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BSC (PART – II) EXAMINATION, 2018

MATHEMATICS

Second Paper-2018

(Differential Equations & Integral Transforms)

Note:- Attempt questions from all sections as per instructions.

Section-A

(Very Short Answer Type Questions)

Attempt *all* parts of this question. Give answer of each part in about 50 words.

1^{1/2} × 10 = 15

1. (i) Define linear and non-linear differential equation.

(ii) Solve: $\frac{d^3y}{dx^3} - 13 \frac{dy}{dx} + 12y = 0.$

(iii) Define "Cauchy-Euler equations."

(iv) Write working rule to find orthogonal trajectories.

(v) Define "Legendre's differential equation."

(vi) Find the P.D. F. by the elimination of a and b from $z = ax + by + ab.$

(vii) Prove that:

$$L(t^{-1/2}) = \frac{\sqrt{\pi}}{\sqrt{p}}, p > 0.$$

(viii) Write Euler-Lagrange equation.

(ix) Find $L^{-1} \left(\frac{p}{2p^2 - 8} \right)$

(x) Define Fourier sine and cosine transform.

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Section-B (Short Answer Type Questions)

Attempt all questions. Give answer of each question in about 200 words.

6x5=30

2. Solve: $x^2 y dx - (x^3 + y^3) dy = 0$.

Or

Solve: $\frac{d^2 y}{dx^2} - 3 \frac{dy}{dx} + 2 = e^{5x}$.

3. Solve : $p^2 + 2py \cot x - y^2 = 0$

Or

Solve: $\frac{d^2 y}{dx^2} - (2x-1) \frac{dy}{dx} + (x-1)y = 0$

4. Solve $\frac{d^2 y}{dx^2} - 2x^2 \frac{dy}{dx} + 4xy = x^2 + 2x + 2$

in power of x.

Or

Prove that:

$(2n + 1) x P_n(x) = (n + 1) P_{n+1}(x) + n P_{n-1}(x)$

5. Solve $q^2 r - 2 pqs + p^2 t = 0$

Or

Find L (sin at sin h at) and L (cosat sin hat).

6. Find the value of $L^{-1} \left(\frac{2P^2 - 6P + 5}{P^3 - 6P^2 + 11P - 6} \right)$

Or

Find the Fourier sine transform of :

$$\frac{e^{ax} + e^{-ax}}{e^{\pi x} - e^{-\pi x}}$$

section-C (Long Answer type Questions)

Attempt any two questions. Give answer of each question in about 500 words.

10x 2=20

7. Solve $x^2 + \frac{d^2 y}{dx^2} - x \frac{dy}{dx} - 3y = x^2 \log x$.

8. Solve by the method of variation of parameters.

$$\frac{d^2 y}{dx^2} - 2 \frac{dy}{dx} + y = e^x \log x$$

9. Find the power series solution of differential equation

$x^2 y'' + xy' + x^2 y = 0$ about $x = 0$.

10. Find Fourier transform of the following:

$$f(x) = \begin{cases} (1-x^2), & |x| \leq 1 \\ 0, & |x| > 1 \end{cases}$$

11. Using Chowpit's methods find a complete integral of $p^2 x + q^2 y = z$