

GANPAT UNIVERSITY

B. TECH. SEM. IV (MARINE) CBCS REGULAR EXAMINATION. April - June 2015

Sub : (2MR403) ENGINEERING MATHEMATICS – III

Time: 3 hrs

Total marks: 70

- 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

Que-1 Answer the following. (12)

[A] Find the Fourier series for the function $f(x) = x + x^2, -\pi \leq x \leq \pi$.

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

[B] Find the Fourier series expansion for the function $f(x) = |\sin x|; x \in [-\pi, \pi]$

[C] If $f(x) = \begin{cases} x, & 0 < x < \frac{\pi}{2} \\ \pi - x, & \frac{\pi}{2} < x < \pi \end{cases}$ then find half range sine series for $f(x)$.

OR

Que-1 Answer the following. (12)

[A] Find the Fourier series for the function $f(x) = e^{ax}, -\pi \leq x \leq \pi$

[B] Express $f(x)$ as fourier series where $f(x) = x^2, -\pi \leq x \leq \pi$

[C] Show that the sine series for $x(\pi - x), 0 \leq x \leq \pi$ is $\frac{8}{\pi} \left(\frac{\sin x}{1^3} + \frac{\sin 3x}{3^3} + \frac{\sin 5x}{5^3} + \dots \right)$.

Que-2 Answer the following.

[A] Find value of y when $x = 90$ from the following observation table (04)

x	100	150	200	250	300	350	400
y	10.63	13.03	15.04	16.81	18.42	19.90	21.27

[B] It is given that $y_{35.0} = 1175, y_{35.5} = 1280, y_{39.5} = 2180, y_{40.5} = 2420$ then find y_{40} by Lagrange's interpolation formula. (04)

[C] Prove that $E = e^{hD}$ (03)

OR

Que-2 Answer the following.

- [A] Given the following data for the polynomial $f(x) = 3x^3 - 5x^2 + 4x + 1$. (04)
Compute $f(0.3)$ using Newton's divided difference formula.

x	0	1	3	4	7
f(x)	1	3	49	129	813

- [B] Given that $\sin 45 = 0.7071$, $\sin 50 = 0.7660$, $\sin 55 = 0.8192$, $\sin 60 = 0.8660$. (04)
Find $\sin 57$, using Newton's interpolation formula.
- [C] Prove that $(1 + \Delta)(1 - \nabla) = 1$ (03)

Que-3 Attempt any three: (12)

- [A] Evaluate $\int_0^1 \frac{dx}{1+x^2}$ using Simpson's $3/8^{\text{th}}$ rule taking three equal parts. Hence obtain an approximate value of π .
- [B] Using Taylor's series method obtain the solution of $\frac{dy}{dx} - x^2 = y^2$ where $y(0) = 1$. Also find the values of y at $x = 0.1$.
- [C] Apply fourth order Runge-kutta method to find an approximate value of y for $x = 0.1$ if $\frac{dy}{dx} = x + y^2$, given that $y = 1$ when $x = 0$ and $h = 0.1$
- [D] Evaluate $\int_0^4 e^x dx$ by Simpson's $\frac{1}{3}$ rule with $h = 1$.

SECTION -II

Que-4 Answer the following. (12)

- [A] Solve $2 \frac{d^2y}{dx^2} - 2 \frac{dy}{dx} + y = \sin 3x \sin 2x$.
- [B] Solve Cauchy's homogeneous equation $x^2 \frac{d^2y}{dx^2} - 2x \frac{dy}{dx} - 4y = x^4$.
- [C] Apply the method of variation of parameters to solve $\frac{d^2y}{dx^2} + a^2y = \sec ax$.

OR

Que-4 Answer the following. (12)

- [A] Solve $\frac{d^2y}{dx^2} - 4y = (1 + e^x)^2 - 2 \cosh x$.
- [B] Solve Cauchy's homogeneous equation $x^3 \frac{d^3y}{dx^3} + 2x^2 \frac{d^2y}{dx^2} + 2y = 10 \left(x + \frac{1}{x}\right)$.
- [C] Apply the method of variation of parameters to solve $\frac{d^2y}{dx^2} + 4y = \tan 2x$.

Que-5 Answer the following.

[A] Obtain the equations of the two lines of regression for the following data (04)

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

[B] From the data given below find out the co-efficient of correlation between the two variables using Karl Pearson's method. (04)

Marks in Mathematics	1	2	3	4	5
Marks in Statistics	6	7	8	9	10

[C] Given the following data find two regression equations. (03)

	x	y	$r_{xy} = 0.66$
Arithmetic mean	36	85	
Standard deviation	11	8	

OR

Que-5 Answer the following.

[A] The two regression equations of the variables x and y are $x = 19.13 - 0.87y$ and $y = 11.64 - 0.50x$. Find (1) mean of x 's (2) mean of y 's (3) the correlation co-efficient between x and y . (04)

[B] Calculate rank correlation co-efficient from the following data. (04)

x	48	33	40	9	16	16	65	24	16	57
y	13	13	24	6	15	4	20	9	6	19

[C] From the data given below find out the co-efficient of correlation between the two variables using Karl Pearson's method using change of scale. (03)

x	75	60	45	30	15
y	150	175	200	225	250

Que-6 Attempt any two:

(12)

[A] For studying a characteristic, the observations of a population are 10, 12, 20, 22, 26. How many samples of size two with replacement can be taken from it? Making a list of all the samples and verify the following results.

$$(1) E(\bar{x}) = \bar{y} \text{ and } (2) E(s^2) = S^2$$

[B] If the observation of population are 12, 14, 15, 16, 18. Taking all possible samples of size two without replacement answer the following.

(1) Show that sample mean is unbiased estimate of population mean.

(2) Show that sample mean square is unbiased estimate of population mean square.

[C] Give difference between population study and sample study.

END OF PAPER