

E 1089

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Reg. No.....

Name.....

B.Sc. DEGREE (C.B.C.S.S.) EXAMINATION, MARCH 2015

Fourth Semester

**FOURIER SERIES, DIFFERENTIAL EQUATIONS, NUMERICAL ANALYSIS AND
ABSTRACT ALGEBRA**

(Complementary Course to Physics, chemistry, Petrochemicals, Geology, Food Science and
Quality control and Computer Maintenance and Electronics)

[2011 and 2012 Admissions]

Time : Three Hours

Maximum Weight : 25

Part A

Answer all questions.

Each bunch of 4 questions has weight 1.

- I. 1 Find the smallest positive period of $\cos \frac{2\pi n_x}{k}$.
- 2 Define a power series.
- 3 Define Legendry Polynomial of degree u .
- 4 Write the Bessel's differential equation.
- II. 5 Write the parametric equation of the spherical surface $x^2 + y^2 + z^2 = a^2$.
- 6 What are direction cosines ?
- 7 Write the partial differential equation representing the set of all spheres with centers on the z -axis.
- 8 Give an example of a first order non-linear partial differential equation.
- III. 9 Find the relative error of the number 8.6 if both of its digits are correct.
- 10 Define the term absolute error.
- 11 Distinguish between algebraic functions and transcendental function.
- 12 If $X = 0.51$ and is correct to 2 decimal places, then what is ΔX ?
- IV. 13 What is an abelian group ?
- 14 In every cyclic group, every element is a generator, write True or False.
- 15 How many elements are in the group S_n .
- 16 Compute $(11)^{-4}$ in Z_{15} .

(4 × 1 = 4)

Turn over

Part B

Answer any five questions.
Each questions has weight 1.

- 17 Write the Bessel's function of 1st kind of order n .
- 18 Sketch the graph of $f(x) = \pi - |x|$ in the interval $-\pi < x < \pi$.
- 19 Eliminate the constants a and b from the equation $z = (x + a)(y + b)$.
- 20 Eliminate the arbitrary function f from the equation $z = f(x - y)$.
- 21 Find the product of the numbers 56.54 and 12.4 which are both correct to the significant digits given.
- 22 An approximate value of π is given by $X_1 = 2217 = 3.1428571$ and its true value is $X = 3.1415926$. Find the absolute and relative errors.
- 23 Write the group table of Klein 4-group.
- 24 Find a basis for $\mathbb{Q}(i)$ over \mathbb{Q} .

(5 × 1 = 5)

Part C

Answer any four questions.
Each question has weight 2.

- 25 Find the Fourier co-efficients of $f(x) = \begin{cases} -1 & \text{if } 0 < x < \pi/2 \\ 0 & \text{if } \pi/2 < x < 2\pi \end{cases}$.
- 26 Find a power series solution of $(x - 2)y' = xy$.
- 27 Find the general solution of the differential equation $x^2 \frac{\partial z}{\partial x} + y^2 \frac{\partial z}{\partial y} = (x + y)z$.
- 28 Obtain a root correct to 3 decimal places using bisection method of the equation $x^3 - 3x - 5 = 0$.
- 29 Use the method of false position to obtain a root correct to three decimal places the equation $x^3 + x - 1 = 0$.
- 30 Describe all the elements in the cyclic subgroup of $GL(2, \mathbb{R})$ generated by $\begin{bmatrix} 1 & 1 \\ 0 & 1 \end{bmatrix}$.

(5 × 1 = 5)

Part D

*Answer any two questions.
Each question has weight 4.*

31. (a) Find the Fourier series of $f(x) = 3x^2$, $-1 < x < 1$, $p = 2$.
- (b) Find the Fourier cosine series as well as sine series of $f(x) = e^x$, $0 < x < L$.
32. Find the general integral of $p x (z - 2y^2) = (z - qy) (z^2 - y^2 - 2x^3)$.
33. (a) Apply the quotient-difference method to obtain the approximate roots of $x^3 - 7x^2 + 10x - 2 = 0$.
- (b) Use Newton-Raphson method to obtain a root $x + \log x = 2$ correct to 3 decimal places.

(2 × 4 = 8)