

**INDIAN MARITIME UNIVERSITY**  
**(A Central University, Government of India)**

B.Tech. (Marine Engineering )  
Semester – II – December 2015 End Semester Examinations

Mathematics - II  
Subject Code: UG11T2202/UG11T1202

Time: 3 Hours  
Date: 10.12.2015

Max Marks: 100  
Pass Marks: 50

**PART – A**  
**Compulsory question**

**(3 x 10=30 Marks)**

- 1 (a) Find the Fourier coefficients  $a_0$  for the function

$$f(x) = |\sin x|$$

- (b) Use first shifting property to find the Laplace transform of the following function:

$$f(t) = e^{2t} \sin 3t$$

- (c) Solve the separable equation  $\frac{dy}{dx} = e^{x-y} + x^2 e^{-y}$ .

- (d) Find inverse Laplace transform of  $\frac{2s-3}{s^2+4s+13}$ .

- (e) Calculate the complimentary function for the differential equation

$$(D^2 - 7D + 12)u(x) = 0.$$

- (f) Derive the conditions for the equation  $Mdx + Ndy = 0$  to be exact.

- (g) Let A and B are two mutually exclusive events of an experiment. If

$$P(\bar{A}) = 0.65, P(A \cup B) = 0.65 \text{ and } P(B) = p, \text{ find } p.$$

- (h) A random variable x has the following probability function

x:	-2	-1	0	1	2	3
P(x):	0.1	k	0.2	2k	0.3	k

Find the value of k and calculate the mean.

- (i) If a random variable has a Poisson distribution such that  $P(1)=P(2)$ , find (i) the mean of the distribution.

- (j) Write down the Pearson's constants  $\beta_1, \beta_2, \gamma_1, \gamma_2$  for Binomial distribution in terms of  $n, p, q$ .

**PART – B**  
**Answer any five questions**

**(5 x 14=70 Marks)**

- 2 (a) Expand the Fourier series for the following function

$$f(t) = \begin{cases} 0, & -\pi \leq t < 0 \\ 1, & 0 < t \leq \pi \end{cases}.$$

- (b) Find the Fourier series for the function  $f(x) = e^{-x}, 0 < x < 2\pi$

(7+7 Marks)

- 3 (a) Use Laplace transform to evaluate the integral  $\int_0^{\infty} e^{-3t} t \sin t dt$
- (b) Solve the initial value problem  $\frac{d^2 x}{dt^2} - 6 \frac{dx}{dt} + 9x = t^2 e^{-3t}$ ,  $x(0) = 2, x'(0) = 6$
- ( 6+8 Marks)

- 4 (a) Solve the differential equation  $(x^4 + y^4)dx - xy^3 dy = 0$
- (b) Find the complete solution (CS) for the differential equation

$$\frac{d^2 y}{dx^2} - 5 \frac{dy}{dx} + 6y = x^2 e^{3x} \quad ( 6+8 \text{ Marks})$$

- 5 (a) Solve by the method of variation of parameters

$$\frac{d^2 y}{dx^2} - 2 \frac{dy}{dx} + 2y = e^x \tan x$$

- (b) When a resistance R ohms is connected in series with an inductance L henries with an e.m.f. of E volts, the current  $i$  amperes at time  $t$  is given by

$$L \frac{di}{dt} + Ri = E. \text{ Use method of integrating factor to find } i(t) \text{ with } E = 10 \sin t,$$

while the initial condition is  $i(t) = 0$  at  $t = 0$ . (8+6 Marks)

- 6 (a) A married couple appeared for interview for two vacancies. The probability of husband's selection is  $1/6$  and that of wife's selection is  $2/5$ . What is the probability that (i) both of them be selected (ii) only one of them selected (iii) none of them will be selected.
- (b) An item is manufactured by three factories A, B, and C. The number of such items produced by the three factories are  $2x$ ,  $x$ , and  $x$  respectively. It is known that 2% of the items produced by A and B are defective while 4% of the items produced by C are defective. All these units are put together in one stockpile and one unit is chosen at random from this stockpile. It is found that the item is defective. Calculate the probabilities of this defective unit came from A, B, or C. (6+8 Marks)

- 7 (a) Obtain the moment generating function for

$$f(x) = \begin{cases} x, 0 \leq x < 1 \\ 2 - x, 1 \leq x < 2 \\ 0, \text{otherwise} \end{cases}$$

- (b) The probability that a bomb dropped from a fighter jet will strike the target is  $1/5$ . If six bombs are dropped, find the probability that (i) exactly two will strike the target and (ii) at least two will strike the target. (7+7 Marks)

- 8 (a) The probability density  $p(x)$  of a continuous random variable is given by

$$p(x) = y_0 e^{-|x|}, -\infty < x < \infty. \text{ Find } y_0, \text{ mean and the variance of the distribution.}$$

- (b) The mortality rate for a certain disease is 6 per 1000. What is the probability for just four deaths from that disease in a group of 400? (7+7 Marks)

\*\*\*\*\*