 PG/IVS/A.MATH/MA - 2205/09

2009

APPLIED MATHEMATICS WITH OCEANOLOGY AND COMPUTER PROGRAMMING

Candidates are required to give their answers in their own words as far as practicable

Illustrate the answers wherever necessary

(*Operational Research Modelling* -II)

PAPER—MA - 2205 (OR)

[*Full Marks* : 25]

Time : 1 hour

The figures in the right-hand margin indicate marks

Answer **Q.No.1** and *two* from the rest

1. Answer any *two* questions : 2x2

(*a*) What do you mean by memory less channel and noiseless channel.

(*Turn Over*)

(*b*) Deduce an expression to compute the reliability of an item during the time interval $(0, t)$.

(*c*) Show that the entropy of the following probability distribution is $2 - \left(\frac{1}{2}\right)^{n-2}$

Events :	x_1	x_2	x_3	x_i	x_{n-1}	x_n
Probability :	$\frac{1}{2}$	$\frac{1}{4}$	$\frac{1}{8}$	$\frac{1}{2^i}$	$\frac{1}{2^{n-1}}$	$\frac{1}{2^{n-1}}$.

2. There are five jobs, each of which must go through three machines A, B, C in the order $\overrightarrow{ABC}$. Processing times (in hours) are given in the following table. Determine a optimum sequence for the five jobs that will minimize the elapsed time. Find that elapsed time also. 8

Job	Processing time		
i	A_i	B_i	C_i
1	8	5	4
2	10	6	9
3	6	2	8
4	7	3	6
5	11	4	5

3. Calculate the reliability of a system when the components are connected in (*a*) series, and in (*b*) parallel.

An electronics circuit consist of 5 silicon transistor. 3 silicon diodes, 10 resistors and 2 capacitors in series configuration. The hourly failure rate of each component is

silicon transistor : $\lambda_t = 4 \times 10^{-5}$

silicon diode : $\lambda_d = 3 \times 10^{-5}$

resistor : $\lambda_r = 2 \times 10^{-4}$

capacitor : $\lambda_c = 2 \times 10^{-4}$

Calculate the reliability of the circuit for 10 hrs. When the components follow exponential distribution. (2 + 2) + 4

4. (*a*) Prove that the functional

$$J = \int_{x_0}^{x_1} F(y(x), y'(x), y''(x), \ldots, y^{(n)}(x), x)\, dx$$

will be extrema along the path $y = y(x)$ if

$$\frac{\partial F}{\partial y} - \frac{d}{dx}\left(\frac{\partial F}{\partial y'}\right) + \frac{d^2}{dx^2}\left(\frac{\partial F}{\partial y''}\right) - \ldots + (-1)^n \frac{d^n}{dx^n}\left(\frac{\partial F}{\partial y^{(n)}}\right) = 0.$$

(*b*) Find the stationary path $x = x(t)$ for the functional

$$J = \int_0^1 [1 + \ddot{x}^2]\, dt$$

subject to the boundary conditions $x(0) = 0$, $\dot{x}(0) = 1$, $x(1) = 1$ and $\dot{x}(1) = 1$. 5+3

5. Define joint and conditional entropies. Deduce that

(*a*) $H(X, Y) \leq H(X) + H(Y)$, with equality iff X and Y are independent.

(*b*) $H(X, Y) = H(X/Y) + H(Y) = H(Y/X) + H(X)$

where $H(X) \geq H(X/Y)$. 2+3+3

[*Internal Assessment*: 5 Marks]

(*Dynamical Meteorology* -II)

PAPER—MA - 2205 (OM)

[*Full Marks* : 25]

Time : 1 hour

Answer **Q.No.1** and any *two* from the rest

1. Answer any *one* : 2

(*a*) What is CAPE ?

(*b*) What is front and dynamic boundary condition for front ?

2. Derive the general equations of horizontal motion including the effect of frictional forces resulting from the turbulent air motion. 9

3. Discuss the pressure distribution near the fronts. Explain the Kinematic boundary condition at the ideal frontal surface. Show that in a geostrophic wind field, an ideal front is necessarily stationary. 5 + 2 + 2

4. Explain the development of rotation in supercell thunder-storms. 9

[*Internal Assessment* : 5 Marks]
