SECOND SEMESTER 2021-22
COURSE HANDOUT

Date: 12.01.2022

In addition to part I (General Handout for all courses appended to the Time Table) this portion gives further specific details regarding the course.

Course No	**: CE F416**
Course Title	**: COMPUTER APPLICATIONS IN CIVIL ENGINEERING**
Instructor-in-Charge	**: NISHANT ROY**
Instructor(s)	**: MD RUSHDIE IBNE ISLAM**

1. Course Description: Idealization of real life problems in computational framework, Analysis of structural elements and buildings in STAAD.Pro, Design and detailing using STAAD RCDC, Seismic analysis and design as per relevant codes of practice, Blast simulations, contact and interactions in Abaqus, Introduction to MATLAB codes. Mesh-free methods, Types of mesh-free methods, Smoothed particle hydrodynamics (SPH), Basic SPH concept and formulation; Modelling of problems in structural, soil, rock and fluid mechanics, Fluid structure interaction problems, Geomaterial flows.

2. Scope and Objective of the Course:

The availability of computational resources has transformed the working environment in the industry. Challenging projects are now planned and designed at a fast pace using various software packages. It is imperative for a graduating civil engineer to develop the skill-sets required to apply engineering knowledge in a computational framework. This course is designed to provide sufficient background required to use various software packages and computational tools to solve civil engineering problems.

On successful completion of the course, the student will be able to:

- Understand the applications of various software packages and mesh-free methods.
- Understand the idealizations required for simulation of a real life problem.
- Derive required input parameters from data and reports available to the design engineer.
- Set up proper numerical simulations in software packages and/or develop customized computer programs.
- Integrate python and MATLAB codes for extending the utility of commercial softwares
- Develop the necessary skill-set to take up advanced numerical studies.

3. Text Books:
T1. Relevant IS Codes and Class Notes/PPT

4. Reference Books:
R1. Staad.Pro Connect Edition Readme.
R2. Abaqus/Standard User's Manual.
R3. Liu, G. R. and Liu, M. B. "Smoothed Particle Hydrodynamics - A Meshfree Particle Method", World Scientific Publishing Co Pte Ltd – 2003, ISBN: 978-981-4365-57-4.

5. Course Plan:

Module No.	Lecture Session	Reference	Learning outcomes
	Introduction to the Course		General idea of the course
I: Analysis and Design of Structural Components	Introduction to various features available in Staad.Pro Connect Edition	T1	Familiarity with various modules available in STAAD.Pro Connect Edition
	Idealization of structural components, Load paths in buildings, Analysis of Multi-storey building, Codal provisions for design and detailing, STAAD RCDC for automating the design and detailing.	T1,R1,R3	Complete design and detailing of various components of buildings including substructures as per relevant codes of practice
	Behavior of buildings under earthquake, Introduction to IS 1893:2016, Equivalent static method, Response spectrum method, Time-history analysis, Seismic analysis and design using traditional methods and computational softwares. Introduction to capacity based design	T1,R1,R3	Behavior of buildings under earthquake, Seismic analysis and design of structures. Capacity based design
II: Blast Simulations	Introduction to Abaqus, Coupled Eulerian-Lagrangian method for blast simulation, Air blasts, Contact and interaction problems, Stress Concentrations	T1,R1,R3	Blast simulations for above ground and buried structures, contact and interactions, advance usage of FE package
III: Particle-based methods	Overview of mesh-free methods and their types; Particle representation and approximation; Application to real-life problems and their limitations	Class Notes/PPT	Basics of particle-based methods
	Basic SPH concepts and formulation; Smoothing functions; Artificial Viscosity; Tensile instability and artificial pressure	Class Notes/PPT	Basics of SPH
IV: Constitutive modelling, equation of states	Numerical modelling of elasticity and plasticity models such as elastic model, elastic-perfect plastic model, material hardening and softening etc.; Different types of EOS for various materials	Class Notes/PPT	Numerical implementation of constitutive models, EOS

V: Development of computational framework and open-source codes	Development of codes for modelling of solids, fluids, soil, rocks, and their interaction, Modelling of material damage and failure; Introduction to open-source codes	Class Notes/PPT	Development of particle-based codes and their coupling

6. Evaluation Scheme:

Component	**Duration**	**Weightage (%)**	**Date & Time**	**Nature of component (Close Book/ Open Book)**
Mid-Semester Test	90 Min.	30	<TEST_1>	Close Book/Open Book
Comprehensive Examination	3 h	30	<TEST_C>	Close Book/Open Book
Project/Continual Assessment		40		

7. Chamber Consultation Hour: To be notified in class.

8. Notices: Notices, if any, will be notified via Google Classroom.

9. Make-up Policy: Genuine cases as per institute guidelines will be considered provided it is intimidated before the examination.

10. Note (if any): - A laptop with a battery backup of minimum 3 hours is required.

Instructor-in-charge
Course No. CE F416