18BME0133
MEE4006

Digital Assignment - 1

- MCQ:

1> 'b' 2> 'a' 3> 'a' 4> 'a'

8> 'd' 9> 'a' 10> 'b'

- Short - Answers.

5. (i) Compressive flow

$\Rightarrow \frac{d}{dt}(\rho) + \nabla.(\rho V) = 0$

$P_x: \frac{d(\rho u)}{dt} + \nabla(\rho . uV) = -\frac{\partial}{\partial x}(P) + \mu\left[\frac{\partial^2}{\partial x^2} + \frac{\partial^2}{\partial y^2}\right]$

$P_y: \frac{d}{dt}(\rho v) + \nabla(\rho . vV) = -\frac{\partial}{\partial x}(P) + \mu\left[\frac{\partial^2 v}{\partial x^2} + \frac{\partial^2 v}{\partial y^2}\right]$

(ii) Incompressible flow.

$\Rightarrow \frac{du}{dx} + \frac{dv}{dy} = 0$ (cont. equ.)

$P_x: \frac{du}{dt} + u\frac{du}{dx} + v\frac{du}{dy} = -\frac{1}{\rho}.\frac{dP}{dx} + \frac{\mu}{\rho}\left(\frac{\partial^2 u}{\partial x^2} + \frac{\partial^2 u}{\partial y^2}\right)$

$P_y: \frac{dv}{dt} + v\frac{dv}{dy} + u\frac{dv}{dx} = -\frac{1}{\rho}\frac{dP}{dy} + \frac{\mu}{\rho}\left(\frac{\partial^2 v}{\partial x^2} + \frac{\partial^2 v}{\partial y^2}\right)$

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6. $\left(\frac{du}{dx}\right)_i = \frac{au_i + bu_{i-1} + cu_{i-2}}{\Delta x}$;

$u_{i-1} = u_i - \left(\frac{\Delta x}{1!}\right)\frac{\partial u}{\partial x} + \left(\frac{\Delta x^2}{2!}\right)\frac{\partial^2 u}{\partial x^2} - \left(\frac{\Delta x^3}{3!}\right)\frac{\partial^3 u}{\partial x^3} + \dots$

$u_{i-2} = u_i - \frac{\partial u}{\partial x}\frac{2(\Delta x)}{1!} + 4\left(\frac{\Delta x^2}{2!}\right)\frac{\partial^2 u}{\partial x^2} - 8\left(\frac{\Delta x^3}{3!}\right)\frac{\partial^3 u}{\partial x^3} + \dots$

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7. (i) $\left(\frac{dT}{dx}\right)_{N+1} = \frac{T_{N+2} - T_N}{2\Delta x}$ → Image point method

(ii) $T_{i+1} = T_i + \frac{dT}{dx}(\Delta x) + \frac{d^2T}{dx^2}\left(\frac{\Delta x^2}{2!}\right) + \frac{d^3T}{dx^3}\left(\frac{\Delta x^3}{3!}\right)$ → Taylor's series method

(iii) $T = Ax^2 + Bx + C$ → Polynomial extension method