

SET 1

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| **Scheme of Valuation/Answer Key**  (Scheme of evaluation (marks in brackets) and answers of problems/key) | | | | | |
| **APJ ABDUL KALAM TECHNOLOGICAL UNIVERSITY**  **FOURTH SEMESTER B.TECH DEGREE EXAMINATION, MAY 2019** | | | | | |
| **Course Code: CH202** | | | | | |
| **Course Name: PROCESS HEAT TRANSFER (CH)** | | | | | |
| Max. Marks: 100 | | |  | Duration: 3 Hours | |
| **PART A** | | | | | |
| ***Answer any two questions. Each question carries 15 marks.*** | | | | | |
|  |  |  | | |  |
| 1 | a) | Take energy balance over a differential section of a slab (2) rearrange (2) general heat conduction equation (3) | | | 7 |
|  | b) | Energy balance (3) rearrange and equation for temperature profile in terms of Biot number and Fourier number (5) | | | 8 |
| 2 | a) | Presentation of given data (2) equation for heat loss for a pipe (1) rate of heat loss per metre length (5) | | | 8 |
|  | b) | Definition of critical radius (2) critical radius of insulation for cylinders equation - derivation (5) | | | 7 |
| 3 | a) | General heat conduction equation for spheres with internal generation (1) integration (2) Application of boundary conditions (2) expressions for temperature profile and heat flux (1) | | | 6 |
|  | b) | Concept of thermal conductivity (1) Energy balance (1) Expression for heat flux for a plane rectangular wall without internal generation(1) | | | 3 |
|  | c) | Equation for temperature profile for a lumped capacity system (2) substitute and find the time to attain the required temperature (4) | | | 6 |
| **PART B** | | | | | |
| ***Answer any two questions. Each question carries 15 marks*** | | | | | |
| 4 | a) | Factors on which h depends (2) write pi groups (2) perform dimensional analysis (2) Relation between Nusselt number, Reynolds number and Prandtl number (2) | | | 8 |
|  | b) | Find the flow is laminar or turbulent by finding the Reynolds number (1) find q(1) find h using relevant equation (2) Find LMTD (1) use q= hA(LMTD), find A and hence length of tube (2) | | | 7 |
| 5 | a) | Present the given data (1) Find Re, Pr and check whether flow is laminar or turbulent (1) If turbulent use Dittus Boelter equation find Nu (3) Find h from Nu (2) | | | 7 |
|  | b) | Expression for heat transfer rate by radiation for two infinitely long parallel planes whose temperatures are T1 and T2, emissivities are ε1 and ε2 respectively (4). determine the reduction in heat transfer rate when radiation shield of temperature T3 and emissivity ε3 placed between two planes (4) | | | 8 |
| 6 | a) | natural convection flow patterns for a i) cold vertical plate (2) ii) horizontal plate with heated surface facing upwards (2) iii) horizontal plate with heated surface facing downwards (2) | | | 6 |
|  | b) | Present the given data (1) Determine the heat loss without shield (1) determine the shield temperature (1) Find the heat loss with shield (1) % reduction in heat transfer rate between the two plates as a result of the shield (1) | | | 5 |
|  | c) | Advantages of a multipass heat exchanger over a single pass heat exchanger (2) Draw the temperature profile for a 1-2 exchanger (2) | | | 4 |
| **PART C** | | | | | |
| ***Answer any two questions. Each question carries 20 marks.*** | | | | | |
| 7 | a) | STV evaporator neat sketch (4) working (4) | | | 8 |
|  | b) | Write the basic equations and assumptions (4) Derivation of Nusselt equation (8) | | | 12 |
| 8 | a) | Forward feed (2) backward feed (2) mixed feed (2) parallel feed (2) | | | 8 |
|  | b) | Sketch (2) Temperature distribution (5) and heat flux (3) for infinitely long fin of uniform cross section | | | 10 |
|  | c) | Drop condensation (1) film condensation (1) | | | 2 |
| 9 | a) | Present the given data (1) Write the material balance solute balance and energy balance equation for a single effect evaporator (3) Find economy (3) and U (3) | | | 10 |
|  | b) | Graph showing regimes of pool boiling (4) Explain regimes like interfacial evaporation, nucleate, film and transition boiling (6) | | | 10 |