II Semester BTech Examination August 2022 (Common to ALL Branches)	Set No.: 1
Course name: ENGINEERING MATHEMATICS II	Course code: MAT 1251

Q. No.	Description	Marks	Course Outcome (1-5)	Competency Levels (1-6)
1 (A)	(i) Using Euler's theorem, if $u = \sin^{-1}\left(\frac{x+y}{\sqrt{x}+\sqrt{y}}\right)$ then prove that $x\frac{\partial u}{\partial x} + y\frac{\partial u}{\partial y} = \frac{\tan u}{2}$. (ii) Evaluate $\lim_{x\to\pi/2} \frac{\log\cos x}{\tan x}$.	6	1	3
1 (B)	Find the extreme values of the function $f(x,y) = x^4 + y^4 - 2x^2 + 4xy - 2y^2$.	4	2	3
2 (A)	Expand $f(x,y) = e^x \cos y$ in powers of x and y up to third degree terms.	5	2	3
2 (B)	Find the equation of the sphere having the circle $x^2 + y^2 + z^2 + 10y - 4z - 8 = 0 \; ; x + y + z = 3$ as a great circle.	5	2	3
3 (A)	Test the convergence of the series $\sum_{n=1}^{\infty} \frac{2n+3}{n(2n+1)(2n+2)}$.	5	5	3
3 (B)	(i) Find $L\{e^{-2t}\cos 2t\}$ (ii) Find $L^{-1}\left\{\frac{s}{s^2+10s+26}\right\}$	5	4	3
4 (A)	Solve the differential equation using Laplace transform $y''(t) - 7y'(t) + 12y(t) = 0,\ y(0) = 1,\ y'(0) = 0$.	5	4	3
4 (B)	Using beta and gamma functions, evaluate (i) $\int_0^{\frac{\pi}{2}} \sin^5\theta \cos^7\theta \, d\theta$ (ii) $\int_0^1 x^3\left(1-\sqrt{x}\right)^5 dx$	5	3	3
5 (A)	Change the order of integration and evaluate $\int_0^4 \int_{\frac{x^2}{4}}^{2\sqrt{x}} xy \, dy \, dx$.	5	3	3
5 (B)	Using double integration, find the area of the region bounded by $r = a(1+\cos\theta)$.	5	3	3