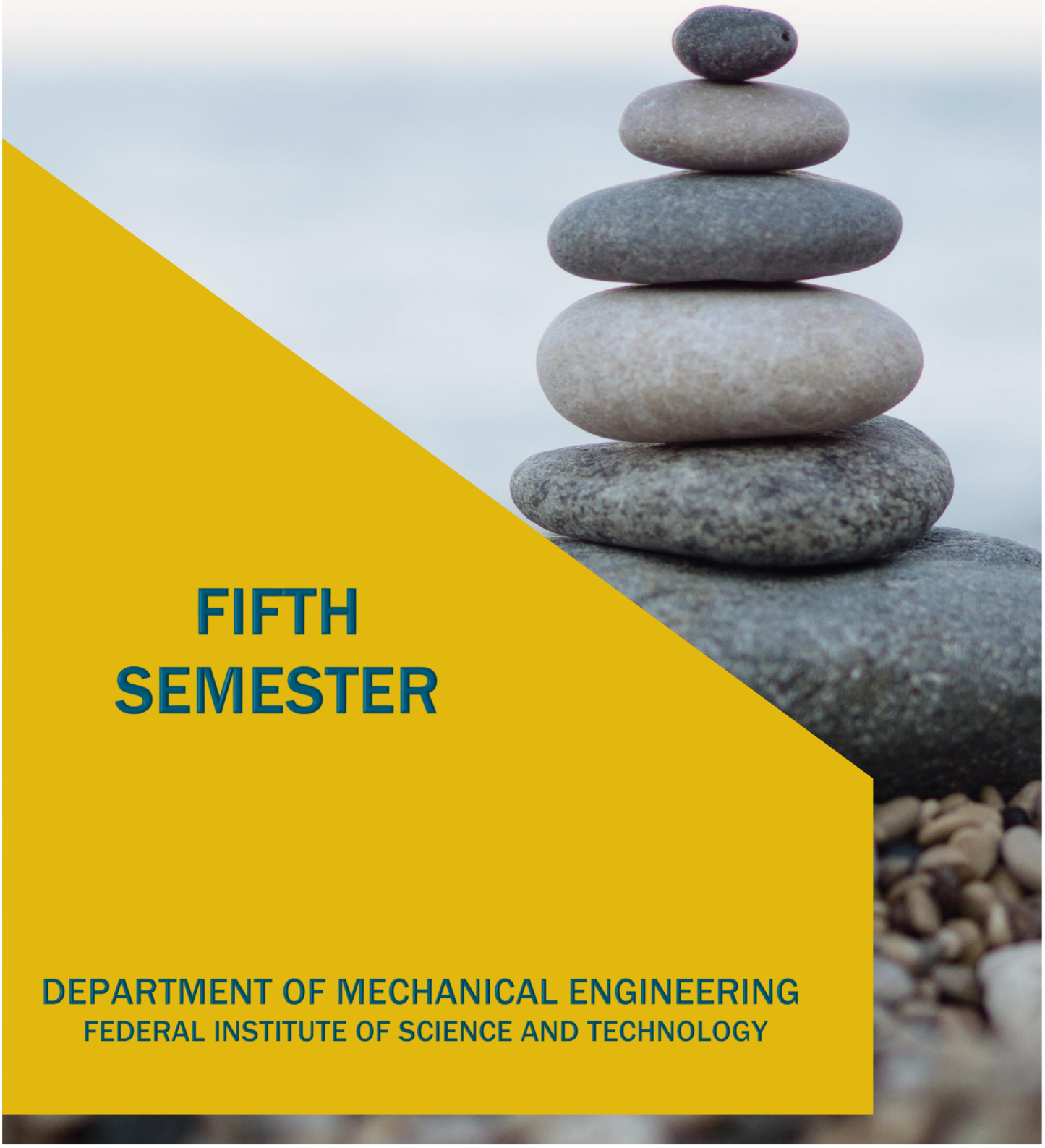
VALUE ADDED COURSES



FIFTH SEMESTER

DEPARTMENT OF MECHANICAL ENGINEERING
FEDERAL INSTITUTE OF SCIENCE AND TECHNOLOGY

Introduction to FEA using ANSYS 2021

Fifth Semester - Mechanical Engineering - 2019 Admission

Faculty Information

Instructor	Contact Information	Area of Interest
Mr.Renjith R	**renjithr@fisat.ac.in** **Mob:9496563100** **Linkedin: linkedin.com/in/renjith-r-a929a2143** **Research gate: https://www.researchgate.net/profile/Renith-Ravindranathan**	Finite Element Analysis, Computational Fluid Dynamics, Composite Materials, Open Source Numerical Modeling, Robotics and 3D printing

General Information

Course Objectives

a. Students should perform essential steps in setting up a FEA analysis

b. Students should Create high quality FEA Simulation meshes from imported CAD geometry

c. Perform all steps of a FEA simulation from CAD import to meshing to solution to results

Course Outcomes

Upon completion of the course, student will be able to effectively use Excel to

- Prepare CAD models for use in Ansys 2021 for FEA analysis
- Setup high quality meshes using fluent
- Do an introductory FEA analysis using ANSYS 2021
- Use the parametric workflow with Ansys to execute parametric studies on FEA analysis
- Post process and judge results from FEA analysis
- **Verify and validate FEA model with experimental analysis**

Reference Books and Tutorials

- Logan, D. L. (2016). A First Course in the Finite Element Method. United States: Cengage Learning
- Zienkiewicz, O. C., Taylor, R. L., Taylor, R. L. (2000). The Finite Element Method: Solid mechanics. Netherlands: Butterworth-Heinemann.
- Rao, S. S. (1989). The Finite Element Method in Engineering. United Kingdom: Pergamon Press.

Course Contents

Module	Topic	Exercises
Module 1	FEA theory, Introduction to ANSYS Workbench, Geometry basics (Design Modeler), Geometry (Design Modeler), Geometry (Design Modeler), Engineering data, Matrials and coordinate systems.	Exercises: CAD geometry creation using Design modeler and space claim
Module 2	Composite Materials, connections, Meshing, Analysis settings, Loads and Supports, Loads and Supports, Post processor(Results).	Exercises: Material property (Iso-Ortho-Anisotropic) calculations and assignment of material to a particular model
Module 3	static Structural Analysis (monotonic loading), static Structural Analysis (Cyclic), static Structural Analysis (Functional Loading), Non-Linear Static Analysis.	Exercises: Analysis of a cantilever beam, Analysis of a plate, Analysis of a solid column
Module 4	Transient analysis, Mesh for transient analysis, Temporal and spatial variation of loads, Time step and sub steps, Damping controls, Time history post processor.	Exercises: Drop analysis, UVL and UDL on different beams
Module 5	Modal Analysis (Natural Frequency), Eigen Value Buckling Analysis, Eigen Value Buckling Analysis, Random Vibration Analysis, Harmonic Excitation	Exercises : Modal analysis of a crank shaft, Buckling analysis of long column, Vibrational analysis of automobile chassis.

Evaluation Schedule

Date	Details
	Project 1: Structural analysis of composite machine part

Additional Information and Resources

Additive manufacturing

Fifth Semester - Mechanical Engineering - 2019 Admission

Faculty Information

Instructor	Contact Information	Area of Interest
Mr Arun J Kulangara	arunjkulangara@fisat.ac.in Mob: 9496576162 LinkedIn: www.linkedin.com/in/arun-joseph-42755390/	Additive Manufacturing, DfAM, Lattice Structures, Material characterization and mechanical behaviour
Mr Ranjit Joy	ranjitjoy@fisat.ac.in Mob: 9895400785 LinkedIn: www.linkedin.com/in/ranjit-joy	Additive manufacturing Material Characterization Process Modelling

General Information

Course Objectives

a. To introduce additive manufacturing concept and various technologies used for additive manufacturing

b. To study 3D modelling of any product with a knowledge of various file formats and materials used for 3D printing

c. To enable students to have experiential learning in 3D modelling, build-setup preparation and 3D printing through assignments

Course Outcomes

Upon completion of the course, student will be able to

a. Have an understanding of various additive manufacturing technologies

b. Design and develop products using fused deposition modelling

c. Have an understanding of various materials used for 3D printing and the associated challenges

d. Optimize various process parameters to develop products

e. Use DfAM methods and lattice structures to develop products efficiently

Course Materials

Reference Books and Tutorials

- **Additive Manufacturing Technologies:** 3D Printing, Rapid Prototyping, and Direct Digital Manufacturing, By Ian Gibson, David Rosen, Brent Stucker
- https://www.coursera.org/programs/federal-institute-of-science-and-technology-ke3cq/browse?productId=OhRHyaH8EeuGZQrYTGtRUQ&productType=s12n&query=3d+rinting&showMiniModal=true
- https://www.mheducation.co.in/additive-manufacturing-9789390727483-india

Course Contents

Module	Topic	Exercises
Module 1	Introduction to AM- Comparison of AM with conventional manufacturing methods; Steps in AM; AM Processes- Material Jetting, Material Extrusion, PBF, DED, Binder Jetting, Photopolymerization, Sheet Lamination; Advantages and applications of AM	Identification of a part that can be 3D printed that has application in your day today life and justify why you prefered FDM than the conventional manufacturing method? Explain in not less than 100 words.
Module 2	Introduction to Fused Deposition Modelling; FDM Hardware; process parameters of FDM- effect of parameters on properties of printed part; Introduction to CAD file formats	Develop an improved design: proper orientation, optimal setup, process parameters for 3D printing an engineering component with a FDM.
Module 3	Materials used for FDM- PLA, ABS, Nylon- Advantages, challenges of each material	Find the methods to overcome various challenges occurring during FDM
Module 4	Slicing softwares-Functions; Introduction to CURA- Parameters- procedure to develop a sliced file	Optimising printing process with respect to print time by varying parameters in Cura

Module 5	Design for Additive Manufacturing- Topology Optimization, Generative Design,Lattice Structures; Advantages, CAD Modelling, Reverse engineering-photogrammetry.	Improve the design of an engineering component utilizing DfAM methodologies.

Evaluation Schedule

Date	Details
	Project 1: Design and additive manufacturing (prototypes) of slider crank mechanism, crank rocker mechanism and slotted lever mechanism.

Additional Information and Resources