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B.Sc. DEGREE (C.B.C.S.S.) EXAMINATION, MARCH/APRIL 2012

Fourth Semester

DIFFERENTIAL EQUATIONS, ABSTRACT ALGEBRA, NUMERICAL ANALYSIS

(Complementary Course to Physics / Chemistry / Petrochemicals / Geology,

Food Science and Quality Control and Computer Maintenance and Electronics)

Time : Three Hours   Maximum Weight : 25

Part A (Objective Type Questions)

Answer **all** *questions.*
Each bunch of 4 *objective questions has weight* 1.

I.   1   Find a solution of the differential equation $\dfrac{dy}{dx} = \cos 5x$.

     2   Give an example of an exact differential equation.

     3   Find an integrating factor of the differential equation $(2y^2 + 3x)\, dx + 2xy\, dy = 0$.

     4   What is the order of the differential equation :

$$\left(\frac{dy}{dx} - 1\right)\left(y - x\frac{dy}{dx}\right) = \frac{dy}{dx} \; ?$$

II.   5   Write down the equation of a three dimensional surface.

     6   Give an example of first order partial differential equation in three variables.

     7   What is the general form of a first order partial differential equation ?

     8   Form a partial differential equation from the surface $x^2 + y^2 = (z - c)^2 = a^2$.

III.   9   Write down the formula for calculating the absolute error.

     10   Give an example of a transcended function.

     11   In the method of false postion to find a root of $f(x) = 0$ between x_0 and x_1, what we are

          replacing by the part of the curve between $(x_0, f(x_0)$ and $\left(x_1, f(x_1)\right)$?

     12   What is the Newton-Raphson formula ?

IV.   13   Give an example of a cyclic group of order 8.

     14   What is the order of the subgroup of $\mathbb{Z}_{12}$ generated by 3 ?

Turn over

15 How many elements are there in the group of symmetries of an equilateral triangle ?

16 Give an example of a group homomorphism from $\mathbb{Z}$ to $5\,\mathbb{Z}$.

$(4 \times 1 = 4)$

Part B (Short Answer Questions)

Answer any **five** *questions.*
Each question has weight 1.

17 Find the general solution of the differential equation $x\dfrac{dy}{dx} + (3x+1)\,y = e^{-3x}$

18 Solve $\left(\dfrac{dy}{dx}\right)^2 = y - x$.

19 Eliminate the constants a and b from the equation $ax^2 + by^2 + z^2 = 1$.

20 Find $\dfrac{\partial (F, G)}{\partial (x, y)}$ if $F = ax^2 + by^2 + cz^2 - 1$ and $G = x + y + z - 1$.

21 Find an approximate root of $x^3 - x - 4 = 0$ using bisection method.

22 Find an approximate root of $x = \dfrac{1}{(1+x)^2}$ using the iterative method.

23 Draw the lattice diagram for subgroup of S_3.

24 Check whether the set of integers $\mathbb{Z}$ over the real numbers $\mathbb{R}$ is a vector space with usual addition and multiplication.

$(5 \times 1 = 5)$

Part C (Short Essay Questions)

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

25 Verify whether $\left(x + \sin y\right) dx + \left(y^2 + x \cos y\right) dy = 0$ is exact. If exact, solve it.

26 Solve $xy^2 \dfrac{dy}{dx} + y^3 = 1$

27 Find the general integral linear partial differential equation : $z\,(xp - yq) = y^2 - x^2$.

28 Find the integral curves of the equations $\dfrac{dx}{x(y-z)} = \dfrac{dy}{y(z-x)} = \dfrac{dz}{z(x-y)}$.

29 Use Newton-Raphson method to obtain a root to three decimal places of the equation $x^3 - 2x - 5 = 0$.

30 Show that the set of all $m \times n$ matrices with entries from $\mathbb{R}$ under usual addition is an abelian group.

$(4 \times 2 = 8)$

Part D

Answer any two questions.
Each question has weight 4.

31 Sovle $\dfrac{dy}{dx} - y = e^x \, y^2$.

32 Find a real root of the equation $f(x) = x^3 - 2x - 5 = 0$ using the method of false position.

33 Show that the set of all rational numbers with usual addition and multiplication is a field.

$(2 \times 4 = 8)$