1. Determine the day length in hours at Mumbai (Latitude =19.07°) on May 27 in a leap year.
2. Calculate the local apparent time (LAT) and declination at a location latitude of 24°20' N, longitude of 77°21' E at 13:30 IST on July 24. Equation of time correction is (-1°09").
3. Calculate the monthly average hourly radiation falling on a flat plate collector facing south (γ =0°) with a slope of 15°, given the following data:
   Location: Chennai (13° 00'N), Month: October, Time: 11:00 to 12:00 (LAT), $(I_g)_{avg}$ = 2408 kJ/m^{2}h, $(I_d)_{avg}$ = 1073 kJ/m^{2}h, Assume ground reflectivity to be 0.2.
4. List different types of concentrating collectors. Explain any one of them with a neat sketch.
5. Explain flat plate collector with a neat sketch.
6. Explain sensible heat storage and latent heat storage methods with neat sketches.
7. Explain the method of calculating radiation flux on a tilted surface.
8. Define the tilt factors for beam, diffused and reflective components of radiation and write the expressions used to calculate them.
9. Explain how solar energy can used for drying with a neat sketch.
10. Explain briefly the parameters affecting the performance of flat plate collector.
11. Explain active and passive systems of solar energy.
12. Explain passive heating and cooling systems of solar energy with neat sketch.
13. Explain solar distillation with neat sketch.
14. Write short notes on
    a. Stagnation temperature.
    b. Collector efficiency factor
    c. Heat removal factor
    d. Overall heat loss coefficient
15. Two glass covers 3 mm each thick have refractive index of 1.526 and extinction co-efficient 'K' of 0.0161 mm. Calculate the transmittance taking into account the absorption and reflection both for normal and an angle of incidence of 75° and also find the absorptance transmittance product. If absorptance of the absorber plate is 0.94