Your Dreams Our Goal

# POORNIMA UNIVERSITY

Member of Association of Indian Universities & Approved by UGC (Govt. of India) under 2(f) & 12(B)

# FACULTY OF ENGINEERING & TECHNOLOGY

## DEPARTMENT OF CIVIL ENGINEERING

## M.TECH IN STRUCTURAL ENGINEERING

# SCHEME & SYLLABUS BOOKLET

**BATCH 2023-2025**

# SCHEME & SYLLABUS

# BATCH: 2023-25

# INDEX



**Disclaimer:** The scheme, syllabus and other materials published in this booklet may be changed or modified as per the requirement after approval of competent authority. The decision taken by the management of Poornima University will be final and abiding to all.

**Student Details**

Name of Student:

Name of Program:

Semester:

Your Dreams Our Goal

POORNIMA UNIVERSITY

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## *VISION*

To create knowledge based society with scientific temper, team spirit and dignity of labor to face global competitive challenges.

## *Mission*

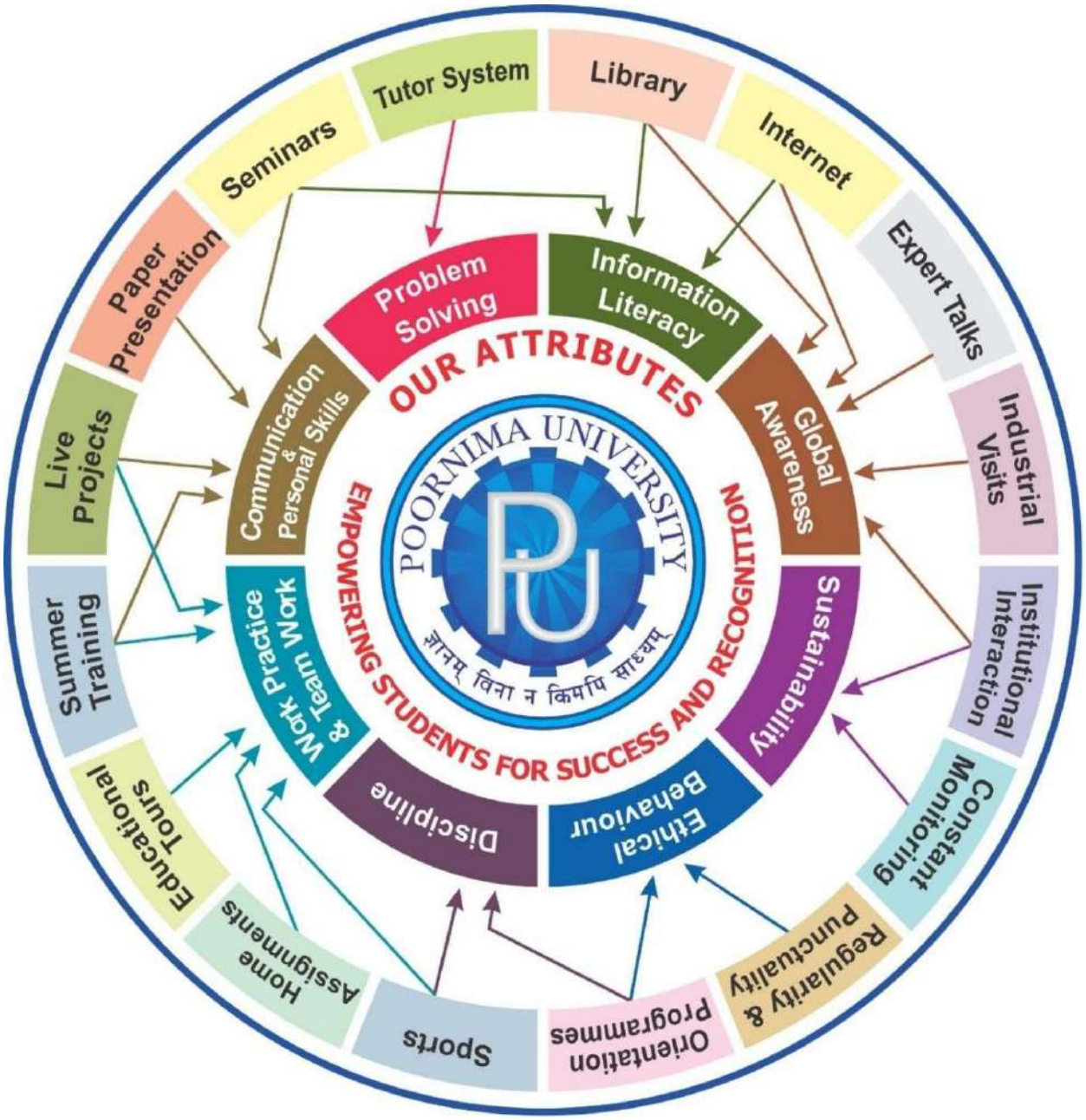
To evolve and develop skill based systems for effective delivery of knowledge so as to equip young professionals with dedication and commitment to excellence in all spheres of life.

## *Quality Policy*

To provide Quality Education through Faculty development, updating of facilities and continual improvement meeting University norms and keeping stake holders satisfied

## *Knowledge Wheel*

At Poornima, the academic atmosphere is a rare blend of modern technical aswell as soft skills and traditional systems of learning processes.



## About Program and Program Outcomes (PO):

**Title of the Programme:** Bachelor of Technology (B. Tech.)

**Nature of the Programme:** B. Tech. is four year full-time programme.

## Program Outcomes (PO) :

Engineering Graduates will be able to:

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

B. **Problem analysis:** Identify, formulate, review research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.

C. **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.

D. **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.

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

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

G. **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.

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

I. **Individual and team work:** Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.

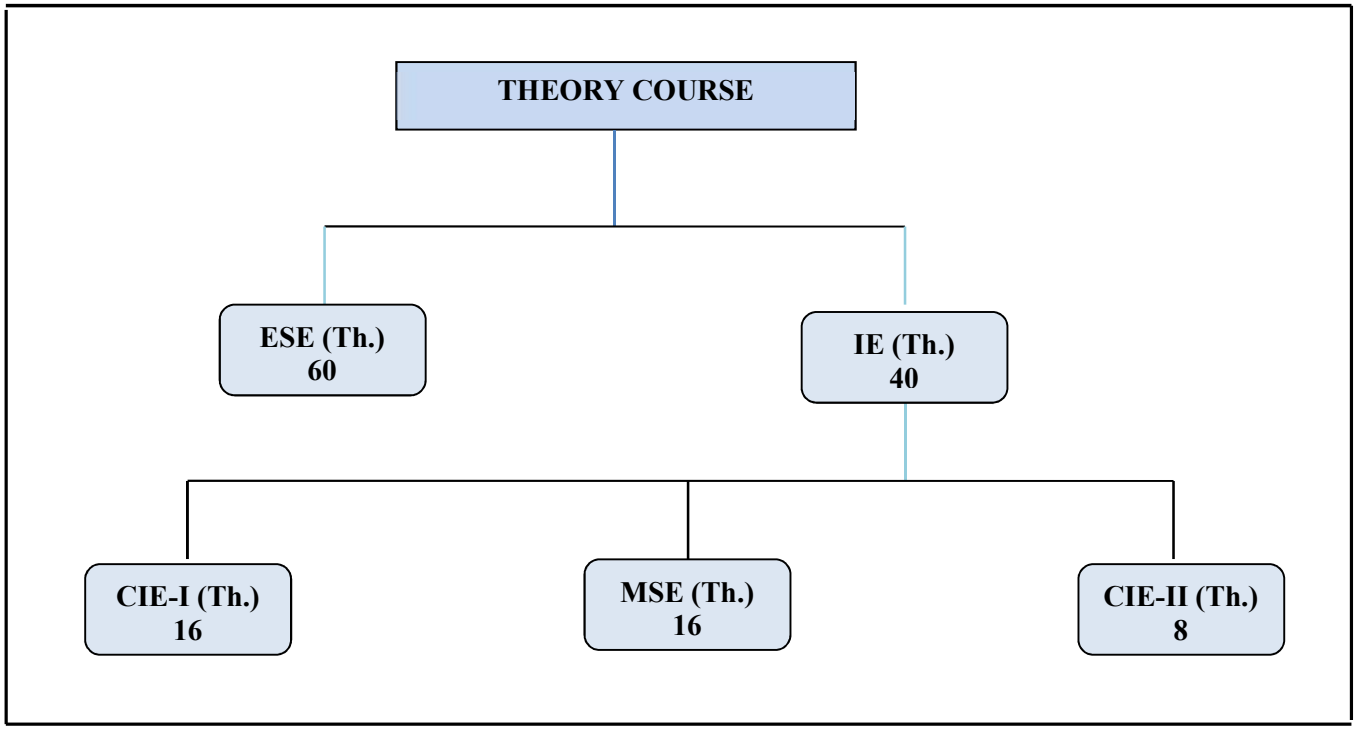
J. **Communication:** Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.

K. **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.

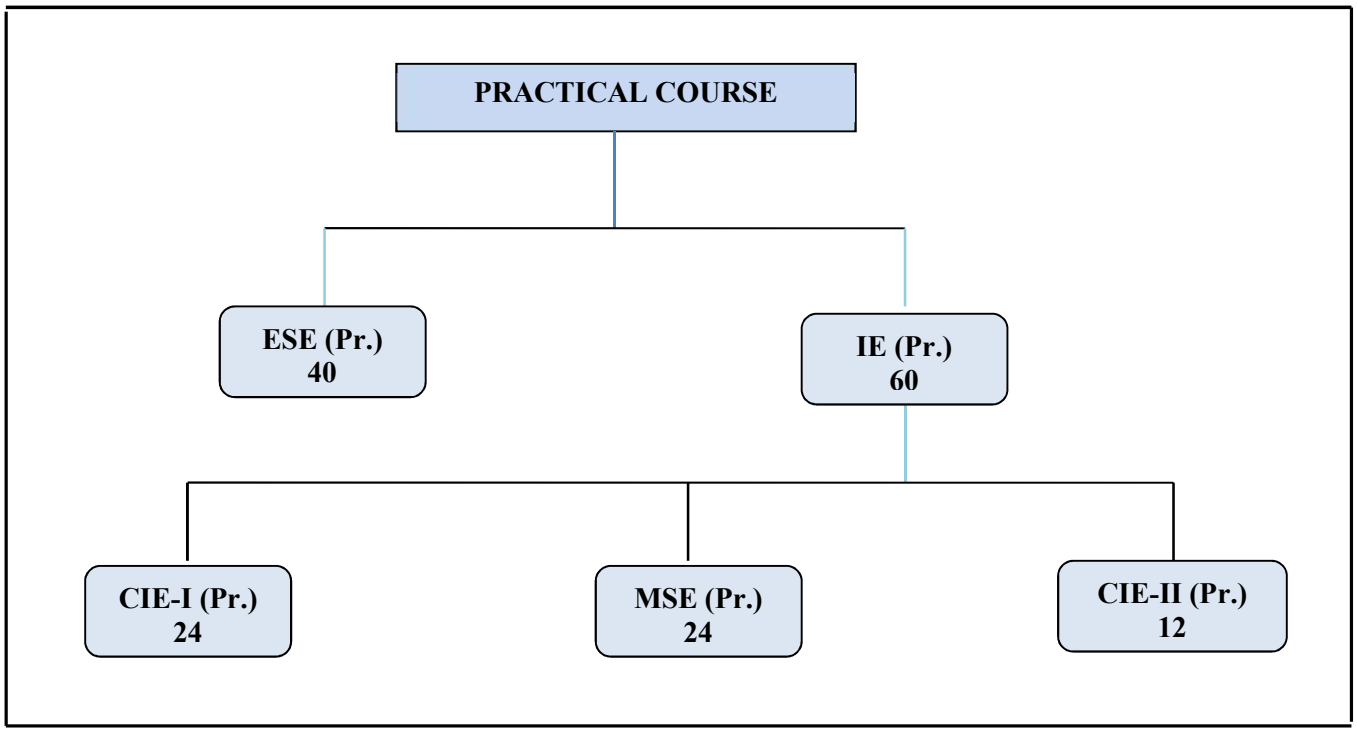
L. **Life-long learning:** Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change.

## Examination System :

### A. Marks Distribution of Theory Course:




### B. Marks Distribution of Practical Course :




**Th**.: Theory, Pr.: Practical, **ESE:** End Semester Examination, **MSE:** Mid Semester Examination, **CIE:** Continuous Internal Evaluation.

**CO Wise Marks Distribution:**

| Exam Entity | Theory Subject | | Practical/ Studio Subject | |
|---|---|---|---|---|
| | Maximum Marks | CO to be Covered | CO to be Covered | Maximum Marks |
| CIE-I | 16 ( 8 + 8) | 1 & 2 | 1 & 2 | 24 (12 + 12) |
| MSE | 16 ( 8 + 8) | 3 & 4 | 3 & 4 | 24 (12 + 12) |
| CIE-II (Activity/ Assignment ) | 8 (8) | 5 | 5 | 12 (12) |
| ESE | 60 | - | - | 40 |
| TOTAL | 100 | - | - | 100 |

**Minimum Passing Percentage in All Exams:**

| S No. | Program Name | Minimum Passing Percentage in | | |
|---|---|---|---|---|
| | | IE Component | ESE Component | Total Component |
| 1 | Course Work for PhD Registration | - | - | 50% |
| 2 | B. Arch. | - | 45% | 50% |
| 3 | MBA, MCA, M.Des., M.Tech., M.Plan, MHA, MPH | - | 40% | 40% |
| 4 | MBA, MCA, M.Des., M.Tech., M.Plan, MHA, MPH | - | 35% | 35% |

## SGPA Calculation

$$SGPA = \frac{C_1G_1 + C_2G_2 + \ldots\ldots\ldots + C_nG_n}{C_1 + C_2 + \ldots\ldots + C_n}$$

$$SGPA = \frac{\sum_i C_i \times G_i}{\sum_i C_i}$$

where (as per teaching scheme & syllabus):

$C_i$ is the number of credits of subject i,

$G_i$ is the Grade Point for the subject I and i = 1 to n,

n = number of subjects in a course in the semester

## CGPA Calculation

$$CGPA = \frac{C_1G_1 + C_2G_2 + \ldots\ldots\ldots + C_nG_n}{C_1 + C_2 + \ldots\ldots + C_n}$$

$$CGPA = \frac{\sum_i C_i \times G_i}{\sum_i C_i}$$

where (as per teaching scheme & syllabus):

$C_i$ is the number of credits of subject i,

$G_i$ is the Grade Point for the subject I and i = 1 to n,

n = number of subjects in a course of all the semesters up to which CGPA is computed

## Grading Table:

**Applicable for B.Arch. & Ph.D. Courses**

| Academic Performance | Grade | Grade Point | Marks Range (in %) |
|---|---|---|---|
| Outstanding | O | 10 | 90≤ x ≤100 |
| Excellent | A+ | 9 | 80≤ x <90 |
| Very Good | A | 8 | 70≤ x <80 |
| Good | B+ | 7 | 60≤ x <70 |
| Above Average | B | 6 | 50≤ x <60 |
| Fail | F | 0 | x <50 |
| Absent | Ab | 0 | Absent |

**Applicable for All Courses except B.Arch. & Ph.D.**

| Academic Performance | Grade | Grade Point | Marks Range (in %) |
|---|---|---|---|
| Outstanding | O | 10 | 90≤ x ≤100 |
| Excellent | A+ | 9 | 80≤ x <90 |
| Very Good | A | 8 | 70≤ x <80 |
| Good | B+ | 7 | 60≤ x <70 |
| Above Average | B | 6 | 50≤ x <60 |
| Average | C | 5 | 40≤ x <50 |
| Pass | P | 4 | 35≤ x <40 |
| Fail | F | 0 | x <35 |
| Absent | Ab | 0 | Absent |

## CGPA to percentage conversion rule:

**Equivalent % of Marks in the Program = *CGPA* *10**

## Award of Class

| CGPA | Percentage | Equivalent Division |
|---|---|---|
| 7.50 ≤ CGPA | 75% or more | First Division with Distinction |
| 6.00 ≤ CGPA < 7.50 | 60% ≤ x <75% | First Division |
| 5.00 ≤ CGPA < 6.00 | 50% ≤ x <60% | Second Division |
| 4.00 ≤ CGPA < 5.00 | 40% ≤ x < 50% | Pass Class |

# Guidelines for Massive Open Online Courses (MOOCs)

**(Session 2023-24)**

Poornima University, in its never ending endeavor to equip students with best-of-class learning and knowledge, has undertaken to include MOOC courses as part of its credit scheme from session 2023-24 onwards. The objective behind this is to enable students to study courses designed by the best teachers in the country and to scale their knowledge base with the rest of learners from the nation. The MOOCs which are included under this scheme is can be chosen from SWAYAM and NPTEL.

## 1. Introduction of MOOCs: SWAYAM and NPTEL

### About SWAYAM:

SWAYAM is a programme initiated by Government of India and designed to achieve the three cardinal principles of Education Policy viz., access, equity and quality. The objective of this effort is to take the best teaching learning resources to all, including the most disadvantaged. SWAYAM seeks to bridge the digital divide for students who have hitherto remained untouched by the digital revolution and have not been able to join the mainstream of the knowledge economy.

This is done through a platform that facilitates hosting of all the courses, taught in classrooms to be accessed by anyone, anywhere at any time. All the courses are interactive, prepared by the best teachers in the country and are available, free of cost to any learner. However learners wanting a SWAYAM certificate should register for the final proctored exams that come at a fee and attend in-person at designated centers on specified dates. Eligibility for the certificate will be announced on the course page and learners will get certificates only if this criteria is matched.

The courses hosted on SWAYAM are in 4 quadrants – (1) video lecture, (2) specially prepared reading material that can be downloaded/printed (3) self-assessment tests through tests and quizzes and (4) an online discussion forum for clearing the doubts. Steps have been taken to enrich the learning experience by using audio-video and multi-media and state of the art pedagogy / technology.

In order to ensure that best quality content is produced and delivered, nine National Coordinators have been appointed. They are:

1. AICTE (All India Council for Technical Education) for self-paced and international courses
2. NPTEL (National Programme on Technology Enhanced Learning) for Engineering
3. UGC (University Grants Commission) for non-technical post-graduation education
4. CEC (Consortium for Educational Communication) for under-graduate education
5. NCERT (National Council of Educational Research and Training) for school education
6. NIOS (National Institute of Open Schooling) for school education
7. IGNOU (Indira Gandhi National Open University) for out-of-school students
8. IIMB (Indian Institute of Management, Bangalore) for management studies
9. NITTTR (National Institute of Technical Teachers Training and Research) for Teacher Training programme

Two types of courses are offered on SWAYAM platform: Credit Courses and Non- Credit Courses. Credit courses are offered for each semester in January and July every year. The list is available on SWAYAM official website: https://onlinecourses.swayam2.ac.in/

### About NPTEL:

NPTEL (National Programme on Technology Enhanced Learning), is a joint venture of the IITs and IISc, funded by the Ministry of Education (MoE) Government of India, and was launched in 2003. Initially started as a project to take quality education to all corners of the country, NPTEL now offers close to 600+ courses for certification every semester in about 22 disciplines.

### Some highlights:

- Largest online repository in the world of courses in engineering, basic sciences and selected humanities and management subjects
- YouTube channel for NPTEL – most subscribed educational channel, 1.3 billion views and 40+ lakhs subscribers

- More than 56000 hours of video content, transcribed and subtitled
- Most accessed library of peer-reviewed educational content in the world
- Translation of more than 12000 hrs of English transcripts in regional Indian languages

### NPTEL Online Certification:

The objective of enabling students obtain certificates for courses is to make students employable in the industry or pursue a suitable higher education programme. Through an online portal, 4, 8, or 12-week online courses, typically on topics relevant to students in all years of higher education along with basic core courses in sciences and humanities with exposure to relevant tools and technologies, are being offered. Enrolment to and learning from these courses is free. Following these online courses, an in-person, proctored certification exam is conducted and a certificate is provided through the participating institutions and industry, as applicable.
Some statistics regarding the open online courses since March 2014 till Dec 2021
Completed courses: 3496;
Enrollments across courses: 1.58 CRORE +
Number of exam registrations: 15.1 LAKH +
All the statistics pertaining to completed courses are available at https://beta.nptel.ac.in/courses. All courses are completely free to enroll and learn from. The certification exam is optional and comes at a fee of Rs 1000/course exam.

## 2. MOOCs at Poornima University:

MOOCs envelops best in class teaching - learning processes along with meeting the requirements of various courses in terms of quality of teaching and evaluation system. To promote the MOOCs among students of Poornima University, it is decided to consider the credits earned through MOOCs.

### (a) Options for MOOCs at Poornima University

**(For this document, only those MOOCs will be considered which are available on SWAYAM & NPTEL platforms)**

- Credit and Non-credit SWAYAM MOOCs can be opted by anyone, anytime, anywhere and in any language. However, prior-permission of the University Authorities is mandatory if the credits are to be transferred to regular degree.
- In case of credit courses, there are two ways to opt these courses for the purpose of credit transfer to PU system as given below:

### OPTION–I: As Open Elective (for batches entered till 2022) / Multidisciplinary Courses (for batches admitted from 2023-24 onwards):

Open Elective (for batches entered till 2022) / Multidisciplinary Courses (for batches admitted from 2023-24 onwards) are available at University level in offline mode for which relevant booklets are already published. **These courses carries 02 credits.** These category/type of courses (similar/different) are also available as MOOC courses. The respective Deans / HODs shall provide both the options to all the students to either select offline courses or MOOCs as per details given below:

- Deans / HODs shall prepare a list of upto 05 appropriate MOOC courses of 02/03 credits each, well in advance (at-least 15 days prior to commencement of semester) and take approval from the Office of Dean, Academics / Pro-President, PU.
- After approval, the respective Deans / HODs shall circulate a notice to all their respective students so that they can select any one course from the list, the credits **(only 02)** of which will be counted against Open Elective/ Multidisciplinary courses pertaining to that particular semester.
- If the students are not willing to opt for MOOC Open Elective/ Multidisciplinary course, they can proceed with the current offline practice of opting for Multidisciplinary courses.
- The tutor of the class shall monitor the progress (assignments, feedback, any problem etc.) on weekly basis and report to Head/Dean.

**OR**

## OPTION–II: As Major / Minor Courses:

- Deans / HODs shall identify a course of **03 credits** for each semester, well in advance (at-least 15 days prior to commencement of semester) and take approval from the Office of Dean, Academics / Pro-President, PU.
- After approval, the respective Deans / HODs shall circulate a notice to all their respective students citing that the particular course will be conducted through MOOCs only and is compulsory for all respective students. The credits of this course will be counted against Major/Minor courses pertaining to that particular semester.
- The tutor of the class shall monitor the progress (assignments, feedback, any problem etc.) on weekly basis and report to Head/Dean.
- This is to be noted that if Deans / HODs decide to conduct any major/minor course in any semester through MOOCs, no offline course will be conducted against that.

## (b) Important points related to MOOCs at Poornima University

- Only one MOOC shall be allowed in a particular semester for the purpose of credit transfer in the beginning.
- No attendance will be taken for MOOC courses.
- Last period of T/T/S shall be taken for MOOC courses which shall be in self-study mode.
- The method of assessments of MOOC such as assignments and examination are completely associated with that particular MOOC and no exam will be conducted by the department as well as by the Examination Cell.
- The respective Dean / HOD must submit the detail of course i.e., code, name and credit of MOOC opted against that particular course in particular semester attached with highlighting in the related examination scheme of syllabus of that semester signed by BOS Convener / HoD and Dean of Faculty to the office of Pro-President before commencement of the classes.
- SWAYAM will award a certificate to all the students passing the examination along with the credit earned. The center of examination for SWAYAM MOOCs will be finalized by SWAYAM. All the responsibility related to registration for MOOCs, timely submission of assignments, examinations etc. will be borne by the students only.
- The list of registered students in MOOC along with name of course will be submitted to the Examination Cell by the Deans / HoDs before commencement of the classes.
- Any student who would not be able to register/present/clear/pass the MOOC in the stipulated time, it is the choice of the student that he or she may register in next semester (odd or even) with MOOC again or appear as a back exam candidate of the University as per PU norms.
- There will be no provision of re-evaluation of MOOC.
- The scorecard and related certificate of MOOC along with a consolidated list of students with marks of assignment and final exam will be submitted to the examination cell by the concerned Dean / HOD for further process. It is also recommended that alteration/changes/scaling in marks obtained by the students in any MOOC will not be considered.
- The exam registration fee of MOOC up to Max. INR 1000/- will be reimbursed to the student only after successful completion of the course in first attempt and submission of the fee receipt, score-card and certificate of the MOOC to the concerned department within stipulated time after declaration of the results.

**NOTE: This is to be noted that the procedure for getting approval from BOS, Faculty Board, Academic Council and BoM is to be followed as per regular process.**

**Attached Items:**

| | |
|---|---|
| Open Elective Booklet | Annexure-1 |
| Soft Skills Booklet | Annexure-2 |
| Value Added Course Booklet | Annexure-3 |

**Required credits for Honors:**

| S.No | Program Duration | Required credits for Honors |
|---|---|---|
| 1. | 2- Year | 10- Credits |
| 2. | 3- Year | 15- Credits |
| 3. | 4-Year | 20- Credits |

| S. No | NPTEL/ SWAYAM<br>Course duration (in weeks) | Equivalent Credits |
|---|---|---|
| 1 | 4 | 2 |
| 2 | 8 | 3 |
| 3 | 12 | 4 |

**Attached Items:**

| | |
|---|---|
| Open Elective Booklet | Annexure-1 |
| Soft Skills Booklet | Annexure-2 |
| Value Added Course Booklet | Annexure-3 |

| | POORNIMA UNIVERSITY, JAIPUR | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | Faculty of Engineering and Technology | | | | | | | | |
| **Name of Program:** | **M.Tech. in Structural Engineering** **Duration: 2 Years** **Total Credits: 80** | | | | | | | | |
| | **Teaching Scheme for Batch 2023-25** | | | | | | | | |
| | **Semester-I** | | | | | | | | |
| **Course Code** | **Name of Course** | **Teaching Scheme** | | | | **Marks Distribution** | | | **Credits** |
| | | **Lecture (L)** | **Tutorial (T)** | **Practical** | **SH** | **IE** | **ESE** | **Total** | |
| **A.** | | **Major (Core Courses)** | | | | | | | |
| **A.1** | **Theory** | | | | | | | | |
| MSTCCV1101 | Advanced Structural Analysis | 3 | 1 | - | - | 40 | 60 | 100 | 4 |
| MSTCCV1102 | Structural Dynamics | 3 | 1 | - | - | 40 | 60 | 100 | 4 |
| **A.2** | **Practical** | | | | | | | | |
| MSTCCV1201 | Structure Lab-I | - | - | 2 | | 60 | 40 | 100 | 1 |
| **B.** | | **Minor Stream Courses/ Department Electives I and II** | | | | | | | |
| **B.1** | **Theory** | | | | | | | | |
| MSTECV1101 | Concrete Construction Technology | 3 | 1 | - | - | 40 | 60 | 100 | 4 |
| MSTECV1102 | Computational Methods | | | - | - | 40 | 60 | 100 | |
| MSTECV1103 | Design of Precast and Composite Structures | | | - | - | 40 | 60 | 100 | |
| MSTECV1104 | Bridge Engineering | | | - | - | 40 | 60 | 100 | |
| MSTECV1105 | Design of Pre-Stressed Concrete Structures | 3 | 1 | - | - | 40 | 60 | 100 | 4 |
| MSTECV1106 | Foundation design and Construction | | | - | - | 40 | 60 | 100 | |
| MSTECV1107 | Repair and Rehabilitation of Structures | | | - | - | 40 | 60 | 100 | |
| MSTECV1108 | Soil Structure Interaction | | | - | - | 40 | 60 | 100 | |
| **B.2** | **Practical** | | | | | | | | |
| | - | - | - | - | - | - | - | - | - |
| **C** | | **Multidisciplinary Courses** | | | | | | | |
| | | - | - | - | - | - | - | - | - |
| **D** | | **Ability Enhancement Courses (AEC)** | | | | | | | |
| MULCHM1201 | Soft Skills - I | - | - | 2 | | 60 | 40 | 100 | 1 |
| **E** | | **Skill Enhancement Courses (SEC)** | | | | | | | |
| MULCSE1201 | Skill Enhancement Technical Course | - | - | 2 | - | 60 | 40 | 100 | 1 |
| **F** | | **Value Added Courses (VAC)** | | | | | | | |
| | - | - | - | - | - | - | - | - | - |
| **G** | | **Summer Internship / Research Project / Dissertation** | | | | | | | |
| MSTCCV1401 | Seminar-I | - | - | 4 | - | 60 | 40 | 100 | 2 |
| **Total** | | 12 | 4 | 10 | | | | | **21** |
| **Total Teaching Hours** | | **26** | | | | | | | |

| | POORNIMA UNIVERSITY, JAIPUR | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | Faculty of Engineering and Technology | | | | | | | | |
| **Name of Program:** | **M.Tech. in Structural Engineering** | | **Duration: 2 Years** | | | | | **Total Credits: 80** | |
| | **Teaching Scheme for Batch 2023-25** | | | | | | | | |
| | **Semester-II** | | | | | | | | |
| **Course Code** | **Name of Course** | **Teaching Scheme** | | | | **Marks Distribution** | | | **Credits** |
| | | **Lecture (L)** | **Tutorial (T)** | **Practical** | **SH** | **IE** | **ESE** | **Total** | |
| **A.** | | **Major (Core Courses)** | | | | | | | |
| **A.1** | **Theory** | | | | | | | | |
| MSTCCV2101 | Advanced Steel Structures | 3 | 1 | - | | 40 | 60 | 100 | 4 |
| MSTCCV2102 | Design of Advanced Concrete Structure | 3 | 1 | - | | 40 | 60 | 100 | 4 |
| **A.2** | **Practical** | | | | | | | | |
| MSTCCV2201 | Structure Lab-II | - | - | 2 | | 60 | 40 | 100 | 1 |
| **B.** | | **Minor Stream Courses/ Department Electives I and II** | | | | | | | |
| **B.1** | **Theory** | | | | | | | | |
| MSTECV2101 | Finite Element Method | 3 | 1 | - | - | 40 | 60 | 100 | 4 |
| MSTECV2102 | Structural Optimization | | | - | - | 40 | 60 | 100 | |
| MSTECV2103 | Plates and Shells | | | - | - | 40 | 60 | 100 | |
| MSTECV2104 | Stability Analysis of Structure | | | - | - | 40 | 60 | 100 | |
| MSTECV2105 | Tall Structures | 3 | 0 | - | - | 40 | 60 | 100 | 3 |
| MSTECV2106 | Earthquake Resistant Design of Structures | | | - | - | 40 | 60 | 100 | |
| MSTECV2107 | Design Concept of Substructure | | | - | - | 40 | 60 | 100 | |
| MSTECV2108 | Industrial Structures | | | - | - | 40 | 60 | 100 | |
| **B.2** | **Practical** | | | | | | | | |
| | - | - | - | - | - | - | - | - | - |
| **C** | | **Multidisciplinary Courses** | | | | | | | |
| MULEBX2109 | Engineering Economics | 3 | - | - | - | 40 | 60 | 100 | 3 |
| **D** | | **Ability Enhancement Courses (AEC)** | | | | | | | |
| MULCHM2201 | Soft Skills - II | - | - | 2 | | 60 | 40 | 100 | 1 |
| **E** | | **Skill Enhancement Courses (SEC)** | | | | | | | |
| MULCSE2201 | Skill Enhancement Technical Course-II | | | 2 | | 60 | 40 | 100 | 1 |
| **F** | | **Value Added Courses (VAC)** | | | | | | | |
| | - | - | - | - | - | - | - | - | - |
| **G** | | **Summer Internship / Research Project / Dissertation** | | | | | | | |
| MSTCCV2401 | Seminar-II | - | - | 2 | - | 60 | 40 | 100 | 1 |
| **Total** | | 15 | 3 | 8 | | | | | **22** |
| **Total Teaching Hours** | | **26** | | | | | | | |

| | POORNIMA UNIVERSITY, JAIPUR | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | Faculty of Engineering and Technology | | | | | | | | |
| **Name of Program:** | **M.Tech. in Structural Engineering** **Duration: 2 Years** **Total Credits: 80** | | | | | | | | |
| | **Teaching Scheme for Batch 2023-25** | | | | | | | | |
| | **Semester-III** | | | | | | | | |
| **Course Code** | **Name of Course** | **Teaching Scheme** | | | | **Marks Distribution** | | | **Credits** |
| | | **Lecture (L)** | **Tutorial (T)** | **Practical** | **SH** | **IE** | **ESE** | **Total** | |
| **A.** | | **Major (Core Courses)** | | | | | | | |
| **A.1** | **Theory** | | | | | | | | |
| MSTCCV3101 | Advanced Solid Mechanics | 3 | 1 | - | | 40 | 60 | 100 | 4 |
| MSTCCV3102 | Research Methodology | 3 | 1 | - | | 40 | 60 | 100 | 4 |
| **A.2** | **Practical** | | | | | | | | |
| MSTCCV3201 | Structure Lab-III | - | - | 2 | | 60 | 40 | 100 | 1 |
| MSTCCV3401 | Review/Research Paper | - | - | 2 | | 60 | 40 | 100 | 1 |
| **B.** | | **Minor Stream Courses/ Department Electives/*Open Elective*** | | | | | | | |
| **B.1** | **Theory** | | | | | | | | |
| MULEEE3107 | E-Commerce and Knowledge Management | 3 | 1 | - | | 40 | 60 | 100 | 3 |
| MULECV3108 | Water and Environmental Pollution | | | - | | 40 | 60 | 100 | |
| MULEME3109 | IPR & Patents | | | - | | 40 | 60 | 100 | |
| MULEEE3110 | Robotics | | | - | | 40 | 60 | 100 | |
| MULEEE3111 | Digital India Implementation | | | - | | 40 | 60 | 100 | |
| MULECV3112 | Smart City Design | | | - | | 40 | 60 | 100 | |
| MULEEE3113 | Renewable Energy | | | - | | 40 | 60 | 100 | |
| **B.2** | **Practical** | | | | | | | | |
| | | | | | | | | | |
| **C** | | **Multidisciplinary Courses** | | | | | | | |
| MSTEMC3121 | MOOC Course - I | 3 | - | - | - | - | - | - | 3 |
| **D** | | **Ability Enhancement Courses (AEC)** | | | | | | | |
| | | | | | | | | | |
| **E** | | **Skill Enhancement Courses (SEC)** | | | | | | | |
| - | - | - | - | - | - | - | - | - | - |
| **F** | | **Value Added Courses (VAC)** | | | | | | | |
| | | | | | | | | | |
| **G** | | **Summer Internship / Research Project / Dissertation** | | | | | | | |
| MSTCCV3402 | Dissertation Part - I | - | - | 12 | - | 60 | 40 | 100 | 6 |
| **Total** | | 12 | 3 | 16 | | | | | **22** |
| **Total Teaching Hours** | | **31** | | | | | | | |

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | **POORNIMA UNIVERSITY, JAIPUR** | | | | | | | | |
| | **Faculty of Engineering and Technology** | | | | | | | | |
| **Name of Program:** | **M.Tech. in Structural Engineering** **Duration: 2 Years** **Total Credits: 80** | | | | | | | | |
| | **Teaching Scheme for Batch 2023-25** | | | | | | | | |
| | **Semester-IV** | | | | | | | | |
| **Course Code** | **Name of Course** | **Teaching Scheme** | | | | **Marks Distribution** | | | **Credits** |
| | | **Lecture (L)** | **Tutorial (T)** | **Practical** | **SH** | **IE** | **ESE** | **Total** | |
| **A.** | | **Major (Core Courses)** | | | | | | | |
| **A.1** | **Theory** | | | | | | | | |
| - | - | - | - | - | - | - | - | - | - |
| **A.2** | **Practical** | | | | | | | | |
| - | - | - | - | - | - | - | - | - | - |
| **B.** | | **Minor Stream Courses/ Department Electives/*Core Elective*** | | | | | | | |
| **B.1** | **Theory** | | | | | | | | |
| - | - | - | - | - | - | - | - | - | - |
| **B.2** | **Practical** | | | | | | | | |
| - | - | - | - | - | - | - | - | - | - |
| **C** | | **Multidisciplinary Courses** | | | | | | | |
| - | - | - | - | - | - | - | - | - | - |
| **D** | | **Ability Enhancement Courses (AEC)** | | | | | | | |
| - | - | - | | | | | | | |
| **E** | | **Skill Enhancement Courses (SEC)** | | | | | | | |
| - | - | - | - | - | - | - | - | - | - |
| **F** | | **Value Added Courses (VAC)** | | | | | | | |
| | - | - | - | - | - | - | - | - | - |
| **G** | | **Summer Internship / Research Project / Dissertation** | | | | | | | |
| MSTCCV4401 | Dissertation Part - II | - | - | 30 | - | 250 | 250 | 500 | 15 |
| **Total** | | 0 | 0 | 30 | | | | | **15** |
| **Total Teaching Hours** | | **30** | | | | | | | |

| PO No. | PO's |
|---|---|
| 1 | **Engineering knowledge:** Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems. |
| 2 | **Problem analysis:** Identify, formulate, review research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences. |
| 3 | **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 |
| 4 | **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. Considerations. |
| 5 | **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. |
| 6 | **The engineer and society:** Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional engineering practice. |
| 7 | **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. |
| 8 | **Ethics:** Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice. |
| 9 | **Individual and team work:** Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings. |
| 10 | **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. |
| 11 | **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. |
| 12 | **Life-long learning:** Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change. |
| **PSO No.** | **PSO's** |
| 1 | A civil engineering graduate is efficient in fundamentals of civil engineering, mathematical & scientific reasoning and are able to plan, design the building structure, roads, sewage and water supply networks & other component of infrastructure system considering environmental, safety & health aspects. |
| 2 | A civil engineer is able to use modern tools, techniques, software's to solve complex engineering problems. |
| 3 | A civil Engineer able to prepare BOQ & cost estimation & able to execute the projects in lined with set project goals. |
| 4 | A civil engineer is able to compile detailed project report & give technical specifications to provide required quality of work. |
| 5 | A civil engineer is able to access the quality of material used for construction & able to find out deviations & able to suggest preventative and corrective measures for sustainable development. |

| | POORNIMA UNIVERSITY, JAIPUR | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | Faculty of Engineering and Technology | | | | | | | | |
| **Name of Program:** | **M.Tech. in Structural Engineering Duration: 2 Years Total Credits: 80** | | | | | | | | |
| | **Teaching Scheme for Batch 2023-25** | | | | | | | | |
| | **Semester-I** | | | | | | | | |
| **Course Code** | **Name of Course** | **Teaching Scheme** | | | | **Marks Distribution** | | | **Credits** |
| | | **Lecture (L)** | **Tutorial (T)** | **Practical** | **SH** | **IE** | **ESE** | **Total** | |
| **A.** | | **Major (Core Courses)** | | | | | | | |
| **A.1** | **Theory** | | | | | | | | |
| MSTCCV1101 | Advanced Structural Analysis | 3 | 1 | - | - | 40 | 60 | 100 | 4 |
| MSTCCV1102 | Structural Dynamics | 3 | 1 | - | - | 40 | 60 | 100 | 4 |
| **A.2** | **Practical** | | | | | | | | |
| MSTCCV1201 | Structure Lab-I | - | - | 2 | | 60 | 40 | 100 | 1 |
| **B.** | | **Minor Stream Courses/ Department Electives I and II** | | | | | | | |
| **B.1** | **Theory** | | | | | | | | |
| MSTECV1101 | Concrete Construction Technology | 3 | 1 | - | - | 40 | 60 | 100 | 4 |
| MSTECV1102 | Computational Methods | | | - | - | 40 | 60 | 100 | |
| MSTECV1103 | Design of Precast and Composite Structures | | | - | - | 40 | 60 | 100 | |
| MSTECV1104 | Bridge Engineering | | | - | - | 40 | 60 | 100 | |
| MSTECV1105 | Design of Pre-Stressed Concrete Structures | 3 | 1 | - | - | 40 | 60 | 100 | 4 |
| MSTECV1106 | Foundation design and Construction | | | - | - | 40 | 60 | 100 | |
| MSTECV1107 | Repair and Rehabilitation of Structures | | | - | - | 40 | 60 | 100 | |
| MSTECV1108 | Soil Structure Interaction | | | - | - | 40 | 60 | 100 | |
| **B.2** | **Practical** | | | | | | | | |
| | - | - | - | - | - | - | - | - | - |
| **C** | | **Multidisciplinary Courses** | | | | | | | |
| | | - | - | - | - | - | - | - | - |
| **D** | | **Ability Enhancement Courses (AEC)** | | | | | | | |
| MULCHM1201 | Soft Skills - I | - | - | 2 | | 60 | 40 | 100 | 1 |
| **E** | | **Skill Enhancement Courses (SEC)** | | | | | | | |
| MULCSE1201 | Skill Enhancement Technical Course | - | - | 2 | - | 60 | 40 | 100 | 1 |
| **F** | | **Value Added Courses (VAC)** | | | | | | | |
| | - | - | - | - | - | - | - | - | - |
| **G** | | **Summer Internship / Research Project / Dissertation** | | | | | | | |
| MSTCCV1401 | Seminar-I | - | - | 4 | - | 60 | 40 | 100 | 2 |
| **Total** | | 12 | 4 | 10 | | | | | **21** |
| **Total Teaching Hours** | | **26** | | | | | | | |

## Major (Core Courses)

# M. Tech. Structural Engineering Syllabus- FirstSemester

**Code: MSTCCV1101 Advanced Structural Analysis 4 Credits [LTP:3-1-0]**

**COURSE OVERVIEW AND OBJECTIVES:**

This course is concerned with the conception, analysis of structural components or assemblies to resist loads arising from internal and external forces. It covers the calculation of deflection, shear force and bending moment by flexibility and stiffness method. Structural analysis incorporates the fields of applied mechanics, materials science and applied mathematics to compute a structure's deformations, internal forces, stresses, support reactions, accelerations, and stability. It makes the students capable to analyse the structure's fitness for use which will help the student in designing structures.

**COURSE OUTCOME**

The student would be able

CO1101.1. To understand and distinguish the behavior of member on the basis of degree of freedom.

CO1101.2 To assess the bending moment, shear force an deflection by flexibility method.

CO1101.3 To evaluate the concept of local and global coordinates.

C01101.4 To interpret the moment and shear force through energy methods.

CO1101.5 To understand the fundamentals plastic analysis.

**A. OUTLINE OF THE COURSE**

| Unit No. | Title of the unit | Time required for the Unit (Hours) |
|---|---|---|
| 1. | Stiffness Method (Systems Approach) | 11 |
| 2. | Flexibility Method (Systems Approach) | 7 |
| 3. | Introduction to Element Approach | 11 |
| 4. | Structural Stability Analysis | 7 |
| 5. | Plastic Analysis | 6 |

**B. DETAILED SYLLABUS**

| Unit | Unit Details |
|---|---|
| 1. | **Stiffness Method (Systems Approach)**<br>Basis of stiffness method, Degrees of freedom, Force-displacement relationships, Nodal stiffness. |
| 2. | **Flexibility Method (Systems Approach)**<br>Flexibility coefficients, Basis of the method, Application to various types of structures. |
| 3. | **Introduction to Element Approach**<br>Member stiffness matrix, Local or Member co-ordinate system, Global or Structural co-ordinate system, Rotation of axes etc., Structure stiffness matrix |
| 4. | **Structural S t a b i l i t y Analysis**<br>Elastic Instability, Introduction to stability problem, Energy methods, buckling of axially loaded members for different end conditions, Concept of effective length, approximate techniques, Stability analysis of beam-column and frames |

| | |
|---|---|
| 5. | **Plastic Analysis**<br>Concept of Limit load analysis, Upper and lower bonds, Plastic analysis of beams and multi-storey frames using mechanism method. |

**C. RECOMMENDED STUDY MATERIAL:**

| S. No | Title of the Book | Author |
|---|---|---|
| 1. | Matrix Analysis of Framed Structures | Gere, G. M. and Weaver, Jr. W, CBS Publishers (1987). |
| 2. | Structural Analysis: A Classical and Matrix Approach | Mc. Cormac, J. C. & Nelson, J. K., John Wiley and Sons1997). |
| 3. | Matrix Analysis of Structures | Pandit & Gupta, Tata McGraw Hill Publications |
| 4. | Elastic Stability of Structural Elements | Iyengar, N.G.R., Macmillan India Ltd (1980) |
| Important Web links | | |
| 1. https://nptel.ac.in/courses/105/106/105106050/<br>2. https://www.youtube.com/playlist?list=PLEE5D02698EAAF2C0<br>3. http://web.iitd.ac.in/~sbhalla/flexibility.pdf<br>4. https://www.slideshare.net/280632796/ch-1-structural-analysis-stiffness-method<br>5. https://www.aboutcivil.org/plastic-analysis-definition-principles.html | | |

**D.COs AND POs MAPPING**

| COs and POs | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **CO1101.1** | 1 | 1 | - | 3 | - | 1 | - | - | - | - | 1 | - |
| **CO1101.2** | 1 | 3 | - | 2 | 1 | - | - | - | - | - | - | - |
| **CO1101.3** | 1 | - | - | 3 | 1 | - | - | - | - | - | 1 | - |
| **CO1101.4** | 1 | 1 | 3 | - | - | - | 1 | - | - | - | 1 | - |
| **CO1101.5** | 1 | 1 | 3 | - | 1 | 1 | - | - | - | - | - | 1 |

**E. COs AND PSOs MAPPING**

| COs and PSOs | PSO1 | PSO2 | PSO3 | PSO4 | PSO5 |
|---|---|---|---|---|---|
| **CO1101.1** | 1 | 2 | 3 | 1 | - |
| **CO1101.2** | - | 2 | 2 | - | 3 |
| **CO1101.3** | 1 | 1 | - | 3 | 2 |
| **CO1101.4** | 1 | 3 | - | 2 | - |
| **CO1101.5** | 1 | 3 | - | 2 | - |

**Note:** On the basis of mapping of COs with POs, this course is related to Employability / Skill Development

| Code: MSTCCV1102 | Structural Dynamics | 4 Credits [LTP:3-1-0] |
|---|---|---|

**COURSE OVERVIEW AND OBJECTIVES:**

This course aims to equip students with knowledge in structural dynamics, with particular emphasis on the building and bridge structures. Topics include single-degree-of-freedom (SDOF) systems, response to harmonic loading, response to impulsive transient Loading, numerical integration, element stiffness, mass and damping matrices, multi-degree-of-freedom (MDOF) systems, classical and non-classical damping, distributed parameter systems, eignevalue problems, modal analysis and system identification

**COURSE OUTCOME**

The student would be able

CO01102.1 Recognize physical phenomenon in the context of structural vibration.

CO01102.2 Identify and define key concepts related to structural dynamics, such as natural frequencies, modeshapes, damping and vibration characteristics of structures.

CO01102.3 Formulate the equation of motion for dynamics analysis of structures.

CO01102.4 Demonstrate an understanding the multi degree freedom analysis of the structural dynamics theories.

CO01102.5 Develop competence in using computer programming skill to perform modelling and dynamic analysis of structural systems.

**A. OUTLINE OF THE COURSE**

| Unit No. | Title of the unit | Time required for the Unit (Hours) |
|---|---|---|
| **1.** | **Theory of vibrations** | 10 |
| **2.** | **Introduction to Structural Dynamics** | 7 |
| **3.** | **Single Degree of Freedom Systems** | 11 |
| **4.** | **Multi Degree of Freedom Systems** | 7 |
| **5.** | **Practical Vibration Analysis: Continuous Systems: Introduction** | 7 |

**B. DETAILED SYLLABUS**

| Unit | Unit Details |
|---|---|
| 1. | **Theory of vibrations**<br>Introduction Elements of vibratory system, Degrees of Freedom, Continuous System, Lumped mass idealization, Oscillatory motion, Simple Harmonic motion, Vectoral representation of S.H.M., Free vibrations of single degree of freedom system, undamped and damped vibrations, critical damping, Logarithmic decrement, Forced vibration of SDOF systems, Harmonicexcitation, Dynamic magnification factor, Phase angle. |
| 2. | **Introduction to Structural Dynamics**<br>Fundamental objectives of dynamic analysis, Types of prescribed loading, Methods of discretization, Formulation of equations of motion by different methods, direct equilibration using Newton‟s law of motion / D‟ Alembert‟s principle, Principle of virtual. |

| | |
|---|---|
| 3. | **Single Degree of Freedom Systems**<br>Formulation and solution of the equation of motion, Free Vibration response, Response to Harmonic, Periodic, Impulsive and general dynamic loadings, Duhamel integral. Selection of the degrees of Freedom, Evaluation of structural Property matrices, Formulation of the MDOFequations of motion, |
| 4. | **Multi Degree of Freedom Systems**<br>Undamped free vibrations, Solutions of Eigen value problem for natural frequencies and mode shapes, Analysis of Dynamic Response, Normal co-ordinates, uncoupled equations of motion, orthogonal properties of normal Modes, Mode superposition procedure. |
| 5. | **Practical Vibration Analysis: Continuous Systems: Introduction**<br>Introduction, Stodola method, Fundamental mode analysis, Analysis of second and higher modes, Holzer method, Basic procedure. Flexural vibrations of beams, Elementary case, Derivation of Governing differential equation of motion, Analysis of undamped free vibrations of beams in flexure, Natural frequencies and mode- shapes of simple beams with different end conditions, Principles of Application of continuous beams.<br>Introduction, Excitation by rigid base translation, Lumped Mass approach, SDOF and MDOF systems. |

**C. RECOMMENDED STUDY MATERIAL:**

| S. No | Title of the Book | Author |
|---|---|---|
| 1 | Dynamics of Structures | Clough &Penzien, McGraw Hill, New york |
| 2 | Structural Dynamics | Mario Paz, C.B.S Publishers, New Delhi. |
| 3 | Dynamics of Structures | Anil K. Chopra, Pearson Education (Singapore), Delhi |
| 4 | Code of practice for Earthquake resistant design of Structures | I.S: 1893 - 2002 (version) Part-1 |
| Internal Web Links: | | |
| https://nptel.ac.in/courses/105/101/105101006/<br>https://nptel.ac.in/courses/101/105/101105081/<br>https://www.reliableplant.com/vibration-analysis-31569<br>https://www.youtube.com/watch?v=mP79BkYccFU<br>https://www.youtube.com/watch?v=uSqDK5tlj_c | | |

**D. COs AND POs MAPPING**

| COs and POs | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **CO1102.1** | 1 | 1 | 1 | - | - | 2 | 1 | - | - | - | - | 1 |
| **CO1102.2** | 1 | 1 | 2 | 1 | 1 | - | 1 | - | - | - | - | - |
| **CO1102.3** | 1 | 1 | 3 | 1 | 1 | - | - | - | 1 | - | - | - |
| **CO1102.4** | 1 | 1 | 3 | - | - | - | 1 | - | 1 | 1 | 1 | - |
| **CO1102.5** | 1 | 1 | 3 | - | 1 | 1 | - | - | - | - | - | 1 |

**E. COs AND PSOs MAPPING**

| COs and PSOs | PSO1 | PSO2 | PSO3 | PSO4 | PSO5 |
|---|---|---|---|---|---|
| **CO1102.1** | 2 | 3 | - | - | 1 |
| **CO1102.2** | 1 | 3 | - | 2 | 1 |
| **CO1102.3** | 3 | 1 | 1 | 1 | - |
| **CO1102.4** | 3 | 2 | 2 | - | - |
| **CO1102.5** | 3 | 2 | - | - | 2 |

**Note:** On the basis of mapping of COs with POs, this course is related to Employability / Skill Development

| Code: MSTCCV1201 | Structural Lab – I | 1 Credit [LTP: 0-0-2] |
|---|---|---|

**A. DETAILED SYLLABUS**

| List of Experiments |
|---|
| Design as per syllabus of theory |

# Department Elective-I&II

| Code: MSTECV1101 | Advanced Concrete Technology | 4 Credits [LTP:3-1-0] |
|---|---|---|

**COURSE OVERVIEW AND OBJECTIVES:**

This course will provide the students with state-of-the art knowledge on durable and sustainable cement and concrete, on the various mineral additions and chemical admixtures to enhance the workability, strength, durability and sustainability of concrete, and will empower them in the decision-making process regarding the various concrete products, construction procedures and performance test methods that will improve the durability and sustainability of concrete civil infrastructure.

**COURSE OUTCOME**

The student would be able

CO1101.1 Identify Quality Control tests on concrete making materials

CO1101.2 Understand the behavior of fresh and hardened concrete

CO1101.3 Design concrete mixes as per IS and ACI codes

CO1101.4 Understand the durability requirements of concrete

CO1101.5 Understand the need for special concretes

**A. OUTLINE OF THE COURSE**

| Unit No. | Title of the unit | Time required for the Unit (Hours) |
|---|---|---|
| **1** | Introduction of hydration effect | **11** |
| **2.** | Admixtures | **7** |
| **3.** | Properties of Concrete | **10** |
| **4.** | Special Concrete | **7** |
| **5.** | Test on Concrete | **7** |

**B. DETAILED SYLLABUS**

| Unit | Unit Details |
|---|---|
| **Unit 1** | **Introduction of hydration effect**<br>Importance of Bogue‟s compounds, structure of a hydrated cement paste, volume of hydrated product, porosity of paste and concrete, transition zone, elastic modulus, factors affecting strength and elasticity of concrete, rheology of concrete in terms of Bingham‟s parameter. Microstructure of concrete: deterioration mechanisms, assessment and control of corrosion in concrete structures. Introduction to special concretes. |
| **Unit 2** | **Admixtures**<br>Chemical admixtures- mechanism of chemical admixture, plasticizers and super plasticizers and their effect on concrete, marsh cone test for optimum dosage of super plasticizer, retarder, accelerator, air-entraining admixtures. Mineral admixture- fly ash, silica fume, gcbs, and their effect on concrete. Concrete mix design – design of concrete mix by BIS method using is10262 provisions in revised is10262-2004. Concrete mix design using various admixtures. |

| | |
|---|---|
| **Unit 3** | **Properties of Concrete**<br>Durability of concrete - introduction, permeability of concrete, chemical attack, acid attack, efflorescence, corrosion in concrete. Thermal conductivity, thermal diffusivity, specific heat. Alkali aggregate reaction, is456-2000 requirement for durability. RMC concrete - manufacture, transporting, placing, precautions, methods of concreting- pumping, under water concreting, shot Crete, high volume fly ash concrete concept, properties, typical mix self-compacting concrete concept, materials, tests, properties, application and typical mix. |
| **Unit 4** | **Special Concrete**<br>Fiber reinforced & light weight concrete - types and properties, behavior of FRC and LWC in compression, tension including pre-cracking stage and post-cracking stages,behavior in flexure and shear, ferro cement - materials, techniques of manufacture, properties and application. |
| **Unit 5** | **Test on Concrete**<br>Test on hardened concrete-effect of end condition of specimen, capping, h/d ratio, rate of loading, moisture condition. Compression, tension and flexure tests. NDT tests concepts-rebound hammer, pulse velocity methods. |

**C. RECOMMENDED STUDY MATERIAL:**

| S. No | Title of the Book | Author |
|---|---|---|
| **1.** | Properties of Concrete | Nevelli, A. M.,Prentice Hall of India (1995). |
| **2.** | Concrete Technology | Santhakumar A.R (2006), World Rights Publisher |
| **3.** | Special Structural Concretes | Siddique, R., Galgotia Publications (2000). |
| **4.** | Concrete Technology | Gambhir, M. L., Tata-McGraw Hill, 3rd Edition |
| **5.** | Waste Materials and By-products in Concrete | Siddique, R.,Springer (2008) |
| **6.** | High Performance Concrete | Power T.C.- E and FN, London |
| **7.** | Properties of Fresh Concrete | Power T.C.- E and FN, London |

Important Web Links:

1. https://nptel.ac.in/courses/105/106/105106176/
2. https://nptel.ac.in/content/syllabus_pdf/105106176.pdf
3. https://www.researchgate.net/project/Online-NPTEL-Course-on-Advanced-Concrete-Technology
4. https://www.youtube.com/watch?v=SdWh05agJtg
5. https://www.youtube.com/watch?v=Qulc_ofmz5M

**A. COs AND POs MAPPING**

| COs and POs | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **CO1101.1** | 2 | 3 | | - | 1 | - | - | - | - | - | - | - |
| **CO1101.2** | 1 | 3 | 1 | - | 2 | - | - | - | - | - | - | - |
| **CO1101.3** | 2 | 3 | - | 1 | - | - | - | - | - | - | - | - |
| **CO1101.4** | 2 | - | 3 | - | 1 | - | - | - | - | - | - | - |
| **CO1101.5** | 2 | 2 | 2 | 1 | - | - | - | - | - | - | - | - |

**B. COs AND PSOs MAPPING**

| COs and PSOs | PSO1 | PSO2 | PSO3 | PSO4 | PSO5 |
|---|---|---|---|---|---|
| **CO1101.1** | 2 | - | 3 | - | 1 |
| **CO1101.2** | 3 | 2 | - | 1 | - |
| **CO1101.3** | 2 | 1 | 3 | 1 | - |
| **CO1101.4** | 1 | 2 | 2 | - | 2 |
| **CO1101.5** | 1 | 1 | - | 3 | 2 |

**Note:** On the basis of mapping of COs with POs, this course is related to Employability

| Code: MSTECV1102 | Computational Methods | 4 Credits [LTP:3-1-0] |
|---|---|---|

**COURSE OVERVIEW AND OBJECTIVES:**

This course will provide to the students the various computational techniques by using Eigen equation, interpolation, optimization and iterative method to solve the complex structural problem.

**COURSE OUTCOME**

The student would be able

CO1102.1 To develop mathematical models of lower-level engineering problems

CO1102.2 To analyze, quantify and minimize errors, concept of significant digits and how errors are related to correct number of significant digits.

CO1102.3 To understand the fundamental matrix algebra concepts

CO1102.4 To understand the curve fit (interpolation and regression) discrete date for the analysis of structural

CO1102.5To identify the numerically integrate continuous and discrete functions.

**A. OUTLINE OF THE COURSE**

| Unit No. | Title of the unit | Time required for the Unit (Hours) |
|---|---|---|
| **1.** | Introduction | 11 |
| **2.** | Interpolation | 7 |
| **3.** | Integration | 10 |
| **4.** | Optimization | 7 |
| **5.** | Iterative method | 7 |

**B. DETAILEDSYLLABUS**

| Unit | Unit Details |
|---|---|
| **Unit 1** | **Introduction**<br>Solution of equations and eigen value problems: error analysis; the roots of nonlinear equations, solutions of large system of linear equations and eigen value problem of a matrix; Pascal‟s triangle for one and two dimensions, divided differences; Newton‟s forward and backward difference formulas; differentiation using interpolation formulae; numerical integration by trapezoidal and Simpson‟s rules; Romberg‟s method; two and three point Gaussian quadrature formulae. |
| **Unit 2** | **Interpolation**<br>Interpolation and approximation: solution of equation; fixed point iteration: x=g(x) method; Newton's method; solution of linear system by Gaussian elimination and gauss- Jordon method; |
| **Unit 3** | **Integration**<br>Numerical differentiation and integration: advanced numerical linear algebra; direct and iterative methods for linear systems; decompositions and SVD factorizations; stability and accuracy of numerical algorithms; nonlinear ordinary differential equations & partial differential equations; |
| **Unit 4** | **Optimization**<br>Nonlinear optimization, ffts, and wavelet analysis. Note: problem sets will involve use of mat lab® or any other programming language. |

| | |
|---|---|
| **Unit 5** | **Iterative method**<br>Iterative method-gauss seidel method, inverse of a matrix by gauss Jordon method; Eigen value of matrix by power method and by Jacobi method for symmetric matrix. |

**C. RECOMMENDED STUDYMATERIAL:**

| S. No | Title of the Book | Author |
|---|---|---|
| 1. | Numerical Methods for Scientific & Engineering Computation. | M.K. Jain , S.R. K. Lyengar and R.K.Jain, New Age International |
| 2. | Computer Oriented Numerical Methods | R.S. Salaria, Khanna Publications. |
| 3. | Higher Engineering Mathematics | B.V. Ramana, Tata Mc Hill |
| 4. | Advance Engineering Mathematics | Ervin Kreszig, Wiley EastenEdd. |
| 5. | AppliedNumericalMethodswith MATLAB | Steven C Chapra, TMH. |
| 6. | IntroductoryMethodsofNumericalAnalysis | S.S. Shastry, |
| 7. | Numerical Mathematical Analysis | James B. Scarborogh |

Important Web Links:

1. https://nptel.ac.in/courses/103/106/103106074/
2. https://nptel.ac.in/courses/122/102/122102009/
3. http://www.nptelvideos.in/2012/11/computational-techniques.html
4. https://www.classcentral.com/course/swayam-matlab-programming-for-numerical-computation-5303
5. https://iemcse.files.wordpress.com/2017/08/lp1-11.pdf

**D.COs AND POs MAPPING**

| COs and POs | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **CO1102.1** | 2 | - | 3 | - | 2 | - | - | - | - | - | - | 1 |
| **CO1102.2** | 2 | - | 3 | - | 1 | - | - | - | - | - | - | 2 |
| **CO1102.3** | 2 | - | 2 | - | 2 | - | - | - | - | - | - | 2 |
| **CO1102.4** | 1 | - | 2 | - | 2 | - | - | - | - | - | - | 2 |
| **CO1102.5** | 1 | - | - | - | - | 1 | - | - | - | - | - | - |

**E.COs AND PSOs MAPPING**

| COs and PSOs | PSO1 | PSO2 | PSO3 | PSO4 | PSO5 |
|---|---|---|---|---|---|
| **CO1102.1** | 2 | - | - | 1 | - |
| **CO1102.2** | 2 | - | 2 | 3 | - |
| **CO1102.3** | 1 | 3 | - | 2 | 1 |
| **CO1102.4** | 3 | 1 | 1 | 1 | - |
| **CO1102.5** | 2 | 2 | 3 | - | - |

**Note:** On the basis of mapping of COs with POs, this course is related to Entrepreneur

| Code: MSTECV1103 | Design of Precast & Composite Structure | 4 Credits [LTP:3-1-0] |
|---|---|---|

**COURSE OVERVIEW AND OBJECTIVES:** This course will provide to the students the details of the precast and the composite structure design. Various codal provision also explained for the designing of the stricture.

**COURSE OUTCOME**:

CO1103.1 To understand the basic philosophy of the precast elements.
CO1103.2 To design the precast beam by the use of IS code
CO1103.3 To analyze and design the precast column and wall by the use of IS code
CO1103.4 To develop the structural integrity
CO1103.5 To design and analyze the precast steel structure member

**A. Outline of the course**

| Unit No. | Title of the unit | Time required for the Unit (Hours) |
|---|---|---|
| **1** | **Introduction** | **9** |
| **2.** | **Design of beam** | **9** |
| **3.** | **Design of column** | **10** |
| **4.** | **Structural Integrity** | **7** |
| **5.** | **Design of Steel member** | **7** |

**B. DETAILED SYLLABUS**

| Unit | Unit Details |
|---|---|
| **Unit 1** | **Introduction**<br>Concepts, components, Structural Systems and Design of precast concrete floors Need and types of precast construction, Modular coordination, Precast elements- Floor, Beams, Columns and walls. Structural Systems and connections. Design of precast Concrete Floor: Theoretical and Design Examples of Hollow core slabs, Precast Concrete Planks floor with composite toppings with and without props. |
| **Unit 2** | **Design of beam**<br>Design of precast reinforced and pre stressed Concrete beams. Theoretical and Design Examples of ITB – Full section precast Semi Precast. Propped and unpropped conditions. Design of RC Nibs. |
| **Unit 3** | **Design of column**<br>Design of precast concrete columns and walls, Design of braced and unbraced columns with corbels subjected to pattern and full loading. Design of Corbels Design of RC walls subjected to Vertical, Horizontal loads and moments, Design of vertical ties and horizontal joints. |
| **Unit 4** | **Structural Integrity**<br>Design of Precast Connections and Structural Integrity, Beam bearing, Beam half Joint, Steel Inserts, Socket Connection, Structural integrity Avoidance of progressive collapse, Design of Structural Ties. |
| **Unit 5** | **Design of Steel member**<br>Design of Steel Concrete Composite Floors and Beams, Composite Floors: Profiled Sheeting with concrete topping. Design method, Bending and Shear Resistance of Composite Slabs, Serviceability Criteria, Design Example |

**C. RECOMMENDED STUDYMATERIAL:**

| S. No | Title of the Book | Author |
|---|---|---|
| 1. | Prestressed Concrete | Krishna Raju, Tata McGraw Hill Publishing Co, 2000 |
| 2. | Fundamentals of Prestressed Concrete | Sinha .N.C. and. Roy. S.K, "", S. Chand and Co., 1998 |
| 3. | Composite Structures of Steel and Concrete Beams, Slabs, Columns and Frames for Buildings | Johnson R.P., Vol. I, Blackwell Scientific Publications, 2004 |
| 4. | Composite Steel and Concrete Structural Members, Fundamental behavior | Oehlers D.J. and Bradford M.A., Pergamon press, Oxford, 1995 |
| 5. | Steel Designers Manual | Owens. G.W and Knowles. P, Steel Concrete |
| Important Website Link: | | |
| 1. https://nptel.ac.in/courses/105/106/105106117/ | | |
| 2. https://nptel.ac.in/courses/105/106/105106118/ | | |
| 3. https://nptel.ac.in/content/syllabus_pdf/105106118.pdf | | |
| 4. https://www.youtube.com/watch?v=4KYPltsNAWs | | |
| 5. https://www.youtube.com/watch?v=b9WQhnYq81s | | |

**D. COs AND POs MAPPING**

| COs and POs | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **CO1103.1** | 2 | 2 | 2 | - | - | - | - | - | - | - | - | - |
| **CO1103.2** | 1 | 2 | 3 | - | - | - | - | - | - | - | - | - |
| **CO1103.3** | 2 | - | 2 | 3 | - | - | - | - | - | - | - | - |
| **CO1103.4** | 2 | - | 2 | - | - | 2 | - | - | - | - | - | - |
| **CO1103.5** | 2 | 2 | 1 | - | 1 | - | - | - | - | - | - | - |

**E. COs AND PSOs MAPPING**

| COs and PSOs | PSO1 | PSO2 | PSO3 | PSO4 | PSO5 |
|---|---|---|---|---|---|
| **CO1103.1** | 2 | 3 | 1 | - | - |
| **CO1103.2** | 3 | 3 | - | - | - |
| **CO1103.3** | 3 | 2 | 1 | - | - |
| **CO1103.4** | 2 | - | 1 | - | - |
| **CO1103.5** | 2 | 2 | - | 3 | - |

**Note:** On the basis of mapping of COs with POs, this course is related to Employability / Skill Development

| Code: MSTECV1104 | Advanced Bridge Design | 4 Credits [LTP:3-1-0] |
|---|---|---|

**COURSE OVERVIEW AND OBJECTIVES:**

This course will provide to the students the details of the component of the bridge, various Indian standard code for bridge and the design of sub structure and super structure of the beam.

**COURSE OUTCOME:**

The student would be able

CO1104.1: Discuss the IRC standard live loads and design the deck slab type bridges.
CO1104.2: Analyse the box culverts for the given loading and detail the box culverts.
CO1104.3: Design and detail of T-Beam bridges.
CO1104.4: Discuss the bridge foundations and prepare the bar bending schedule.
CO1104.5: Design and check the stability of piers and abutments.

**A. OUTLINE OF THE COURSE**

| Unit No. | Title of the unit | Time required for the Unit (Hours) |
|---|---|---|
| 1 | **Introduction** | 9 |
| 2. | **Loads on the bridge** | 9 |
| 3. | **Design of structural element** | 9 |
| 4. | **Foundation design** | 8 |
| 5. | **Dynamic analysis of the structure** | 7 |

**B. DETAILED SYLLABUS**

| Unit | Unit Details |
|---|---|
| **Unit 1** | **Introduction:** General: Bridge System, Considerations in alignment, Planning, Economic consideration, Aesthetics and selection of type of bridge (Review). |
| **Unit 2** | **Loads on the bridge:** Loading Standards and Super Structure Analysis: Standards followed in U.K., U.S.A. and Europe.: Bridge deck analysis using different methods, Load distribution theories – Carbon specifications for loading, Geometrical proportioning etc. of road, rail-cum-road bridges, Indian Road Congress (IRC) and Indian Railway Loading standards and their comparison with loading, Hendry-Jaegar, Morris-Little (Orthotropic platetheories) methods, Stiffness method, Finite difference method, Folded Plate method, Finite strip method and Finite Element method (General treatment), Limit analysis, Design of bridge decks. |
| **Unit 3** | **Design of structural element:** Connections and Substructure Analysis and Design: Design of different connections, Bearings and joints. Piers, Abutments, Wing walls and other appurtenant structures. |
| **Unit 4** | **Foundation design:** Foundations and Construction & Maintenance: Well foundations and pile foundation, Design and construction and field problems. Erection of bridge super structure, Maintenance, Rating and Strengthening of existing bridges. |
| **Unit 5** | **Dynamic analysis of the structure:** Dynamics Behavior: Behavior of bridges under dynamic loads, Discussion of code provisions for design of bridges for wind and earthquake forces. Long Span Bridges: General discussion of suspension and cable stayed bridges |

### C. RECOMMENDED STUDYMATERIAL:

| S. | Title of the Book | Author |
|---|---|---|
| 1. | Bridge Analysis Simplified | Bakht, B. and Jaeger, L.G, McGraw Hill Book Company |
| 2. | Bridge Deck Analysis | Cusens, A.R. and Parma, R.P., John Wiley & Sons Ltd. |

Important Web Links:

1. https://nptel.ac.in/courses/105/105/105105165/
2. https://swayam.gov.in/nd1_noc19_ce23/preview
3. https://www.youtube.com/playlist?list=PLYX9X4ZldqpYMaPURxSbY1i8vgfVsZfmQ
4. https://www.youtube.com/playlist?list=PLZzO5hTp04ec6uwdZ_Iem0kO_8ob1MtVt
5. https://www.slideshare.net/soniafaisal/bridge-engineering

### D.COs AND POs MAPPING

| COs and POs | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **CO1104.1** | 2 | - | - | 3 | 1 | - | - | - | - | - | - | - |
| **CO1104.2** | 2 | - | - | - | 3 | - | - | - | - | - | - | - |
| **CO1104.3** | 2 | - | - | - | 2 | - | - | - | - | - | - | 1 |
| **CO1104.4** | 3 | - | - | - | - | 1 | - | - | - | - | - | - |
| **CO1104.5** | 2 | - | 1 | - | 2 | - | - | - | - | - | - | - |

### E.COs AND PSOs MAPPING

| COs and PSOs | PSO1 | PSO2 | PSO3 | PSO4 | PSO5 |
|---|---|---|---|---|---|
| **CO1104.1** | 1 | - | - | 2 | 3 |
| **CO1104.2** | 2 | - | - | 1 | 3 |
| **CO1104.3** | 2 | - | - | 1 | 3 |
| **CO1104.4** | 3 | - | - | 2 | 1 |
| **CO1104.5** | 3 | - | - | 2 | 1 |

**Note:** On the basis of mapping of COs with POs, this course is related to Skill Development

| Code: MSTECV1105 | Pre-stressed Structures | 4 Credits [LTP: 3-1-0] |
|---|---|---|

**COURSE OVERVIEW AND OBJECTIVES:**

This course will provide to the students the perform analysis and design of pre-stressed concrete members andconnections. Student will be able to identify and interpret the appropriate relevant industry.

**COURSE OUTCOME**

The student would be able to

CO1105.1 Understand the general mechanical behavior of pre-stressed concrete

CO1105.2 able to analyze and design pre-stressed concrete flexural members

CO1105.3 Able to identify and apply the applicable industry design codes relevant to the design of pre-stressed concrete members.

CO1105.4 will be familiar with professional and ethical issues and the importance of lifelong learning instructural engineering

CO1105.5 will be able to perform an industry relevant design project in a team setting.

## A. OUTLINE OF THE COURSE

| Unit No. | Title of the unit | Time required for the Unit (Hours) |
|---|---|---|
| 1 | **Introduction** | 9 |
| 2. | **Pre-stressing** | 9 |
| 3. | **Inderminate structure** | 9 |
| 4. | **Loess in Prestres concrete** | 8 |
| 5. | **Codal Provision** | 7 |

## B. DETAILED SYLLABUS

| Unit | Unit Details |
|---|---|
| **Unit 1** | **Introduction:** Basic philosophy of pre-stressing: Various techniques of pre-stressing with and without pre-stressing cables, different systems of pre-stressing, materials and design concepts. |
| **Unit 2** | **Pre-stressing:** Pre-stressing of concrete structures, Analysis and design of beams, Design of end blocks, Ultimate strength in flexure and shear, |
| **Unit 3** | **Indeterminate structure:** Statically indeterminate structures, Tension members, tanks, compression members, partial pre-stressing, composite construction, precast pre-stressed elements. |
| **Unit 4** | **Loess in Pre-stress concrete:** Materials, pre-stressing systems, losses in pre-stress. Analysis and design of simple and continuous beams by working stress and limit-state methods. |
| **Unit 5** | **Codal Provision:** Deflection and cracking consideration. Anchorage and bond. End block stresses. |

**C. RECOMMENDED STUDYMATERIAL:**

| S. No. | Title of the Book | Author |
|---|---|---|
| 1. | Design of Reinforced Concrete Structure‟ | P. Dayaratnam, „Oxford and IBH, |
| 2. | Design of pre-stress concrete structures | T.Y. Lin and Burn, John Wiley, New York |
| Important Web Links: | | |
| 1. https://nptel.ac.in/courses/105/106/105106117/<br>2. https://nptel.ac.in/content/syllabus_pdf/105106118.pdf<br>3. https://crescent.education/wp-content/uploads/2018/08/Prestressed-Concrete.pdf<br>4. https://www.civilsutras.com/nptel-lectures-on-prestressed-concrete-structures/<br>5. https://www.youtube.com/watch?v=4KYPltsNAWs | | |

**D.COs AND POs MAPPING**

| COs and POs | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **CO1105.1** | 1 | 2 | 2 | - | - | - | 1 | - | - | - | - | 1 |
| **CO1105.2** | 2 | 1 | 2 | - | 1 | - | - | - | - | - | - | 2 |
| **CO1105.3** | - | 3 | - | 2 | - | - | - | - | - | 1 | - | - |
| **CO1105.4** | 1 | 1 | - | 2 | 1 | - | - | - | - | 1 | - | - |
| **CO1105.5** | - | 1 | - | 2 | 1 | - | - | - | - | 1 | - | 1 |

**E.COs AND PSOs MAPPING**

| COs and PSOs | PSO1 | PSO2 | PSO3 | PSO4 | PSO5 |
|---|---|---|---|---|---|
| **CO1105.1** | 1 | 2 | 1 | 2 | 2 |
| **CO1105.2** | 1 | 2 | 1 | 2 | 1 |
| **CO1105.3** | 2 | 3 | - | 1 | - |
| **CO1105.4** | 1 | 1 | 2 | 2 | - |
| **CO1105.5** | - | - | - | 2 | 3 |

**Note:** On the basis of mapping of COs with POs, this course is related to Skill Development

| Code: MSTECV1106 | Advanced Foundation Design | 4 Credits [LTP:3-1-0] |
|---|---|---|

**COURSE OVERVIEW AND OBJECTIVES:**

To provide an overview to students about the essential features of foundation design, different aspects of foundation engineering ranging from soil exploration to the design of different types of foundation, including the ground improvement measures to be taken for poor soil conditions have been covered in this course.

**COURSE OUTCOMES**

CO1106.1 Understand various aspects of foundation engineering including soil exploration
CO1106.2 Design of various foundation components, retaining walls etc.
CO1106.3 Estimate safe bearing pressure of different type of soils and rocks.
CO1106.4 Design different foundation components
CO1106.5 To be able to apply the consolidation theory in the design of RE application

**A. OUTLINES OF COURSE**

| Unit No. | Title of the unit | Time required for the Unit (Hours) |
|---|---|---|
| 1 | **Introduction** | 9 |
| 2. | **Design Criteria for Foundation Design** | 10 |
| 3. | **Factors for Selection of Type of Foundation** | 8 |
| 4. | **Design Principles** | 8 |
| 5. | **Consolidation theory** | 7 |

**B. DETAILEDSYLLABUS**

| Unit | Unit Details |
|---|---|
| Unit 1 | **Introduction:** Terminology involved in Foundation Analysis and Design, Gross bearing capacity, ultimate bearing capacity, net-ultimate bearing capacity, safe bearing capacity, net safe bearing capacity, safe bearing pressure, allowable bearing pressure. |
| Unit 2 | **Design Criteria for Foundation Design:** Location and depth criteria, shear failure criteria (safe bearing capacity criteria), settlement criteria (safe bearing pressure criteria). |
| Unit 3 | **Factors for Selection of Type of Foundation**. Critical study of conventional methods of foundation design, analysis of settlement of soil and foundations, Foundations of in expensive and swelling soils, raft foundations, well foundations, pile foundations |
| Unit 4 | **Design Principles:** Theory of vibrations, liquefaction of soils, coffer dams, types and design principles, underpinning of foundations, design of bridge abutment |
| Unit 5 | **Consolidation theory:** Three-dimensional consolidation and theory of sand drains, reinforced earth and its applications. |

**C. RECOMMENDED STUDYMATERIAL:**

| S. No | Title | Author |
|---|---|---|
| 1. | Foundation Engineering | Kasmalkar, J.B. (1997). PuneVidyarthi Graha Prakashan-1786, Pune-411030. |
| 2. | Principles of foundation Engineering, 4th edition, PWS | Das, Braja M. (1999). Publishing, Pacific Grov. Calif. |
| 3. | Analysis and Design of Foundation and | Sham Sher Prakets, et al. |
| 4. | Vibration of Soils & Foundations | Richant Hall & Woods. |
| 5. | Soil Mechanics & Foundation Engineering. | B.C. Punmia |
| Important Web Links: | | |
| 1. https://nptel.ac.in/courses/105/108/105108069/ | | |
| 2. https://nptel.ac.in/content/syllabus_pdf/105108069.pdf | | |
| 3. https://nptel.ac.in/courses/105/105/105105176/ | | |
| 4. https://freevideolectures.com/course/3269/advanced-foundation-engineering | | |
| 5. http://www.digimat.in/nptel/courses/video/105105039/L10.html | | |

**D. COs AND POs MAPPING**

| COs and POs | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **CO1106.1** | 1 | 1 | 3 | - | 1 | - | 1 | - | - | - | - | 1 |
| **CO1106.2** | 1 | - | 3 | - | 1 | - | - | - | - | - | - | - |
| **CO1106.3** | 1 | - | 3 | - | 1 | - | - | - | - | - | - | 1 |
| **CO1106.4** | 2 | - | 3 | - | 1 | - | - | - | - | - | - | - |
| **CO1106.5** | 1 | 1 | 3 | - | 1 | - | - | - | - | - | - | 1 |

**E. COs AND PSOs MAPPING**

| COs and PSOs | PSO1 | PSO2 | PSO3 | PSO4 | PSO5 |
|---|---|---|---|---|---|
| **CO1106.1** | 1 | - | 3 | 2 | - |
| **CO1106.2** | 1 | - | 2 | 3 | 1 |
| **CO1106.3** | 1 | - | 2 | 2 | - |
| **CO1106.4** | 2 | - | 3 | - | - |
| **CO1106.5** | 2 | - | 1 | 3 | 1 |

**Note**: On the basis of mapping of COs with POs, this course is related to Employability / Skill Development

| Code: MSTECV1107 | Repair & Rehabilitation of Structures | 4 Credits [LTP: 3-1-0] |
|---|---|---|

**COURSE OVERVIEW AND OBJECTIVES:**

To provide an overview to students about the essential features of foundation design, different aspects of foundation engineering ranging from soil exploration to the design of different types of foundation, including the ground improvement measures to be taken for poor soil conditions have been covered in this course.

**COURSE OUTCOME:**

CO1107.1 To learn various distress and damages to concrete and masonry structures
CO1107.2 To understand the importance of maintenance of structures
CO1107.3 To study the various types and properties of repair materials
CO1107.4 To learn the importance and methods of substrate preparation
CO1107.5 To learn various repair techniques of damaged structures, corroded structures

**A. OUTLINE OF COURSE**

| Unit No. | Title of the unit | Time required for the Unit (Hours) |
|---|---|---|
| 1 | **Introduction** | 9 |
| 2. | **Properties** | 10 |
| 3. | **Repair and Maintenance** | 8 |
| 4. | **Materials for repair** | 8 |
| 5. | **Repair Techniques** | 7 |

**B. DETAILEDSYLLABUS**

| Unit | Unit details |
|---|---|
| **Unit 1** | **Introduction:** General: Introduction, Cause of deterioration of concrete structures, Diagnostic methods & analysis, preliminary investigations, experimental investigations using NDT, load testing, corrosion mapping, core drilling and other instrumental methods, Quality assurance for concrete construction, as built concrete properties strength, permeability, thermal properties and cracking. |
| **Unit 2** | **Properties:** Influence on Serviceability and Durability: Effects due to climate, temperature, chemicals, wear and erosion, Design and construction errors, corrosion mechanism, Effects of cover thickness and cracking, methods of corrosion protection, corrosion inhibitors, corrosion resistant steels, coatings, and catholic protection. |
| **Unit 3** | **Repair and Maintenance:** Maintenance and Repair Strategies: Definitions: Maintenance, repair and rehabilitation, Facets of Maintenance, importance of Maintenance, Preventive measures on various aspects. Inspection, Assessment procedure for evaluating a damaged structure, causes of deterioration, testing techniques |
| **Unit 4** | **Materials for repair:** Materials for Repair: Special concretes and mortars, concrete chemicals, special elements for accelerated strength gain, Expansive cement, polymer concrete, sulphur infiltrated concrete, Ferro cement, Fibre reinforced concrete. Techniques for Repair: Rust eliminators and polymers coating for rebar during repair foamed concrete ,mortar and dry pack, vacuum concrete ,Gunite and Shot Crete Epoxy injection, Mortar repair for cracks, shoring and underpinning. |
| **Unit 5** | **Repair Techniques:** Examples of Repair to Structures: Repairs to overcome low member strength, Deflection, Cracking, Chemical disruption, weathering wear, fire, leakage, marine exposure, engineered demolition techniques for dilapidated structures - case studies |

**C. RECOMMENDED STUDYMATERIAL:**

| S. No | Title of the Book | Author |
|---|---|---|
| 1 | Earthquake resistant design of structures | Pankaj Agarwal and Manish Shrikhande |
| 2 | Handbook on Repairs and Rehabilitation of RCC | CPWD, Government of India |
| 3 | Appraisal and Repair of Reinforced concrete | R.Holland |
| 4 | Repair and Strengthening of Concrete structures | FIP guide |
| Important Web Links: | | |
| 1. https://nptel.ac.in/courses/105/106/105106202/ | | |
| 2. https://nptel.ac.in/courses/105/102/105102176/ | | |
| 3. https://swayam.gov.in/nd1_noc20_ce26/preview | | |
| 4. http://fmcet.in/CIVIL/CE2071_uw.pdf | | |
| 5. https://www.youtube.com/watch?v=fikRPFpbgVo | | |

**D. COs AND POs MAPPING**

| COs and POs | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **CO1107.1** | 1 | 2 | 2 | - | 1 | - | 1 | - | - | - | - | 1 |
| **CO1107.2** | 1 | 1 | 1 | - | 2 | - | - | - | - | - | - | - |
| **CO1107.3** | 1 | - | 2 | - | 2 | - | - | - | - | - | - | 1 |
| **CO1107.4** | 2 | - | 3 | - | 1 | - | - | - | - | - | - | - |
| **CO1107.5** | 2 | 1 | 2 | - | 1 | - | - | - | - | - | - | 1 |

**E. COs AND PSOs MAPPING**

| COs and PSOs | PSO1 | PSO2 | PSO3 | PSO4 | PSO5 |
|---|---|---|---|---|---|
| **CO1107.1** | 1 | - | 3 | 2 | - |
| **CO1107.2** | 1 | - | 2 | 3 | 1 |
| **CO1107.3** | 1 | - | 2 | 2 | - |
| **CO1107.4** | 2 | - | 3 | - | - |
| **CO1107.5** | 2 | - | 1 | 3 | 1 |

**Note**: On the basis of mapping of COs with POs, this course is related to Employability / Skill Development

| Code: MSTECV1108 | Soil Structure Interaction | 4 Credits [LTP:3-1-0] |
|---|---|---|

**COURSE OVERVIEW AND OBJECTIVES**

To acquire knowledge for computing stress and settlement at any point in the semi-infinite elastic soil medium, anisotropic medium and evaluation of stability of foundations, slopes, cuts and retaining structures both for the conditions of undrained and drained loading through theorems of plastic collapses.

**COURSE OUTCOME:**

The student would be able to:

CO1107.1 Ability to select suitable soils for various geotechnical applications based on the factors governing the Engineering behavior of soils.

CO1107.2 Students are able to select the shear strength and compressibility parameters to design differentstructures for different conditions of loading, drainage and failure criteria.

CO1107.3 Capable to estimate the stresses in soil medium of any type due to foundation load, settlement offoundation and to evaluate bound and true collapse loads of soil structures.

CO1107.4 To impart knowledge on the various factors governing the Engineering behaviour of soils andthe suitability of soils for various Geotechnical Engineering applications.

CO1107.5 To characterize stress-strain behaviour of soils, the failure criteria and to evaluate the shearstrength and compressibility parameters of soils.

**A. OUTLINE OF COURSE**

| Unit No. | Title of the unit | Time required for theUnit (Hours) |
|---|---|---|
| 1 | **Introduction** | 9 |
| 2. | **Elastic Foundation** | 10 |
| 3. | **Analysis of elastic and plastic plate** | 8 |
| 4. | **Pile foundation** | 9 |
| 5. | **Laterally loaded pile** | 8 |

**B. DETAILEDSYLLABUS**

| Unit | Unit details |
|---|---|
| **Unit 1** | **Introduction:** Soil foundation Interaction: Introduction to soil foundation interaction problems, soil behavior, foundation behavior, interface behavior, scope of soil foundation interaction analysis, soil response models, Winkler, Elastic continuum, two parameter elasticmodel, Elastic Plastic behavior, Time dependent behavior. |
| **Unit 2** | **Elastic Foundation:** Beam on Elastic foundation-soil models: Infinite beam, two parameters, Isotropic elastic half space, analysis of beams of finite length, classification of finite beams in relation to their stiffness. |
| **Unit 3** | **Analysis of elastic and plastic plate:** Plate on Elastic medium: Infinite plate, Winkler, two parameters, isotropic elastic medium, thin and thick plates, Analysis of finite plates:rectangular and circular plates, Numerical analysis of finite plates, simple solutions. |
| **Unit 4** | **Pile foundation:** Elastic analysis of piles: Elastic analysis of single pile, theoretical solutions for settlement and load distributions, Analysis of pile group, interaction analysis, loads distribution in groups with rigid cap |
| **Unit 5** | **Laterally loaded pile:** Laterally loaded pile: Load deflection prediction for laterally loaded piles, sub-grade reaction and elastic analysis, interaction analysis, pile raft system, solution through influence charts. |

**C. RECOMMENDED STUDYMATERIAL:**

| S. No | Title of the Book | Author |
|---|---|---|
| 1. | Elastic analysis of soil foundationinteraction | By Selva durai, A.P.S |
| 2. | Pile Foundation Analysis and Design | By Poulos, H.G. & Davis E.H |
| 3. | Structure Soil Interaction | State of Art Report, Institution |
| Important Web Links: | | |
| 1. https://nptel.ac.in/courses/105/105/105105200/ | | |
| 2. https://www.youtube.com/watch?v=GKmW9j3qWfA | | |
| 3. https://www.youtube.com/watch?v=Ng2tH7CX-WU | | |
| 4. https://swayam.gov.in/nd1_noc20_ce22 | | |
| 5. https://freevideolectures.com/course/3354/port-and-harbour-structures/13 | | |

**D. COs AND POs MAPPING**

| COs and POs | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **CO1108.1** | 1 | 1 | 2 | - | 1 | 1 | 1 | - | - | - | - | 1 |
| **CO1108.2** | 1 | 1 | 2 | - | 1 | - | - | - | - | - | - | - |
| **CO1108.3** | 1 | - | 2 | - | 2 | - | - | - | - | - | - | 1 |
| **CO1108.4** | 2 | - | 3 | - | 1 | - | - | - | - | - | - | - |
| **CO1108.5** | 2 | 1 | 2 | - | 1 | - | - | - | - | - | - | 1 |

**E. COs AND PSOs MAPPING**

| COs and PSOs | PSO1 | PSO2 | PSO3 | PSO4 | PSO5 |
|---|---|---|---|---|---|
| **CO1108.1** | 1 | - | 3 | 2 | - |
| **CO1108.2** | 2 | - | 1 | 3 | 1 |
| **CO1108.3** | 1 | - | 3 | 1 | - |
| **CO1108.4** | 1 | - | 2 | - | 2 |
| **CO1108.5** | 2 | - | 1 | 3 | 1 |

**Note**: On the basis of mapping of COs with POs, this course is related to Employability / Skill Development

| Code: MULCHM1201 | Soft Skills-I | 1 Credits [LTP:0-0-2] |
|---|---|---|

**COURSE OUTCOME**

- CO1301.1: To present themselves in an effective manner and know about their short-term and long-term goals.
- CO1301.2: To works in a team by managing time properly and focus on personal grooming, etiquettes and body language.
- CO1301.3:To demonstrate their abilities by improving skills of LSRW (Listening /Speaking/Reading/Writing).
- CO1301.4: To present different viewpoints or ways of thinking about a situation, expand their abilities to resolve situations and get experience within the given context
- CO1301.5: To enhance their employability skills by working on the presentation of Résumé and giving impactful performance during Group Discussion.

## A. DETAILED SYLLABUS

| | |
|---|---|
| 1. | Self-Introduction & knowing your environment |
| 2. | Goal Setting & Planning |
| 3. | Etiquettes (Personal, Social, Professional & Corporate) etiquettes |
| 4. | Personal Grooming and Body language |
| 5. | Time Management & Team Work |
| 6. | Negotiation and conflict management |
| 7. | Oral Communication &Writing Skills: Extempore & Paper Presentations. |
| 8. | Resume Writing |
| 9. | Group Discussion |
| 10. | Interview Skills |

| Code: MSTCCV1401 | SEMINAR-I | 2 Credits [LTP:0-0-4] |
|---|---|---|

**A. SYLLABUS**

| Unit | Contents |
|---|---|
| | |
| | Students will be grouped in two to three, will have to decide final thesis area, download research papers from IEEE, ACM, Elsevier, Springer etc. Summarizing paper – Reading abstracts and finding ideas, conclusion, Advantages of Their approach, the drawbacks of the papers. Generalize results froma research paper to related research problems. Comparing the approach - Identify weaknesses and strengths in recent research articles in the subject. Practice sessions on how to read, analyze and summarize research papers. Students in group will have to deliver seminar, prepare a report and a<br>review paper based on analysis. |

| | POORNIMA UNIVERSITY, JAIPUR | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | **Faculty of Engineering and Technology** | | | | | | | | |
| **Name of Program:** | **M.Tech. in Structural Engineering** **Duration: 2 Years** **Total Credits: 80** | | | | | | | | |
| | **Teaching Scheme for Batch 2023-25** | | | | | | | | |
| | **Semester-II** | | | | | | | | |
| **Course Code** | **Name of Course** | **Teaching Scheme** | | | | **Marks Distribution** | | | **Credits** |
| | | **Lecture (L)** | **Tutorial (T)** | **Practical** | **SH** | **IE** | **ESE** | **Total** | |
| **A.** | | **Major (Core Courses)** | | | | | | | |
| **A.1** | **Theory** | | | | | | | | |
| MSTCCV2101 | Advanced Steel Structures | 3 | 1 | - | | 40 | 60 | 100 | 4 |
| MSTCCV2102 | Design of Advanced Concrete Structure | 3 | 1 | - | | 40 | 60 | 100 | 4 |
| **A.2** | **Practical** | | | | | | | | |
| MSTCCV2201 | Structure Lab-II | - | - | 2 | | 60 | 40 | 100 | 1 |
| **B.** | | **Minor Stream Courses/ Department Electives I and II** | | | | | | | |
| **B.1** | **Theory** | | | | | | | | |
| MSTECV2101 | Finite Element Method | 3 | 1 | - | - | 40 | 60 | 100 | 4 |
| MSTECV2102 | Structural Optimization | | | - | - | 40 | 60 | 100 | |
| MSTECV2103 | Plates and Shells | | | - | - | 40 | 60 | 100 | |
| MSTECV2104 | Stability Analysis of Structure | | | - | - | 40 | 60 | 100 | |
| MSTECV2105 | Tall Structures | 3 | 0 | - | - | 40 | 60 | 100 | 3 |
| MSTECV2106 | Earthquake Resistant Design of Structures | | | - | - | 40 | 60 | 100 | |
| MSTECV2107 | Design Concept of Substructure | | | - | - | 40 | 60 | 100 | |
| MSTECV2108 | Industrial Structures | | | - | - | 40 | 60 | 100 | |
| **B.2** | **Practical** | | | | | | | | |
| | - | - | - | - | - | - | - | - | - |
| **C** | | **Multidisciplinary Courses** | | | | | | | |
| MULEBX2109 | Engineering Economics | 3 | - | - | - | 40 | 60 | 100 | 3 |
| **D** | | **Ability Enhancement Courses (AEC)** | | | | | | | |
| MULCHM2201 | Soft Skills - II | - | - | 2 | | 60 | 40 | 100 | 1 |
| **E** | | **Skill Enhancement Courses (SEC)** | | | | | | | |
| BULCSE2201 | Skill Enhancement Technical Course-II | | | 2 | | 60 | 40 | 100 | 1 |
| **F** | | **Value Added Courses (VAC)** | | | | | | | |
| | - | - | - | - | - | - | - | - | - |
| **G** | | **Summer Internship / Research Project / Dissertation** | | | | | | | |
| MSTCCV2401 | Seminar-II | - | - | 2 | - | 60 | 40 | 100 | 1 |
| **Total** | | 15 | 3 | 8 | | | | | **22** |
| **Total Teaching Hours** | | **26** | | | | | | | |

**PO's and PSO's are as follows**

| PO No. | PO's |
|---|---|
| 1 | **Engineering knowledge:** Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems. |
| 2 | **Problem analysis:** Identify, formulate, review research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences. |
| 3 | **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 |
| 4 | **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. Considerations. |
| 5 | **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. |
| 6 | **The engineer and society:** Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional engineering practice. |
| 7 | **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. |
| 8 | **Ethics:** Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice. |
| 9 | **Individual and team work:** Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings. |
| 10 | **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. |
| 11 | **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. |
| 12 | **Life-long learning:** Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change. |
| **PSO No.** | **PSO's** |
| 1 | A civil engineering graduate is efficient in fundamentals of civil engineering, mathematical & scientific reasoning and are able to plan, design the building structure, roads, sewage and water supply networks & other component of infrastructure system considering environmental, safety & health aspects. |
| 2 | A civil engineer is able to use modern tools, techniques, software's to solve complex engineering problems. |
| 3 | A civil Engineer able to prepare BOQ & cost estimation & able to execute the projects in lined with set project goals. |
| 4 | A civil engineer is able to compile detailed project report & give technical specifications to provide required quality of work. |
| 5 | A civil engineer is able to access the quality of material used for construction & able to find out deviations & able to suggest preventative and corrective measures for sustainable development. |

| Code: MSTCCV2101 | Advanced Steel Structure | 4 Credits [LTP:3-1-0] |
|---|---|---|

**COURSE OVERVIEW AND OBJECTIVES**

To acquire knowledge for computing plastic analysis and various different type of strength to analyze the steel structure. The collapsing mechanism and design of industrial building is also an important parameter to understand the steel structure design.

**COURSE OUTCOME**

The student will be able to:

CO02101.1 To be able to understand the biaxial loading system on the structure.

CO02101.2 To analyze various types of statically determinate and indeterminate structures

CO02101.3 To design the various type of connection system.

CO02101.4 To understand the mechanisms to provide stability to the structures.

CO02101.5 To analyze and design the industrial building.

**A. OUTLINE OF COURSE**

| Unit No. | Title of the unit | Time required for the Unit (Hours) |
|---|---|---|
| 1 | General | 9 |
| 2. | Connections | 10 |
| 3. | Towers | 8 |
| 4. | Plastic Analysis | 9 |
| 5. | Industrial Building | 8 |

**B. DETAILED SYLLABUS**

| Unit | Unit Details |
|---|---|
| 1. | **General**<br>Beams subjected to biaxial bending - Built-up Purlins - Various types and design - Design of Wind girders-Beam-columns - With various support conditions-Design of foundations-with lateral forces |
| 2. | **Connections**<br>Bearing type joints- unstiffened and stiffened seat connections resisting connection of brackets-bolted and welded-semi-rigid connections |
| 3. | **Towers**<br>Basic structural configurations - free standing and guyed towers towers-wind loads-foundation design-design criteria for different configurations and transmission line towers. |
| 4. | **Plastic Analysis**<br>Elastic Instability, Introduction to stability problem, Energy methods, buckling of axially loaded members for different end conditions, Concept of effective length, approximate techniques, Stability analysis of beam-column and frames |
| 5. | **Industrial Building**<br>Industrial buildings-braced and unbraced - Gable frames with gantry industrial frames-Fire resistant design-Fatigue resistant design |

**C. RECOMMENDED STUDYMATERIAL:**

| S. No | Title of the Book | Author |
|---|---|---|
| 1. | Design of Steel Structures | Duggal.S.K, McGraw Hill New Delhi, 2010 |
| 2. | Design of Steel Structures | Arya. S and Ajmani. J.L Nem Chand & Bros, Roorkee |
| 3. | Design of Steel Structures | Dayaratnam P. S. Chand Limited, New Delhi. 2008 |
| 4. | Structural Design in Steel | John E. Lothers, "", Prentice Hall, 1999 |

Important Web Links:

1. https://nptel.ac.in/courses/105/106/105106113/
2. https://nptel.ac.in/courses/105/106/105106112/
3. https://www.youtube.com/watch?v=mtRR-5fzKo8
4. https://www.digimat.in/nptel/courses/video/105105162/L01.html
5. http://www.digimat.in/nptel/courses/video/105105162/L60.html

**D.COs AND POs MAPPING**

| COs and POs | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **CO2101.1** | 1 | 1 | 3 | - | 1 | - | 1 | - | - | - | - | - |
| **CO2101.2** | 1 | 1 | 1 | - | 2 | - | - | - | 1 | - | - | 1 |
| **CO21011.3** | 2 | - | - | 3 | 1 | - | - | - | - | 1 | - | - |
| **CO2101.4** | - | 2 | - | 2 | - | - | - | - | - | - | - | - |
| **CO2101.5** | 1 | - | 1 | 2 | - | - | - | - | - | - | - | 2 |

**E.COs AND PSOs MAPPING**

| COs and PSOs | PSO1 | PSO2 | PSO3 | PSO4 | PSO5 |
|---|---|---|---|---|---|
| **CO2101.1** | 1 | 1 | 3 | - | - |
| **CO2101.2** | 1 | 2 | 1 | 1 | 1 |
| **CO21011.3** | 2 | - | 3 | - | - |
| **CO2101.4** | 2 | 3 | - | 1 | - |
| **CO2101.5** | - | - | - | 2 | 3 |

**Note:** On the basis of mapping of COs with POs, this course is related to Employability / Skill Development

| Code: MSTCCV2102 | Design of Advanced Concrete Structure | 4 Credits [LTP: 3-1-0] |
|---|---|---|

**COURSE OVERVIEW AND OBJECTIVES**

To acquire knowledge for computing design, mix and various different type of concrete to analyze the strength.

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

CO1: Discuss the concrete ingredients and its influence at gaining strength.
CO2: Design of concrete mix and grade as per IS codes.
CO3: Summaries the concepts of conventional concrete and its differences with other concretes like no fines, light weight etc.
CO4: Describe the application and use of fiber reinforced concrete.
CO5: Design and develop the self-compacting and high performance concrete.

**D. OUTLINE OF COURSE**

| Unit No. | Title of the unit | Time required for the Unit (Hours) |
|---|---|---|
| **1** | **General** | **9** |
| **2.** | **Manufacturing and properties of cement.** | **10** |
| **3.** | **Design of Cement** | **8** |
| **4.** | **Design of FRC** | **9** |
| **5.** | **Design of High performance concrete** | **8** |

**E. DETAILED SYLLABUS**

| Unit | Unit Details |
|---|---|
| 1. | **General**<br>Properties of cement, fine aggregate and coarse aggregates, Additives and Admixtures in Concrete, Rheology of Concrete. |
| 2. | **Manufacturing and properties of cement.**<br>Manufacturing and methods of concreting, Properties of fresh and hardened concrete, mix design by I.S. method |
| 3. | **Design of Cement**<br>Design and manufacture of normal concrete, Light weight concrete – Cellular concrete – No fines concrete – Aerated & foamed concrete |
| 4. | **Design of FRC**<br>Design and manufacture of fiber reinforced concrete – Polymer concrete – Fly ash concrete |
| 5. | **Design of High performance concrete**<br>Design and manufacture of Self compacting concrete – High performance concrete – Very high strength concrete – High density concrete |

**F. RECOMMENDED STUDYMATERIAL:**

| S. No | Title of the Book | Author |
|---|---|---|
| 1. | Design of Advance Concrete Structures. | Duggal.S.K, McGraw Hill New Delhi, 2010 |
| 2. | Design of Advance Concrete Structures. | Neville, A.M. and Brookes, J.J., "Concrete Technology", 2nd Edition, Pearson Education, 2010. |
| 3. | Concrete Technology | Gambhir, M.L., "Concrete Technology", 2nd Edition,Tata McGraw Hill Publishers, New Delhi, 2009. |
| 4. | Design of Concrete Mixes | Krishna Raju. N, "Design of Concrete Mixes", 2nd Edition, CBS Publishers and Distributors, 2009. |
| Important Web Links: | | |
| 1. https://archive.nptel.ac.in/courses/105/106/105106176/ | | |
| 2. https://www.youtube.com/watch?v=RSnNrQUTEnY&ab_channel=NPTEL-NOCIITM | | |
| 3. https://onlinecourses.nptel.ac.in/noc19_ce44/preview | | |

**D.COs AND POs MAPPING**

| COs and POs | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **CO2101.1** | 1 | 3 | 3 | - | 3 | - | 2 | - | - | - | - | - |
| **CO2101.2** | 1 | 3 | 3 | - | 2 | - | - | - | 2 | - | - | 1 |
| **CO21011.3** | 2 | - | - | 3 | 2 | - | - | - | - | 1 | - | - |
| **CO2101.4** | - | 2 | - | 2 | - | - | - | - | - | - | - | - |
| **CO2101.5** | 1 | - | 2 | 2 | - | - | - | - | - | - | - | 2 |

**E.COs AND PSOs MAPPING**

| COs and PSOs | PSO1 | PSO2 | PSO3 | PSO4 | PSO5 |
|---|---|---|---|---|---|
| **CO2101.1** | 2 | 2 | 3 | - | - |
| **CO2101.2** | 1 | 2 | 1 | 1 | 1 |
| **CO21011.3** | 2 | - | 3 | - | - |
| **CO2101.4** | 2 | 3 | - | 2 | - |
| **CO2101.5** | - | - | - | 2 | 3 |

**Note:** On the basis of mapping of COs with POs, this course is related to Employability / Skill Development

| Code: MSTCCV2201 | Structural Lab-II | 2 Credits [LTP:0-0-2] |
|---|---|---|

## A. DETAILED SYLLABUS

| List of Experiments |
|---|
| Design as per syllabus of theory |

**Department Elective Courses**

| Code: MSTECV2101 | Finite Element Methods | 4 Credits [LTP:3-1-0] |
|---|---|---|

**COURSE OVERVIEW AND OBJECTIVES**

To familiarize students with basic of research and the research process. To enable the students in conducting research work and formulating research synopsis and report. Develop understanding on various kinds of research, objectives of doing research, `research process, research designs and sampling.

**COURSE OUTCOME**

The student will be able to:
CO02104.1 To Implement numerical methods to solve mechanics of solids problems.
CO02104.2 To Formulate and Solve axially loaded bar Problems.
CO02104.3 To Formulate and analyze truss and beam problems
CO02104.4 To Implement the formulation techniques to solve two-dimensional problems using triangle and quadrilateral elements.
CO02104.5 To Formulate and solve Axi-symmetric and heat transfer problems

**A. OUTLINE OF COURSE**

| Unit No. | Title of the unit | Time required for the Unit (Hours) |
|---|---|---|
| 1 | **Introduction** | 9 |
| 2. | **Stress-strain concept** | 10 |
| 3. | **Stiffness matrix** | 8 |
| 4. | **Coordinates System** | 9 |
| 5. | **Isoparametric function** | 8 |

**B. DETAILED SYLLABUS**

| Unit | Unit Details |
|---|---|
| 1. | **Introduction**<br>Concepts of FEM –steps involved –merits &demerits –energy principles–Discretization – Rayleigh – Ritz method of functional approximation |
| 2. | **Stress-strain concept**<br>Stress equations-strain displacement relationships in matrix form-plane stress, plane strain and Axi-symmetric bodies of revolution with axis-symmetric loading |
| 3. | **Stiffness matrix**<br>Stiffness Matrix for Beam and bar elements shape functions for ID elements –static condensation of global stiffness matrix-solution –Initial strain And temperature effects. |
| 4. | **Coordinates System**<br>Different types of elements for plane stress and plane strain analysis –Displacement models – generalized coordinates-shape functions-convergent and compatibility requirements –Geometric Invariance –Natural coordinate system area and volume coordinates-Generation of element stiffness and nodal load matrices–static condensation |
| 5. | **Isoparametric function**<br>Concept, Different isoparametric elements for 2d analysis-Formulation of 4-noded and 8- node disoparametric quadrilateral elements –Lagrangian elements-serendipity elements. Bodies of revolution-axisymmetric modeling –strain Displacement relationship- formulation of axisymmetric elements. Different 3-D elements, 3D strain–displacement relationship- formulation of hexahedral |

| | |
|---|---|
| | and isoparametric solid element |

**C. RECOMMENDED STUDY MATERIAL:**

| S. No | Title of the Book | Author |
|---|---|---|
| 1. | Finite element analysis in Engineering Design | S. Rajasekharan, S.ChandPublications, New Delhi |
| 2. | Finite element analysis | S.S. Bhavakatti-New age international publishers |
| 3. | Finite Elements Methods in Engineering | Tirupati. R. Chandrnpatla and Ashok D. Belegundu – Pearson Education Publications |
| 4. | Finite Element analysis – Theory & Programming by | C.S.Krishna Murthy- Tata Mc.Graw Hill Publishers Finite Elements Methods in Engineering by Tirupati.R. Chandrnpatla, Universities Press India Ltd.Hyderabad |
| 5. | Finite element method and its application | Desai, 2012, Pearson Pubilications |
| 6. | Finite element analysis and procedures in engineering | H.V. Lakshminaryana, 3rd edition, universities press, Hyderabad |
| Important Web Links: | | |
| 1. https://interestingengineering.com/what-is-finite-element-analysis-and-how-does-it-work | | |
| 2. https://www.simscale.com/docs/content/simwiki/fea/whatisfea.html | | |
| 3. https://www.simscale.com/blog/2016/10/what-is-finite-element-method/ | | |
| 4. https://www.youtube.com/watch?v=0kFjOz05d2k | | |
| 5. https://www.youtube.com/watch?v=boSLQYhDXoE | | |

**A. COs AND POs MAPPING**

| COs and POs | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **CO2101.1** | 2 | 1 | 2 | - | 1 | - | - | - | - | - | - | 1 |
| **CO2101.2** | 1 | 2 | 2 | - | 1 | - | 1 | - | - | - | - | - |
| **CO2101.3** | 1 | 1 | 2 | - | 1 | - | - | - | 1 | - | - | 1 |
| **CO2101.4** | 1 | - | 2 | - | 2 | - | - | 1 | - | - | - | 1 |
| **CO2101.5** | 1 | 1 | 2 | - | 1 | - | - | - | 1 | - | - | 1 |

**B. COs AND PSOs MAPPING**

| COs and PSOs | PSO1 | PSO2 | PSO3 | PSO4 | PSO5 |
|---|---|---|---|---|---|
| **CO2101.1** | - | 2 | 3 | - | 1 |
| **CO2101.2** | 3 | 1 | - | 2 | - |
| **CO2101.3** | 1 | 3 | - | 1 | 1 |
| **CO2101.4** | 2 | - | 1 | - | 3 |
| **CO2101.5** | 3 | 2 | 1 | - | 1 |

**Note:** On the basis of mapping of COs with POs, this course is related to Employability / Skill Development

| Code: MSTECV2102 | Structural Optimization | 4 Credits [LTP:3-1-0] |
|---|---|---|

**COURSE OVERVIEW AND OBJECTIVES**

To familiarize students to Formulate engineering design problems for load carrying structures as optimization

**COURSE OUTCOME**

The student will be able to:
CO2102.1 To understand the basics of optimization
CO2102.2 To assign the various techniques to optimize the structural problem
CO2102.3 To develop various programming methods for structural optimization
CO2102.4 To Implement the developed theorem for optimization.
CO2102.5 To Formulate strategies for structural complex problems.

**A. OUTLINE OF COURSE**

| Unit No. | Title of the unit | Time required for the Unit (Hours) |
|---|---|---|
| 1. | **General** | **9** |
| 2. | **Optimization Techniques** | **9** |
| 3. | **Programming methods** | **9** |
| 4. | **Theoram's** | **9** |
| 5. | **Strategies and their properties** | **8** |

**B. DETAILEDSYLLABUS**

| Unit | Unit details |
|---|---|
| **1** | **General**<br>Introduction, Basic concepts of minimum weight, minimum cost design, Objective function, constraints, classical methods. |
| **2** | **Optimization Techniques**<br>Optimization Techniques and Algorithms, Linear, Integer, Quadratic, Dynamic and Geometric programming methods for optimal design of structural elements. |
| **3** | **Programming methods**<br>Computer Search Methods, Linear programming methods for plastic design of frames, Computer search methods for univariate and multivariate Minimization |
| **4** | **Theoram's**<br>Optimization Theorems, Optimization by structural theorems, Maxwell, Mitchell and Heyman's theorems for trusses and frames, Fully stressed design with deflection constraints, optimality criterion methods. |
| **5** | **Strategies and their properties**<br>Game Theory, Strategies and their properties - pure and mixed strategies, two person zero games, Minimax, Maximin, saddle point, value of game - Rule of Dominance- Graphical solution. |

**C. Recommended Study Materials**

| S. No | Title of the Book | Author |
|---|---|---|
| 1 | Operation Research | Richard Bronson, Schaum's Outline series, MacGraw Hill Book Co, Singapore, 1983 |
| 2 | Introduction to Optimization in Practice | Pun John Wiley Eastern Limited, New Delhi,1997 |
| 3 | Probabilistic Approaches to | John Wiley Eastern Limited, New Delhi, 1997 |
| 4 | Optimization methods for | Fox, R.C, Wesley, 1997 |
| 5 | Optimization Theory and | Rao, S.S., Limited, New Delhi, 2004 |
| 6 | Optimum structural Design | Spunt, Civil Engineering and Engineering mechanics Services, Prentice hall, New Jersey |
| Important Web links: | | |
| http://www.solid.lth.se/research/structural-optimization/<br>https://www.frontiersin.org/research-topics/10265/structural-design-optimization<br>https://link.springer.com/chapter/10.1007/978-3-0348-8553-9_1<br>https://www.sciencedirect.com/topics/engineering/structural-topology-optimization<br>https://www.google.co.in/search?source=univ&tbm=isch&q=structural+optimization&sa=X&ved=2ahUKEwi7q-bezdDpAhUOxTgGHRDNDL8QsAR6BAgHEAE | | |

**D.COs AND POs MAPPING**

| COs and LOs | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **CO2106.1** | 3 | 2 | - | 1 | - | - | - | - | - | - | - | 1 |
| **CO2106.2** | 3 | 1 | - | 1 | - | - | - | - | - | - | - | 1 |
| **CO2106.3** | 3 | 2 | - | 1 | - | - | - | - | - | - | - | 1 |
| **CO2106.4** | 3 | 1 | 2 | 1 | - | - | - | - | - | - | - | 1 |
| **CO2106.5** | 3 | - | - | 1 | 1 | - | - | - | - | - | - | 1 |

**E.COs AND PSOs MAPPING**

| COs and PSOs | PSO1 | PSO2 | PSO3 | PSO4 | PSO5 |
|---|---|---|---|---|---|
| **CO2106.1** | 3 | - | - | 2 | - |
| **CO2106.2** | 3 | - | - | 2 | - |
| **CO2106.3** | 3 | - | - | 2 | - |
| **CO2106.4** | 3 | - | - | 2 | 1 |
| **CO2106.5** | 3 | 1 | - | - | 1 |

**Note:** On the basis of mapping of COs with POs, this course is related to Employability / Skill Development

| Code: MSTECV2104 | Stability Analysis of Structure | 4 Credits [LTP:3-1-0] |
|---|---|---|

COURSE OVERVIEW AND OBJECTIVES

This course provides to the student the techniques to stable the various determinate and inderminate structure. The software methodology also used to analyze the structure.

**COURSE OUTCOME**

The student will be able to:

CO2104.1 To impart the principles of elastic structural analysis and behaviourof indeterminate structures.
CO2104.2 To impart knowledge about various methods involved in the analysis of indeterminate structures.
CO2104.3 To apply these methods for analyzing the indeterminate structures to evaluate the response of structures
CO2104.4 To enable the student get a feeling of how real-life structures behave
CO21024.5 To make the student familiar with latest computational techniques and software used for structural analysis

**A. OUTLINE OF COURSE**

| Unit No. | Title of the unit | Time required for the Unit (Hours) |
|---|---|---|
| 1 | **General** | 9 |
| 2. | **Buckling** | 9 |
| 3. | **Deflection** | 9 |
| 4. | **Lateral buckling and torsion** | 9 |
| 5. | **Strain energy** | 8 |

**B. DETAILEDSYLLABUS**

| Unit | Unit Details |
|---|---|
| 1 | **General**<br>Beam – column – Differential equation. Beam column subjected to (i) lateral concentrated load, (ii) several concentrated loads, (iii) continuous lateral load. Application of trigonometric series, Euler‟s formulation using fourth order differentialequationforpined–pined,fixed–fixed,fixed–freeandfixed–pinned column. |
| 2 | **Buckling**<br>Buckling of frames and continuous beams. Elastic Energy method: Approximate calculation of critical loads for a cantilever. Exact critical load for hinged – hinged column using energy approach. Buckling of bar on elastic foundation. Buckling of cantilever column under distributed loads. Determination of Critical loads by successive approximation. Bars with varying cross section. Effect of shear force on critical load. Column subjected to non-conservative follower and pulsating forces. |

| | |
|---|---|
| **3** | **Deflection**<br>Small deflections of laterally loaded plates Stability analysis by finite element approach – deviation of shape function for a two nodded Bernoulli – Euler beam element (lateral and translation of) –element stiffness and element geometric stiffness matrices – assembled stiffness and geometric stiffness matrices for a discredited column with different boundary condition – calculation of critical loads for a discredited (two elements) column (both ends built in). Buckling of pin jointed frames (maximum of two active DOF) – symmetrical single bay portal frame. |
| **4** | **Lateral buckling and torsion**<br>Lateral buckling of beams – differential equation –pure bending – cantilever beam with tip load – simply supported beam of I section subjected to central concentrated load. Pure Torsion of thin – walled bars of open cross section. Non-uniform Torsion of thin –Walled bars of open cross section |
| **5** | **Strain energy**<br>Expression for strain energy in plate bending with in plate forces (linear and non – linear). Buckling of simply supported rectangular plate–unaxial load and biaxial load.Bucklingofuniformlycompressedrectangularplatesimplysupportedalong two opposite sides perpendicular to the direction of compression and having various edge condition along the other two sides |

## C. RECOMMENDED STUDY MATERIAL:

| S. No | Title of the Book | Author |
|---|---|---|
| 1 | Stability Theory of Structures | Ashwini Kumar, Allied publishers Ltd., New Delhi, 2003 |
| 2 | Principles of Structures | Chajes, A., Prentice Hall, 1974 |
| 3 | Stability Analysis and Design | Gambhir, Springer, New York, 2004 |
| 4 | Fundamentals of Structural | Simitser.G.J and Hodges D.H, Elsevier Ltd., 2006 |
| 5 | Theory of Elastic Stability | Timoshenko, S.P, and Gere, J.M, McGraw HillBook Company, 1963 |
| Important Web Links: | | |
| 1. https://theconstructor.org/structural-engg/basic-concepts-stability-structure/1887/ | | |
| 2. https://ascelibrary.org/doi/full/10.1061/%28ASCE%29ST.1943-541X.0001434 | | |
| 3. http://civil.northwestern.edu/people/bazant/PDFs/Papers/S36.pdf | | |
| 4. https://www.ajol.info/index.php/jfas/article/view/168721 | | |
| 5. https://www.youtube.com/watch?v=Oj8hIdXukkE | | |

## D. COs AND POs MAPPING

| COs and POs | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **CO2104.1** | 3 | 2 | 1 | 1 | - | 1 | - | - | - | - | - | - |
| **CO2104.2** | 3 | 2 | 3 | - | 1 | - | - | - | - | - | - | - |
| **CO2104.3** | 2 | 2 | 3 | 1 | 1 | - | - | - | - | - | - | - |
| **CO2104.4** | 1 | 3 | - | 2 | 2 | 1 | - | - | - | - | - | - |
| **CO2104.5** | 1 | 1 | 2 | 3 | 1 | - | - | - | - | - | - | - |

## E. COs AND PSOs MAPPING

| COs and PSOs | PSO1 | PSO2 | PSO3 | PSO4 | PSO5 |
|---|---|---|---|---|---|
| **CO2104.1** | 3 | 2 | - | - | 2 |
| **CO2104.2** | - | 3 | 2 | - | 1 |
| **CO2104.3** | 2 | 3 | - | 1 | - |

| | | | | | |
|---|---|---|---|---|---|
| **CO2104.4** | 1 | 3 | - | 2 | - |
| **CO2104.5** | - | 3 | 2 | - | 2 |

**Note:** On the basis of mapping of COs with POs, this course is related to Employability / Skill Development

| Code: MSTECV2105 | Tall Structures | 3 Credits [LTP:3-0-0] |
|---|---|---|

**COURSE OVERVIEW AND OBJECTIVES**

The objective of this course is to develop thorough understanding of structural systems of Tall Structures. It also aims to expose students to analysis and design of high rise structures using software.

**COURSE OUTCOME**

The student will be able to:

CO2105.1 To apply all types loads on tall buildings according IS code

CO2105.2 To analyze and design tall buildings.

CO2105.3 To understand behavior of various structural systems under different loading conditions.

CO2105.4 To design towers, chimneys and shear walls.

CO2105.5 To check stability of tall structures against buckling, Torsion.

**A. OUTLINE OF COURSE**

| Unit No. | Title of the unit | Time required for the Unit (Hours) |
|---|---|---|
| 1 | General | 9 |
| 2. | Loads | 10 |
| 3. | Analysis of tall building | 8 |
| 4. | Design of tall building | 9 |
| 5. | Design philosophy | 8 |

**B. DETAILED SYLLABUS**

| Unit | Unit details |
|---|---|
| 1 | **General**<br>Principles of Planning of Tall Buildings, Technological Planning, Mechanical systems, Fire rating, Local considerations, Structures elements, Types of structural systems for tall buildings, Shear Walls and their arrangement |
| 2 | **Loads**<br>Loads on Tall Buildings, Gravity loads, Live loads, Wind loads and seismic loading, Code Provisions, Discussion of relevant codes of practices and loading standards. |
| 3 | **Analysis of tall building**<br>Analysis of Tall Buildings (With and Without Shear Walls) Approximate analysis for gravity loads, Lateral loads, Analysis of tube-in-tube constructional and 3-Dimensional analysis of shear core buildings, Stability, Stiffness and fatigue, Factor of safety and load factor |
| 4 | **Design of tall building**<br>Design of Tall Buildings, Procedures of elastic design, Ultimate strength design. |
| 5 | **Design philosophy**<br>Limit state design of super structure, Limit state design of super structures including structural connections, soil structure interaction. |

## C. RECOMMENDED STUDYMATERIAL:

| S. No | Title of the Book | Author |
|---|---|---|
| 1. | Tall Building Structures: Analysis and Design | Smith, Byran Stafford and Coull, Alex, John Wiley and Sons (1991). |
| 2. | Analysis and Design of Tall | Taranath, B. S., Tata McGraw Hill Limited (1988). |
| 3. | Symposium on Tall Buildings with particular reference to Shear | Held at University of Southampton (1996). |
| **Important Web links:** | | |
| **1.** https://smallbusiness.chron.com/tall-vs-flat-organizational-structure-283.html | | |
| **2.** https://smallbusiness.chron.com/tall-organizational-structure-3835.html | | |
| **3.** https://www.upcounsel.com/tall-organizational-structure-definition | | |
| **4.** https://bizfluent.com/info-7759895-tall-organizational-structure.html | | |
| **5.** https://www.google.co.in/search?source=univ&tbm=isch&q=tall+structure&sa=X&ved=2ahUKEwiGlNGo6NDpAhVabn0KHWgqBDwQsAR6BAgJEAE | | |

### A. COs AND POs MAPPING

| COs and LOs | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **CO2106.1** | 3 | 2 | - | 1 | - | - | - | - | - | - | - | 1 |
| **CO2106.2** | 3 | 1 | - | 1 | - | - | - | - | - | - | - | 1 |
| **CO2106.3** | 3 | 2 | - | 1 | - | - | - | - | - | - | - | 1 |
| **CO2106.4** | 3 | 1 | 2 | 1 | - | - | - | - | - | - | - | 1 |
| **CO2106.5** | 3 | - | - | 1 | 1 | - | - | - | - | - | - | 1 |

### B. COs AND PSOs MAPPING

| COs and PSOs | PSO1 | PSO2 | PSO3 | PSO4 | PSO5 |
|---|---|---|---|---|---|
| **CO2106.1** | 3 | - | - | 2 | - |
| **CO2106.2** | 3 | - | - | 2 | - |
| **CO2106.3** | 3 | - | - | 2 | - |
| **CO2106.4** | 3 | - | - | 2 | 1 |
| **CO2106.5** | 3 | 1 | - | - | 1 |

**Note:** On the basis of mapping of COs with POs, this course is related to Employability / Skill Development

| Code: MSTECV2106 | Earthquake Resistant Design of Structures | 3 Credits [LTP:3-0-0] |
|---|---|---|

**COURSE OVERVIEW AND OBJECTIVES**

The objective of this course is to provide a coherent development to the students for the courses in sector of earthquake engineering. This course also provides to present the foundations of many basic engineering concepts related earthquake Engineering

**COURSE OUTCOME**

The student will be able to:

CO2106.1 To provide a coherent development to the students for the courses in sector of earthquake

CO2106.2 To present the foundations of many basic engineering concepts related earthquake Engineering

CO2106.2.3 To give an experience in the implementation of engineering concepts which are applied in field of earthquake engineering conditions.

CO2106.4 To provide a coherent development to the students for the courses in sector of earthquake engineering

CO2106.5 To involve the application of scientific and technological principles of planning, analysis, design of buildings according to earthquake design philosophy.

**A. OUTLINE OF COURSE**

| Unit No. | Title of the unit | Time required for the Unit (Hours) |
|---|---|---|
| 1 | **General** | 9 |
| 2. | **Elastic vibrations** | 10 |
| 3. | **Analysis methods** | 9 |
| 4. | **Graphical analysis** | 8 |
| 5. | **Design philosophy** | 8 |

**B. DETAILEDSYLLABUS**

| Unit | Unit details |
|---|---|
| 1 | **General**<br>Earthquake – causes of earthquake – earthquakes and seismic waves – scale and intensity of earthquakes–seismic activity, seismometer-strong motion accelerograph / field observation of ground motion analysis of earthquakes waves– earthquake motion –amplification of characteristics of surface layers – earthquake motion onthe ground surface |
| 2 | **Elastic vibrations** Elasticvibrationofsimplestructures– modelingofstructuresandequationsofmotion –free-vibrationsof simple structures – steady state forced vibrations – Non steady state forced vibrations – response spectrum representations; Relation between the nature of the ground motion and structural damage. |
| 3. | **Analysis methods** Methods of analysis – selection of analysis – equivalent lateral force procedure seismic base shear – seismic design co-efficient - vertical distribution of seismic forces and horizontal shear – twisting moment - Over turning moment – vertical seismic load and orthogonal effects lateral deflection – P– soil structure Interaction |

| | |
|---|---|
| **4.** | **Graphical analysis**<br>Graphs study, earthquake records for design – factors affecting Accelerogram characteristics - artificial Accelerogram–zoningmap, Model analysis –Inelastic –time history analysis Evaluation of the results |
| **5.** | **Design philosophy**<br>Introduction – monolithic reinforced – concrete structures – precast concrete structures –Pre-stressed concrete structures – steel structures – composite – structures, masonry structures – Timber structures, Selection of materials and types of construction, form of superstructure – framing systems and seismic units – devices for reducing. Earthquake loads |

**C. ECOMMENDED STUDY MATERIAL:**

| S. No | Title of the Book | Author |
|---|---|---|
| 1. | Dynamics of structures | R.W.Clough ‟. Mc Graw – Hill, 2nd edition, 1992 |
| 2. | Design of earthquake resistant structures | Minoru Wakabayashi |
| 3. | Structural Dynamics for Earthquake Engineering | A.K.Chopra,", PearsonPubilications |
| 4. | Fundamentals of Earthquake Engineering | N.M Newmark and E.Rosenblueth, ‟prentice hall,1971 |
| 5. | Earthquake design practice for buildings | David Key,." Thomas telford,London,1988 |
| 6. | Earthquake Engg | R.L. Wegel,; Prentice Hall 12nd edition 1989 |
| 7. | Design of Multi –storied Buildings for Earthquake ground motions | J.A. Blume, N.M. Newmark, L.H. Corning., ‟, Portland Cement Association, Chicago,1961 |
| 8. | Earthquake Resistant Design | Pankaj Agarwal |
| Important Web Links: | | |
| 1. https://theconstructor.org/earthquake/earthquake-resistant-techniques/5607/ | | |
| 2. https://en.wikipedia.org/wiki/Earthquake-resistant_structures | | |
| 3. https://sjce.ac.in/wp-content/uploads/2018/01/05-Earthquake-Resistant-Design.pdf | | |
| 4. https://cdn.ymaws.com/www.nibs.org/resource/resmgr/BSSC/FEMA_P-749.pdf | | |
| 5. https://www.bigrentz.com/blog/earthquake-proof-buildings | | |

**C. COs AND POs MAPPING**

| COs and LOs | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **CO2106.1** | 3 | 2 | - | 1 | - | - | - | - | - | - | - | 1 |
| **CO2106.2** | 3 | 1 | - | 1 | - | - | - | - | - | - | - | 1 |
| **CO2106.3** | 3 | 2 | - | 1 | - | - | - | - | - | - | - | 1 |
| **CO2106.4** | 3 | 1 | 2 | 1 | - | - | - | - | - | - | - | 1 |
| **CO2106.5** | 3 | - | - | 1 | 1 | - | - | - | - | - | - | 1 |

**D. COs AND PSOs MAPPING**

| COs and PSOs | PSO1 | PSO2 | PSO3 | PSO4 | PSO5 |
|---|---|---|---|---|---|
| **CO2106.1** | 3 | - | - | 2 | - |
| **CO2106.2** | 3 | - | - | 2 | - |
| **CO2106.3** | 3 | - | - | 2 | - |
| **CO2106.4** | 3 | - | - | 2 | 1 |
| **CO2106.5** | 3 | 1 | - | - | 1 |

**Note:** On the basis of mapping of COs with POs, this course is related to Employability / Skill Development

**Code: MSTECV2107 Design Concept of Sub-structures 3 Credits [LTP:3-0-0]**

**COURSE OVERVIEW AND OBJECTIVES**

The objective of this course is to provide a coherent development to the students for the courses in sector of earthquake engineering. This course also provides to present the foundations of many basic engineering concepts related earthquake Engineering

**COURSE OUTCOME**

The student will be able to:

CO2107.1 To provide a coherent development to the students for the courses in sector of earthquake

CO2107.2 To present the foundations of many basic engineering concepts related earthquake Engineering

CO2107.3 To give an experience in the implementation of engineering concepts which are applied in field of earthquake engineering conditions.

CO2107.4 To provide a coherent development to the students for the courses in sector of earthquake engineering

CO2107.5 To involve the application of scientific and technological principles of planning, analysis, design of buildings according to earthquake design philosophy.

**A. OUTLINE OF COURSE**

| Unit No. | Title of the unit | Time required for the Unit (Hours) |
|---|---|---|
| **1** | **General** | **9** |
| **2.** | **Important parameter** | **10** |
| **3.** | **Raft foundation** | **9** |
| **4.** | **Deep foundation** | **9** |
| **5.** | **Caissons foundation** | **7** |

**B.** DETAILED SYLLABUS

| Unit | Unit details |
|---|---|
| 1 | **General**<br>Introduction, Site investigation, In-situ testing of soils, Subsoil exploration, Classification of Foundations systems. General requirement of foundations, Selection of foundations, Computations of Loads, Design concepts. |
| **2** | **Important parameter**<br>Concept of soil shear strength parameters, Settlement analysis of footings, Shallow foundations in clay, Shallow foundation in sand & C-Φ soils, Footings on layered soils and sloping ground, Design for Eccentric or Moment Loads. |
| **3** | **Raft foundation**<br>Types of rafts, bearing capacity & settlements of raft foundation, Rigid methods, Flexible methods, soil structure interaction, different methods of modelling the soil. Combined footings (rectangular &trapezoidal), strap footings & wall footings, Raft –super structure interaction effects & general concepts of structural design, Basement slabs |

| | |
|---|---|
| **4** | **Deep foundation**<br>Deep Foundations: Load Transfer in Deep Foundations, Types of Deep Foundations, Ultimate bearing capacity of different types of piles in different soil conditions, Laterally loaded piles, tension piles & batter piles, Pile groups: Bearing capacity, settlement, uplift capacity, load distribution between piles, Proportioning and design concepts of piles. |
| **5** | **Caissons foundation**<br>Types of caissons, Analysis of well foundations, Design principles, Well construction and sinking. Foundations for tower structures: Introduction, Forces on tower foundations, Selection of foundation type, Stability and design considerations, Ring foundations -general concepts. |

**C. RECOMMENDED STUDY MATERIAL:**

| S. No | Title of the Book | Author |
|---|---|---|
| **1.** | Foundation Analysis and Design | Bowles .J.E, McGraw Hill Publishing co., New York,1986 |
| **2.** | Analysis and Design of substructures | Swamy Saran, Oxford and IBH Publishing Co. Pvt. Ltd., 2006 |
| **3.** | Foundation Design and Construction | Tomlinson. M. J, Longman, Sixth Edition, New Delhi, 1995 |
| **4.** | Design of Reinforced Concrete Foundations | PHI learning private limited, New Delhi – 2009 |
| Important web links | | |
| 1. https://theconstructor.org/building/superstructure-substructure-building-construction/1651/ | | |
| 2. https://link.springer.com/chapter/10.1007/978-81-322-2319-1_8 | | |
| 3. https://www.designingbuildings.co.uk/wiki/Substructure | | |
| 4. https://www.rbkc.gov.uk/idoxWAM/doc/Other-1455352.pdf?extension=.pdf&id=1455352&location=volume2&contentType=application/pdf&pageCount=1 | | |
| 5. http://www.iricen.gov.in/iricen/Bridge_Manuals/FoundationSubstructureCode.pdf | | |

**E. COs AND POs MAPPING**

| COs and LOs | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **CO2107.1** | 2 | - | 2 | - | 1 | 1 | 1 | - | - | - | - | 1 |
| **CO2107.2** | 2 | - | 3 | 2 | - | - | - | - | - | - | - | - |
| **CO2107.3** | - | 1 | 1 | - | 2 | 2 | - | - | - | - | - | - |
| **CO2107.4** | 2 | 2 | 3 | - | - | - | - | - | - | - | - | - |
| **CO2107.5** | - | - | 3 | - | 2 | 2 | - | - | - | - | - | - |

**A. COs AND PSOs MAPPING**

| COs and PSOs | PSO1 | PSO2 | PSO3 | PSO4 | PSO5 |
|---|---|---|---|---|---|
| **CO2107.1** | 3 | | - | - | 2 |
| **CO2107.2** | - | - | 2 | 2 | 2 |
| **CO2107.3** | 2 | | 2 | - | 1 |
| **CO2107.4** | 2 | | - | 2 | - |
| **CO2107.5** | - | | 2 | - | 2 |

**Note:** On the basis of mapping of COs with POs, this course is related to Skill Development

| **Code:** MSTECV2108 | **Industrial Structures** | **3 Credits [LTP:3-0-0]** |
|---|---|---|

**COURSE OVERVIEW AND OBJECTIVES**

The objective of this course is to provide a coherent development to design Steel Gantry Girders, Portal & Gable Frames, Bunkers, Silos, Chimneys and water tank Engineering

**COURSE OUTCOME**

The student will be able to:

CO2108.1 To provide a coherent development to the students for the courses in sector of earthquake

CO2108.2 To present the foundations of many basic engineering concepts related earthquake Engineering

CO2108.3 To give an experience in the implementation of engineering concepts which are applied in field of earthquake engineering conditions.

CO2108.4 To provide a coherent development to the students for the courses in sector of earthquake engineering

CO2108.5 To involve the application of scientific and technological principles of planning, analysis, design of buildings according to earthquake design philosophy.

**A. OUTLINE OF COURSE**

| Unit No. | Title of the unit | Time required for the Unit (Hours) |
|---|---|---|
| **1** | **General** | **9** |
| **2.** | **Important parameter** | **10** |
| **3.** | **Raft foundation** | **9** |
| **4.** | **Deep foundation** | **9** |
| **5.** | **Caissons foundation** | **7** |

**B. DETAILED SYLLABUS**

| Unit | Unit details |
|---|---|
| | |
| **1** | **General**<br>Review of Plastic Design: Concept of minimum weight design, Design of Industrial Buildings: General, Framing, Crane girders & columns, Analysis of trussed bents, Design of industrial frame. |
| **2** | **Storage Structure**<br>Design of Storage Structures: Design of containers like bunkers, silos. Design of Space Structures: Transmission towers, Steel domes, Pre-cast building components. |
| **3** | **Light gauge section**<br>Design using Light Gauge Sections: Structural use of pressed sections and light gauge sections, Aluminum as a material of construction for industrial structures and design of such structures, Tubular structures and Sandwich plate construction. |

| | |
|---|---|
| **4** | **Aluminium structure**<br>Aluminum structures: Introduction, Permissible stresses, Tension members, Compression members, Design of beams, Local buckling of compression elements, Riveted and bolted construction, Design of chimneys, Load analysis, Design of steel supporting chimney, Chimney foundation |
| **5** | **Design Philosophy**<br>Construction Practices: Shop practice in steel construction, Fabrication erection and production. |

**C. RECOMMENDED STUDYMATERIAL:**

| S. No | Title of the Book | Author |
|---|---|---|
| 1. | Design of Steel Structures | Ajmani, A. L. and Arya, A. S., Nem Chand and Brothers (2000). |
| 2. | Planning of Industrial Structure | Dunham, C.W., s, John Wiley and Sons (2001). |
| 3. | Steel Designer‟s Manual | Gary, W, Prentice Hall (2008). |
| 4. | Structural Pre-cast Concrete | Glower, F Oxford Publishers (2008). |

Important Web Links:

1. https://link.springer.com/chapter/10.1057/9781137340313_2
2. https://nptel.ac.in/courses/112/107/112107292/
3. https://nptel.ac.in/courses/112/107/112107143/
4. https://nptel.ac.in/courses/108/105/108105062/
5. https://nptel.ac.in/content/syllabus_pdf/105105162.pdf

**E. COs AND POs MAPPING**

| COs and LOs | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **CO2108.1** | 2 | - | 2 | - | 1 | 1 | 1 | - | - | - | - | 1 |
| **CO2108.2** | 2 | - | 3 | 2 | - | - | - | - | - | - | - | - |
| **CO2108.3** | - | 1 | 1 | - | 2 | 2 | - | - | - | - | - | - |
| **CO2108.4** | 2 | 2 | 3 | - | - | - | - | - | - | - | - | - |
| **CO2108.5** | - | - | 3 | - | 2 | 2 | - | - | - | - | - | - |

**A. COs AND PSOs MAPPING**

| COs and PSOs | PSO1 | PSO2 | PSO3 | PSO4 | PSO5 |
|---|---|---|---|---|---|
| **CO2108.1** | 3 | | - | - | 2 |
| **CO2108.2** | - | - | 2 | 2 | 2 |
| **CO2108.3** | 2 | | 2 | - | 1 |
| **CO2108.4** | 2 | | - | 2 | - |
| **CO2108.5** | - | | 2 | - | 2 |

**Note:** On the basis of mapping of COs with POs, this course is related to Skill Development

| Code: MULEBX2109 | Engineering Economics | 3 Credits [LTP:3-0-0] |
|---|---|---|

**COURSE OVERVIEW AND OBJECTIVES:**

This course Acquire knowledge of economics to facilitate the process of economic decision making.
Acquire knowledge on basic financial management aspects.
Develop the skills to analyze financial statements.

| COURSE OUTCOME |
|---|
| The student would be able |
| CO1101.1. Evaluate the economic theories, cost concepts and pricing policies. |
| CO1101.2 Understand the market structures and integration concepts |
| CO1101.3 Understand the measures of national income, the functions of banks and concepts of globalization |
| C01101.4 Apply the concepts of financial management for project appraisal |
| CO1101.5 Understand accounting systems and analyze financial statements using ratio analysis |

| A. | Outline of the Course | |
|---|---|---|
| **Unit No.** | **Title of the unit** | **Time required for the Unit (Hours)** |
| 1 | Economics, Cost and Pricing Concepts | 9 |
| 2 | Concepts on Firms and Manufacturing Practices. | 9 |
| 3 | National Income, Money and Banking, Economic Environment | 9 |
| 4 | Concepts of Financial Management | 9 |
| 5 | Accounting System, Statement and Financial Analysis | 9 |

| B. | DETAILED SYLLABUS |
|---|---|
| 1 | **Economics, Cost and Pricing Concepts** |
| | Economic theories – Demand analysis – Determinants of demand – Demand forecasting – Supply – Actual cost and opportunity cost – Incremental cost and sunk cost – Fixed and variable cost – Marginal costing – Total cost – Elements of cost – Cost curves – Breakeven point and breakeven chart – Limitations of breakeven chart – Interpretation of breakeven chart – Contribution – P/V-ratio, profit-volume ratio or relationship – Price fixation – Pricing policies – Pricing methods |
| 2 | **Concepts on Firms and Manufacturing Practices**. |
| | Firm – Industry – Market – Market structure – Diversification – Vertical integration – Merger – Horizontal integration |
| 3 | **National Income, Money And Banking, Economic Environment** |
| | National income concepts – GNP – NNP – Methods of measuring national income – Inflation – Deflation – Kinds of money – Value of money – Functions of bank – Types of bank – Economic liberalization – Privatization – Globalization |
| 4 | **Concepts of Financial Management** |
| | Financial management – Scope – Objectives – Time value of money – Methods of appraising project profitability – Sources of finance – Working capital and management of working capital |
| 5 | **Accounting System, Statement And Financial Analysis** |
| | Accounting system – Systems of book-keeping – Journal – Ledger – Trail balance – Financial |

| | |
|---|---|
| | statements – Ratio analysis – Types of ratios – Significance – Limitations |

| C. | RECOMMENDED STUDY MATERIAL: | |
|---|---|---|
| **S. No** | **Title of the Book** | **Author** |
| 1 | Financial Management‖ (Theory & Practice) TMH | Prasanna Chandra |
| 2 | Essentials of Managerial Finance | Weston & Brigham |
| 3 | Financial Management | Pandey, I. M |
| 4 | Fundamentals of Financial Management | James C. Van Horne |
| **Important Web links** | | |
| 1 | https://www.youtube.com/watch?v=mX9nd0eQ-6g&ab_channel=KrassimirPetrov | |
| 2 | https://www.youtube.com/watch?v=CCQwz_Gwo6o&ab_channel=IITRoorkeeJuly2018 | |

| D | COs AND POs MAPPING | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| COs and POs | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 |
| CO1101.1 | 1 | 1 | - | 3 | - | 1 | - | - | - | - | 1 | - |
| CO1101.2 | 1 | 3 | - | 2 | 1 | - | - | - | - | - | - | - |
| CO1101.3 | 1 | - | - | 3 | 1 | - | - | - | - | - | 1 | - |
| CO1101.4 | 1 | 1 | 3 | - | - | - | 1 | - | - | - | 1 | - |
| CO1101.5 | 1 | 1 | 3 | - | 1 | 1 | - | - | - | - | - | 1 |

| E | COs AND PSOs MAPPING | | | | |
|---|---|---|---|---|---|
| COs and PSOs | PSO1 | PSO2 | PSO3 | PSO4 | PSO5 |
| CO1101.1 | 1 | 2 | 3 | 1 | - |
| CO1101.2 | - | 2 | 2 | - | 3 |
| CO1101.3 | 1 | 1 | - | 3 | 2 |
| CO1101.4 | 1 | 3 | - | 2 | - |
| CO1101.5 | 1 | 3 | - | 2 | - |

**Note:** On the basis of mapping of COs with POs, this course is related to Employability/ Skill Developm

| Code: MULCHM2201 | Soft Skill-II | 1 Credits [LTP:2-0-0] |
|---|---|---|

**COURSE OUTCOMES**

Students will be able:

- CO2212.1: To present themselves in an effective manner and know about their short-term and long-term goals.
- CO2212.2 To works in a team by managing time properly and focus on personal grooming, etiquettes and body language.
- CO2212.3 to demonstrate their abilities by improving skills of LSRW (Listening /Speaking/Reading/Writing).
- CO2212.4To present different viewpoints or ways of thinking about a situation , expand their abilities to resolve situations and get experience within the given context
- CO2212.5to enhance their employability skills by working on the presentation of Résumé and giving impactful performance during Group Discussion.

## DETAILED SYLLABUS

| Unit | Unit Details |
|---|---|
| 1 | Self-Awareness, Self Esteem & Confidence |
| 2 | The Corporate Fit-Dressing and Grooming, Etiquette: Social etiquette, business etiquette – civic sense – social norms |
| 3 | Effective Management Skills Time & Stress Management: Act in time on commitment |
| 4 | Personal Grooming and Body language |
| 5 | **Time Management &Conflict Management** |
| 6 | **Planning & Prioritizing, Emotional Intelligence: Managing Emotions** |
| 7 | Oral Communication &Writing Skills: Extempore & Paper Presentations. |
| 8 | **Selling Self/Job Hunting Writing resume / Curriculum vitae** |
| 9 | Mock GD – Goal setting - Career planning |
| 10 | Mock interview or Interview skills |

**A. COs AND POs MAPPING**

| COs and LOs | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **CO2201.1** | 3 | 2 | - | 1 | - | - | - | - | - | - | - | 1 |
| **CO2201.2** | 3 | 1 | - | 1 | - | - | - | - | - | - | - | 1 |
| **CO2201.3** | 3 | 2 | - | 1 | - | - | - | - | - | - | - | 1 |
| **CO2201.4** | 3 | 1 | 2 | 1 | - | - | - | - | - | - | - | 1 |
| **CO2201.5** | 3 | - | - | 1 | 1 | - | - | - | - | - | - | 1 |

**B. COs AND PSOs MAPPING**

| COs and PSOs | PSO1 | PSO2 | PSO3 | PSO4 | PSO5 |
|---|---|---|---|---|---|
| **CO2201.1** | 3 | - | - | 2 | - |
| **CO2201.2** | 3 | - | - | 2 | - |
| **CO2201.3** | 3 | - | - | 2 | - |
| **CO2201.4** | 3 | - | - | 2 | 1 |
| **CO2201.5** | 3 | 1 | - | - | 1 |

**Note:** On the basis of mapping of COs with POs, this course is related to Employability / Skill Development

| Code: MSTCCV2401 | SEMINAR-II | 1 Credits [LTP:0-0-2] |
|---|---|---|

A. DETAILED SYLLABUS

| Unit | Contents |
|---|---|
| | |
| | Students grouped in two to three during Semester I, will now continue to download further the research papers in the area, analyze, allocate individually, the set of papers,<br>**Literature survey** Overview- What is literature survey, Functions of literature survey, maintaining a notebook, developing a Bibliography Methods of data collection – Observation, survey, contact methods, experimental, determining sample design Searching for publications – Publication databases,search engines and patent databases, Find some/all of the references for a given paper, including thosethat are not on the web Online tools-google, Cite Seer, ACM Digital Library, IEEE, The on-line Computer Science bibliography, Survey papers, Finding material not on the web, Searching patents.<br>**Publishing a paper** How to write scientific paper Structure of a conference and journal paper, how (and How Not) to write a Good Systems Paper: Abstract writing, chapter writing, discussion, conclusion, references, bibliography, and In-class discussion of technical writing examples, Poster papers, review papers, how to organize thesis Project report, How to write a research proposal? How research is funded? Research ethics – Legal issues, copyright, and plagiarism General advice about writing technical papers in English Tips for writing correct English Practice sessions on above will beconducted. Students will have to deliver seminar, prepare a report and a review paper based on<br>analysis individually. |

| | POORNIMA UNIVERSITY, JAIPUR | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | Faculty of Engineering and Technology | | | | | | | | |
| **Name of Program:** | **M.Tech. in Structural Engineering** **Duration: 2 Years** **Total Credits: 80** | | | | | | | | |
| | **Teaching Scheme for Batch 2023-25** | | | | | | | | |
| | **Semester-III** | | | | | | | | |
| **Course Code** | **Name of Course** | **Teaching Scheme** | | | | **Marks Distribution** | | | **Credits** |
| | | **Lecture (L)** | **Tutorial (T)** | **Practical** | **SH** | **IE** | **ESE** | **Total** | |
| **A.** | | **Major (Core Courses)** | | | | | | | |
| **A.1** | **Theory** | | | | | | | | |
| MSTCCV3101 | Advanced Solid Mechanics | 3 | 1 | - | | 40 | 60 | 100 | 4 |
| MSTCCV3102 | Research Methodology | 3 | 1 | - | | 40 | 60 | 100 | 4 |
| **A.2** | **Practical** | | | | | | | | |
| MSTCCV3201 | Structure Lab-III | - | - | 2 | | 60 | 40 | 100 | 1 |
| MSTCCV3401 | Review/Research Paper | - | - | 2 | | 60 | 40 | 100 | 1 |
| **B.** | | **Minor Stream Courses/ Department Electives/*Open Elective*** | | | | | | | |
| **B.1** | **Theory** | | | | | | | | |
| MULEEE3107 | E-Commerce and Knowledge Management | 3 | 1 | - | | 40 | 60 | 100 | 3 |
| MULECV3108 | Water and Environmental Pollution | | | - | | 40 | 60 | 100 | |
| MULEME3109 | IPR & Patents | | | - | | 40 | 60 | 100 | |
| MULEEE3110 | Robotics | | | - | | 40 | 60 | 100 | |
| MULEEE3111 | Digital India Implementation | | | - | | 40 | 60 | 100 | |
| MULECV3112 | Smart City Design | | | - | | 40 | 60 | 100 | |
| MULEEE3113 | Renewable Energy | | | - | | 40 | 60 | 100 | |
| **B.2** | **Practical** | | | | | | | | |
| | | | | | | | | | |
| **C** | | **Multidisciplinary Courses** | | | | | | | |
| MSTEMC3121 | MOOC Course - I | 3 | - | - | - | - | - | - | 3 |
| **D** | | **Ability Enhancement Courses (AEC)** | | | | | | | |
| | | | | | | | | | |
| **E** | | **Skill Enhancement Courses (SEC)** | | | | | | | |
| - | - | - | - | - | - | - | - | - | - |
| **F** | | **Value Added Courses (VAC)** | | | | | | | |
| | | | | | | | | | |
| **G** | | **Summer Internship / Research Project / Dissertation** | | | | | | | |
| MSTCCV3402 | Dissertation Part - I | - | - | 12 | - | 60 | 40 | 100 | 6 |
| **Total** | | 12 | 3 | 16 | | | | | **22** |
| **Total Teaching Hours** | | **31** | | | | | | | |

## PO's and PSO's are as follows

| PO No. | PO's |
|---|---|
| 1 | **Engineering knowledge:** Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems. |
| 2 | **Problem analysis:** Identify, formulate, review research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences. |
| 3 | **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 |
| 4 | **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. Considerations. |
| 5 | **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. |
| 6 | **The engineer and society:** Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional engineering practice. |
| 7 | **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. |
| 8 | **Ethics:** Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice. |
| 9 | **Individual and team work:** Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings. |
| 10 | **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. |
| 11 | **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. |
| 12 | **Life-long learning:** Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change. |
| **PSO No.** | **PSO's** |
| 1 | A civil engineering graduate is efficient in fundamentals of civil engineering, mathematical & scientific reasoning and are able to plan, design the building structure, roads, sewage and water supply networks & other component of infrastructure system considering environmental, safety & health aspects. |
| 2 | A civil engineer is able to use modern tools, techniques, software's to solve complex engineering problems. |
| 3 | A civil Engineer able to prepare BOQ & cost estimation & able to execute the projects in lined with set project goals. |
| 4 | A civil engineer is able to compile detailed project report & give technical specifications to provide required quality of work. |
| 5 | A civil engineer is able to access the quality of material used for construction & able to find out deviations & able to suggest preventative and corrective measures for sustainable development. |

# M. Tech. Structural Engineering Syllabus-Third Semester

| Code: MSTCCV3101 | Advanced Solid Mechanics | Credits [LTP:3-1-0] |
|---|---|---|

**COURSE OVERVIEW AND OBJECTIVES**

To solve advanced solid mechanics problems using classical methods To apply commercial software on select, applied solid mechanics problems

**COURSE OUTCOME**

The student would be able to

CO3101.1 To understand the theory of elasticity including strain/displacement and Hooke's law relationships;

CO3101.2 To analyze solid mechanics problems using classical methods and energy methods;

CO3101. 3 To solve torsion problems in bars and thin walled members;

CO3101.4 To solve for stresses and deflections of beams under unsymmetrical loading;

CO3101.5 To locate the shear center of thin wall beams;

**A. OUTLINE OF COURSE**

| Unit No. | Title of the unit | Time required for the Unit (Hours) |
|---|---|---|
| 1 | MECHANICAL PROPERTIES OF MATERIALS | 9 |
| 2. | STRESS IN MATERIAL | 10 |
| 3. | UNSYMMETRICAL BENDING | 9 |
| 4. | STRESS IN CURVED MEMBER | 9 |
| 5. | FUNDAMENTALS OF VIBRATION | 7 |

## B. DETAILED SYLLABUS

| Unit | Unit Details |
|---|---|
| Unit 1 | **MECHANICAL PROPERTIES OF MATERIALS**<br>Stress-Strain Diagrams- Elastic and Plastic Deformation–Brittle and Ductile Failures of Materials- Mechanical Tests like Surface Hardness, Fatigue, Creep etc. |
| Unit 2 | **STRESS IN MATERIAL**<br>Principal stresses in a 3D field. - Computation -Mohr's Circle - Lame's Ellipsoid. Theories of failure - Criteria for Failure - Different failure theories for ductile and brittle materials. Equivalent bending and twisting moments. |
| Unit 3 | **UNSYMMETRICAL BENDING**<br>Properties of unsymmetrical sections- Circle of inertia- Dyadic circle-Momental ellipse- Stresses and deflection due to unsymmetrical bending - Concept and relevance of Z polygon. Shear Centre - |

| | |
|---|---|
| | Concept and significance. |
| **Unit 4** | **STRESS IN CURVED MEMBER**<br>Shear flow for thin walled open sections- Location of shear center for singly symmetric sections. Stresses in curved flexural members-Winkler Bach Formula - Crane hooks - rings and links. |
| **Unit 5** | **FUNDAMENTALS OF VIBRATION**<br>Free vibration of single degree of freedom systems - Undamped and damped free vibration with different types of damping.-Resonance-Harmonic response of single degree of freedom systems with and without damping. |

**C. RECOMMENDED STUDY MATERIAL:**

| S. No | Title of the Book | Author |
|---|---|---|
| 1. | Advanced Mechanics of Solids | Srinath, L. S., Tata McGraw Hill,1980 |
| 2. | Solid Mechanics | Kazimi, S.M.A., Tata McGraw Hill, 1976 |
| 3. | Strength of Materials Part II | B.C., Punmia, Standard Publishers and Distributors, 1991. |
| 4. | Engineering Mechanics | Shames I.H., Prentice Hall of India,1996 |
| Important Web Links: | | |
| 1. https://nptel.ac.in/content/storage2/courses/105106049/pdf-assignments/main.pdf | | |
| 2. https://nptel.ac.in/courses/105/106/105106049/ | | |
| 3. https://www.brown.edu/Departments/Engineering/Labs/Gudurulab/ENGN1750/Lecture%20Notes/Intro_Lecture_090513%20[Compatibility%20Mode].pdf | | |
| 4. https://edurev.in/courses/9617_Advanced-Solid-Mechanics-Notes--Videos--MCQs--PPTs | | |
| 5. http://dl.booktolearn.com/ebooks2/engineering/mechanical/9781783323616_Advanced_Mechanics_of_Solids_925c.pdf | | |

**D. COs AND POs MAPPING**

| COs and POs | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **CO3101.1** | 2 | 3 | - | - | 1 | - | - | - | - | - | - | - |
| **CO3101.2** | 3 | 1 | 2 | 1 | - | - | - | - | - | - | - | - |
| **CO3101.3** | 1 | - | 3 | 2 | 1 | - | - | - | - | - | - | - |
| **CO3101.4** | - | 2 | - | 2 | 3 | - | - | - | - | - | - | - |
| **CO3101.5** | 2 | - | 2 | 3 | - | - | - | - | - | - | - | - |

**E. COs AND PSOs MAPPING**

| COs and PSOs | PSO1 | PSO2 | PSO3 | PSO4 | PSO5 |
|---|---|---|---|---|---|
| **CO3101.1** | 3 | - | 2 | - | 2 |
| **CO3101.2** | 1 | 3 | - | 2 | 1 |
| **CO3101.3** | 2 | 1 | 3 | 1 | - |
| **CO3101.4** | - | 2 | - | 3 | 2 |
| **CO3101.5** | 2 | - | 2 | - | 3 |

**Note:** On the basis of mapping of COs with POs, this course is related to Employability / Skill Development

| Code: MSTCCV3102 | Research Methodology | Credits [LTP:3-1-0] |
|---|---|---|

**COURSE OVERVIEW AND OBJECTIVES**

To familiarize students with basic of research and the research process. To enable the students in conducting research work and formulating research synopsis and report. Develop understanding on various kinds of research, objectives of doing research, research process, research designs and sampling

**COURSE OUTCOME**

The student will be able to:

CO3102.1 To be able to distinguish a purpose statement, a research question or hypothesis, and a research objective.

CO3102.2 To be able to define the meaning of a variable, and to be able to identify independent, dependent, and mediating variables

CO3102.3 To be able to distinguish between categorical and continuous measures

CO3102.4 To be able to design a good quantitative purpose statement and good quantitative research questions and hypotheses

CO3102.5 To understand the link between quantitative research questions and data collection and how research questions are operationalized in educational practice.

**A. OUTLINE OF COURSE**

| Unit No. | Title of the unit | Time required for the Unit (Hours) |
|---|---|---|
| 1 | General | 9 |
| 2. | Connections | 10 |
| 3. | Towers | 8 |
| 4. | Plastic Analysis | 9 |
| 5. | Industrial Building | 8 |

**B. DETAILED SYLLABUS**

| Unit | Unit Details |
|---|---|
| 1. | **Overview of Research Methodology**<br>Introduction, Mathematical tools for analysis, Research problems in management, Types ofresearch, Research Process, Data Collection & Presentation: Introduction, Primary data, Secondary data, Data Presentation |
| 2. | **Review of Basic Statistical Measures & Basic Multivariate Analysis**<br>Introduction, Measures of Central Tendencies, Measures of Variation, Measures of Skewness. Basic Multivariate Analysis: Introduction, Correlation analysis, Forecasting, Linear regression & Timeseries |
| 3. | **Design and Analysis of Experiments**<br>Introduction, Analysis of Variance, Completely Randomized design, Randomized complete blockdesign, Latin square design, Duncan‟s multiple Range Test, Functional design, second factorial experiment, Expected Mean Square. |
| 4. | **Algorithmic Research &Simulation**<br>Introduction, Algorithmic Research Problems, Types, Types of Solution Procedures, Steps of development, Steps of Algorithmic Research, Design of Experiments, Meta Heuristics for Combinational Problems Simulation: Introduction, Need for simulation, Types, Simulation Languages, case study. |
| 5. | **Report Writing and Presentation**<br>Introduction, Types of report, Guidelines for review draft, Report format, Typing Instructions, Oral Presentations |

**C. RECOMMENDED STUDYMATERIAL:**

| S. No | Title of the Book | Author |
|---|---|---|
| 1. | Research Methodology | R. Panneerselvam, PHI |
| 2. | Research Methodology: Methods and Trends | Dr. C. R. Kothari |
| 3. | Research Methodology: A Step by Step Guide for Beginners | Ranjit Kumar |

Important Web Links

1. https://libguides.wits.ac.za/c.php?g=693518&p=4914913
2. https://www.scribbr.com/dissertation/methodology/
3. https://www.open.edu/openlearn/money-management/understanding-different-research-perspectives/content-section-8
4. https://www.researchgate.net/publication/270956555_CHAPTER_3_-_RESEARCH_METHODOLOGY_Data_collection_method_and_Research_tools
5. https://www.youtube.com/watch?v=ze5bS-DNERk

**D. COs AND POs MAPPING**

| COs and POs | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **CO3201.1** | 3 | 2 | 1 | 1 | - | - | - | - | - | - | - | - |
| **CO3201.2** | - | 2 | 3 | - | 2 | - | - | - | - | - | - | - |
| **CO3201.3** | 2 | 1 | 3 | - | 1 | - | - | - | - | - | - | - |
| **CO3201.4** | 2 | 3 | - | 2 | - | - | - | - | - | - | - | - |
| **CO3201.5** | 1 | 1 | 2 | 3 | - | - | - | - | - | - | - | - |

**E. COs AND PSOs MAPPING**

| COs and PSOs | PSO1 | PSO2 | PSO3 | PSO4 | PSO5 |
|---|---|---|---|---|---|
| **CO3201.1** | 3 | 2 | 1 | - | 1 |
| **CO3201.2** | 2 | - | 3 | 2 | - |
| **CO3201.3** | 1 | - | 3 | 1 | 2 |
| **CO3201.4** | - | 2 | 2 | - | 3 |
| **CO3201.5** | 2 | 1 | - | 3 | 1 |

Note: On the basis of mapping of COs with POs, this course is related to Employability / Skill Development

| Code: MSTCCV3201 | Structural Lab-III | 2 Credits [LTP:2-0-0] |
|---|---|---|

A. DETAILEDSYLLABUS

| List of Experiments |
|---|
| Design as per syllabus of theory |

| Code: MTECCV3401 | Review/Research Paper | 1 Credits [LTP: 0-0-2] |
|---|---|---|

**A. COURSE OVERVIEW AND OBJECTIVES**

To familiarize students with basic of research and the research process. To enable the students in conducting research work and formulating research synopsis and report. Develop understanding on various kinds of research, objectives of doing research, research process, research designs and sampling

**COURSE OUTCOME**

The student will be able to:

CO02102.1 To be able to distinguish a purpose statement, a research question or hypothesis, and a research objective.

CO02102.2 To be able to define the meaning of a variable, and to be able to identify independent, dependent, and mediating variables

CO02102.3 To be able to distinguish between categorical and continuous measures

CO02102.4 To be able to design a good quantitative purpose statement and good quantitative research questions and hypotheses.

CO02102.5 To understand the link between quantitative research questions and data collection and how research questions are operationalized in educational practice.

**A. DETAILED SYLLABUS**

| Unit | Contents |
|---|---|
| **1.** | **Foundations of Research** |
| | Foundations of Research: Meaning, Objectives, Motivation, Utility. Concept of theory, empiricism, deductive and inductive theory. Characteristics of scientific method – Understanding the language of research – Concept, Construct, Definition, Variable. Research Process |
| **2.** | **Problem Identification & Formulation** |
| | Problem Identification & Formulation – Research Question – Investigation Question – Measurement Issues – Hypothesis – Qualities of a good Hypothesis –Null Hypothesis & Alternative Hypothesis. Hypothesis Testing – Logic & Importance |
| **3.** | **Research Design** |
| | Research Design: Concept and Importance in Research – Features of a good research design – Exploratory Research Design – concept, types and uses, Descriptive Research Designs – concept, types and uses. Experimental Design: Concept of Independent & Dependent variables. |
| **4.** | **Qualitative and Quantitative** |
| | Qualitative and Quantitative Research: Qualitative research – Quantitative research – Concept of measurement, causality, generalization, replication. Merging the two approaches. |
| **5.** | **Data Analysis** |

| | |
|---|---|
| | Data Analysis: Data Preparation – Univariate analysis (frequency tables, bar charts, pie charts, percentages), Bivariate analysis – Cross tabulations and Chi-square test including testing hypothesis of association. |
| **6.** | **Interpretation of Data and Paper Writing** |
| | Interpretation of Data and Paper Writing – Layout of a Research Paper, Journals in Computer Science, Impact factor of Journals, When and where to publish ? Ethical issues related to publishing, Plagiarism and Self-Plagiarism. |
| **7.** | **Use of Encyclopedias, Research Guides, Handbook** |
| | Use of Encyclopedias, Research Guides, Handbook etc., Academic Databases for Computer Science Discipline |
| **8.** | **Use of tools / techniques for Research** |
| | Use of tools / techniques for Research: methods to search required information effectively, Reference Management Software like Zotero/Mendeley, Software for paper formatting like LaTeX/MS Office, Software for detection of Plagiarism |

**B. RECOMMENDED STUDY MATERIAL:**

| S.No | Title of the Book | Author |
|---|---|---|
| 1. | Research Methodology | R. Panneerselvam, PHI |
| 2. | Research Methodology: Methods and Trends | Dr. C. R. Kothari |
| 3. | Research Methodology: A Step by Step Guide for Beginners | Ranjit Kumar |

| Code: MULEEE3107 | E- Commerce & Knowledge Management | 3 Credits [LTP:3-1-0] |
|---|---|---|

**COURSE OVERVIEW AND OBJECTIVES**

This course provides an introduction to information systems for business and management. It is designed to familiarize students with organizational and managerial foundations of systems, the technical foundation for understanding information systems

**COURSE OUTCOME**

The student would be able to

CO3107.1 Understand the basic concepts and technologies used in the field of management information systems;

CO3107.2To impart the knowledge of the different types of management information systems;

CO3107.3 To Understand the processes of developing and implementing information systems;

CO3107.4 To aware of the ethical, social, and security issues of information systems;

CO3107.5 To familiarize students with organizational and managerial foundations of systems

**A. OUTLINE OF COURSE**

| Unit No. | Title of the unit | Time required for the Unit (Hours) |
|---|---|---|
| 1 | **INTRODUCTION TO ELECTRONIC COMMERCE** | 9 |
| 2. | **BUILDING OWN WEBSITE** | 8 |
| 3. | **INTERNET AND EXTRANET** | 9 |
| 4. | **ELECTRONIC DATA INTERCHANGE** | 9 |
| 5. | **PLANNING FOR ELECTRONIC COMMERCE** | 9 |

**B. Detailed Syllabus**

| Unit | Unit Details |
|---|---|
| **Unit 1** | **INTRODUCTION TO ELECTRONIC COMMERCE**<br>Introduction of Unit, what is E-Commerce (Introduction and Definition), Main activities E-Commerce, Goals of E-Commerce, Technical Components of E-commerce, Functions of E-commerce, Advantages and Disadvantages of E-commerce, Scope of E-commerce, Electronic commerce Applications, Electronic commerce and Electronic Business, Conclusion of Unit. |
| **Unit 2** | **BUILDING OWN WEBSITE**<br>Introduction of Unit, Reasons for building own website, Benefits of website, Bandwidth requirements, Cost, Time, Reach, Registering a Domain Name, Web promotion, Target email, Banner Exchange, Shopping Bots, Conclusion of Unit |
| **Unit 3** | **INTERNET AND EXTRANET**<br>Introduction of Unit, Definition of Internet, Advantages and Disadvantages of the Internet, Component of an Intranet Information technology structure, Development of a Intranet, Extranet and Intranet Difference, Role of Intranet in B2B Application, Conclusion of Unit. |

| | |
|---|---|
| **Unit 4** | **ELECTRONIC DATA INTERCHANGE**<br>Introduction of Unit, Concepts of EDI and Limitation, Application of EDI, Disadvantages of EDI, EDI model, Conclusion of Unit. |
| **Unit 5** | **PLANNING FOR ELECTRONIC COMMERCE**<br>Introduction of Unit, planning electronic commerce initiatives, linking objectives to business strategies, measuring cost objectives, comparing benefits to costs, strategies for developing electronic commerce web sites, Conclusion of Unit. |

**C. RECOMMENDED STUDY MATERIAL:**

| S. No | Title of the Book | Author |
|---|---|---|
| 1. | E-Commerce | Greenstein &Feinman, Tata McGrew Hill |
| 2. | Frontiers of Electronic Commerce | KalakotaWinston ,Pearson Education |

Important Web Links:

1. https://www.kmslh.com/3-reasons-why-ecommerce-must-have-knowledge-management/
2. https://link.springer.com/chapter/10.1007/978-3-642-23993-9_31
3. https://ieeexplore.ieee.org/document/5279962
4. https://www.sciencedirect.com/science/article/pii/S0268401207001120
5. https://www.slideshare.net/monoaziz/knowledge-management-1852596

**D. COs AND POs MAPPING**

| COs and POs | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **CO3107.1** | 2 | - | - | - | - | 2 | - | - | - | - | - | - |
| **CO3107.2** | 2 | - | - | - | - | 2 | 2 | - | - | - | - | - |
| **CO3107.3** | 2 | - | - | - | - | 2 | 2 | - | - | - | - | - |
| **CO3107.4** | 2 | - | - | - | - | 1 | - | - | - | - | - | - |
| **CO3107.5** | 2 | - | - | - | - | 2 | 2 | - | - | - | - | - |

**E. COs AND PSOs MAPPING**

| COs and PSOs | PSO1 | PSO2 | PSO3 | PSO4 | PSO5 |
|---|---|---|---|---|---|
| **CO3107.1** | 2 | - | - | - | 2 |
| **CO3107.2** | 2 | - | - | - | 2 |
| **CO3107.3** | 2 | | 1 | - | 2 |
| **CO3107.4** | 2 | - | - | - | 2 |
| **CO3107.5** | 1 | - | - | - | - |

**Note**: On the basis of mapping of COs with POs, this course is related to Employability / Skill Development / Entrepreneur

| Code:MULECV3108 | Water and Environmental Pollution | 3 Credits [LTP:3-1-0] |
|---|---|---|

**COURSE OVERVIEW AND OBJECTIVES**

The aim of this course is to teach students about current environmental problems. From an environmental perspective, the student will learn how to develop an activity using various strategies to control, reduce and monitor all environmental problems that might arise as a result.

**COURSE OUTCOME**

The student would be able to

CO3108.1 To be able to identify and value the effect of the pollutants on the environment: atmosphere, water and soil.

CO3108.2 To be able to analyse an industrial activity and identify the environmental problems.

CO3108.3 TO be able to plan strategies to control, reduce and monitor pollution.

CO3108.4 To be able to select the most appropriate technique to purify and/or control the emission of pollutants.

CO3108.5 To be able to apply the basis of an Environmental Management System (EMS) to an industrial activity.

**A.OUTLINE OF COURSE**

| Unit No. | Title of the unit | Time required for the Unit (Hours) |
|---|---|---|
| 1 | **WATER AND WATER ANALYSIS** | 9 |
| 2. | **WASTEWATER AND THEIR TREATMENT** | 8 |
| 3. | **GLOBAL ATMOSPHERIC CHANGE** | 9 |
| 4. | **AIR POLLUTION & METEOROLOGY** | 9 |
| 5. | **SOLID WASTE MANAGEMENT** | 9 |

**A. DETAILEDSYLLABUS**

| | |
|---|---|
| **Unit 1** | **WATER AND WATER ANALYSIS**<br>Water resources, Sources of water, characteristics of water, water pollutants, oxygen demanding wastes, surface water quality, ground water quality. Municipalwater supply: Requisites of drinking water, Steps involved in treatment of water |
| **Unit 2** | **WASTEWATER AND THEIR TREATMENT**<br>Wastewater Characteristics: Quality parameters: BOD, COD, TOC, Solids, DO, Nitrogen, Phosphorus, Standards of disposal into natural watercourses and on land, Indian standards. wastewater treatment systems, disposal scope |
| **Unit 3** | **GLOBAL ATMOSPHERIC CHANGE**<br>The atmosphere of earth, greenhouse effect, radiative forcing of climate change, global warming potential, carbon cycle, carbon emissions from fossil fuels, regionalimpacts of temperature change, global initiatives. |

| | |
|---|---|
| **Unit 4** | **AIR POLLUTION & METEOROLOGY**<br>Atmospheric motion, Lapse rate, atmospheric stability, inversion, atmospheric dispersion, maximum mixing depth, Air quality standards, plume rise, emission controls. Air pollution control methods in industries.<br>**NOISE POLLUTION:** Effect of noise on people, rating systems, community noise sources and criteria, traffic noise prediction, noise control |
| **Unit 5** | **SOLID WASTE MANAGEMENT**<br>Integrated solid waste management, hazardous waste management, biomedical waste treatment technologies and disposal options, e-waste management, waste minimization for sustainability, waste management – Indian scenario. |

**B. RECOMMENDED STUDYMATERIAL:**

| S.No | Title of the Book | Author |
|---|---|---|
| 1. | Environmental Engineering | Howard S Peavy, Donald RRowe, George Tchobanoglous |
| 2. | Engineering: Treatment, and Reuse, 4th edition, Tata McGraw Hill, 2007. | Metcalf and Eddy Inc |
| 3. | Manual for Water Treatment. | Ministry of Urban development, Govt of India |
| 4. | Manual for Sewage Treatment | Ministry of Urban development, Govt of India |
| 5. | Air Pollution | M N Rao |
| 6. | Air Pollution Control Engineering | De Nevers |
| 7 | Solid Wastes: Engineering principles and Management issues | Tchobanoglous G. |

Important Web Links:

1. https://www.google.co.in/search?biw=1366&bih=608&ei=Y4HLXvytHffYz7sPn9eB4AY&q=water+and+enviroment+polluation+nptel&oq=water+and+enviroment+polluation+nptel&gs_lcp=CgZwc3ktYWIQAzIKCCEQFhAKEB0QHjIKCCEQFhAKEB0QHjIKCCEQFhAKEB0QHjoECAAQRzoGCAAQFhAeOgcIIRAKEKABUIsYWP4mYMItaABwAXgAgAG8AogBuw2SAQcwLjEuNS4xmAEAoAEBqgEHZ3dzLXdpeg&sclient=psy-ab&ved=0ahUKEwi868D4y87pAhV37HMBHZ9rAGwQ4dUDCAw&uact=5\
2. https://www.nrdc.org/stories/water-pollution-everything-you-need-know
3. https://www.environmentalpollutioncenters.org/water/
4. https://www.explainthatstuff.com/waterpollution.html
5. https://wwf.panda.org/knowledge_hub/teacher_resources/webfieldtrips/water_pollution/

**F. COs AND POs MAPPING**

| COs and POs | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **CO3108.1** | 2 | - | - | - | - | 2 | - | - | - | - | - | - |
| **CO3108.2** | 2 | - | - | - | - | 2 | 2 | - | - | - | - | - |
| **CO3108.3** | 2 | - | - | - | - | 2 | 2 | - | - | - | - | - |
| **CO3108.4** | 2 | - | - | - | - | 1 | - | - | - | - | - | - |
| **CO3108.5** | 2 | - | - | - | - | 2 | 2 | - | - | - | - | - |

**F. COs AND PSOs MAPPING**

| COs and PSOs | PSO1 | PSO2 | PSO3 | PSO4 | PSO5 |
|---|---|---|---|---|---|
| **CO3108.1** | 2 | - | - | - | 2 |
| **CO3108.2** | 2 | - | - | - | 2 |
| **CO3108.3** | 2 | | 1 | - | 2 |
| **CO3108.4** | 2 | - | - | - | 2 |
| **CO3108.5** | 1 | - | - | - | - |

**Note**: On the basis of mapping of COs with POs, this course is related to Employability / Skill Development / Entrepreneur

| Code: MULEME3109 | IR& Patents | 3 Credits [LTP:3-1-0] |
|---|---|---|

**COURSE OVERVIEW AND OBJECTIVES**: The main objective of the IPR is to make the students aware of their rights for the protection of their invention done in their project work.Further teacher will have to demonstrate with products and ask the student to identify the different types of IPR's

**COURSE OUTCOME**:

CO3109.1 To introduce fundamental aspects of Intellectual property Rights to students who are going to play a major role in development and management of innovative projects in industries.

CO3109.2 To disseminate knowledge on patents, patent regime in India and abroad and registration aspects

CO3109.3 To acquire knowledge on copyrights and its related rights and registration aspects

CO3109.4 To understand knowledge on trademarks and registration• aspects

CO3109.5 To disseminate knowledge on Design, Geographical Indication (GI), Plant Variety and Layout Design Protection and their registration aspects

## A. OUTLINE OF COURSE

| Unit No. | Title of the unit | Time required for the Unit (Hours) |
|---|---|---|
| 1 | INTRODUCTION TO IPR | 9 |
| 2. | TYPES OF IPR AND WIPO | 8 |
| 3. | LEGAL AND COMMERCIAL ASPECTS OF IPR | 9 |
| 4. | INTRODUCTIONS TO PATENTS | 9 |
| 5. | PATENT PROCEDURES | 9 |

## B. DETAILED SYLLABUS

| Unit | Unit details |
|---|---|
| Unit 1 | **INTRODUCTION TO IPR**<br>General Regime of Intellectual Property Rights, Concept of Property vis-à-vis Intellectual Property, Concept of Property and Theories of Property - An Overview. Theories of Intellectual Property Rights, Intellectual Property as an Instrument of Development, Need for Protecting. Intellectual Property- Policy Consideration-National Perspectives and International demands. |
| Unit 2 | **TYPES OF IPR AND WIPO**<br>Types of Intellectual Property- Origin and Development- An Overview, Intellectual Property Rights as Human Right, Role of International Institutions, World Intellectual Property Organization (WIPO), Function of WIPO, Membership of WIPO, Agreement between the WIPO and the WTO. |
| Unit 3 | **LEGAL AND COMMERCIAL ASPECTS OF IPR**<br>Dispute Settlement- New Treaties, Commercialization of Intellectual Property Rights by Licensing, Determining Financial Value of Intellectual Property Rights, Negotiating Payments Terms in Intellectual Property Transaction, Intellectual Property Rights in the Cyber World. |

| | |
|---|---|
| **Unit 4** | **INTRODUCTIONS TO PATENTS**<br>Introduction to Patent Law, Paris Convention, Patent Cooperation Treaty, WTO- TRIPS, Harmonization of CBD and TRIPs, Indian Patent Law, The Patents Act, 1970, Amendments to the Patents Act, Patentable Subject Matter, Patentability Criteria. |
| **Unit 5** | **PATENT PROCEDURES**<br>Procedure for Filing Patent Applications, Patent Granting Procedure, Revocation, Patent Infringement and Remedies, Relevant Provisions of the Biological Diversity Act, 2002, Access and Benefit SharingIssues. |

**C. RECOMMENDED STUDY MATERIAL:**

| S. No | Title of the Book | Author |
|---|---|---|
| 1. | Intellectual Property Rights in India | VK Ahuja (Lexis Nexis butter worths Publications) |
| Important Web Link: | | |
| 1. https://www.cencenelec.eu/ipr/Pages/default.aspx | | |
| 2. http://www.ipindia.nic.in/ | | |
| 3. https://en.wikipedia.org/wiki/Intellectual_property | | |
| 4. https://en.wikipedia.org/wiki/Intellectual_propert | | |
| 5. https://www.itu.int/en/ITU-T/ipr/Pages/default.aspx | | |

**H. COs AND POs MAPPING**

| COs and POs | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **CO3109.1** | 2 | - | - | - | - | 2 | - | - | - | - | - | - |
| **CO3109.2** | 2 | - | - | - | - | 2 | 2 | - | - | - | - | - |
| **CO3109.3** | 2 | - | - | - | - | 2 | 2 | - | - | - | - | - |
| **CO3109.4** | 2 | - | - | - | - | 1 | - | - | - | - | - | - |
| **CO3109.5** | 2 | - | - | - | - | 2 | 2 | - | - | - | - | - |

**I. COs AND PSOs MAPPING**

| COs and PSOs | PSO1 | PSO2 | PSO3 | PSO4 | PSO5 |
|---|---|---|---|---|---|
| **CO3109.1** | 2 | - | - | - | 2 |
| **CO3109.2** | 2 | - | - | - | 2 |
| **CO3109.3** | 2 | | 1 | - | 2 |
| **CO3109.4** | 2 | - | - | - | 2 |
| **CO3109.5** | 1 | - | - | - | - |

**Note**: On the basis of mapping of COs with POs, this course is related to Employability / Skill Development / Entrepreneur

| Code: MULEEE3110 | Robotics | 3 Credits [LTP: 3-1-0] |
|---|---|---|

**COURSE OVERVIEW AND OBJECTIVES:** To understand the basic concepts associated with the design and Functioning and applications of Robots To study about the drives and sensors used in Robots To learn about analyzing robot kinematics and robot programming.

**COURSE OUTCOME:**

The student would be able to:

CO3110.1 To be able to introduce basics of robotics.

CO3110.2 To understand robot kinematics and robot programming

CO3110.3 To understand the application of Robots

CO3110.4 To learn about force and torque sensing

CO3110.5 To acquire knowledge of robotics programming.

**A. OUTLINE OF COURSE**

| Unit No. | Title of the unit | Time required for the Unit (Hours) |
|---|---|---|
| 1 | FUNDAMENTALS | 9 |
| 2. | ROBOT KINEMATICS | 9 |
| 3. | ROBOT DYNAMIC ANALYSIS AND FORCES | 8 |
| 4. | ACTUATORS AND SENSORS | 9 |
| 5. | ROBOT PROGRAMMING, SYSTEMS AND APPLICATIONS | 9 |

**B. Detailed Syllabus**

| Unit | Unit details |
|---|---|
| Unit 1 | **FUNDAMENTALS**<br>Historical information, robot components, Robot characteristics, Robot anatomy,Basic structure of robots, Resolution, Accuracy and repeatability, Position Analysis forward and inverse kinematics of robots, Including frame representations. |
| Unit 2 | **ROBOT KINEMATICS**<br>Transformations, position and orientation analysis and the Denavit-Hartenberg representation of robot kinematics, The manipulators, The wrist motion and grippers. Differential motions, Inverse Manipulator Kinematics: Differential motions andvelocity analysis of robots and frames. |
| Unit 3 | **ROBOT DYNAMIC ANALYSIS AND FORCES**<br>Analysis of robot dynamics and forces, Lagrangian mechanics is used as the primary method of analysis and development. Trajectory Planning: Methods of path and trajectory planning, Both in joint-space and in Cartesian-space. |
| Unit 4 | **ACTUATORS AND SENSORS**<br>Actuators, including hydraulic devices, Electric motors such as DC servomotorsandstepper motors, Pneumatic devices, as well as many other novel actuators, It also covers microprocessor control of these actuators, Mechatronics, Tactile sensors, Proximity and range sensors, Force and torque sensors, Uses of sensors in robotics. |

| | |
|---|---|
| **Unit 5** | **ROBOT PROGRAMMING, SYSTEMS AND APPLICATIONS**<br>Robot languages, Method of robots programming, Lead through programming methods, A robot programs as a path in space, Motion interpolation, WAIT, SIGNAL and DELAY commands, Branching capabilities and limitation of lead through methods and robotic applications. Basic principles of fuzzy logic and its applications inmicroprocessor control and robotics. |

**C. RECOMMENDED STUDYMATERIAL:**

| S.No | Title of the Book | Author |
|---|---|---|
| 1. | Robotics Control Sensing, Vision and Intelligence | McGraw Hill Gonzalez, R. C., Fu, K. S. and Lee, C.S.G. |
| 2. | Robotics for Engineers | McGraw Hill Koren,Y |
| 3. | Introduction to Robotics, Analysis, Systems, Applications, | Dorling Kingsley, Dorling Kingsley Niku, S.B |
| 4. | Programming robot controllers | McGraw Hill Predko, M |

Important Web Links:

1. https://nptel.ac.in/courses/112/105/112105249/
2. https://nptel.ac.in/courses/112/101/112101099/
3. https://nptel.ac.in/courses/112/101/112101098/
4. https://swayam.gov.in/nd1_noc20_me03
5. https://www.youtube.com/watch?v=DaWMvEY3Qgc

**J. COs AND POs MAPPING**

| COs and POs | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **CO3110.1** | 2 | - | - | - | - | 2 | - | - | - | - | - | - |
| **CO3110.2** | 2 | - | - | - | - | 2 | 2 | - | - | - | - | - |
| **CO3110.3** | 2 | - | - | - | - | 2 | 2 | - | - | - | - | - |
| **CO3110.4** | 2 | - | - | - | - | 1 | - | - | - | - | - | - |
| **CO3110.5** | 2 | - | - | - | - | 2 | 2 | - | - | - | - | - |

**K. COs AND PSOs MAPPING**

| COs and PSOs | PSO1 | PSO2 | PSO3 | PSO4 | PSO5 |
|---|---|---|---|---|---|
| **CO3110.1** | 2 | - | - | - | 2 |
| **CO3110.2** | 2 | - | - | - | 2 |
| **CO3110.3** | 2 | | 1 | - | 2 |
| **CO3110.4** | 2 | - | - | - | 2 |
| **CO3110.5** | 1 | - | - | - | - |

**Note**: On the basis of mapping of COs with POs, this course is related to Employability / Skill Development / Entrepreneur

| Code: MULEEE3111 | Digital India Implementation | 3 Credits [LTP: 3-1-0] |
|---|---|---|

**COURSE OVERVIEW AND OBJECTIVES**: The Digital India programme aims to provide broadband highways, universal access to mobile connectivity, public internet access programme, e-governance: Reforming government through technology, eKranti - Electronic delivery of services, Information for all, Electronics manufacturing: Target net zero imports, IT for jobs and early harvest programmes

**COURSE OUTCOME**:

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

CO3111.1. Understand concepts and objectives digital India and digital infrastructure.

CO3111.2 Understand the pillars of the digital India.

CO31111.3 Understand the concept of new digital services and platforms for implementations purpose.

CO3111.4 Understand the various digital facilities to empower citizen.

CO3111.5 Apply the digital India initiative for training objective.

**A. OUTLINE OF THE COURSE**

| Unit No. | Title of the Unit | Time required for the Unit (Hours) |
|---|---|---|
| 1. | Digital India Initiative | 8 |
| 2. | Focus Area | 8 |
| 3. | Implementation | 9 |
| 4. | Facilities To Digitally Empower Citizen | 7 |
| 5. | Training | 8 |

**B. DETAILEDSYLLABUS**

| Unit | Unit Details |
|---|---|
| **1.** | **Digital India Initiative** |
| | Concept, aims and objectives, opportunities, inclusive growth in areas of electronic services, products, manufacturing and job opportunities, centered on three keyareas– Digital Infrastructure as a Utility to Every Citizen, Governance & Services on Demand and Digital Empowerment of Citizens. |
| **2.** | **Focus Area** |
| | The Government of India specifically targets nine 'Pillars of the Digital India' as follows: Broadband Highway, Universal Access to Mobile connectivity, Public Internet Access Programme, E-Governance, reforming Government through Technology, E- Kranti, electronic delivery of services, Information for All, Electronics Manufacturing,IT for Jobs |
| **3.** | **Implementation** |
| | New digital services, MyGov.in is a platform to share inputs and ideas on matters of policy and governance, UMANG (Unified Mobile Application for New-age Governance) ,AADHAR,Digi-Locker,BharatBill Payment System, PAN, EPFO services, PMKVY services, Indian railway tickets bookings, birth certificates, e-District, e-Panchayat, e-Sign framework, Swachh Bharat Mission(SBM) Mobile app, e-Hospital application, Digital attendance. |
| **4.** | **Facilities To Digitally Empower Citizen** |
| | Digital locker facility, eliminating the use of physical documents and enables the sharing of verified electronic documents across government agencies, three key stakeholders of citizen, issuer and requester. BPO and job growth, government is planning to create 28,000 seats of bpos in various states and set up at least one common service centre in each of the gram panchayats in the state.Easy access to a common services center (CSC), Shareable private space on a public cloud, Safe and secure cyberspace, Universally accessible digital resources, Collaborative digital platforms for intergovernmental operations. E- Samparkvernacular email service: connect rural India with the |

| | |
|---|---|
| | digital India, the government of India impelled email services provider giants including Gmail, office and rediff to provide the email address in regional languages, anIndian-based company, data Xgen technologies pvt.ltd, has launched world‟s first free linguistic email address under the name „Data mail‟ which allows creating email ids in 8 Indian languages, English; and 3 foreign languages – Arabic, Russian and Chinese. Overthe period of time the email service in 22 languages will be offered by Data Xgen technologies. |
| **5.** | **Training** |
| | PradhanMantriGramin, Digital SakshartaAbhiyan, PMG Disha, Ongoing awareness campaign, reception within country and the outside world, criticism and impact. |

**C. RECOMMENDED STUDY MATERIAL:**

| S.No | Book | Author | Publication |
|---|---|---|---|
| **a. Reference Books** | | | |
| 1. | Digital India: Understanding Information,Communication and Social Change | PradipNinan Thomas | SAGE |
| 2. | Book on Digital India (Special Edition) by National e-governance mission, Government of India | | |
| Important Web Links: | | | |
| 1. https://economictimes.indiatimes.com/tech/internet/digital-india-15-salient-things-to-know-about-pm-narendra-modis-project/articleshow/47893380.cms | | | |
| 2. https://en.wikipedia.org/wiki/Digital_India | | | |
| 3. https://www.researchgate.net/publication/303643369_Digital_India_Objectives_Initiatives_and_Inherent_Challenges | | | |
| 4. https://digitalindia.gov.in/content/programme-pillars | | | |
| 5. https://www.civilserviceindia.com/subject/Essay/digital-india-or-green-india-discuss3.html | | | |

**D.COs AND POs MAPPING**

| COs and POs | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **CO3111.1** | 2 | - | - | - | - | 2 | - | - | - | - | - | - |
| **CO3111.2** | 2 | - | - | - | - | 2 | 2 | - | - | - | - | - |
| **CO3111.3** | 2 | - | - | - | - | 2 | 2 | - | - | - | - | - |
| **CO3111.4** | 2 | - | - | - | - | 1 | - | - | - | - | - | - |
| **CO3111.5** | 2 | - | - | - | - | 2 | 2 | - | - | - | - | - |

**E.COs AND PSOs MAPPING**

| COs and PSOs | PSO1 | PSO2 | PSO3 | PSO4 | PSO5 |
|---|---|---|---|---|---|
| **CO3111.1** | 2 | - | - | - | 2 |
| **CO3111.2** | 2 | - | - | - | 2 |
| **CO3111.3** | 2 | | 1 | - | 2 |
| **CO3111.4** | 2 | - | - | - | 2 |
| **CO3111.5** | 1 | - | - | - | - |

**Note**: On the basis of mapping of COs with POs, this course is related to Employability / Skill Development / Entrepreneur

| Code:MULECV3112 | SMART CITY DESIGN | 3 Credits [LTP: 3-1-0] |
|---|---|---|

**COURSE OVERVIEW AND OBJECTIVES:**

The objective of the Smart Cities **Mission** is to promote cities that provide core infrastructure and give a decent quality of life to its citizens, a clean and sustainable environment and **application** of 'Smart' Solutions.

**COURSE OUTCOME**:

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

C03112.1 Understand the concept of smart city and smart energy business concepts.

CO3112.2 Apply governance of smart city by various techniques like Augmented Reality for City Planning.

CO3112.3. Understand the concept and characteristics of Smart City Intelligent Buildings and Urban Spaces.

CO3112.4 Understand the environmental and economic impacts on buildings by Multi-objective optimization.

CO3112.5 Apply the energy management and Smart City Distributed Energy.

**A. OUTLINE OF THE COURSE**

| Unit No. | Title of the Unit | Time required for the Unit (Hours) |
|---|---|---|
| 1. | Smart City Introduction And Concept | 7 |
| 2. | Smart City Governance | 8 |
| 3. | Smart City Intelligent Buildings And Urban Spaces | 7 |
| 4. | Multi Objective Optimization- Smart City | 7 |
| 5. | Smart City Distributed Energy | 8 |

**B. DETAILED SYLLABUS**

| Unit | Unit Details |
|---|---|
| **1.** | **Smart City Introduction And Concept** |
| | Smart City: local but networked, distributed but integrated Smart City, City monitoringandoperationsystemsVisionofanopensmartcityinteroperability environment Road maps for research and innovation policy Smart energybusiness concepts for Energy Hub districts Identifying development trends in smart citytechnologies – VTT Trend generator Public procurement of innovation for smart city solutions. |
| **2.** | **Smart City Governance** |
| | Real-time decision support systems for city management, Boosting collaborative planning with visualisation technology, Virtual Model Facilitating Citizen Interaction, Mobile Augmented Reality for City Planning, Co-creating future smart cities - Visual and participative urban planning services Citizen-driven co- design for a smarter city Social media for citizen participation Gamification as an enabler of mutual learning in complex health care systemsDecision-makingsupport: A smart city perspective |
| **3.** | **Smart City Intelligent Buildings And Urban Spaces** |
| | Intelligent buildings and urban spaces in smart cities Intelligent urban spaces– automatic real-time responses to people behavior Occupancy in smart buildings of smart cities – case hospital smart lighting Mobile augmented reality for building maintenance Autonomous management system for buildings and districts |
| **4.** | **Multi Objective Optimization- Smart City** |

| | |
|---|---|
| | Multi-objective optimization for the minimization of environmental and economic impacts on buildings at district level Intelligent Street lights adapt to conditions City mills leading the positive change in recycling. |
| **5.** | **Smart City Distributed Energy** |
| | Distributed renewable energy and energy management Highlights from the Smart Grids and Energy Systems programme. Active distribution networks with full integration of demand and distributed resources Integration of variable power generation into urban energy systems Future district heating solutions for residential districts Smart metering cyber security ICT for neighborhoods‟ energy management Energy-Hub for residential and commercial districts and transport ICT-supported business in energy positive neighborhood‟s Renewable energy and energy efficiency in new districts – how to accelerate systemic change towards smart cities Internet of Energy: Electric Mobility with Smart Grids. |

**C. RECOMMENDED STUDY MATERIAL:**

| S.No | Book | Author | Publication |
|---|---|---|---|
| **a. Reference Books** | | | |
| 1. | Building smart cities-Analytics, design building and thinking | Carol l. Stimmel | Auerbach Publications |
| 2. | Smart City- Foundation, principles and application | Houbing Song | JOHN WILEY |
| 3. | Smart city and urban development of India | N. Mani | New Century Publications |
| **b. Important Web Links:** | | | |
| 1. | https://nptel.ac.in/courses/105/105/105105160/ | | |
| 2. | https://nptel.ac.in/courses/124/107/124107007/ | | |
| 3. | https://swayam.gov.in/nd1_noc20_ce43/preview | | |
| 4. | https://www.youtube.com/watch?v=8G8ewFxE_V8 | | |
| 5. | http://www.digimat.in/nptel/courses/video/105105160/L41.html | | |

**D.COs AND POs MAPPING**

| COs and POs | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **CO3112.1** | 1 | - | - | - | - | 2 | 2 | - | - | - | - | - |
| **CO3112.2** | 2 | - | - | 1 | 1 | 1 | 1 | - | - | - | - | - |
| **CO3112.3** | 2 | 1 | 1 | 1 | - | 1 | - | - | 1 | - | 1 | - |
| **CO3112.4** | 2 | - | - | 1 | - | 1 | - | - | 1 | - | - | 1 |
| **CO3112.5** | - | - | 2 | - | 1 | 2 | - | - | - | - | 1 | - |

**E.COs AND POs MAPPING**

| COs and PSOs | PSO1 | PSO2 | PSO3 | PSO4 | PSO5 |
|---|---|---|---|---|---|
| **CO3112.1** | 3 | 1 | 1 | 1 | 1 |
| **CO3112.2** | 1 | - | 3 | - | 2 |
| **CO3112.3** | 2 | 2 | - | 2 | 1 |
| **CO3112.4** | 1 | 1 | 1 | - | 2 |
| **CO3112.5** | 1 | 1 | 3 | 2 | - |

**Note:** On the basis of mapping of COs with POs, this course is related to Skill Development / Entrepreneur

| Code:MULEEE3113 | Renewable Energy | 3 Credits [LTP: 3-1-0] |
|---|---|---|

**COURSE OVERVIEW AND OBJECTIVES**

The course should enable the students to : 1. Understand the various forms of conventional energy resources. 2. Learn the present energy scenario and the need for energy conservation 3. Explain the concept of various forms of renewable energy 4. Outline division aspects and utilization of renewable energy sources for both domestics and industrial application 5. Analyse the environmental aspects of renewable energy resources.

**COURSE OUTCOME**

**The student would be able to**

**CO03113.1** Describe the environmental aspects of non-conventional energy resources. In Comparison with various conventional energy systems, their prospects and limitations

**CO03113.2** Know the need of renewable energy resources, historical and latest developments.

**CO03113.3** Describe the use of solar energy and the various components used in the energy production with respect to applications like - heating, cooling, desalination, power generation, drying, cooking etc

**CO03113.4** Appreciate the need of Wind Energy and the various components used in energy generation and know the classifications.

**CO03113.5** Understand the concept of Biomass energy resources and their classification, types of biogas Plants- applications

**B. OUTLINE OF COURSE**

| Unit No. | Title of the unit | Time required for the Unit (Hours) |
|---|---|---|
| **1** | CLASSIFICATION OF ENERGY | **9** |
| **2** | APPLICATIONS OF SOLAR ENERGY | **10** |
| **3** | BIO ENERGY SOURCES | **8** |
| **4** | WIND ENERGY & SMALL HYDRO POWER SYSTEMS | **10** |
| **5** | OCEAN & GEOTHERMAL ENERGY | **7** |

**C. Detailed Syllabus**

| Unit No. | Description |
|---|---|
| **UNIT 1** | **CLASSIFICATION OF ENERGY**<br>Energy chain and common forms of usable energy- Present energy scenario-World energy status-Energy scenario in India - Introduction to renewable energy resources Introduction to Solar Energy-Energy from sun-Spectral distribution of Solar radiation- Instruments for measurement of solar radiation-Solar radiation data analysis |
| **UNIT 2** | **APPLICATIONS OF SOLAR ENERGY**<br>Thermal applications -Introduction to Solar thermal collectors- Types - Principle of operation of different collectors - Flat plate- Evacuated tube collectors-Compound parabolic collectors- |

| | |
|---|---|
| | Solar air heaters - Solar dryers-solar cookers- solar stills - Solar ponds - concentrating collectors- line type - point type - Methods of Solar power generation - Power towers. Physics of solar cells - Cell and module Characteristics of cells and module - Performance parameters -BoS- PV System applications - Stand- alone- Grid connected systems |
| **UNIT 3** | **BIO ENERGY SOURCES**<br>Energy through various processes - Energy through fermentation - Gasification - various types of gasifiers -Pyrolysis - Fixed bed and fast Pyrolysis - Bio energy through digestion - Types of Digesters- Factors affecting the yield of products |
| **UNIT 4** | **WIND ENERGY & SMALL HYDRO POWER SYSTEMS**<br>Resource assessment - types of wind turbines - selection of components - blade materials - power regulation - various methods of control - wind farms - site selection - off shore wind farms - Solar Wind Hybrid energy systems. Introduction - types - system components, discharge curve and estimation of power potential- Turbines for SHP |
| **UNIT 5** | **OCEAN & GEOTHERMAL ENERGY**<br>Power generation through OTEC systems - various types - Energy through waves and tides - Energy generation through geothermal systems - types |

**D. COs AND POs MAPPING**

| COs and POs | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **CO3113.1** | 3 | 2 | 1 | 1 | - | 1 | - | - | - | - | - | - |
| **CO3113.2** | 3 | 2 | 3 | - | 1 | - | - | - | - | - | - | - |
| **CO3113.3** | 2 | 2 | 3 | 1 | 1 | - | - | - | - | - | - | - |
| **CO3113.4** | 1 | 3 | - | 2 | 2 | 1 | - | - | - | - | - | - |
| **CO3113.5** | 1 | 1 | 2 | 3 | 1 | - | - | - | - | - | - | - |

**E. COs AND PSOs MAPPING**

| COs and PSOs | PSO1 | PSO2 | PSO3 | PSO4 | PSO5 |
|---|---|---|---|---|---|
| **CO3113.1** | 3 | 2 | - | - | 2 |
| **CO3113.2** | - | 3 | 2 | - | 1 |
| **CO3113.3** | 2 | 3 | - | 1 | - |
| **CO3113.4** | 1 | 3 | - | 2 | - |
| **CO3113.5** | - | 3 | 2 | - | 2 |

**Note:** On the basis of mapping of COs with POs, this course is related to Employability / Skill Development

| Code: MSTCCV4301 | Dissertation Part-II | Credits [LTP:-0-0] |
|---|---|---|

The Project can be carried out in the Institution/Industry/Research laboratory or any other competent institutions.