JAIPUR ENGINEERING COLLEGE
AND RESEARCH CENTRE

JAIPURENGINEERINGCOLLEGEANDRESEARCHCENTRE

JECRCCampus,ShriRamkiNangal,Via-Vatika,TonkRoad,Jaipur

DepartmentofMechanicalEngineering

Name of Subject: Manufacturing Processes

Subject Code: 4ME-06

Year:2nd Year, 4thSemester

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DepartmentofMechanicalEngineering

Vision and Mission of Institute:

Vision: To become a renowned center of outcome based learning, and work towards academic, professional, cultural and social enrichment of the lives of individuals and communities.

Mission:

M1:Focusonevaluationoflearningoutcomesandmotivatestudentsto inculcateresearch aptitude by project based learning.

M2:Identify,basedoninformedperceptionofIndian,regionalandglobalneeds,areasof focus and provide platform to gain knowledge and solutions.

M3:Offeropportunitiesforinteractionbetween academiaandindustry.

M4:Develophumanpotentialtoitsfullestextentsothatintellectuallycapableand imaginatively gifted leaders can emerge in a range of professions.

VisionandMissionof Department:

Vision: The Mechanical Engineering Department strives to be recognized globally for outcomebasedtechnicalknowledgeandtoproducequalityhumanresource,whocan manage the advance technologies and contribute to society.

Mission:

M1:Toimpartqualitytechnicalknowledgetothelearners tomakethemgloballycompetitive mechanical engineers.

M2:Toprovidethelearnersethicalguidelinesalongwithexcellentacademicenvironmentfor a long productive career.

M3:To promoteindustry-institute relationship.

PROGRAMEDUCATIONAL OBJECTIVES(PEOS)

PEO1: To equip graduates with a strong foundation in engineering sciences, with an emphasis on mechanical engineering principles, enabling them to analyze, design, and solve real-world engineering challenges.

PEO2: To prepare graduates with sound scientific and engineering fundamentals to innovate and deliver effective solutions addressing practical challenges in mechanical engineering

PEO3: To inculcate in graduates a professional and ethical attitude, effective communication and teamwork skills, a multidisciplinary approach, entrepreneurial mindset, and the ability to connect engineering solutions with societal and environmental concerns.

PEO4: To provide students with an academic environment that fosters excellence, leadership, adherence to ethical standards, and encourages self-motivated lifelong learning essential for a successful professional career in mechanical

PEO5: To prepare students to excel in industry and higher education by providing quality education grounded in strong technical knowledge and high moral values

Program Specific Outcomes (PSOs)

PSO1: Graduates will be able to design, analyze, and fabricate electric and hybrid vehicles using modern engineering tools and sustainable practices.

PSO2: Graduates will be able to apply design principles and computational techniques, including programming and data structures, to analyze and solve mechanical engineering problems.

ProgramOutcomes(POs)

PO1: Engineering Knowledge: Apply knowledge of mathematics, natural science, computing, engineering fundamentals and an engineering specialization as specified in WK1 to WK4 respectively to develop to the solution of complex engineering problems.

PO2: Problem Analysis: Identify, formulate, review research literature and analyze complex engineering problems reaching substantiated conclusions with consideration for sustainable development. (WK1 to WK4)

PO3: Design/Development of Solutions: Design creative solutions for complex engineering problems and design/develop systems/components/processes to meet identified needs with consideration for the public health and safety, whole-life cost, net zero carbon, culture, society and environment as required. (WK5)

PO4:ConductInvestigationsofComplexProblems: Conductinvestigationsof complex engineering problems using research-based knowledge including design of experiments, modelling, analysis & interpretation of data to provide validconclusions. (WK8).

PO5: Engineering Tool Usage: Create, select and apply appropriate techniques, resources and modern engineering & IT tools, including prediction and modelling recognizing their limitations to solve complex engineering problems. (WK2 and WK6)

PO6: The Engineer and The World: Analyze and evaluate societal and environmental aspects while solving complex engineering problems for its impact on sustainability with reference to economy, health, safety, legal framework, culture andenvironment. (WK1, WK5, and WK7).

PO7:Ethics: Apply ethical principles and commit to professional ethics, human values, diversity and inclusion; adhere to national & international laws. (WK9)

PO8:Individual and Collaborative Team work: Function effectively as an individual, and as a member or leader in diverse/multi-disciplinary teams.

PO9: Communication: Communicate effectively and inclusively within the engineering community and society at large, such as being able to comprehend and write effective reports and design documentation, make effective presentationsconsidering cultural, language, and learning differences

PO10:Project Management and Finance: Apply knowledge and understanding of engineering management principles and economic decision-making and apply these to one's own work, as a member and leader in a team, and to manage projects and in multidisciplinary environments.

PO11:Life-Long Learning: Recognize the need for, and have the preparation and ability for i) independent and life-long learning ii) adaptability to new and emerging technologies and iii) critical thinking in the broadest context of technological change. (WK8)

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SYLLABUS

S.N	Contents	Hours
1	**Introduction:** Objective ,scope and outcome of the course.	1
2	General Classification and Introduction to Manufacturing processes. **Foundry Technology**: Casting: Definition and major classification; Casting materials, Patterns: types, material and pattern allowances. Moulding sands; composition, preparation, properties and testing; Grain fineness ;moisture content, clay content and permeability test. Core&core prints; Gating system: types, pouring basin, sprue, runner and risers; Melting, pouring and solidification.	3
	Principles and method of floor mould casting, shell mould casting, pit mould and loam mould casting; centrifugal casting, investment casting; Permanent mould casting .Die casting; Slush casting. Casting defects ;types, causes and remedy	5
3	**Forming Processes**: Classification; Hot working and cold working; principle, advantages, disadvantages and applications.	3
	Forging: Classification ,drop forging and press forging methods and use; Forging dies; types ,materials.	4
	Rolling:Characteristicsandapplicationsofhotrollingandcoldrolling;	3
4	Extrusion; Work materials and products; Press tool works; Basic principles ,system, operations and applications. Shearing; Parting, notching, trimming ,nibbling, blanking and piercing,	4
	Drawing: wire drawing, tube drawing and deep drawing.	3
5	**Metal Joining Processes**: Welding, Brazing and soldering, classification of welding process, Principle, characteristics and applications of gas welding ,thermit welding, electrical arc welding; Submerged arc welding; TIG and MIG welding; Resistance welding; Spot welding; Butt welding; Seam welding; Projection welding.	6
	Principles and process details of Forge welding; Friction welding; Diffusion welding; Ultrasonic welding. Explosive welding. Welding defects ;Types, causes, effects and remedy. Electrodes and Electrode Coating	3
6	**Powder Metallurgy**: Properties of Powder processed materials, Powder manufacturing,mechanicalpulverization,sintering,ElectrolyticProcess,chemicalreduction,atomization,propertiesofmetalpowders, Compacting of powders sintering, advantages and applications of Powder metallurgy.	4
	TOTAL	39

REFERENCE BOOKS(MP)

1."Manufacturing Science" by Ghosh A and Mallick A K

2."Manufacturing Technology: Foundry, Forming and Welding" by Rao P N

3."Introduction to Manufacturing Processes" by Schey J

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COURSE OUTCOME

4ME4-06: MANUFACTURING PROCESSES **Credit:** 3

Max. Marks: 100 (IA:30, ETE70) 3L+0T+0P **End Term Exam:** 3 Hours

Subject: Manufacturing Processes **Code: 4ME4-06**

CO-1: Understand different manufacturing processes and classify them based onmaterial, energy, and production methods.
CO-2: Analyze metal forming processes including casting, forging, rolling, andextrusion.
CO-3: Examine machining processes and evaluate material removal rates, tolerances,and surface finish.
CO-4: Apply joining processes such as welding, brazing, and soldering to engineeringproblems.
CO-5: Evaluate the selection of manufacturing processes for a given component basedon cost, quality, and sustainability.
CO-6: Develop manufacturing solutions and process improvements for enhancedproductivity and efficiency.

CO-PO Mapping

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
CO1	3	2	1	2	3	1	1	1	2	1	2	1	2
CO2	3	3	2	3	3	1	1	2	2	2	2	1	3
CO3	3	3	2	3	3	2	1	2	3	2	3	2	3
CO4	3	3	2	3	3	2	1	2	3	2	3	2	3
CO5	3	3	3	3	3	2	1	2	3	2	3	2	3
CO6	3	3	3	3	3	2	1	2	3	3	3	2	3

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Course Plan

Name of the Course: Manufacturing Processes

Code of the course: 4ME-06

Name of Faculty: Mr.Hukam chand

Course Outcomes

CO-1: Understand different manufacturing processes and classify them based on material, energy, and production methods.
CO-2: Analyze metal forming processes including casting, forging, rolling, and extrusion.
CO-3: Examine machining processes and evaluate material removal rates, tolerances, and surface finish.
CO-4: Apply joining processes such as welding, brazing, and soldering to engineering problems.
CO-5: Evaluate the selection of manufacturing processes for a given component based on cost, quality, and sustainability.
CO-6: Develop manufacturing solutions and process improvements for enhanced productivity and efficiency.

Unit	Topic	Lec	CO	Specific Objectives	Expected Outcomes	Primary Reference (P.N. Rao)
Intro	General Classification and Introduction to Manufacturing processes.	1	CO1	Student will be to understand the importance of manufacturing for human kind.	Student will be able to understand about diff. manufacturing processes	Ch.1 p.1–4
1	Casting: Definition and major classification; Casting materials, Patterns: types, material and pattern allowances.	2	CO2	Knowledge of Casting will provide a base to learn different types, methods & techniques used for casting in industries.	Student will be able to learn about casting and the terms related to this process.	Ch.2 p.60–75
	Moulding sands; composition, preparation, properties and testing; Grainfineness; moisture content, clay content and permeability test.	3	CO2	Understand the various moulding material used in making of moulds & cores.	Student will understand about the sands used in casting and the internal properties needed for that.	Ch.2 p.81–95 112-114

	Core & core prints;					
	Gating system: types, pouring basin, sprue, runner and risers; Melting, pouringand solidification.	4	CO2	Understand the various elements & design requirements for gating system.	Student will learn howthe casting material reaches the mould &how does it solidifies	125-139
2	Principles and method offloor mould casting, shell mould casting	5	CO2	Learn flow of molten metal and solidification process	Student will be able tounderstand different types of casting	209-211
	pit mould and loam mouldcasting	6	CO2	Learn flow of molten metal and cooling process	Student will be able tounderstand different types of casting	NPTEL
	centrifugal casting, investment casting	7	CO2	Study of various object and designed by centrifugal casting.	Student will be able tounderstand different types of casting	223
	Permanent mould casting.Die casting, Slush casting	8	CO2	Understand the concept of permanent mould casting and how it differs from sand casting.	Student will be able tounderstand different types of casting	213,216 ,230
	Casting defects; types,causes and remedy	9	CO2	Improve quality and reliability of cast products	Student will be able tounderstand the defects in casting and how toremove them.	187
3	Forming Processes: Classification; Hot workingand cold working; principle, advantages, disadvantagesand applications	10	CO2	Understand the advantages of utilizing metal-working processes	Student will be able to understand forming processes	Ch.5 p. 234-239
	Forging: Classification, drop forging and press forging methods and use	11	CO2	1. Utilize different forging processes and applications	Student will be able to learn about forging & its types	Ch.5 p.253–256
	Forging dies; types, materials	12	CO2	Design sheet Metal dies for different applications.	Will help student learn about types of forging dies	NPTEL

	Characteristics and applications of hot rolling and cold rolling; Extrusion Work materials and products;	13	CO2	Understand the advantages of utilizing metal-working processes.	Student will be able to understand about rolling	Ch.6 p.239,279–183
	Press; tool works; Basic principles, system, operations and applications	14	CO2	Understand the advantages of utilizing metal-working processes	Student will get knowledge about toolworks.	300-310
4	Shearing; Parting, notching, trimming, nibbling, blanking and piercing	15	CO2		Student will be able to understand different forming processes.	305-309
	Drawing: wire drawing, tube drawing and deep drawing	16	CO2		Student will be able to understand different Drawing processes	NPTEL
	Design of blanks for blanking, piercing and drawing operations	17	CO3	Understand the advantages of utilizing metal-working processes.	Student will get Knowledge of different forces & Power	304-316
	Estimation of forces and power required for shearingand drawing operations	18	CO3	Understand the advantages of utilizingmetal	Student will be able tolearn about types of drawing process	318-319 323
	Introduction to Spinning, Bulging, Coining, embossing, cold heading and riveting process	19	CO3	Understand the advantages of utilizingmetal	Student will be able tolearn about types of drawing process	Ch.8 p.261–272
	Metal working defects	20	CO3	Understand the effect of metal working defects	Students will get to know about defects in metal working	NPTEL
	Turning & Lathe	21	CO3	Understand lathe operations	Perform turning calculations	Ch.9 p.297–310
	Milling & Drilling	22	CO3	Study machining operations	Select appropriate machining process	Ch.9 p.310–325
	MRR & Surface Finish	23	CO3	Evaluate machining parameters	Calculate MRR & analyze finish	Ch.10 p.343–352
5	Welding	24	CO4	Learn welding principles	Apply welding techniques	Ch.10 p.352–360
	Brazing & Soldering	25	CO4	Understand joining differences	Select suitable joining method	Examples from

						competitive exams
	Welding Defects	26	CO4	Identify defects & remedies	Prevent welding defects	Ch.10 p.372–380
6	Process Selection	27	CO4	Analyze cost & quality factors	Select suitable manufacturing process	Ch.10 p.380–387
	Sustainability in Manufacturing	28	CO5	Understand environmental impact	Apply sustainable practices	Ch.11 p.401–410
	Productivity Improvement	29	CO5	Study process optimization	Improve efficiency & output	Ch.11 p.410–418
	Case Studies	30	CO6	Apply knowledge to real problems	Develop manufacturing solutions	Examples from competitive exams
	Content Beyond					
	Additive manufacturing ,	31		Understand the concept of **Additive Manufacturing (AM)** and how it differs from conventional manufacturing	Compare additive manufacturing with traditional manufacturing processes	NPTEL
	3D printing	32		basic working principle of **3D printing**	Classify different 3D printing technologies	NPTEL

REFERENCE BOOKS(MP)

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