DEPARTMENT OF MINING ENGINEERING

INDIAN INSTITUTE OF TECHNOLOGY (INDIAN SCHOOL OF MINES), DHANBAD

Mid-Semester Examination

Examination: VII B. Tech.

Semester: Monsoon **Session: 2024-2025**

Subject: Advanced Mine Ventilation (MND 401)

Time: 2 Hours Total Marks: 60

Instruction: Answer any THREE questions

Q. No.		Marks
1.	Discuss in detail the different psychrometric properties of mine air.	20
2.	With neat sketches explaining the boundary layer effects discuss the various heat transfer processes at wet surface in underground mines.	20
3.	In a mine galley of 3.5 m wide, 2.5 m high and 20 m long, air is flowing at a flow rate of 30 m^3/s. The friction factor of the gallery k is 0.014 Ns^2m^{-4} and surface temperature of the gallery is 28°C. The dry-bulb temperature, thermal conductivity and dynamic viscosity of air in the gallery are 25°C, 0.026 W/m°C and 18.3×10^{-6} Ns/m^2, respectively. Calculate the convective heat flow from the surface of mine gallery to the air. Assume your own data, if necessary.	20
4.	a) A galvalised steel pipe of 100 mm in diameter carrying hot water at 70°C passes through an underground excavation of 7 m long, 5 m wide and 3 m high. The pipe passes along the long side of the excavation. Determine the emissivity and view factor (F_{ev}) and the rate of heat transfer by radiation into the underground excavation. Assume that all surfaces in the excavation have an emissivity of 0.95 and that the emissivity of the galvanized pipe is 0.8. The excavation has an average temperature of 25°C.	12
	b) Discuss the importance of geothermal energy, its generation, and utilization.	8

Important formulae:

$e = e'_{wb} - 0.000644B(t_{db}-t_{wb})$, $e'_{wb} = 0.6105 \exp [17.27t_{wb}/(t_{wb}+237.3)]$

$q = 2\pi K.T.L\ (t_{vr} - t_s)$, $q_R = h_r.A_1\ (t_{db}-t_s).F_{ev}$

$q_C = h_c.A\ (t_s-t_{db})$, $q_L = hc.A.\lambda\ [0.7\ (\phi e'_{db}-e'_s)/B]$, $hc = Nu.K_a/D$

$Nu = 0.35.f.Re/[1+1.592(15.217.f.Re^{0.2}-1)/Re^{0.125}]$

$T = 0.685/Fo^{0.146}$

$q_R = 5.67 \times 10^{-8}\ (T_1^4-T_2^4) \times A_1 \times F_{ev}$

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