DEPARTMENT OF AEROSPACE ENGINEERING

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Year & Branch	:	**II AEROSPACE**	Semester	:	**III**
Course	:	**23AST202 – Fluid Mechanics for Aerospace**			

UNIT I - FLUID PROPERTIES AND FLOW CHARACTERISTICS

1. A Liquid has a specific gravity of 0.72. Find its density, specific weight and also the weight per liter of the liquid. If the above liquid is used for lubrication between a shaft and a sleeve, find the power lost in liquid for a sleeve length of 100 mm. The diameter of the shaft is 0.5 m and the thickness of the liquid film is 1 mm. Take the viscosity of fluid as 0.5 N-s/m2and the speed of the shaft as 200rpm.

Sol: Volume V = 1 litre = 0.001 m3

Specific gravity S = 0.72

(i) Density $\rho = S * 1000 = 0.72 * 1000 = 720$ kg/m3

(ii) Specific weight $W = \rho * g = 720 * 9.81 = 7063.2$ N/m3

(iii) Weight $w = W*V = 7063.2 * 0.001 = 7.063$ N

(iv) $\mu = 0.5$ Ns/m2

Diameter D = 0.5 m

Speed of shaft N = 200 rpm0

Sleeve length L = 100 mm

Thickness of oil film t = 1 mm

$u = (\pi DN) / 60 = (\pi * 0.5 * 100)/60 = 2.62$ m/s

du = 2.62 m/s

dy = 1mm = 0.001 m

$\tau = \mu (du/dy) = 0.5 * (2.62/0.001) = 1310$ N/mm2

$F = \tau * A = 1310 * \pi DL = 205.77$ N

Torque $T = F * D/2 = 205.77 * 0.5/2 = 51.44$ Nm

Power lost $= 2\pi NT/60 = (2*\pi*100*51.44)/60 = 538.68$ W