

LESSON PLAN

Duration	16 Weeks (30.07.2026 to 23.11.2026)
Subject	Stainless Steel Technology (SST)
Discipline / Semester	Mechanical Engineering / 5th Semester
Name of Faculty / Designation	Amit Kumar / Mechanical

Teaching Load: Theory – 3 Lectures / Week

Week /	Lecture/Day	Unit / Topic	Topic /Content
1	1	Unit 1 – Introduction	Definition of stainless steel; need for stainless steel; major alloying elements and their functions; effect of alloying elements on stainless-steel properties.
	2	Unit 1 – Introduction	Classification of stainless steels; comparison of major stainless-steel families; cost implications of alloy additions and substitutions.
	3	Unit 1 – Introduction	Comparison of stainless-steel production in India and the world; overview of production routes and shop-floor practices.
2	4	Unit 1 – Making and Processing	Raw materials for stainless-steel production; Electric Arc Furnace (EAF); Induction Furnace; basic process sequence.
	5	Unit 1 – Making and Processing	Plasma Furnace; Argon Oxygen Decarburisation (AOD); purpose and sequence of decarburisation during stainless-steel making. Assignment 1
	6	Unit 1 – Making and Processing	Ladle Refining; Vacuum Oxygen Decarburisation (VOD); Vacuum Degassing; role of refining in controlling composition and quality.
3	7	Unit 1 – Casting	Ingot casting versus continuous casting; casting process sequence; casting defects and inclusion control.
	8	Unit 1 – Rolling and Forging	Hot rolling and hot forging of stainless steels; purpose, basic operations and effect on product shape and properties.
	9	Sessional Test-I	Sessional Test-I covering Unit 1 topics completed up to this stage.
4	10	Unit 1 – Finishing Processes	Annealing and pickling; cold rolling; final annealing and pickling; purpose of surface cleaning and restoration of properties.
	11	Unit 1 – Finishing Processes	Skin pass mill; strip grinding line; finishing of stainless steels; surface-quality requirements.
	12	Unit 1 – Coating Processes	Colour coating of stainless steels; powder coating process; thermal spray Eutalloy process for wear resistance. ASSIGNMENT 1a
5	13	Unit 2 – Phase Transformations	Relevance of Nickel Equivalent and Chromium Equivalent; use of equivalents in understanding stainless-steel structure.
	14	Unit 2 – Phase Transformations	Inadequacy of Fe-Fe ₃ C diagram for stainless steels; role of alloying elements in ferrite and austenite stabilization;
	15	Unit 2 – Heat Treatment and Properties	Heat treatment of ferritic, martensitic, austenitic, duplex and precipitation-hardening stainless steels; precipitation reaction in stainless steels.
6	16	Unit 2 – Mechanical Behaviour	Deformation behaviour of stainless steel; role of precipitates on mechanical properties; tensile, hardness.
	17	Unit 3 – Fabrication of Steels I	Cold rolling/forming (CRF) processes; forging; extrusion; deep drawing; coin blanking of stainless steels.
	18	Unit 3 – Fabrication of Steels I	Machining and cutting of stainless steels; factors affecting machining; cutting practices and precautions.
7	19	Unit 3 – Welding and Joining	Welding of stainless steels; welding, brazing, soldering and overlaying; common welding techniques; welding consumables and required precautions.
	20	Unit 3 – Fusion Welding	Fusion welding processes: Shielded Metal Arc Welding (SMAW); Gas Tungsten Arc Welding (GTAW); Gas Metal Arc Welding (GMAW) with inert/active gas.
	21	Sessional Test-II	Sessional Test-II / Revision Flux-cored Arc Welding (FCAW); Plasma Arc Welding (PAW); Submerged Arc Welding (SAW); Electro-slag Welding (ESW).
8	22	Unit 3 – Welding Processes	Electron Beam Welding (EBW); Laser Beam Welding (LBW); comparison and applications of fusion welding processes.

	23	Unit 3 – Solid-State Welding	Resistance welding variations: Spot, Seam, Projection, Flash, Upset and High-Frequency welding; basic principles and applications.
	24	Unit 3 – Solid-State Welding	Percussion welding and Friction Stir Welding; comparison of solid-state and fusion welding; selection of suitable joining process. ASSIGNMENT 2
9	25	Unit 4 – Fabrication of Steels II	Specific welding difficulties of martensitic, ferritic, austenitic, duplex and precipitation-hardening stainless steels; precautions and remedies.
	26	Unit 4 – Weldability Problems	Welding of dissimilar metal combinations with stainless steels;
	27	Unit 4 – Weldability Problems	475°C embrittlement; alpha (α) phase transformation;
10	28	Unit 4 – Schaeffler–De Long Diagram	Schaeffler and De Long diagram interpretation; tools and equipment; common fabrication issues and their solutions.
	29	Unit 4 – Testing, Handling and Storage	PMI technique; XRF; ultrasonic testing; magnetic particle testing; dye penetrant testing; portable hardness testing.
	30	Unit 4/5 – Testing and Corrosion	recommended procedures for handling and storage of stainless steel. Unit 5: types of corrosion and basic mechanisms.
11	31	Unit 4/5 – Testing and Corrosion	ASSIGNMENT 3
	32	Unit 4 – Weldability Problems	sensitization/weld decay; causes, mechanism, remedies and high-temperature sensitization.
	33	Unit 4 – Weldability Problems	distortion—causes, mechanisms and remedies; effect of alloying elements on weldability.
12	34	Unit 5 – Corrosion and application Sessional Test	PREN interpretation; Sessional Test (Tentative) inter-granular and trans-granular crack propagation;
	35	Unit 5 – Corrosion and Applications	Surface roughness measurement; surface reflectivity measurement;
	36	Unit 5 – Corrosion and Applications	Galvanic, pitting, crevice and stress corrosion cracking (SCC);
13	37	Unit 5 – Corrosion and Applications	Assignment
	38	Revision	Unit 1 and 2
	39	Unit 5 – Corrosion and Applications	Cold rolling/forming (CRF) processes
14	40	Unit 5 – Corrosion and Applications	High-temperature corrosion; corrosion testing procedures;
	41	Unit 5 – Corrosion and Applications	role of precipitates; corrosion resistance of stainless steels;
	42	Unit 5 – Corrosion and Applications	applications in automotive, railways/transport,
15	43	Unit 5 – Corrosion and Applications	architecture/construction,
	44	Unit 5 – Corrosion and Applications	reinforcement bars, roofing sheets, utensils, furniture,
	45	Unit 5 – Corrosion and Applications	material handling,
16	46	Unit 5 – Corrosion and Applications	process industries and biomedical applications;
	47	Unit 5 – Corrosion and Applications	Life Cycle Cost Analysis.
	48	Unit 5 – Corrosion and Applications	Sessional Test-III / Revision