M.E. First Semester (Mechanical Engineering (Thermal Engg.)) (New-CGS)

13507 : Fluid Dynamics : 1 MTE 3

P. Pages : 2 | **AU - 3361**

Time : Three Hours | Max. Marks : 80

Notes : 1. All question carry equal marks.
2. Assume suitable data wherever necessary.
3. Illustrate your answer necessary with the help of neat sketches.
4. Use of pen Blue/Black ink/refill only for writing book.
5. Answer **three** question from section A and **three** question from section B.

SECTION - A

1. a) Give complete classification of fluid flows. with brief explanation of each. **7**

b) Define explain and sketch the following terms by giving examples of each : **7**
i) Laminar and turbulent flow.
ii) Rotational & Irrotational flow.
iii) Vortex flow.

2. a) Distinguish between following terms : **6**
i) Steady and unsteady flow.
ii) Uniform and nonuniform flow.
iii) Streamlines and equipotential lines.

b) Define, sketch & explain the following terms. **7**
i) Velocity potential function
ii) Stream function

3. a) Show that for irrotational motion of incompressible fluid $\nabla \times V = 0$. **6**

b) Explain the uniform flow with source and sink. Obtain an expression for stream and velocity potential function. **7**

4. a) What do you mean by continuity equation ? Derive it. **6**

b) A flow field is specified by - **7**
$V = i\, x^2y + iy^2z \quad k\,(2xyz + yz^2)$
Calculate velocity and acceleration at point (2, 1, 3)

5. a) Sketch the flow pattern of an ideal fluid flow past a cylinder with circulation. **6**

b) A uniform flow of 12 m/s is flowing over a doublet of strength 18 m^2/sec. The doublet is in the line of the uniform flow. Determine : **7**
i) Shape of the Rankine oval
ii) Radius of Rankine oval
iii) Value of stream line function at Rankine circle.

SECTION - B

6.	a)	Describe the phenomenon of Boundary layer separation when the flow takes over a curved surface. What are the different methods of controlling boundary layer separation ?	**7**
	b)	What is sound ? How it is generated ? How does it travel ? Can sound waves travel through vacuum ?	**7**
7.	a)	Explain Prandtl's Meyer function and also find the working equation for it.	**6**
	b)	A projectile is travelling in air having pressure and temperature as 8.829 N/cm^2 and -10°C at a speed of 1200 km/hr. Find the Mach Number and Mach angle. Take K = 1.4 and R = 287 J/kg k.	**7**
8.	a)	Derive the integrated from of the momentum equation for the boundary layer over a flat plate.	**6**
	b)	For a laminar boundary layer over a flat plate, if the velocity distribution is assumed to be - $u = A + By + Cy^2 + Dy^3$ determine its form using the necessary boundary conditions.	**7**
9.	a)	With the neat sketch explain the development of boundary layer along a thin flat smooth plate held parallel to a uniform flow and explain its salient features.	**6**
	b)	What do you mean by subsonic, sonic & supersonic flows ? What is Mach Number. What is its relation with speed, explain by examples & figures.	**7**
10.	a)	Discuss Karman's similarity hypothesis in brief.	**6**
	b)	Explain Eddy viscosity ? How does it differ from the viscosity of fluid ?	**7**

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