College of Engineering, Pune

(An Autonomous Institute of Government of Maharashtra)

(IE 5111) F.Y.M.Tech

(Thermal Power , Design , Process , Bio-medical)

End Semester Examination

Date : 22 /11 /2013 Max. Marks : 60

Time : 2 p.m to 5 p.m

Instructions :

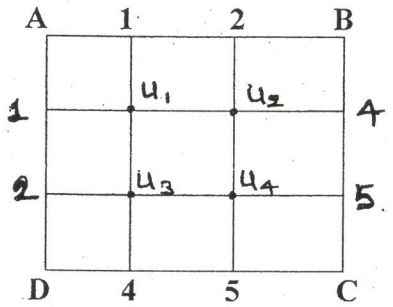
1. All questions are compulsory.
2. Assume suitable data if necessary.
3. All symbols have their usual meanings.
4. Figures to the right indicate full marks

Q.I **(A)** Given $y' = x^2(1+y)$ and $y(1) = 1$, $y(1.1) = 1.233$, $y(1.2) = 1.548$ and $y(1.3) = 1.979$. Evaluate $y(1.4)$ by Milne's predictor-corrector method. **(5)**

OR

(A) Solve $y'' = x^2y' + 2xy$, $y(0) = 1$, $y'(0) = 0$ to approximate $y(0.1)$ using Runge Kutta's Method of 4^{th} order **(5)**

(B) Solve the *elliptic equation* $u_{xx} + u_{yy} = 0$ using Gauss Siedel Method for the following square mesh with the boundary values as shown : *(till 2^{nd} iteration)* **(6)**



Q.II **(A)** Solve *hyperbolic equation* $u_{tt} = 25\, u_{xx}$ for half period of oscillation taking h=1 , subjected to boundary conditions $(i)\ u(0,t) = 0$ $(ii)\ u(5,t) = 0$ and initial conditions $(iii)\ u_t(x,0) = 0$ $(iv)\ u(x,0) = 2x \quad , \quad 0 \le x \le 2$
$= 10 - 2x, \quad 2.5 \le x \le 5$ **(5)**

OR

(A) Consider the following problem faced by a production planner in a soft drink plant He has two bottling machines A and B . A is designed for 8-ounce bottles and B for 16 ounce bottles . However each can be used on both types with some loss of efficiency . The following data is available **(5)**

Machine	8-ounce bottles	16-ounce bottles
A	100/minute	40/ minute
B	60/ minute	75/ minute

Each machine can be run 8-hours per day , 5 days per week . Profit on a 8-ounce bottle is 25 paise and on a 16-ounce bottle is 35 paise. Weekly production of the drink cannot exceed 3,00,000 ounces and the market can absorb 25000 8-ounce bottles and 7000 16- ounce bottles per week . The planner wishes to maximize his profit subject , of course , to all the production & marketing restrictions.

Formulate this as LPP

(B) Use **Big-M method** to (6)

$$\textit{Maximize} : z = 6x_1 + 4x_2$$

$$\textit{Subject to constraints} : \quad 2x_1 + 3x_2 \leq 30$$
$$3x_1 + 2x_2 \leq 24$$
$$x_1 + x_2 \geq 3 \qquad x_1 \geq 0 \ , \ x_2 \geq 0$$

Q.III **(A)** Let X be ***normal*** with mean **50** and variance **9** .Determine $\boldsymbol{c}$ such that (5)
$P(50 - c < X < 50 + c) = 50\ \%$, $P(X \geq c) = 1\ \%$

(B) Suppose that in an automatic process of filling of oil into the cans , the content of a can $(in\ gallons)$ is $Y = 100 + X$,where X is a random variable with density $f(x) = 1 - |x|$ $when$ $|x| \leq 1$ and 0 $when$ $|x| > 1$ .In a lot of 1000 cans , about how many will contain 100 gallons or more ? (5)

(C) Classical experiments showed that the number of alpha particles emitted per second in a radioactive process is a random variable X having a Poisson distribution .If X has mean 0.5 , what is the probability of observing two or more particles during any given second ? (5)

Q.IV **(A)** Write short notes on : (6)
1) Bath Tub curve
2) Operating Characteristic curves

(B) Given probability density function for a random variable $\boldsymbol{T}$ the time $(in\ hours)$ to failure of a compressor , what is its reliability for a 100 $hours$ operating life (5)

$$f(t) = \frac{0.001}{(0.001\ t + 1)^2} \qquad t > 0$$
$$= \quad 0 \qquad\qquad otherwise$$

OR

(B) If probability density is (5)

$$f(t) = 0.002e^{0.002\ t} \qquad t \geq 0$$
$$= \quad 0 \qquad\qquad otherwise$$

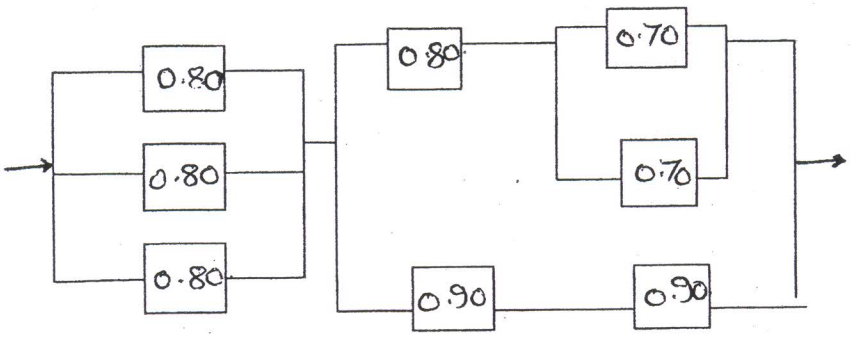
Find **MTTF** (mean time to failure) .

Q. V (A) Construct Mean chart & Range chart for the following data .Also calculate the Control Limits on both the charts. **(6)**

Sample no.	Sample size			
1	15	12	13	20
2	10	8	8	14
3	8	15	17	10
4	12	17	11	12
5	18	13	15	4

Given that for $n = 4$, $A_2 = 0.729$, $D_3 = 0$, $D_4 = 2.282$

(B) Find the system reliability of the following series – parallel configurations. Component reliabilities are given **(6)**



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