

JK Lakshmi Pat University Jaipur

INSTITUTE OF ENGINEERING AND TECHNOLOGY

End Term Examination, April-May, 2018
M.Tech. in Thermal Engineering, Semester II

Roll No.....

Course Code : TEMTECH201

Time: 3 hours

Max. Marks: 100

Instructions to students:

1. Do not write anything other than your roll number on question paper.
2. Assume suitable data wherever required and mention it clearly.
3. Writing appropriate units, nomenclature, and drawing neat sketches/schematics/ flow chart wherever, required are an integral part of the answer.
4. Students are allowed to carry scientific calculator

Q.1	Short questions (10 questions @ 2 mark)	20
i.	Define simulation and also highlight key benefits of simulation in thermal systems design.	
ii.	Define liner regression and explain the use of linear regression in simulation.	
iii.	List down the type of models used in thermal system simulation.	
iv.	What does optimization mean?	
v.	What are the key differences in Simulation and Optimization (atleast two)?	
vi.	What do you understand by single variable problem in thermal system & simulation?	
vii.	Define knowledge based design and highlight its benefits (atleast two).	
viii.	List down atleast five professional ethics. Also define primary and secondary greatness.	
ix.	Calculus, Search, Linear, Geometric Programming and Dynamic Programming methods are used for(Optimisation / Simulation).	
x.	If the function is continuous and differentiable, its derivative becomes zero at the extremum. For a function $y(x)$, this condition is written as: $dy/dx=0$, where x is the independent variable. For a maximum, what would be the conditions: $d^2y/dx^2 > 0$ or $d^2y/dx^2 < 0$	
Q.2	Short type questions (4 questions@ 5 mark)	20
i.	Explain prescriptive and whole building simulation methods. Also highlight the use of parametric simulation in thermal system efficiency.	05
ii.	Highlight various components with the help of schematic of Solar thermal system (Flat Plate Collect Hot Water System).	05
iii.	Explain how a heat pump delivers simultaneous heating and cooling. Can heat pump be used for water heating, if yes, describe the working principle?	05
iv.	Define and describe the relevance of LPD, EPD, Economizer and Heat Recovery Wheel.	05

Q3.	Apply the calculus-based optimization technique given to the minimization of cost C for hot rolling a given amount of metal. This cost is expressed in terms of the mass flow rate m of the material as : $C= 3.5m^{1.4} + (14.8/m^{2.2})$ where the first term on the right-hand side represents equipment costs, which increase as the flow rate increases, and the second term represents the operating costs, which go down as m increases.	06																		
Q.4	Define sensitivity analysis and highlight benefits of sensitivity analysis in simulation of thermal system.	06																		
Q.5A	Dynamic performance evaluation offers Economic benefits as compared to Static, please explain with the support of an example and justify the statement.	06																		
Q.5B	What is Trade-off ? Highlight the benefits of using this approach in prescriptive method ?	06																		
Q.6	Define 'Curve Fitting' and 'Linear Algebraic Systems' with examples.	08																		
Q.7	Find the best-fit values of a and b so that $y = a + bx$ fits the data given in the table <table><tr><td>x</td><td>0</td><td>1</td><td>2</td><td>3</td><td>4</td></tr><tr><td>y</td><td>1</td><td>1.8</td><td>3.3</td><td>4.5</td><td>6.3</td></tr></table>	x	0	1	2	3	4	y	1	1.8	3.3	4.5	6.3	12						
x	0	1	2	3	4															
y	1	1.8	3.3	4.5	6.3															
Or																				
	Explain building components and highlight the requirement of building code in design, simulation and optimization. Also describe the following : 1. EPI and EPI ratio 2. How to calculate capacity of solar water heating system using simulation? 3. What is the relevance of nomenclatures such as : sq ft/ TR and kW/TR in simulation results. 4. What is LPD and EPD ? Can EPD vary in both base case and proposed case, please clarify. 5. Justify, whether schedules of thermal system shall be similar in both base case and proposed case or savings can be claimed by varying schedules ?																			
Q.8	A manufacturing system, which is being designed, needs a laser welding machine. Two machines, A and B, both of which are suitable for the manufacturing process, are being considered. The applicable costs in INR are given as: <table><tr><td></td><td>A</td><td>B</td></tr><tr><td>Initial cost</td><td>20,000</td><td>3,0000</td></tr><tr><td>Annual maintenance cost</td><td>4,000</td><td>2,000</td></tr><tr><td>Refurbishing cost at end of 3 years</td><td>3,000</td><td>0</td></tr><tr><td>Annual savings</td><td>500</td><td>1000</td></tr><tr><td>Salvage value</td><td>500</td><td>3000</td></tr></table> The useful life is 6 years for both machines, and the rate of interest is 8%, compounded annually. Determine which machine is a better acquisition.		A	B	Initial cost	20,000	3,0000	Annual maintenance cost	4,000	2,000	Refurbishing cost at end of 3 years	3,000	0	Annual savings	500	1000	Salvage value	500	3000	12
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Q.9	Explain with the support of two examples, wherein simulation and optimization are being used for economic benefits.	04																		