# MALLA REDDY COLLEGE OF ENGINEERING AND TECHNOLOGY

~~~~~

# DEPARTMENT OF AERONAUTICAL ENGINEERING

# **II B.TECH I SEMESTER**

# R18 REGULAR / SUPPLEMENTARY PREVIOUS QUESTION PAPERS

# LIST OF SUBJECTS

| CODE     | NAME OF THE SUBJECT                         |
|----------|---------------------------------------------|
| R18A2102 | Applied Mechanics                           |
| R18A2106 | Aerospace Materials and Composites          |
| R18A2105 | Aircraft Production Technology              |
| R18A2103 | Engineering Thermodynamics                  |
| R18A2104 | Introduction to Aeronautical<br>Engineering |
| R18A2101 | Mechanics of Fluids                         |

2

# **MALLA REDDY COLLEGE OF ENGINEERING & TECHNOLOGY**

#### (Autonomous Institution – UGC, Govt. of India)

# II B.Tech I Semester Regular/Supplementary Examinations, February 2021



All Questions carries equal marks.

\*\*\*\*

- **1** a) Classify Engineering Mechanics.
  - b) Define and explain the following terms
  - i) Coplanar and non-coplanar forces. ii) Collinear and concurrent forces iii) Parallel and non-parallel forces

[10M]

[4M]

**R18** 

a) The three like parallel forces of magnitude 50 N, F and 100 N are [10M] shownin Fig. 3.13. If the resultant R = 250 N and is acting at a distance of 4 m from point A, then find (i)Magnitude of force F.



b) Define Varignon's theorem?

[4M]

**3** The five forces F1, F2, F3, F4 and F5 are acting at a point on a body as shown in Fig.and **[14M]** the body is in equilibrium. If F1 = 18 N, F2 = 22.5N, F3=15NandF4= 30 N, find the force F5 in magnitude and direction.



**4** A semi-circular area is removed from the trapezoid as shown in Fig. Determine the **[14M]** centroid of the remaining area.



5 Fig. shows a T-section of dimensions 10 × 10 × 2 cm. Determine the moment of inertia [14M] of the section about the horizontal and vertical axes, passing through the centre of gravity of the section. Also find the polar moment of inertia of the given T-section.



- 6
- a) Determine moment of inertia of given section about centriodel axis X-X. [14M]



7

8

b) Describe the method of finding moment of inertia of composite areas.

A truck weighing 6 kN just moves freely (engine is not running) at36 kilometre per hour [14M] down a slope of 1 in 40, the road resistance at this speed just being sufficient to prevent any acceleration. Find the road resistance per kN weight of truck. What power will the engine have to exert to run up the same slope at double the speed when the road resistance remains the same?



\*\*\*\*\*\*

- a) Classify the different types of supports.
- b) Solve reactions at supports A and B.



[10M]

[4M]

# MALLA REDDY COLLEGE OF ENGINEERING & TECHNOLOGY

**R18** 

# (Autonomous Institution – UGC, Govt. of India)

# II B.Tech I Semester Regular/Supplementary Examinations, February 2021

# **Aerospace Materials and Composites**

|       | (AE)                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |              |
|-------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------|
| Time: | Roll No       Image: Solution of the second se |              |
|       | Answer Any <b>Five</b> Questions                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |              |
|       | All Questions carries equal marks.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |              |
|       | ***                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |              |
| 1     | Define Tensile strength and elastic limit. How do you determine the elastic limit                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      | [14M]        |
|       | of a material?                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |              |
| 2     | <ul><li>Explain the following briefly:</li><li>(a) linear and non-linear elastic properties</li><li>(b) Bauschinger's effect</li></ul>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 | [7M]<br>[7M] |
| 3     | Explain briefly the following heat treatment process of aluminum alloys                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |              |
|       | <ul><li>a) Solution heat treatment</li><li>b) Precipitation heat treatment</li></ul>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   | [7M]         |
|       |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        | [7M]         |
| 4     | Describe the properties and applications of the following metals or alloys:                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            | [7M]         |
|       | (a) magnesium alloys                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   | [714]        |
| -     | (b) maraging steels                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |              |
| 5     | Explain briefly the fabrication of metal matrix composites.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            | [14171]      |
| 6     | Explain the following reinforcement materials briefly:                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 | [5+5         |
|       | (a) Particulate composites                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             | +4M]         |
|       | (b) Polymer composites                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |              |
|       | (c) Kevlar                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |              |

| 7 | Explain in detail the factors effecting the selection of materials for aircraft engines | [14M] |
|---|-----------------------------------------------------------------------------------------|-------|
| 8 | Explain in detail the non – destructive flaw detection techniques used in aerospace     | [14M] |
|   | industry.                                                                               |       |

\*\*\*\*\*

# **MALLA REDDY COLLEGE OF ENGINEERING & TECHNOLOGY**

## (Autonomous Institution – UGC, Govt. of India)

# II B.Tech I Semester Regular/Supplementary Examinations, February 2021

## **Aircraft Production Technology**

(AE)

| Roll No |  |  |  |  |  |
|---------|--|--|--|--|--|
|         |  |  |  |  |  |
|         |  |  |  |  |  |
|         |  |  |  |  |  |

Time: 2 hours 30 min

Max. Marks: 70

Answer Any Five Questions

All Questions carries equal marks.

#### \*\*\*

| 1 | Explain in detail about Centrifugal casting with neat sketch.                        | [14M]  |
|---|--------------------------------------------------------------------------------------|--------|
| 2 | Explain in detail the working principle of the following joining processes. Also     |        |
|   | state their advantages, limitations and applications:                                | [7M]   |
|   | (a) Soldering                                                                        | [78.4] |
|   | (b) Brazing                                                                          | [ייין  |
| 3 | With the help of a neat sketch explain in detail the working procedure of lathe      | [14M]  |
|   | machine.                                                                             |        |
| 4 | Explain briefly the following:                                                       |        |
|   | (a) Quick return mechanism in shaper mechanism                                       | [7M]   |
|   | (b) Metal spinning                                                                   | [7M]   |
| 5 | Describe the principle of working, and applications of Electron Discharge machining. | [14M]  |
|   | Draw neat sketch showing the principle of operation. Mention its advantages and      |        |

disadvantages over other un-conventional machining processes.

| 6 | Illustrate and explain in detail the working of Ultrasonic Machining.            | [14M] |
|---|----------------------------------------------------------------------------------|-------|
| 7 | (a) Explain the requirement and advantage of heat treatment & surface finishing. | [7M]  |
|   | (b) Discuss the process of heat treatment of aluminum alloys                     | [7M]  |
| 8 | Explain about the process of magnetic particle testing and it types with neat    | [14M] |
|   | sketches and required equations.                                                 |       |

\*\*\*\*\*\*\*

# **MALLA REDDY COLLEGE OF ENGINEERING & TECHNOLOGY**

# (Autonomous Institution – UGC, Govt. of India)

# II B.Tech I Semester Regular/Supplementary Examinations, February 2021

### **Engineering Thermodynamics**

(AE)



Answer Any Five Questions

All Questions carries equal marks

#### \*\*\*

| 1 | a Show that internal energy is a property.                                                           | [7M]               |
|---|------------------------------------------------------------------------------------------------------|--------------------|
| _ | b How the first law of thermodynamics is applied to a closed sy-<br>undergoing a non-cyclic process? | stem [7 <b>M</b> ] |
| 2 | Determine the heat transfer and its direction for a system in which a pe                             | rfect              |
|   | gas having molecular weight of 16 is compressed from 101.3 kPa, 20°                                  | C to               |
|   | a pressure of 600 kPa following the law $pV^{1.3}$ = constant. Take spe                              | cific              |
|   | heat at constant pressure of gas as 1.7 kJ/kg.K.                                                     | [14 4 ]            |
| 3 | a Explain the reversible and irreversible processes.                                                 | [7M]               |
|   | b Describe Carnot cycle and obtain expression for its efficiency                                     | y as [7M]          |
|   | applied to a heat engine.                                                                            |                    |
| 4 | A refrigerator operates on reversed Carnot cycle. Determine the power requ                           | uired              |
|   | to drive refrigerator between temperatures of 42ºC and 4ºC if heat at the ra                         | te of [14M]        |
|   | 2 kJ/s is extracted from the low temperature region.                                                 |                    |
| 5 | a Define 'available energy' and 'unavailable energy.                                                 | [7M]               |

|   | b         | Differentiate between useful work and maximum useful work in reference to the availability.        | [7M]  |
|---|-----------|----------------------------------------------------------------------------------------------------|-------|
| 6 | Obi<br>Wa | tain the expression for change in internal energy of gas obeying the Vander als equation of state. | [14M] |
| 7 | а         | What is meant by real gas? Why ideal equation of state cannot be used for it?                      | [7M]  |
|   | b         | State the Dalton's law of partial pressures and assumptions for it.                                | [7M]  |
| 8 | а         | Explain Otto cycle, Diesel cycle and Dual cycle in light of these limitations.                     | [7M]  |
|   | b         | Derive expression for efficiency of diesel cycle.                                                  | [7M]  |

#### \*\*\*\*\*

[5M]

# **MALLA REDDY COLLEGE OF ENGINEERING & TECHNOLOGY**

(Autonomous Institution – UGC, Govt. of India)

## II B.Tech I Semester Regular/Supplementary Examinations, February 2021

### **Introduction to Aeronautical Engineering**



All Questions carries equal marks.

\*\*\*

- Describe major achievements in the history of human fight leading to present [14M] day aircrafts.
- Explain the different layers of atmosphere with a graph showing the temperature [14M] and pressure variation
- 3 (a) Describe an airfoil and explain its nomenclature. [4M]
  (b) Define center of pressure, coefficient of pressure and aerodynamic center. [5M]
  - (c) Express lift and drag of an airfoil in terms of normal and axial forces
- 4 Explain the various components, types and working principle of a helicopter. [14M]
- **5** Draw, explain the working of 2-stroke and 4-stroke aircraft engines. Compare their **[14M]** merits and demerits.

| 6 | List the types of missile configurations and explain each one briefly. Mention one example for each configuration. | [14M] |
|---|--------------------------------------------------------------------------------------------------------------------|-------|
| 7 | Draw and explain the following fuselage structures briefly:                                                        |       |
|   | (a) Monocoque type                                                                                                 | [7M]  |
|   | (b) Semi-monocoque type                                                                                            | [7M]  |
| 8 | Derive the expression for Drag polar and explain its significance in aerodynamic                                   | [14M] |
|   | performance valuation of an aircraft.                                                                              |       |

ARTER A RACEA A

\*\*\*\*\*\*

# **MALLA REDDY COLLEGE OF ENGINEERING & TECHNOLOGY**

## (Autonomous Institution – UGC, Govt. of India)

# II B.Tech I Semester Regular/Supplementary Examinations, February 2021

**Mechanics of Fluids** 

(AE)



Time: 2 hours 30 min

Answer Any Five Questions

All Questions carries equal marks.

\*\*\*

# **1** a) Calculate the specific weight, specific mass, specific volume and specific [7M] gravity of a liquid having a volume of $6 m^3$ and weight of 44 kN.

b) Define viscosity. Derive the formula for Newton's law of viscosity. Classify the fluids based on the same.

[7M]

2 The velocity distribution of flow over a plate is parabolic with vertex 30cm from [14M] the plate, where the velocity is 180 cm/s. If the viscosity of the fluid is 0.9N.s/m<sup>2</sup>, find the velocity gradients and shear stresses at distances of 0, 15 cm and 30 cm from the plate.

| 3 | a) What are the properties of stream function?                                       | [6M]  |
|---|--------------------------------------------------------------------------------------|-------|
|   | b) Explain the following with example                                                |       |
|   | <i>i</i> ) Steady flow                                                               | [8M]  |
|   | <i>ii)</i> Non uniform flow                                                          |       |
|   | <i>iii</i> )Laminar flow                                                             |       |
|   | <i>iv)</i> Two-dimensional flow                                                      |       |
| 4 | In a two-dimensional incompressible flow, the fluid velocity components are given by | [14M] |
|   | <i>u=x-4y</i> and <i>v=-y-4x</i> .                                                   |       |

Show that velocity potential exists and determine its form. Find also the stream function.

- 5 Describe an orificemeter and find an expression for measuring discharge of fluid [14M] through a pipe with this device.
  6 a) Derive an expression for the loss of head due to (i) sudden enlargement and [7M] (ii) sudden contraction of a pipe.
  b) State Bernoulli's theorem for steady flow of an incompressible fluid.
  - b) State Bernoulli's theorem for steady flow of an incompressible fluid. Derive an expression for Bernoulli's equation from first principle and state the assumptions made for such a derivation. [7M]
     Obtain Von Karman momentum integral Equation. [14M]
- 8 What are dimensionless numbers? Explain the following [14M]
  - a) Reynold's number
  - b) Froude's number
  - c) Euler's number

7

- d) Weber's number
- e) Mach's number

\*\*\*\*\*\*