COURSE CODE: 10M11CE115

MAX. MARKS: 25

COURSE NAME: Mechanical and Electrical Systems in Building   COURSE INSTRUCTOR: SAURABH RAWAT

COURSE CREDITS: 03

MAX. TIME: 1Hr 30 Min

Note: All questions are compulsory. Marks are indicated against each question in square brackets.

[1] Conditions at a construction site are recorded as a wet bulb temperature (WBT) of 70°F, a black globe temperature (BGT) of 89°F, and a dry bulb temperature (DBT) of 4°F. Determine the wet bulb globe temperature (WBGT). Is this temperature deemed safe for working conditions if an immediate supply of water is available? Give reasons.   [6]

[2] What is a thermal bridge in a building envelope assembly, and how does it affect heat loss in a building?   [2]

[3] Describe the differences between the center-of-wall R-value, clear-wall R-value, and whole-wall R-value.   [3]

[4] Determine the conduction heat transfer through the glass of a 3 ft by 4 ft single-glazed window with 1/8 in. thick (double strength thickness) glass and a single-glazed window with 3/32 in. thick (single-strength thickness) glass. Assume the temperatures of the glass surfaces are 0°F and 70°F. Given thermal conductivity of ordinary glass is 6.5 Btu · in/hr · °F · ft².   [6]

[5] Calculate the whole-wall U-factor for the following standard frame wall with 2 x 4 studs at 16 in. OC based on 20% of the wall area backed by framing.   [8]

Framing	R_{bf}	R_{af}
Outside air film, 15 mph wind	0.17	0.17
Wood bevel siding	0.81	0.81
1/2 in. plywood sheathing	0.62	0.62
2 x 4 wood stud @16 in OC	—	4.38
$3\frac{1}{2}$ in. fiberglass insulation	11.0	—
Vapor retarder, plastic film	negligible	negligible
1/2 in. gypsum board	0.45	0.45
Inside air film	0.68	0.68