

**ACADEMIC AFFAIRS OFFICE
INDIAN INSTITUTE OF TECHNOLOGY ROORKEE**

No. Acd./1274 /IAPC-108

Dated: September 01, 2021

Head, Department of Earthquake Engg.

The IAPC in its 108th meeting held on 11.08.2021 vide Item No. 108.3.1 considered and approved the proposal of Department of Earthquake Engineering to introduce Programme Elective Course (PEC) i.e., EQN-591: Seismic Design of Steel Buildings with minor modifications.

The modified syllabus is attached as **Appendix-A**.


Assistant Registrar (Curriculum)

Encl: as above

Copy to (through e mail):-

1. All faculty
2. Head of all Departments / Centres
3. Dean, Academic Affairs
4. Associate Dean of Academic Affairs (Curriculum)
5. Channel i/ Acad portal/ Academic webpage of iitr.ac.in

INDIAN INSTITUTE OF TECHNOLOGY ROORKEE

NAME OF DEPARTMENT/CENTRE: Department of Earthquake Engineering

1. **Subject Code:** EQN-591 **Course Title:** Seismic Design of Steel Buildings
2. **Contact Hours:** **L:** 3 **T:** 0 **P:** 2/2
3. **Examination Duration (Hrs.):** **Theory:** 3 **Practical:** 0
4. **Relative Weightage:** **CWS:** 15-30 **PRS:** 20 **MTE:** 15-25 **ETE:** 30-40 **PRE:** 0
5. **Credits:** 3 6. **Semester:** Both 7. **Subject Area:** PEC
8. **Pre-requisite:** Basic design of steel structures
9. **Objective:** To provide the basic framework for designing steel buildings for gravity loads as well as lateral loads, especially for earthquakes.

10. Details of the Course

S.No.	Contents	Contact hours
1.	Introduction: Description of different steel structures and their performance during previous earthquakes. Material Level Understanding: stress-strain curve, effect of temperature on stress-strain curve and ductility, strain-rate effects, plasticity and hysteresis, low-cycle and high-cycle fatigue, buckling, material models.	10
2.	Plastic Analysis for Member Level Understanding: Plastic analysis at sectional level under pure flexural yielding, combined flexural and axial loading, combined flexural and shear loading, combined flexural-axial-shear loading, pure torsion, combined flexure and torsion, systematic methods of plastic analysis, moment redistribution methods and capacity design.	10
3.	Building Design Philosophy (Code guidelines and their orientation): Historical perspective of seismic codes, importance of ductility, collapse mechanism versus yield mechanism, seismic performance factors, brief overview of working stress and limit state design of steel structures, capacity design framework, performance based seismic design framework, discussion on international code guidelines.	3
4.	Structural System Level Understanding: Ductile design of moment resisting frames, concentrically braced frames, eccentrically braced frames, buckling restrained frames, steel plate shear walls, steel truss moment frames, light gauge steel systems and other energy dissipating systems. Consideration in designs for high seismic and low seismic areas. Design of panel zones and specific connection details for each system.	14
5.	Ductile Connection Design: Design of welded and bolted connections, design of gusset plates, balanced design procedure, pre-qualifying connection details.	5
Total		42

11. List of Experiments and Semester Project:

1. Coupon testing and material modelling using ABAQUS (Offline/Online mode)
2. Connection (Bolted) design and testing
3. Connection (Welded) design and testing
4. Controlled failure design of connections and testing
5. Three-point bending test of steel and numerical validation (ABAQUS) (Offline/ Online mode)

Semester Project:

To design a steel structural building system (eg: six storeys BRBF structure) from scratch and check its performance including seismic strength and ductility using a numerical software.

12. Suggested Books:

S.No.	Name of Authors/Book/Publisher	Year of Publication/ Reprint
1.	Chen W. F. and Sohal I. "Plastic design and second order analysis of steel frames" Springer-Verlag.	1995
2.	Subramanian N. "Design of steel structures", Oxford, IBH.	2008
3.	Bruneau M., Uang C. M. and Sabelli R. "Ductile design of steel structures", Mc Graw Hill	2011
4.	Gioncu V. and Mazzolani F. M. "Seismic design of steel structures", CRC Press, Taylor and Francis Group.	2014

13. Design Standards

S.No.	Code
1.	IS800:2007. "General construction in steel-code of practice." Bureau of Indian Standards, New Delhi.
2.	ANSI/AISC 360-10. (2010). "Specifications for structural steel buildings." American Institute of Steel Construction, Chicago, IL.
3.	ANSI/AISC 341-10. (2010). "Seismic provisions for structural steel buildings." American Institute of Steel Construction, Chicago, IL.
4.	EC3. (2010). "Design of Steel Structures – Part 1-1: General Rules and Rules for Buildings." EN 1993-1-1:2005, European Committee for Standardization (CEN), Brussels.
5.	EC8. (2008). "Design of structures for earthquake resistance, Part 1: General rules, seismic actions and rules for buildings." European Standard EN 1998-1:2004, European Committee for Standardization (CEN), Brussels.