



G1110

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APJ ABDUL KALAM TECHNOLOGICAL UNIVERSITY

Scheme for Valuation/Answer Key

Scheme of evaluation (marks in brackets) and answers of problems/key

SEVENTH SEMESTER B.TECH DEGREE EXAMINATION (S), MAY 2019

Course Code: ME409

Course Name: COMPRESSIBLE FLUID FLOW

Max. Marks: 100

Duration: 3 Hours

PART A

Answer any three full questions, each carries 10 marks.

Marks

- 1 a) Definition of Mach angle **1mark**, figure **1mark**, derivation and final expression **(4)**
2 marks.
- b) Finding characteristic gas constant **2 marks**, finding flow velocity **2 marks** and **(6)**
finding cross sectional area **2 marks.**
- 2 a) Assumptions **1 mark**, figure **2 marks**, derivation intermediate steps **6 marks** **(10)**
and final expression **1 mark**
- 3 a) Intermediate steps **5marks**, final expression of mass flux **1 mark** and condition **(10)**
for maximum mass flux **4 marks.**
- 4 a) i) Throat area **2 marks**, **(10)**
ii) pressure and temperature at the throat **2 marks**,
iii) temperature at exit **2 mark**,
iv) exit velocity as fraction of the maximum attainable velocity **2 marks** and
v) mass flow rate **2 marks.**

PART B

Answer any three full questions, each carries 10 marks.

- 5 a) Definition 2 marks, Equation 1 mark **(3)**
b) Explanation - 3 marks **(3)**
c) 2 parts – 2 marks each **(4)**
- 6 a) Mach number = 0.28 (4 Marks) **(10)**
Static pressure = 477.95 kN/m² (3 Marks)
Static temperature = 357.6 K (3 Marks)
- 7 a) Explanation – 3 marks **(3)**
b) Length of pipe = 968 cm (2Marks) **(7)**
Diameter of the nozzle throat = 33.5 cm (3Marks)
Pressure = 4.41 bar (1Mark)

- Temperature = 500.28 K (1Mark)
- 8 a) Differentiate between Fanno flow and Isothermal flow = 3 marks (4)
limit for continuous subsonic isothermal = 1 mark
- b) Diameter of the duct = 22.66 cm (1 Mark) (6)
Length of duct = 309 m (1 Mark)
Pressure = 1.008 bar (1 Mark)
Temperature = 297.59 K (1 Mark)
Stagnation pressure loss = 2.31 bar(2 Marks)

PART C

Answer any four full questions, each carries 10 marks.

- 9 a) i) $M_2 = 0.68$, $P_{01} = 0.565$ bar , $P_{02} = 0.484$ bar, $P_{01} - P_{02} = 0.081$ bar (3+3 = 6 (10)
marks)
ii) $Q_{\max} = 1606.4$ kJ/kg (4 marks)
- 10 a) i) $M_1 = 0.173$, $M_2 = 0.525$ (1+3 = 4 marks) (10)
ii) $P_2 = 41.505$ kPa , $T_2 = 1574.75$ K , $V_2 = 795.45$ m/s (1+1+1 = 3 marks)
iii) Percentage loss in Stagnation pressure = 11.15 % (3 marks)
- 11 a) Correct Derivation of Q_{\max} (6 marks) (10)
Explanation of thermal choking (4 marks)
- 12 a) Sketch and working (2+2 = 4marks) (4)
b) Correct figure of Open and closed type wind tunnel with parts labelled (3+3 = 6 (6)
marks)
- 13 a) Correct circuit diagram(2 marks) (4)
Correct explanation (2marks)
- b) Shadowgraph – Diagram and simple explanation(3 marks) (6)
Schlieren – Diagram and simple explanation(3 marks)
- 14 a) Correct circuit diagram(2 marks) (4)
Correct explanation (2marks)
- b) Kiel probe simple figure with explanation (4 marks) (6)
For a Pitot tube the opening diameter should be small and it is sensitive to yaw angle. Kiel probe is insensitive to yaw angle(2 marks)
