

# STRUCTURAL REPAIRS AND MAINTENANCE FOR BUILT HERITAGE

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ONLINE CERTIFICATE COURSE





The Center for Heritage Conservation (CHC) has a vision of becoming the focal point in research, advisory and capacity building of the practice and policy of heritage conservation in the country.

With a firm belief in the ethics of conservation and sustainability, the Center intends to engage with municipal corporations, departments and ministries at central and state level, private practitioners and developers to inform practices on the ground and create sustainable and equitable solutions. CHC will also act as a repository of existing knowledge and contribute towards generating awareness and an intelligent discourse around the subject among the citizens and other interest groups.

[www.crdf.org.in/center/center-for-heritage-conservation](http://www.crdf.org.in/center/center-for-heritage-conservation)



## ABOUT THE COURSE

This Online Certificate Course, to be held on four consecutive Saturdays, aims to provide the participants an exposure of the aspects related to the structural conservation of the built heritage.

The structures of architectural, monumental, and cultural significance, by their very nature, present numerous challenges in the analysis, diagnosis, and restoration, limiting the application of the modern building codes and standards.

Pertaining to a large number of monuments and world heritage sites in India, the conservation and rehabilitation of heritage structures has become an issue of significant importance in our country.

Most of the work being done in the field of heritage conservation today is being focused on the post-disaster repair and strengthening of their architectural aspects and the task of structural conservation becomes relatively challenging in terms of defining an efficient approach of conservation.

Through this course such challenges shall be addressed and the participants will get to learn the various techniques of repair, assessment and the process of structural conservation.

## CONTACT TIME

This Course will be conducted from 10.30 am to 4.30 pm on the following dates:

2021	27 <sup>th</sup> FEB	06 <sup>th</sup> MAR	13 <sup>th</sup> MAR	20 <sup>th</sup> MAR
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## COURSE STRUCTURE & MODULES

This course focuses on the approach to conserve the structural aspects of heritage buildings. It has been divided into four interdisciplinary modules. The first two modules will focus on understanding the structural systems and construction materials of heritage structures. The methodology of determining the extent of damage and interventions required to curb those damages will be discussed during the third and the fourth module.

### ORIENTATION SESSION

Saturday, February 20, 2021; from 6.30 pm to 7.30 pm with Course Coordinator Nigar Shaikh

### WEEK 1

#### Module I Basic Understanding of Structures

Tutor: Mehul R Shah

Guest Lectures: 'Why conserve? Understanding heritage values' by Dr. Jigna Desai  
'Professional Ethics and Challenges' by Dr. Arun Menon

This module will deal with the basics of heritage structures. The classification of heritage structures with respect to time, materials, and methodology of construction will be briefly discussed. Depending on the structural system of few monuments, the discussions will be elaborated on the types of loads coming on the structure, load flow path, joint mechanism of the structural elements, and strengths and weaknesses of each will be highlighted. Common actions that induce stresses and strains in the structure, and any chemical, physical or biological phenomenon which affects the material, reducing its strength shall be discussed elaborately in this module.

### WEEK 2

#### Module II Historic Building Materials

Tutor: Khushi Shah

Guest Lectures: 'Use and Conservation of Lime in Heritage buildings' by Dr. Thirumalini S.  
'Conservation of Timber Structures' by Dr. Jorge Branco

Most of the historic monuments and traditional buildings have been built using locally available materials, technology, and crafts skills. A scientific understanding of historic building materials and construction technology is a prerequisite for successful and sympathetic interventions on built heritage. This module aims to introduce the participants to criteria and principles in the selection of appropriate building materials for repairs and restoration of historic structures. The key properties of traditional buildings materials; their common uses in construction; the processes of their deterioration and challenges in conservation and restoration will be discussed, followed by an introduction to scientific techniques for investigation and material characterization leading to the selection of compatible materials for intervention. Widely used traditional materials - earth, timber, stones, and lime will be focused upon during this module.

## WEEK 3

### Module III Structural Assessment and Testing

Tutor: Aanal Shah

Guest Lectures: 'Condition Assessment & Numerical Analysis of Qutub Minar using Non-Linear Plastic-Damage Macro Model for constituent masonry'  
by Dr. Ajay Chourasia

'Vulnerability Assessment of a Heritage Structure Subjected to Blast - Induced Vibrations: A Case Study on 800 year Old Ramappa Temple'  
by Dr. Ramancharla Pradeep Kumar

This module will introduce the participants to the steps of structural assessment through input lectures and case study presentations. Prior to any structural strengthening or repair interventions in a heritage structure, the estimation of the expected strength of the existing structural elements is indispensable. This includes the evaluation of material strengths, extensive knowledge of the presence of cracks, joint openings, and other discontinuities. Investigation of the structure done in the right way can help in providing the most cost-effective, optimal remedial solutions that would require the least amount of intervention. Impact of visual inspection, field and laboratory tests (destructive, non-destructive, and partially destructive) to determine mechanical, physical, and chemical characteristics and continuous monitoring methods will be discussed. To summarize, this module lays emphasis on the various interventions and methodologies involved in the assessment (qualitative and quantitative approach of the damaged structures). The applicability of current standards and assessment of factor of safety will also be briefly discussed and will be supported by referring to the existing national and international case studies.

## WEEK 4

### Module IV Repair Techniques

Tutor: Aanal Shah

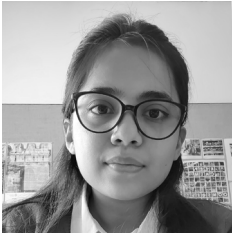
Guest Lectures: 'Structural Inputs for Conservation of Ananda-Ok-Kyaung'  
by Dr. Tamali Bhowmik

'From Structural Assessment to Structural Intervention in Historical Constructions' by Dr. Arun Menon

To safeguard the cultural heritage, stabilization and strengthening of the structure are required. This module will focus on different repair techniques required for different types of material and damages in historic buildings. After the investigative procedure is completed, and the correct reason/s of the damage is diagnosed, the progressive phenomena of the assessed damages are studied and recorded. These observations lead to a suitable rational solution for structural repairs involving minimal interventions, cost-effectiveness, environmental sustainability, and feasibility of execution. The decisions regarding the interventions made should be taken after the careful diagnostic and safety evaluation by a team of individuals from various fields involved in conservation. These decisions should take into account both the structural safety and considerations of historic character. The various types of interventions, their pros and cons on the basis of the level of intervention, and their correlation with cost and historic character of the building will be discussed in this module.

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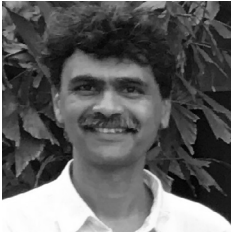
## COURSE COORDINATOR



**NIGAR SHAIKH**

Nigar Shaikh is a civil engineer with a Bachelors in Construction Technology (Hons.) from Faculty of Technology, CEPT University, Ahmedabad. She holds a MSc in Advanced Structural Analysis of Monuments and Historic Construction (SAHC), a double degree course from University of Minho, Portugal and Czech Technical University, Czech Republic. She has worked on projects like the restoration work of City palace and Zanana Hospital in Udaipur, Laxmi Villas Palace in Vadodara, etc. She is currently working as the Conservation Laboratory In-charge at CEPT University and Research Associate at Center for Heritage Conservation (CHC), CEPT University. Her area of interest lies in risk assessment of built heritage, structural health monitoring, material characterization and working on reverse engineering of historic building materials.

## COURSE TUTORS



**MEHUL R SHAH**

Mehul R Shah has been working as a Structural Engineer after completing his master's in CASAD. He was a core faculty member at the School of Building Science and Technology, CEPT University, and then continued as a visiting professional in different faculties at CEPT University, mainly involved in guiding students in the area of structural concepts and earthquake-resistant design. He is also a visiting faculty at National Forensic Sciences University teaching students of the Forensic Structural Engineering masters programme. He is involved as a Professional in the area of Earthquake Structural Engineering, investigation, repairs, and rehabilitation of structures and structural conservation of heritage structures.



**KHUSHI SHAH**

Khushi Shah is a Conservation Architect and Adjunct Assistant Professor at Faculty of Architecture, CEPT University. She completed her Specialisation in Heritage Conservation from Centre des Hautes Etudes de Chaillot (Ecole de Chaillot), Paris, France and B. Arch from M. S. University, Baroda. She has over 17 years of experience in the field of Architectural & Urban Heritage Conservation. She was a key team member for the preparation of the World Heritage Nomination dossier for the Historic City of Ahmadabad with CEPT. She has also worked on various documentation and restoration projects as part of the Indo-French Collaboration project on the revitalisation of the walled city of Ahmedabad. Her key research interests include built heritage conservation, traditional building materials, structural behaviour of historic buildings and traditional settlements.



**DR. AANAL SHAH**

Associated with CEPT University since 14 years, Aanal is a Professor and Acting Dean at the Faculty of Technology and the Program Chair of Structural Engineering Design. She was also the Director of Diploma Certificate office for almost six years, under which CEPT's prestigious Summer Winter Schools are offered. Her experience of working with faculty members across the world for developing the course structure was useful in contributing to the pedagogical shift and restructuring of the Bachelor of Construction Technology program at the Faculty of Technology, CEPT University. Aanal has done her post-graduation in Structural Design from CEPT University and holds a bachelor's degree in Civil Engineering from L D College of Engineering. About 43 research theses have been accomplished under her able guidance. She has presented her research at various national and international conferences. At CEPT, she takes studios and subjects related to the design of reinforced concrete structures (buildings, shell structures, silos, water tanks, chimneys, construction failures, and rehabilitation). Promoting the development of sustainable alternatives for building materials, she has received a Ph.D. in the area of geo-polymer concrete from CEPT University.



## GUEST SPEAKERS



**DR. JIGNA DESAI**

Jigna Desai is an Associate Professor and the Program Chair for Masters in Conservation and Regeneration at the Faculty of Architecture at CEPT University. She brings to the institute her experience in working with traditional urban environments and framing how traditional architecture may be understood, studied and transformed. Her current work focuses on formulating frameworks, tools and methods through which theoretical ideas of sustainability and conservation of living historic environments can be translated into practice, while addressing the challenges of co-production of space and commodification of heritage. Jigna has studied architecture and has a master's degree in sustainable architecture from Cardiff University and a PhD in Conservation Studies from CEPT University.



**DR. ARUN MENON**

Arun Menon, Associate Professor of Structural Engineering at IIT Madras, holds a first degree in architecture, and Ph.D. in earthquake engineering from the University of Pavia, Italy. He has authored/co-authored 75 technical articles in areas of structural aspects of historical constructions, earthquake behavior of historical masonry structures, and earthquake-resistant structural masonry. He currently coordinates the activities of the National Centre for Safety of Heritage Structures (NCSHS), a Ministry of HRD (Govt. of India) -supported research centre at IIT Madras. He was an Expert Member on the International Coordinating Committee (BICC) for the UNESCO World Heritage Site of Bagan, Myanmar, and currently is a Member, Expert Advisory Group to International Conservation Committee (ICC) for Vat Phou UNESCO World Heritage Site in Laos PDR. He has been involved in conservation projects in India, Bhutan, Myanmar, and The Philippines.



**DR. THIRUMALINI  
SELVARAJ**

Dr. S. Thirumalini is an Associate Professor at the Vellore Institute of Technology, Vellore, India. She has been an associate professor at the R.M.K Engineering College, lecturer at the Jaya Engineering College, SVCET, Tirupachur and Pallavan Engineering College. She holds a Ph.D from Vellore Institute of Technology and has two patents under her name. She has undertaken various consultancy projects involving production of limecrete, organic lime mortars for green building, chemical analysis, analytical testing and interpretation of lime mortar samples for private heritage structures. Additionally she has been the Scientific advisor for Hindu Religious and Charitable Endowments department, for Tamil Nadu State Archaeological department, Heritage consultant for Archaeological Survey of India, Govt. of India, New Delhi, Material consultant for Maharana Mewar Charitable Foundation for Udaipur palace, Rajasthan, India among others.



**DR. JORGE  
BRANCO**

Jorge Branco is an Assistant Professor in the Department of Civil Engineering, University of Minho, Portugal, where he has been developing research in the field of timber constructions. Jorge Branco is experienced in the fields of timber structures, from wood and wood-based products characterization, design of connections, to the diagnosis and strengthening of timber elements and joints. The robustness and resilience of timber structures, in particular, the ones located in seismic regions, are important topics of his research. Jorge Branco is Chair of the RILEM Technical Committee RTE - Reinforcement of Timber Elements in Existing Structures, member of the WG8 for the seismic performance of timber structures, and member of the Portuguese standardization committee CT14.



**DR. AJAY  
CHOURASIA**

Dr. Ajay Chourasia is a Senior Principal Scientist and Group Leader of 3D Concrete Printing Group at CSIR - Central Building Research Institute, Roorkee with a Ph.D. (Structural Engineering) from IIT Roorkee. Presently, he is a Team Leader for 'Post-earthquake reconstruction of Education and Health Infrastructure in Nepal' under Govt. of India funded projects. He has published over 100 papers, 75 reports and books on Earthquake Resistant Design & Construction, Guidelines for Confined Masonry, Structural Design & Detailing of Confined Masonry EWS Houses, and Good Construction Practices.

He has filed 4 Indian patents. He developed 'Spinners: Tool for the design of RC Slabs and Beams for Residential Buildings' and a documentary on 'Confined Masonry'- both widely referred to in the construction sector.

He was a pioneer in establishing the Building Dynamics Laboratory; Construction Technology Demonstration Park at CSIR-CBRI and was instrumental in the post-disaster rehabilitation of Kedarpuri at Kedarnath.

He has done many collaborative and sponsored industrial projects for industrial & strategic sectors; notable of them include those funded by IGCAR, BARC, NTPC, NDMA, Airport Authority of India, IOCL, BPCL, Navodaya Vidhyalaya Samiti, Ministry of External Affairs, Fertilizer Plants, Ports, etc.

His area of interest encompasses precast buildings, structural health monitoring; experimental investigation of buildings and their components; earthquake resistant design, construction; confined masonry, repair & retrofitting of structures, seismic vulnerability assessment, post-earthquake damage assessment, numerical analysis, historical construction, etc.



**DR.  
RAMANCHARLA  
PRADEEP KUMAR**

R Pradeep Kumar pursued a Ph.D. from Tokyo, Japan and then worked as a post-doctoral research fellow for a year (2001- 02). He joined IIT Hyderabad in September 2002 and started the Earthquake Engineering Research Centre (EERC). He was also instrumental in initiating a graduate program on Computer-Aided Structural Engineering (CASE) at IIT Hyderabad in 2002.

He has published over 100 papers in international and national journals and has developed the Applied Element Method (AEM) to solve crack initiation and propagation in near-fault rupture phenomenon and reduced computation time, to understand future possible large earthquakes in the Himalayan region. He has extended this method to study the collapse behavior of structures subjected to blast loading.

He has developed a new methodology for documenting Housing Typologies and estimating the Earthquake Disaster Risk Index of cities. Currently, this Indexing method is adopted by the National Disaster Management Authority for ranking cities across the nation to understand their relative risk profiles towards launching Disaster Management initiatives. In association with NDMA, he developed A Primer on Rapid Visual Screening of Buildings for Earthquake Safety Assessment. He has also undertaken vulnerability assessment of buildings for many state governments and 6 major ports in Gujarat.

He is an expert committee member of the Post-Earthquake Reconnaissance Team (PERT) of NDMA, Government of India, a BIS panel member of IS 456 & IS 1343, Earthquake Engineering Sectional Committee, and of the National Building Code of India.



**DR. TAMALI  
BHOWMIK**

Dr. Tamali Bhowmik is currently serving as the Senior Project Officer at National Centre for Safety of Heritage Structures (NCSHS), Indian Institute of Technology, Madras, India. She received her Ph.D. in Civil Engineering from the National University of Singapore in 2012. Her research interests include retrofitting of concrete structures, FEM & structural dynamics, and conservation of heritage structures. She has been working in NCSHS for the last 6 years and has worked on various projects for the conservation of heritage structures in India and Myanmar. She is currently working on a DST funded project entitled “Developing seismic strengthening strategies for ancient South Indian mandapas”.

## APPLICATION AND ADMISSIONS

Civil engineers, teachers and researchers of civil engineering, construction technology, architecture, urban design, and conservation will find this course extremely useful in understanding the structural conservation aspect of safeguarding built heritage.

**REGISTER NOW**

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Application Process	Online applications have been open since January 09, 2021. Applicants should complete the online registration and attach the following documents. <ul style="list-style-type: none"><li>• Statement of purpose</li><li>• Resume / CV</li></ul> Alternatively, participants can download the form and email it with the required documents at <a href="mailto:chc@cept.ac.in">chc@cept.ac.in</a> . Add 'Application for Online Course on Structural Repairs and Maintenance for Built Heritage' in the Subject line.
Application Deadline	February 12, 2021
Program Commences	February 27, 2021
Prerequisites	Participants must have a Bachelor's in Civil Engineering, Architecture or any field allied to applied mechanics studies.
Fees	INR 22,000 + GST
Certificate	Participants will receive a certificate on successful completion of all the assignments in the course and a minimum of 85% attendance.

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For regular updates, visit: [www.crdf.org.in](http://www.crdf.org.in)



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