**E 1089** **(Pages : 3)** **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 trancendental function.

12 If X = 0·51 and is correct to 2 decimal places, then what is $\Delta X$?

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 $\pi$ is given by $X_1 = 2217 = 3{\cdot}1428571$ and its true value is $X = 3{\cdot}1415926$. Find the absolute and relative errors.

23 Write the group table of Klein 4-group.

24 Find a basis for Q (i) over Q.

(5 × 1 = 5)

## Part C

*Answer any* **four** *questions.*
*Each question has weight* 2.

25 Find the Fourier co-efficients of $f(x) = \begin{cases} -1 & if \quad 0 < x < \pi/2 \\ 0 & if \quad \pi/2 < x < 2\pi \end{cases}$.

26 Find a power series solution of $(x - 2)\, y' = xy$.

27 Find the general solution of the differential equation $x^2 \dfrac{\partial z}{\partial x} + y^2 \dfrac{\partial z}{\partial y} = (x + y)\, z$.

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, 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 $f(x) = 3x^2, \ -1 < x < 1, \quad p = 2$.

(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 $p\,x\left(z - 2y^2\right) = (z - qy)\left(z^2 - y^2 - 2x^3\right)$.

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.

$(2 \times 4 = 8)$