

Q P Code:13740

3 Hrs.

[Total Marks: 80]

Note: 1. Answer any FOUR question.

2. Assume suitable additional data if necessary and draw the sketches wherever required.

- Qu 1. a) Explain use of optimization in Environmental and Safety Systems. [10]
- Qu 1. b) Explain the difference between analysis and design is that of a particular thermal process? [10]
- Qu 2. a) What are the commonly used methods for optimization and the nature and type of equations? [10]
- Qu 2. b) Explain the importance of Modelling in design. [10]
- Qu 3. a) Explain various types of models which may be developed for representing the thermal system with example. [10]
- Qu 3. b) What are the different types of governing equations leading for mathematical modelling of thermal systems? [10]
- Qu 4. a) Tests are performed on a nuclear power system to ensure safe shutdown in case of an accident. The measurements yield the power output  $P$  versus time  $\tau$  in hours as [10]
- |                |      |     |     |     |     |     |
|----------------|------|-----|-----|-----|-----|-----|
| $\tau$ (hours) | 1    | 3   | 5   | 6   | 10  | 12  |
| $P$ (MW)       | 13.0 | 7.0 | 5.4 | 4.7 | 4.5 | 4.2 |
- From theoretical considerations, the power is expected to vary as  $a + b/\tau$ , where  $a$  and  $b$  are constants. It is also known that there is experimental error in the data. Will you use a best or an exact fit? Use an appropriate fit to these data points and determine the relevant constants. Is it a good curve fit? Briefly explain your answer.
- Qu 4. b) What are the methods using for raising capital? [10]
- Qu 5. a) In a system for providing hot water for industrial use, the heating unit has a power input of 150 kW and a thermal efficiency in percent is represented by the expression  $150(0.2 + 0.07 HT^{0.5} - H^2)$  and the rate of energy loss by  $0.15 HT^{1.25}$ , where  $H$  is the height of the system including an additional independent variables. Formulate the optimization problem to maximize the rate of energy supply. [10]
- Qu 5. b) What are important decisions based on economic considerations in thermal systems? [10]

- Qu 6. a) What are the main components of a knowledge-based design system? [10]
- Qu 6. b) The design of the cooling system for a personal computer requires a fan. Three different manufacturers are willing to provide a fan with the given specifications. The first one, Fan A, is at Rs.3500/-, payable immediately on delivery. The second one, Fan B, requires two payments of Rs.1950/- each at the end of the first and second years after delivery. The last one, Fan C, requires a payment of Rs.4250/- at the end of two years after delivery. Since a large number of fans are to be purchased, the price is an important consideration. Consider three different interest rates, 6, 8, and 10%. Which fan is the best buy? [10]