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 $f(x) = \begin{cases} x, & 0 \le x \le 2 \\ 4-x, & 2 < x < 4 \end{cases}$	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