USN | | | | | | | | | | |

06ME71

Seventh Semester B.E. Degree Examination, June/July 2011
Control Engineering

Time: 3 hrs. Max. Marks:100

Note: ***1. Answer any FIVE full questions, selecting at least TWO questions from each part.***
2. Missing data may be suitably assumed.

PART – A

1 a. With suitable example the explain regulator system and follow-up system. **(06 Marks)**

b. What are the requirements of an ideal control system? Explain them. **(04 Marks)**

c. Discuss, giving equations, the effect of the following controller on the system:
i) Proportional plus derivative controller, ii) Proportional plus Integral controller. **(10 Marks)**

2 a. Obtain the transfer function $\frac{Y_1(S)}{F(S)}$ of the mechanical system shown in Fig. Q2 (a) and draw a schematic diagram of an equivalent electrical circuit using force-voltage analogy. **(12 Marks)**

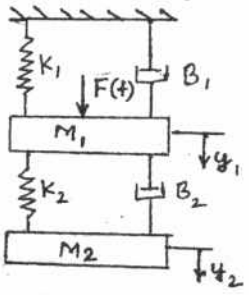

Fig. Q2 (a)

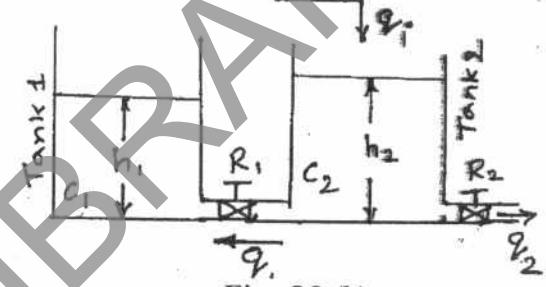

Fig. Q2 (b)

b. Fig. Q2 (b) shows the liquid level system in which q is flow rate, C is hydraulic capacitance, R is hydraulic resistance and h is head of liquid. Obtain the transfer function $\frac{Q_2(S)}{Q_i(S)}$. **(08 Marks)**

3 a. Obtain the closed loop transfer function of the block diagram shown in Fig. Q3 (a).

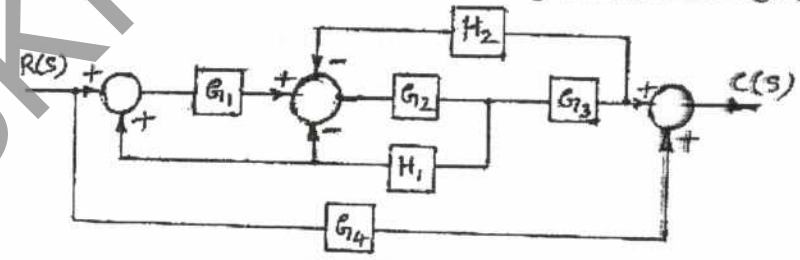

Fig. Q3 (a)

b. For the signal flow graph shown in Fig. Q3 (b), determine C/R using mason's gain formula. **(10 Marks)**

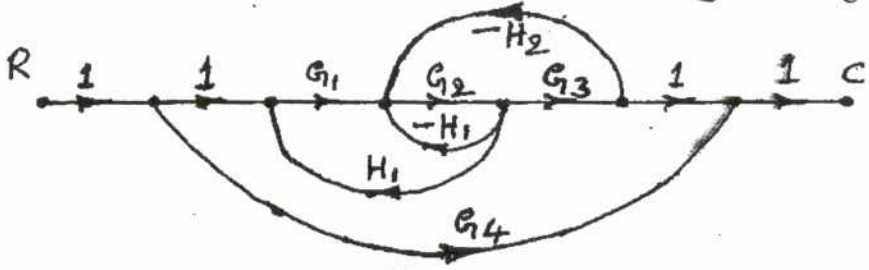

Fig. Q3 (b) **(10 Marks)**

4 a. A second order control system is represented by the differential equation; $\frac{d^2y(t)}{dt^2} + 2\frac{dy(t)}{dt} = 4 \times x(t)$; $y(o) = \dot{y}(o) = 0$. Obtain its total response for unit step input. **(08 Marks)**

b. When the system shown in Fig. Q4 (b) is subjected to a unit step input, it responds as shown. Determine the value of K and T from the response curve.

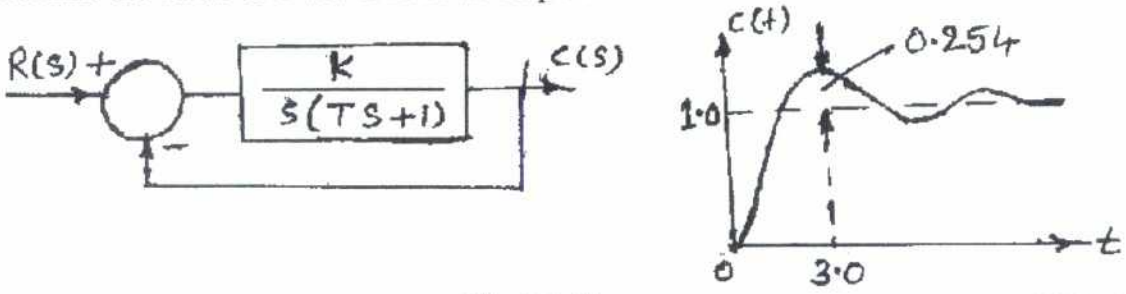

Fig. Q4 (b) **(06 Marks)**

c. The characteristic equation of a system is given by $S^2+6S^3+11S^2+K=0$. Determine the range of K for the system to be stable. Use Routh criterion **(06 Marks)**

PART – B

5 a. Sketch the polar plot for $GH(S) = \frac{1}{(S+P_1)(S+P_2)}$ where $P_1, P_2 > 0$. **(05 Marks)**

b. The OLTF of a system is given by $GH(S) = \frac{K(T_1S+1)}{S^2(T_2S+1)}$; $K, T_1, T_2 > 0$.

Sketch the Nyquist plot for $T_1 < T_2$ and ascertain system stability. **(15 Marks)**

6 A unity feedback system has $G(S) = \frac{K}{S(S+1)(S+10)}$. Draw Bode plot and determine the value of K so that the gain margin of the system is 20db. **(20 Marks)**

7 Draw the root locus plot using guidelines for the OLTF $G(S)H(S) = \frac{K(S+2)}{S(S^2+2S+2)}$ Discuss stability of the system as a function of K. **(20 Marks)**

8 a. Explain the need for system compensation. List the types of compensators used. **(10 Marks)**

b. Write notes on:
i) Lag Compensator.
ii) Lead Compensator. **(10 Marks)**

* * * * *

USN | | | | | | | | | | |

06ME72

Seventh Semester B.E. Degree Examination, June/July 2011
Computer Integrated Manufacturing

Time: 3 hrs. Max. Marks:100

Note: ***1. Answer any FIVE full questions, selecting at least TWO questions from each part.***
2. Draw sketches wherever necessary.

PART – A

1 a. Define Automation? Briefly explain with one example each of different types of automation. **(08 Marks)**

b. Explain the following terms related to manufacturing: i) Utilization & Availability. ii) W/P & T/P ratio. iii) Production rate & MLT. **(06 Marks)**

c. The average part produced in a certain batch manufacturing plant must be processed through an average of the machines. There are 20 new batches parts launched each week. Data for the above problem are;
Average operation time : 6min
Average setup time : 5 hours
Average batch size : 25 parts
Average non-operation time per batch : 10 hours
There are 18 machines in the plant. The plant operates an average of 70 production hours per week. Scrap rate is neglizable
i) Determine the manufacturing lead time.
ii) Plant capacity.
iii) Plant utilization. **(06 Marks)**

2 a. Explain the various methods of work part transport in an automated flow line. **(08 Marks)**

b. Explain with sketches the following transfer machines used for the automated flow lines.
i) Linear transfer mechanism. ii) Rotary transfer mechanism. **(12 Marks)**

3 a. Using the lower bound approach analyze the transfer lines without storage and with storage buffers. **(10 Marks)**

b. With suitable assumptions, determine the line performance for the single stage, two stage & three stage cases.

Station	P_i	Station	P_i
1	0.01	9	0.03
2	0.02	10	0.01
3	0.01	11	0.02
4	0.03	12	0.02
5	0.02	13	0.02
6	0.04	14	0.01
7	0.01	15	0.03
8	0.01	16	0.01

(10 Marks)

4 a. With suitable terminology, explain following terms related to line balancing problems.
i) Minimum Rational work element ii) Workstation process time iii) Precedence constraint & diagram iv) Balance delay. **(12 Marks)**

b. Explain with an example, any one method of line balancing. **(08 Marks)**

PART – B

5 a. Explain with sketches, the various elements of a parts delivery system. **(10 Marks)**

b. Analyse the multi station assembly machine with suitable assumption and parameters. **(06 Marks)**

c. Explain briefly i) The vehicle guidance and routing system. ii) traffic control & safety related to automated guided vehicles(AVG's). **(04 Marks)**

6 a. Explain the following two approaches designed for the computer aided process planning system i) Retrieval CAPP system. ii) Generative CAPP system. **(12 Marks)**

b. What is a material requirement planning? Explain the various inputs to the MRP system. **(08 Marks)**

7 a. Explain with a block diagram, the general configuration of a computer numerical control system (CNC). **(10 Marks)**

b. Explain the fundamental steps involved in development of part programming for milling and turning. **(10 Marks)**

8 a. Explain with sketches, the common robot configurations. **(10 Marks)**

b. Explain the different methods of programming a robot. **(08 Marks)**

c. List the various types of sensors used for the robot? **(02 Marks)**

* * * * *

USN | | | | | | | | | | |

06ME73

Seventh Semester B.E. Degree Examination, June/July 2011
Manufacturing Process - III

Time: 3 hrs. Max. Marks:100

Note: ***Answer any FIVE full questions, selecting at least TWO questions from each part.***

PART – A

1 a. Derive the flow stress equation. **(05 Marks)**

b. Explain clearly the two important yield criteria used in metal working process. **(08 Marks)**

c. Show triaxial stress system, with a neat figure and also represent the same in a matrix form. **(05 Marks)**

d. Define wrought product clearly. **(02 Marks)**

2 a. Discuss the effect of various parameters on metal working process. **(10 Marks)**

b. Explain deformation zone geometry. **(05 Marks)**

c. Write a note on workability of materials. **(05 Marks)**

3 a. Explain "friction hill concept" and the factors affecting it in forging. **(05 Marks)**

b. Explain die design parameters in forging, with a neat figure. **(10 Marks)**

c. A flat circular disc of 25 mm diameter and thickness 75 mm is to be forged to half the height between flat disc. Calculate the maximum forging load. Take $\mu = 0.4$ and Y.S of material 40 kN/mm^2. **(05 Marks)**

4 a. What is roll separating force? Explain clearly its influence on metal working process. **(06 Marks)**

b. Discuss the effect of front tension and back tension on the rolling process, with neat figures. **(08 Marks)**

c. In rolling a slab from 35 to 30 mm, calculate the coefficient of friction and the length of arc of contact. Take the value of roll radius as 250 mm. **(04 Marks)**

PART – B

5 a. With a neat sketch, represent all the details of a drawing die. Explain briefly. **(06 Marks)**

b. With a flow chart, show the steps involved in wire drawing. **(04 Marks)**

c. What are drawing variables? Explain briefly. **(05 Marks)**

d. Explain the steps in tube drawing process. **(05 Marks)**

6 a. Explain clearly the variables influencing extrusion process. **(10 Marks)**

b. Explain impact extrusion. **(05 Marks)**

c. Show how metal flow pattern varies with and without friction in extrusion, with simple sketches. **(05 Marks)**

7 a. With a simple sketch, explain what is sheet metal work. **(05 Marks)**

b. With neat sketches, explain combination die and progressive die. List the type of components produced in sheet metal work. **(10 Marks)**

c. Explain different type of defects in deep drawn products. **(05 Marks)**

8 a. What is HERF? Explain the need. **(04 Marks)**

b. Explain explosive forming, with a neat figure. **(06 Marks)**

c. What is sintering? Explain its mechanism. **(05 Marks)**

d. Explain HIP, with a neat figure. **(05 Marks)**

* * * * *

USN | | | | | | | | | | |

06ME74

Seventh Semester B.E. Degree Examination, June/July 2011
Operations Research

Time: 3 hrs. Max. Marks:100

Note: ***Answer any FIVE full questions, selecting at least TWO questions from each part.***

PART – A

1 a. "Operations research is more than just mathematics". Justify the statement, with an example. **(03 Marks)**

b. List and explain the steps in conducting an 'operations research' study. **(05 Marks)**

c. A plant manufactures two products A and B. The profit contribution of each product has been estimated to be Rs.20 and Rs.24 for products A and B respectively. Each product passes through two departments of the plant. The time required for each product and the total time available in each department are as follows :

Department	Time (hrs) required/unit of		Available time
	Product – A	Product – B	(hrs) per month
1	2	3	1500
2	3	2	1500

The plant has to supply the products to market where the maximum demand for product B is 450 units/month. Formulate the problem as an LP model and find graphically, the number of products A and B to maximize the total profit per month. **(12 Marks)**

2 a. Obtain the dual of the following primal LP problem.

Minimize $Z = 3x_1 - 2x_2 + x_3$

Subject to $2x_1 - 3x_2 + x_3 \leq 5$

$4x_1 - 2x_2 \geq 9$

$-8x_1 + 4x_2 + 3x_3 = 8$

$x_1, x_2 \geq 0$, x_3 unrestricted in sign. **(05 Marks)**

b. Solve the following LP problem by Big – M method.

Maximize $Z = 2x_1 + 3x_2 + 4x_3$

Subject to $3x_1 + x_2 + 4x_3 \leq 600$

$2x_1 + 4x_2 + 2x_3 \geq 480$

$2x_1 + 3x_2 + 3x_3 = 540$

$x_1, x_2, x_3 \geq 0$. **(15 Marks)**

3 a. Distinguish between : i) a balanced and an unbalanced transportation problem ; ii) a transportation problem and an assignment problem. **(02 Marks)**

b. Obtain the initial solution by VAM and optimal solution by MODI method for the transportation problem shown below :

Unit transportation cost (Rs.) to markets

Warehouses	A	B	C	Supply
W_1	5	4	6	65
W_2	7	4	7	42
W_3	8	6	7	43
Demand -	70	30	50	

(08 Marks)

c. A solicitors firm would like to employ typists on hourly piece-rate basis for their work. There are five typists and their charges and capability (typing speed) are different. There are five jobs available with the firm and one job is to be assigned to one typist. A typist is paid for full hours even if he/she works for a fraction of an hour. Find an optimum assignment of typists to jobs to minimize the total cost to the firm, given the following data :

Typist	Rate/hr, Rs.	No. of pages typed/hr.
A	5	12
B	6	14
C	3	8
D	4	10
E	4	11

Job	Number of pages
P	199
Q	175
R	145
S	298
T	178

(10 Marks)

4 a. List the assumptions made while dealing with sequencing problems. **(03 Marks)**

b. There are seven jobs, each of which has to be processed through two machines in the order M-1 M-2. Processing time in minutes are given as

Job	A	B	C	D	E	F	G
Machine M_1	3	12	15	6	10	11	9
Machine M_2	8	10	10	6	12	1	3

Determine a sequence of the jobs that will minimize the total elapsed time. Also, find the total elapsed time, and idle time for machine M_1 and machine M_2. Show the sequence on a Gantt chart. **(08 Marks)**

c. Use graphical method to minimize the time required to process the two jobs on five machines. For each machine, specify the job which should be done first. Find the total elapsed time to complete both jobs.

Job 1	Sequence :	A	B	C	D	E
	Time (hr) :	6	8	4	12	4
Job 2	Sequence :	B	C	A	D	E
	Time (hr) :	10	8	6	4	12

(09 Marks)

PART – B

5 a. Explain the need for studying queues. **(05 Marks)**

b. At the balcony ticket counter of a cinema hall, customers arrive at the rate of 12 per hour according to Poisson distribution. The single clerk at the counter serves the customers at the rate of 30 per hour.

i) What is the probability that there is no customer in the counter?

ii) What is the probability that there are more than 2 customers in the counter?

Find :

i) Average number of customers in the system (counter) and in the queue.

ii) Average time a customer spends in the system and in the queue. **(07 Marks)**

c. Goods trucks arrive randomly at a stockyard with a mean of 8 trucks/hour. A crew of four operatives can unload a truck in 6 min. Trucks waiting in queue to be unloaded are paid a waiting charge at the rate of Rs.60/hour. Operatives are paid a wage rate of Rs.20/hour. It is possible to augment the crew strength to 2 or 3 (of four operatives per crew) when the unloading time will be 4 minutes or 3 minutes respectively per truck. Find the optimal crew size. **(08 Marks)**

6 a. With sketches, give the meaning of merge and burst events as applicable to a project network. **(02 Marks)**

b. A small project consists of six activities. The duration (in days) of each activity and their immediate predecessors are shown below :

Activity	A	B	C	D	E	F
Immediate predecessor	-	-	-	A,B	B	B,C
Duration (days)	5	3	7	8	4	5

i) Draw the network
ii) Find the critical path
iii) Verify the critical path by earliest time and latest time values. **(09 Marks)**

c. The activities in a project are defined by three time estimates – optimistic, most likely, and pessimistic – the values of which are shown below :

Activity	1 – 2	2 – 3	2 – 4	3 – 5	4 – 5	5 – 6
t_o, days	1	1	1	1	2	2
t_m, days	2	4	2	2	3	3
t_p, days	3	7	9	9	4	4

Draw the network and determine, i) expected completion time of each activity ; ii) expected completion time of the project ; iii) probability of completing the project in 14 days (for a 'z' value of 1.6, area under normal curve is 0.877). **(09 Marks)**

7 a. Solve the following game by sing the principle of dominance :

		Player B					
		I	II		IV	V	VI
Player A	1	4	2	0	2	1	1
	2	4	3	1	3	2	2
	3	4	3	7	-5	1	2
	4	4	3	4	-1	2	2
	5	4	3	3	-2	2	2

(10 Marks)

b. Reduce the following game to '3 × 2' by dominance principle and then solve it by graphical method.

		Player B			
		y_1	y_2	y_3	y_4
Player A	x_1	19	6	7	5
	x_2	7	3	14	6
	x_3	12	8	18	4
	x_4	8	7	13	-1

(10 Marks)

8 a. Solve the following linear programming problem by Gomory technique :

Maximize $Z = 3x_2$

Subject to $3x_1 + 2x_2 \leq 7$

$-x + x_2 \leq 2$

$x_1, x_2 \geq 0$ and are integers. **(12 Marks)**

b. Use branch and bound method to solve the following linear programming problem :

Minimize $Z = 4x_1 + 3x_2$

Subject to $5x_1 + 3x_2 \geq 30$

$x_1 \leq 4$

$x_2 \leq 6$

$x_1, x_2 \geq 0$ and are integers. **(08 Marks)**

* * * * *

USN | | | | | | | | | | |

06ME754

Seventh Semester B.E. Degree Examination, June/July 2011
Solar Energy

Time: 3 hrs. Max. Marks:100

Note: ***Answer any FIVE full questions, selecting atleast TWO questions each from Part – A and Part - B.***

PART – A

1 a. With the help of statistics, discuss the potential and achievements of India with regard to wind, solar and biomass energy sources. **(12 Marks)**

b. Explain the following : i) Spectral distribution of extraterrestrial solar radiation ii) Beam and diffuse radiation. **(08 Marks)**

2 a. Explain the following : i) Solar radiation data of India ii) Local apparent time. **(12 Marks)**

b. With the help of a neat sketch, explain the method of measurement of global radiation using pyranometer. **(08 Marks)**

3 a. Define the following : i) Hour angle ii) Declination angle iii) Solar azimuth angle iv) Day length v) Tilt factor for beam radiation vi) Zenith. **(12 Marks)**

b. Calculate the monthly average daily global and diffuse radiation falling on a horizontal surface at Bhavanagar (21^0 45'N, 72^0 11'E) during the month of January. The monthly average sunshine hours is 9.8. Given the representative day is Jan 17, a = 0.28 and b = 0.47. Use the following correlations.

$$\frac{\overline{Hg}}{Ho} = a + b\left[\frac{\overline{S}}{\overline{S}_{max}}\right] \text{ and } \frac{\overline{Hd}}{\overline{Hg}} = 1.411 - 1.696\left[\frac{\overline{Hg}}{\overline{Ho}}\right]$$ **(08 Marks)**

4 a. With neat sketches, explain i) solar air heaters ii) cylindrical parabolic concentrating collector. **(12 Marks)**

b. Write a note on the following : i) Solar space cooling ii) Working principle of solar pond. **(08 Marks)**

PART – B

5 a. Explain the following : i) Working of a solar cell ii) Selective surface iii) Maximum conversion efficiency of a solar cell. **(12 Marks)**

b. Derive an expression for transmissivity based on absorption (τ_a) for glass cover system of solar flat plate collector and calculate the same using the following data.
Angle of incidence : 15^0 ; Material : glass ; Number of glass covers : 3 ; Thickness of each cover : 4mm ; Refractive index of glass relative to air : 1.52 ; Extinction coefficient of glass : $15m^{-1}$. **(08 Marks)**

6 a. Calculate the top loss coefficient for the GI collector with the selective absorber plate having $\alpha = 0.95$ and $\epsilon p = 0.12$ adopting the iterative procedure. Following data are given :
Collector tilt = $18^0 32'$; Collector length = 1.6m ; Collector width = 1.1m ;

Emissivity of glass = 0.88 ; Spacing between plate and glass cover = 2.5cm ; Spacing between first and second glass covers = 2.5cm ; Number of glass covers = 2 ; Mean plate temperature = 359.3K ; Wind speed = 3.1m/s. Use the following correlations and property data for air.

$Nu_L = 0.229(R_{a_L} \cos \beta)^{0.252}$; $j = 0.86 (R^*_{e_L})^{-½}$.

Take $\rho_{air} = 1.15 kg/m^3$ and $C_p = 1.005$ kJ/kg K. **(12 Marks)**

Property table for air

$T\ ^0C$	$\nu \times 10^6\ m^2/s$	P_r	K W/m-k
30	16	0.701	0.0267
40	16.96	0.699	0.0276
50	17.95	0.698	0.0283
60	18.97	0.696	0.0290
70	20.02	0.694	0.0297
80	21.09	0.692	0.0305

b. With the help of appropriate line diagrams, explain the significance of i) collector efficiency factor ii) collector heat removal factor. **(08 Marks)**

7 a. Discuss the effect of following parameters on instantaneous efficiency of solar flat plat collector : i) Selective surface ii) Collector orientation iii) Fluid inlet temperature. **(14 Marks)**

b. Define the following : i) Aperture area ii) Concentration ratio iii) Acceptance angle. **(06 Marks)**

8 a. With appropriate line diagram, explain any three types of concentrating collectors. **(12 Marks)**

b. A compound parabolic collector, 1m long has an acceptance angle of 20^0. The absorber surface of the collector is flat and has a width of 10cm. Calculate the concentration ratio, the aperture, the height and the surface area of the collector. **(08 Marks)**

*****

USN | | | | | | | | | | |

06ME762

Seventh Semester B.E. Degree Examination, June/July 2011
Engineering System Design

Time: 3 hrs. Max. Marks:100

Note: ***Answer FIVE full questions selecting at least TWO questions from each part.***

PART – A

1 a. Explain the term Designing. What are the inputs required for a designer? **(08 Marks)**

b. Explain design by evaluation and discuss the inadequacies of evolutionary design practice. **(12 Marks)**

2 a. Give the morphology of design and discuss the phases of design. **(08 Marks)**

b. Discuss the importance of writing the need statement properly with an example. State how one gets missed by a wrong need statement. **(06 Marks)**

c. Write the need statement for any three of the following:
i) An umbrella ii) An automobile clutch iii) A table fan iv) A mobile phone. **(06 Marks)**

3 a. Conduct the morphological Analysis for a kerosene stove for kitchen. **(12 Marks)**

b. Explain briefly i) Synectics ii) AIDA **(08 Marks)**

4 a. What is a model? Describe the different types of models with examples. **(10 Marks)**

b. Explain the concepts of sensitivity analysis and compatibility analysis citing examples. **(10 Marks)**

PART – B

5 a. Explain law of Diminishing returns. **(08 Marks)**

b. A company produces four different designs of fountain pens. Their performance may be summarized as

Performance parameter	Writing time b/w refills (min)	Nib life (months)	Cost	Writing pr.
A	35	24	10	0.30
B	15	30	08	0.20
C	35	20	20	0.40
D	30	18	12	0.25
Min. acceptable value	10	15	20	0.20

Assign proper weights to the quality dimensions and determine which design gives the max. utility. **(12 Marks)**

6 a. Explain Bath tub curve and derive for law of reliability. **(12 Marks)**

b. A newly produced twin-engined aeroplane is required to fly continuously for 10 hrs. Given the following data, calculate the reliability of the plane.

i) Major control failure occurs once in every 1,00,000 hrs.
ii) Major structural failure once in every 10,00,000 hrs.
iii) Major engine failure occurs once in every 1,000 hrs.
iv) For the first 10 minutes both engines must operate and thereafter only one engine is enough.

(Assumption: The flight duration of 10 hrs includes first 10 min. of running of both the engines.) **(08 Marks)**

7 a. Explain two types of optimization. **(08 Marks)**

b. In a nursing supply depot, plaster rolls 20 cm wide are produced and then used to fill in an order of 30 rolls of 11 cm width, 25 rolls of 7 cm width and 50 rolls of 3 cm width. This is done by cutting 20 m roll along lines parallel to the edge. There are various combinations that can be cut from a standard roll (scrap may become inevitable). List out the various possible combinations. Formulate a mathematical statement of optimization, to minimize the scrap in effecting the given order. **(12 Marks)**

8 a. What is man-machine interaction cycle? Explain. **(08 Marks)**

b. Explain the compatibility conditions of displays and control interface. **(06 Marks)**

c. Describe the different types of visual displays. **(06 Marks)**

* * * * *

USN | | | | | | | | | | |

06ME767

Seventh Semester B.E. Degree Examination, June/July 2011
Computational Fluid Dynamics

Time: 3 hrs. Max. Marks:100

Note: ***Answer FIVE full questions selecting at least TWO questions from each part.***

PART – A

1 a. Mention the advantages and applications of CFD. **(10 Marks)**

b. Mention the future prospects of CFD. **(10 Marks)**

2 a. Mention the preprocessing steps in CFD solution procedure. **(10 Marks)**

b. Name the different methods of result report of CFD solution and explain the same. **(10 Marks)**

3 a. Write and explain the different parameters of continuity, momentum and energy equation. **(10 Marks)**

b. Mention the generic form of the governing equations for CFD under different boundary conditions. **(10 Marks)**

4 a. Mention the different methods of discretisation of governing equations. **(04 Marks)**

b. Employ Taylors method to obtain the appropriate value of y at x = 0, for the differential equation $dy/dx = x - y^2$ and $y = 1$. **(08 Marks)**

c. Solve $dy/dx = 1 + xy$ by Eulers method with $y(0) = 2$. Find $y(0.1)$, $y(0.2)$ and $y(0.3)$. **(08 Marks)**

PART – B

5 Explain consistency, stability, convergence, accuracy and efficiency. **(20 Marks)**

6 a. Explain the methods of grid generation. **(10 Marks)**

b. Explain the method of turbulent modeling. **(10 Marks)**

7 a. Explain the CFD method of analysis of indoor air flow distribution. **(10 Marks)**

b. Explain the CFD method of analysis of flow over vehicle platform. **(10 Marks)**

8 a. Mention the application of moving grids and parallel computing in CFD analysis. **(10 Marks)**

b. Explain multiple flows and combustion analysis of CFD problems (modeling and analysis). **(10 Marks)**

* * * * *