Ratio, Pore-Pressure Coefficients

**Unit-IV: Compaction of Soil:**

**4.1** General Principles, Moisture-Density Relationship, Optimum Moisture Content,
**4.2** Relevant Laboratory and Field Tests,
**4.3** Factors Affecting Compaction,
**4.4** Field Compaction,
**4.5** Compaction Techniques.

**Unit-V: Consolidation of Soil:**

**5.1** Fundamentals,
5.2 1-D Consolidation, Normally and Over-Consolidated Clays,

**5.3** Void Ratio- Pressure Relationships, Determination of Pre-Consolidation Pressure,
**5.4** Compressibility Characteristics,
**5.5** Terzaghi's One Dimensional Consolidation Theory and Coefficient of Consolidation,
**5.6** Time Rate of Consolidation, Determination of Coefficient of Consolidation in the Laboratory:
**5.7** Curve Fitting Techniques,
**5.8** Primary and Secondary Consolidation and Settlement,
**5.9** Settlement Analysis,
**5.10** 3-D Consolidation,
**5.11** Vertical Sand Drains

**Text / Reference Books:**

1. Arora, K.R. (2009), "Soil Mechanics & Foundation Engineering", Standard Publishers Distributors, New Delhi.
2. Ranjan, G. and Rao, A.S.R. (2000), "Basic and Applied Soil Mechanics", New Age Publication, New Delhi
3. Venkataramaiah, C. (2006), "Geotechnical Engineering", New Age Publications, New Delhi.
4. V.N.S. (2010), "Soil Mechanics and Foundation Engineering", Marcel Dekker Publications, New Delhi.
5. Singh A., Modern Geotechnical Engineering

# Rama University Uttar Pradesh, Kanpur

(vide U.P. Act No. 1 of 2014 as passed by State Legislature and recognized by UGC U/s 2(f))

**Faculty of Engineering &Technology,**

**B.Tech. Civil Engineering**

**Course Curriculum (effective from Session 2021-22)**

## PCE-651: Geotechnical Engineering Laboratory

| L | T | P | Credit |
|---|---|---|---|
| 0 | 0 | 2 | 1 |

Pre-requisite: **PCE-501: Geotechnical Engineering**

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

| | |
|---|---|
| **PCE-551.1** | Conduct experiments to find the index and engineering properties of different types of soil. |
| **PCE-551.2** | Prepare laboratory reports on the interpretation of experimental results. |
| **PCE-551.3** | Assess the strength parameters of soil using various field tests. |

**Mapping of course outcomes with Program Outcomes**

| CO | PO1: Engineering knowledge | PO2 Problem analysis | PO3:Design/development of solutions | PO4:Conduct investigations of complex problems | PO5:Modern tool usage | PO6: The engineer and society | PO7:Environment and sustainability | PO8:Ethics | PO9:Individual and team work | PO10:Communication | PO11:Project management and finance | PO12:Life-long learning |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **PCE-551.1** | 3 | 3 | | 3 | | | | | 3 | 3 | | 3 |
| **PCE-551.2** | 3 | 3 | | 3 | | | | | 3 | 3 | | 3 |
| **PCE-551.3** | 3 | 3 | | 3 | | | | | 3 | 3 | | 3 |

**List of Experiments:**

1. Specific gravity of coarse and fine-grained soils
2. Grain size analysis
3. Atterberg's limits and indices
4. Determination of field density (a) sand replacement method (b) core cutter method
5. Determination of coefficient of permeability by (a) Constant head method; (b)Variable head method
6. Consolidation test
7. Direcr Shear Test

8. Triaxial Shear Test
9. Compaction test (a) IS light compaction test (b) IS heavy compaction test
10. California Bearing Ratio test
11. Unconfined compressive strength test & Laboratory vane shear test.

**Text / Reference Books :**

1. Bowles, J.E. (2001), Analysis and Design of Foundation, McGraw Hill Higher Education, New York, USA.
2. Lambe, T.W. (1951), Soil Testing for Engineering, Wiley Eastern, New Delhi.
3. Prakash S.(1969),Introductory soil testing,Asia Publishing house,New Delhi

# Rama University Uttar Pradesh, Kanpur

(vide U.P. Act No. 1 of 2014 as passed by State Legislature and recognized by UGC U/s 2(f))

## Faculty of Engineering &Technology,

### B.Tech. Civil Engineering

### Course Curriculum (effective from Session 2021-22)

## PCE-502: Environmental Engineering

| L | T | P | Credit |
|---|---|---|---|
| 3 | 1 | 0 | 4 |

**Pre-requisite:** PME-301: Fluid Mechanics & Machinery
PCE-402: Open Channel Flow

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

| | |
|---|---|
| **PCE-502.1** | Understand the sources and collection of water and waste water |
| **PCE-502.2** | characterize water and waste water including physical, chemical and biological parameters. |
| **PCE-502.3** | Understand the different water and waste water treatment technologies |
| **PCE-502.4** | attain basic knowledge of storage, transmission and distribution of water. |
| **PCE-502.5** | understand Disposal of Wastewater. |

**Mapping of course outcomes with Program Outcomes**

| CO | PO1: Engineering knowledge | PO2 Problem analysis | PO3:Design/development of solutions | PO4:Conduct investigations of complex problems | PO5:Modern tool usage | PO6: The engineer and society | PO7:Environment and sustainability | PO8:Ethics | PO9:Individual and team work | PO10:Communication | PO11:Project management and finance | PO12:Life-long learning |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **PCE-502.1** | 3 | | 2 | | 1 | 1 | | 3 | | | 2 | |
| **PCE-502.2** | 3 | | 2 | | 1 | 1 | | 3 | | | 2 | |
| **PCE-502.3** | 3 | | 2 | | 1 | 1 | | 3 | | | 2 | |
| **PCE-502.4** | 3 | | 2 | | 1 | 1 | | 3 | | | 2 | |
| **PCE-502.5** | 3 | | 2 | | 1 | 1 | | 3 | | | 2 | |

**Unit-I: Introduction & Scopes:**

1.1 Water Demand for Domestic Use, Factors Affecting Water Consumption, Variations in Demand and Its Effects on Design of Different Components of System, Design Periods,
1.2 Population Forecasting Methods.
1.3 Kinds of Water Sources and Their Characteristics, Collection and Quality of Surface and Ground Water,
1.4 Factors Governing the Selection of a Source of Water Supply,
1.5 Intakes and Their Design for Lakes, Streams, Canals and Rivers, Impounding Reservoir and Determination of Its Capacity.
1.6 Types of Sewers, Flow in Full and Partially Full Sewers, Design of Sewers,
1.7 Types, Materials, and Construction of Sewers, Joints and Sewer Appurtenances,
1.8 Layout and Construction of Sewer Lines, Planning of Sewerage Systems,
1.9 Construction & Maintenance, Storm water Sewers.
1.10 **Water & Wastewater Characteristics:** Physical, Chemical, and Bacteriological Examination of Water & Wastewater,
1.11 Indian and Global Standards of Water and Effluent Quality Standards.

**Water Treatment:**

**Unit-II: Water and Wastewater Treatment::**

2.1 Conventional Surface Water Treatment Using Coagulation, Flocculation, Settling,
2.2 Filtration and Disinfection,
2.3 Treatment of Ground Water for Fluoride, Arsenic, Iron and Manganese,
2.4 Domestic Water Purifiers.
2.5 Failure of Beam Under Shear, Concept of Equivalent Shear and Moments.

**Unit-III: Wastewater Treatment:**

3.1 On Site and Centralized Treatment Systems of **Waste Water Treatment**
3.2 Septic Tank, Soakage Pit and Dispersion Trench
3.3 **Pre-and Primary Treatment:** Screens, Grit Removal, Primary Settling of Waste Water
3.4 **Secondary Treatment:** Theory of Organic Matter Removal,
3.5 Aerobic and Anaerobic Treatment Processes,
3.6 Activated Sludge Process,
3.7 Conventional and Extended Aeration Systems,
3.8 Trickling Filters, Aerated Lagoons,
3.9 Waste Stabilization Ponds, Oxidation Ditches, R.B.C., Up-Flow Anaerobic Sludge Blanket (USAB) Process. MBBR Technique.
3.10 **Tertiary/Advanced Wastewater Treatment Processes:** Removal of Nitrogen and Phosphorus.
3.11 **Sludge Management**: Thickening of Sludge, Anaerobic Digestion of Sludge, Sludge Drying and Final Disposal..

**Text / Reference Books / Cases:**

1. Davis, M. L. and Cornwell, D. A. (2008). "*Introduction to Environmental Engineering*", Fourth Edition, McGraw-Hill, Boston.
2. Garg, S. K. (2008). "*Water Supply Engineering*" Vol-I & ii, Khanna Publishers, New Delhi.
3. Modi, P. N. (2001). "*Water Supply Engineering*", Standard Book House, New Delhi.
4. Peavy, H. S., Rowe, D. R. and Tchobanoglous, G. (1985). "*Environmental Engineering*", McGraw-Hill, New York et al.
5. Punmia, B. C., Jain, A. and Jain, A. (2010), "*Water Supply Engineering*", Laxmi Publications (P), Bangalore.
6. Manual on Water Supply and Treatment, C. P. H. E. E. O., Ministry of Urban Development, Government of India, New Delhi.
7. Manual on Sewerage and Sewage Treatment, C. P. H. E. E. O., Ministry of Urban Development, Government of India, New Delhi

## CE-552: Environmental Engineering Laboratory

| L | T | P | Credit |
|---|---|---|---|
| 0 | 0 | 2 | 1 |

Pre-requisite: **PCE-502: Environmental Engineering**

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

| | |
|---|---|
| **PCE-552.1** | explain the different aspects of quality of water. and waste water |
| **PCE-552.2** | understand various aspects of Water and Wastewater Treatment |

**Mapping of course outcomes with Program Outcomes**

| CO | PO1: Engineering knowledge | PO2 Problem analysis | PO3:Design/development of solutions | PO4:Conduct investigations of complex problems | PO5:Modern tool usage | PO6: The engineer and society | PO7:Environment and sustainability | PO8:Ethics | PO9:Individual and team work | PO10:Communication | PO11:Project management and finance | PO12:Life-long learning |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **PCE-552.1** | 3 | | 2 | | 1 | 1 | | 3 | | | 2 | |
| **PCE-552.2** | 3 | | 2 | | 1 | 1 | | 3 | | | 2 | |

**List of Experiments:**

1. To determine the pH of the given sample of water & sewage.
2. To determine the turbidity of the given sample of water &wastewater.
3. To determine the Total Solids of the given sample of water & sewage.
4. To determine the Total Dissolved Solids of the given sample of water & sewage.
5. To find out conductivity of the given water sample.
6. Determination of the iron and fluoride content in drinking water.

7. Determination of BOD & COD of waste water.
8. To find out chloride of the given water sample.
9. To determine alkalinity of the given water sample.
10. To determine hardness of the given water sample.
11. To determine the optimum dose of alum by Jar test.
12. Determine the dissolved oxygen in water by winkler method.
13. Determine the color and odor of a given sample of water
14. To find out Total Settle able Solids of the given sewage sample.
15. To determine Total Suspended Solids of the given sewage sample

| Engineering Minor Elective | Specialization | | | | | |
|---|---|---|---|---|---|---|
| | **Structural Engineering** | **Geo-technical Engineering** | **Transportation Engineering** | **Construction Technology & Management** | **Water Resources Engineering** | **Environmental Engineering** |
| I | *Plastic Analysis of Structure* | *Ground Improvement Engineering* | *Railway & Airport Engineering* | *Elementary Architectural Science* | *Ground Water Management* | *Rural Water Supply & Sanitation* |

## ECE-501: Plastic Analysis Of Structure

| L | T | P | Credit |
|---|---|---|---|
| 3 | 0 | 0 | 3 |

Pre-requisite: PCE-401: StructuralAnalysis

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

| | |
|---|---|
| **ECE-501.1** | Perform plastic analysis of structures. |
| **ECE-501.2** | analyze frames and cables |
| **ECE-501.3** | analyze multistory frames and buildings |

## Mapping of course outcomes with Program Outcomes

| CO | PO1: Engineering knowledge | PO2 Problem analysis | PO3:Design/development of solutions | PO4:Conduct investigations of complex problems | PO5:Modern tool usage | PO6: The engineer and society | PO7:Environment and sustainability | PO8:Ethics | PO9:Individual and team work | PO10:Communication | PO11:Project management and finance | PO12:Life-long learning |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| ECE-501.1 | 3 | 2 | 2 | 2 | | 1 | | 2 | | | 3 | |
| ECE-501.2 | 3 | 2 | 2 | 2 | | 1 | | 2 | | | 3 | |
| ECE-501.3 | 3 | 2 | 2 | 2 | | 1 | | 2 | | | 3 | |

**Unit-I:** Introduction, Historical review, Plastic Failure, Plastic Moment, Capacity of a Cross-Section, Shape Factor, Concept of Load Factor.

**Unit-II:** Plastic Hinge and Collapse Mechanisms. Analysis of beams and frames.
**Unit-III:** Semi Graphical Method and Mechanism Method.

**Unit-IV:** Plastic Moment Distribution for Multi-Storey and Multi-Bay Frames.

**Unit-V:** Analysis for deflections at collapse. Effect of axial force and shear

**Expected Course Outcome**: Upon completion of this course, the student will be able to:

**Text / Reference Books /:**

1. Plastic Analysis of Structures by P G Hodge, McGraw Hill
2. Plastic Analysis and Design of steel structures by M Bill Wong
3. Inelastic Analysis of Structures by M Jirasek& Z P Bazant

# Rama University Uttar Pradesh, Kanpur

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**Faculty of Engineering &Technology,**

**B.Tech. Civil Engineering**

**Course Curriculum (effective from Session 2021-22)**

## ECE-502: Ground Improvement Engineering

| L | T | P | Credit |
|---|---|---|---|
| 3 | 0 | 0 | 3 |

Pre-requisite: PCE-501: Geotechnical Engineering

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

| | |
|---|---|
| ECE-502.1 | Evaluate the various ground improvement techniques using mechanical methods such as compaction, vibro-flotation, preloading etc. |
| ECE-502.2 | Analyze the various types of drainage techniques, pre-compression methods and grouting. |
| ECE-502.3 | Examining the effectiveness of chemical additives and reinforcing materials in ground improvement |

**Mapping of course outcomes with Program Outcomes**

| CO | PO1: Engineering knowledge | PO2 Problem analysis | PO3:Design/development of solutions | PO4:Conduct investigations of complex problems | PO5:Modern tool usage | PO6: The engineer and society | PO7:Environment and sustainability | PO8:Ethics | PO9:Individual and team work | PO10:Communication | PO11:Project management and finance | PO12:Life-long learning |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| ECE-502.1 | 3 | 2 | | | | | | | | | | 2 |
| ECE-502.2 | 3 | 2 | | | | | 2 | | | | | |
| ECE-502.3 | 3 | 2 | | | | | | | | | | 2 |

**Unit-I: Ground Improvement:**

1.1 Objective of ground improvement,
1.2 In-situ ground improvement methods,
1.3 Introduction to soil improvement without the addition of many materials,
1.4 Surface compaction, Compaction methods: moisture density relations – compactive efforts – field methods – surface compaction, deep compactions-, vibro-probes, stone columns, sand compaction
1.5 Quality Control – specifications for compaction process for solving field problems.

**Unit-II: Drainage Methods:**

2.1 seepage, ground water seepage control – filter requirements,
2.2 methods of dewatering – deep bored wells.
2.3 Precompression methods: compressibility and consolidation properties of soils,
2.4 estimation of rate of consolidation settlements – accelerating methods – consolidation by electro osmosis and vacuum compression methods.
2.5 Grouting and injection methods: principles,
2.6 selection of methods and requirements.
2.7 Aspects of grouts, types of grouts and chemical applications, seepage control.

**Unit-III: Stabilization Methods:**

1.1 Mechanical Methods of Soil Stabilization
1.2 Cement Methods of Soil Stabilization
1.3 Lime Methods of Soil Stabilization
1.4 Chemical Methods of Soil Stabilization, Use of Admixtures

**Unit-IV: Soil Reinforcement:**

4.1 Reinforcing Materials
4.2 Reinforced Earth Retaining Walls,
4.3 Reinforced Embankments,
4.4 Soil Nailing,
4.5 Geo-synthetics: Types, General Applications,
4.6 Types of Geo-textiles and Geo-grids,
4.7 Physical and Strength Properties of Geo-textiles and Geo-grids,
4.8 Behavior Of Soils on Reinforcing with Geo-textiles and Geo-grids,
4.9 Design Aspects with Geo-textiles and Geo-grids.

**Text / Reference Books:**

1. Purushottam Raj, Ground Improvement Techniques, Tata McGraw Hills, Delhi.
2. Moseley, "Text Book on Ground Improvement", Blackie Academic Professional, Chapman & Hall, 1994.
3. Shashi K. Gulati and Manoj Dutta, "Geotechnical Engineering", Tata Mcgraw Hill, 2005.
4. Boweven R., "Text Book on Grouting in Engineering Practice", John Wiley and Sons, 1981.
5. Jewell R.A., Soil reinforcement with geotextiles- CIRIA Special Publication, Thomas Telford, 1996.
6. Donald H Gray Robbin B Sotir, "Text Book on Biotechnical and Soil Engineering Slope Stabilization", Wiley International, 1996.
7. Rao G.V. & Rao G.V.S. "Text Book on Engineering with Geotextiles", Tata Mcgraw Hill, 1990.
8. Robert M. Koerner, Construction & Geotechnical methods in Foundation Engineering", McGraw Hill, 1986.

# Rama University Uttar Pradesh, Kanpur

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**Faculty of Engineering &Technology,**

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**Course Curriculum (effective from Session 2021-22)**

## ECE-503: Railways & Airport Engineering

| L | T | P | Credit |
|---|---|---|---|
| 3 | 0 | 0 | 3 |

Pre-requisite: **None**

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

| | |
|---|---|
| ECE-503.1 | Identify and explain the role of different components in a railway track |
| ECE-503.2 | Design the geometric and other elements of a railway track |
| ECE-503.3 | Assess the suitable location for an airport and design the landing area. |
| ECE-503.4 | Specify design guidelines for the various elements within the airport. |

**Mapping of course outcomes with Program Outcomes**

| CO | PO1: Engineering knowledge | PO2 Problem analysis | PO3:Design/development of solutions | PO4:Conduct investigations of complex problems | PO5:Modern tool usage | PO6: The engineer and society | PO7:Environment and sustainability | PO8:Ethics | PO9:Individual and team work | PO10:Communication | PO11:Project management and finance | PO12:Life-long learning |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| ECE-503.1 | 1 | | 2 | | | 2 | 1 | | | | | 1 |
| ECE-503.2 | 3 | 3 | 2 | | | | | | 1 | | | 1 |
| ECE-503.3 | 3 | 3 | 2 | | | 2 | 1 | | 1 | | | |
| ECE-503.4 | 1 | | 2 | | | | 1 | | | | | |

**Unit-I: Permanent Way and Railway Engineering Materials:**

1.1 Permanent way components
1.2 Railway Track Gauge
1.3 Cross Section of Permanent Way
1.4 Functions of various Components like Rails, Sleepers and Ballast
1.5 Rail Fastenings

1.6 Creep of Rails- Theories related to creep
1.7 Adzing of Sleepers- Sleeper density
1.8 Rail joints.

**Unit-II: Geometrical Design of Railways:**

2.1 Track: Alignment – Engineering Surveys
2.2 Gradients- Different types of Gradients, Grade Compensation,
2.3 Cant and Negative Super elevation- Cant Deficiency – Degree of Curve – safe speed on curves
2.4 Transition curve – Compound curves – Reverse curves
2.5 Extra clearance on curves – widening of gauge on curves
2.6 Vertical Curves – Cheek Rails on Curves.
2.7 Horizontal Curves, Radius, Super elevation, Cant Deficiency,
2.8 Transitional Curves,

**Unit-III:**

3.1 Track layouts – Switches
3.2 Design of Tongue Rails – Crossings
3.3 Turnouts – Layout of Turnout – Double Turnout
3.4 Diamond crossing – Scissors crossing.
3.5 Signal Objectives – Classification – Fixed signals – Stop signals –
3.6 Signalling systems – Mechanical signalling system – Electrical signalling system
3.7 System for Controlling Train Movement – Interlocking
3.8 Modern signaling Installations.
3.9 Different types of stations and Yards: classification and functioning

**Unit-IV: Airport Planning:**

4.1 Regional Planning, Topographical and Geological Features,
4.2 Air Traffic Characteristics, Development of New Airports,
4.3 Airport Site Selection.
4.4 Aircraft Characteristics: Size, Capacity, Range, Speed, Components of Aircraft, Different Weights Related with Aircraft, Turning Radius.
4.5 Airport Obstruction: Zoning Laws, Classification of Obstructions, Imaginary Surfaces,
4.6 Approach Zones, Turning Zones.

**Unit-V: Airport Layout:**

5.1 Runway Orientation, Wind Rose Diagram,
5.2 Basic Runway Length, Correction for Runway Length,
5.3 Airport Classification,
5.4 Geometric Design, Airport Capacity, Runway Configuration, Taxiway Design, Factors Affecting, Geometric Standards,
5.5 Exit Taxiways, Holding Aprons,

5.6 Location of Terminal Buildings and Aircraft Hangers.
5.7 Structural Design of Airport Pavements: Design Factors, Design Methods for Flexible and Rigid Pavements,
5.8 LCN System. Visual Aids:
5.9 Airport Marking and Lighting, Threshold Lighting, Runway Lighting and Taxiway Lighting Runway Marking and Taxiway Marking.
5.10 Introduction to Airport Drainage System

Text / Reference Books / **Cases:**

1. Satish Chandra and M. M Agarwal", Railway Engineering", Oxford university Press, Second Edition 2013.
2. Rangwala, "Airport Engineering", Charotar Publishing House, 17th Edition 2018.
3. Arora and Saxena, "Railway Engineering", Dhanpat Rai Publications, 2011.
4. R Srinivasan, "Harbour, Dock and Tunnel Engineering", Charotar Publishing House, 2012.
5. Khanna S K, Arora, M G and Jain S S., "Airport Planning and Design", Nem Chand and Bros, 2009.
6. Oza, H. P and Oza, G. H., "Dock and Harbour Engineering", Charotar Book House, 2011).

# Rama University Uttar Pradesh, Kanpur

(vide U.P. Act No. 1 of 2014 as passed by State Legislature and recognized by UGC U/s 2(f))

**Faculty of Engineering &Technology,**

**B.Tech. Civil Engineering**

**Course Curriculum (effective from Session 2021-22)**

## ECE-504: Elementary Architectural Science

| L | T | P | Credit |
|---|---|---|---|
| 3 | 0 | 0 | 3 |

**Pre-requisite:** PCE-301: Building Materials & Construction

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

| | |
|---|---|
| ECE-504.1 | Evaluate quality of indoor climate based on thermal comfort indices. |
| ECE-504.2 | Apply knowledge of thermo-physical properties of materials in evaluating heat flow through buildings. |
| ECE-504.3 | Suggest thermal control methods for buildings |
| ECE-504.4 | Evaluate the natural and artificial lighting of indoor spaces |
| ECE-504.5 | Apply knowledge of behavior sound in free field and enclosures to analyze acoustical features. |

**Mapping of course outcomes with Program Outcomes**

| CO | PO1: Engineering knowledge | PO2 Problem analysis | PO3:Design/development of solutions | PO4:Conduct investigations of complex problems | PO5:Modern tool usage | PO6: The engineer and society | PO7:Environment and sustainability | PO8:Ethics | PO9:Individual and team work | PO10:Communication | PO11:Project management and finance | PO12:Life-long learning |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| ECE-504.1 | 2 | 3 | | | | | | | | | | |
| ECE-504.2 | 3 | 3 | | | | | | | | | | |
| ECE-504.3 | 2 | 3 | 2 | | | | 2 | | | | | |
| ECE-504.4 | 3 | 3 | 2 | | | | | | | | | |
| ECE-504.5 | 2 | 3 | 1 | | | | | | | | | |

**Unit-I: The Thermal Environment:**

1.1 Climatic elements: climate graph – comparison and classification of climates.

1.2 Earth's thermal balance. Thermal balance of human body – thermal comfort indices – comfort zone.

1.3 Thermo-physical properties of building materials: resistance and transmittance – sol- air temperature - solar gain factor.

1.4 Heat flow through buildings – thermal transmittance of structural elements - periodic heat flow.
1.5 Design criteria for control of climate – passive and active building design – passive approach. Active systems – low energy cooling.

**Unit-II: The Luminous Environment:**
2.1 Types of Visual Tasks
2.2 Principles of Day Lighting – Day Light Factor
2.3 Evaluation of Lighting by Windows, Skylights
2.4 Artificial Lighting – Illumination Requirements –Lamps and Luminaries
2.5 Design of Artificial Lighting - Coefficient of Utilisation – Room Index – Maintenance Factor – Room Reflectance - Flood lighting of building exteriors

**Unit-III: The Sonic Environment:**
3.1 Physics of sound – airborne and structure borne propagation – effect of noise on man - behavior of sound in free field and enclosures
3.2 Design Criteria for Spaces – Acoustical Defects – Sound Reduction, Sound Insulation and Reverberation
3.3 Control – Acoustic Materials – Properties – Types and Fixtures.

**Reference Books/ Text Books :**
1. Steven V. Szokolay., "Introduction to Architectural Science - The Basis of Sustainable Design", Routledge, 2014.
2. Koenigseberger., "Manual of Tropical housing and Building – Climatic Design", Universities Press, 2010.
3. Bureau of Indian standards, Handbook on Functional Requirement of Buildings – SP:41(S and T) – 1987
4. Krishnan, "Climate Responsive Architecture", McGraw Hill Education, 2017.
5. Narasimham V., "An Introduction to Building Physics", Kabeer Printing Works, Chennai, 1974.

# Rama University Uttar Pradesh, Kanpur

(vide U.P. Act No. 1 of 2014 as passed by State Legislature and recognized by UGC U/s 2(f))

## Faculty of Engineering &Technology,

**B.Tech. Civil Engineering**

**Course Curriculum (effective from Session 2021-22)**

## *ECE-505:* Ground Water Management

| L | T | P | Credit |
|---|---|---|---|
| 3 | 0 | 0 | 3 |

**Pre-requisite:** PCE-405: Water Resources Engineering

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

| | |
|---|---|
| ECE-505.1 | Understand the hydrologic cycle and about the porous media which is responsible for ground water improvement. |
| ECE-505.2 | Learn the methods to extract the water from ground |
| ECE-505.3 | Understand the role of hydrological cycle in recharge of ground water.. |
| ECE-505.4 | Develop and design of well and monitor recharge capacity as well as efficiency of well. |
| ECE-505.5 | Understand the occurrence of ground water, different types of aquifers and the flow of ground water using various equation. |

**Mapping of course outcomes with Program Outcomes**

| CO | PO1: Engineering knowledge | PO2 Problem analysis | PO3:Design/development of solutions | PO4:Conduct investigations of complex problems | PO5:Modern tool usage | PO6: The engineer and society | PO7:Environment and sustainability | PO8:Ethics | PO9:Individual and team work | PO10:Communication | PO11:Project management and finance | PO12:Life-long learning |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| ECE-505.1 | 3 | 3 | | | | | | | | | | |
| ECE-505.2 | 3 | 2 | | | | | | | | | | |
| ECE-505.3 | 2 | | 3 | | | | | | | | | |
| ECE-505.4 | 3 | 3 | 2 | 3 | | | | | | | | |
| ECE-505.5 | 3 | 3 | | | | | | | | | | |

**Unit-I: Introduction:**

1.1 Ground Water Occurrence and Its Role in Hydrologic Cycle,

1.2 Vertical Distribution of Ground Water,

1.3 Ground Water Bearing Formations,
1.4 Aquifer and Its Classification,
1.5 Flow and Storage Characteristics of Different Types of Aquifers, Storage Release Mechanisms ofAquifers.

**Unit-II: Equations for Flow Through Porous Media:**
2.1 Darcy's Law and Differential Equations Governing Ground Water Flow in Cartesian Coordinates,
2.2 Dupuit-Forchheimer Assumptions.

**Unit-III: Well Hydraulics:**
1.9 Differential Equations Governing Ground Water Flow in Polar Coordinates,
1.10 Well Hydraulics, Well Interference, Wells Near Boundaries,
1.11 Test Pumping Analysis.

**Unit-IV: Ground Water Management:**
4.1 Ground Water Exploration Methods,
*4.2* Types of Wells Construction of Wells,
*4.3* Well Completion and Development,
*4.4* Well Protection, Contamination of Ground Water

**Text / Reference Books:**

1. Todd, D.K. "*Ground Water Hydrology*", New York: John Wiley and Sons;2001
2. Kashef, A.I."*Ground Water Engineering*", New York: McGraw-Hill Book Company;1987
3. Raghunath, H.M. "*Ground Water*", New Delhi: New Age International (P) Limited, Publishers;1990

# Rama University Uttar Pradesh, Kanpur

(vide U.P. Act No. 1 of 2014 as passed by State Legislature and recognized by UGC U/s 2(f))

**Faculty of Engineering &Technology,**

**B.Tech. Civil Engineering**

**Course Curriculum (effective from Session 2021-22)**

## *ECE-506: Rural Water Supply & Sanitation*

| L | T | P | Credit |
|---|---|---|---|
| 3 | 0 | 0 | 3 |

**Pre-requisite:** PCE-502: Environmental Engineering

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

| | |
|---|---|
| **ECE-506.1** | understand about rural sanitation. |
| **ECE-506.2** | understand water treatment and different schemes of rural water supply.. |
| **ECE-506.3** | Understand the new technology used for water supply & its quality. |
| **ECE-506.4** | Understand about the communicable Diseases. |
| **ECE-506.5** | understand about the Fly and Mosquito control |

**Mapping of course outcomes with Program Outcomes**

| CO | PO1: Engineering knowledge | PO2 Problem analysis | PO3:Design/development of solutions | PO4:Conduct investigations of complex problems | PO5:Modern tool usage | PO6: The engineer and society | PO7:Environment and sustainability | PO8:Ethics | PO9:Individual and team work | PO10:Communication | PO11:Project management and finance | PO12:Life-long learning |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **ECE-506.1** | 2 | | 2 | | | | | 1 | 1 | | | |
| **ECE-506.2** | 2 | | 2 | | | | | 1 | 1 | | | |
| **ECE-506.3** | 2 | | 2 | | | | | 1 | 1 | | | |
| **ECE-506.4** | 2 | | 2 | | | | | 1 | 1 | | | |
| **ECE-506.5** | 2 | | 2 | | | | | 1 | 1 | | | |

**Unit-I: General:**

1.1 Importance of village community in India,

1.2 Condition of Indian villages with special regard to economics, social and health aspects.

1.3 **Sources of Water:** Traditional sources of water in rural areas.

1.4 Different types of wells, sanitary aspects in well construction,

1.5 Pumps used for village wells,
1.6 Hand pump Technology, its operation and maintenance.
1.7 Water harvesting techniques

**Unit-II: Quality of Water:**
2.1 Estimation of total water requirement including cattle water demand,
2.2 Quality of water needed for village community,
2.3 Water quality surveillance, standards of water quality.
2.4 Communicable Diseases: Diseases and immunity,
2.5 Source of communicable diseases, Mode of transfer, Control of communicable diseases, Guinea worm Eradication.

**Unit-III: Water Treatment:**
3.1 Slow sand filter, horizontal roughing filter and their combination.
3.2 Disinfection of rural water sources,
*3.3* Fluoride and its removal.
*3.4* Schemes of Rural water supply: Different Schemes of Rural water supply in Rajasthan, Their Design and project formulation including the programmes and standards laid by Govt. of India

**Unit-IV: Milk and Food Sanitation:**
1.12 Essentials of dairy farm and cattle shed sanitation,
1.13 Tests for milk and dairy products, food epidemics, food poisoning, Botulism.
1.14 Fly and Mosquito control: Life cycle of flies and mosquitoes, various methods of flies and mosquito control.

**Unit-IV: Rural Sanitation:**
5.1 Village latrines, VIP latrines, pour flush latrines, materials, construction and cost of the latrines,
5.2 Pollution aspects and pollution travel from latrines.
5.3 Storm water and sludge problems.
5.4 Septic tank, soak pit, small bore sewer system; its design and construction.
*5.5* Animal waste, method of composting, Biogas, collection and disposal of wastes.
*5.6* Community Awareness and user participation: Planning of communication support in rural supply and sanitation projects.

**Text / Reference Books:**
1. Mann H.T. and Williamson D., Water Treatment and Sanitation – Simple Method for Rural Area"
2. Brikké F, Operation and maintenance of rural water supply and sanitation systems
3. Wanger E.G. and Lanoix J.N., Water Supply for Rural Areas & Small Communities"

4. E.W.Steel & T.J.Mcghee, WHO „Water Supply and Sewerage", Tata McGraw Hill.
5. Manual on Water Supply and Treatment", CPHEEO, Ministry of Urban Development, Govt. of India.
6. Manual on Sewerage and Sewage Treatment", CPHEEO, Ministry of Urban Development, Govt. of India
7. Environmental Engineering" by D. Srinivasan, PHI Learning Pvt. Ltd. 2009.
8. Metcalf & Eddy, " Wastewater Engineering: Treatment and Reuse", McGraw Hill Education Pvt. Ltd. (India) Noida

# Rama University Uttar Pradesh, Kanpur

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**Faculty of Engineering &Technology,**

**B.Tech. Civil Engineering**

**Course Curriculum (effective from Session 2021-22)**

## LCE-551: Mini Project-I

| L | T | P | Credit |
|---|---|---|---|
| 0 | 0 | 2 | 1 |

Pre-requisite: **None**

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

| | |
|---|---|
| **LCE-551.1** | Use the engineering knowledge acquired to make preliminary investigations and do functional and/or structural design of a facility. |
| **LCE-551.2** | Present the project with clarity, following ethical norms in oral and written mode |
| **LCE-551.3** | Develop a team and effectively participate in the team to execute the project |
| **LCE-551.4** | Address environmental / social / engineering problems through the project |

**Mapping of course outcomes with Program Outcomes**

| CO | PO1: Engineering knowledge | PO2 Problem analysis | PO3:Design/development of solutions | PO4:Conduct investigations of complex problems | PO5:Modern tool usage | PO6: The engineer and society | PO7:Environment and sustainability | PO8:Ethics | PO9:Individual and team work | PO10:Communication | PO11:Project management and finance | PO12:Life-long learning |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **LCE-551.1** | 3 | 3 | 3 | 3 | | | | | | | | |
| **LCE-551.2** | | | | | | | | 3 | 3 | 3 | | 3 |
| **LCE-551.3** | | | | | | | | 3 | 3 | | | |
| **LCE-551.4** | | | | | 3 | 3 | 3 | 3 | 3 | | | 3 |

**List of Experiments:**

- ***Students will be asked to work upon minimum two of the following topics during the semester.***

- **They will submit the report of each topic containing following information (as per need of topic) like: introduction, general information, usage/application (if any) detailed description of work/process, relevant diagrams, drawings & tabulation (if any), observation and results (as applicable) or any other relevant information as per topic.**

1. Work related to preparation of layout plan of a building and its marking on ground.
2. Structural Analysis of a G+5 residential building and determination of design parameters.
3. Work related to design of a small sewage treatment plant (STP) unit for a residential society.
4. Work related to design of a small water treatment plant (STP) unit for a residential society.
5. Work related to design of a Water Distribution System for a residential society.
6. Work related to computation of surface runoff and design of rain water harvesting system for given area (relevant software may be used for runoff computation).

**HSC-501: Reasoning Ability–I**

| L | T | P | Credit |
|---|---|---|---|
| 2 | 0 | 0 | 2 |

**PATHWAY ELECTIVE-I**

| L | T | P | Credit |
|---|---|---|---|
| 3 | 0 | 0 | 3 |

**OPEN ELECTIVE-I**

| L | T | P | Credit |
|---|---|---|---|
| 3 | 0 | 0 | 3 |

# Rama University Uttar Pradesh, Kanpur

(vide U.P. Act No. 1 of 2014 as passed by State Legislature and recognized by UGC U/s 2(f))

**Faculty of Engineering &Technology,**

**B.Tech. Civil Engineering**

**Course Curriculum (effective from Session 2021-22)**

**SEMESTER-VI (THIRD YEAR)**

## PCE-601: Reinforced Cement Concrete Design

| L | T | P | Credit |
|---|---|---|---|
| 3 | 1 | 0 | 4 |

Pre-requisite: **PCE-401: Structural Analysis**

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

| | |
|---|---|
| **PCE-601.1** | Understand the concept of shear and shear reinforcement. |
| **PCE-601.2** | analyze and design beams. |
| **PCE-601.3** | analyze and design columns. |
| **PCE-601.4** | analyze and design slab. |
| **PCE-601.5** | analyze and design footings. |

**Mapping of course outcomes with Program Outcomes**

| CO | PO1: Engineering knowledge | PO2 Problem analysis | PO3:Design/development of solutions | PO4:Conduct investigations of complex problems | PO5:Modern tool usage | PO6: The engineer and society | PO7:Environment and sustainability | PO8:Ethics | PO9:Individual and team work | PO10:Communication | PO11:Project management and finance | PO12:Life-long learning |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **PCE-601.1** | 3 | | 2 | | 3 | 1 | | 2 | | | 3 | |
| **PCE-601.2** | 3 | | 2 | | 3 | 1 | | 2 | | | 3 | |
| **PCE-601.3** | 3 | | 2 | | 3 | 1 | | 2 | | | 3 | |
| **PCE-601.4** | 3 | | 2 | | 3 | 1 | | 2 | | | 3 | |
| **PCE-601.5** | 3 | | 2 | | 3 | 1 | | 2 | | | 3 | |

**Unit-I: Introduction to Various Design Philosophies:**

1.1 Design of Rectangular Singly and Doubly Reinforced Sections by Working Stress Method
1.2 Design of Rectangular Singly and Doubly Reinforced Sections by Limit State Method,
1.3 Design and analysis of T- Beams by Limit State Design Method
1.4 Design and analysis of L-Beams by Limit State Design Method

**Unit-II: Behavior of RC Beam in Shear:**

1.15 Shear Strength of Beams with and without Shear Reinforcement,
1.16 Minimum and Maximum Shear Reinforcement,
1.17 Design of Beam in Shear,
1.18 Development Length, Anchorage Bond, Flexural Bond,
1.19 Failure of Beam Under Shear, Concept of Equivalent Shear and Moments.

**Unit-III: Design of Slab:**

3.1 Design of One Way Solid Slabs by Limit State Design Method,
3.2 Design of Two Way Solid Slabs by Limit State Design Method,
3.3 Circular Slab by Limit State Design Method,
3.4 Serviceability, Control of Deflection, Cracking and Vibrations.
3.5 Introduction to Flat Slabs

**Unit-IV: Design of Columns:**

4.1 Columns: Short and long columns, their structural behavior.
4.2 Analysis and design of axially loaded short columns, using Limit State Method.
4.3 Analysis of uniaxial eccentrically loaded short columns.
4.4 Introduction to Pu-Mu interaction curves and their use for eccentrically loaded columns.

**Unit-V: Design of Column Footings:**

5.1 Analysis and design of isolated column footing for axial loads using Limit State Method.
5.2 Analysis and design of combined footing for two columns (without central beam) for axial loads using Limit State Method.

**Text / Reference Books:**

1. Dayaratnam, P. (2008), "Limit State Design of Reinforced Concrete Structures", Oxford Publishers, New Delhi.

2. Gambhir, M.L. (2009), "Fundamentals of Reinforced Concrete Design", PHI Publisher, New Delhi.
3. IS:456. (2000), 'Plain and Reinforced Concrete - Code of Practice", Bureau of Indian Standards, New Delhi.
4. Jai Krishna. (2007), "Plain and Reinforced Concrete", Vol. 1 and 2, Nem Chand Brothers, Roorkee.
5. Jain, A.K. (2007), "Reinforced Concrete: Limit State Design", Nem Chand and Brothers, Roorkee.
6. Krishna Raju, N. (2007), "Prestressed Concrete", Tata McGraw Hill, New Delhi.
7. Menon, D. and Pillai, S. (2007), "Reinforced Concrete Design", Tata McGraw Hill, New Delhi.
8. Park, R. and Paulay, T. (2009), "Reinforced Concrete Structures", Wiley India Pvt. Ltd., New Delhi.
9. Shetty, M.S. (2008). "Concrete Technology", S. Chand Publishers, New Delhi.

| Engineering Minor Elective | Specialization | | | | | |
|---|---|---|---|---|---|---|
| | **Structural Engineering** | **Geo-technical Engineering** | **Transportation Engineering** | **Construction Technology & Management** | **Water Resources Engineering** | **Environmental Engineering** |
| II | *Advanced Design of Concrete Structures* | *Geo-synthesis & Reinforced Soil Structures* | *Pavement Designs* | *Remote Sensing & GIS* | *Ground Water Hydrology* | *Integrated Waste Management for a Smart City* |

## *ECE-601: Advanced Design of Concrete Structure*

| L | T | P | Credit |
|---|---|---|---|
| 3 | 0 | 0 | 3 |

Pre-requisite: **PCE-601: Reinforced Cement Concrete Design**

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

| | |
|---|---|
| **ECE-601.1** | Design the various types of retaining walls, RC walls and shear wall. |
| **ECE-601.2** | Apply the concept of various theories in designing the storage structures and domes. |
| **ECE-601.3** | Analyze and design transportation structures |

## Mapping of course outcomes with Program Outcomes

| CO | PO1: Engineering knowledge | PO2 Problem analysis | PO3:Design/development of solutions | PO4:Conduct investigations of complex problems | PO5:Modern tool usage | PO6: The engineer and society | PO7:Environment and sustainability | PO8:Ethics | PO9:Individual and team work | PO10:Communication | PO11:Project management and finance | PO12:Life-long learning |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| ECE-601.1 | 3 | | | | | | | | | | | 2 |
| ECE-601.2 | 3 | 2 | 2 | | | | | | | | | |
| ECE-601.3 | 3 | 3 | 3 | | 2 | | | | 2 | 1 | | |

**Unit-I: Earth Retaining Structures:**

1.1 Retaining walls- types - Cantilever and Counterfort

1.2 Design - Drainage and Other Construction Details.

1.3 Design of RC walls - Shear walls.

**Unit-II: Design of Spherical and Conical Domes:**

2.1 Detailing- Liquid Retaining structure - Water tanks - types - square, rectangular, circular

2.2 Design of underground and elevated tanks - design of staging.

2.3 Design of circular silo using Jansen's theory

**Unit-III: Columns and Transportation Structures:**

3.1 Design of corbels,

3.2 Design of long columns

3.3 Bridges - Slab Bridge - Design of single span slab bridge

3.4 Tee Beam Bridge with cross girders

**Text / Reference Books:**

1. Punmia, B.C., Jain, A.K.& Jain, A.K. - RCC Designs (Reinforced Concrete Design), 10th Edition, Lakshmi Publishers, 2006
2. Dayaratnam P. *Limit State Design of Reinforced Concrete Structures* New Delhi: Oxford Publishers; 2008.
3. Jain A.K., "Reinforced Concrete - Limit State Design- 7th Edition", Nem Chand & Bros., 2012
4. Varghese P.C., "Advanced Reinforced Concrete Design", PHI, 2010.
5. N .Krishna Raju, "Design of bridges", Oxford University Press, 2019.

6. Gambhir M. L *Fundamentals of Reinforced Concrete Design* New Delhi: PHI Publisher; 2009.
7. IS: 456:2000 *Plain and Reinforced Concrete - Code of Practice* New Delhi: Bureau of Indian Standards.
8. Krishna Jai, *Plain and Reinforced Concrete*-Vol.1, Roorkee: Nem Chand Brothers; 2007.
9. Jain A.K. *Reinforced Concrete: Limit State Design* Roorkee: Nem Chand and Brothers; 2007.
10. Menon D. and Pillai, S. *Reinforced Concrete Design* New Delhi: Tata McGraw Hill; 2007.
11. Park R. and Paulay T *Reinforced Concrete Structures* New Delhi: Wiley India Pvt. Ltd; 2009.
12. Varghese, P. C. *Limit State Design of Reinforced Concrete* New Delhi: PHI Publishers; 2009.
13. N. Krishnaraju, "Advanced Reinforced Concrete Design", CBS Publisher, 2016
14. R.D. Anchor., "Design of Liquid Retaining Concrete Structures – Second edition" British Library Cataloguing in Publication Data, 1992.
15. D.Johnson Victor, "Essentials of bridge engineering", Oxford University Press, 2019.
16. Mosley. B., John B., & Ray Hulse "Reinforced Concrete Design to Eurocode-2"Red Globe Press, 2012.
17. BIS codes (IS 456 -2000, IS 4995 – 1978 Part (I&II), IS 3370- 2009 Part I&II), IS3370 – 1967 Part IV, IS1893- 2016 PART 1, IS13920-2016, SP16-1980, SP24-1983, SP34-1999)
18. IRC Codes (IRC 5 – 2015, IRC 6-2017, IRC 112-2011, IRC SP105-2015, IRC SP13-2004)

# Rama University Uttar Pradesh, Kanpur

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**Faculty of Engineering &Technology,**

**B.Tech. Civil Engineering**

**Course Curriculum (effective from Session 2021-22)**

## *ECE-602:* Geo-synthetics & Reinforced Soil Structures

| L | T | P | Credit |
|---|---|---|---|
| 3 | 0 | 0 | 3 |

Pre-requisite: **PCE-501: Geotechnical Engineering**

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

| | |
|---|---|
| **ECE-602.1** | understand the concept and types of Geo-synthetics |
| **ECE-602.2** | assess and apply Applications of Geo-synthetics in flexible pavements, landfills, drainage and retaining walls |

**Mapping of course outcomes with Program Outcomes**

| CO | PO1: Engineering knowledge | PO2 Problem analysis | PO3:Design/development of solutions | PO4:Conduct investigations of complex problems | PO5:Modern tool usage | PO6: The engineer and society | PO7:Environment and sustainability | PO8:Ethics | PO9:Individual and team work | PO10:Communication | PO11:Project management and finance | PO12:Life-long learning |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **ECE-602.1** | 2 | 2 | 2 | 2 | | | | | | | | 1 |
| **ECE-602.2** | 2 | 2 | 3 | 2 | | | | | | | | 1 |

**Unit-I: Introduction to Geo-synthetics**

1.1 Types of Geo-synthetics,

**1.2** Artificial and Natural Geo-synthetics and their Applications,

**1.3** Manufacture of Geo-synthetics,

**1.4** Strength of Reinforced Soils,

**1.5** Testing of Geo-synthetics.

**1.6** Drainage Application of Geo-synthetics ,

**1.7** Filtration Applications of Geo-synthetics, Erosion Control using Geo-synthetics

**1.8** Geo-synthetics in Flexible Pavements,

1.9 Introduction to Geo-synthetics in Landfills,

1.10 Geo-synthetics For Construction of Landfills.

**Unit-II:**

2.1 Sustainable Infrastructure Development,
2.2 Different Types of Soil Retaining Structures,
2.3 Design Codes for Reinforced Soil Retaining Walls,
2.4 Construction Aspects of Geo-synthetics Reinforced Soil Retaining Wall,
2.5 Testing Requirements for Reinforced Soil Retaining Walls,
2.6 Geo-synthetic Reinforced Soil Embankments.

**Unit-III:**

3.1 Pavement Evaluation and Rehabilitation.
3.2 Design of Reinforced Soil Retaining Walls – Simple Geometry,
3.3 Design Of Reinforced Soil Retaining Walls – Sloped Backfill Soil, Soil Embankments Supported on Geo-cell Mattresses,
3.4 Geo-synthetic Reinforced Pile Systems for High Embankments,
3.5 Reinforced Soil for Supporting Shallow Foundations,
3.6 Response of Footings Resting on Reinforced Foundation Soils,
3.7 Bearing Capacity Analysis of Footings Resting on Reinforced Foundation Soils,
3.8 Carbon Footprint Analysis

**Text / Reference Books:**

1. Koerner, R.M. "Designing with Geo-synthetics", Prentice Hall, New Jersey, USA, 4thedition, 1999.
2. Jewell, R.A., "Soil Reinforcement with Geo-textiles", Special Publication No. 123,CIRIA, Thomas Telford. London, UK, 1996.
3. Geo-synthetics - New Horizons, Eds. G.V. Rao, PK Banerjee, J.T. Shahu, G.V. Ramana,Asian Books Private Ltd., New Delhi, 2004.
4. Hoe I. Ling, Guido Gottardi , Daniele Cazzuffi , Jie Han , Fumio Tatsuoka "Design andPractice of Geo-synthetic-Reinforced Soil Structures"
5. Sanjay Kumar Shukla, Erol Guler "Advances in Reinforced Soil Structures".

# Rama University Uttar Pradesh, Kanpur

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**Faculty of Engineering &Technology,**

**B.Tech. Civil Engineering**

**Course Curriculum (effective from Session 2021-22)**

***ECE-603: Pavement Design***

| L | T | P | Credit |
|---|---|---|---|
| 3 | 0 | 0 | 3 |

Pre-requisite: **PCE-404: Highway Engineering**

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

| | |
|---|---|
| **ECE-603.1** | Evaluate the constituents of flexible and rigid pavements |
| **ECE-603.2** | Analyze the stresses in flexible pavement |
| **ECE-603.3** | Design the structure of a flexible pavement. |
| **ECE-603.4** | Analyse the stresses in rigid pavement |
| **ECE-603.5** | Design the structure of a rigid pavement. |

**Mapping of course outcomes with Program Outcomes**

| CO | PO1: Engineering knowledge | PO2 Problem analysis | PO3:Design/development of solutions | PO4:Conduct investigations of complex problems | PO5:Modern tool usage | PO6: The engineer and society | PO7:Environment and sustainability | PO8:Ethics | PO9:Individual and team work | PO10:Communication | PO11:Project management and finance | PO12:Life-long learning |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **ECE-603.1** | | 2 | 2 | 3 | | | | | | | | 1 |
| **ECE-603.2** | 2 | 2 | 3 | 2 | | | | | | | | 1 |
| **ECE-603.3** | 2 | 2 | 3 | 2 | | | | | | | | 1 |
| **ECE-603.4** | 2 | 2 | 3 | 2 | | | | | | | | 1 |
| **ECE-603.5** | 2 | 2 | 3 | 2 | | | | | | | | 1 |

**Unit-I: Introduction:**

1.1 Types and component parts of pavements

1.2 Factors affecting design and performance of pavements
1.3 Functions and significance of different layers of a pavement.
1.4 Test conducted to assess the properties of subgrade soil, aggregate and bitumen.
1.5 Design of bituminous mixes by Marshall method.

**Unit-II: Stress Analysis and Design of Flexible Pavement:**

2.7 Stresses and deflections in homogeneous masses.
2.8 Burmister's 2-layer, 3-layer and multi-layer theories.
2.9 Wheel load stresses - ESWL of multiple wheels, repeated loads and EWL factors - empirical, semi-empirical and theoretical approaches for flexible pavement design.
2.10 Design of flexible pavements as per IRC.

**Unit-III: Stresses analysis and Design of Rigid Pavement:**

3.9 Types Of Stresses and Causes
3.10 Factors Influencing Stresses,
3.11 General Conditions In Rigid Pavement Analysis.
3.12 Types of stresses - wheel load stresses, warping stresses, friction stresses, combined stresses.
3.13 Functions of various types of joints in cement concrete pavements
3.14 Design of longitudinal, contraction and expansion joints as per IRC recommendations.
3.15 Pavement evaluation and rehabilitation.

**Text / Reference Books:**

1. Yoder and W Nitezak, "Principles of Pavement Design", John Wiley, 1975.
2. Khanna S. K. and Justo, C E G, "Highway Engineering", Nem Chand and Bros, 2017.
3. Yang. H. H., "Pavement Analysis and Design", Pearson Education, 2010.
4. David Croney, "The Design and Performance of Road pavements", McGraw Hill, 1997.
5. Haas R., Hudson W. R., and Zaniewski, J., "Pavement Management System", McGraw Hill Book Co, 1994.
6. IRC 37- 2018, "Guidelines for the Design of Flexible Pavements"
7. IRC 58-2015, "Guidelines for the Design of Plain Joined Rigid Pavements for Highways"
8. IRC 81-1991, "Guidelines for Strengthening of Flexible Road Pavements using Benkelman Beam Deflection Technique".

# Rama University Uttar Pradesh, Kanpur

(vide U.P. Act No. 1 of 2014 as passed by State Legislature and recognized by UGC U/s 2(f))

**Faculty of Engineering &Technology,**

**B.Tech. Civil Engineering**

**Course Curriculum (effective from Session 2021-22)**

***ECE-704: Sustainable Construction***

| L | T | P | Credit |
|---|---|---|---|
| 3 | 0 | 0 | 3 |

Pre-requisite: **PCE-501-**

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

| | |
|---|---|
| **ECE-604.1** | Understand building assessment standards and apply in documentation processes. |
| **ECE-604.2** | Assess building energy issues and suggest design options |
| **ECE-604.3** | Propose strategies for water conservation and recycling |
| **ECE-604.4** | Ensure proper indoor air quality during construction |

**Mapping of course outcomes with Program Outcomes**

| CO | PO1: Engineering knowledge | PO2 Problem analysis | PO3:Design/development of solutions | PO4:Conduct investigations of complex problems | PO5:Modern tool usage | PO6: The engineer and society | PO7:Environment and sustainability | PO8:Ethics | PO9:Individual and team work | PO10:Communication | PO11:Project management and finance | PO12:Life-long learning |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **ECE-604.1** | 2 | 3 | | | | | 2 | | | | | |
| **ECE-604.2** | 3 | 3 | 2 | | | | 2 | | | | | |
| **ECE-604.3** | 2 | 3 | 2 | | | 1 | 2 | | | | | |
| **ECE-604.4** | 2 | 3 | | | 1 | 1 | 2 | | | | | |

**Unit-I: Introduction:**

1.1 Sustainability in the built environment: sustainable development relative to ecological, economic and social conditions

1.2 Efforts in Sustainable Development and Construction

1.3 International Organisations involved. Ethics and sustainability:
1.4 Environmental and resource concerns – resource consumption by construction industry-Green building movement.
1.5 Ecological design – concept – major contributions.
1.6 Building assessment and eco labels – standards (LEED, GRIHA) – assessment structure and process.
1.7 Green building design process – documentation requirements.

**Unit-II:**

2.1 Sustainable site and landscape
2.2 Storm Water Management,
2.3 Heat Island Mitigation
2.4 Assessment of Sustainable Sites.
2.5 Building Energy Issues - Building Energy Design Strategy- Building Envelope – Internal Load Reduction
2.6 Energy Optimisation - Renewable Energy Systems.
2.7 Reducing Carbon Footprint.
2.8 Built Environment Hydrologic Cycle – Water Resources Issues
2.9 Strategies For Conservation And Recycling – Waste Water And Storm Water Handling Strategies.
2.10 Materials Resources - Life Cycle Assessment – Embodied Energy
2.11 Green Building Materials And Products – Assessing For Environmental Impacts
2.12 Design For Deconstruction – Leed Credits For Different Aspects.

**Unit-III:**

3.1 Indoor Environmental Quality – Issues and Causes,
3.2 Components of Integrated Design – Emissions from Building Materials.
3.3 Construction Operations – Site Planning, Indoor Air Quality During Construction
3.4 Materials Management

**Reference Books/ Text Books :**

1. "Sustainable Building Design Manual- Volume II", Published by TERI, New Delhi, 2009.
2. Kibert, C.J., "Sustainable Construction: Green Building Design and Delivery", John Wiley & Sons, 2016.
3. Steven V. Szokolay., "Introduction to Architectural Science - The Basis of Sustainable Design", Elsevier, 2008.

# Rama University Uttar Pradesh, Kanpur

(vide U.P. Act No. 1 of 2014 as passed by State Legislature and recognized by UGC U/s 2(f))

**Faculty of Engineering &Technology,**

**B.Tech. Civil Engineering**

**Course Curriculum (effective from Session 2021-22)**

## ECE-605: Ground Water Hydrology

| L | T | P | Credit |
|---|---|---|---|
| 3 | 0 | 0 | 3 |

Pre-requisite: **PCE-405: Water Resources Engineering**

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

| | |
|---|---|
| ECE-605.1 | Understand the basics of groundwater and analyse movement of groundwater in aquifer. |
| ECE-605.2 | Estimate the aquifer parameters and groundwater resources for different hydro-geological boundary conditions. |
| ECE-605.3 | Comprehend the types, design principles and construction of wells. |

**Mapping of course outcomes with Program Outcomes**

| CO | PO1: Engineering knowledge | PO2 Problem analysis | PO3:Design/development of solutions | PO4:Conduct investigations of complex problems | PO5:Modern tool usage | PO6: The engineer and society | PO7:Environment and sustainability | PO8:Ethics | PO9:Individual and team work | PO10:Communication | PO11:Project management and finance | PO12:Life-long learning |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| ECE-605.1 | 3 | 1 | | | | | | | | | | |
| ECE-605.2 | 3 | 1 | | | | | | | | | | |
| ECE-605.3 | 3 | 1 | 3 | | | | | | | | | |

**Unit-I: Occurrence Of Ground Water:**

**1.1 Origin** - Rock Properties Affecting Ground Water Vertical Distribution
**1.2** Geologic Formations As Aquifers -Types Of Aquifers - Aquifer Parameters-Ground Water Basins - Springs
**1.3** Laplace Equation - Potential Flow Lines
**1.4** Flownet – Flownet For Anisotropic Soils
**1.5** Seepage Under A Dam
**1.6** Groundwater Contours

1.7 Determination Of Flow Direction
1.8 Steady Unidirectional Flows In Aquifers- Confined And Unconfined
1.9 Aquifer With Percolation
1.10 Steady Radial Flow Towards A Well- Well In Uniform Flow
1.11 Steady Flow With Uniform Discharge- Partially Penetrating Wells- Steady Flow In Leaky Aquifer.

**Unit-II: Unsteady Flow:**

2.1 General Equation- Cartesian and Polar Coordinate
2.2 Unsteady Radial Flow in to a Well - Confined, Unconfined and Leaky Aquifers
2.3 Multiple Well System - Pumping Tests
2.4 Non Equilibrium Equation For Pumping Tests
2.5 Thies' Method - Jacob Method - Chow's Method
2.6 Characteristics Well Losses –Step Draw Down Test- Well Near Aquifer Boundaries
2.7 Determination Of Boundaries From Pumping Test. Image Wells for Various Boundary Conditions
2.8 Cavity Well And Open Well- Yield Tests-Pumping and Recuperation Test.

**Unit-III: Tube Wells: Design:**

3.1 Screened Wells - Gravel Packed Wells
3.2 Well Loss-Selection Of Screen Size
3.3 Yield Of A Well - Test Holes - Well Logs
3.4 Methods Of Construction - Dug Wells -Shallow Tube Wells - Deep Wells - Gravity Wells
3.5 Drilling In Rocks - Screen Installation - Well Completion - Well Development
3.6 Testing Wells For Yield - Collector - Or Radial Wells - Infiltration Galleries
3.7 Well Point System
3.8 Failure Of Tube Wells
3.9 Ground Water Investigation Methods

**Text / Reference Books:**

1. Asawa, G.L. "*Irrigation And Water Resources Engineering*", New Delhi: New Age International (P) Limited, Publishers;2005
2. Ojha, C.S.P., Berndtsson, R., And Bhunya, P. "*Engineering Hydrology*", New Delhi: Oxford University Press;2008
3. Singh, V.P. "*Elementary Hydrology*", New Delhi: Prentice-Hall;1992
4. Subramanya, K "*Engineering Hydrology*", New Delhi: Tata Mcgraw-Hill Publishing Company Limited;1994
5. Todd, D.K., And Mays, L.W. "*Groundwater Hydrology, 3rd Edition*", U.S.A: John Wiley & Sons, Inc;2004

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**Faculty of Engineering &Technology,**

**B.Tech. Civil Engineering**

**Course Curriculum (effective from Session 2021-22)**

## ECE-606: Integrated Waste Management for a Smart City

| L | T | P | Credit |
|---|---|---|---|
| 3 | 0 | 0 | 3 |

Pre-requisite: **PCE-502: Environmental Engineering**

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

| | |
|---|---|
| ECE-606.1 | Study of physical, chemical, and biological properties of solid wastes |
| ECE-606.2 | Analyze of solid waste generation and collection |
| ECE-606.3 | Dispose off Solid waste materials |
| ECE-606.4 | Study hazardous Wastes |
| ECE-606.5 | explain the various aspects of solid waste management |

**Mapping of course outcomes with Program Outcomes**

| CO | PO1: Engineering knowledge | PO2 Problem analysis | PO3:Design/development of solutions | PO4:Conduct investigations of complex problems | PO5:Modern tool usage | PO6: The engineer and society | PO7:Environment and sustainability | PO8:Ethics | PO9:Individual and team work | PO10:Communication | PO11:Project management and finance | PO12:Life-long learning |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| ECE-606.1 | 1 | 2 | 3 | 1 | | 1 | | 3 | 1 | | 3 | |
| ECE-606.2 | 1 | 2 | 3 | 1 | | 1 | | 3 | 1 | | 3 | |
| ECE-606.3 | 1 | 2 | 3 | 1 | | 1 | | 3 | 1 | | 3 | |
| ECE-606.4 | 1 | 1 | 3 | 1 | | 1 | | 3 | 1 | | 3 | |
| ECE-606.5 | 1 | 1 | 3 | 1 | | 1 | | 3 | 1 | | 3 | |

**Unit-I: Solid Waste Management:**

1.1 Definition, Composition, Properties,

1.2 Concept of 4Rs (reduce, reuse, recycle and recover) of waste management

1.3 Elements of a waste management system,
1.4 Current Issues in Solid Waste Management,
1.5 Integrated Waste Management Hierarchy: Source reduction, Recycling, Waste-to-Energy and Land filling.
1.6 Review of waste management under Swachh Bharat Mission and Smart Cities Program.

**Unit-II: Municipal Solid Waste:**
2.1 Waste Composition and Quantities, Collection, Transportation, Segregation, and Processing.
2.2 Disposal of Municipal Solid Waste: Landfill, Biochemical Processes and Composting,
2.3 Energy Recovery from Municipal Solid Waste.
2.4 Municipal Solid Waste (MSW) Rules 2016.

**Unit-III: Construction and Demolition**(C&D) Waste:
3.1 (C&D) Waste Management: Overview,
3.2 Components; C&D Waste Management Rules 2016,
3.3 Beneficial Reuse of C & D Waste Materials.

**Unit-IV: Hazardous and Electronic Wastes** :
1.1 **Definition**, Classification, Risk assessment, Transportation of hazardous waste,
1.2 Current Management Practices: Environmental audit, Containment, Remedial alternatives
1.3 **Electronic Waste (E-Waste) Management** – Issues and Status in India and Globally,
1.4 E-Waste Management Rules 2016 and Management Challenges.

**Text / Reference Books:**

1. George Tchobanoglous, Hilary Theisen and Samuel A Vigil, Integrated Solid Waste management, Tata McGraw Hill
2. Ramachandra T.V., *Management of Municipal Solid Waste*, 2009; by The Energy and Resource Institute, TERI
3. Sasikumar, K, Gopi Krishna, Sanoop, *Solid Waste Management*; 2009, PHI.
4. A D Bhide: Solid waste management in developing countries, Nagpur Publications.
5. Lagrega, Buckingham and Evans: Hazardous Waste Management, McGraw Hill, N.Y.
6. Manual on Solid Waste Management, prepared by The Central Public Health and Environmental Engineering Organization(CPHEEO), India
7. MSW Management Rules 2016, Govt. of India, available online at CPCB website
8. Construction and Demolition Waste Management Rules, 2016, MoEF&CC
9. Electronic Waste Management Rules 2016, Govt. of India, available online at CPCB website.
10. O P Gupta, " Element of Solid waste hazardous management, Khanna Publishinghouse.
11. Freeman, M. H.1988. Standard Handbook of Hazardous Waste Treatment and Disposal, McGraw-Hill Book Company, New York
12. http://swachhbharatmission.gov.in/sbmcms/index.htm
13. http://swachhbharaturban.gov.in/

## HSC-601: Reasoning Ability–II

| L | T | P | Credit |
|---|---|---|---|
| 2 | 0 | 0 | 2 |

## PATHWAY ELECTIVE-II

| L | T | P | Credit |
|---|---|---|---|
| 3 | 0 | 0 | 3 |

## OPEN ELECTIVE-II

| L | T | P | Credit |
|---|---|---|---|
| 3 | 0 | 0 | 3 |

# Rama University Uttar Pradesh, Kanpur

(vide U.P. Act No. 1 of 2014 as passed by State Legislature and recognized by UGC U/s 2(f))

**Faculty of Engineering & Technology,**

**B.Tech. Civil Engineering**

**Course Curriculum (effective from Session 2021-22)**

## PCE-651: STAAD Pro Laboratory

| L | T | P | Credit |
|---|---|---|---|
| 0 | 0 | 2 | 1 |

**Pre-requisite:**

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

| | |
|---|---|
| **PCE-651.1** | Design of Concrete Beam using STAAD Pro |
| **PCE-651.2** | Design of Concrete Column using STAAD Pro |
| **PCE-651.3** | Design of Concrete footing using STAAD Pro |
| **PCE-651.4** | Design of Concrete G+2 building using STAAD Pro. |

**Mapping of course outcomes with program outcomes**

| CO | PO1: Engineering knowledge | PO2 Problem analysis | PO3:Design/development of solutions | PO4:Conduct investigations of complex problems | PO5:Modern tool usage | PO6: The engineer and society | PO7:Environment and sustainability | PO8:Ethics | PO9:Individual and team work | PO10:Communication | PO11:Project management and finance | PO12:Life-long learning |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **PCE-651.1** | 3 | 2 | | | | | | | | | 1 | |
| **PCE-651.2** | 3 | 2 | | | | | | | | | 1 | |
| **PCE-651.3** | 3 | 2 | | | | | | | | | 1 | |
| **PCE-651.4** | 3 | 2 | | | | | | | | | 1 | |

**List of Experiments:**

Design of Concrete Structures as per all major international codes

1. Design of Concrete Beam
2. Design of Cantilever Beam

3. Design of Concrete Column
4. Design of Concrete Slab
5. Design of Concrete Footing
6. Design a G+2 building
7. Numerical and Graphical Design Outputs with complete reinforcement details.
8. IS 456-2000 for RCC design implemented.
9. RC detailer as per IS 456-2000 has been implemented which has given a new dimension to RCC design never witnessed in STAAD before

## LCE-651: Mini Project-II

| L | T | P | Credit |
|---|---|---|---|
| 0 | 0 | 2 | 1 |

**Pre-requisite:**

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

| | |
|---|---|
| LCE-651.1 | apply the engineering knowledge acquired to make preliminary investigations and do functional and/or structural design of a facility. |
| LCE-651.2 | estimate the material and/or cost requirement involved in a project . |
| LCE-651.3 | present the project with clarity, following ethical norms in oral and written mode |
| LCE-651.4 | develop a team and effectively participate in the team to execute the project |
| LCE-651.5 | address environmental / social / engineering problems through the project |

**Mapping of course outcomes with program outcomes**

| CO | PO1: Engineering knowledge | PO2 Problem analysis | PO3:Design/development of solutions | PO4:Conduct investigations of complex problems | PO5:Modern tool usage | PO6: The engineer and society | PO7:Environment and sustainability | PO8:Ethics | PO9:Individual and team work | PO10:Communication | PO11:Project management and finance | PO12:Life-long learning |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| LCE-651.1 | 3 | 3 | 3 | 3 | | | | | | | | |
| LCE-651.2 | | | | | | | | | | | 3 | |
| LCE-651.3 | | | | | | | | 3 | 3 | 3 | | 3 |
| LCE-651.4 | | | | | | | | 3 | 3 | | | |
| LCE-651.5 | | | | | 3 | 3 | 3 | 3 | 3 | | | 3 |

Course Content:

- ***Students will be asked to work upon minimum three of the following topics during the semester.***
- **They will submit the report of each topic containing following information (as per need of topic) like: introduction, general information, usage/application (if any) detailed description of work/process, relevant diagrams, drawings & tabulation (if any), observation and results (as applicable) or any other relevant information as per topic.**

1. Work related to preparation of bill of quantity & tender document.
2. Work related to design & drawing of flat slab using IS code method.
3. Work related to cost estimation of (including market survey of rates by students) building/earth work for a highway.
4. Work related to scheduling of activities of a project using relevant software
5. Work related to preparation of layout plan of a building and its marking on ground.
6. Design & analysis of a G+5 residential building using structural design and analysis software like STAAD Pro/STRUDS/SAP/ETAB/STRAP.
7. Work related to design of a small sewage treatment plant (STP) unit for a residential society.
8. Work related to computation of surface runoff & design of rain water harvesting system for given area (relevant software may be used for runoff computation).

## LCE-652: Departmental Seminar

| L | T | P | Credit |
|---|---|---|---|
| 0 | 0 | 2 | 1 |

**Pre-requisite:**

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

| | |
|---|---|
| LCE-652.1 | apply and associate the engineering knowledge acquired in socio-economic needs of the society. |
| LCE-652.2 | Develop effectively communication and presentation skill through seminar. |
| LCE-652.3 | address environmental / social / engineering problems through the seminar |

**Mapping of course outcomes with program outcomes**

| CO | PO1: Engineering knowledge | PO2 Problem analysis | PO3:Design/development of solutions | PO4:Conduct investigations of complex problems | PO5:Modern tool usage | PO6: The engineer and society | PO7:Environment and sustainability | PO8:Ethics | PO9:Individual and team work | PO10:Communication | PO11:Project management and finance | PO12:Life-long learning |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| LCE-652.1 | 3 | 3 | 3 | 3 | | | | | | | | |
| LCE-652.2 | | | | | | | | 3 | 3 | | | |
| LCE-652.3 | | | | | 3 | 3 | 3 | 3 | 3 | | | 3 |

**Course Content :**

Students will have prepare a topic of National /International / Academic Interest pertaining to present scenario .

The marks by the external examiner would be based on the report submitted by the student which shall be evaluated by the external examiner and cross examination done of the student concerned.

The evaluation committee shall consist of faculty members constituted by the HOD which would comprise of at-least three members comprising of the Department Coordinator, Class Coordinator and te students guide would be a special invitee to the presentation. The seminar session shall be an open house session. The internal marks would be the average of the marks given by each member of the committee separately in a sealed envelope to the HOD.

**The marking shall be as follows. Internal: 30 marks By the Faculty Guide - 20 marks by Committee appointed by the HOD. External: 50 marks by External examiner appointed by the University.**

# Rama University Uttar Pradesh, Kanpur

(vide U.P. Act No. 1 of 2014 as passed by State Legislature and recognized by UGC U/s 2(f))

**Faculty of Engineering &Technology,**

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**Course Curriculum (effective from Session 2021-22)**

## SEMESTER-VII (FOURTH YEAR)

## PCE-701: Design of Steel Structures

| L | T | P | Credit |
|---|---|---|---|
| 3 | 0 | 0 | 3 |

Pre-requisite: **None**

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

| | |
|---|---|
| **PCE-701.1** | Understand the basic principles of reliability based design on steel structures. |
| **PCE-701.2** | design bolted and welded connections |
| **PCE-701.3** | Design tension and compression members |
| **PCE-701.4** | design of beams .beam columns and column bases |
| **PCE-701.5** | understand plastic design method in steel structures and classification of section. |

**Mapping of course outcomes with Program Outcomes**

| CO | PO1: Engineering knowledge | PO2 Problem analysis | PO3:Design/development of solutions | PO4:Conduct investigations of complex problems | PO5:Modern tool usage | PO6: The engineer and society | PO7:Environment and sustainability | PO8:Ethics | PO9:Individual and team work | PO10:Communication | PO11:Project management and finance | PO12:Life-long learning |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **PCE-701.1** | 1 | | | | 3 | | | 2 | 3 | | 3 | |
| **PCE-701.2** | 3 | | 2 | | 3 | 1 | | 2 | | | 3 | |
| **PCE-701.3** | 3 | | 2 | | 3 | 1 | | 2 | | | 2 | |
| **PCE-701.4** | 3 | | 2 | | 3 | 1 | | 2 | | | 3 | |
| **PCE-701.5** | 3 | | 2 | | 3 | 1 | | 2 | | | 3 | |

**Unit-I: Connections:**

1.1 Types of bolts, load transfer mechanism, prying action.
1.2 Design of bolted and welded connections under axial and eccentric loadings.
1.3 **Tension Members:** Design strength in gross section yielding, net section rupture and block shear.
**1.4** Design of axially loaded tension members.
**1.5** Design of laterally supported and unsupported beam

**Unit-II: Columns and Bases:**

2.1 Design of columns under axial loads using single or multiple rolled steel sections,
2.2 Design of lacing and battens, columns subjected to axial load and bending,
2.3 Design of slab and Gusseted base

**Unit-III: Plastic Analysis of Steel Structures:**

3.1 fundamentals, and static and mechanism method of analysis,
3.2 Bending of beams of rectangular and I sections beams,
3.3 Shape Factor. Classification of Cross Sections:
3.4 As per IS 800-2007 Plastic, compact, semi compact, slender sections, their characteristics including moment rotation

**Reference Books/ Text Book / Cases:**

1. Negi, L. - Design of Steel Structures, Tata McGraw Hill, New Delhi
2. Duggal, SK - Limit State Design of Steel Structures, Tata McGraw-Hill Education
3. Shah, V.L.& Gore, V. - Limit State Design of Steel Structures IS: 800-2007,Structures Publications, 2010.
4. Bhavikatti, S.S. - Design of Steel Structures,I.K. International Publishing House Limited, 2010
5. Englekirk, R.E. (1994), "*Steel Structures: Controlling Behavior through Design*", John Wiley and Sons Publishers, New Delhi.
6. Sai Ram, K.S. (2010), "*Design of Steel Structures*", Pearson Publishers, New Delhi.
7. Subramanian, N. - Design of Steel Structures, Oxford University Press, 2010
8. Relevant Codes IS: 800-2007

## PCE-702: Quantity Surveying & Estimation

| L | T | P | Credit |
|---|---|---|---|
| 3 | 0 | 0 | 3 |

Pre-requisite: **None**

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

| | |
|---|---|
| **PCE-702.1** | Quantify the items of work and estimate material requirement for construction |
| **PCE-702.2** | Derive the cost rates and build up the overall cost of the structure. |
| **PCE-702.3** | Apply the technical specifications for various works to be performed for a project. |
| **PCE-702.4** | Understand and apply the basic principles for valuation of properties.. |
| **PCE-702.5** | Understand the ethics governing the profession and recognize the roles of stakeholders in professional practice |

**Mapping of course outcomes with Program Outcomes**

| CO | PO1: Engineering knowledge | PO2 Problem analysis | PO3:Design/development of solutions | PO4:Conduct investigations of complex problems | PO5:Modern tool usage | PO6: The engineer and society | PO7:Environment and sustainability | PO8:Ethics | PO9:Individual and team work | PO10:Communication | PO11:Project management and finance | PO12:Life-long learning |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **PCE-702.1** | 3 | 3 | | | 2 | | | | 3 | | | 3 |
| **PCE-702.2** | 3 | 3 | | | 2 | | | | 3 | | | 3 |
| **PCE-702.3** | 3 | 3 | | | | | | | 3 | | | 3 |
| **PCE-702.4** | 3 | 3 | | | | | | | 3 | | | 2 |
| **PCE-702.5** | 3 | 2 | | | | | | 3 | 3 | | | 2 |

**Unit-I: Estimations:**

1.1 Measurements for various items- Introduction to the process of Estimation;
1.2 Use of relevant Indian Standard Specifications of works
1.3 Taking out quantities from the given requirements of the work, comparison of different alternatives,
1.4 Bar bending schedules,
1.5 Mass haul Diagrams, Estimating Earthwork and Foundations,
1.6 Estimating Concrete and Masonry, Finishes, Interiors, MEP works;
1.7 Material survey-Thumb rules for computation of materials requirement for different materials for buildings,
1.8 Use of Computers in quantity surveying; BIM and quantity take-offs.
1.9 Bill of Quantities and Bill of Materials
1.10 Work Charged Establishments

**Unit-II: Rate Analysis, Specification and Tenders:**

2.1 Analysis of rates knowing cost of material, labour, equipment, overheads, profit, taxes etc,
2.2 **Cost of Works:** Factors affecting cost of work, overhead charges, Contingencies and work charge establishment, various percentages for different services in building,
2.3 Specifications – Preparation of detailed and general specifications, Legal aspects of contracts, laws related to contracts,
2.4 Land Acquisition, Labour Safety and Welfare.,
2.5 Different types of contracts, their relative advantages and disadvantages.
2.6 Elements of tender preparation,
2.7 Process of tendering, pre-qualification of contracts, Evaluation of tenders, contract negotiation and award of work, monitoring of contract extra items:

**Unit-III: Valuation and Professional Practices:**

3.1 Purpose of Valuation, Principle of Valuation,
3.2 Qualities of a Good Valuer,
3.3 Definition of various terms related to valuation like depreciation, sinking fund, salvage and scrap value, market value, fair rent, year's purchase, capitalized value, annuity, etc.
3.4 Methods of Valuation,
3.5 Rent Fixation, Calculation of Standard Rent.
3.6 Professional Practice – Respective roles of various stakeholders: Government; Standardization Bodies; professional bodies; Clients/ owners; Developers; Consultants; Contractors; Manufacturers/ Vendors/ Service

**Reference Books/ Text Book / Cases:**

1. Dutta, B.N., "Estimating and Costing in Civil Engineering", UBS Publishers & Distributors Pvt. Ltd., 2003
2. Srinath, L.S., "PERT and CPM Principles and applications" Affiliated East-West Press Pvt. Ltd., New Delhi.
3. Patil, B.S., "Civil Engineering Contracts and Estimates" University Press India, Pvt. Ltd. Hyderabad –500 004
4. Srivastava, U.K., "Construction Planning and Management", Galgotia Publications Pvt. Ltd., New Delhi.
5. R.L. Peurifoy. "Construction Planning", Equipment and Methods", T.M.H., International Book Company
6. Sarkar, Construction Technology, Oxford
7. Delhi Schedule of Rates (latest version)
8. S V Deodhar and S.C. Sharma, "Construction Engineering and Management", Khanna Publishing House.
9. Rangwala, Estimating, Costing and Valuation, Charotar Publishing House, 2017.
10. B.S. Patil, Legal Aspects of Building and Engineering Contracts, 1974. The National Building Code, BIS, 2016
11. RERA Act, 2017
12. Vee, Charles &Skitmore, Martin (2003) Professional Ethics in the Construction Industry, Engineering Construction and Architectural management, Vol.10, Iss2, pp 117-127, MCB UP Ltd
13. American Society of Civil Engineers (2011) ASCE Code of Ethics – Principles Study and Application Ethics in Engineering-M.W.Martin&R.Schinzinger, McGraw-Hill
14. Engineering Ethics, National Institute for Engineering Ethics, USA www.ieindia.org
15. Engineering ethics: concepts and cases – C. E. Harris, M.S. Pritchard, M.J.Rabins
16. Kohli, D.D and Kohli,R.C, "A text book of Estimating and Costing (Civil)", S.Chand& Company Ltd., 2004.
17. IS : 1200 – 1974 – Parts 1 to 25, Methods of Measurement of Building and Civil Engineering Works, Bureau of Indian Standards, New Delhi.
18. Standard Data Books of Central Public Works Departments and Public Work Department of States.

# Rama University Uttar Pradesh, Kanpur

(vide U.P. Act No. 1 of 2014 as passed by State Legislature and recognized by UGC U/s 2(f))

**Faculty of Engineering &Technology,**

**B.Tech. Civil Engineering**

**Course Curriculum (effective from Session 2021-22)**

***Engineering Minor Elective-III***

| Engineering Minor Elective | Specialization | | | | | |
|---|---|---|---|---|---|---|
| | Structural Engineering | Geotechnical Engineering | Transportation Engineering | Construction Technology & Management | Water Resources Engineering | Environmental Engineering |
| III | *Seismic Design of Structures* | *Earth & Earth Retaining Structures* | *Traffic Engineering & Management* | *Sustainable Construction* | *Water Resource Systems* | *Industrial Wastes Treatment* |

## *ECE-701:* Seismic Design Of Structures

| L | T | P | Credit |
|---|---|---|---|
| 3 | 0 | 0 | 3 |

Pre-requisite:

1. PCE-401- Structural Anaysis
2. PCE-601-Reinforced Concrete Design

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

| | |
|---|---|
| ECE-701.1 | Explain the importance of structural dynamics with basic terminology. |
| ECE-701.2 | Assess and analyse the single dof and 2 dof structures and its responses |
| ECE-701.3 | Familiarize the elements of seismology |
| ECE-701.4 | Understand the concept of analysis and design of earthquake resistant simple framed structures |

## Mapping of course outcomes with Program Outcomes

| CO | PO1: Engineering knowledge | PO2 Problem analysis | PO3:Design/development of solutions | PO4:Conduct investigations of complex problems | PO5:Modern tool usage | PO6: The engineer and society | PO7:Environment and sustainability | PO8:Ethics | PO9:Individual and team work | PO10:Communication | PO11:Project management and finance | PO12:Life-long learning |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| ECE-701.1 | 3 | 2 | | | | 1 | | | | | | 2 |
| ECE-701.2 | 3 | 2 | 2 | | | | | | 2 | | | |
| ECE-701.3 | 3 | | | | | 1 | | | | | | 2 |
| ECE-701.4 | 3 | 3 | 3 | 1 | 2 | 2 | | | 2 | | | |

**Unit-I:** Introduction to Structural Dynamics:

1.1 Importance of Structural Dynamics
1.2 Types and Sources of Dynamic Loads
1.3 Distinguishing Features of a Dynamic Problem
1.4 Methodology For Dynamic Analysis
1.5 Types of Structural Vibration - Basic Terminology.

**Single Degree of Freedom**

1.6 Components of Vibration System - Natural Frequency - Viscous Damping
1.7 Response to Un-damped & Damped Free and Forced Vibration
1.8 Response to Support Motion
1.9 Principle of Accelerometers and Displacement Meters.

**Unit-II: Two Degrees of Freedom:**

2.1 Equations of motion
2.2 Eigen value problem

2.3 Free Vibration Response – Forced Vibration Response to
2.4 Harmonic Excitation
2.5 Support Motion - Modal Analysis.

**Elements of Engineering Seismology**

2.6 Indian Seismicity – faults – seismic waves – earthquake intensity and magnitude
2.7 Earthquake Ground Motion
2.8 Behaviour of Structures in the Past Earthquakes – Basic Terminology.

**Earthquake Response:**

2.9 Linear systems: Earthquake ground motion
2.10 Response Spectrum - Response History Analysis

**Unit-III: Earthquake Resistant Design:**

3.1 IS codal provisions for the determination of lateral loads – modal analysis.
3.2 Soil liquefaction – soil-structure interaction effects.

**Design Concepts:**

3.3 Seismic Design Concepts - design spectrum
3.4 Earthquake Resistant Design of simple framed structures
3.5 IS 1893 codal provisions - ductile detailing of Reinforced Concrete frames as per IS 13920.

**Reference Books / Text Books:**

1. Pankaj Agarwal and Manish Shrikhande, Earthquake resistant design of structures, Prentice-Hall India Pvt Ltd., 2012
2. Duggal, S.K, "Earthquake Resistant Design of Structures", Oxford university press, 2007.
3. Mario Paz," Structural Dynamics", Spinger, 2007.
4. Park, R & Paulay, "Design of Reinforced Concrete Structure Elements", John Wiley & sons, 2009.
5. Kramer.S.L, "Geotechnical Earthquake Engineering", Prentice-Hall India Pvt. Ltd., 2010.
6. IS: 1893 (Part 1)-2002, Criteria for earthquake resistant design of structures, BIS, New Delhi.
7. IS: 13920-1993, Ductile detailing of reinforced concrete structures subjected to seismic forces,BIS, New Delhi.
8. IS:13935 – Repair and Seismic strengthening of buildings
9. IS:4326 - Earthquake Resistant Design and Constructions of buildings
10. IS:13920 – Ductile detailing of RC Structures subject to Seismic forces

# Rama University Uttar Pradesh, Kanpur

(vide U.P. Act No. 1 of 2014 as passed by State Legislature and recognized by UGC U/s 2(f))

**Faculty of Engineering & Technology,**

**B.Tech. Civil Engineering**

**Course Curriculum (effective from Session 2021-22)**

## *ECE-702:* Earth & Earth Retaining Structures

| L | T | P | Credit |
|---|---|---|---|
| 3 | 0 | 0 | 3 |

Pre-requisite: PCE-501-Geotechnical Engineering

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

| | |
|---|---|
| ECE-702.1 | Understand about different ways of dam failures. |
| ECE-702.2 | Analyze problem and stability through geotechnical model of a dam. |
| ECE-702.3 | Apply soil nailing and its applications of modern geotechnical filed. |
| ECE-702.4 | Analyze the type of reinforcement of soil and their relevance in geotechnical field including bearing capacity of soil |

**Mapping of course outcomes with Program Outcomes**

| CO | PO1: Engineering knowledge | PO2 Problem analysis | PO3:Design/development of solutions | PO4:Conduct investigations of complex problems | PO5:Modern tool usage | PO6: The engineer and society | PO7:Environment and sustainability | PO8:Ethics | PO9:Individual and team work | PO10:Communication | PO11:Project management and finance | PO12:Life-long learning |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| ECE-702.1 | 2 | 2 | | | | 1 | | | | | | 2 |
| ECE-702.2 | 2 | 2 | 2 | | | | | | 2 | | | |
| ECE-702.3 | 2 | 2 | | | | 1 | | | | | | 2 |
| ECE-702.4 | 2 | 2 | 2 | 1 | 2 | 2 | | | 2 | | | |

**Unit-I: Earth and Rock Fill Dams:**

1.1 Earth and Rock Fill Dams, Types,

1.2 Material, Foundation, Safety Requirements of Earth Dams,

1.3 Seepage Analysis, Mechanically Stabilized Earth Retaining Walls,

1.4 General Considerations, Backfill and Reinforced Materials,
1.5 Construction Details, Design Method, Stability.

**Unit-II: Soil Nailing:**

2.1 Soil Nailing, Applications, Advantages, Limitations,
2.2 Methods of Soil Nailing,
2.3 Case Histories,
2.4 Analysis and Design

**Unit-III: Reinforced Soil:**

3.1 Introduction, Basic Components, Strength Characteristics,
3.2 Soil-Reinforcement Interface Friction,
3.3 Reinforced Earth Wall, Stability Analysis,
3.4 Construction Procedure, Drainage, Design Procedure,
3.5 Foundation on Reinforced Soil Bed,
3.6 Pressure Ratio, Analysis of Strip, Isolated, Square and Rectangular Footing on Reinforced Soil Bed,
3.7 Ultimate Bearing Capacity of Footing on Reinforced Earth Slab,
3.8 Fiber Reinforced Soil.

**Reference Books / Text Books:**

1. Bell F.C. "Engineering Treatment of Soils" London: Chapman and Hall;1993.
2. Bowles J.E. "Analysis and Design of Foundation" New York, USA:McGraw Hill Higher Education; 2001.
3. Hausmann M.R. "Engineering Principles of Ground Modification" New Delhi: McGraw Hill; 1990.
4. Koerner R.M. "Designing with geosynthetics" US: Prentice Hall; 1997.
5. Murthy V.N.S. "Soil Mechanics and Foundation Engineering" New Delhi: Marcel Dekker Publisher; 2010.
6. Swami Saran" Reinforced soil and its Applications" New Delhi: Gyan Books Pvt. Ltd.; 2011.

# Rama University Uttar Pradesh, Kanpur

(vide U.P. Act No. 1 of 2014 as passed by State Legislature and recognized by UGC U/s 2(f))

**Faculty of Engineering &Technology,**

**B.Tech. Civil Engineering**

**Course Curriculum (effective from Session 2021-22)**

## *ECE-703: Traffic Engineering & Management*

| L | T | P | Credit |
|---|---|---|---|
| 3 | 0 | 0 | 3 |

Pre-requisite: PCE-404:Highway Engineering-

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

| | |
|---|---|
| ECE-703.1 | Understand the road traffic components and their characteristics in traffic engineering. |
| ECE-703.2 | Conduct different types of traffic engineering studies and perform basic statistical analysis of traffic data. |
| ECE-703.3 | Use speed-flow relationships and analyse the capacity of different kinds of intersections. |
| ECE-703.4 | Understand elements of road safety and approaches to accident studies. |
| ECE-703.5 | Use different distribution models and analyse traffic flow characteristics. |

**Mapping of course outcomes with Program Outcomes**

| CO | PO1: Engineering knowledge | PO2 Problem analysis | PO3:Design/development of solutions | PO4:Conduct investigations of complex problems | PO5:Modern tool usage | PO6: The engineer and society | PO7:Environment and sustainability | PO8:Ethics | PO9:Individual and team work | PO10:Communication | PO11:Project management and finance | PO12:Life-long learning |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| ECE-703.1 | 2 | 2 | | | | | | | | | | 1 |
| ECE-703.2 | 3 | 3 | 1 | 3 | | | 1 | 1 | | | | 1 |
| ECE-703.3 | 2 | 2 | 1 | 2 | | | 2 | 1 | | | | 1 |
| ECE-703.4 | 3 | 2 | 1 | 2 | | | 2 | 1 | | | | 1 |
| ECE-703.5 | 3 | 3 | 1 | 3 | | 2 | 2 | 1 | | | | 1 |

**Unit-I: Introduction:**

1.1 Objectives and scope of traffic engineering,
1.2 Components of road traffic: vehicle, driver and road. Road user and vehicle characteristics and their effect on road traffic. Traffic manoeuvre.
1.3 Traffic Surveys - Objectives, methods, equipment's used for data collection, analysis and interpretation.
1.4 Traffic Forecast: General travel forecasting principles, different methods of traffic forecast.

**Unit-II:**

2.1 Concept of Design vehicle units and determination of PCU under mixed traffic conditions.
2.2 Traffic Stream Characteristics - Relationship between Speed, Flow and Density.
2.3 Determination of design hourly volume.
2.4 Highway Capacity: Factors affecting capacity, level of service; Capacity studies - Capacity of different highway facilities including unsignalised and signalised intersections-IRC guidelines

**Unit-III:**

3.1 Accident Analysis - Analysis of individual accidents and statistical data,
3.2 Methods of representing accident rate.
3.3 Factors in traffic accidents - influence of roadway and traffic conditions on traffic safety.
3.4 Shock waves, Queuing theory and applications.
3.5 Probabilistic Aspects of Traffic Flow -Vehicle arrivals, distribution models, gaps and headway distribution models; gap acceptance merging parameters, delay models.

**Reference Books / Text Books:**

1. Fred L. Mannering, Scott S. Washburn, Walter P. Kilareski (2012) "Principles of Highway
2. Elena S. Prassas, Roger P. Roess, William R. McShane, "Traffic Engineering", Pearson, 2010. Kadiyali, L. R., "Traffic Engineering and Transport Planning", Khanna Publishers, 2013.
3. 0' Flaherty C. A., "Traffic Planning and Engineering", Elsevier India, 2006.
4. Fred L. Mannering, Scott S. Washburn, and Walter P. Kilareski, "Principles of Highway Engineering and Traffic Analysis", Wiley, 2011.
5. Pignataro, L., "Traffic Engineering - Theory and Practice", Prentice Hall, 1973.
6. Institute of Transportation Engineers, "Transportation and Traffic Engg. Hand Book", 6th edition, 2009. IRC-SP41, Guidelines for the Design of At-Grade Intersections in Rural and Urban Areas, 1994.
7. Leonard Evans, "Traffic Safety", Science Serving Society, 2004.
8. Michael, A. P. Taylor, William Young, and Peter W. Bonsall, "Understanding Traffic Systems", Ashgate Publishing, 2000.
9. Mike Slinn, Paul Matthews, Peter Guest, "Traffic Engineering Design - Principles and Practice", Butterworth- Heinemann, 2005.
10. Nicholas Garber, Lester A. Hoel, "Traffic and Highway Engineering", 5th Edition, Cengage earning, USA, (2015)
11. L.R.Kadiyali, N.B.Lal, "Traffic Engineering and Transport Planning", Khanna Publishers, New Delhi, India, (2011).

# Rama University Uttar Pradesh, Kanpur

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**Faculty of Engineering &Technology,**

**B.Tech. Civil Engineering**

**Course Curriculum (effective from Session 2021-22)**

## ECE-704: *Remote Sensing & GIS*

| L | T | P | Credit |
|---|---|---|---|
| 3 | 0 | 0 | 3 |

Pre-requisite: PCE-302: Engineering Survey

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

| | |
|---|---|
| ECE-704.1 | Identify the basic remote sensing concepts and its characteristics |
| ECE-704.2 | Perform digital image processing of satellite images |
| ECE-704.3 | Use various analysis and interpretation of GIS results. |

**Mapping of course outcomes with Program Outcomes**

| CO | PO1: Engineering knowledge | PO2 Problem analysis | PO3:Design/development of solutions | PO4:Conduct investigations of complex problems | PO5:Modern tool usage | PO6: The engineer and society | PO7:Environment and sustainability | PO8:Ethics | PO9:Individual and team work | PO10:Communication | PO11:Project management and finance | PO12:Life-long learning |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| ECE-704.1 | 2 | 2 | | | 1 | 1 | 1 | | 1 | | | |
| ECE-704.2 | 3 | 3 | | | | | 1 | | 1 | | | |
| ECE-704.3 | 3 | 3 | | | | | 1 | | 1 | | | |

**Unit-I: Basic concepts of Remote Sensing:**

**1.12** Introduction to Remote Sensing,

**1.13** Electromagnetic Spectrum and radiation,

**1.14** Remote Sensing Platforms

**1.15** , Satellite Sensors, Orbits in Remote Sensing

**Sensors and Scanning Systems:**

**1.16** Indian Remote Satellites (IRS), ,

**1.17** Spectral characteristics earth surface features i.e.vegetation

**1.18** water and soil,

1.19 Understanding the spectral curves to create spectral library groundwater contours

**Unit-II: Digital Image processing:**

2.1 Elements of Image Interpretation
2.2 , Concepts of Digital Image Processing,
2.3 Image Registration,
2.4 Feature Extraction Techniques,
2.5 Image Classification,
2.6 Land Use and Land Cover

**Basic concepts of GIS:**

2.7 Introduction to GIS,
2.8 History of development of GIS,
2.9 Elements of GIS - Computer hardware and software,
2.10 Map reading, various maps in GIS.

**Spatial Analysis tools:**

2.11 Map overlay operations,
2.12 Vector and Raster data model,
2.13 storage and database management,
2.14 Spatial data analysis techniques yield of a well - test holes - well logs

**Unit-III: Introduction and Principles of Photogrammetry:**

3.1 Type of Photogrammetry,
3.2 Stereoscopic Instruments / views,
3.3 Vertical Photography,
3.4 Ortho-photos,
3.5 Oblique Photographs,
3.6 Topographic Mapping ,
3.7 Digital Elevations/
3.8 Terrain Modelling

**Applications of Remote Sensing in Civil Engineering and GIS, Case Studies**

**Text / Reference Books:**

1. Basudeb Bhatta, Remote Sensing and GIS, Oxford University Press, New Delhi, Second Edition, 2012
2. Thomos Lilles, Ralph W. Kiefer and Jonathan Chripman, Remote Sensing and Image Interpretation, Wiley Publisher, 7th Edition, (2015).

3. Kang-tsung Chang, Introduction to Geographic Information Systems, McGraw-Hill Education; 8th Edition, (2015).
4. G S Srivastava, An Introduction to Geoinformatics, McGraw Hill Education (India) Private Limited, (2014)
5. Paul Wolf, Bon DeWitt and Benjamin Wilkinson, Elements of Photogrammetry with Application in GIS, McGraw-Hill Education; 4th Edition, (2014)

# Rama University Uttar Pradesh, Kanpur

(vide U.P. Act No. 1 of 2014 as passed by State Legislature and recognized by UGC U/s 2(f))

**Faculty of Engineering & Technology,**

**B.Tech. Civil Engineering**

**Course Curriculum (effective from Session 2021-22)**

## *ECE-705:* Water Resources Systems

| L | T | P | Credit |
|---|---|---|---|
| 3 | 0 | 0 | 3 |

**Pre-requisite:** PCE-405- Water Resources Engineering

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

| | |
|---|---|
| ECE-705.1 | Understand the water resources systems and express it using mathematical models. |
| ECE-705.2 | Formulate and solve various optimization models of water resources planning and management problems. |
| ECE-705.3 | Identify the advantages and limitations of various modeling methods and algorithms used in water resources planning and management. |
| ECE-705.4 | Use the simulation and optimization models for planning and management decision making |

**Mapping of course outcomes with Program Outcomes**

| CO | PO1: Engineering knowledge | PO2 Problem analysis | PO3:Design/development of solutions | PO4:Conduct investigations of complex problems | PO5:Modern tool usage | PO6: The engineer and society | PO7:Environment and sustainability | PO8:Ethics | PO9:Individual and team work | PO10:Communication | PO11:Project management and finance | PO12:Life-long learning |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| ECE-705.1 | 3 | 3 | | | | | | | | | | |
| ECE-705.2 | 3 | 2 | | | | | | | | | | |
| ECE-705.3 | 2 | | 3 | | | | | | | | | |
| ECE-705.4 | 3 | 3 | 2 | 3 | | | | | | | | |

**Unit-I:**

1.1 Water systems engineering –scope and approach.

1.2 Issues and the systems planning approach

1.3 water system dynamics- water resource development alternatives

1.4 Water systems planning objectives- Constraints and Criteria – Economic and Econometric principles,
1.5 Hydrologic input analysis, Demand analysis,
1.6 System elements & Subsystem planning - Stochastic planning and management
1.7 Design and management issues.

**Unit-II:**

2.1 Optimization methods and their application in Water resources systems.
2.2 Linear programming and Dynamic programming models.
2.3 Problem formulation for water resources systems
2.4 Multi objective planning – Largescale system analysis
2.5 Case studies.

**Unit-*III*:**

*1.1* Ground water system planning
*1.2* Conjunctive surface and ground water development-
*1.3* Hierarchical approach
*1.4* Water quality management planning-
*1.5* Regional planning- Policy issues.

**Text / Reference Books:**

1. Larry W Mays, Water Resources Engineering, John Wiley India
2. Wurbs and James,Water Resources Engineering, John Wiley India
3. R.K. Linsley, Water Resources Engineering, McGraw Hill

## *ECE-706: Industrial* Waste Treatment

| L | T | P | Credit |
|---|---|---|---|
| 3 | 0 | 0 | 3 |

Pre-requisite: PCE-502-Environmental Engineering

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

| | |
|---|---|
| ECE-706.1 | Understand the characteristics of Industrial wastes and develop a holistic view on pollution prevention strategies |
| ECE-706.2 | Analyze and design the Preliminary treatment unit for industrial waste waters. |
| ECE-706.3 | Analyze and design the treatment scheme for textile, paper, dairy and fertilizer industry |

**Mapping of course outcomes with Program Outcomes**

| CO | PO1: Engineering knowledge | PO2 Problem analysis | PO3:Design/development of solutions | PO4:Conduct investigations of complex problems | PO5:Modern tool usage | PO6: The engineer and society | PO7:Environment and sustainability | PO8:Ethics | PO9:Individual and team work | PO10:Communication | PO11:Project management and finance | PO12:Life-long learning |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| ECE-706.1 | 3 | | | 3 | | | 2 | | 3 | | | |
| ECE-706.2 | | 3 | 3 | | | | | | 2 | | 2 | |
| ECE-706.3 | 2 | 3 | 3 | 2 | 3 | | | | | 2 | | |

**Unit-I:**

1.1 Nature and characteristics of Industrial wastes
1.2 prevention versus control of industrial pollution
1.3 Linkage between technology and pollution prevention
1.4 Tools for Clean Processes - Reuse, Recycle, Recovery, Source Reduction, Raw Material Substitution,
1.5 Toxic Use Reduction and Process Modification - Separation Technologies as Tools for Waste Minimization

1.6 Flow sheet analysis
1.7 Energy and resource audits - waste audits.

**Unit-II:**

2.1 Preliminary treatment of industrial waste water – volume reduction – strength reduction – neutralization – equalization and proportioning.
2.2 Treatment of industrial waste - suitability of different techniques
2.3 Disposal of Industrial Wastes.

**Unit-III:**

3.9 Effluent generation from textile industry – paper industry – dairy – fertilizer – thermal power plants
3.10 Effluent Characteristics - Treatment.
3.11 Membrane process, ion exchange process, Reverse osmosis, Ultra filtration, electrolysis.
3.12 Study of Damages Caused by Industrial Pollution in India.

**Reference Books / Text Books:**

1. Nelson Leonard Nemerow, "Industrial waste treatment – contemporary practice and vision for the future", Elsevier, Singapore, 2007
2. Gerard Kiely, "Environmental Engineering", McGraw Hill, 2009.
3. Sincero A. P. and Sincero G. A., "Environmental Engineering - A Design Approach", Prentice Hall, 1996. Mahajan S. P., "Pollution Control in Process Industries", Tata McGraw Hill, 2001.
4. Babbitt H. E, "Sewerage & Sewage Treatment", Nabu Press, 2010.
5. Abbasi S. A, and Ramasami E, "Biotechnical Methods of Pollution Control", Universities Press (India) Ltd., 1999.

## PATHWAY ELECTIVE-III

| L | T | P | Credit |
|---|---|---|---|
| 3 | 0 | 0 | 3 |

## OPEN ELECTIVE-III

| L | T | P | Credit |
|---|---|---|---|
| 3 | 0 | 0 | 3 |

# Rama University Uttar Pradesh, Kanpur

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**Faculty of Engineering & Technology,**

**B.Tech. Civil Engineering**

**Course Curriculum (effective from Session 2021-22)**

## PCE-751: Construction Management Laboratory

| L | T | P | Credit |
|---|---|---|---|
| 0 | 0 | 2 | 1 |

**Pre-requisite:** Civil Engineering

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

| | |
|---|---|
| PCE-751.1 | prepare detailed estimates of roads and buildings |
| PCE-751.2 | prepare rate analysis and identify the main sources of current and forecast labour rates and quantify the various items of constructions and estimation of overhead costs |
| PCE-751.3 | prepare bill of Quantities and tender document |
| PCE-751.4 | understand Project and Cost Management |

**Mapping of course outcomes with Program Outcomes**

| CO | PO1: Engineering knowledge | PO2 Problem analysis | PO3:Design/development of solutions | PO4:Conduct investigations of complex problems | PO5:Modern tool usage | PO6: The engineer and society | PO7:Environment and sustainability | PO8:Ethics | PO9:Individual and team work | PO10:Communication | PO11:Project management and finance | PO12:Life-long learning |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| PCE-751.1 | 3 | 3 | | | 2 | | | | 3 | | | 3 |
| PCE-751.2 | 3 | 3 | | | 2 | | | | 3 | | | 3 |
| PCE-751.3 | 3 | 3 | | | | | | | 3 | | | 3 |
| PCE-751.4 | 3 | 3 | | | | | | | 3 | | | 2 |

***Course Content:***

1. Estimation of quantities for any one of the following: Building/ Septic tank/Water supply pipe line/road/bridge.
2. Preparation of Bill of Quantities (BOQ) for above project.

3. Practice of MS Project/Primavera software for same problem.
4. Study of any full set of tender documents (Institute shall provide the set from ongoing/ completed tenders).
5. Analyze rates of any ten items of Civil Works for above project

**Note : These exercises will be done through use of software and spread in 8-10 classes.** *The basic objective of this laboratory is to teach estimation of quantities, preparation of bill of quantities and tender documents, analysis of rates, etc.*

## *LCE-751: Presentation on Industrial Training*

| L | T | P | Credit |
|---|---|---|---|
| 0 | 0 | 2 | 1 |

**Pre-requisite:** Civil Engineering

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

| | |
|---|---|
| **LCE-751.1** | Work in actual working environment. |
| **LCE-751.2** | Utilize technical resources |
| **LCE-751.3** | Prepare technical documents and give oral presentations related to the work completed. |

**Mapping of course outcomes with Program Outcomes**

| CO | PO1: Engineering knowledge | PO2 Problem analysis | PO3:Design/development of solutions | PO4:Conduct investigations of complex problems | PO5:Modern tool usage | PO6: The engineer and society | PO7:Environment and sustainability | PO8:Ethics | PO9:Individual and team work | PO10:Communication | PO11:Project management and finance | PO12:Life-long learning |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **LCE-751.1** | 3 | 2 | | | 2 | 2 | 2 | 2 | | 2 | 2 | 2 |
| **LCE-751.2** | | 2 | | | 2 | | | | 2 | | | 2 |
| **LCE-751.3** | | | | | | | | | 2 | 3 | | |

***Course Content:***
Students will have to undergo industrial training of six weeks in any industry or reputed organization after the VI semester examination in summer. The evaluation of this training shall be included in the VII semester evaluation. The student will be assigned a faculty guide who would be the supervisor of the student. The faculty would be identified before the end of the VI semester and shall be the nodal officer for coordination of the

training. Students will prepare an exhaustive technical report of the training during the VII semester which will be duly signed by the officer under whom training was undertaken in the industry/ organization. The covering format shall be signed by the concerned office in-charge of the training in the industry. The officer-in-charge of the trainee would also give hisrating of the student in the standard University format in a sealed envelope to the Director/Principal of the college. The student at the end of the VII semester will present his report about the training before a committee constituted by the HOD which would comprise of at least three members comprising of the Department Coordinator and Class Coordinator. The students guide would be a special invitee to the presentation. The seminar session shall be an open house session. The internal marks would be the average of the marks given by each member of the committee separately in a sealed envelope to the HOD.

The marks by the external examiner would be based on the report submitted by the student which shall be evaluated by the external examiner and cross examination done of the student concerned.

Not more than three students would form a group for such industrial training/ project submission. The marking shall be as follows. Internal: 50 marks by the Faculty Guide – 50 marks by a Committee appointed by HOD.

External: 100 marks by External examiner appointed by the University.

Technical report will consist of five chapter as per given format:

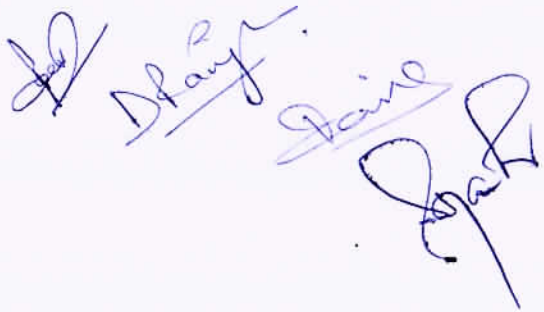
Chapter-1: Brief about organization

Chapter-2: Detail of business carried out by organization

Chapter-3: Specific contribution during the industrial training (not more than 500 words)

Chapter-4: Learning during the industrial training (not more than 200 words)

**Chapter-5: Conclusion (Plagiarism will check of technical report in chapter 3, 4 & 5 only)** *The objective of the course is to enable students to* familiarize with site/ industrial working conditions.



# Rama University Uttar Pradesh, Kanpur

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**Faculty of Engineering &Technology,**

**B.Tech. Civil Engineering**

**Course Curriculum (effective from Session 2021-22)**

## *LCE-752: Capstone Project-I*

| L | T | P | Credit |
|---|---|---|---|
| 0 | 0 | 2 | 1 |

**Pre-requisite:** Civil Engineering

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

| | |
|---|---|
| LCE-851.1 | Create a set up through proper design and investigate the system using the engineering knowledge acquired. |
| LCE-851.2 | Estimate and manage the time, material and cost aspects of the project |
| LCE-851.3 | Present the project with clarity, following ethical norms in oral and written mode |
| LCE-851.4 | Develop a team and effectively participate in the team to execute the project |
| LCE-851.5 | Address environmental / social / engineering problems through the project |

**Mapping of course outcomes with Program Outcomes**

| CO | PO1: Engineering knowledge | PO2 Problem analysis | PO3:Design/development of solutions | PO4:Conduct investigations of complex problems | PO5:Modern tool usage | PO6: The engineer and society | PO7:Environment and sustainability | PO8:Ethics | PO9:Individual and team work | PO10:Communication | PO11:Project management and finance | PO12:Life-long learning |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| LCE-851.1 | 3 | 3 | 3 | 3 | | | | | | | | |
| LCE-851.2 | | | | | | | | | | | 3 | |
| LCE-851.3 | | | | | | | | 3 | 3 | 3 | | 3 |
| LCE-851.4 | | | | | | | | 3 | 3 | | | |
| LCE-851.5 | | | | | 3 | 3 | 3 | 3 | 3 | | | 3 |

**Course Content:**

A group of students, not more than three, who were assigned a faculty guide in the starting of the VII semester. The group may carry forward Mini

Project-I and Mini Project-I or fresh topic will be allocated. The Students will conduct Literature survey, devise Problem Formulation and Proposed Methodology on expected outcome prepare a brief synopsis in prescribed format, to be submitted to the Guide .

The assessment of performance of students should be made at least twice in Vii semester, the student shall present the progress of project live on power point presentation on LCD to the internal committee.

The evaluation committee shall consist of faculty members constituted by the HOD which would comprise of at-least three members comprising of the Department Coordinator, Class Coordinator and te students guide would be a special invitee to the presentation. The seminar session shall be an open house session. The internal marks would be the average of the marks given by each member of the committee separately in a sealed envelope to the HOD.

The marking shall be as follows. Internal: 25 marks By the Faculty Guide - 25 marks by Committee appointed by the HOD.

**External: 50 marks by External examiner appointed by the University.**

# Rama University Uttar Pradesh, Kanpur

(vide U.P. Act No. 1 of 2014 as passed by State Legislature and recognized by UGC U/s 2(f))

**Faculty of Engineering & Technology,**

**B.Tech. Civil Engineering**

**Course Curriculum (effective from Session 2021-22)**

**SEMESTER-VIII (FOURTH YEAR)**

## *PCE-801: Construction Management*

| L | T | P | Credit |
|---|---|---|---|
| 3 | 0 | 0 | 3 |

Pre-requisite: **None**

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

| | |
|---|---|
| **PCE-801.1** | Apply knowledge of network scheduling techniques to identify critical activities |
| **PCE-801.2** | Apply knowledge of construction procedures in assessing different contract options. |
| **PCE-801.3** | Assess quality and safety aspects in project environment |
| **PCE-801.4** | Take decisions on inventory and transportation of construction materials. |
| **PCE-801.5** | Select appropriate equipment for various construction activities |

**Mapping of course outcomes with Program Outcomes**

| CO | PO1: Engineering knowledge | PO2 Problem analysis | PO3:Design/development of solutions | PO4:Conduct investigations of complex problems | PO5:Modern tool usage | PO6: The engineer and society | PO7:Environment and sustainability | PO8:Ethics | PO9:Individual and team work | PO10:Communication | PO11:Project management and finance | PO12:Life-long learning |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **PCE-801.1** | 3 | 3 | | | 1 | | | | | | 1 | |
| **PCE-801.2** | | 3 | | | | | | | | | 3 | |
| **PCE-801.3** | | 2 | 1 | | | 3 | | | | | | |
| **PCE-801.4** | 2 | 3 | | | | | | | | | 2 | |
| **PCE-801.5** | 2 | 3 | | | | | | | | | 2 | |

**Unit-I: Construction Management Environment:**

1.1 Construction Activities and Sequence.
1.2 Elements of Construction Management
1.3 Construction Planning - Network scheduling - Bar chart, linked bar chart,
1.4 Work-breakdown structures, activity-on-arrow diagrams - event based networks.
1.5 Critical path method.
1.6 PERT network analysis.
1.7 Introduction to Precedence networks

**Unit-II: Network Compression:**

2.1 Time-cost study.
2.2 Resource management.
2.3 Funds: cash flow, sources of funds;
2.4 Histograms and S-Curves. Earned Value.
2.5 Construction procedure –
2.6 Contracts – Types – Bidding Process – Contract Conditions, -
2.7 Specifications
2.8 Quality Management Principles. Construction Safety.

**Unit-III: Materials and Equipment Management:**

3.1 Inventory Control. Transportation Model and Application For Distribution Of Materials.
3.2 Construction Equipment - Selection Factors –
3.3 Owning And Hiring Of Equipment
3.4 Planning Of Equipment – Equipment for Excavation, Transport, Hoisting, Piling, And Concrete Construction.
3.5 Work-Motion Study
3.6 Introduction To Project Management Softwares.

**Reference Books/ Text Book / Cases:**

1. George Ritz and Sidney Levy: Total construction project management: McGraw Hill Publications.
2. S.Keoki Sears and Richard H.Clough: Construction Project Management: A guide to field construction management.
3. L.S. Srinath, "PERT & CPM Principles and Applications", E.W.P. Ltd., New Delhi.
4. S.K. Bhatnagar, "Network Analysis Techniques", Willey Eastern Ltd.
5. Kumar Neeraj Jha, "Construction Project Management", Pearson Education, 2015.
6. R. L. Peurifoy and Schexnayder, "Construction Planning, Equipment, and Methods", Tata McGraw Hill, 2013.
7. Gahlot, P. S. and Dhir, B. M., "Construction Planning and Management", New Age International, 2018. Jerome D. Wiest, Ferdinand K. Levy, "A Management guide to PERT / CPM", PHI Learning, 2009.

8. L.S. Srinath, "PERT and CPM - Principles and Applications", Affiliated to East West Press, 2001.
9. Shrivastava. U. K., 'Construction Planning and Management', Galgothia Publications Pvt. Ltd, New Delhi, 2013.
10. Chitkara, K. K. "Construction Project Management - Planning, Scheduling and Control", McGraw Hill Education, 2014.

# Rama University Uttar Pradesh, Kanpur

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**Faculty of Engineering &Technology,**

**B.Tech. Civil Engineering**

**Course Curriculum (effective from Session 2021-22)**

***Engineering Minor Elective-IV***

| Engineering Minor Elective | Specialization | | | | | |
|---|---|---|---|---|---|---|
| | Structural Engineering | Geotechnical Engineering | Transportation Engineering | Construction Technology & Management | Water Resources Engineering | Environmental Engineering |
| IV | *Advanced Design of Steel Structures* | *Advanced Foundation Engineering* | *Urban Transportation Planning* | *Alternate Building Materials & Techniques* | *Irrigation Engineering* | *Advanced Environmental Engineering* |

## *ECE-801: Advanced Design of Steel Structure*

| L | T | P | Credit |
|---|---|---|---|
| 3 | 0 | 0 | 3 |

Pre-requisite:

1. PCE-401-Structural Analysis
2. PCE-701-Design of Steel Structures

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

| | |
|---|---|
| **PCE-801.1** | Design the eccentrically loaded compression members and their base plates. |
| **PCE-801.2** | Analyze and design the plate girder, gantry girder and its components. |
| **PCE-801.3** | Evaluate, analyze and design the PEB and its components. |

## Mapping of course outcomes with Program Outcomes

| CO | PO1: Engineering knowledge | PO2 Problem analysis | PO3:Design/development of solutions | PO4:Conduct investigations of complex problems | PO5:Modern tool usage | PO6: The engineer and society | PO7:Environment and sustainability | PO8:Ethics | PO9:Individual and team work | PO10:Communication | PO11:Project management and finance | PO12:Life-long learning |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| PCE-801.1 | 3 | | | | | | | | | | | 2 |
| PCE-801.2 | 3 | 2 | 2 | | | | | | | | | |
| PCE-801.3 | 3 | 3 | 3 | | 2 | | | | 2 | 1 | | |

**Unit-I:**

1.1 Introduction to Beam-Column - Behavior - Strength Interaction
1.2 Design of Beam Column - Beam Column Subjected to Combined Forces
1.3 Column Bases - Slab Base - Gusseted Base - Moment Resistant Base Plate.

**Unit-II:**

2.1 Bolted and Welded plate girders – analysis and design using IS800-2007
2.2 Curtailment of flange plates –stiffeners – Web yielding, web crippling, bearing stiffeners.
2.3 Introduction to hybrid girders - analysis and design of gantry girder - design of girder splice.

**Unit-III:**

3.1 Analysis And Design Of Pre-Engineered Building
3.2 Design Of Purlins And Wall Girts Using Channel And Angle Sections; Cold Formed Steel Purlin – Design Of Wind Bracings.

**Reference Books / Text Books:**

1. Negi, L.S. - Design of Steel Structures, Tata McGraw Hill, New Delhi
2. Bhavikatti, S.S. - Design of Steel Structures, I.K. International Publishing House Limited, 2010
3. Arya AS & Ajmani "Design of Steel Structures" 2nd ed. Roorkee: Nem chand and Brothers; 1992.
4. Duggal SK. "Limit State Design of Steel Structures" 3rd ed. New Delhi: TMH Publications; 2009.
5. Subramanian N, "Design of steel structures" 4th ed. New Delhi: Oxford University Press; 2011.
6. Kazimi, S.M. A. & Jindal, R.S. - Design of Steel Structures, Prentice Hall of India
7. Ram Chandra and Gehlot, "Limit State Design of Steel Structures", Scientific Publishers, 2015.

8. G.W. Owens and P.R. Knowles, "Steel Designers' Manual" , John Wiley & Sons, 2012.
9. Lin and Breslar, "Design of Steel Structures", John Wiley & Sons, 1968.
10.BIS codes ( IS 800-2007, IS-801-1975, SP 6 PART (1 TO 6),)

# Rama University Uttar Pradesh, Kanpur

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**Faculty of Engineering &Technology,**

**B.Tech. Civil Engineering**

**Course Curriculum (effective from Session 2021-22)**

## *ECE-802: Advance* Foundation Engineering

| L | T | P | Credit |
|---|---|---|---|
| 3 | 0 | 0 | 3 |

Pre-requisite: PCE-501-Geotechnical Engineering

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

| | |
|---|---|
| **PCE-802.1** | Evaluate the properties of expansive soil and analyze the problems posed by them. |
| **PCE-802.2** | Select the suitable environmental or structural solution for the expansive soil based on the site condition. |
| **PCE-802.3** | Apply theory of vibration to assess the dynamic behavior of soil and to design suitable type of machine foundations. |
| **PCE-802.4** | Comprehend the concepts and general principles of special type of foundation systems. |
| **PCE-802.5** | Apply the knowledge of engineering judgement to analyze and design various geotechnical problems. |

**Mapping of course outcomes with Program Outcomes**

| CO | PO1: Engineering knowledge | PO2 Problem analysis | PO3:Design/development of solutions | PO4:Conduct investigations of complex problems | PO5:Modern tool usage | PO6: The engineer and society | PO7:Environment and sustainability | PO8:Ethics | PO9:Individual and team work | PO10:Communication | PO11:Project management and finance | PO12:Life-long learning |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **PCE-802.1** | 3 | 3 | 3 | | | 2 | | | | | | |
| **PCE-802.2** | 3 | 3 | 3 | | | 2 | | | | | | |
| **PCE-802.3** | 3 | 3 | 3 | | | 2 | | | | | | |
| **PCE-802.4** | 3 | 3 | 3 | | | 2 | | | | | | |
| **PCE-802.5** | 3 | 3 | 3 | | | 2 | | | | | | 3 |

**Unit-I: Foundation on Expansive Soils:**

1.1 Introduction to expansive soil - Clay mineralogy and mechanism of swelling

1.2 Identification of expansive soils - Swelling potential, swelling pressure, free swell - Free swell index
1.3 Classification of expansive soil - Tests for swell pressure (IS code method)
1.4 Damages in buildings on expansive soils
1.5 Elimination of swelling- Environmental solutions such as soil replacement techniques and lime columns
1.6 Principles of design of foundations in expansive soil deposits
1.7 Structural solutions such as provision of rigid foundation, under reamed piles, T Beams as strip footing for walls etc. (basic aspects).

**Unit-II: Soil Dynamics and Machine Foundations:**

2.1 Introduction to Soil Dynamics
2.2 Soil behaviour under dynamic loads
2.3 Difference between Static and Dynamic Load Behaviour Of Soil
2.4 Dynamic soil properties - Free vibrations and Forced Vibrations
2.5 Types of Machines
2.6 Types of Machine Foundations - Vibration Analysis of a Machine Foundation
2.7 General design criteria for Machine Foundations
2.8 Design criteria for foundation for reciprocating machines (IS specifications)
2.9 Design procedure for block foundation for a reciprocating machine (IS code method)
2.10 Vibration isolation and control.

**Unit-III: Special Foundations:**

3.1 Introduction to shell foundations
3.2 Structural form and efficiency
3.3 Different types of shell foundations
*3.4* General principles of geotechnical design of shell foundations.
*3.5* Special features of the foundations for water tanks, silos, chimneys and transmission line towers.

**Reference Books / Text Books:**

1. Arora K.R. "Soil Mechanics and Foundation Engineering" New Delhi: Standard Publishers; 2009.
2. Varghese P.C., "Foundation Engineering", Prentice-Hall of India Private Ltd, 2009.
3. Swami saran, "Soil dynamics and Machine Foundations", Galgotias, 2012.
4. Ninan P Kurian, "Design of Foundation Systems", Narosa Publishers, 2009
5. ShamsherPrakash, "Soil Dynamics", McGraw Hill, 1981.
6. Tomlinson M.J., "Foundation Design & Construction", Prentice-Hall, 2003.
7. Joseph E. Bowles, "Foundation Analysis & Design", Tata McGraw Hill, 1996.
8. Coduto, "Geotechnical Engineering Principles and Practices", PHI, New Delhi, 2010.

9. Srinivasalu and Vaidyanathan, "Handbook of Machine Foundations", Tata McGraw Hill, 2004.
10. Swami Saran, "Analysis and Design of Substructures", Oxford & IBH, 2008.

# Rama University Uttar Pradesh, Kanpur

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**Faculty of Engineering & Technology,**

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**Course Curriculum (effective from Session 2021-22)**

## *ECE-803: Urban* Transportation Planning

| L | T | P | Credit |
|---|---|---|---|
| 3 | 0 | 0 | 3 |

Pre-requisite: PCE-404-Highway Engineering

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

| | |
|---|---|
| **PCE-803.1** | Evaluate urban transport problems using the travel demand concept. |
| **PCE-803.2** | Develop trip distribution and trip generation models |
| **PCE-803.3** | Estimate mode choice and develop traffic assignment models |

**Mapping of course outcomes with Program Outcomes**

| CO | PO1: Engineering knowledge | PO2 Problem analysis | PO3:Design/development of solutions | PO4:Conduct investigations of complex problems | PO5:Modern tool usage | PO6: The engineer and society | PO7:Environment and sustainability | PO8:Ethics | PO9:Individual and team work | PO10:Communication | PO11:Project management and finance | PO12:Life-long learning |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **PCE-803.1** | 3 | 1 | | | | | 1 | | | | | |
| **PCE-803.2** | 3 | 3 | | 2 | 1 | | | | | | | |
| **PCE-803.3** | 3 | 2 | | | 1 | 1 | | | | | | |

**Unit-I: Urban Transportation Planning Process & Concepts:**

1.1 Transportation Problems,
1.2 Urban Travel Characteristics,
1.3 Evolution Of Transportation Planning Process,
1.4 Concept of Travel Demand. Demand Function - Independent Variables, Travel Attributes, Assumptions In Demand Estimation. Sequential, Recursive And Simultaneous Processes.

**Transportation Survey and Analysis:**

1.5 Definition Of Study Area,
1.6 Zoning, Types And Sources Of Data.
1.7 Type Of Surveys-Road Side Interviews, Home Interview Surveys.

**Unit-II: Trip Generation Analysis:**
2.1 Trip Classification,
2.2 Factors Influencing Productions And Attractions,
2.3 Trip Rate Analysis, Multiple Regression Models, Category Analysis.
**Trip Distribution Analysis:**
2.4 Trip Distribution Models,
2.5 Growth Factor Models, Gravity Models, Opportunity Models.

**Unit-III: Mode Split Analysis:**
3.1 Mode Choice Behavior
3.2 Trip End And Trip Interchange Models,
3.3 Probabilistic Models,
3.4 Utility Functions, Logit Models.
**Traffic Assignment:**
3.5 Elements Of Transportation Networks,
3.6 Minimum Path Algorithms. Assignment Methods – All Or Nothing Assignment,
3.7 Capacity Restrained Assignment And Multi Path Assignment.

**Text / Reference Books:**

1. Kadiyali, L. R., "Traffic Engineering and Transport Planning", Khanna Publishers, 2013.
2. William W. Hay, Introduction to Transportation Engineering
3. E.K.Mortak, Introduction to Transportation Engineering Planning
4. Hutchinson,B.G.(1974), Principles of Urban Transport Systems Planning. Mc Graw Hill Book Company, New York.
5. John W.Dickey.(1975), Metropolitan Transportation Planning. Mc Graw Hill Book Company, New York.
6. 0' Flaherty C. A., "Traffic Planning and Engineering", Elsevier India, 2006.
7. Khisty C. J. and Iall. B. K., "Transportation Engineering - An Introduction", Prentice Hall, 2002.
8. Bruton M.J., "Introduction to Transportation Planning", Hutchinson of London, 1992.
9. Papacostas, C S, and Prevedouros. P. D, "Transportation Engineering and Planning", Prentice Hall, 2009

# Rama University Uttar Pradesh, Kanpur

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**Faculty of Engineering &Technology,**

**B.Tech. Civil Engineering**

**Course Curriculum (effective from Session 2021-22)**

## ECE-804: Alternative Building Materials & Technologies

| L | T | P | Credit |
|---|---|---|---|
| 3 | 0 | 0 | 3 |

**Pre-requisite:** PCE-301: Building Materials & Construction

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

| | |
|---|---|
| ECE-804.1 | Understand concept of energy efficient materials and building |
| ECE-804.2 | Analyze the advantages of alternate building materials and technologies over conventional building materials and technologies. |
| ECE-804.3 | Understand concept of cost effective sustainable appropriate building materials and technologies. |

**Mapping of course outcomes with Program Outcomes**

| CO | PO1: Engineering knowledge | PO2 Problem analysis | PO3:Design/development of solutions | PO4:Conduct investigations of complex problems | PO5:Modern tool usage | PO6: The engineer and society | PO7:Environment and sustainability | PO8:Ethics | PO9:Individual and team work | PO10:Communication | PO11:Project management and finance | PO12:Life-long learning |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| ECE-804.1 | 3 | 3 | 3 | 3 | 3 | 1 | 3 | 2 | | | 3 | |
| ECE-804.2 | 3 | 3 | 2 | 2 | 3 | 1 | 3 | 2 | | 3 | 3 | |
| ECE-804.3 | 3 | 3 | | | | 2 | | 1 | | | | |

**Unit-I: Introduction:**

1.1 Energy in building materials,
1.2 Environmental issues concerned to building materials,
1.3 Global warming and construction industry,
1.4 Environmental friendly and cost effective building technologies,
1.5 Requirements for building of different climatic regions,
1.6 Traditional building methods and vernacular architecture

**Unit-II: Alternative Building Materials:**

2.1 Characteristics of building blocks for walls, Stones and Laterite blocks, . Bricks and hollow clay blocks, Concrete blocks, Stabilized blocks : mud

blocks, steam cured blocks, Fal-G Blocks stone masonry block,

2.2 **Lime-pozzolana cements :** Raw materials, Manufacturing process, Properties and uses,
2.3 **Fibre reinforced concretes:**. Matrix materials, Fibers : metal and synthetic, Properties and applications,
2.4 **Fibre Reinforced Plastics:** Matrix materials,
2.5 **Fibers :** organic and synthetic, Properties and applications,
2.6 **Building Materials From Agro & Industrial Wastes:** Types of agro wastes, Types of industrial and mine wastes, Properties and applications,
2.7 Field quality control test methods

**Unit-III: Alternative Building Technologies:**

3.1 Alternative for wall construction, Types, Construction method, Masonry mortars-Types, Preparation, Properties,
3.2 **Ferro cement and ferroconcrete building components:** Materials and specifications, Properties, Construction methods, Applications,
3.3 **Alternative roofing systems:** Concepts, Filler slabs, Composite beam panel roofs, Masonry vaults and domes,
3.4 **Structural Masonry:** Compressive strength of masonry elements, Factors affecting compressive strength, Strength of units, prisms / wallettes and walls, Effect of brick work bond on strength,
3.5 **Bond strength of masonry:** Flexure and shear, Elastic properties of masonry materials and masonry
3.6 IS Code Provisions: IS Code provisions, Design of masonry compression elements, Concepts in lateral load resistance,
3.7 Cost Effective Building Design: Cost concepts in buildings, Cost saving techniques in planning, design and construction, Cost analysis: Case studies using alternatives,
3.8 Equipment for Production of Alternative Materials: Machines for manufacture of concrete, Equipments for production of stabilized blocks, Moulds and methods of production of precast elements.

**Text / Reference Books:**

1. K.S. Jagadish. B.V. Venkatarama Reddy. K.S. Nanjunda Rao, "Alternative Building Materials & Technologies", New Age Publications

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**Faculty of Engineering & Technology,**

**B.Tech. Civil Engineering**

**Course Curriculum (effective from Session 2021-22)**

***ECE-805: Irrigation Engineering***

| L | T | P | Credit |
|---|---|---|---|
| 3 | 0 | 0 | 3 |

**Pre-requisite:** PCE-405: Water Resources Engineering

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

| | |
|---|---|
| **ECE-805.1** | attain Theoretical knowledge of fundamentals, classification and function of irrigation systems in relation with crop production. |
| **ECE-805.2** | Design and classification canal and channel for irrigation purpose using various methods and knowledge of water distribution |
| **ECE-805.3** | gain theoretical knowledge of canal water distribution and its hydraulic characteristics for alluvial rivers. |
| **ECE-805.4** | have Theoretical knowledge of water logging, its impacts, causes and prevention. |

**Mapping of course outcomes with Program Outcomes**

| CO | PO1: Engineering knowledge | PO2 Problem analysis | PO3:Design/development of solutions | PO4:Conduct investigations of complex problems | PO5:Modern tool usage | PO6: The engineer and society | PO7:Environment and sustainability | PO8:Ethics | PO9:Individual and team work | PO10:Communication | PO11:Project management and finance | PO12:Life-long learning |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **ECE-805.1** | 3 | 1 | 3 | 1 | 3 | 3 | 3 | 3 | 3 | 2 | 3 | |
| **ECE-805.2** | 3 | 1 | 3 | 2 | 3 | 3 | 3 | 3 | 3 | 3 | 2 | |
| **ECE-805.3** | 3 | 1 | 3 | 1 | 3 | 3 | 3 | 3 | 3 | 3 | 1 | |
| **ECE-805.4** | 3 | 1 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 2 | 2 | |

**Unit-I: Introduction:**

1.1 Definitions, Functions And Advantages Of Irrigation,
1.2 Present Status Of Irrigation In India,
1.3 Classification For Agriculture, Soil Moisture And Crop Water Relations,
1.4 Irrigation Water Quality.
1.5 Consumptive Use Of Water,
1.6 Principal Indian Crop Seasons And Water Requirements,

1.7 Multiple Cropping, Hybrid Crops,
1.8 Water Harvesting And Conservation,

**Canal Irrigation:**

1.9 Types Of Canals, Parts Of Canal Irrigation System,
1.10 Channel Alignment,
1.11 Assessment Of Water Requirements,
1.12 Estimation Of Channel Losses, Design Of Channels,
1.13 Regime And Semi Theoretical Approaches (Kennedy's Theory, Lacey's Theory), Cross Section Of Channels, Silt Control In Canals.

**Unit-II: Water Distribution System:**

2.1 Rotational Delivery (Warabandi, Jama Bandi, Khasra Bandi, Sajra Sheets),
2.2 Continuous Delivery And Delivery On Demand,
2.3 Role Of Command Area Development Authority,
2.4 Functions and Organizational Structures.

**Distribution of Canal Water:**

2.5 System Of Regulation And Control,
2.6 Outlets,
2.7 Assessment of Canal Revenue.

**Hydraulics Of Alluvial Rivers :**

2.8 Critical Tractive Force, Regimes Of Flow,
2.9 Resistance Relationship For Natural Streams,
2.10 Bed Load, Suspended Load And Total Equations,
2.11 Different Stages Of Rivers, Meandering,
2.12 Aggradations, And Degradation,
2.13 River Training & Bank Protection Works.

**Unit-III: Water Logging:**

3.8 Causes, Preventive And Curative Measures,
3.9 Drainage Of Irrigated Lands,
3.10 Saline And Alkaline Lands,
3.11 Types Of Channels Lining And Design Of Lined Channel.

**Well Irrigation:**

3.12 Open Wells And Tube Wells,
3.13 Types Of Tube Wells,
3.14 Duty Of Tube Well Water.

**Text / Reference Books:**

1. Basak, N. N. - Irrigation Engineering and, McGraw Hill Education Publication.
2. Arora, K.R. - Irrigation Water Power and Water Resource Engineering, Standard Publisher
3. Asawa, G.L. - Irrigation Engineering, Wiley Eastern
4. Garg, S.K. - Irrigation Engineering & Hydraulic Structures, Khanna Publishers
5. Modi, P.N. - Irrigation Engineering & Hydraulic Structures
6. Zimmerman, J.D. - Irrigation, John Wiley & Sons
7. Varshney, Gupta & Gupta - Theory and Design of Irrigation Structures, Nem Chand & Bros.

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**Faculty of Engineering &Technology,**

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**Course Curriculum (effective from Session 2021-22)**

## *ECE-806:* Advanced Environmental Engineering

| L | T | P | Credit |
|---|---|---|---|
| 3 | 0 | 0 | 3 |

**Pre-requisite:** PCE-502: *Environmental* Engineering

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

| | |
|---|---|
| ECE-806.1 | Analyze the air pollutants and select the most appropriate technique for the treatment of air pollutants . |
| ECE-806.2 | Analyze the waste water quality and design the treatment unit for removal of nitrogen and phosphorus |
| ECE-806.3 | Analyze the quality of water and design the treatment unit for removal of emerging contaminants |

**Mapping of course outcomes with Program Outcomes**

| CO | PO1: Engineering knowledge | PO2 Problem analysis | PO3:Design/development of solutions | PO4:Conduct investigations of complex problems | PO5:Modern tool usage | PO6: The engineer and society | PO7:Environment and sustainability | PO8:Ethics | PO9:Individual and team work | PO10:Communication | PO11:Project management and finance | PO12:Life-long learning |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| ECE-806.1 | 3 | 3 | 3 | 3 | | | | | 1 | | | |
| ECE-806.2 | 3 | 3 | 3 | 3 | 1 | | 1 | | | 1 | | |
| ECE-806.3 | 3 | 2 | 3 | | 1 | | | | 1 | | 1 | |

**Unit-I:**

1.1 Instrumental methods for analysis of contaminants in air, water and soil - colorimetry,

1.2 Chromatography, spectroscopy, electrochemical probes,

1.3 Indoor and outdoor air pollution – meteorology-influence of solar radiation and wind fields - lapse rate and stability conditions - characteristics

of stack plumes - effective stack height.,

1.4 Characteristics and health effects of various air pollutant particulates (PM2.5, PM10) and gaseous pollutants (CO, NOx, SOx, etc)- their behaviour in atmosphere – monitoring. Photochemical reactions - secondary pollutants. Control devices for Particulate and Gaseous pollutants – applications.

**Unit-II: Advances In Waste Water Treatment**

2.1 Aerobic Suspended growth Process
2.2 Process for biological nitrogen removal
2.3 Design Criteria – Anoxic, Aerobic Process Design – Sequencing Batch Reactor (SBR) – Process Analysis - Process For Biological Phosphorus Removal – Design Criteria.

**Aerobic Attached Growth Process**

**2.4** Rotating biological contactor,
**2.5** Activated Bio-filter
**2.6** Fluidized bed bioreactor (FBBR) -design criteria.
**2.7** Anaerobic suspended and attached growth process - Up flow anaerobic sludge blanket reactor.

**Unit-II: Tertiary Treatment:**

3.1 Emerging Contaminants Removal
3.2 Disinfection Of Waste Water
3.3 Waste Water Recycling – Water Reuse.
3.4 Advances Treatment Units
3.5 Removal Of Organic And Inorganic Colloidal And Suspended Solids
3.6 Removal Of Dissolved Organic Constituents
3.7 Removal Of Dissolved Inorganic Constituents
3.8 Filtration – Membrane Filtration – Adsorption - Distillation Processes

**Text / Reference Books:**

1. Metcalf and Eddy, "Waste Water Engineering Treatment Disposal Reuse", Tata McGraw Hill, 2002.
2. Clarence, J. Velz, "Applied Stream Sanitation", Krieger Pub Co., 1984.
3. C. S Rao, "Environmental Pollution Control Engineering", New Age Publications, 2006.

# Rama University Uttar Pradesh, Kanpur

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**Faculty of Engineering &Technology,**

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**OPEN ELECTIVE-IV**

| L | T | P | Credit |
|---|---|---|---|
| 3 | 0 | 0 | 3 |

## *LCE-851: Capstone Project-II*

| L | T | P | Credit |
|---|---|---|---|
| 0 | 0 | 16 | 8 |

**Pre-requisite:** Civil Engineering

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

| | |
|---|---|
| **LCE-851.1** | Create a set up through proper design and investigate the system using the engineering knowledge acquired. |
| **LCE-851.2** | Estimate and manage the time, material and cost aspects of the project |
| **LCE-851.3** | Present the project with clarity, following ethical norms in oral and written mode |
| **LCE-851.4** | Develop a team and effectively participate in the team to execute the project |
| **LCE-851.5** | Address environmental / social / engineering problems through the project |

**Mapping of course outcomes with Program Outcomes**

| CO | PO1: Engineering knowledge | PO2 Problem analysis | PO3:Design/development of solutions | PO4:Conduct investigations of complex problems | PO5:Modern tool usage | PO6: The engineer and society | PO7:Environment and sustainability | PO8:Ethics | PO9:Individual and team work | PO10:Communication | PO11:Project management and finance | PO12:Life-long learning |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| LCE-851.1 | 3 | 3 | 3 | 3 | | | | | | | | |
| LCE-851.2 | | | | | | | | | | | 3 | |
| LCE-851.3 | | | | | | | | 3 | 3 | 3 | | 3 |
| LCE-851.4 | | | | | | | | 3 | 3 | | | |
| LCE-851.5 | | | | | 3 | 3 | 3 | 3 | 3 | | | 3 |

**Course Content:**

A group of students, not more than three, who were assigned a faculty guide in the starting of the VII semester. The group will carry forward ***Capstone Project-I*** and conduct Experimental /Technical Works and prepare a detailed Project Report in prescribed format, to be submitted to the Guide .

The assessment of performance of students should be made at least twice in each semester i.e. VII and VIII. In VIII semester, the student shall present the progress of project live as also using overheads project (100% Project completion) or power point presentation on LCD to the internal committee.

The evaluation committee shall consist of faculty members constituted by the HOD which would comprise of at-least three members comprising of the Department Coordinator, Class Coordinator and te students guide would be a special invitee to the presentation. The seminar session shall be an open house session. The internal marks would be the average of the marks given by each member of the committee separately in a sealed envelope to the HOD.

The marking shall be as follows. Internal: 100 marks By the Faculty Guide - 100 marks by Committee appointed by the HOD.

**External: 300 marks by External examiner appointed by the University.**