1. Write the Poisson's equation for heat conduction.
2. What is lumped heat capacity analysis?
3. Define thermal boundary layer thickness.
4. What do you understand by free and forced convection?
5. What is effectiveness of a heat exchange?
6. Give the expression for NTU.
7. Find the temperature of the sun assuming as a black body, if the intensity of radiation is maximum at the wave length of 0.5^.
8. State Kirchhoff s law.
9. Define molar concentration.
10. What is mass average velocity?

11. (a) Derive the general heat conduction equation in cylindrical coordinates.

(16)

Or

(b) Derive the general heat conduction equation for a hollow cylinder. (16)

12. (a) Air at 20°C at 3m/s flows over a thin plate of 2m long and 1m wide. Estimate the boundary layer thickness at the trailing edge, total drag force, mass flow of air between x = 30cm and x = 80cm . Take $\nu = 15 \times 10^{6}$ and p = 1.17kg/m^3. (16)

Or

(b) Calculate the convective heat transfer from a radiator 0.5m wide and 1m high at 84°C in a room at 20°C. Treat the radiator as a vertical plate.¥16)

13. (a) Dry steam at 2.45 bar condenses on a vertica[1] '.ub; f h igh t of 1m at 117°C. Estimate the thickness of the condensa e Hm [n]nd tne local heat transfer coefficient at a distance 0.2 m from th *e* upper end of the plate.

(16)

Or

(b) Derive th" L MT D for a parallel flow heat exchanger stating the assumptions '» (16)

14. (a) Derive the radiation exchange between

(i) Large parallel gray surfaces and

(ii) Small gray bodies. (16)

Or

(b) Two large parallel plates of 1mx1m spaced 0.5m apart in a very large room whose walls are at 27°C. The plates are at 900°C and 400°C with emissivities 0.2 and 0.5 respectively. Find the net heat transfer to each plate and to the room. (16)

15. (a) The temperature recorded by a thermometer whose bulb covered by a wet wick in dry air at atmospheric pressure is 22°C. Estimate the true air temperature.(16)

Or

(b) Dry air at 27°C and 1 bar flows over a wet plate of 50cm at 50m/s. Calculate the mass transfer coefficient of water vapour in air at the end of the plate. (16)