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BTECH
(SEM II) THEORY EXAMINATION 2023-24
MATHEMATICS II

TIME: 3 HRS**M.MARKS: 100**

Note: 1. Attempt all Sections. If require any missing data; then choose suitably.

SECTION A**1. Attempt all questions in brief.****2 x 10 = 20**

Q no.	Question	Marks	CO
a.	Find order and degree of the equation $(\frac{d^3y}{dx^3})^4 - 6x^2(\frac{dy}{dx})^8 = 0$.	02	1
b.	Solve $(4D^3 + 4D^2 + D)y = 0$.	02	1
c.	What is the value of $\Gamma(1/2)$?	02	2
d.	Evaluate $\int_0^\infty e^{-x} x^{n-1} dx$.	02	2
e.	Find the limit of $a_n = (n!)^{1/n}$.	02	3
f.	Find the constant term if the function $f(x) = x + x^2$ is expanded in Fourier series defined in $(-1, 1)$.	02	3
g.	Define Harmonic function.	02	4
h.	Describe analytic function with example.	02	4
i.	Define Laurent's series.	02	5
j.	Find the Residue of $\frac{z^2}{(z-1)(z-2)^2}$ at $z = 2$.	02	5

SECTION B**2. Attempt any three of the following:****3 x 10 = 30**

Q no.	Question	Marks	CO
a.	Solve by method of variation of parameter $\frac{d^2y}{dt^2} - 3\frac{dy}{dt} + 2y = \frac{e^t}{1+e^t}$.	10	1
b.	Prove that $\beta(m, n) = \frac{\Gamma(m)\Gamma(n)}{\Gamma(m+n)}$	10	2
c.	Test the convergence of the series $1 + \frac{2}{5}x + \frac{6}{9}x^2 + \frac{14}{17}x^3 + \dots$	10	3
d.	Show that the function $u(x, y) = 4xy - 3x + 2$ is harmonic.	10	4
e.	Evaluate $\int \frac{e^z}{(z-1)(z-4)} dz$ where C is the circle $ z = 2$ by using Cauchy's Residue theorem.	10	5

SECTION C**3. Attempt any one part of the following:****1 x 10 = 10**

Q no.	Question	Marks	CO
a.	Solve the following simultaneous differential equation: $\frac{dx}{dt} + x - 2y = 0, \frac{dy}{dt} + x + 4y = 0$.	10	1
b.	Solve $\frac{d^2y}{dx^2} - 2\frac{dy}{dx} + 5y = x e^x$.	10	1



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BTECH
(SEM II) THEORY EXAMINATION 2023-24
MATHEMATICS II

TIME: 3 HRS**M.MARKS: 100****4. Attempt any one part of the following:****1 x 10 = 10**

Q no.	Question	Marks	CO
a.	Evaluate the area enclosed between the parabola $y = x^2$ and the straight line $y = x$.	10	2
b.	Apply Dirichlet integral to find the volume of an octane of the ellipsoid $\left(\frac{x^2}{a^2}\right) + \left(\frac{y^2}{b^2}\right) + \left(\frac{z^2}{c^2}\right) = 1$.	10	2

5. Attempt any one part of the following:**1 x 10 = 10**

Q no.	Question	Marks	CO
a.	Find the half range Fourier sine series $f(x)$ defined over the range $0 < x < 4$ as $f(x) = \begin{cases} x, & 0 < x < 2 \\ 4 - x, & 2 < x < 4 \end{cases}$	10	3
b.	Test the convergence of the series: $\frac{x}{1} + \frac{1}{2} \frac{x^3}{3} + \frac{1}{2} \frac{3}{4} \frac{x^5}{5} + \frac{1}{2} \frac{3}{4} \frac{5}{6} \frac{x^7}{7} + \dots$	10	3

6. Attempt any one part of the following:**1 x 10 = 10**

Q no.	Question	Marks	CO
a.	Find the points where C-R equation satisfies for the function $f(z) = xy^2 + i x^2 y$.	10	4
b.	Find Harmonic conjugate of $v = \log(x^2 + y^2) + x - 2y$.	10	4

7. Attempt any one part of the following:**1 x 10 = 10**

Q no.	Question	Marks	CO
a.	Expand $\frac{1}{z^2 - 3z + 2}$ in the given region: (i). $ z-1 < 1$ (ii). $1 < z < 2$.	10	5
b.	Evaluate $\int \frac{z^2}{(z-1)^2(z+2)} dz$ where C is the circle $ z = 3$ by using Cauchy's integral formula.	10	5