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

TIME: 3 HRS   M.MARKS: 70

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

SECTION A

1. **Attempt** *all* **questions in brief.**   **2 x 7 = 14**

Q no.	Question	Marks	CO
a.	Find Particular integral of $\frac{d^2y}{dx^2} + 4y = \sin 2x$.	2	1
b.	Find the complementary function of $(D^2+a^2)y = 0$	2	1
c.	Find the Laplace transform of $f(t) = t^4 e^{2t}$.	2	2
d.	Find the constant term if the function $f(x) = x+x^2$ is expanded in Fourier series defined in (-1, 1).	2	3
e.	Find the Residue of $\frac{z^2}{(z-1)(z-2)^2}$ at z = 2.	2	4
f.	$\int_c \frac{e^{2z}}{(z+1)^5} dz$ where c is the circle $|z| = 2$	2	5
g.	Define Laurent's series.	2	5

SECTION B

2. **Attempt any** *three* **of the following:**   **7 x 3 = 21**

Q no.	Question	Marks	CO
a.	Using variation of parameter method, solve $x^2 \frac{d^2y}{dx^2} +2x \frac{dy}{dx} -12y = 0$.	7	1
b.	Use convolution theorem to find the inverse Laplace transform of $\frac{1}{(s^2+a^2)^2}$.	7	2
c.	Test the convergence of the series $1+\frac{2}{5}x + \frac{6}{9}x^2 + \frac{14}{17}x^3 +\ldots$	7	3
d.	Show that the function $u = \frac{1}{2} \log (x^2 + y^2)$ is harmonic. Find its harmonic conjugate.	7	4
e.	Evaluate the following integral using Cauchy Integral formula $\int_c \frac{4-3z}{z(z-1)(z-2)}dz$, where C is circle $|z| = \frac{3}{2}$	7	5

SECTION C

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

Q no.	Question	Marks	CO
a.	Solve the following differential equation (D^2 -4D +4)y = $8x^2 e^{2x} \sin 2x$.	7	1
b.	Solve simultaneous differential equation : $D^2x-4Dx+4x = y$, $D^2y+4Dy +4y= 25x+16e^t$, where $D = \frac{d}{dt}$.	7	1

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

Q no.	Question	Marks	CO
a.	Find the Laplace transform of $f(t) = \frac{1 - \cos t}{t^2}$.	7	2
b.	Using Laplace transformation solve the following differential equation $y'' + 4y' + 4y = 6e^{-t}$, if $y(0) = -2$, $y'(0) = 8$	7	2

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

Q no.	Question	Marks	CO
a.	Find the half range Fourier sine series f(x) defined over the range 0<x<4 as $f(x) = \begin{cases} \mathbf{x}, & \mathbf{0 < x < 2} \\ \mathbf{4 - x}, & \mathbf{2 < x < 4} \end{cases}$	7	3
b.	Test for the convergence of the series $1 + \frac{x}{2} + \frac{1.3}{2.4}x^2 + \frac{1.3.5}{2.4.6}x^3 + \ldots\ldots$, x > 0	7	3

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

Q no.	Question	Marks	CO
a.	Show that e^x (x cosy – y siny) is a harmonic function. Find the analytic function for which e^x (x cosy – y siny) is imaginary part.	7	4
b.	Define analytic function and show that f(z) = z |z| is not analytic anywhere.	7	4

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

Q no.	Question	Marks	CO
a.	Expand $f(z) = \frac{z}{(z-1)(2-z)}$ is Laurent series valid for $a) |z - 1| > 1$ and b) $0 < |z - 2| < 1$	7	5
b.	Evaluate $\int \frac{e^z}{(z-1)(z-4)}$ dz where C is the circle $|z| = 2$ by using Cauchy's integral formula.	7	5