

Annual Report

Department of Earthquake Engineering

2020-2021



Indian Institute of Technology Roorkee

Roorkee, Uttarakhand

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Table of Contents

1.	Salient Features	3
	a Introduction	3
	b Academic Programme	4
2.	List of Faculty Members	4
	a Professors	4
	b Associate Professors	4
	c Assistant Professors	4
3.	Honours and Awards to Faculty Members	5
4.	Participation of faculty in Conferences /Seminar /Symposia /Workshop/ Guest Lectures (National & International).	5
5.	Total Number of Faculty Members Participated in Short Term Courses.	8
6.	Distinguished Visitors to The Department (National/International)	8
7.	(a) Internships By IIT-Roorkee Students	9
7.	(b) Internships Offered to Other Students in IIT-Roorkee	9
8.	Academic Activities Organized by the Department	9
9.	Sponsored Research Projects	9
10.	Service to Industries	9
	a. Consultancy Projects	9
	b. Testing Services	10
11.	Summary of Major Sponsored Research Schemes and Consultancy Projects (Rs. 20 lacs)	10
12.	Scientific and Technical Reports	10
13.	Research Publication	10
	a. Conference/Symp./Seminars	11
	b. International Conference	12
	c. National Journals	13
	d. International Journals	14
14.	Contact Address	16

Academic Staff: 15, Students Admitted: PG: 30; Ph.D.: 10,
Publications in: Journals: 17, Conferences: 20, Book: NIL,
Projects: Research (Rs. in Lacs): 396.94 , Consultancy (Rs. in Lacs): 1252.43

1. Salient Features

a. Introduction

The Department of Earthquake Engineering at the Indian Institute of Technology Roorkee (erstwhile University of Roorkee) was established in 1960 as School of Research and Training in Earthquake Engineering. Four major areas of earthquake engineering viz., Structural Dynamics, Soil Dynamics, Engineering Seismology and Seismotectonics, and Instrumentation have been nurtured for the last fifty years. The department provides Master's degree in three specializations namely, Structural Dynamics, Soil Dynamics, and Seismic Vulnerability and Risk Assessment. The major functions of the Department include teaching and research, and rendering expert advice to various organizations in the area of earthquake resistant design of structures and systems, such as dams, bridges, power plants, etc. The Department has played a key role at the national level in the formulation of Indian Standard Codes of Practice for earthquake resistant design of Structures.

Several major facilities have been developed in the Department to conduct experiments related to earthquake engineering. Some of the major facilities include: recently commissioned full scale pseudo-dynamic structural test facility having 8 m tall reaction walls, a low cost shock table on railway wagons, for dynamic testing of structural models, a computer controlled shake table to stimulate strong ground motion, a quasi-static testing laboratory having servocontrolled dynamic actuator systems and servo-controlled compression testing machine, a soil dynamics laboratory equipped with liquefaction table, cyclic triaxial testing system, and resonant column apparatus, a seismological observatory having state of the art broadband seismograph to record earthquake ground motion, a strong motion network of 300 digital accelerographs deployed in the Himalayan region to measure strong ground motion due to moderate and major earthquakes and a state-of-the-art 12-station telemetered network to monitor local seismicity in the environs of Tehri Dam.

b. Academic Programs

The Department of Earthquake Engineering offers postgraduate M.Tech. (admission through GATE/sponsorships) and Ph.D. (through selections/ sponsorships) programs in following three specializations:

- *Soil Dynamics*
- *Structural Dynamics*
- *Seismic Vulnerability and Risk Assessment.*

During 2020-2021, - M.Tech. degrees and 05 Ph.D. degrees were awarded from the Department.

2. List of Faculty Members**a. Professors**

- i. Pankaj Agrawal
- ii. Josodhir Das
- iii. B. K. Maheshwari
- iv. J. P. Narayan
- v. M. L. Sharma
- vi. Manish Shrikhande
- vii. Yogendra Singh

b. Associate Professors

- i. R. N. Dubey
- ii. S. C. Gupta
- iii. Ravi S. Jakka
- iv. D. Shanker

c. Assistant Professors

- i. P. C. Ashwin Kumar
- ii. Ritesh Kumar
- iii. Sohom Ray
- iv. Saurabh Shiradhonkar

3. Honours and Awards to Faculty Members

a. B. K. Maheshwari

- Nominated "Secretary of TC-206", Committee on Interactive Design and Observational Methodology of "International Society of Soil Mechanics and Geotechnical Engineering (ISSMGE)" in September 2020.
- Received "Reviewer of the year 2019 (EBM) award" from Indian Geotechnical Society (IGS) in its annual conference in December 2020.

b. Ravi S. Jakka

- Ravi Jakka has been elected as National Executive Committee member of Indian Geotechnical Society for the term 2020-2022 (2 years).
- Ravi Jakka has taken over the responsibilities as an Editor, International Journal of Geotechnical Earthquake Engineering since January 2021.

4. Participation of faculty in Conferences /Seminar /Symposia /Workshop / Guest Lectures (National & International).

National			
Name of Faculty	Detail of Conf./Semi/Symp./ Workshop/Guest Lecture	Venue	Date
Ravi S. Jakka	Indian Geotechnical Conference	Visakhapatnam, Andhra Pradesh (Online)	December 17-19, 2020
Ravi S. Jakka	Delivered 12th ISET Webinar on "Influence of Local Soil Conditions on Seismic Site Response and the Challenges involved in their Estimation"	NIT Rourkela (Online)	September 18, 2020
P. C. Ashwin Kumar	'Design of steel Moment Resisting Frames' under five day FDP on "Earthquake Resistant Design of Concrete & Steel Moment Resisting frame Buildings"	Poornima College of Engineering, Jaipur (Online)	September 23, 2020

P. C. Ashwin Kumar	'Steel Passive Devices for Seismic Resilience' under online short term course on "Modern Materials & Structural Systems for Resilient and Sustainable Infrastructure "	TKM College of Engineering Kollam, Kerala	September 24, 2020
P. C. Ashwin Kumar	'Refresher Course on Building Design and Construction for the Engineers of Tata Steel'	CEC, IIT Roorkee	February 2021
M. L. Sharma	Delivered first AS Arya Memorial lecture "Understanding Earthquakes"	Webinar, NIDM (Online)	September 01, 2020
M. L. Sharma	ISET Webinar "Seismic Hazard Assessment"	Webinar, ISET (Online)	May 27, 2020
M. L. Sharma	International Webinar on Computational Trends and Applications in Civil Engineering	Webinar, JSS (Online)	June 10, 2020
M. L. Sharma	Seismic Hazard of Urban Areas and Relevance of Microzonation in Risk Mitigation	Webinar, NIDM (Online)	July 27, 2020
Saurabh Shiradhonkar	M6.5 Delhi Earthquake of July, 1720 – Description of Damage Pattern	National Institute of Disaster Management (NIDM) (online)	July 27, 2020
Saurabh Shiradhonkar	'Risk Targeted Seismic Design' under online short term course on STTP on Wind and Earthquake Resistant Design.	Prof. Ram Meghe Institute of Technology & Research, Badnera, Amaravati (online)	November 27, 2020
Saurabh Shiradhonkar	'Towards Risk Targeted Seismic Design' under online short term course on Short Term Course on Advances in Structural Engineering (ASE-2021),	NIT Hamirpur (Online)	January 12, 2021

Saurabh Shiradhonkar	'Importance of Strength, Stiffness and Ductility in design' Short Term Course on Building Design and Construction	CEC, IIT Roorkee	February 24, 2021
Yogendra Singh	Performance-Based seismic Design of Structures	NIT Srinagar (J&K) (Online)	February 17, 2021
Yogendra Singh	Analysis, Design & Detailing of Shear Walls	IITR-EPICONS Webinar (Online)	January 30, 2021
Yogendra Singh	Seismic Design of Code Exceeding Buildings	IITR-EPICONS Webinar (Online)	May 30, 2020
Yogendra Singh	ISET Webinar on Performance Based Seismic Design of structures	ISET Webinar (Online)	May 16, 2020
Yogendra Singh	Codal Provisions and Modelling for Linear and Nonlinear Analysis	IITR-EPICONS Webinar (Online)	August 08, 2020
Yogendra Singh	Behaviour and Earthquake Resistant Design of Masonry Buildings	TATA Steel Webinar (Online)	February 22, 2021
Yogendra Singh	Seismic Evaluation of RC Buildings	HILTI Academy Webinar (Online)	September 25, 2020
Yogendra Singh	Seismic Behaviour and ERD of Structures	NIT Uttarakhand Webinar (Online)	September 06, 2020

International			
Name of Faculty	Detail of Conf./Semi/Symp. /Workshop/Guest Lecture	Venue	Date
B. K. Maheshwari	Delivered a Keynote Lecture entitled "Recent Advances in Seismic Soil-Structure Interaction" in online international FDP on Soil-Structure Interaction and its Applications organized by GBPIET, Pauri Garhwal, Uttarakhand	GBPIET, Pauri Garhwal, Uttarakhand (Online)	September 01, 2020

Daya Shanker	U K International Geophysics and Tectonics (Seminar)	Virtual Meeting (Online)	November 25, 2020
Daya Shanker	U K International Geophysics and Tectonics (Seminar)	Virtual Meeting (Online)	September 30, 2020
Daya Shanker	SZ4D MCS - Volcanic Systems Modeling Workshop	Virtual Meeting (Online)	February 25, 2021
Daya Shanker	The Role of Computational Geoscience in the Predictive Assessment of Plate Boundary Systems and Hazards	Virtual Meeting (Online)	January 19, 2021
Sohom Ray	Presentation: Aseismic creep in steady-state rate-weakening interfaces. Conference: American Geophysical Union-Fall Meeting	Virtual Meeting (Online)	December 01-17, 2020

5. Total Number of Faculty Members Participated in Short Term Courses.

National	NIL
International	NIL

6. Distinguished Visitors to The Department (National/International)

National			
Name	Designation and Affiliation	Purpose	Dates
International			
Name	Designation and Affiliation	Purpose	Dates

7(a). Internships By IIT-Roorkee Students

Sl. No.	Name of Student	Name of Internship Programme	Under Graduate	Post Graduate	Name of Institute Visited	Period

7(b). Internships Offered to Other Students in IIT-Roorkee

Sl. No.	Name of Student	Name of Internship Programme	Under Graduate	Post Graduate	Name of Institute Visited	Period

8. Academic Activities Organized by the Department

Name of Conf./Seminar/Symp./Workshop	Name of the Chairman	Sponsored by	Dates

9. Sponsored Research Projects

Sl. No.	Project Status	Total No. of Projects	Amount (Rs. In Lacs)
1.	Complete Projects	02	138.63
2.	Ongoing Projects	06	258.31
3.	New Projects	04	299.20

10. Service to Industries**a. Consultancy Projects**

Sl. No.	Project Status	Total No. of Projects	Amount (Rs. In Lacs)
1.	Complete Projects	12	303.84
2.	Ongoing Projects	25	948.59
3.	New Projects	31	414.46

b. Testing Services

Sl. No.	No. of Industries Served	Total Outlay (Rs. In Lacs)
1.	-	-

11. Summary of Major Sponsored Research Schemes and Consultancy Projects (Rs. 20 lacs) (a brief write-up upto 100 words) (new projects during the year).

12. Scientific and Technical Reports

Title of the Projects	Participants	Authors	Remarks

13. Research Publication

Sl. No.	Details	Total Number
a.	Conference/Symp./Seminars	09
b.	International Conference	11
c.	National Journals	05
d.	International Journals	12

Research Publication during the year under report (To be listed on the basis of first author only, as given below). **Separate group for Conference/Symp./Papers and Books/Monographs be made.**

a. Conference/ Symp./ Seminars

- i. Vishal and Narayan, J.P. (2020). Quantification of effects of single and complex 3D topography on ground motion characteristics. 17WCEE, Sendai, Japan, If-0007**
- ii. Narayan, J.P., Singh, P., and Verma, S. (2020) Role of density of building in site city interaction effects on shear wave response of building and basin. 17WCEE, Sendai, Japan, If-0008.**
- iii. Sharma M. L. and P. Sharma (2020). Site Characterization and Soil Structure Interaction with Deep Bedrock Depth in Indo-Gangetic Plains. 17th World Conference on Earthquake Engineering, 17WCEE, Sendai, Japan.**
- iv. Sharma, M. L. and Bajaj, S. (2020). Discordant Seismicity In Himalaya And Its Implications In Seismic Hazard Assessment For HE Projects. ICOLD, 2020.**
- v. Sharma. M. L. and Kumari, N. (2020). Simulation of near field ground motion for western Himalaya region based on hybrid method. 17th World Conference on Earthquake Engineering, 17WCEE, Sendai, Japan.**
- vi. Nath, R. R and Sharma, M. L. (2020). Neotectonic motion and its implications on landslides in Himalayas. 17th World Conference on Earthquake Engineering, 17WCEE, Sendai, Japan.**
- vii. Sharma, M. L. and Bajaj, S. (2020). Time-dependent seismic hazard assessment for Nepal Himalayas. 17th World Conference on Earthquake Engineering, 17WCEE, Sendai, Japan.**
- viii. Sharma P., Sharma M. L., and Sawant, V. A. (2020). Ground Response Analysis with Deep Bedrock Depth in Indo- Gangetic Plains. 7th International Conference on Recent Advances in Geotechnical Earthquake Engineering.**

- ix. Sharma P., Sharma M. L., and Sawant, V. A. (2020). Ground Response Analysis with Deep Bedrock Depth in Indo- Gangetic Plains. **Lecture Notes in Civil Engineering, Springer.**

b. International Conference

- i. Shanker, D. and Kumar, A. (2020). Spatial Variability of Resonance Frequency and Ground Amplification in Kochi City South- Central Kerala (SCK) Region – Paradigm to Seismic Microzonation, **17th World Conference on Earthquake Engineering, 17WCEE Sendai, Japan - September 13th to 18th 2020, Paper No. C000017.**
- ii. Marrapu, B.M. and Jakka, R.S. (2020). A Comparative Study on the Performance of ANN, MLR and MNR in the Assessment of Slope Stability for Kalla-Coonor Hill Road Stretch of Nilgiris, **International Conference on Emerging Trends in Engineering (ICETE), pp. 105-114, Hyderabad, India.**
- iii. Dubey, R. and Patel, K. P. (2020). Homogenized Model for In-Plane Analysis of Unreinforced Masonry Walls. **17th World Conference on Earthquake Engineering, 17WCEE, Sendai, Japan Paper No. C000088.**
- iv. Maheshwari, B. K. and Firoj, M. (2020). Equivalent Linear Spring-Dashpot Model for Embedded Foundations of NPP. **17th World Conference on Earthquake Engineering, Sendai Japan.**
- v. Shiradhonkar, S. and Sinha, R. (2020). A New Strain-Based Member Damage Classification for Post-Earthquake Visual Assessment of RC Frame Buildings **17th World Conference on Earthquake Engineering, Sendai Japan.**
- vi. Bashir, K., Shukla, R.P. and Jakka, R.S. (2020). Lateral Capacity of Skirted Footing Resting on Level Ground. **7th International Conference on Recent Advances in Geotechnical Earthquake Engineering.**

- vii. Desai, A. and Jakka, R.S. (2020). Numerical Simulation of MASW Test. **17th World Conference on Earthquake Engineering, 17WCEE, Sendai, Japan**
- viii. Bashir, K., Shukla, R.P. and Jakka, R.S. (2020). Skirted Footing for Enhancing Bearing Capacity. **17th World Conference on Earthquake Engineering, 17WCEE, Sendai, Japan.**
- ix. Zachariah, J.P. and Jakka, R.S. (2021). Liquefaction Potential of Ash Pond using SPT In: Sitharam, T.G., Kolathayar, S., and Sharma, M.L. (eds) Seismic Hazards and Risk. **Lecture Notes in Civil Engineering, vol 116. Springer, Singapore.**
- x. Gupta, S.C., Sachdeva, R., Sharma, M.L., Vishnoi, R.K. and Mani, M. (2020). Strong motion network in Tehri dam and Koteshwar dam in Uttarakhand Himalaya. **17th World Conference on Earthquake Engineering, Sendai Japan, Paper No. C002514.**
- xi. Sen, A., Gupta, S.C., Sharma, M.L. and Kumar, A. Seismotectonic prospective adjacent to Main Frontal Thrust and Ganga Foredeep in the Garhwal Himalaya, India. **17th World Conference on Earthquake Engineering, Sendai, Japan, Paper No. C002865.**

c. National Journals

- i. Kumar, N., Narayan, J.P., Kumar, V., and Tiwari, V. (2020). Effect of shape and complexity of ridge topography on the comparative amplification scenario for the SH- and SV-waves.
Journal of Earth System Science, 130(1), 1-20.
- ii. Kumar, V., Narayan, J.P., Khatri, V., Kumar, N., and Kamal. (2021). Effect of P-SV wave propagation on ground motion characteristics due to variation in subsurface basement topography.
Journal Ind. Geophys. Union, 25 (1) 1-8.
- iii. Kranthikumar, A. and Jakka, R.S. (2020). Effect of Edge Distance on Lateral Capacity of Piles in Cohesionless Soil Slopes.
IGT Journal (Springer), 50 (6), 925-934.

- iv. Nath, R.R., Sharma, M.L. and Tyagi, A. (2020). Review of the current practice of inclusion of seismicity in landslide susceptibility conation: A case study for Himalaya.
Himalayan Geology, 41 (2), 222-233.
- v. Kadam, S., and Singh, Y. (2020). Experimental investigations on masonry buildings strengthened using ferro-cement overlay under dynamic loading.
ISSET Journal of Earthquake Technology, 57(1), 1-16.

d. International Journals

- i. Narayan, J.P., Singh, P., and Verma, S. (2020). Quantification of role of impedance contrast in site-city-interaction effects on the response of building and basin,
Contribution to Geophysics and Geodesy,50(1), 135-159.
- ii. Ghowsi, A.F., Sahoo, D.R. and Kumar, P.C.A., (2020), Cyclic tests on hybrid buckling-restrained braces with Fe-based SMA core elements.
Journal of Constructional Steel Research, 175 (12), 106323.
- iii. Padalu, P.K.V.R., Singh, Y., and Das, S. (2020). Analytical modelling of out-of-plane flexural response of unreinforced and strengthened masonry walls.
Engineering Structures, 218, 110797, 1-22.
- iv. Padalu, P.K.V.R. and Singh, Y. (2021). Variation in Compressive Properties of Indian Brick Masonry and its Assessment using Empirical Models.
Structures, 33, 1734-1753.
- v. Kedia N.K., Kumar A. and Singh, Y. (2021). Effect of Rail Irregularities and Rail Pad on Track Vibration and Noise.
KSCE Journal of Civil Engineering, 25, 1341–1352.
- vi. Ahmad, A. and Singh, Y. (2021). In-plane behaviour of expanded polystyrene core reinforced concrete sandwich panels.
Construction and Building Materials, 269, 121804.

- vii. Roy, N., and Jakka, R.S. (2020). Mapping Surface Wave Dispersion Uncertainty in Vs Profiles to VS,30 and Site Response Analysis. **Soil Dynamics and Earthquake Engineering (Elsevier)**, 138, 1-17.
- viii. Roy, N., Desai, A., and Jakka, R.S. (2020). Surface Wave Dispersion in a Layered Medium for Varying Subsurface Scenarios. **International Journal of Geotechnical Earthquake Engineering (IJGEE)**, 11 (2), 26-49.
- ix. Kadiyan, N., Chatterjee, R.S., Pranjali, P., Agrawal, P., Jain, S.K., Angurala, M.L., Biyan, A.K., Sati, M.S., Kumar, D., Bhardwaj, A. and Ray, P.K.C. (2021). Assessment of Groundwater Depletion–induced land subsidence and Characterization of Damaging Cracks on Houses: a case study in Mohali-Chandigarh Area, India. **Bulletin of Engineering Geology and the Environment (Springer)**, 80, 3217–3231.
- x. Yadav, D., Kwatra, N. and Agarwal, P. (2021). Comparative Post-yield Performance Evaluation of Flexure Member with Corroded Reinforcement. **Structure and Infrastructure Engineering (Taylor & Francis)**, 17 (1), 103-123.
- xi. Majhi, D.R. and Shrikhande, M. (2021). Residual life of earthquake damaged structures. **Soil Dynamics and Earthquake Engineering**, 145,106694.
- xii. Goswami, N., Gupta, S.C. and Kumar, A. (2021). Estimation of quality factor, seismic moment and stress drop of local earthquakes along the MCT in Chamoli region, India. **Arabian Journal of Geosciences**, 14, 1236, 1-8.

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