Seat No.______

Ganpat University

B.Tech. Sem. IV (MR) CBCS Regular Examination APRIL-JUNE 2017

Sub:(2MR403) Mathematics for Marine Engineering

Time: 3 hrs **Total marks: 60**

Instruction: (1) All questions are compulsory.

(2) Write answer of each section in separate answer books.

(3) Figures to the right indicate marks of questions.

Section – I

Question-1 Attempt the following.

(A) Find Fourier series expansion of $f(x) = \begin{cases} -\pi, 0 < x < \pi \\ x - \pi, \pi < x < 2\pi \end{cases}$ **(04)**

(B) Find Fourier series of $f(x) = |x|, -2 < x < 2.$ **(03)**

(C) Find half range cosine series for $f(x) = (x-1)^2, 0 < x < 1$ **(03)**

OR

(A) Expand $e^{ax}, -\pi < x < \pi$ as Fourier series. **(04)**

(B) Find Fourier series for x^2 in the interval $-\pi < x < \pi$. **(03)**

Hence deduce that $\frac{\pi^2}{12} = \frac{1}{1^2} - \frac{1}{2^2} + \frac{1}{3^2} - \cdots$

(C) If $f(x) = \begin{cases} x, & 0 < x < \frac{\pi}{2} \\ \pi - x, & \frac{\pi}{2} < x < \pi \end{cases}$ show that $f(x) = \frac{4}{\pi}\left(\frac{\sin x}{1^2} - \frac{\sin 3x}{3^2} + \frac{\sin 5x}{5^2} - \cdots\right)$ **(03)**

Question-2 Attempt the following.

(A) Solve $\frac{d^2y}{dx^2} - 4y = xe^x$ **(04)**

(B) Using variation of parameters method, solve $\frac{d^2y}{dx^2} + 4y = \tan 2x$ **(03)**

(C) Solve Cauchy homogeneous equation $x^2\frac{d^2y}{dx^2} + 4x\frac{dy}{dx} + 2y = x^2 \sin(\ln x)$ **(03)**

OR

(A) Solve simultaneous equations $\frac{dx}{dt} = y + 1, \frac{dy}{dt} = x + 1$ **(04)**

(B) Solve $(D^2 + 2D - 3)y = e^x + 4e^{2x}$ **(03)**

(C) Find particular integral (P.I.) of $\frac{d^3y}{dx^3} - \frac{dy}{dx} = x^3$ **(03)**

Question-3 Attempt the following. **(10)**

(A) Give difference between population study and sample study.

(B) For studying a characteristic the observations of a population are 2, 5, 8, and 9. How many samples of size 2 with replacement can be taken from it? Making a list of all the samples and: (I) verify the result $E(\bar{x}) = \bar{y}$ and (II) calculate $Var(\bar{x})$.

(C) What are the characteristic of good sample?

Section –II

Question-4Attempt the following.

(A) Using square formula compute regression line of y on x from the following data. **(04)**

x	23	27	28	29	30	31	33	35	36	39
y	18	22	23	24	25	26	28	29	30	32

(B) Apply Taylor's series method solve y at $x=1.1$ and $x=1.2$ if $y' = x^2 + y^2,\ y(1) = 2.3$. **(03)**

(C) Use Newton's interpolation formula to find the value of y for $x=1.4$ and $x=1.8$ from the following data. **(03)**

x	1.1	1.3	1.5	1.7
y	0.21	0.69	1.25	2.61

OR

(A) Obtain the equation of regression line of x on y of the form $x-\bar{x} = b_{xy}\left(y-\bar{y}\right)$ **(04)**

(B) Using difference formula compute regression line of x on y from the following data. **(03)**

x	91	97	108	121	67	124	51	73	111	57
y	71	75	69	97	70	91	39	61	80	47

(C) Use Picard's method to solve $\frac{dy}{dx} = x + y^2,\ y(0) = 1$ up to second approximation. **(03)**

Question-5 Attempt the following.

(A) Derive Karl Pearson's rank correlation coefficient $r = \frac{n\sum xy - \sum x.\sum y}{\sqrt{n\sum x^2 - \left(\sum x\right)^2}\sqrt{n\sum y^2 - \left(\sum y\right)^2}}$ **(04)**

(B) Calculate the rank correlation coefficient for the following data using Spearman's formula **(03)**

x	68	64	75	50	64	80	75	40	55	64
y	62	58	68	45	81	60	68	48	50	70

(C) Define probable error in Bivariate distribution and Calculate it for the following distribution. **(03)**

x	1	2	3	4	5	6	7
y	8	6	10	12	14	16	18

OR

(A) Use fourth order R-K method to solve $\frac{dy}{dx} = xy + y^2,\ y(0) = 1$ to compute $y(0.2)$ with $h=0.2$. **(04)**

(B) For the two independent variables x and y if $\sigma_x = 6$ and $\sigma_y = 4$, find the correlation coefficient between $x+y$ and $x-y$. **(03)**

(C) Prove that correlation coefficient is independent of shift origin and change of scale. **(03)**

Question-6 Attempt the following.

(A) Using Lagrange's interpolation formula find second degree polynomial which passes through the following points. **(04)**

x	1	3	7
y	12	16	48

(B) **Attempt any Two.** **(06)**

(a) Derive the equation of regression line of y on x of the form $y-\bar{y} = b_{yx}\left(x-\bar{x}\right)$

(b) Use Euler's method to solve differential equation $\frac{dy}{dx} = x + y + xy,\ y(0) = 1$ to calculate $y(1)$ with $h=0.2$

(c) Evaluate: $\int_0^1 \frac{1}{1+x^2}dx$ using (1) Simpson's 1/3 rule and (2) Trapezoidal rule.

END OF PAPER