



# INSTITUTE OF AERONAUTICAL ENGINEERING

(Autonomous)

Dundigal, Hyderabad - 500 043

## AERONAUTICAL ENGINEERING COURSE DESCRIPTION FORM

<b>Course Title</b>	<b>AIRCRAFT PRODUCTION TECHNOLOGY</b>			
<b>Course Code</b>	<b>A42104</b>			
<b>Regulation</b>	<b>R15 - JNTUH</b>			
<b>Course Structure</b>	Lectures	Tutorials	Practicals	Credits
	3	1	-	4
<b>Course Coordinator</b>	Dr. D.Govardhan, Professor			
<b>Team of Instructors</b>	Dr. D.Govardhan, C.Satya Sandeep, R.Suresh, P.Ravi			

### I. COURSE OVERVIEW:

**Production engineering** is a combination of manufacturing technology with management science. The goal is to accomplish the production process in the smoothest, most-judicious and most-economic way. Production engineering encompasses the application of castings, machining processing, joining processes, metal cutting & tool design, metrology, machine tools, machining systems, automation, jigs and fixtures, and die and mould design and material science and design of automobile parts and machine designing and manufacturing. Production engineering also overlaps substantially with manufacturing engineering and industrial engineering. In industry, once the design is realized, production engineering concepts regarding work-study, ergonomics, operation research, manufacturing management, materials management, production planning, etc., play important roles in efficient production processes. These deal with integrated design and efficient planning of the entire manufacturing system, which is becoming increasingly complex with the emergence of sophisticated production methods and control systems.

### II. PREREQUISITE(S):

Level	Credits	Periods/ Week	Prerequisites
UG	4	4	Basic mechanical principles and processes.

### III. MARKS DISTRIBUTION:

Sessional marks	University End Exam marks	Total marks
<b>Mid Semester Test</b> There shall be two midterm examinations. Each midterm examination consists of subjective type and objective type tests.	75	100

<p>The subjective test is for 10 marks of 60 minutes duration.  Subjective test of shall contain 4 questions; the student has to answer 2 questions, each carrying 5 marks.</p> <p>The objective type test is for 10 marks of 20 minutes duration. It consists of 10 Multiple choice and 10 objective type questions, the student has to answer all the questions and each carries half mark.</p> <p>First midterm examination shall be conducted for the first two and half units of syllabus and second midterm examination shall be conducted for the remaining portion.</p> <p><b>Assignment</b>  Five marks are earmarked for assignments.  There shall be two assignments in every theory course. Marks shall be awarded considering the average of two assignments in each course.</p>		
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#### IV. EVALUATION SCHEME:

S. No	Component	Duration	Marks
1.	I Mid Examination	80 minutes	20
2.	I Assignment	-	5
3.	II Mid Examination	80 minutes	20
4.	II Assignment	-	5
5.	External Examination	3 hours	75

I.

#### V. COURSE OBJECTIVES:

- I. **Discuss** the basic tasks of theory of elasticity and methods of solving the problems and to apply the methods in technical calculations on the basis of illustrative examples.
- II. **Understand** to determine the components of the stress and strain tensors and how to apply the conditions of compatibility and equations of equilibrium.
- III. **Analyze** statically indeterminate structure by using different approximate methods.
- IV. **Demonstrate** curvature beams and how to determine deflection using various approximation methods.
- V. **Understand** concept of stability of structural systems and different modes of instability of structures.
- VI. **Demonstrate** the basic concepts energy methods and to apply them on different structures.
- VII. **Understand** the concept of shear flow for various aerospace structures.

## VI. COURSE OUTCOMES:

**At the end of the course the students are able to:**

1. **Apply** the stress strain relations in conjunction with elasticity and material properties to determine the strain given stress or vice versa.
2. **Differentiate** between redundant structures and determinate structures.
3. **Analyze** the redundant structures of complex structural components subjected to different loading and boundary conditions.
4. **Evaluate** beams with elastic supports.
5. **Analyze** the stability of structural elements and determine buckling loads.
6. **Apply** the structural analysis theories and to predict the performance of bars under axial loading including buckling.
7. **Analyze** the behavior of thin-walled beams subjected to combined loads, including bending, torsion, and shear.
8. **Discuss** about exact solution methods for various members.
9. **Calculate** analysis for different structural members by different energy methods.
10. **Explain** shear analysis for aerospace closed section box structures.

Program Outcomes		Level	Proficiency Assessed by
PO 1	Knowledge in fundamentals of mathematics, science and engineering.	H	Discussions
PO 2	An ability to identify, formulate and solve problems in key areas of Aerodynamics, Structures, Propulsion, Flight Dynamics and Control, Design, Testing, Space and Missile Technologies and Aviation of Aeronautical Engineering discipline	H	Discussions Assignments
PO 3	An ability to design and conduct experiments, analyze and interpret data related to various areas of Aeronautical Engineering.	S	Discussions
PO 4	An ability in conducting investigations to solve problems using research based knowledge and methods to provide logical conclusions.	H	Mini Projects
PO 5	Skills to use modern engineering and IT tools, software and equipment to analyze the problems in Aeronautical Engineering.	S	Mini Projects
PO 6	Understanding of impact of engineering solutions on the society to assess health, safety, legal, and social issues in Aeronautical Engineering.	N	
PO 7	The impact of professional engineering solutions in environmental context and to be able to respond effectively to the needs of sustainable development.	N	
PO 8	The knowledge of Professional and ethical responsibilities.	N	

PO 9	An ability to work effectively as an individual and as a team member/leader in multidisciplinary areas.	S	
PO10	An ability to critique writing samples (abstract, executive summary, project report), and oral presentations.	S	
PO11	Knowledge of management principles and apply these to manage projects in multidisciplinary environments.	N	
PO12	The need of self-education and ability to engage in life - long learning.	H	Assignments

**N-None**

**S-Supportive**

**H-Highly Related**

<b>Program Outcomes</b>		<b>Level</b>	<b>Proficiency assessed by</b>
PSO 1	<b>Professional skills:</b> Able to utilize the knowledge of aeronautical/aerospace engineering in innovative, dynamic and challenging environment for design and development of new products	H	Discussions
PSO 2	<b>Problem solving skills:</b> imparted through simulation language skills and general purpose CAE packages to solve practical, design and analysis problems of components to complete the challenge of airworthiness for flight vehicles	H	Discussions Assignments
PSO 3	<b>Practical implementation and testing skills:</b> Providing different types of in house and training and industry practice to fabricate and test and develop the products with more innovative technologies	H	Project
PSO 4	<b>Successful career and entrepreneurship:</b> To prepare the students with broad aerospace knowledge to design and develop systems and subsystems of aerospace and allied systems and become technocrats	H	

**N-None**

**S-Supportive**

**H-Highly Related**

## **VII. SYLLABUS:**

### **UNIT – I**

#### **CASTING AND WELDING**

General principles of various Casting Processes - Sand casting, die-casting, centrifugal casting, investment casting, shell molding types

Principles and equipment used in arc welding, gas welding, resistance welding, Laser welding, Electron beam welding, Soldering and brazing techniques.

### **UNIT - II**

#### **MACHINING AND FORMING**

General Principles (with schematic diagram only) of working and types-lathe, shaper, milling machines, grinding, drilling m/c, CNC machining and general principles.

Sheet metal operations-shearing, punching, super plastic forming and diffusion bonding, Automation in bend forming and different operations in bending like stretch forming spinning drawing etc.

### **UNIT- III**

#### **UNCONVENTIONAL MACHINING**

Principles (with schematic diagram only) of working and applications of abrasive jet machining, ultrasonic machining, electric discharge machining, and electro chemical machining, laser beam/electron beam/plasma arc machining

### **UNIT-IV**

#### **HEAT TREATMENT AND SURFACE FINISHING**

Heat treatment of Aluminum alloys, titanium alloys, steels, case hardening, Initial stresses and the stress alleviation procedures. Corrosion prevention, protective treatment for aluminum alloys, steels, anodizing of titanium alloys, organic coating, and thermal spray coatings.

### **UNIT - V**

#### **JIGS & FIXTURES**

Jigs, fixtures, stages of assembly, types of equipment for riveted joints, bolted joints, Aircraft tooling concepts.

**NDT and other Inspection techniques:** Dye penetrant test, X-Ray, magnetic particle, and ultrasonic testing, Acoustic holography.

#### **TEXTBOOKS:**

1. "Manufacturing Engineering and Technology" by Kalpakajam – Addison Wesley.

#### **REFERENCES:**

1. "Air craft production techniques" Keshu S.C, Ganapathy K.K., Interline Publishing House, Banglore-1993

2."Production technology "- R.K Jain-Khanna Publishers-2002.

3."Production technology" O.P Khanna and lal.M.Dhanpat rai publications-1997

## VIII. COURSE PLAN:

At the end of the course, the students are able to achieve the following course learning outcomes.

Lecture No.	Course Learning Outcomes	Topics to be covered	Reference
1-3	<b>Explain</b> Casting process	<b>UNIT I : CASTING AND WELDING</b> General principles of various Casting Processes - Sand casting, die-casting, centrifugal casting, investment casting.	T1
3-5	<b>Describe</b> the shell molding types	shell molding types	T1
5-7	<b>Define</b> Welding	Principles and equipment used in arc welding, gas welding	T1
7-10	<b>Explain</b> Types of Welding	Laser welding , Electron beam welding	T3
10-12	<b>Explain</b> Soldering and Brazing	Soldering and brazing techniques	T3
12-14	<b>Describe</b> the working of lathe machine with general principles	<b>UNIT II : MACHINIG AND FORMING</b> General principles of working and types of lathe	T2
14-19	<b>Explain</b> the working of the machines	Shaper, milling machines, grinding, drilling m/c, CNC machining and general principles.	T2
19-21	<b>Discuss</b> the process in sheet metal operations	Sheet metal operations-shearing	T2
21-23	<b>Define</b> punching super plastic forming and diffusion bonding	punching, super plastic forming and diffusion bonding	-
23-25	<b>Explain</b> the process of Automation in bend forming	Automation in bend forming	-
25-27	<b>Define and explain</b> the bending operations	Different operations in bending like stretch forming spinning drawing etc.	-
27-30	<b>Describe</b> the unconventional machining processes <b>Explain</b> its working principle <b>Discuss</b> its applications	<b>UNIT III: UNCONVENTIONAL MACHINING</b> Principles (with schematic diagram only) of working and applications of abrasive jet machining,	-
30-32	<b>Explain</b> ultrasonic machining	ultrasonic machining	-
32-34	<b>Explain</b> EDM	electric discharge machining	T3
34-36	<b>Describe</b> and Discuss ECM	electro chemical machining	T3
36-39	<b>Describe</b> Laser and electron beam plasma arc machining	laser beam/electron beam/plasma arc machining	-
39-41	<b>Describe</b> the process of		T3

	heat treatment	<b>UNIT IV : HEAT TREATMENT AND SURFACE FINISHING</b> Heat treatment of Aluminum alloys	
41-44	<b>Discuss</b> case hardening	titanium alloys, steels, case hardening	T3
44-48	<b>Explain</b> Stresses and stress elevation procedures	Initial stresses and the stress alleviation procedures	T3
48-50	<b>Define and Discuss</b> Corrosion prevention	Corrosion prevention	T3
50-52	<b>Explain</b> protective treatment of aluminum alloys	protective treatment for aluminum alloys	T3
52-54	<b>Explain</b> anodizing titanium alloys	anodizing of titanium alloys	-
54-57	<b>Discuss</b> coating types	organic coating, and thermal spray coatings	-
57-60	<b>Define</b> jigs and stages of the assembly	<b>UNIT V : JIGS &amp; FIXTURES</b> Jigs, fixtures, stages of assembly	T2
60-61	<b>Discuss</b> types of riveted joints	types of equipment for riveted joints	T2
61-62	<b>Define</b> bolted joints	bolted joints	T2
63-64	<b>Discuss</b> aircraft tooling concepts	Aircraft tooling concepts.	T2
64-65	<b>Explain</b> Dye penetration test	Dye penetrate test	T2
65-66	<b>Discuss</b> X-Ray magnetic particle and ultrasonic testing	X-Ray, magnetic particle, and ultrasonic testing	T1
66-67	<b>Explain</b> Acoustic holography	Acoustic holography	T1

### IX. MAPPING COURSE OBJECTIVES LEADING TO THE ACHIEVEMENT OF PROGRAM OUTCOMES

Course Objectives	Program Outcomes												Program Specific Outcomes			
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
I	S	H	S		S					S		H	H	S	S	
II	H	H	S	S	S							H	H	S	S	
III	H	H	H		S					S		H	S	H		
IV	H	S	S	H	S					S		H	H	S		
V	H	H	H	H	S					S		H	H		S	
VI	H	H	S	S	S							H	H	S		
VII	H	H	H	H	S					S		H	H	S		

**S = Supportive**

**H = Highly Related**

**X.MAPPING COURSE OUTCOMES LEADING TO THE ACHIEVEMENT OF PROGRAM OUTCOMES:**

Course Outcomes	Program Outcomes												Program Specific Outcomes			
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
1	H	H	H	S	H				S			H	H	S		
2	H				H								H	S		
3	H	H	H	H	H							H		H	S	
4	H	H	H	H								H		H	S	
5	H	S	H	H	H							H		H	S	
6	H	S	H	H								S	H	S		
7	H	H		H	S							H		H	S	
8	H			S								H	H	S		
9	H													H	S	
10	H												H	S		

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**Prepared by:** Dr. D.Govardhan, Professor.

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