

JAYPEE UNIVERSITY OF INFORMATION TECHNOLOGY, WAKNAGHAT

TEST -2 EXAMINATION- October, 2019

M.Tech. Ist Semester

COURSE CODE: 10M11CE115

MAX. MARKS: 25

COURSE NAME: Mechanical and Electrical Systems in Building

COURSE CREDITS: 03

MAX. TIME: 1Hr 30 Min

Note: All questions are compulsory. Carrying of mobile phone during examinations will be treated as case of unfair means.

[1] An insulated wall is composed of $\frac{1}{2}$ in. wood bevel siding, $\frac{1}{2}$ in. plywood sheathing, $3\frac{1}{2}$ in. fiberglass insulation, a vapor retarder (plastic film), and $\frac{1}{2}$ in gypsum board. The following R-values are found:

S. No.	Insulators	R - Values
1.	Outside air film, 15 mph wind	0.17 hr. °F .ft ² /Btu
2.	$\frac{1}{2}$ in. wood bevel siding	0.81 hr. °F .ft ² /Btu
3.	$\frac{1}{2}$ in. plywood sheathing	0.62 hr. °F. ft ² /Btu
4.	$3\frac{1}{2}$ in. fiberglass batt insulation	11.00 hr. °F .ft ² /Btu
5.	Vapor retarder (plastic film)	negligible
6.	$\frac{1}{2}$ in gypsum board	0.45 hr. °F. ft ² /Btu
7.	Inside air film (for vertical surface, horizontal flow)	0.68 hr. °F. ft ² /Btu

Determine:

- U-factor for this wall under winter conditions [2]
- Temperature between outside air film and wood bevel siding. [1]
- Temperature between wood bevel siding and plywood sheathing [1]
- Temperature between plywood sheathing and fiberglass insulation [1]
- Temperature between fiberglass insulation and vapor retarder [1]
- Temperature between vapor retarder and gypsum board [1]
- Temperature between gypsum board and inside air film [1]
- At the midpoint of the insulation [2]

based on an outside air temperature of -2°F and an inside air temperature of 68°F (a ΔT of 70°F).

[2] With respect to radiation heat transfer, describe the terms absorptivity, reflectivity and transmissivity. [3]

[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. [4]

[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. [5]

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
3½ 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

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