Total No. of Questions :10]

SEAT No. :

P4005

[Total No. of Pages :3

[4959]-1208

B.E. (Instrumentation and Control)

C - Process Modelling and Optimization

(2012 Pattern) (Semester - II) (Elective - III) (406269)

Time : 2½ Hours ***[Max. Marks :70]***

Instructions to candidates:

1) ***Solve Que.1 or 2, Que.3 or 4, Que.5 or 6, Que.7 or 8, Que.9 or 10.***
2) ***Neat diagrams must be drawn wherever necessary.***
3) ***Figures to the right indicate full marks.***
4) ***Use of non-programmable calculator is allowed.***
5) ***Assuume suitable data, if necessary.***

Q1) a) With an example explain Lagrange Interpolation formula **[5]**

b) Derive a mathematical model of any second order electrical system in differential equations form. **[5]**

OR

Q2) Derive mathematical model of any electromechanical system. **[10]**

Q3) Derive transfer function of Gravity flow tank. **[10]**

OR

Q4) a) Explain advantages and limitations of sine wave testing. **[5]**

b) Write the difference between on-line and off-line identification. **[5]**

P.T.O.

Q5) a) Calculate the Niederlinski index for the system. **[10]**

$$\begin{bmatrix} y_1 \\ y_2 \\ y_3 \end{bmatrix} = \begin{bmatrix} \frac{4e^{-3.2s}}{7.5s+1} & \frac{-1.51e^{-2.3s}}{17s+1} & \frac{-0.019e^{-s}}{19.8s+1} \\ \frac{10.17e^{-5.5s}}{47.5s+1} & \frac{-6.5e^{-3.5s}}{16s+1} & \frac{-0.118e^{-2.2s}}{18.9s+1} \\ \frac{44.18e^{-19.6s}}{9.5s+1} & \frac{46.6e^{-18.5s}}{11.6s+1} & \frac{1.87e^{-2.5s}}{8.8s+1} \end{bmatrix} \begin{bmatrix} u_1 \\ u_2 \\ u_3 \end{bmatrix}$$

b) Write an advantages and limitation of Niederlinski index. **[8]**

OR

Q6) a) Calculate the RAG for the system represented by transfer function matrix. **[10]**

$$\begin{bmatrix} y_1 \\ y_2 \\ y_3 \end{bmatrix} = \begin{bmatrix} \frac{4e^{-3.2s}}{7.5s+1} & \frac{-1.51e^{-2.3s}}{17s+1} & \frac{-0.019e^{-s}}{19.8s+1} \\ \frac{10.17e^{-5.5s}}{47.5s+1} & \frac{-6.5e^{-3.5s}}{16s+1} & \frac{-0.118e^{-2.2s}}{18.9s+1} \\ \frac{44.18e^{-19.6s}}{9.5s+1} & \frac{46.6e^{-18.5s}}{11.6s+1} & \frac{1.87e^{-2.5s}}{8.8s+1} \end{bmatrix} \begin{bmatrix} u_1 \\ u_2 \\ u_3 \end{bmatrix}$$

b) With an example explain Morari Resiliency Index. **[8]**

Q7) a) With an example explain the measures of profitability. **[8]**

b) With an example explain classification of optimization problem based on existence of constrains. **[8]**

OR

Q8) a) Explain advantages and limitations of payback period. Net present value and Internal rate of returns. **[8]**

b) With an example explain classification of optimization problem based on physical structure of the problem. **[8]**

Q9) A company manufactures two types of chocolates. Using three different ingredients say A,B and C. Type 1 chocolate of 1 kg requires 4 gms A,5 gms B and 3 gms C ingredients respectively. Type 2 chocolate of 1 kg requires 5 gms A, 2 gms B and 8 gms C ingredients. The ingredients available for manufacture is 1000 gms of A,1000 gms of B and 1200 gms of C. The manufacturer can make profit of Rs. 50 on 1 kg of type 1 and Rs. 30 on 1 kg of type 2. Find the best combination of quantities of type 1 and type 2 chocolates which gives him/her maximum profit using Linear programming problem. **[16]**

OR

Q10)a) Solve the Linear programming problem using graphical method. **[8]**

$$\text{Maximize } Z = 3x_1 + 4x_2$$
$$\text{Subject to } 4x_1 + 2x_2 \leq 80$$
$$2x_1 + 5x_2 \geq 180$$
$$x_1, x_2 \geq 0$$

b) With an example the algorithm of Steepest Descent method. **[8]**