



Paper id: 252182

Printed Page: 1 of 2
Subject Code: KAS203

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BTECH
(SEM II) THEORY EXAMINATION 2024-25
MATHEMATICS II

TIME: 3 HRS

M.MARKS: 100

Note: Attempt all Sections. In case of any missing data; choose suitably.

SECTION A

1. Attempt all questions in brief.

2 x 10 = 20

Q No.	Question	CO	Level
a.	Solve the ODE $\frac{dy}{dx} = ay$, $y(0) = 1$ & $y(1) = 2$ and find the value of a .	1	K1
b.	Find the limit of $\frac{1 + 2^{\frac{1}{n}} + 3^{\frac{1}{n}} + \dots + n^{\frac{1}{n}}}{n}$	3	K2
c.	Find the nature of singularity in $f(z) = \frac{z - \sin z}{z^3}$	5	K3
d.	Classify the regular singular points and irregular singular points of the differential equation $x^2(x^2 - 4)y'' + 2x^3y' + 3y = 0$.	1	K2
e.	For what values of p , series $\frac{1}{1^p} + \frac{1}{2^p} + \frac{1}{3^p} + \dots$ is convergent?	3	K3
f.	Evaluate the integral $\int e^z dz$ in any closed contour.	5	K1
g.	Find the argument and modulus of $z = -1 + \sqrt{3}i$.	4	K2
h.	Prove that $\int_0^{\frac{\pi}{2}} \sqrt{\tan \theta} d\theta = \frac{1}{2} \Gamma\left(\frac{1}{4}\right) \Gamma\left(\frac{3}{4}\right) = \frac{\pi\sqrt{2}}{2}$.	2	K2
i.	Show $f(z) = z ^2$ is differentiable only at $z = 0$.	4	K3
j.	Show that $\int_0^{\infty} \frac{x^c}{c^x} dx = \frac{\Gamma(c+1)}{(\log c)^{c+1}}$, $c > 0$.	2	K3

SECTION B

2. Attempt any three of the following:

10 x 3 = 30

a.	Find a general solution of given differential equation by method of variation of parameters $y'' - 2y' + y = \frac{e^t}{t^2 + 1}$	1	K4
b.	Find the volume of the solid generated by the revolution of the cardioid $r = a(1 + \cos \theta)$ about the initial line.	2	K5
c.	Find the Fourier series expansion for $f(x)$, if $f(x) = \begin{cases} -\pi, & -\pi < x < 0, \\ x, & 0 < x < \pi \end{cases}$ Hence deduce $\frac{1}{1^2} + \frac{1}{3^2} + \frac{1}{5^2} \dots = \frac{\pi^2}{8}$.	3	K3
d.	If $u(x, y) = x^3 - 3xy^2$, find $v(x, y)$ such that $f(z) = u + iv$ is an analytic function.	4	K6



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e.	Evaluate the integral $\int \frac{\sinh(z)}{z^2(z-2)} dz$ within the circle $ z =1$.	5	K2
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SECTION C

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

a.	Find particular integral of the differential equation $y'' + 2y' + 2y = e^{e^x}$	1	K3
b.	Obtain series solution for $(1-x^2)\frac{d^2y}{dx^2} - x\frac{dy}{dx} + 4y = 0$.	1	K3

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

a.	Evaluate $\iiint x^\alpha y^\beta z^\gamma (1-x-y-z)^\lambda dx dy dz$ over the interior of tetrahedron formed by the coordinate planes and plane $x+y+z=1$.	2	K6
b.	Show that the integral $\int_0^1 \frac{dx}{\sqrt{x(1-x)}}$ converges.	2	K6

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

a.	Find the sum of series $\left(\frac{1}{2.3} + \frac{1}{2^2.3}\right) + \left(\frac{1}{2^2.3} + \frac{1}{2^3.3^2}\right) + \dots + \left(\frac{1}{2^a.3^a} + \frac{1}{2^{a+1}.3^a}\right) + \dots$	3	K4
b.	Find the value of $\lim_{n \rightarrow \infty} \frac{1}{n} [(n+1)(n+2) \dots \dots (n+n)]^{\frac{1}{n}}$.	3	K4

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

a.	Prove $\left(\frac{\partial^2}{\partial x^2} + \frac{\partial^2}{\partial y^2}\right) f(z) ^2 = 4 f'(z) ^2$ where $f(z)$ analytic function is.	4	K5
b.	Find the Möbius transformation that sends $1 \rightarrow 3, i \rightarrow 0$ & $2 \rightarrow -1$.	4	K5

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

a.	Expand $f(z) = \frac{1}{z(z^2-1)}$ into a Laurent series in the region $0 < z < 1$.	5	K2
b.	Find the value of integral $\int \frac{z^2}{z^2-3z+2} dz$ within the circle $ z =4$ by residue method.	5	K2