

C.U.SHAH UNIVERSITY

Winter Examination-2018

Subject Name: Automobile Heat Transfer

Subject Code: 4TE05AHT1

Branch: B.Tech (Automobile)

Semester: 5

Date: 28/11/2018

Time: 10:30 To 01:30

Marks: 70

Instructions:

- (1) Use of Programmable calculator & any other electronic instrument is prohibited.
 - (2) Instructions written on main answer book are strictly to be obeyed.
 - (3) Draw neat diagrams and figures (if necessary) at right places.
 - (4) Assume suitable data if needed.
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- Q-1 Attempt the following questions: (14)**
- a) Which of the following material has least thermal conductivity at room temperature? **01**
(a) Human skin (b) Urethane (c) Wood (d) Brick
 - b) Heat transfer from one place to another take place through **01**
(a) conduction (b) convection (c) radiation (d) all of the above
 - c) Overall heat transfer coefficient associated with **01**
(a) conduction & radiation (b) convection & radiation
(c) conduction, convection & radiation (d) None
 - d) In which material non-isotropic conductivity is exhibited **01**
(a) lead (b) wood (c) copper (d) brass
 - e) Temperature variation in pipe is **01**
(a) linear (b) parabolic (c) logarithmic (d) None
 - f) The effectiveness of fin will be maximum in environment with **01**
(a) free convection (b) force convection (c) radiation (d) None
 - g) The Prandtl number will be lowest for **01**
(a) water (b) liquid metal (c) aqueous solution (d) lube oil
 - h) Which of the dimensionless number is different from others? **01**
(a) Eckert (b) Reynolds (c) Nusselt (d) Stanton
 - i) The value of Prandtl number for air is about **01**
(a) 0.1 (b) 0.3 (c) 0.7 (d) 1.7
 - j) The automobile radiator is a heat exchanger of **01**
(a) Parallel flow type (b) Counter flow type
(c) Cross flow type (d) Regenerator type
 - k) Fouling factor is used **01**
(a) In heat exchanger design as a safety factor (b) In case of Newtonian fluids
(c) When a liquid exchanges heat with a gas (d) None of the above
 - l) In pool boiling, as soon as the temperature of heating surface reaches the boiling point of the liquid, heat transfer takes place **01**
(a) by conduction (b) by natural convection (c) by forced convection (d) cannot say



- m) Emissivity of a white polished body in comparison to a black body is **01**
 (a) Higher (b) Lower (c) Same (d) Depends upon the shape of body
- n) When the formation of bubbles becomes very high in pool boiling, then the heat flux **01**
 (a) rises (b) reduces (c) remains constant (d) becomes unpredictable

Attempt any four questions from Q-2 to Q-8

Q-2

Attempt all questions

- a) Derive an expression for one-dimensional (Radial) steady-state heat conduction through hollow sphere without heat generation. **(7)**
- b) A wall 30 mm thick of size 5m x 3m made of red bricks ($k=0.35 \text{ W/mK}$). It is covered on both sides by the layers of plaster 2 cm thick ($k=0.6 \text{ W/mK}$). The wall has a window of size 1 m x 2 m. The 12 mm thick window glass is having thermal conductivity of 1.2 W/mK. Estimate the rate of heat flow through the wall. The temperatures of inner and outer faces are 10°C and 40°C respectively. **(7)**

Q-3

Attempt all questions

- a) Why fins are widely used? Explain the following terms: (i) Efficiency of fin (ii) Effectiveness of fin. **(7)**
- b) What do you mean by critical thickness of insulation? Explain its physical significance and derive the equation for the same for cylindrical shaped body. **(7)**

Q-4

Attempt all questions

- a) A gas turbine blade made of stainless steel ($k=32\text{W/m}^\circ\text{C}$) is 70 mm long, 500 mm^2 cross sectional area and 120 mm perimeter. The temperature of the root of blade is 500°C and it is exposed to the combustion product of the fuel passing from turbine at 830°C . If the film coefficient between the blade and the combustion gases is $300 \text{ W/m}^2\text{C}$, Determine: Temperature at the middle of blade and The rate of heat flow from the blade. **(7)**
- b) Write a short note on Radiator used in Car including construction, working and application with neat sketch. **(7)**

Q-5

Attempt all questions

- a) Explain Heat Exchanger according to geometry of construction with neat sketch. **(7)**
- b) For Natural convection heat transfer, show that $\text{Nu}=f(\text{Gr}, \text{Pr})$. **(7)**

Q-6

Attempt all questions

- a) Explain properties of radiation and types of surfaces are considered in thermal radiation. **(7)**
- b) Discuss in details the various regimes in boiling. **(7)**

Q-7

Attempt all questions

- a) What do you understand by convection? State the types of heat convection and differentiate between them. Write application of heat convection. **(7)**
- b) What is condensation? When does it occur? Differentiate between film wise and drop wise condensation. Which type has better heat transfer coefficient? In condenser design which type of condensation is usually selected and why? **(7)**

Q-8

Attempt all questions

- a) State Wien's Displacement Law and derives proof of Wien's law. **(7)**
- b) Explain heat exchanger between two finite black surfaces by radiation. **(7)**

