Vidya Pratishthan's
Kamalnayan BajajInstitute of Engineering and Technology, Baramati.

# Faculty of Science and Technology

## Board of Studies

## Civil Engineering

# Syllabus

**Honors Subjects in Advanced Structural Engineering**

S.Y. B. Tech. (SEM.-IV)
Civil Engineering

**(w.e.f. AY: 2024 - 2025)**

| Syllabus: Honors Subjects in Advanced Structural Engineering w.e.f. AY:2024-25 | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| SEMESTER-IV | | | | | | | | | | | | | | | |
| Course Code | Courses Name | Teaching Scheme (Hrs.) | | | Examination Scheme and Marks | | | | | | | Credits | | | |
| | | TH | PR | TUT | Activity | ISE | ESE | TW | PR | OR | Total | TH | PR | TUT | Total |
| CE23291 | Advanced mechanics of structures | 2 | 2 | - | 20 | 20 | 50 | 20 | 20 | - | 130 | 2 | 1 | - | 3 |
| Total | | 2 | 2 | - | 20 | 20 | 50 | 20 | 20 | - | 130 | 2 | 1 | - | 3 |

BOS
Civil Engineering

DEAN
Academics

DEAN
Autonomy

PRINCIPAL
VPKBIET, Baramati.

Head
Department of Civil Engineering
VPKBIET, Baramati-413133

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# Faculty of Science and Technology

## Board of Studies

## Civil Engineering

# Syllabus

**Honors Subjects in Advanced Structural Engineering**

S.Y. B. Tech. (SEM.-III)
Civil Engineering

**(w.e.f. AY: 2024 - 2025)**

DEPARTMENT OF CIVIL ENGINEERING
VPKBIET
Baramati
413133

| Syllabus: Honors Subjects in Andvanced Structural Engineering w.e.f. AY:2024-25 | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| SEMESTER-III | | | | | | | | | | | | | | | |
| Course Code | Courses Name | Teaching Scheme (Hrs.) | | | Examination Scheme and Marks | | | | | | | Credits | | | |
| | | TH | PR | TUT | Activity | ISE | ESE | TW | PR | OR | Total | TH | PR | TUT | Total |
| CE23281 | Engineering Seismology | 2 | 2 | - | 10 | 20 | 50 | 20 | 20 | - | 120 | 2 | 1 | - | 3 |
| **Total** | | **2** | **2** | - | **10** | **20** | **50** | **20** | **20** | - | **120** | **2** | **1** | - | **3** |

| BOS | DEAN | DEAN | PRINCIPAL |
|---|---|---|---|
| Civil Engineering | Academics | Autonomy | VPKBIET, Baramati. |

**Course Name with Code: Advanced Mechanics of Structure (CE23291)**

| Teaching Scheme: | Credits | Examination Scheme: |
|---|---|---|
| TH: 2 Hrs./week | 03 | Activity:10 Marks |
| PR: 2 Hrs./week | | In Semester:20 Marks |
| | | End Semester:50 Marks |
| | | TW:20 Marks |
| | | PR:20 Marks |

**Prerequisite:**

1. Fundamentals of Engineering Mechanics, Mechanics of Structure.

**Companion Course, if any: Laboratory Practical**

**Course Objectives:**

1. To know the concept of arch with influence line diagram.
2. To study and analyze plane frames using approximate analysis.
3. To understand the concept of finite element analysis
4. To analyze beams and frames using flexibility matrix method.

**Course Outcomes:**

After successful completion of the course, students will be able to:

1. Understand the concept of three hinged arch.
2. Analyze plane frames using approximate methods.
3. Understand the concept of finite element analysis
4. Analyze beams and frames using flexibility matrix method.

**Course Contents**

**Unit I: Arches:** **(6 Hours)**

Introduction to Arches, Analysis of three hinged and semicircular arches-Three Hinge Parabolic Arch Subjected to UDL over Entire Span, Three Hinge Semi-circular Arch Subjected to UDL over Entire Span, Temperature Effect on Three Hinged Arches.

**Unit II: Approximate Methods of Structural Analysis** **(6 Hours)**

Portal frame method- analysis of building frames subjected to vertical and lateral loads, Analysis of tall and slender frame by Cantilever method

**Unit III: Finite Element Analysis** **(6 Hours)**

Definition of FEM, discretization of materials, Concept of Plane Stress and Plane Strain, 1-D 2-D 3-D elements, CST, LST, axisymmetric bending, analysis of cantilever and simply supported beams using central finite difference method considering five nodes.

**Unit IV: Flexibility Matrix Method** **(6 Hours)**

Basic concepts of flexibility, conditions of equilibrium, indeterminacy of beams and frames, Analysis of beams and frames with 03 unknowns using flexibility matrix method.

**Books & Other Resources:**

**Text books:**


1. R. C. Hibbeler, "Structural Analysis", Pearson Education Publication
2. Pandit and Gupta (1999), "Theory of Structures", Vol. I, Tata McGraw Hill Publication
3. Gere and Weaver (1998), "Matrix Analysis of Framed Structures", CBS Publication Delhi, 2nd Edition
4. S.S. Bhavikatti , "Finite element analysis", New Age International Publication.


**Reference books:**


1.Wilbur and Norris, "Elementary Structural Analysis", Tata McGraw Hill Publication.
2. C. K. Wang (1983), "Intermediate structural analysis", Tata McGraw Hill Publication.
3. Pandit and Gupta (1997), "Structural analysis: A matrix approach", Tata McGraw Hill Publication.
4. C. S. Reddy (1996), "Basic structural analysis", Tata McGraw Hill Publication, 2nd Edition
5. Structural Analysis by Devdas Menon, Narosa Publishing Housing Pvt Ltd.
6. Indeterminate Structural Analysis by K U. Muttu,IK International Publishing House Pvt.ltd
7. Matrix Analysis of Frames structures by William Weaver J.R and James M.Gere, CBS publications.


**Practical:**

1. Analyze a portal frame with 02 bays subjected to lateral loadings.
2. Analyze Cantilever or Supported Beam using CFDM.
3. Analyze three hinged arches subjected to UDL & Point Loads.
4. Write 04 assignments (includes Minimum 06 questions from each unit).

**Activity:**

1.Visit to the traditional Arch site and write a detailed report.
2.Visit to any industrial shed/Structure and Write a detailed report.
3. Mini Project on Analyses of Arch/ Beams/ Portal Frame using any Software.

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**Course Name with Code: Engineering Seismology (CE23281)**

**Teaching Scheme:**
**TH: 2 Hrs./week**
**PR: 2 Hrs./week**

**Credits**
**3**

**Examination Scheme:**
**Activity:10 Marks**
**In Semester:20 Marks**
**End Semester:50 Marks**
**TW:20 Marks**
**PR:20 Marks**

**Prerequisite:**

**Companion Course, if any: Laboratory Practical**

**Course Objectives:**

1. To get idea about geology and plate tectonics
2. To get the knowledge of the physical properties of mineral and differentiate between the rocks types, their inherent characteristics with Civil Engineering applications.
3. To comprehend Structural geology applied to civil engineering projects
4. Introduce the aspect of earthquakes and vibrations

**Course Outcomes:**

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

CO1: Recognize effect of plate tectonics and its significance and utility in civil engineering activities.

CO2: Exploring the importance of mass wasting processes and various tectonic processes that hampers the design of civil engineering projects and its implications on environment and sustainability.

CO3: Identify effects of structural geology and their significance and utility in civil engineering activities.

CO4: Define the concepts of earthquakes, seismology and vibrations.

**Course Contents**

**Unit I: General Geology and Plate Tectonics** **(6 Hours)**

a) Introduction to the subject and scope. General Geology: The Earth as a planet, Interior & General composition of the Earth, The rock cycle.

b)Introduction to plate tectonics and Mountain building activity.

**Unit II: Mineralogy and Petrology** **(6Hours)**

a) Introduction to mineralogy: Physical Properties of Minerals, Classification of Minerals, silicate and non-silicate minerals, Rock forming minerals.

b) Introduction to petrology and Broad classification of rocks.

Igneous Petrology: Plutonic, Hypabyssal and Volcanic rocks, Structures, Textures and Classification of Igneous rocks. Study of common rock types prescribed in practical work and their engineering applications.

Secondary Petrology: Rock weathering, Sedimentary Structures, lithification and digenesis Process, Genetic classification of secondary rocks and grain size classification and Textures, Study of common rock types prescribed in practical work and their civil engineering applications.

Metamorphic Petrology: Agents, Types of metamorphism, Texture and structures. Study of common rock types prescribed in practical work and their civil engineering applications.

**Unit III: Structural Geology** **(6 Hours)**

a) Structural Geology: Out crop, dip and strike, conformable series, unconformity, its types and overlap, faults and their types, folds and their types, inliers and outlier. Civil engineering importance of faults and folds with examples.

b) Structures of rocks: Igneous intrusions and their types, joints and their types, stratification and lamination.

**Unit IV: Earthquake and Seismology** **(6 Hours)**

Causes of earthquakes, seismic waves, magnitude and intensity of earthquakes, seismographs, accelerometers, ground motion parameters, peak acceleration, peak velocity, peak displacement, ground motion spectra.

**Books & Other Resources:**

**Text books:**

1.A Text Book of Engineering Geology by N. Chenna Kesavulu. 2010, McMillan India Ltd.
2.Text Book of Engineering Geology by R.B. Gupte , 2001, P.V.G. Publications, Pune.
3.tructural Dynamics: Theory and Computation, Mario Paz & William Leigh, Springer Publications

**Reference books:**

1. Kramer, S.L., "Geotechnical Earthquake Engineering", Second Indian reprint, Pearson Education.
2. Geology P. K. Mukerjee, World Press
3. Engineering Geology by F. G. H Blyth and De Frietus, Reed Elsevier India
4. Engineering Geology, Parbin Singh
5. Dynamics of Structures, A. K. Chopra, Pearson Education India.

**Laboratory Experiments/Assignments**

1. **Megascopic identification of following mineral specimens (around 50).**
   Rock Forming Minerals, Economic Minerals and Ore Minerals such as:
   **Silica group:** Rock Crystal, Rosy Quartz, Transparent Quartz, Milky Quartz, Smoky Quartz, Amethyst, Chalcedony, different varieties of Agate, Jasper Banded Hematite Jasper
   **Feldspar group:** Orthoclase, Microcline, Plagioclase
   **Mica group:** Muscovite, Biotite
   **Olivine group:** Olivine Pyroxene group: Augite, Diopside, Hypersthene,
   **Amphibole group:** Hornblende, Asbestos,
   **Zeolite and other group:** Apophyllite, Stilbite, different varieties of Calcite, Gypsum Tourmaline, Chromite, Limonite, Laterite, Kyanite, Graphite, Hematite, Micaceous Haematite, Pyrite, Garnet etc.

2. **Megascopic identification of following different rock specimens. (Around 50).**
   **a) Igneous Petrology:** Plutonic, Hypabyssal, Volcanic Rocks and their varieties like Granites , Syenite, Pegmatite, Graphic Granite, Dolerite,Andesite,Diorite, Gabbro, Rhyolite, Pumice, Trachyte, All varieties of Basalt like Compact, Giant Phenocryst Basalt (GPB),Amygdaloidal, Pipe A.B, Volcanic Breccia, Tachylytes,Tuff breccia.
   **b) Sedimentary Rocks:** Rudaceous, Areanceous, Argillaceous, Chemical and Organic Deposits: Laterite, Bauxite, Conglomerates, Secondary Breccia, varieties of Sandstones (Red), Grit,Arkose sandstone, Sandstone with Ripple marks, Sandstone (Current Bedding), Shahabad Limestone, Black Limestone (Cudappah), Stalactite Limestone, Oolitic limestone, Shelly Limestone, Mudstone, Shale (White), Shale (Yellow), Shale (Black).
   **c) Metamorphic Petrology:** Contact Metamorphic rocks, Dynamothermal Metamorphic rocks:

Quartzite's, Marbles, Phyllite, Slate, varieties of Schists (Mica Schist, Biotite Schist with Garnet, Muscovite Schist, Chlorite Schist, Hornblende Schist, Chlorite Schist, Talc Schist, Quartz Sericite Schist), varieties of Gniesses (Augen Gneiss, Hornblende Biotite Gneiss, Hornblende Gneiss), Khondalite, Charnockite, Amphibolite.

3. **Interpretation and construction of geological sections from contoured geological maps** (A. G. Series—IV Total 8 maps and 2 maps to be constructed by the faculty members). Solution of engineering geological problems such as alignment of dams, tunnels, roads, canals, bridges, etc. based on geological maps.

4. **Site Visit**

**Activity:**

1. Identify the minerals and rocks based on their inherent properties and write a report.
2. Write a report on engineering significance of faults and folds
3. Study and interpretation of any Geological map (Individual or group activity)