B.E.(with Credits)-Regular-Semester 2012 - Instrumentation Engineering Sem VIII

IN802 - Process Modelling and Optimization

P. Pages : 2 **GUG/W/16/7103**

Time : Three Hours * 4 8 7 5 * Max. Marks : 80

Notes : 1. Same answer book must be used for each question.
2. All questions carry marks as indicated.
3. Due credit will be given to neatness and adequate dimensions.
4. Assume suitable data wherever necessary.
5. Illustrate your answers wherever necessary with the help of neat sketches.

1. a) Derive model of CSTR. **9**

b) Differentiate between Gray box model and black box model. **7**

OR

2. a) Explain white box modelling in detail. **8**

b) Derive mathematical model of D. C. motor (any). **8**

3. a) Solve $2x^3 - 2.5x - 5 = 0$ for the root in [1,2] by Newton Raphson method. **8**

b) Find the minimum of **8**
$f = x(x - 1.5)$ in the interval (0.0, 1.0) to within 10% of the exact value

OR

4. a) What is curve Fitting? State its need. Also derive the equations to find the coefficients for exponential reaction. **10**

b) Apply Runge Kutta fourth order method to find an approximate value of y when x = 0.2 **6**
given that $\frac{dy}{dx} = x + y$ and y = 1 when x = 0.

5. Develop model of Distillation column. **16**

OR

6. Explain optimization of Boiler/Turbo – Generator system. **16**

7. a) Find the minimum of the function **9**

$$f(\lambda) = 0.65 - \frac{0.75}{1+\lambda^2} - 0.65\,\lambda \tan^{-1}\frac{1}{\lambda}$$

using the secant method with an initial Step size of to = 0.1, $\lambda_1 = 0.0$, and $\in = 0.01$.

b) Find by Newton methods, a root of the following equation to 3 decimal places **7**

OR

8. a) Minimize a quadratic function $f(x) = x^2 - x$ using one iteration of Quasi Newton method. **8**

b) Explain unimodal and multimodal Functions in short. **8**

9. a) A Firm making castings uses electric Furnace to melt iron with the following specifications: **10**

	Minimum	Maximum
Carbon	3.20%	3.40%
Silicon	2.25%	2.35%

Specifications and costs of various raw materials used for this purpose are given below:

Material	Carbon%	Silicon%	Cost(Rs)
Steel scrap	0.4	0.15	850/tonne
Cast iron scrap	3.80	2.40	900/tonne
Remelt from industry	3.50	2.30	500/tonne

If the total charge of iron metal required is 4 tonnes. Find the weight in kg of each raw material that must be used in the optimal mix at minimum cost.

b) Explain Non Linear Programming in short. **6**

OR

10. a) Find the maximum value of **8**
$Z = 2x + 3y$ subject to the constraints
$x + y \le 30,\ y \ge 3$
$0 \le y \le 12,\ x - y \ge 0$
$0 \le x \le 20.$ using graphical method.

b) Explain Karmarkar algorithm. **8**

****