INSTITUTE OF AERONAUTICAL ENGINEERING

(Autonomous)

Dundigal - 500 043, Hyderabad, Telangana

COURSE CONTENT

AEROSPACE MATERIALS AND PROCESSING LABORATORY								
III Semester: AE								
Course Code	**Category**	**Hours / Week**			**Credits**	**Maximum Marks**		
AAEE06	**Core**	**L**	**T**	**P**	**C**	**CIA**	**SEE**	**Total**
		0	0	2	1	40	60	100
Contact Classes: Nil	**Tutorial Classes: Nil**	**Practical Classes: 36**				**Total Classes: 36**		
Prerequisite: Aerospace Materials and Processing Techniques								

I. COURSE OVERVIEW:

Aerospace Materials and Processing laboratory is structured to provide in-depth practical exposure to the characterization and testing of engineering materials, along with conventional material removal and forming processes essential to aircraft component manufacturing. The laboratory focuses on correlating material microstructure, mechanical behaviour, and machinability with appropriate manufacturing and joining techniques. Emphasis is placed on the selection of processes, tooling, and parameters to achieve aerospace components with high dimensional precision, structural integrity, cost effectiveness, and enhanced operational life.

II. COURSE OBJECTIVES:

The students will try to learn:

I. The basic material properties to identify the suitable applications in aerospace industries.

II. The conventional machining techniques required for aircraft production.

III. The tooling and material joining technique used in aircraft assembly.

III.COURSE OUTCOMES:

After successful completion of the course, students should be able to:

CO1 Identify the microstructures of the materials for selecting the suitability in industrial applications

CO2 Illustrate various jobs for joining the materials using welding operation in real time applications.

CO3 Identify the types of machining process required for producing desired shape of components used in Aerospace and allied industries.

CO4 Demonstrate moulding processes and their application for producing machine components used in industries.

CO5 Select the suitable tools and process parameters required in machining, drilling and slotting operations for producing components with minimum cost

CO6 Illustrate various jobs for joining the materials using Riveting operation in industries.

IV. COURSE CONTENT:

EXERCISE -1: BASIC METALLURGY -I
Preparation of metallographic specimens and microscopic examination of pure metals such as Copper (Cu) and Aluminium (Al) to study grain structure and phase distribution.

EXERCISE -2: BASIC METALLURGY -II
Study and comparison of microstructures of non-ferrous alloys and heat-treated steels, focusing on the effect of alloying and heat treatment on material properties.

EXERCISE -3: LATHE OPERATIONS -I
Introduction- lathe machine, plain turning, Step turning & grooving.

EXERCISE -4: LATHE OPERATIONS -II
Taper turning-compound rest/offset method & Drilling using lathe, External Threading-Single start

EXERCISE -5: SHAPING
Machining of V-block using shaping operations.

EXERCISE -6: SLOTTING
Machining of keyways using slotting process.

EXERCISE -7: MILLING
Performing face milling, end milling, and side milling operations.

EXERCISE -8: GRINDING
Performing cylindrical grinding, surface grinding, and tool & cutter grinding operations to achieve high dimensional accuracy and surface finish.

EXERCISE -9: DRILLING
Performing drilling, reaming, counterboring, countersinking, and tapping operations for hole-making applications.

EXERCISE -10: WELDING PROCESSES I
Performing brazing and soldering operations, focusing on joint preparation, filler materials, and application suitability.

EXERCISE -11: WELDING PROCESS II
Performing Arc welding and Spot welding

EXERCISE -12: BASIC CASTING
Preparation of simple castings using sand Moulds and basic patterns, including gating and riser concepts.

EXERCISE -13: INJECTION MOULDING
Perform polymer processing techniques, including blow moulding and injection moulding

EXERCISE -14: ADDITIVE MANUFACTURING
Performing the Fused Deposition Modelling (FDM) process to design and fabricate a component, with emphasis on process parameters and part quality

V. TEXT BOOKS:

1. S. Kalpakjian, Steven R. Schmid, “Manufacturing Engineering and Technology”, Addison Wesley , 5th Edition, 1991.
2. G. F. Titterton, Aircraft Materials and Processes, 5/e, Sterling Book House,1998.
3. S. C. Keshu, K. K Ganapathy, “Aircraft production technology and management”, Interline Publishing House, Bangalore, 3rd Edition, 1993.

4. C. P. Paul, A. N. Jinoop, “Additive Manufacturing”, 1st edition-2021, McGraw Hill India

VI. REFERENCE BOOKS:

1. S. C. Keshu, K. K Ganapathy, “Aircraft production techniques”, Interline Publishing House, Bangalore, 3rd edition,1993.
2. R. K. Jain, “Production technology”, McGraw Hill, 1st edition, 2002.
3. O. P. Khanna, M. Lal, “Production technology”, DhanpatRai Publications, 5th edition, 1997.
4. L. Gupta, Advanced Composite Materials, 2/e, Himalayan Books, 2006.

VII. ELECTRONICS RESOURCES:

1. https://nptel.ac.in/courses/112107145/
2. https://nptel.ac.in/courses/112105126/
3. https://books.google.co.in/books?id=6wFuw6wufTMC&redir_esc

VIII. MATERIALS ONLINE

1. Course Outline Description
2. Lab Manual