PRODUCTION TECHNOLOGY (ME304PC)

COURSE PLANNER

OBJECTIVE AND RELEVANCE:

- To understand basic manufacturing processes like casting , welding, rolling, forming and forging
- To learn different methods of manufacturing techniques such as various casting, welding and forming methods
- To have a broad knowledge to select and design appropriate manufacturing process(including tooling, process parameters) for a product.

COURSE PURPOSE: This course is designed to provide students with *an overview of a wide variety of manufacturing processes*. The fundamental principles behind the processes will be discussed with the intent of providing a working knowledge of a broad range of manufacturing processes. Introduction to manufacturing processes, emphasize interrelationship between the properties of the material, the manufacturing process and the design of components. In addition, this course also discuss quality aspects, process defects and economics so as to make a student to select right manufacturing process and material to produce hardware economically with high quality and productivity.

SCOPE OF COURSE:

At the end of the course the student will be in a position to,

1. Get the knowledge of basics of Manufacturing processes
2. Get the knowledge to manufacture a product utilizing various manufacturing processes efficiently and economically .

PRE REQUISITES:

The knowledge of following subjects is essential to understand the subject:

1.Materials and Metallurgy- Crystal Structure

2. Heat transfer-Phase diagrams, Cooling Curves

3. Fluid Mechanics

COURSE OUTCOMES:

S. No.	Course Outcomes (CO)
After completing this course the student must demonstrate the knowledge and ability to:	
CO1	Understand the idea for selecting right casting process for a product. Design pattern used in casting and analyze the components of moulds. Design of core, runner ,riser and gating system for metal casting processes. Understand the causes for defects in casting and to find remedial methods to avoid casting defects by selecting appropriate casting process, parameters of mould, pattern, riser, runner, core and Gating system.

CO2	**Understand** Types of welds and welded joints; Understand Arc, Gas ,forge welding, Resistance and Thermit welding. Selection of appropriate welding process based on functionality, cost and time in development of product..
CO3	Understand advanced welding techniques such as Inert Gas,Friction, induction,explosive and Laser Welding; Analyse the effect of Heat affected zone in welding ; Understand causes for the welding defects and planning methodology to avoid the costly errors by implementing quality tools such as visual methods, destructive and non destructive testing methods.
CO4	Develop process-maps for metal forming processes using plasticity principles. Identify the effect of process variables to manufacture defect free products. Understand Rolling, Stamping, Blanking, Bending, Drawing, Coining and Spinning processes. Calculate Forces and power requirements for forming processes. Select appropriate forming process based on functionality, cost and time in development of critical products.
CO5	Understand Different types of Extrusion and forging processes.Calculate forces and Power requirements of extrusion and forging processes to choose right process and tooling(Dies) for production

HOW PROGRAM OUTCOMES ARE ASSESSED:

	Program Outcomes (PO)	Level	Proficiency assessed by
PO1	Engineering knowledge: Graduates will demonstrate the ability to use basic knowledge in mathematics, science and engineering and apply them to solve problems specific to mechanical engineering.	2	Assignments
PO2	Problem analysis: Graduates will demonstrate the ability to design and conduct experiments, interpret and analyze data, and report results.	2	--
PO3	Design/development of solutions: Graduates will demonstrate the ability to design any mechanical system or thermal that meets desired specifications and requirements.	2	IVs
PO4	Conduct investigations of complex problems: Graduates will demonstrate the ability to identify, formulate and solve mechanical engineering problems of a complex kind.	2	Assignments
PO5	Modern tool usage: Graduates will be familiar with applying software methods and modern computer tools to analyze mechanical engineering problems.	2	-
PO6	The engineer and society: Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional engineering practice.	2	-

PO7	Environment and sustainability: Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.	2	-
PO8	Ethics: Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.	1	-
PO9	Individual and team work: Graduates will demonstrate the ability to function as a coherent unit in multidisciplinary design teams, and deliver results through collaborative research.	2	Projects
PO10	Communication: Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.	2	Seminars
PO11	Project management and finance: Graduate will be able to design a system to meet desired needs within environmental, economic, political, ethical health and safety, manufacturability and management knowledge and techniques to estimate time, resources to complete project.	2	Projects
PO12	Life-long learning: Graduates should be capable of self-education and clearly understand the value of life-long learning.	2	Exams

1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High) - : None

HOW PROGRAM SPECIFIC OUTCOMES ARE ASSESSED

Program SpecificOutcomes		Levels	Proficiency accessed by
PSO1	**Foundation of mathematical concepts:** To use mathematical methodologies to crack problem using suitable mathematical analysis, data structure and suitable algorithm.	2	Assignments
PSO2	**Foundation of Mechanical System:** The ability to interpret the fundamental concepts and methodology of Mechanical systems. Students can understand the functionality of different machine, men and material.	2	Assignments
PSO3	**Layout of plant:** The ability to grasp the knowledge of plant layout and material handling along with the systematic allocation of all the facilities.	3	-

VII. MAPPING COURSE OUTCOMES LEADING TO THE ACHIEVEMENT OF PROGRAM OUTCOMES AND PROGRAM SPECIFIC OUTCOMES:

CO's	Program Outcomes (PO's)											
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	**3**	**3**	**2**	**2**	**2**	**1**	**2**	**1**	**2**	**1**	**1**	**2**
CO2.	3	2	2	2	2	1	2	1	2	1	1	2
CO3	2	2	2	2	1	1	2	1	1	1	1	2
CO4	3	3	2	2	2	1	2	1	2	1	1	2
CO5	3	3	2	2	1	1	2	1	2	1	1	2
Average	**2.6**	**2.6**	**2**	**2**	**1.8**	**1**	**2**	**1**	**1.8**	**1**	**1**	**2**

1:Slight(Low) ; 2:Moderate(Medium); 3: Substantial (High)

Course Outcomes-CO's	PSO ATTAINMENT		
	PSO1	PSO2	PSO3
CO1	**2**	**2**	**2**
CO2	2	2	2
CO3	2	2	2
CO4	2	2	2
CO5	2	2	2
Average	2	2	2

VIII COURSE CONTENT:

JNTUH SYLLABUS

UNIT – I

Casting: Steps involved in making a casting – Advantage of casting and its applications; Patterns -Pattern making, Types, Materials used for patterns, pattern allowances; Properties of molding sands. Methods of Melting - Crucible melting and cupola operation – Defects in castings; Principles of Gating– Requirements – Types of gates, Design of gating systems – Riser – Function, types of Riser andRiser design. Casting processes – Types – Sand mounding, Centrifugal casting, die- casting, Investmentcasting, shell molding; Solidification of casting – Solidification of pure metal, Directional Solidification.

UNIT – II

Welding: Classification – Types of welds and welded joints; Welding Positions - Gas welding - Types,oxy-fuel gas cutting – standard time and cost calculations. Arc welding, forge welding, submerged arcwelding, Resistance welding, Termite welding.

UNIT – III

Inert Gas Welding _ TIG Welding, MIG welding, Friction welding, Friction Stir Welding, inductionwelding, explosive welding, Laser Welding; Soldering and Brazing; Heat affected zone in welding.Welding defects – causes and remedies; destructive and non- destructive testing of welds.

UNIT – IV

Hot working, cold working, strain hardening, recovery, recrystallisation and grain growth. Sheet metalOperations: Stamping, Blanking and piercing, Coining, Strip layout, Hot and cold spinning – Bendingand deep drawing. Rolling fundamentals – theory of rolling, types of Rolling mills and products. Forcesin rolling and power requirements. Drawing and its types – wire drawing and Tube drawing –. Types of presses and press tools. Forces and power requirement in the above operations.

UNIT – V

Extrusion of Metals: Basic extrusion process and its characteristics. Hot extrusion and cold extrusion- Forward extrusion and backward extrusion – Impact extrusion – Extruding equipment – Tubeextrusion, Hydrostatic extrusion. Forces in extrusion Forging Processes: Forging operations and principles – Tools – Forging methods – Smith forging,Drop Forging – Roll forging – Forging hammers: Rotary forging – forging defects – cold forging, swaging, Forces in forging operations.High Energy Rate Forming Processes: Limitations, Principles of Explosive Forming, Electro-hydraulic Forming, Electro-magnetic forming and rubber pad Forming.

GATE SYLLABUS:

Casting, Forming and Joining Processes: Different types of castings, design of patterns, moulds and cores; solidification and cooling; riser and gating design. Plastic deformation and yield criteria; fundamentals of hot and cold working processes; load estimation for bulk (forging, rolling, extrusion, drawing) and sheet (shearing, deep drawing, bending) metal forming processes; principles of powder metallurgy. Principles of welding, brazing, soldering and adhesive bonding.

IES SYLLABUS: Metal casting-Metal forming, Metal Joining and NDT Techniques in Condition Monitoring

SUGGESTED BOOKS:

TEXT BOOK:

1. A Ghosh and A K Mallik, Manufacturing Science, Wiley Eastern, 1986
2. P Rao, Manufacturing Technology: Foundry, Forming And Welding, Tata McGraw Hill, 2008.
3. M.P. Groover, Introduction to manufacturing processes, John Wiley & Sons, 2012
4. Prashant P Date, Introduction to manufacturing technologies Principles and technologies, Jaico publications, 2010 (new book)

REFERENCES:

1. J S Campbell, Principles Of Manufacturing Materials And Processes, Tata McGraw Hill, 1995.
2. P C Pandey and C K Singh, Production Engineering Sciences, Standard Publishers Ltd., 2003.
3. S Kalpakjian and S R Schmid, Manufacturing Processes for Engineering Materials, Pearson education, 2009.
4. E. Paul Degarmo, J T Black, Ronald A Kohser, Materials and processes in manufacturing, John wiley and sons, 8th edition, 1999

Additional Reading:

NPTEL Web Course:

https://nptel.ac.in/courses/112105182/.

NPTEL Video Course:

https://nptel.ac.in/courses/112105182/1

IX. Lesson Plan

Lecture. No.	UNIT No.	Topics to be covered	Content to be covered under each topic	links for PDF	links for ppt	Link for Small Projects/ Numericals(if any)	Course Learning Outcomes	Teaching Methodology	References
1	I	Manufacturing	Introduction to Manufacturing Processes	https://drive.google.com/drive/folders/1Whn8LIYGdmYntAsI8n4k3kCDQEWRqBlK?usp=sharing	https://drive.google.com/drive/folders/1kl3BdVNKmV2uboaJfRjmmuzXicY_ZxPv?usp=sharing	https://drive.google.com/drive/folders/1kl3BdVNKmV2uboaJfRjmmuzXicY_ZxPv?usp=sharing	Understand	Chalk and Talk	T1, T2 & R1, R2

2	I	Processes	Introduction to basics of Materials and their processing	https://drive.google.com/drive/folders/1Whhn8LIYGdmYntAsI8n4k3kCDQEWRqBlK?usp=sharing	https://drive.google.com/drive/folders/1kl3BdVNKmV2uboaJfRjmmuzXicY_ZxPv?usp=sharing	https://drive.google.com/drive/folders/1kl3BdVNKmV2uboaJfRjmmuzXicY_ZxPv?usp=sharing	Understand	Chalk and Talk	T1, T2 & R1, R
3	I	Materials and their processing	Introduction to Castings and steps involved in Casting Process Advantage of casting and its applications	https://drive.google.com/drive/folders/1Whhn8LIYGdmYntAsI8n4k3kCDQEWRqBlK?usp=sharing	https://drive.google.com/drive/folders/1kl3BdVNKmV2uboaJfRjmmuzXicY_ZxPv?usp=sharing	https://drive.google.com/drive/folders/1kl3BdVNKmV2uboaJfRjmmuzXicY_ZxPv?usp=sharing	Understand	Chalk and Talk	T1, T2 & R1, R
4	I	Castings	Pattern making, Types, Materials used for	https://drive.google.com/drive/folders/1Whhn8LIYGdmYntAsI8n4k3kCDQEWRqBlK?usp=sharing	https://drive.google.com/drive/folders/1kl3BdVNKmV2uboaJfRjmmuzXicY_ZxPv?usp=sharing	https://drive.google.com/drive/folders/1kl3BdVNKmV2uboaJfRjmmuzXicY_ZxPv?usp=sharing	Understand	Chalk and Talk	T1, T2 & R1, R

5	I	Patterns & Methods of Melting	Patterns, Pattern allowances and there	https://drive.google.com/drive/folders/1Whhn8LIYGdmYntAsI8n4k3kCDQEWRqBlK?usp=sharing	https://drive.google.com/drive/folders/1kl3BdVNKmV2uboaJfRjmmuzXicY_ZxPv?usp=sharing	https://drive.google.com/drive/folders/1kl3BdVNKmV2uboaJfRjmmuzXicY_ZxPv?usp=sharing	Understand	Chalk and Talk	T1, T2 & R1, R
6	I	Moulding sands & Casting processes	Construction, Crucible melting and cupola operation	https://drive.google.com/drive/folders/1Whhn8LIYGdmYntAsI8n4k3kCDQEWRqBlK?usp=sharing	https://drive.google.com/drive/folders/1kl3BdVNKmV2uboaJfRjmmuzXicY_ZxPv?usp=sharing	https://drive.google.com/drive/folders/1kl3BdVNKmV2uboaJfRjmmuzXicY_ZxPv?usp=sharing	Understand	Chalk and Talk	T1, T2 & R1, R
7	I	Gating	Properties, Types – Sand moulding, Centrifugal casting, die-casting, Investment casting, shell Moulding, Defects in castings	https://drive.google.com/drive/folders/1Whhn8LIYGdmYntAsI8n4k3kCDQEWRqBlK?usp=sharing	https://drive.google.com/drive/folders/1kl3BdVNKmV2uboaJfRjmmuzXicY_ZxPv?usp=sharing	https://drive.google.com/drive/folders/1kl3BdVNKmV2uboaJfRjmmuzXicY_ZxPv?usp=sharing	Understand	Chalk and Talk	T1, T2 & R1, R

8	II	Welding	Introduction to Welding, Classification of welding	https://drive.google.com/drive/folders/1eywSlzfbo9K7rr_sEuRPEjefIpW3g-mQ?usp=sharing	https://drive.google.com/drive/folders/1owHghYRUgh9MpBU4xOp5M6MRs3xz8kOZ?usp=sharing	https://drive.google.com/drive/folders/1kl3BdVNKmV2uboaJfRjmmuzXicY_ZxPv?usp=sharing	Understand	Chalk and Talk	R1,R2
9	II	Welding Types	Types of welds and welded	https://drive.google.com/drive/folders/1eywSlzfbo9K7rr_sEuRPEjefIpW3g-mQ?usp=sharing	https://drive.google.com/drive/folders/1owHghYRUgh9MpBU4xOp5M6MRs3xz8kOZ?usp=sharing	https://drive.google.com/drive/folders/1kl3BdVNKmV2uboaJfRjmmuzXicY_ZxPv?usp=sharing	Understand	Chalk and Talk	T1, T2 & R1, R
10	II	Gas Welding	joints; welding - Types, oxy-fuel gas cutting	https://drive.google.com/drive/folders/1eywSlzfbo9K7rr_sEuRPEjefIpW3g-mQ?usp=sharing	https://drive.google.com/drive/folders/1owHghYRUgh9MpBU4xOp5M6MRs3xz8kOZ?usp=sharing	https://drive.google.com/drive/folders/1kl3BdVNKmV2uboaJfRjmmuzXicY_ZxPv?usp=sharing	Understand	Chalk and Talk	T1, T2 & R1, R

11	II	Welding Time	Types of flames in Gas welding, Process, applications, merits and demerits of process	https://drive.google.com/drive/folders/1eywSlzfbo9K7rr_sEuRPEjefIpW3g-mQ?usp=sharing	https://drive.google.com/drive/folders/1owHghYRUgh9MpBU4xOp5M6MRs3xz8kOZ?usp=sharing	https://drive.google.com/drive/folders/1kl3BdVNKmV2uboaJfRjmmuzXicY_ZxPv?usp=sharing	Understand	Chalk and Talk	T1, T2 & R1, R
12	II	Arc Welding	standard time and cost	https://drive.google.com/drive/folders/1eywSlzfbo9K7rr_sEuRPEjefIpW3g-mQ?usp=sharing	https://drive.google.com/drive/folders/1owHghYRUgh9MpBU4xOp5M6MRs3xz8kOZ?usp=sharing	https://drive.google.com/drive/folders/1kl3BdVNKmV2uboaJfRjmmuzXicY_ZxPv?usp=sharing	Understand	Chalk and Talk	T1, T2 & R1, R
13	II	Forge welding	calculations.	https://drive.google.com/drive/folders/1eywSlzfbo9K7rr_sEuRPEjefIpW3g-mQ?usp=sharing	https://drive.google.com/drive/folders/1owHghYRUgh9MpBU4xOp5M6MRs3xz8kOZ?usp=sharing	https://drive.google.com/drive/folders/1kl3BdVNKmV2uboaJfRjmmuzXicY_ZxPv?usp=sharing	Understand	Chalk and Talk	T1, T2 & R1, R

14	II	SAW	Introduction to Arc welding process, Applications, Advantages, and disadvantages	https://drive.google.com/drive/folders/1eywSlzfbo9K7rr_sEuRPEjefIpW3g-mQ?usp=sharing	https://drive.google.com/drive/folders/1owHghYRUgh9MpBU4xOp5M6MRs3xz8kOZ?usp=sharing	https://drive.google.com/drive/folders/1kl3BdVNKmV2uboaJfRjmmuzXicY_ZxPv?usp=sharing	Understand	Chalk and Talk	T1, T2 & R1, R
15	II	Resistance welding	Introduction to forge welding process, Applications, Advantages, and disadvantages	https://drive.google.com/drive/folders/1eywSlzfbo9K7rr_sEuRPEjefIpW3g-mQ?usp=sharing	https://drive.google.com/drive/folders/1owHghYRUgh9MpBU4xOp5M6MRs3xz8kOZ?usp=sharing	https://drive.google.com/drive/folders/1kl3BdVNKmV2uboaJfRjmmuzXicY_ZxPv?usp=sharing	Understand	Chalk and Talk	T1, T2 & R1, R
16	II	Thermit Welding	Introduction to Submerged Arc welding process, Applications, Advantages, and disadvantages	https://drive.google.com/drive/folders/1eywSlzfbo9K7rr_sEuRPEjefIpW3g-mQ?usp=sharing	https://drive.google.com/drive/folders/1owHghYRUgh9MpBU4xOp5M6MRs3xz8kOZ?usp=sharing	https://drive.google.com/drive/folders/1kl3BdVNKmV2uboaJfRjmmuzXicY_ZxPv?usp=sharing	Understand	Chalk and Talk	T1, T2 & R1, R

17	III	Inert Gas Welding	Introduction to TIG Welding, MIG welding process, Applications, Advantages, and disadvantages	https://drive.google.com/drive/folders/1dYoh7d3HJ7GJ01vU1-edp1bPLfQCt7kZ?usp=sharing	https://drive.google.com/drive/folders/1fCgOflBGKyufDsqF1bCEJJQfP5adgfOR?usp=sharing	https://drive.google.com/drive/folders/1kl3BdVNKmV2uboaJfRjmmuzXicY_ZxPv?usp=sharing	Understand	Chalk and Talk	T1, T2 & R1, R
18	III	Friction welding,	Introduction to Friction Welding process, Applications, Advantages, and disadvantages	https://drive.google.com/drive/folders/1dYoh7d3HJ7GJ01vU1-edp1bPLfQCt7kZ?usp=sharing	https://drive.google.com/drive/folders/1fCgOflBGKyufDsqF1bCEJJQfP5adgfOR?usp=sharing	https://drive.google.com/drive/folders/1kl3BdVNKmV2uboaJfRjmmuzXicY_ZxPv?usp=sharing	Understand	Chalk and Talk	T1, T2 & R1, R
19	III	Induction welding	Introduction to Induction Welding process, Applications, Advantages, and disadvantages	https://drive.google.com/drive/folders/1dYoh7d3HJ7GJ01vU1-edp1bPLfQCt7kZ?usp=sharing	https://drive.google.com/drive/folders/1fCgOflBGKyufDsqF1bCEJJQfP5adgfOR?usp=sharing	https://drive.google.com/drive/folders/1kl3BdVNKmV2uboaJfRjmmuzXicY_ZxPv?usp=sharing	Understand	Chalk and Talk	T1, T2 & R1, R

20	III	Explosive welding	Introduction to Explosive Welding process, Applications, Advantages, and disadvantages	https://drive.google.com/drive/folders/1dYoh7d3HJ7GJ01vU1-edp1bPLfQCt7kZ?usp=sharing	https://drive.google.com/drive/folders/1fCgOflBGKyufDsqF1bCEJJQfP5adgfOR?usp=sharing	https://drive.google.com/drive/folders/1kl3BdVNKmV2uboaJfRjmmuzXicY_ZxPv?usp=sharing	Understand	Chalk and Talk	T1, T2 & R1, R
21	III	Laser Welding	Introduction to Laser Welding process, Applications, Advantages, and disadvantages	https://drive.google.com/drive/folders/1dYoh7d3HJ7GJ01vU1-edp1bPLfQCt7kZ?usp=sharing	https://drive.google.com/drive/folders/1fCgOflBGKyufDsqF1bCEJJQfP5adgfOR?usp=sharing	https://drive.google.com/drive/folders/1kl3BdVNKmV2uboaJfRjmmuzXicY_ZxPv?usp=sharing	Understand	Chalk and Talk	T1, T2 & R1, R
22	III	Heat affected zone in welding	Heat affected zone in welding, measures to avoid HAZ, demerits of HAZ	https://drive.google.com/drive/folders/1dYoh7d3HJ7GJ01vU1-edp1bPLfQCt7kZ?usp=sharing	https://drive.google.com/drive/folders/1fCgOflBGKyufDsqF1bCEJJQfP5adgfOR?usp=sharing	https://drive.google.com/drive/folders/1kl3BdVNKmV2uboaJfRjmmuzXicY_ZxPv?usp=sharing	COMPARE	Chalk and Talk	T1, T2 & R1, R

23	III	Defects in welding	Welding defects-causes and remedies;	https://drive.google.com/drive/folders/1dYoh7d3HJ7GJ01vU1-edp1bPLfQCt7kZ?usp=sharing	https://drive.google.com/drive/folders/1fCgOfIBGKyufDsqF1bCEJJQfP5adgfOR?usp=sharing	https://drive.google.com/drive/folders/1kl3BdVNKmV2uboaJfRjmmuzXicY_ZxPv?usp=sharing	COMPARE	Chalk and Talk	T1, T2 & R1, R
24	III	NDT	Concept of Destructive testing of welds, non-destructive testing of	https://drive.google.com/drive/folders/1dYoh7d3HJ7GJ01vU1-edp1bPLfQCt7kZ?usp=sharing	https://drive.google.com/drive/folders/1fCgOfIBGKyufDsqF1bCEJJQfP5adgfOR?usp=sharing	https://drive.google.com/drive/folders/1kl3BdVNKmV2uboaJfRjmmuzXicY_ZxPv?usp=sharing	Understand	Chalk and Talk	T1, T2 & R1, R
25	IV	Metal working	Introduction: Hot working & cold working	https://drive.google.com/drive/folders/1_aoCRX3HqaL3k8aAFQdKR1m0KMp7WhKp?usp=sharing	https://drive.google.com/drive/folders/1ytFovHK7k26ILCdlXftB3RP6HhxbW_Km?usp=sharing	https://drive.google.com/drive/folders/1kl3BdVNKmV2uboaJfRjmmuzXicY_ZxPv?usp=sharing	Understand	Chalk and Talk	T1, T2 & R1, R

26	IV	Behavior of metals	strain hardening, recovery, recrystallisation and grain growth	https://drive.google.com/drive/folders/1_aoCRX3HqaL3k8aAFQdKR1m0KMp7WhKp?usp=sharing	https://drive.google.com/drive/folders/1ytFovHK7k26ILCdlXftB3RP6HhxbW_Km?usp=sharing	https://drive.google.com/drive/folders/1kl3BdVNKmV2uboaJfRjmmuzXicY_ZxPv?usp=sharing	Understand	Chalk and Talk	T1, T2 & R1, R
27	IV	Rolling	Rolling fundamentals – theory of rolling, types of Rolling mills and products.	https://drive.google.com/drive/folders/1_aoCRX3HqaL3k8aAFQdKR1m0KMp7WhKp?usp=sharing	https://drive.google.com/drive/folders/1ytFovHK7k26ILCdlXftB3RP6HhxbW_Km?usp=sharing	https://drive.google.com/drive/folders/1kl3BdVNKmV2uboaJfRjmmuzXicY_ZxPv?usp=sharing	Understand	Chalk and Talk	T1, T2 & R1, R
28	IV	Forces in rolling	Forces in rolling and power requirements	https://drive.google.com/drive/folders/1_aoCRX3HqaL3k8aAFQdKR1m0KMp7WhKp?usp=sharing	https://drive.google.com/drive/folders/1ytFovHK7k26ILCdlXftB3RP6HhxbW_Km?usp=sharing	https://drive.google.com/drive/folders/1kl3BdVNKmV2uboaJfRjmmuzXicY_ZxPv?usp=sharing	Understand	Chalk and Talk	T1, T2 & R1, R

29	IV	Sheet metal operations	Stamping, forming and other cold working processes, Blanking and piercing, Bending, and forming	https://drive.google.com/drive/folders/1_aoCRX3HqaL3k8aAFQdKR1m0KMp7WhKp?usp=sharing	https://drive.google.com/drive/folders/1ytFovHK7k26ILCdlXftB3RP6HhxbW_Km?usp=sharing	https://drive.google.com/drive/folders/1kl3BdVNKmV2uboaJfRjmmuzXicY_ZxPv?usp=sharing	Understand	Chalk and Talk	T1, T2 & R1, R
30	IV	Drawing	Drawing and its types – wire drawing and Tube drawing –	https://drive.google.com/drive/folders/1_aoCRX3HqaL3k8aAFQdKR1m0KMp7WhKp?usp=sharing	https://drive.google.com/drive/folders/1ytFovHK7k26ILCdlXftB3RP6HhxbW_Km?usp=sharing	https://drive.google.com/drive/folders/1kl3BdVNKmV2uboaJfRjmmuzXicY_ZxPv?usp=sharing	Understand	Chalk and Talk	T1, T2 & R1, R
31	IV	Spinning	coining	https://drive.google.com/drive/folders/1_aoCRX3HqaL3k8aAFQdKR1m0KMp7WhKp?usp=sharing	https://drive.google.com/drive/folders/1ytFovHK7k26ILCdlXftB3RP6HhxbW_Km?usp=sharing	https://drive.google.com/drive/folders/1kl3BdVNKmV2uboaJfRjmmuzXicY_ZxPv?usp=sharing	Understand	Chalk and Talk	T1, T2 & R1, R

32	IV	Presses	Hot and cold spinning.	https://drive.google.com/drive/folders/1_aoCRX3HqaL3k8aAFQdKR1m0KMp7WhKp?usp=sharing	https://drive.google.com/drive/folders/1ytFovHK7k26ILCdlXftB3RP6HhxbW_Km?usp=sharing	https://drive.google.com/drive/folders/1kl3BdVNKmV2uboaJfRjmmuzXicY_ZxPv?usp=sharing	Understand	Chalk and Talk	T1, T2 & R1, R
33	V	Extrusion	Introduction Basic extrusion process and its characteristics.	https://drive.google.com/drive/folders/1m2hSgxOk9kaSyfJl5uenQi7hJtucZid2?usp=sharing	https://drive.google.com/drive/folders/1YqKgVGsNNFI_SyKD0YEp8R94sZM02Cf7?usp=sharing	https://drive.google.com/drive/folders/1kl3BdVNKmV2uboaJfRjmmuzXicY_ZxPv?usp=sharing	Understand	Chalk and Talk	T1, T2 & R1, R
34	V	Types of Extrusion & Extruding equipment	Hot extrusion and cold	https://drive.google.com/drive/folders/1m2hSgxOk9kaSyfJl5uenQi7hJtucZid2?usp=sharing	com/drive/fNFI_SyKDf7?usp=sha	https://drive.google.com/drive/folders/1kl3BdVNKmV2uboaJfRjmmuzXicY_ZxPv?usp=sharing	Understand	Chalk and Talk	T1, T2 & R1, R

35	V	Tube and Pipe extrusion	Extrusion, Forward extrusion and	https://drive.google.com/drive/folders/1m2hSgxOk9kaSyfJl5uenQi7hJtucZid2?usp=sharing	https://drive.google.com/drive/folders/1YqKgVGsNNFI_SyKD0YEp8R94sZM02Cf7?usp=sharing	https://drive.google.com/drive/folders/1kl3BdVNKmV2uboaJfRjmmuzXicY_ZxPv?usp=sharing	Understand	Chalk and Talk	T1, T2 & R1, R
36	V	Forging	backward extrusion, Impact extrusion, Hydrostatic extrusion. Forces in extrusion	https://drive.google.com/drive/folders/1m2hSgxOk9kaSyfJl5uenQi7hJtucZid2?usp=sharing	https://drive.google.com/drive/folders/1YqKgVGsNNFI_SyKD0YEp8R94sZM02Cf7?usp=sharing	https://drive.google.com/drive/folders/1kl3BdVNKmV2uboaJfRjmmuzXicY_ZxPv?usp=sharing	Understand	Chalk and Talk	T1, T2 & R1, R
37	V	Forging methods	Concept of Tube extrusion and pipe making	https://drive.google.com/drive/folders/1m2hSgxOk9kaSyfJl5uenQi7hJtucZid2?usp=sharing	https://drive.google.com/drive/folders/1YqKgVGsNNFI_SyKD0YEp8R94sZM02Cf7?usp=sharing	https://drive.google.com/drive/folders/1kl3BdVNKmV2uboaJfRjmmuzXicY_ZxPv?usp=sharing	Application	Chalk and Talk	T1, T2 & R1, R

38	V	Forces in forging	**Forging Processes:** Forging operations and principles – Tools	https://drive.google.com/drive/folders/1m2hSgxOk9kaSyfJl5uenQi7hJtucZid2?usp=sharing	https://drive.google.com/drive/folders/1YqKgVGsNNFI_SyKD0YEp8R94sZM02Cf7?usp=sharing	https://drive.google.com/drive/folders/1kl3BdVNKmV2uboaJfRjmmuzXicY_ZxPv?usp=sharing	Understand	Chalk and Talk	T1, T2 & R1, R

TEXT BOOKS:

1. A Ghosh and A K Mallik, Manufacturing Science, Wiley Eastern, 1986
2. P Rao, Manufacturing Technology: Foundry, Forming and Welding, Tata McGraw Hill, 2008.

REFERENCE BOOKS:

1. J S Campbell, Principles Of Manufacturing Materials And Processes, Tata McGraw Hill, 1995.

QUESTION BANK: (JNTUH)

UNIT-I: Short Answer Questions-

Sl. No	Question	Blooms Taxonomy Level	Course Outcome
1	List different types of patterns	L2.Understand	**CO1**
2	What are the basic requirements of the moldings sand in order to achieve a fine finished casting?	L3.Apply	**CO1**
3	Why is not the cupola furnace used for melting steel?	L4.Analyze	**CO1**
4	How the gates are classified?	L3.Apply	**CO1**
5	What is the function of core and core prints?	L4.Analyze	**CO1**
6	What are the types of casting defects?	L3.Apply	**CO1**

Long Answer Questions-

Sl.No	Question	Blooms Taxonomy Level	Course Outcome
1	What is the purpose of gate in foundry? How the gates are classified. Illustrate with the help of diagrams?	L4.Analyze	**CO1**
2	List important considerations when selecting pattern materials.	L3.Apply	**CO1**

3	Briefly describe the Cupola furnace. Describe the other operations and zones related to the melting of metals in Cupola furnace	L2.Understand	**CO1**
4	Give a step – by – step procedure for the following processes (a) Investment casting (b) Die Casting.	L2.Understand	**CO1**
5	Explain the use of risers. Why can blind risers be smaller than open-top risers?	L4.Analyze	**CO1**
6	Briefly explain the applications of castings.	L4.Analyze	**CO1**
7	Why gating system is required in the casting? Explain the purpose of different elements of gating systems	L4.Analyze	**CO1**

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UNIT-2: Short Answer Questions-

Sl. No	Question	Blooms Taxonomy Level	Course Outcome
1	List out five arc welding equipments?	L2.Understand	**CO2**
2	How resistance welding is performed?.	L2.Understand	**CO2**
3	What is Thermit welding? Explain.	L2.Understand	**CO2**
4	What are the types of Power used for Arc welding?	L3.Apply	**CO2**
5	What is the purpose of flux?	L4.Analyze	**CO2**
6	Write the principle of Submerged Arcwelding..	L2.Understand	**CO2**
7	Describe the characteristics of groove and fillet weld.	L2.Understand	**CO2**

Long Answer Questions-

Sl. No	Question	Blooms Taxonomy Level	Course Outcome
1	What are the different types of welded joints? Classify the welding process and describe the characteristics of groove and fillet weld.	L4.Analyze	**CO2**
2	Describe various resistance welding processes in detail.	L2.Understand	**CO2**
3	Write the applications, advantages and limitation of gas welding.	L2.Understand	**CO2**
4	Explain types of Flames used for Gas welding and gas cutting	L3.Apply	**CO2**
5	**Explain** standard time and how to calculate the cost of welding with a simple example of But welding of two joints.	L3.Apply	**CO2**
6	How many ways weld joints are protected? Explain	L4.Analyze	**CO2**
7	Define polarity as applied to DC arc welding. How it is advantageously used?	L4.Analyze	**CO2**

UNIT-3: Short Answer Questions-

Sl. No	Question	Blooms Taxonomy Level	Course Outcome
1	What is LASER? Describe the characteristics of Laser welding	L2.Understand	**CO3**
2	Write the welding defects.	L2.Understand	**CO3**
3	What is Plasma Arc Welding? Explain.	L2.Understand	**CO3**
4	What are the characteristics of heat affected zones?	L3.Apply	**CO3**
5	What is the purpose of Inert gas used for welding?	L4.Analyze	**CO3**
6	Write the principle of flash welding..	L2.Understand	**CO3**

Long Answer Questions-

Sl. No	Question	Blooms Taxonomy Level	Course Outcome
1	What are the various welding defects? Explain its causes and remedies.	L3.Apply	**CO3**
2	Why do properties vary widely in most welding heat affected zones?	L4.Analyze	**CO3**
3	List out the differences between TIG Welding and MIG welding	L4.Analyze	**CO3**
4	With the help of a neat sketch explain the metal inert gas welding	L2.Understand	**CO3**
5	Describe the advantages and limitations of explosion welding.	L2.Understand	**CO3**
6	Explain various testing methods used for welding joints	L3.Apply	**CO3**
7	List out the differences between Soldering and Brazing	L4.Analyze	**CO3**
8	Explain the induction and Explosive welding.	L2.Understand	**CO3**

Unit 4: Short Answer Questions-

Sl. No	Question	Blooms Taxonomy Level	Course Outcome
1	What is Rolling?	L2.Understand	**CO4**
2	Write about power requirements of Rolling.	L2.Understand	**CO4**
3	What is re-crystallization temperature?	L2.Understand	**CO4**
4	What is the importance of Grain size in Rolling	L3.Apply	**CO4**
5	What is the difference between punching and blanking?	L4.Analyze	**CO4**
6	Explain wire and tube drawing	L2.Understand	**CO4**

Long Answer Questions-

Sl. No	Question	Blooms Taxonomy Level	Course Outcome
1	List the differences between hot working and cold working.	L4.Analyze	**CO4**

2	Describe the different stages of recovery, recrystallization and grain growth.	L2.Understand	**CO4**
3	What effects does re-crystallization have on properties of metals?	L4.Analyze	**CO4**
4	What is strain hardening and what effects does it have on the properties of metals?	L4.Analyze	**CO4**
5	Describe rolling mills and rolling of bars and shapes.	L2.Understand	**CO4**
6	Explain Piercing Process and seamless tube manufacturing	L2.Understand	**CO4**
7	How to find force and power requirement for a)rolling and b)Bending processes?	L3.Apply	**CO4**

Unit 5: Short Answer Questions-

Sl. No	Question	Blooms Taxonomy Level	Course Outcome
1	What is Forward Extrusion?	L2.Understand	**CO5**
2	What is Backward Extrusion?.	L2.Understand	**CO5**
3	What is a smith forging operation?	L2.Understand	**CO5**
4	What is rotary forging methods?	L2.Understand	**CO5**
5	Compare the cold and hot forging methods.	L4.Analyze	**CO5**
6	What is the function of Flash in Impression-die Forging	L2.Understand	**CO5**

Long Answer Questions-

Sl. No	Question	Blooms Taxonomy Level	Course Outcome
1	Differentiate between hot and cold spinning.	L4.Analyze	**CO5**
2	Differentiate between forward and backward extrusion processes.	L4.Analyze	**CO5**
3	Explain about coining.	L2.Understand	**CO5**
4	How are tubes extruded? How are they drawn?	L3.Apply	**CO5**
5	What are the different types of power hammers?	L2.Understand	**CO5**
6	How to find the forces in forging operation?	L3.Apply	**CO5**
7	What is Barrel Effect in Open-Die Forging and How to Control It	L4.Analyze	**CO5**

Blooms Taxonomy Level**: Knowledge(L1) ,Understand(L2), Application(L3), Analyze(L4)**

OBJECTIVE QUESTIONS:JNTUH:

UNIT-1

1. Which of the following are casting defect _____?
   a) Blow holes b) cold cracks c) sand spots d) all of the above
2. In soldering, the melting point of the filler metal should be _____.
   a) Below 300^0 C b) below 420^0 C c) above 420^0 C d) above 300^0 C

3. What are pattern materials?
   a) Wax b) wood c) metal d) plastic
4. Function of core vent option is _____.
   a) External b) Internal core c) reverse vent option d) course detraction
5. The purpose of sprue is to _____.
   a) Acts as reservoir for molten metal b) feed molten metal from pouring basin gate
   c) Removing pattern from the mould d) split the pattern in two parts

UNIT-2

1. A mixture of 70% sand and 30% clay is known as _____ sand.
2. To obtained high density and pure casting, _____ casting is used.
3. For cutting operation _____ flame is used.
4. In TIG welding _____ electrode is used.
5. _____ zinc diffusion process.
6. Best example for neutral flame _____.
7. In DCSP, electrode is connected with _____ terminal.
8. Welding process for analytic part _____.

UNIT-3

1. The process of pouring molten metal under high pressure in to mould, is known as _____.
   a) Die casting b) slush casting c) pressed casting d) permanent mould casting
2. Flux is not used in welding _____.
   a) cast iron b) brass c) bronze d) carbon steel
3. In thermit welding, the aluminum and iron oxide are mixed the proportion of _____.
   a) 1:3 b) 1:2 c) 1:1 d) 2:1
4. In arc welding processes, penetration is least for _____.
   a) DCSP b) DCRP c) A.C d) none of the above
5. Projection welding is a _____.
   a) An arc welding process b) a continuous welding process
   c) A multisport welding process d) a process used for joining round bars
6. Weld spatter refers to _____.
   a) flux b) welding defect c) filler material d) shield
7. In brazing, the melting point of the filler metal should be _____.
   a) Above 1000^0 C b) above 800^0 C c) above 420^0 C d) above 300^0 C
8. The torque of the rolls is _____.
   a) 1 b) 2 c) 0 d) 3

UNIT -4

1. In punching operation, the clearance is provided on _____.
   A) punch B) Die C) both D) none
2. In cold working of metals, the working temperature is _____.
   A) Less than the room temperature B) below the recrystallization temperature.
   C) Above the re-crystallization temperature D) None of the above
3. Which mechanical property of a metal should possess to enable it to be mechanically formed?
   A) Ductility B) Elasticity C) Machinability D) Brittleness.
4. Mass production of cooking utensils is usually done by _____.
   A) Stretching B) Deep drawing C) Coining D) Embossing

5. The following are the defects in forging _____.
   A) Cold shuts B) Internal cracks C) Surface cracks D) All of the above
6. Large size Rivet heads are made by _____.
   A) Hammerzing B) Swaging C) upset forging D) none of the above
7. In press tool operations, the following one is the shaping operation. _____.
   A) Blanking B) Piercing C) Notching D) Drawing
8. In blanking operation, the clearance is provided on _____.
9. The starting material for Rolling is _____
10. In Two-high Rolling mill, the rolls are rotated in _____ direction.
11. In deep drawing the height of the cup is _____ the diameter.

UNIT -5

1. Cold working of metal increases _____.
   A) Hardness B) Tensile strength C) Yield strength D) All of the above
2. Following material is a good example for thermo-plastics _____.
   A) PVC B) Urea formaldehyde C) Phenol-formaldehyde D) none of the above
3. Extrusion ratio is defined as _____.
4. In hydrostatic extrusion the most commonly used pressure transmitting fluid is _____.
5. The _____ additive increases strength, stiffness and impact resistance to the plastics
6. PVC stands for _____.

GATE:

1. In a rolling process, the state of stress of the material undergoing deformation is _____.
   (A) Pure compression (B) Pure shear (C) Compression and shear (D) Tension and shear
2. The maximum possible draft in cold rolling of sheet increases with the:
   A) Increase in coefficient of friction (B) Decrease in coefficient of friction
   C) Decrease in roll radius (D) Increase in roll velocity
3. Green sand mould indicates that:
   (A) Polymeric mould has been cured (B) Mould has been totally dried
   (C) Mould is green in color (D) Mould contains
4. The material property which depends only on the basic crystal structure is:
   (A) Fatigue strength (B) work hardening (C) fracture strength (D) Elastic constant
5. In a gating system, the ratio 1:2:4 represents:
   (A) sprue base area: runner area: ingate area
   (B) pouring basin area: ingate area: runner area
   (C) sprue base area: ingate area: casting area
   (D) runner area: ingate area: casting area
6. Two streams of liquid metal, which are not hot enough to fuse properly, result into a casting defect known as:
   (A) Cold shut (B) swell (C) sand wash (D) scab
7. An expendable pattern is used in
   (A) Slush casting (B) squeeze casting (C) Centrifugal casting (D) investment casting
8. The main purpose of spheroid sing treatment is to improveS
   (A) Hardenability of low carbon steels (B) machinability of low carbon steels
   (C) Hardenability of high carbon steels (D) machinability of high carbon steels.

9. When the temperature of a solid metal increases _____.
   (a) strength of the metal decreases but ductility increases
   (b) both strength and ductility of the metal decrease
   (c) both strength and ductility of the metal increase
   (d) strength of the metal increases but ductility decreases
10. The strength of a brazed joint:
   (a) decreases with increase in gap between the two joining surface
   (b) increases with increase in gap between the two joining surfaces
   (c) decreases up to certain gap between the two joining surfaces beyond which
   (d) it increases
   (e) increases up to certain gap between the two joining surfaces beyond which it decreases
11. The purpose of sprue is to _____.
   a) Acts as reservoir for molten metal b) feed molten metal from pouring basin gate
   c) Removing pattern from the mould d) split the pattern in two parts
12. Which of the following are casting defect _____?
   a) blow holes b) cold cracks c) sand spots d) all of the above
13. In soldering, the melting point of the filler metal should be _____.
   a) Below 300^0 C b) below 420^0 C c) above 420^0 C d) above 300^0 C
14. The process of pouring molten metal under high pressure in to mould, is known as:
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15. Flux is not used in welding _____.
   a) cast iron b) brass c) bronze d) carbon steel
16. In thermit welding, the aluminum and iron oxide are mixed the proportion of _____.
   a) 1:3 b) 1:2 c) 1:1 d) 2:1
17. Projection welding is a _____.
   a) An arc welding process b) a continuous welding process
   c) A multisport welding process d) a process used for joining round bars
18. Weld spatter refers to _____.
   a) flux b) welding defect c) filler material d) shield
19. Match the CORRECT pairs. Processes Characteristics – P. Friction Welding; Q. Gas Metal Arc Welding; R. Tungsten Inert Gas Welding, S. Electro slag welding. Application – 1. Non-consumable electrode: 2. Joining of thick plates: 3. Consumable electrode wire: 4. Joining of cylindrical dissimilar materials.
   (A) P-4;Q-3;R-1;S-2 (B) P-4;Q-2;R-3;S-1 (C) P-2;Q-3;R-4;S-1 (D) P-2;Q-4;R-1;S-3.
20. Match the items of List I (Equipment) with the items of List II (Process) and select the correct answer using the given codes. List I (Equipment) P – Hot Chamber Machine; Q – Muller; R – Dielectric Baker; S – Sand Blaster. List II (Process) 1 – Cleaning; 2 – Core making; 3 – Die casting; 4 – Annealing; 5– Sand mixing.
   (a) P – 2 Q – 1 R – 4 S – 5 (b) P – 4 Q – 2 R – 3 S - 5
   (c) P – 4 Q – 5 R – 1 S - 2 (d) P – 3 Q – 5 R – 2 S - 1

IES:

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   c) hardenability of high carbon steels d) machinability of high carbon steels
4. When the temperature of a solid metal increases.
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EXPERT DETAILS:

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JOURNALS:

International Journal of Manufacturing Technology
CIRP journal of Manufacturing Technology
ASME journal of Manufacturing Technology
International Journal of Manufacturing and Machine Tools

LIST OF TOPICS FOR STUDENT SEMINARS:

Advance Manufacturing Technology
NDT Technology
Advances in Forming Technology
Advances in welding Technology

CASE STUDIES / SMALL PROJECTS

Topics Related to Casting, Forming, Welding and 3D printing