

FR. Conceicao Rodrigues College Of Engineering
 Father Agnel Ashram, Bandstand, Bandra-west, Mumbai-50
Department of Production Engineering

T.E. (Production) (semester V) (2020-2021)

Lecture Plan

Subject: Machine Design - I (MD-I-PEC503)

Credits-04

Subject: Machine Design – I Laboratory (MD-I PEL502)

Credits-01

1. Syllabus.

Module	Contents	Hrs.
01	1.1. Introduction - Steps involved in designing, types of designs, considerations in designing, Design-manufacturing interface, material selection, factor of safety and its implications. 1.2. Operational Joints - Introduction to cottered, pinned & threaded joints, & their applications. 1.3. Design of socket & spigot type 1.4. Design of Pinned Joints - Knuckle joint 1.5. Design of Turn Buckle	10
02	2.1 Determination of stresses in machine components with various cross sections. Circular, rectangular, triangular, trapezoidal, T & I sections subjected to direct & bending stresses. (Including stresses at critical sections) 2.1. Stresses in curved members- Design of crane hooks & C-clamps with various cross sections (Circular, triangular, square, rectangular, trapezoidal) (Circular & oval rings to be excluded).	06
03	3.1. Design of shafts 3.1.1. Design of shafts on the basis of strength. Shafts subjected to bending alone, Torsion alone, combined action of torsion & bending, combined action of torsion & axial loads, combined action of torsion, bending & axial loads (Rankine's and Guest's equations) 3.1.2. Concepts about design of shafts based on rigidity (lateral & torsional rigidity)- only Implications 3.2. Design of keys 3.2.1. Different types of keys and applications. 3.2.2. Fitting of keys – types and effects of keyway on shaft 3.2.3. Stresses in keys and design of key dimensions. 3.3. Design of couplings: 3.3.1. Classification of couplings & application areas.	10

	3.3.2. Design of flanged couplings, muff couplings, bushed pin type flexible coupling.	
04	4.1. Design of welded joints- Types & classification of welded joints, applications. Familiarization of AWS code. Strength of welded joints- Transverse & parallel fillet welds. Welded joints subjected to torsion – circular fillet welds and adjacent fillet welds. 4.2. Design of welded joints subjected to eccentric loading	06
05	5.1. Design of bolted joints- stresses in bolts, joints for leak proof fluid tight applications (like cylinder to cylinder cover fastening in an IC engine), bolts of uniform strength. 5.2. Design of riveted joints- Type of rivets and riveted joints. Failure modes of riveted joints & efficiency of riveted joints. Design of riveted joints for riveting longitudinal & circumferential seams of pressure vessels. Familiarization of Indian Boiler Regulation (IBR) 5.3. Design of bolted and riveted joints subjected to eccentric loading.	10
06	6.1. Design of Springs: Classification and applications, design of helical compression and tension springs (only circular cross-section), co-axial springs. Design of leaf springs—straight and semi elliptical laminated leaf springs. Strain energy of springs—design of buffer springs. 6.2. Design of Pressure Vessels: Design concepts of thick and compound cylinders, Stresses in thick & compound cylinders. Determination of wall thickness, hoop and radial stresses, nature of hoop and radial stress distribution on cylinder walls.	06

2. CO Statements.

Learner will be able to

PEC503.1 Apply basic principles of machine design.

PEC503.2 Design joints such as knuckle joint/turn buckle.

PEC503.3 Design machine elements such keys, shafts, couplings/springs.

PEC503.4 Design pressure vessels.

PEC503.5 Design weld joint.

PEC503.6 Design rivet/bolt joints

3. CO-PO-PSO Mapping.

CO# / PO#	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
PEC503.1	3	3	3	-	-	-	-	-	-	-	-	-
PEC503.2	3	3	3	-	-	-	-	-	-	-	-	-
PEC503.3	3	3	3	-	-	-	-	-	-	-	-	-
PEC503.4	3	3	3	-	-	-	-	-	-	-	-	-
PEC503.5	3	3	3	-	-	-	-	-	-	-	-	-
PEC503.6	3	3	3	-	-	-	-	-	-	-	-	-

CO# / PSO#	PSO1	PSO2
PEC503.1	2	-
PEC503.2	2	-
PEC503.3	2	-
PEC503.4	2	-
PEC503.5	2	-
PEC503.6	2	-

4. CO Assessment tools with target.

	Target for Assessment Tools		
	Unit Test	End Semester Exam	Course Exit Survey
PEC503.1	50%	50%	60%
PEC503.2	50%	50%	60%
PEC503.3	50%	50%	60%
PEC503.4	50%	50%	60%
PEC503.5	50%	50%	60%
PEC503.6	-	50%	60%

5. Curriculum Gap/Content beyond syllabus (if any).

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6. Lecture/Lab/Mini Project/Assignment Plan.

(Due to Online Lectures during Lockdown Period, Machine Design – I lab work is covered during theory lecture *Topic in brown indicate lab work)

Week	Duration (Hrs.)	Topic	Module
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Week 1 (10/07/20)	1	1.1. Introduction - Steps involved in designing, types of designs, considerations in designing	1
Week 2 (13/07/20 – 17/07/20)	4	Design–manufacturing interface, material selection, factor of safety and its implications. 1.2. Operational Joints - Introduction to cottered, pinned & threaded joints, & their applications. 1.3. Design of socket & spigot type	1
Week 3 (20/07/20 – 24/07/20)	4	1.4. Design of Pinned Joints - Knuckle joint 1.5. Design of Turn Buckle	1
Week 4 (27/07/20 – 31/07/20)	4	2.1 Determination of stresses in machine components with various cross sections. Circular, rectangular, triangular, trapezoidal, T & I sections subjected to direct & bending stresses. (Including stresses at critical sections) 2.1. Stresses in curved members- Design of crane hooks & C-clamps with various cross sections (Circular, triangular, square, rectangular, trapezoidal) (Circular & oval rings to be excluded).	2
Week 5 (03/08/20 – 07/08/20)	4	3.2. Design of keys 3.2.1. Different types of keys and applications. 3.2.2. Fitting of keys – types and effects of keyway on shaft 3.2.3. Stresses in keys and design of key dimensions.	3
Week 6 (10/08/20 – 14/08/20)	4	3.3. Design of couplings: 3.3.1. Classification of couplings & application areas. Design of couplings Muff Coupling, Rigid Flange Coupling, Bush Pin type of Flexible Coupling, Marine Flange Coupling Assignment on Couplings (Lab Work)	3
Week 7 (17/08/20 – 21/08/20)	4	Assignment on Couplings (Lab Work) Assignment on Curved Beams (Lab Work) Assignment on Joints (Lab Work)	3
Mid Term Break			

Week 8 (31/08/20 – 09/09/20)	4	3.1. Design of shafts 3.1.1. Design of shafts on the basis of strength. Shafts subjected to- bending alone, Torsion alone Design of Shafts Subjected to: combined action of torsion & bending, combined action of torsion & axial loads, combined action of torsion, bending & axial loads (Rankine's and Guest's equations) Assignment on Shafts (Lab Work)	3
Week 9 (07/09/20 – 11/09/20)	4	3.1.2. Concepts about design of shafts based on rigidity (lateral & torsional rigidity)- only Implications Design of welded joints- Types & classification of welded joints, applications. Familiarization of AWS code. Strength of welded joints- Transverse & parallel fillet welds. Welded joints subjected to torsion – circular fillet welds and adjacent fillet welds.	3 and 4
Week 10 (14/09/20 – 18/09/20)		4.2. Design of welded joints subjected to eccentric loading. Revision for UT	
	UT 1		
Week 12 (28/09/20 – 02/10/20)	4	Assignment on Welded Joints (Lab Work) 5.2. Design of riveted joints- Type of rivets and riveted joints. Failure modes of riveted joints & efficiency of riveted joints. Design of riveted joints for riveting longitudinal & circumferential seams of pressure vessels. Familiarization of Indian Boiler Regulation (IBR)	5
Week 13 (05/10/20 – 09/10/20)	4	5.3. Design of riveted joints subjected to eccentric loading. Assignment on Riveted Joints (Lab Work)	5
Week 14 (12/10/20 – 16/10/20)	4	5.1. Design of bolted joints- stresses in bolts, joints for leak proof fluid tight applications (like cylinder to cylinder cover fastening in an IC engine), bolts of uniform strength	5
Week 15 (19/10/20 – 23/10/20)	4	5.3. Design of bolted joints subjected to eccentric loading. Assignments on Bolted Joints (Lab Work) Module 6 Thin Cylinders	5 and 6
Week 16 (26/10/20 – 30/10/20)	4	6.2. Design of Pressure Vessels: Design concepts of thick and compound cylinders, Stresses in thick & compound cylinders. Determination of wall thickness, hoop and radial stresses, nature of hoop and radial stress distribution on cylinder walls.	6

		Assignment on Pressure Vessels (Lab Work)	
Week 17 (02/11/20 – 06/11/20)	4	6.1. Design of Springs: Classification and applications, design of helical compression and tension springs (only circular cross-section), co-axial springs. Design of leaf springs–straight and semi elliptical laminated leaf springs. Strain energy of springs–design of buffer springs. Assignment on Springs (Lab Work) Design Sheet on Cotter Joint, Rigid Coupling	6
Week 18 (09/11/20 – 10/11/20)	2	Revision for UT2	
Week 19 (26/11/20)		Unit Test – II	

1. Syllabus.

Sr.no	Design Exercises/ Assignments
01	Design of Curved Beams
02	Design of Bolted, Welded and Riveted Joints
03	Design of Springs and Pressure Vessels
04	Design of Socket and Spigot type Cotter Joint, Knuckle Joint, Turnbuckle (Any Two)
05	Design of Shafts (Two Design Problems)
06	Design of Rigid Flange Coupling, Bush Pin Type of Flexible Coupling

2. CO Statements.

Learner will be able to

PEL502.1. Demonstrate various design considerations.

PEL502.2. Apply basic principles of machine design.

PEL502.3. Design machine elements.

PEL502.4. Use design data books and various standard codes of practices.

PEL502.5. Prepare drawings pertaining to various designs.

PEL502.6. Design various joints used in engineering applications.

3. CO-PO-PSO Mapping.

Laboratory												
CO# / PO#	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
PEL502.1	3	3	3	-	-	-	-	-	-	-	-	-
PEL502.2	3	3	3	-	-	-	-	-	-	-	-	-
PEL502.3	3	3	3	-	-	-	-	-	-	-	-	-
PEL502.4	3	3	3	-	-	-	-	-	-	-	-	-
PEL502.5	3	3	3	-	-	-	-	-	-	-	-	-
PEL502.6	3	3	3	-	-	-	-	-	-	-	-	-

CO# / PSO#	PSO1	PSO2
PEL502.1	2	-
PEL502.2	2	-
PEL502.3	2	-
PEL502.4	2	-

PEL502.5	2	-
PEL502.6	2	-

4. CO Assessment tools with target.

Co Statement #	Target for Assessment Tools			
	Assignments	Drawing Sheets	Oral Exam	Course Exit Survey
PEL502.1	70%	-	60%	60%
PEL502.2	70%	-	60%	60%
PEL502.3	70%	-	60%	60%
PEL502.4	70%	-	60%	60%
PEL502.5	-	60%	60%	60%
PEL502.6	70%	-	60%	60%