# AR19

**CODE: 19MTE1002** **SET-1**

**ADITYA INSTITUTE OF TECHNOLOGY AND MANAGEMENT, TEKKALI**
**(AUTONOMOUS)**
**M.Tech. I Semester Regular & Supplementary Examinations, August,2021**

**ADVANCED FLUID DYNAMICS**
**(Thermal Engineering)**

**Time: 3 Hours** **Max Marks:60**

**Answer any FIVE questions**
**All questions carry EQUAL marks**

1. a) Suppose that the velocity potential in an irrotational flow is 6 M

$$\phi = U(r + \frac{a^2}{r})\cos\theta$$

(i) Determine $\psi$. (ii) Sketch the streamlines and the lines of constant ϕ. Justify that it represents the flow over a circular cylinder of radius a.

b) Consider the following steady, two-dimensional, incompressible velocity field: 6 M
$\vec{V} = (u, v) = (ax + b)\vec{i} + (-ay + c)\vec{j}$. Is this flow field irrotational? If so, generate an expression for the velocity potential function..

2. a) Consider an incompressible horizontal Couette flow, which is the flow between two horizontal plates separated by a distance b. The upper plate is moving parallel to itself at speed U, and the lower plate is stationary. Let the x-axis lie on the lower plate. All flow fields are independent of x. Show that the pressure distribution is hydrostatic and that the solution of the Navier-Stokes equation is 8 M

$$u(y) = \frac{Uy}{b}$$

b) In the non-dimensionalized incompressible Navier-Stokes equation, there are four non-dimensional parameters. Name each one, explain its physical significance and discuss what it means physically when the parameter is very small or very large. 4 M

3. a) Write a one-word description of each of the five terms in the incompressible Navier-Stokes equation, 6 M

$$\rho\frac{\partial\vec{V}}{\partial t} + \rho(\vec{V}.\vec{\nabla})\vec{V} = -\vec{\nabla}P + \rho\vec{g} + \mu\nabla^2\vec{V}$$

I II III IV V

When the creeping flow approximation is made, only two of the five terms remain. Which two terms remain, and why is this significant?

b) In a certain region of steady, two-dimensional, incompressible flow, the velocity field is given by $\vec{V} = (u, v) = (ax + b)\vec{i} + (-ay + cx)\vec{j}$. Show that this region of flow can be considered inviscid. 6 M

4. a) Liquid ammonia at -20$^0$C is flowing through a 20 m long section of a 5 mm diameter copper tube at a rate of 0.09 kg/s. Determine the pressure drop, the head loss, and the pumping power required to overcome the frictional losses in the tube. (The density and dynamic viscosity of liquid ammonia at -20°C are $\rho$ = 665.1 kg/m$^3$ and $\mu$ = 2.361×10-4 kg/m·s. The roughness of copper tubing is 1.5×10$^{-6}$ m) 6 M

b) On a hot day ($T = 40^0$C), a truck moves along the highway at 29.1 m/s. The flat side of truck is treated as a simple, smooth flat-plate boundary layer, to first approximation. Estimate the x-location along the plate where the boundary layer begins to transition to turbulence. How far downstream from the beginning of the plate do you expect the boundary layer to become fully turbulent? (Properties of air at $40^0$C and 1 atm: dynamic viscosity $\mu = 1.918 \times 10^{-5}$ kg/m.s, density $\rho = 1.128$ kg/m$^3$) 6 M

5. a) Determine the stagnation temperature and stagnation pressure of air that is flowing at 36 kPa, 283 K, and 325 m/s. 4 M

b) i) Consider a large commercial airplane cruising at a speed of 1050 km/h in air at an altitude of 10 km where the standard air temperature is -$50^0$C. Determine if the speed of this airplane is subsonic or supersonic. Take $k = 1.4$ and $R = 287$ J/kg K. 8 M

ii) A rocket travels in air (pressure 1.033 kgf/cm$^2$, temperature $15^0$C) at a velocity of 458 m/s. Find the Mach number and the Mach angle. Take $k = 1.4$ and $R = 287$ J/kg K.

6. a) A supersonic aircraft flies at 1500m altitude with a constant speed of 750m/s. The air craft passes directly over a stationary ground observer. How much time elapses after it has passed over the observer before the observer hears the aircraft. Assume sonic waves velocity=335m/s . and the aircraft creates a disturbance that may be treated as a sound wave. 6 M

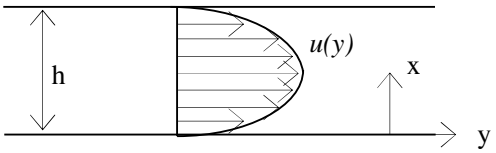
b) (i) What is choking? 6 M

(ii) What is mach number? Explain the importance of mach number.

7. a) Consider fully developed two-dimensional Poiseuille flow-flow between two infinite parallel plates separated by distance h, with both the top plate and bottom plate stationary, and a forced pressure gradient *dP/dx* driving the flow as shown in figure below (*dP/dx* is constant and negative). The flow is steady, incompressible, and two-dimensional in the xy-plane. The velocity components are given by 6 M

$$u = \frac{1}{2\mu}\frac{dP}{dx}(y^2 - hy) \qquad v = 0$$

where $\mu$ is the fluid's viscosity. Is this flow rotational or irrotational? If it is rotational, calculate the vorticity component in the z-direction. Do fluid particles in this flow rotate clockwise or counterclockwise?




b) i) What is *Eulerian description* of fluid motion? How does it differ from the Lagrangian description? 6 M

ii) Define a *steady flow field* in the Eulerian reference frame. In such a steady flow, is it possible for a fluid particle to experience a nonzero acceleration?

8. a) The velocity components in an unsteady plane flow are given by 6 M

$$u = \frac{x}{1+t} \text{ and } v = \frac{2y}{2+t}$$

Describe the path lines and the streamlines

b) Air at $30^0$C flows at a uniform speed of 30 m/s along a smooth flat plate. Calculate the approximate x-location along the plate where the boundary layer begins the transition process toward turbulence. At approximately what x-location along the plate is the boundary layer likely to be fully turbulent? (The density and viscosity of air at $T = 30^0$C are 1.164 kg/m$^3$ and $1.872 \times 10^{-5}$ kg/m·s respectively) 6 M

# AR19

**CODE: 19MPE1002** **SET-1**

**ADITYA INSTITUTE OF TECHNOLOGY AND MANAGEMENT, TEKKALI**
**(AUTONOMOUS)**
**M.Tech. I Semester Regular & Supplementary Examinations, August,2021**

## MODELING AND ANALYSIS OF ELECTRICAL MACHINES
**(POWER ELECTRONICS AND DRIVES)**

**Time: 3 Hours** **Max Marks:60**

**Answer any FIVE questions**
**All questions carry EQUAL marks**

| | | | |
|---|---|---|---|
| 1. | | Derive the general expression of stored magnetic energy, co-energy and force for doubly excited system. | 12 M |
| 2. | a) | Explain the transformation of balanced 3-Φ into equivalent 2- phase. | 6 M |
| | b) | Write the advantages of transformation. | 6 M |
| 3. | | Write the voltage equations for Kron's primitive machine in matrix form. What observations is mode from the impedance matrix of this machine? | 12 M |
| 4. | a) | Explain the reference frame theory with a suitable illustration and diagram. | 6 M |
| | b) | From first principles derive the voltage and torque equations of a three-phase symmetrical induction machines. | 6 M |
| 5. | | Obtain the expressions for a 3-phase induction motor (Voltage and current) in state variable form in i) stator reference frame and ii) synchronously rotating frame. | 12 M |
| 6. | a) | Discuss the reference frame theory in a step-by step basis that how a three phase symmetrical induction machine model to transformed into two phase machine model. | 6 M |
| | b) | Also draw the equivalent circuit model of transformed two phase machine model with respect to synchronous reference frame. | 6 M |
| 7. | | Derive the expressions for voltage and torque of un symmetrical 2 phase induction motor in stationary reference frame . | 12 M |
| 8. | a) | Write short notes on the following<br>Stator reference frame. | 6 M |
| | b) | Rotor reference frame. | 6 M |

# AR19

**CODE: 19MCS1002** **SET-1**

**ADITYA INSTITUTE OF TECHNOLOGY AND MANAGEMENT, TEKKALI**
**(AUTONOMOUS)**
**M.Tech. I Semester Regular & Supplementary Examinations, August,2021**

**Advanced Algorithms and Design**
**(COMPUTER SCIENCE AND ENGINEERING)**

**Time: 3 Hours** **Max Marks: 60 M**

**Answer any FIVE questions**
**All questions carry EQUAL marks**

| | | | |
|---|---|---|---|
| 1. | a) | Implement Quick Sort Technique on the following 20, 6, 89, 32, 65, 92, 8 numbers | 6 M |
| | b) | How do you represent Hash Table? Explain | 6 M |
| 2. | a) | Explain Insertion, deletion and display procedures of AVL tree | 6 M |
| | b) | Define B-Tree. Generate a B-Tree of order 3 (2-3 tree) for the following key values 25,10,12,15,39,64,53 | 6 M |
| 3. | a) | Do you think it is possible for Minimum spanning tree to have a cycle? Justify your answer? | 6 M |
| | b) | Assume that in a network of computers any two computers can be linked. Give a cost estimate for each possible link, should (prim's algorithm) and kruskal's algorithm be used? Justify your answer? | 6 M |
| 4. | a) | Explain the main features of Boyer-Moore algorithm | 6 M |
| | b) | Design a Brute force algorithm for computing the Value of a polynomial? | 6 M |
| 5. | a) | Write the dynamic programming algorithm for 0-1 Knapsack problem? | 6 M |
| | b) | Describe Wars hall's algorithm and its purpose | 6 M |
| 6. | a) | Compare travelling sales person problem in branch and bound method and other methods | 6 M |
| | b) | State and explain the n-Queen problem using backtracking | 6 M |
| 7. | a) | Construct a binary search tree by inserting the keys 4, 12, 8, 16, 6, 18, 24, 2, 14, 3. Draw the tree following each insert. From the tree delete keys 6, 14, 16 and 4. Draw the search tree after each deletion | 6 M |
| | b) | Sort the following set of elements by using Min Heap Priority sorting technique: {50, 60, 30, 10, 40, 20}. | 6 M |
| 8. | a) | Explain about Breadth First Search Traversal technique with an example | 6 M |
| | b) | Generate FIFO branch and bound on the traveling salesman problem and find the solution space tree | 6 M |

# AR19

**CODE: 19MVL1002** **SET-2**

**ADITYA INSTITUTE OF TECHNOLOGY AND MANAGEMENT, TEKKALI**
**(AUTONOMOUS)**
**M.Tech. I Semester Regular & Supplementary Examinations, August,2021**
**DIGITAL SIGNAL AND IMAGE PROCESSING**
**(VLSI System Design)**

**Time: 3 Hours** **Max Marks:60**

**Answer any FIVE questions**
**All questions carry EQUAL marks**

| | | | |
|---|---|---|---|
| 1. | a) | Explain about decimation in time FFT algorithm | 6 |
| | b) | Give the relation between Discrete Time Fourier Transform (DTFT) and Z-Transform. | 6 |
| 2. | | Write the following | |
| | a) | To design a digital band pass filter, which type of Linear Phase FIR filter can used? Why? | 6 |
| | b) | Compare Butterworth & Chebyshev filter. | 6 |
| 3. | a) | What major problem associated with designing of FIR filter using window method and frequency sampling method. How to overcome this problem? | 6 |
| | b) | What are the advantages and disadvantages of FIR over IIR filter? | 6 |
| 4. | a) | What are the differences between Fixed and Binary floating point number representation? | 6 |
| | b) | Explain the different challenges of fixed point representation over FIR filters. | 6 |
| 5. | a) | Explain jpeg image compression in step wise with a neat diagram | 6 |
| | b) | Explain the process of image acquisition briefly. | 6 |
| 6. | | Distinguish between spatial domain techniques and frequency domain techniques of image enhancement. | 12 |
| 7. | a) | Explain the effect of noise on color channels? | 6 |
| | b) | List the advantages and disadvantages of different color spaces. | 6 |
| 8. | | Explain Pipelining and Parallel Processing for Low Power? | 12 |

# AR19

**CODE: 19MSE1002** **SET-1**

**ADITYA INSTITUTE OF TECHNOLOGY AND MANAGEMENT, TEKKALI**
**(AUTONOMOUS)**
**M.Tech. I Semester Regular & Supplementary Examinations, August,2021**

**ADVANCED SOLID MECHANICS**
**(Structural Engineering)**

**Time: 3 Hours** **Max Marks:60**

**Answer any FIVE questions**
**All questions carry EQUAL marks**

| | | | |
|---|---|---|---|
| 1. | a) | Explain the concept and assumptions involved in theory of elasticity? | 5M |
| | b) | Explain the procedure for determination of stresses on any plane inclined to regular set of axes .The inclination of the plane is defined by direction cosines. | 7M |
| 2. | | Determine the principal stresses, maximum shear stress, octa hydral, normal, shear stress for stress at a point $\sigma_x = 150$ MPa, $\sigma_y = 100$ MPa, $\sigma_z = 100$ MPa, $\tau_{xy} = \tau_{yz} = 50$ MPa and $\tau_{zx} = -50$ M | 12M |
| 3. | a) | Explain the term "Compatibility equations". | 6M |
| | b) | Explain the terms "Mean and deviator stresses". | 6M |
| 4. | a) | Derive expressions for compatibility for a two dimensional problems. | 6M |
| | b) | Derive expressions for strain at a point in terms of stress components. | 6M |
| 5. | a) | Explain plane stress and plane strain problems with examples. | 6M |
| | b) | Discuss various applications of polar coordinates and advantages of considering problem using polar coordinates. | 6M |
| 6. | a) | Explain about twisting of rectangular bars. | 6M |
| | b) | Explain with an example Solution of torsional problems by energy method. | 6M |
| 7. | a) | Derive plastic stress strain relationship. | 6M |
| | b) | Describe the yield criteria for plasticity. | 6M |
| 8. | | Write short notes on following<br>a) Homogenous deformations<br>b) Stress invariants<br>c) Membrane analogy | 12M |