INSTITUTE OF AERONAUTICAL ENGINEERING

(Autonomous)

Dundigal, Hyderabad - 500 043

AERONAUTICAL ENGINEERING

TUTORIAL QUESTION BANK

Course Name	:	**AIRCRAFT MATERIALS AND PRODUCTION**
Course Code	:	**AAE005**
Regulation	:	IARE - R16
Year	:	2018 – 2019
Class	:	B. Tech IV Semester
Branch	:	Aeronautical Engineering
Team of Instructors	:	Mr. T. Mahesh Kumar, Assistant Professor Mr. R. Suresh Kumar, Assistant Professor

COURSE OBJECTIVES (COs)

The course should enable the students to:

S. No	Description
I	Study the composition of microstructures of metals and alloys with their applications in aerospace industry
II	Discuss the various manufacturing processes and selection of process for suitable applications.
III	Understand the working principles and applications of conventional and unconventional machining along with their advantages and disadvantages.
IV	Demonstrate the importance of composites with their applications in different areas of aerospace industry.

COURSE LEARNING OUTCOMES (CLOs)

Students, who complete the course, will be able to demonstrate the ability to do the following:

AAE005.01	Understand about the aircraft engineering materials especially aluminium and steel along with the corrosion and coating methods.
AAE005.02	Remember the procedure used in different types of the welding process along with the NDT and inspection techniques.
AAE005.03	Understand the operation methods of Sheet metal operations like shearing, punching, super plastic forming with operations in bending like stretch forming spinning drawing and Riveting.
AAE005.04	Understand about the working principles of fasteners, integral tanks with final assembly of aircraft.
AAE005.05	Understand about the jigs, fixtures with their practical applications in the aeronautical manufacturing firms.
AAE005.06	Remember the operation procedure of turning, milling, grinding and drilling of a specimen.
AAE005.07	Getting knowledge about the techniques to produce a safe, effective, economic final product
AAE005.08	Understand the theoretical knowledge behind the design and development of aircraft components
AAE005.09	Knowledge about the basic convectional, unconventional riveting and welding for knowledge based exams
AAE005.10	Discuss the principle of advanced materials and what factors drive to develop the composite materials.

AAE005.11	Extend the outputs of earlier research and discover good ideas for new products or improving current products.
AAE005.12	Remember the Physical metallurgy of wrought aluminum alloys, Cast aluminum alloys, and the production of semi-fabricated forms along with Aerospace applications.
AAE005.13	Knowledge about what materials used to manufacture each component in an aircraft especially components operating at high temperatures like turbines and combustion chamber.
AAE005.14	Ability to summarize the efficiency of the product development in achieving the mission goal and safety of flight.

TUTORIAL QUESTION BANK

UNIT - I			
AIRCRAFT ENGINEERING MATERIALS			
PART - A (SHORT ANSWER QUESTIONS)			
S No	**QUESTIONS**	**Blooms Taxonomy Level**	**Course Learning Outcomes**
1	Define the term materials? List eight commonly encountered engineering materials.	Remember	AAE005.01
2	Explain the main classes of engineering materials?	Understand	AAE005.02
3	Mention some of the important properties of each of these engineering materials?	Understand	AAE005.02
4	Define is modulus of elasticity?	Understand	AAE005.02
5	Define an alloy and mention most popular alloys in aircraft manufacturing.	Understand	AAE005.03
6	Define phaseand mention most popular alloys in aircraft manufacturing.	Understand	AAE005.02
7	Define Eutectic system.	Understand	AAE005.04
8	Define Partial eutectic system.	Remember	AAE005.04
9	Define Peritectic system.	Remember	AAE005.04
10	Sketch a Monotectic system. Explain the basic parts of it?	Remember	AAE005.04
11	Explain the term is Critical Temperature?	Understand	AAE005.02
12	Define cooling curve. With neat sketch discuss about its parts?	Understand	AAE005.02
13	Draw the stages of structures from Solid to Liquid formation in binary system?	Remember	AAE005.02
14	Give examples of non-ferrous materials?	Understand	AAE005.02
15	Explain corrosion? Write down the chemical equation involved in it.	Understand	AAE005.03
16	How we can protect material from corrosion?	Remember	AAE005.02
17	Define the term annealing? Quote some of the applications.	Remember	AAE005.04
18	Define the term Quenching? Quote some of the applications.	Understand	AAE005.04
19	Define the term normalizing? Quote some of the applications.	Remember	AAE005.02
20	Explain the process of heat treatment of a material?	Remember	AAE005.04
PART - B (LONG ANSWER QUESTIONS)			
1	Explain allotropic forms of iron and give lattice structure of each. Draw the neat diagrams of the structures?	Remember	AAE005.03
2	Define ferrite, pearlite, and austenite. What are the applications of them?	Remember	AAE005.02
3	What is Peritectic reaction and explain with diagram? Write down the applications of them?	Remember	AAE005.01
4	What is eutectic reaction in iron –carbide system and explain with neat diagram?	Understand	AAE005.01
5	Explain various phase reactions in iron-iron carbide system?	Understand	AAE005.02
6	Explain eutectoid reaction with neat sketch. What are the applications of them?	Remember	AAE005.02
7	Explain hyper eutectoid steels. What are the applications of them?	Remember	AAE005.04
8	Explain hypo euctoid steels .What are the applications of them?	Remember	AAE005.04

9	Draw continuous transformation curves and explain the terms in it?	Understand	AAE005.04
10	Explain annealing heat treatment and describe where annealing is practically applicable?	Remember	AAE005.04
11	Explain normalizing describe where normalizing is practically applicable?	Remember	AAE005.03
12	Explain hardening and tempering. What are the changes which happen in the properties of materials?	Remember	AAE005.02
13	Explain mar tempering .What are the changes which happen in the properties of materials?	Understand	AAE005.01
14	Classify stainless steels. What are the changes which happen in the properties of materials?	Understand	AAE005.03
15	Explain properties and applications of austenitic stainless steels. What are the changes which happen in the properties of materials?	Understand	AAE005.02
16	What is corrosion and what are reasons to occur corrosion of material?	Understand	AAE005.01
17	Discuss titanium alloy can be classified? What are the special properties of titanium?	Understand	AAE005.03
18	What is Structure of copper and its property? With neat sketch explain the structure of copper?	Remember	AAE005.02
19	Explain heat treatment of an aluminum alloy? How aluminum alloys play an important role in aeronautical firm?	Remember	AAE005.01
20	Mention the protective treatments available to prevent corrosion? Which is the cheapest and most efficient protective method?	Remember	AAE005.03
PART - C (PROBLEM SOLVING AND CRITICAL THINKING QUESTIONS)			
1	Explain the term allotropy in iron? Draw iron-carbon phase diagram and mention all reactions clearly?	Understand	AAE005.01
2	Explain clearly ferrite, austenite, martensite and cementite. And compare all the states.	Remember	AAE005.01
3	What is heat treatment? Explain clearly heat treatment of aluminum alloy with neat iron-carbon phase diagram?	Remember	AAE005.01
4	Define quenching? Explain clearly heat treatment of steel alloy with neat iron-carbon phase diagram?	Remember	AAE005.01
5	Explain clearly heat treatment of titanium alloy with neat iron-carbon phase diagram?	Understand	AAE005.03
6	What is annealing heat treatment process explain clearly with one material?	Remember	AAE005.02
7	Compare annealing and hardening. Explain how the microstructure of the vehicle is varied by it?	Understand	AAE005.04
8	Compare annealing and normalizing. Explain how the microstructure of the vehicle is varied by it?	Remember	AAE005.04
9	How corrosion can be prevented? And explain it with using one method?	Understand	AAE005.04
10	State difference between surface hardening and case hardening clearly?	Understand	AAE005.04
UNIT - II			
CASTING, WELDING AND INSPECTION TECHNIQUES			
PART - A (SHORT ANSWER QUESTIONS)			
1	Write various steps involved in casting.	Remember	AAE005.04
2	What is the purpose of Core?	Understand	AAE005.04
3	Describe briefly fundamental found production methods.	Understand	AAE005.04
4	When will you use permanent mould casting?	Understand	AAE005.04
5	Define the production and explain how it is important in aircraft manufacturing.	Remember	AAE005.04
6	State the classification of manufacturing process along with its applications.	Remember	AAE005.04
7	Define Welding? What are the different types of welding process? Explain their applications?	Understand	AAE005.04
8	What is the permanent mould a die casting mould?	Remember	AAE005.04
9	Write the bending equation of a simple beam	Remember	AAE005.04

10	What is the use of electrodes? Classify it.	Remember	AAE005.04
11	Classify the types of welding.	Remember	AAE005.04
12	Write the principle of arc welding.	Understand	AAE005.04
13	Describe briefly fundamental sheet metal instruments.	Remember	AAE005.04
14	What is difference between bending and shearing	Remember	AAE005.04
15	What is the use of electrodes? Classify it.	Remember	AAE005.04
PART - B (LONG ANSWER QUESTIONS)			
1	In general Aviation industry what is the importance of casting and molding.	Understand	AAE005.06
2	Define the terms: Sprue, Gate, Drag and Parting line. With a neat sketch mark the parts.	Remember	AAE005.05
3	With help of neat sketch diagram explain the investment casting. Elaborate the applications of this casting.	Understand	AAE005.05
4	A Write the advantages and disadvantages of shell molding. Elaborate the applications of this casting.	Remember	AAE005.05
5	Write the classifications of centrifugal casting. Elaborate the applications of this casting.	Understand	AAE005.06
6	List the advantages and disadvantages of welding process. What welding is used to join hard materials?	Remember	AAE005.06
7	Define the principle of soldering technique. Where soldering is applicable. Write about soldering materials and metals?	Remember	AAE005.05
8	Define the principle of brazing technique. Where brazing is applicable. Write about brazing materials and metals?	Remember	AAE005.05
9	Briefly explain the working principle of resistance welding and write advantages and disadvantages.	Understand	AAE005.05
10	Explain the working principle of arc welding equipment and write advantages and disadvantages.	Understand	AAE005.05
11	Principles and equipment used in arc welding, gas welding, resistance welding, Thermite welding, recent advances in welding technology, Soldering and brazing techniques.	Remember	AAE005.04
12	Classify types of nondestructive tests. Explain about the ultra-sonic resting and X-ray testing along with neat sketch	Remember	AAE005.04
13	Discuss clearly the difference between Nondestructive test and destructive test. Why NDT is so crucial in the production and manufacturing process.	Understand	AAE005.04
14	Discuss about the penetrates used in Dye casting. What are the limitations of dye casting?	Remember	AAE005.04
15	Explain clearly the working principle of magnetic particle inspection technique.	Understand	AAE005.04
PART – C (PROBLEM SOLVING AND CRITICAL THINKING)			
1	Describe the centrifugal casting process and what work piece configurations.	Understand	AAE005.06
2	Write the definition of casting and what are the steps involved in the process.	Remember	AAE005.06
3	Explain the types under shell molding process. Why shell molding is a crucial process. What are the applications of it?	Remember	AAE005.06
4	Principles and equipment used in arc welding, gas welding, resistance welding, Thermite welding, recent advances in welding technology, Soldering and brazing techniques.	Understand	AAE005.05
5	Give a short note and working principle of arc welding equipment and write advantages and disadvantages.	Remember	AAE005.05
6	Principles and equipment used in arc welding, gas welding, resistance welding, Thermite welding, recent advances in welding technology, Soldering and brazing techniques.	Understand	AAE005.05
7	Explain clearly the principle in gas welding with neat sketch? Explain about the carburizing neutral and oxidizing flame?	Remember	AAE005.05
8	What are the main differences between MIG, TIG and PIG welding	Remember	AAE005.06

	techniques? Explain where plasma welding is applicable?		
9	Give a short note on Dye penetration test procedure with all steps involved clearly?	Remember	AAE005.05
10	What is the main working principle of MPI and clearly give a note on how to inspect the welded specimen?	Understand	AAE005.05
11	What is the principle behind Ultrasonic testing and how it works?	Remember	AAE005.05
12	What are main applications of each NDT test with an example?	Remember	AAE005.05
UNIT-III			
SHEET METAL PROCESSES IN AIRCRAFT INDUSTRY			
PART - A (SHORT ANSWER QUESTIONS)			
1	What is advance metal forming process?	Understand	AAE005.09
2	List the tool used in sheet metal.	Understand	AAE005.09
3	State the sheet metal materials and tools.	Remember	AAE005.09
4	Discuss the principle of shearing operation.	Understand	AAE005.09
5	Explain punching operations.	Remember	AAE005.09
6	Explain automation in bending.	Remember	AAE005.09
7	Sketch and explain bending in single plane.	Understand	AAE005.09
8	Sketch different types of rivets?	Remember	AAE005.11
9	Discuss limitations of riveting operations?	Understand	AAE005.11
10	Why riveting technique is so important in aircraft industry?	Remember	AAE005.11
11	Differentiate between solid riveting and blind riveting?	Remember	AAE005.11
PART – B (LONG ANSWER QUESTIONS)			
1	Briefly give a note on below operations Punching and Blanking? Write down the applications and advantages of these?	Remember	AAE005.09
2	Why is blank holding necessary in a sheet metal drawing operation? Give the difference between Punching & Blanking	Understand	AAE005.09
3	Briefly give a note on below operations Drawing and Cupping. Write down the applications and advantages of these?	Remember	AAE005.09
4	Bring out the differences between bending and shearing.	Remember	AAE005.09
5	List the tool used in sheet metal. Write down the applications and advantages of these?	Remember	AAE005.09
6	List the different types of bending operation. Write down the applications and advantages of these?	Remember	AAE005.09
7	Write a shot note on bending in single plane. Write down the applications and advantages of these?	Understand	AAE005.09
8	Write the different types of holding devices. Write down the applications and advantages of these?	Understand	AAE005.09
9	Discuss Riveting operation. Write down the applications and advantages of these?	Remember	AAE005.11
10	Discuss limitations of riveting technique? Write down the applications and advantages of these?	Understand	AAE005.11
11	Classify types of riveting tools used Write down the applications and advantages of these?	Remember	AAE005.11
12	What are the main types of riveting heads? Write down the applications and advantages of these?	Remember	AAE005.11
13	What is the main difference between Daly and Snappy Write down the applications and advantages of these?	Remember	AAE005.11
14	What type of hammer used in riveting technique and why? Write down the applications and advantages of these?	Understand	AAE005.11
15	Discuss the steps involved in drilling operation while riveting to be made?	Remember	AAE005.11

PART – C (PROBLEM SOLVING AND CRITICAL THINKING)			
1	Explain the operation of stretch forming and drawing. With neat sketches explain the bending and shearing operations?	Remember	AAE005.10
2	Explain the tools used in shearing operation. With neat sketches explain the bending and shearing operations?	Understand	AAE005.09
3	Explain the tools used in drop stamp forming. With neat sketches explain the bending and shearing operations?	Remember	AAE005.09
4	A beam is loaded as shown in the figure Evaluate deflection of beam by Moment Area method?	Remember	AAE005.09
5	Bring out the differences between bending and shearing. With neat sketches explain the bending and shearing operations?	Remember	AAE005.10
6	Why is blank holding necessary in a sheet metal drawing operation? Give the difference between Punching &Blanking?	Remember	AAE005.10
7	Elaborate about the operations Punching, Blanking, and Drawing Cupping?	Remember	AAE005.10
8	Explain why riveting so important in aircraft industry even though fasteners are playing main role?	Understand	AAE005.10
9	Discuss what are the advantages over welding operation? Explain the temperatures generated during the welding?	Remember	AAE005.10
10	What are the steps include in riveting operation and clearly explain? Explain the temperatures generated during the welding?	Remember	AAE005.10
UNIT-IV			
CONVENTIONAL AND UNCONVENTIONAL MACHINING PROCESSES			
PART – A (SHORT ANSWER QUESTIONS)			
1	Define machining. Differentiate between machining and welding.	Remember	AAE005.07
2	Why lathe machine is called universal machining machine?	Understand	AAE005.07
3	What is the difference between milling and surface grinding	Understand	AAE005.07
4	Classify the different types of cutting tools used in all types of machining operations?	Remember	AAE005.07
5	What is unconventional machining process? Discuss advantages.	Remember	AAE005.07
6	What are the different types of mechanisms used in unconventional material removal processes?	Understand	AAE005.09
7	What is the mechanism behind Abrasive Jet Machining?	Understand	AAE005.09
8	Define LASER and explain where it is usedin manufacturing?	Understand	AAE005.09
9	Explain working principle of thermally material removal?	Understand	AAE005.09
10	Give list of abrasive particles used for Abrasive Jet Machining?	Understand	AAE005.09
11	What is the purpose of dielectric used in Electron Discharge Machining?	Remember	AAE005.07
12	Where anode and cathode to connect for working of Electron Discharge Machining?	Remember	AAE005.07
13	What is plasma and explain how can it be produced?	Remember	AAE005.07
14	How chemical mechanism of material removal works?	Remember	AAE005.07
15	What is difference between position of cutting tool in both unconventional and conventional marching operation?	Remember	AAE005.07
PART – B (LONG ANSWER QUESTIONS)			
1	SketchLathe machine neatly and lable all the important parts?	Remember	AAE005.08
2	Why cutting tool should be harder than work piece and justify it with an example?	Remember	AAE005.08
3	What is the main difference between Milling and Surface grinding?	Remember	AAE005.08
4	How “V” grooves to be performed on flat work piece explain clearly?	Remember	AAE005.08
5	What type of cutting tool used in Milling machine and why?	Understand	AAE005.08
6	Define Feed and depth of cut.	Understand	AAE005.08
7	What are the advantages of unconventional machining over conventional machining? And list down applications?	Remember	AAE005.08

8	What is the mechanism of material removal for USM, explain it with working principle?	Remember	AAE005.08
9	List down the applications of Laser Beam Machining and Electron Beam Machining?	Remember	AAE005.08
10	How Electric Discharge Machining will work and lists down some electrodes and dielectric used?	Remember	AAE005.08
11	Explain the basic working principle of Electro Chemical Machining?	Understand	AAE005.08
12	What is plasma? How Plasma Arc Machine will work?	Remember	AAE005.09
PART – C (PROBLEM SOLVING AND CRITICAL THINKING)			
1	Discussthe working principle of Lathe with neat sketch? Explain the functions of the important parts of lathe.	Remember	AAE005.09
2	What is the working principle of Milling with neat sketch?	Remember	AAE005.09
3	Explain clearly with CNC machine and advantages of CNC over manual machining?	Understand	AAE005.08
4	How Shaping Machine will work and what is the main application to operate shaper?	Remember	AAE005.09
5	What is Electric Discharge Machining? When do you use reverse polarity in EDM?	Remember	AAE005.09
6	Explain the working principle of ECM with a neat diagram. Write the advantages and applications electro chemical machining.	Understand	AAE005.09
7	Explain in detail the working and construction of plasma arc machining. Give a neat sketch. Write advantages and disadvantages of plasma arc machining.	Understand	AAE005.09
8	With help of neat diagram, explain the working procedure abrasive jet machining. Write some advantages, disadvantages and applications	Remember	AAE005.09
9	Give explanation of laser beam machining by using neat sketch. State some advantages, disadvantages and applications of laser beam machining.	Remember	AAE005.09
10	In detail explain the working and principle of electron beam machining with neat diagrams.	Understand	AAE005.09
11	In machining process, explain the factors which affect the accuracy of machined surface, suggest various ways of reducing chatter.	Understand	AAE005.08
12	What is over cutting in electro discharge machining process and how it is affected by amperage and frequency?	Remember	AAE005.08
13	What are the various materials of which electrodes are made of electro discharge machining process and what are their advantages?	Remember	AAE005.08
14	Explain about abrasive jet machining with neat schematic diagram?	Remember	AAE005.08
15	How USM will work? List down the type of abrasive particles to be used and applications of USM?	Remember	AAE005.08
UNIT-V			
AIRCRAFT COMPOSITES			
PART - A (SHORT ANSWER QUESTIONS)			
1	Define Composite material? Explain why metals are to be replaced by composites?	Understand	AAE005.13
2	Explain the glass transition temperature. Discuss annealing process in glass manufacturing?	Understand	AAE005.09
3	Classify polymers, and discuss the applications of the polymers.	Understand	AAE005.09
4	Illustrate the process of plastic polymerization.	Remember	AAE005.09
5	Explain briefly about thermo plastics.	Remember	AAE005.09
6	What are thermo setting plastics?	Understand	AAE005.09
7	Identify the additives that are used in polymers?	Understand	AAE005.09
8	Discuss about Fiber Reinforced Plastic.	Understand	AAE005.14
9	Describe the applications composites in airline industry.	Understand	AAE005.14
10	Indicate the importance of matrix in composite.	Understand	AAE005.14

11	Explain the role of fiber in composites? Write some of the important fibers.	Remember	AAE005.14
13	Discuss examples of fibers used in composites.	Remember	AAE005.14
14	Elaborate some examples of resins used in composites.	Understand	AAE005.14
15	Define super alloy. Name some of the super alloys.	Understand	AAE005.14
PART - B (LONG ANSWER QUESTIONS)			
1	Discuss about polymers. Classify them and give typical applications in aerospace industry and mention their critical issues?	Remember	AAE005.13
2	Discuss methods of polymerization. Elaborate the material composition and behavior at different temperatures?	Remember	AAE005.13
3	Explain about thermos plastics? Explain properties. Classify them and give typical applications in aerospace industry and mention their critical issues?	Remember	AAE005.13
4	Debate on thermo- setting plastics? Give their properties and load of impacts on them. Elaborate the temperature settings on thermo setting plastics.	Remember	AAE005.13
5	Elaborate the production process of composite. Explain their properties in terms of strength?	Understand	AAE005.14
6	Discuss fiber reinforced plastics and their uses. Is fiber reinforced plastic an asset to aerospace industry?	Understand	AAE005.14
7	Discuss the properties of metal matrix composites. Give their properties and load of impacts on them. Elaborate the temperature settings on thermo setting plastics.	Understand	AAE005.14
8	What are the advantages of composites over metals? Explain about their properties and load of impacts on them. Elaborate the temperature settings on thermo setting plastics.	Remember	AAE005.14
9	Differentiate between alloys and composite materials? Give their properties and load of impacts on them.	Remember	AAE005.14
10	Elaborate applications of composite materials? Give their properties and load of impacts on them. Elaborate the temperature settings on thermo setting plastics.	Understand	AAE005.14
PART – C (PROBLEM SOLVING AND CRITICAL THINKING)			
1	Give a short note on each fiber which commonly used in aerospace industries? Discuss why composites are required to be used in the manufacturing of the aircrafts?	Understand	AAE005.14
2	List down the various components of an aircraft where composite materials were replaced metals?	Remember	AAE005.14
3	Difference between thermo setting and thermo plastic matrix? Where these things are practically used and write the mathematical equations involved in it?	Understand	AAE005.14
4	Explain major Applications of composite materials?	Understand	AAE005.13
5	What is the key role of fiber and matrix in composite materials?	Remember	AAE005.14
6	How composites can be classified? Explain why composites are supposed to be used in aircrafts?	Remember	AAE005.14
7	Sketch the structure of FRP and explain clearly? Explain why composites are supposed to be used in airlines?	Understand	AAE005.14
8	List down the various materials used for aircraft components? Explain why composites are supposed to be used in airlines?	Remember	AAE005.14
9	Define isotropic, anisotropic, orthotropic materials? Why composite materials are isotropic in nature?	Remember	AAE005.14
10	Define homogeneous, heterogeneous materials? Why composite materials are heterogeneous in nature?	Remember	AAE005.14

Prepared By: Dr. D. Govardhan, Professor **HOD, AE**