((Module Name)

Manufacturing Process

Course Catalogue

2023-2024

College/ Institute	Erbil Technical engineering	
Department	Mechanical and Energy Tech. Engineering	
Module Name	Manufacturing Process	
Module Code	MAP604	
Degree	Technical Diploma ☐ Bachler ☑ High Diploma ☐ Master ☐ PhD ☐	
Semester	6	
Qualification	PhD in Mechanical Engineering	
Scientific Title	Assistant professor	
ECTS (Credits)	5.04	
Module type	Prerequisite ☐ Core ☑ Assist. ☐	
Weekly hours	2+1= 3	
Weekly hours (Theory)	(3)hr Class	(36) hr Workload
Weekly hours (Practical)	(0)hr Class	(0) hr Workload
Number of Weeks	12	
Lecturer (Theory)	Assist. Dr. Gailan Ismail Hassan	
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Lecturer (Practical)		
E-Mail & Mobile NO.		
Websites		

Course Book

Course Description	**This course provides an introduction to the manufacturing processes that are used in industry to manufacture products that are widely used in daily life. Confirming the importance manufacturing sciences in the day-to-day life, and to study the basic manufacturing processes and tools used. It covers different manufacturing properties, casting, metal forming (rolling, forging, extrusion, sheet metal forming, and drawing), polymer processing, particulate processing like (powder metallurgy and ceramic/glass forming), heat treatment, welding, and machining** **Theoretical hours will be suitable to the student to learn different manufacturing process and their principles, equipment, application, limitation, how they work...etc.** **Tutorial hours will be helpful to the students to Recognize, understand and develop working knowledge of broad range of manufacturing processes that are used in the industry. All these types of manufacturing processes which student studied on it available in local market and workshops.**
Course objectives	**The main objectives:** **1. Recognize, understand and develop working knowledge of broad range of manufacturing processes that are used in the industry.** **2. To compare the existing technologies used in casting, shaping, forming, property enhancing, joining and assembly process.** **3. To apply the limitations and advantages of different manufacturing processes with an economic point of view to the industry.** **4. To learn how component can be manufactured in sustainable manner and learn about the environmental hazards of different manufacturing processes.** **5. To working on different manufacturing equipment.** **6. To working in mechanical workshops.**
Student's obligation	**Class attendance, preparing yearly report on one subject of manufacturing process by each student using power point not less than 10 slides with the video shot and at the end of every chapter they must be ready to show it as presentation. Quiz for each chapter. (More than 4 quiz at the end). Present one project by (three students in one group) on different processes. Preparing two home works on different manufacturing processes. Attendance at tutorial hours on all manufacturing process.**
Required Learning Materials	**Data show, power point, white board, seminar, pictures and video, tutorial on different types of manufacturing processes.**

	Task		Weight (Marks)	Due Week	Relevant Learning Outcome
Evaluation	Paper Review				
	Assignments	Homework	10%		
		Class Activity	2%		
		Report			
		Seminar	8%		
		Essay			
		Project	8%		
	Quiz		8%		
	Lab.				
	Midterm Exam		24%		
	Final Exam		40%		
	Total		100%		

Specific learning outcome:

The main outcome:

1. **Apply appropriate manufacturing processes for a product and determine its parameters.**
2. **To understand the importance of economic considerations in the selection of manufacturing processes.**
3. **Distinguish between different types of casting and differentiate between their output product characteristics.**
4. **Describe, in engineering sketch form, the bulk deformation processes of forging, rolling, extrusion, and drawing, and formability of sheet metal.**
5. **Identify specific glassmaking and ceramics processing methods based on material and component.**
6. **To understand two another welding processes (Thermite, laser beam welding) as joining processes.**
7. **Characterize the major materials removing process like turning, milling, and drilling via description of cutting tools used and basic components of the machine tools.**
8. **Relate the common mechanisms of cutting tool wear to desirable cutting tool material properties, and surface finishing.**

Course References:	▪ Key references: 1. **Mikell P. Groover; "Fundamentals of Modern Manufacturing" 4th edition, 2010.** 2. **Kalpakjian; "Manufacturing Engineering and Technology"6th, 2009.** ▪ Useful references: 1. **P. J. Harris; "Manufacturing technology 3", 1981.** 2. **D. Brandon and W. Kaplan;" Joining processes; an Introduction", 1997.** 3. **D. Dudzinski, at all "Metal Cutting and High Speed Machining", 2002.** ▪ Magazines and review (internet): 1.

Course topics (Theory)	Week	Learning Outcome
Overview of manufacturing, technological, economic, products, manufacturing capability, materials in manufacturing (metals, ceramics, polymers, composite). Manufacturing processing operations (shaping processes), Assembly operations.	1	**Apply appropriate manufacturing processes**
Pattern making, characteristics, materials, (wood, metals, plastics), finishing, colour scheme, pattern allowances (shrinkage, machining, draft / taper. Product design considerations.	2	***To study pattern fabrication***
Metal casting processes, categories, characteristic, sand moulding, sequence, core, foundry sand, binders, Properties. Expendable mould processes (shell, expanded polystyrene, investment, plaster, ceramic mould).	3	***To study sand casting process***
Permanent mould casting, steps, dies casting machines (hot-chamber, cold-chamber), moulds for die casting, processes (squeeze, continuous, centrifuge). Furnaces (cupolas, direct fuel-fired, crucible, electric-arc, induction). Ladles. Metals for casting.	4	***To study different die casting for different metals.***
Solidification of metals & alloys). Cooling rates, fluid flow, sprue design. Fluidity of molten metal (characteristics, parameters), heat transfer. Solidification time, shrinkage. Casting quality: defects, general & sand defects. Foundry inspection methods.	5	***To study solidification process of different metals.***
Sheet-metal forming, bulk deformation, classification (cold, warm, hot). Types: rolling (steps of rolling, basic types), forging (open-die, barrelling, cogging, impression-die, closed-die /flashness), extrusion (hot, cold, direct, indirect/ hydrostatic extrusion), Drawing.	6	***To study sheet metal forming and making with advantages and disadvantages.***
Sheet-metal characteristics, classification, shearing (engineering analysis, clearance, cutting forces). Bending (allowance, springback, bending forces). Deep-drawing (clearance, engineering analysis, holding force). Stretch forming. Formability of sheet metals. Tests (ductility, tensile test, cupping, dented test).	7	***To study sheet metal forming characteristics, and formability.***
Glassworking, principal, raw materials and melting furnaces,	8	***To study glass***

shaping, discrete (spinning, pressing, blowing), continuous (rolling, float, drawing). Fiber-making, heat treatment, finishing. Traditional Ceramics (slip casting, plastic forming, semi-dry, dry pressing). Drying, sintering. Processing of new ceramics (hot pressing).		***making and Traditional ceramics and new ceramics***
Joining processes, welding, key features of welding, fusion welding, friction welding, friction stir welding (operation, characteristics, parameters, microstructure, friction stir tools (geometry, shoulders, probes, materials). Friction stir processing, surface modification technique.	9	***To study stud stir welding and its applications.***
Joining processes, Thermite, equipment's (refectory crucible, mold, wax pattern, moulding flask, mold handle clamp), principles, procedures. Laser beam welding, properties, types, principle, equipment (laser machine CAM, CAD, shielding gas, power source).	10	***To study gas welding process type thermit and laser beam welding.***
Material removal process, machining, types of operations, cutting tool, cutting conditions, machining operations, machine tools. Theory of chip formation in metal machining, orthogonal cutting model. Actual chip formation, forces in metal cutting.	11	***To recognize cutting process by turning, drilling and milling***
Power & energy in machining, operations, machine tools. Turning (cutting conditions, operations related to turning). Machining centers and turning centers, cutting tool-technology, tool wear, tool materials, cutting fluids, machinability. Tolerances and surface finish.	12	***To study cutting-tool technology***
Course topics (Tutorial)	**Week**	**Learning Outcome**
Casting Process (pattern making, sand casting Procedure, and metals for casting	4	**Recognize between different types of casting.**
Bulk deformation processes, sheet metal forming, glas making and ceramics	3	**Describe the bulk deformation processes**
Joining processes (Thermit. Laser beam welding)	2	**To study thermit welding and laser beam welding.**
Materials removing processes and (tool wear, cutting tool materials, and surface finish)	2	**materials removing, cutting tool wear, tool material properties, and surface finishing.**
Questions Example Design: ***Reviews:***		

1. **How does a shaping process differ from a surface processing operation?**
2. **What is the difference between vacuum permanent-mold casting and vacuum molding?**
3. **What is a chaplet, explain with the help of sketches?**

Multiple choices:

1. **Which one of the following engineering materials is defined as a compound containing metallic and non-metallic elements: (a) ceramic, (b) composite, (c) metal, or, (d) polymer?**
2. **In processes include which of the following (two correct answers): (a) casting, (b) drilling, (c) extrusion, (d) forging, (e) milling, (f) painting, and, (g) sintering?**
3. **A misrun is which one of the following defects in casting: (a) globules of metal becoming entrapped in the casting, (b) metal is not properly poured into the down sprue, (c) metal solidifies before filling the cavity, (d) microporosity, and (e) ‘‘pipe’’ formation?**

Problems:

A cylindrical riser must be designed for a sand-casting mould. The casting itself is a steel rectangular plate with dimensions 7.5 cm * 12.5 cm * 2.0 cm. Previous observations have indicated that the total solidification time (T_{TS}) for this casting = 1.6 min. The cylinder for the riser will have a diameter-to-height ratio= 1.0. Determine the dimensions of the riser so that its, T_{TS} = 2.0 min.

Extra notes:

External Evaluator

I reviewed this course book it is will organized and satisfied the qualification of 3ed year.

Assist. Prof. Dr. Younis Khalid Khdir