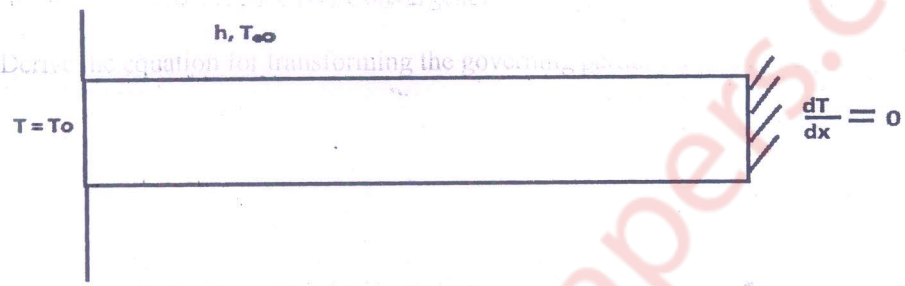
ME/Sem II/MECH THRM/ND-2018

(Time: 3 Hours) (Marks: 80)

N. B. :
i) Solve any **FOUR** questions.
ii) Assume suitable additional data if necessary & draw the sketches wherever required

Q1) a) Explain in detail 'C' Types of grid 05
b) Using Taylor's series, derive first order forward and central difference for $\partial u/\partial x$ 07
c) Explain Eddy Viscosity Model and $k$-$\varepsilon$ Turbulence Model. 08

Q2) a) Consider the 1 D steady state heat conduction in an isolated rectangular horizontal fin. The base temperature is maintained at $T=T_o$ & tip of fin is insulated. The fin is exposed to a convective environment which is at ($T_\infty < T_o$). The length of the fin is 'L' & the coordinate axis begins at the base of the fin. 12




The energy equation for the fin at the steady state is

$$\frac{d^2T}{dx^2} + \frac{hP}{kA}(T - T_m) = 0$$

Where P= perimeter, A= cross section area of the fin,
h = heat transfer coefficient
Solve this problem using FDM and write matrix

b) In the context of FD methods explain what is meant by (i) Truncation error (ii) Stability (iii) Iterative convergence (iv) Convergence 08

Q3) a) Derive the equation for transforming the governing partial differential equations in terms of Jacobian matrix. 10
b) Explain Reynolds's Transport Theorem. 10

Q4) a) Consider a two dimensional viscous incompressible flow of a Newtonian fluid between 2 parallel plates, separated by a distance 'h'. One of the plates is stationary and the other is moving with a uniform velocity U. Obtain the velocity equations from the general Navier stokes equation. Specify the boundary condition for a CFD solution. 12
b) Explain briefly CFD and its methodology. 08

Q5) a) What is SIMPLE algorithm used for? Explain the steps involved in the algorithm. How is it different from SIMPLER 10
b) Derive the Navier Stokes equation in Z- direction and explain in detail physical significance 10

Q6) Write short notes on ( ANY FOUR) 20
i. Mathematical Behavior of PDEs
ii. Implicit Method
iii. Application of CFD
iv. Grid Quality
v. Finite volume method