

B.Tech III Year II Semester (R15) Supplementary Examinations December/January 2018/19

**HEAT TRANSFER**

(Mechanical Engineering)

Use of heat transfer data book is allowed.

Time: 3 hours

Max. Marks: 70

**PART – A**

(Compulsory Question)

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- 1 Answer the following: (10 X 02 = 20 Marks)
- Write the expression for overall heat transfer coefficient for composite wall with two different materials subjected to convection on both sides.
  - Write different types of boundary conditions.
  - Define fin efficiency. Write expression for fin efficiency for a fin with insulated tip.
  - Write significance of Heisler charts in transient heat conduction.
  - Write conservative form of energy equation.
  - Define Prandtl number and Grashof number.
  - Write different stages in a pool boiling.
  - Counter flow heat exchanger is having higher effectiveness than the parallel flow heat exchanger. Justify.
  - What is Wien's displacement law?
  - What is shape resistance and surface resistance in a radiation heat transfer between two surfaces?

**PART – B**

(Answer all five units, 5 X 10 = 50 Marks)

**UNIT – I**

- 2 Derive the generalized three dimensional heat conduction equation in cylindrical coordinates. Reduce it into one dimensional steady state equation.

**OR**

- 3 The exposed surface ( $x = 0$ ) of a plane wall of a thermal conductivity  $K$  is subjected to microwave radiation that causes volumetric heating to vary as:

$$\dot{q}(x) = \dot{q}_0 \left[ 1 - \frac{x}{L} \right]$$

where  $\dot{q}_0$  ( $\text{W/m}^3$ ) is a constant. The boundary at  $x = L$  is perfectly insulated, while the exposed surface is maintained at a constant temperature  $T_0$ . Determine the temperature distribution  $T(x)$  in terms of  $x$ ,  $h$ ,  $K$ ,  $\dot{q}_0$  and  $T_0$ .

**UNIT – II**

- 4 Derive the one dimensional heat conduction generalized equation for a rectangular fin. Consider fin base is at a temperature  $T_b$  and convection coefficient with surroundings fluid is  $h_\infty$ . Reduce it to know the temperature distribution when the fin is assumed as long fin with infinite length.

**OR**

- 5 Carbon steel (AISI 1010) shafts of 0.12 m diameter are heat treated in a gas fired furnace whose gases are at 1250 K and provide a convection coefficient of 104  $\text{W/m}^2\text{K}$ . If the shafts enter the furnace at 305 K, how long must they remain in the furnace to achieve a centre line temperature of 810 K.

Contd. in page 2

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## **Table of Contents Jntua 2 2 Previous Question Papers**

1. Understanding the eBook Jntua 2 2 Previous Question Papers
  - The Rise of Digital Reading Jntua 2 2 Previous Question Papers
  - Advantages of eBooks Over Traditional Books
2. Identifying Jntua 2 2 Previous Question Papers
  - Exploring Different Genres
  - Considering Fiction vs. Non-Fiction
  - Determining Your Reading Goals
3. Choosing the Right eBook Platform
  - Popular eBook Platforms
  - Features to Look for in an Jntua 2 2 Previous Question Papers
  - User-Friendly Interface
4. Exploring eBook Recommendations from Jntua 2 2 Previous Question Papers
  - Personalized Recommendations
  - Jntua 2 2 Previous Question Papers User Reviews and Ratings
  - Jntua 2 2 Previous Question Papers and Bestseller Lists
5. Accessing Jntua 2 2 Previous Question Papers Free and Paid eBooks
  - Jntua 2 2 Previous Question Papers Public Domain eBooks
  - Jntua 2 2 Previous Question Papers eBook Subscription Services
  - Jntua 2 2 Previous Question Papers Budget-Friendly Options

6. Navigating Jntua 2 2 Previous Question Papers eBook Formats
  - ePub, PDF, MOBI, and More
  - Jntua 2 2 Previous Question Papers Compatibility with Devices
  - Jntua 2 2 Previous Question Papers Enhanced eBook Features
7. Enhancing Your Reading Experience
  - Adjustable Fonts and Text Sizes of Jntua 2 2 Previous Question Papers
  - Highlighting and Note-Taking Jntua 2 2 Previous Question Papers
  - Interactive Elements Jntua 2 2 Previous Question Papers
8. Staying Engaged with Jntua 2 2 Previous Question Papers
  - Joining Online Reading Communities
  - Participating in Virtual Book Clubs
  - Following Authors and Publishers Jntua 2 2 Previous Question Papers
9. Balancing eBooks and Physical Books Jntua 2 2 Previous Question Papers
  - Benefits of a Digital Library
  - Creating a Diverse Reading Collection Jntua 2 2 Previous Question Papers
10. Overcoming Reading Challenges
  - Dealing with Digital Eye Strain
  - Minimizing Distractions
  - Managing Screen Time
11. Cultivating a Reading Routine Jntua 2 2 Previous Question Papers
  - Setting Reading Goals Jntua 2 2 Previous Question Papers
  - Carving Out Dedicated Reading Time
12. Sourcing Reliable Information of Jntua 2 2 Previous Question Papers
  - Fact-Checking eBook Content of Jntua 2 2 Previous Question Papers
  - Distinguishing Credible Sources
13. Promoting Lifelong Learning
  - Utilizing eBooks for Skill Development
  - Exploring Educational eBooks
14. Embracing eBook Trends
  - Integration of Multimedia Elements

- Interactive and Gamified eBooks

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