Exam Date & Time: 12-May-2023 (09:30 AM - 12:30 PM)

MANIPAL ACADEMY OF HIGHER EDUCATION

INTERNATIONAL CENTRE FOR APPLIED SCIENCES
END SEMESTER THEORY EXAMINATION - MAY 2023
II SEMESTER B.Sc (Applied Sciences) in Engg.

Introduction To Aerospace Engg. and Avionics [IAV 121]

Marks: 50 **Duration: 180 mins.**

A

Answer all the questions.

Missing data, if any, may be suitably assumed

1) Derive the expression relating geopotential h and geometric altitude h_G, showing all the steps, as

A)

$$h = \frac{r}{r + h_G} h_G$$

(5)

Explain the usage of the two altitudes in brief.

B) Pressure, density, and temperature at 25km altitude are 0.2549×10^4 N/m^2, 0.04 kg/m^3, and 216.66 K respectively. Calculate both pressure and density values in SI units at 30km altitude. Refer Fig. Q2.

(3)

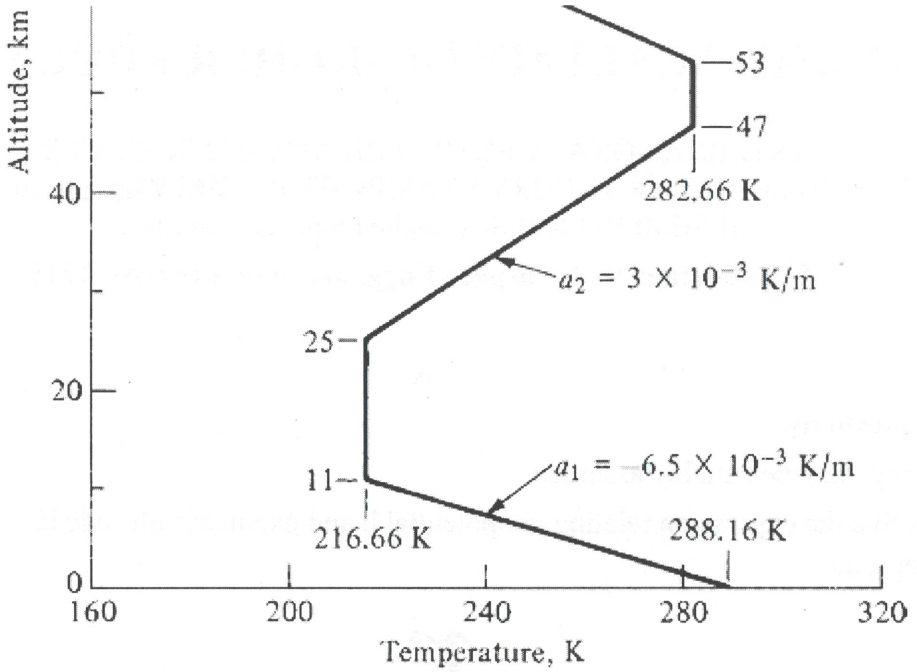

Fig. Q2

C) Define Mach number. Calculate speed of sound at temperature of 288.16 K. Name different types of flows based on Mach number. (2)

2) Derive the following expression for the isentropic flow. Show all the steps.

A) $$\frac{p_2}{p_1} = \left(\frac{\rho_2}{\rho_1}\right)^{\gamma} = \left(\frac{T_2}{T_1}\right)^{\gamma/(\gamma-1)}$$ (5)

B) What is adiabatic flow? Derive the following energy equation for the adiabatic flow.

$$h + \frac{V^2}{2} = constant$$ (3)

C) With diagram, briefly explain viscous flows without drag and with finite drag. (2)

3) Draw and explain the HUD schematic. What are basic functions of pilot's helmet? What are the field of view of HUD and HMD? (5)

A)

B) Explain the concepts of static and dynamic stability. What are the criteria for longitudinal stability? (3)

C) What is Kepler's third law? Period of earth around the sun is 365.256 days. Semi major axes of earth and Mars are 1.49527×10^{11} m and 2.2783×10^{11} m. Calculate the period of Mars in days. (2)

4) Draw a block diagram of the navigation system information flow to user systems. Explain function of each block. (5)

A)

B) What are all quantities are measured by Inertial Navigation System (INS)? What are advantages of INS over other navigation systems? (3)

C) Draw the error profiles due to acceleration bias and gyro drift. (2)

5) Draw the wheel path for instrument landing of jet aircraft. Explain the concept of flare maneuver using it. (5)

A)

B) What are the different head down displays on a civil aircraft and on a military aircraft? Explain in brief. (3)

C) Explain the working of hyperbolic navigation system i.e. LORAN. (2)

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