Roll No. [ ] 122 1

COER University

END SEMESTER EXAMINATION, EVEN SEM 2022-23

Time : 3 hours — Total Marks : 100
Program Name : B. Tech (CE, ME & EEE) — Semester : II
Course Name : Analytical Mathematics — Course Code : BTBS203

Note: All questions are compulsory. No student is allowed to leave the examination hall before the completion of the time.

Q. No 1	Attempt Any Four Parts. Each Question Carries 5 Marks.	CO	BL
(a)	Solve by linear differential Equation of First Order $(x+1)\frac{dy}{dx}-y=e^{x}(x+1)^{2}$	CO 1	3
(b)	Solve by Exact Differential equation method $\{2xy\cos x^2-2xy+1\}dx+\{\sin x^2-x^2+3\}dy=0$	CO 1	3
(c)	Solve the Non Linear Differential equation $y=2px+yp^2$	CO 1	3
(d)	Find the value of λ, for which the differential equation $(xy^2+\lambda x^2y)dx+(x+y)x^2dy=0$ is exact. Solve the equation for the value of λ.	CO 1	3
(e)	Solve : $x^2=1+p^2$	CO 1	3

Q. No 2	Attempt Any Four Parts. Each Question Carries 5 Marks.	CO	BL
(a)	Solve the differential equation $\frac{d^2y}{dx^2}+6\frac{dy}{dx}+9y=5e^{3x}$	CO 2	3
(b)	Solve the following Simultaneous Differential Equation $\frac{d^2y}{dx^2}-3x-4y=0,\ \frac{d^2y}{dx^2}+x+y=0$	CO 2	3
(c)	Solve the following Cauchy Euler Homogeneous Linear Differential Equation. $x^2\frac{d^2y}{dx^2}+x\frac{dy}{dx}+y=\sin(\log x^2)$	CO 2	3
(d)	Solve the following differential equation by method of variation of parameters $\frac{d^2y}{dx^2}-y=\frac{2}{1+e^x}$	CO 2	3
(e)	Solve $\frac{d^2y}{dx^2}+\cot x\frac{dy}{dx}+4y\,\mathrm{cosec}^2x=0$ by changing the independent variable from x to z.	CO 2	3

Q. No 3	Attempt Any Four Parts. Each Question Carries 5 Marks.	CO	BL
(a)	Test for convergence the Series $\frac{1}{1.2.3}+\frac{3}{2.3.4}+\frac{5}{3.4.5}+\ldots\ldots\ldots\ldots\infty$	CO 3	2
(b)	Discuss the convergence of the following series $\left(\frac{2^2}{1^2}-\frac{2}{1}\right)^{-1}+\left(\frac{3^3}{2^3}-\frac{3}{2}\right)^{-2}+\left(\frac{4^4}{3^4}-\frac{4}{3}\right)^{-3}+\ldots\ldots\infty$	CO 3	2
(c)	Given that $f(x)=x+x^2$ for $-\pi<x<\pi$, find the Fourier expression of $f(x)$. Deduce that $\frac{\pi^2}{6}=1+\frac{1}{2^2}+\frac{1}{3^2}+\frac{1}{4^2}+\ldots\ldots$	CO 3	3
(d)	Test the convergence and divergence of the following series: $\sum_{n=1}^{\infty}\frac{2n^2+3n}{5+n^5}$	CO 3	2
(e)	The series $1+r+r^2+r^3+\ldots\infty$ is (i) convergent if $\lvert r\rvert<1$ (ii) divergent if $r\geq1$ (iii) oscillatory if $r\leq-1$.	CO 3	3

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Q. No 4	Attempt Any Two Parts. Each Question Carries 10 Marks.	CO	BL
(a)	From the Partial Differential equation from $z = f\left(x^2 - y^2\right)$	CO 4	3
(b)	Solve the Partial Differential equation $\frac{\partial^3 z}{\partial x^3} - 3\frac{\partial^3 z}{\partial x^2 \partial y} + 4\frac{\partial^3 z}{\partial y^3} = e^{x+2y}$	CO 4	3
(c)	A tightly stretched string with fixed end points x = 0 and x = l is initially in a position given by $y = y_0 \sin^3(\frac{\pi x}{l})$.If it is released from rest from this position ,find the displacement y (x, t).	CO 4	3

Q. No 5	Attempt Any Two Parts. Each Question Carries 10 Marks.	CO	BL
(a)	Show that the function $e^x\left(\cos y + i \sin y\right)$ is an analytic function, find its derivative.	CO 5	2
(b)	Define a Harmonic function and conjugate harmonic function. Find the harmonic conjugate function of the function $u\left(x, y\right) = 2x\left(1 - y\right)$	CO 5	2
(c)	Evaluate $\int_C \frac{e^z}{(z^2+1)} dz$, $where\, C\, is \lvert z \rvert = 2$.	CO 5	3

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