PES University, Bengaluru
(Established under Karnataka Act No. 16 of 2013)

UE20MA101

APRIL 2021: END SEMESTER ASSESSMENT (ESA) B Tech 1 SEMESTER
(Physics Cycle)
UE20MA101 : Engineering Mathematics - I

Time: 3 Hrs	Answer All Questions	Max Marks: 100

1	a)	Test the convergence of the series $1+\frac{a.b}{c}x+\frac{1}{2}\frac{a(a+1).b(b+1)}{c(c+1)}x^2+\frac{1}{2.3}\frac{a(a+1)(a+2).b(b+1)(b+2)}{c(c+1)(c+2)}x^3+\cdots\infty$	7 M
	b)	Examine the convergence of the series $\sum\frac{\sqrt{n}}{\sqrt{n^2+1}}x^n$.	7 M
	c)	Discuss the convergence of the series $1+\frac{2}{3}x+\left(\frac{3}{4}\right)^2x^2+\left(\frac{4}{5}\right)^3x^3+\cdots\infty$ $(x>0)$.	6 M
2	a)	If $\left(\sqrt{x}+\sqrt{y}\right)sin^2u-x^{\frac{1}{3}}-y^{\frac{1}{3}}=0,$ prove that $12x\frac{\partial u}{\partial x}+12y\frac{\partial u}{\partial y}+tanu=0.$	4 M
	b)	If $z=sin^{-1}(x-y),x=3t,y=4t^3$, prove that $\frac{dz}{dt}=\frac{3}{\sqrt{1-t^2}}$ as a total derivative.	4 M
	c)	Use Taylor's theorem to expand $f(x,y)=\ x^2+xy+y^2$ in powers of $(x-1)$ & $(y-2)$ upto second degree terms.	6 M
	d)	A tent on a square base of side x, has its sides vertical of height y and the top is a regular pyramid of height h. Find x and y interms of h, if the canvas required for its construction is to be minimum for the tent to have a given capacity.	6 M
3	a)	Solve: $xe^x(dx-dy)+e^xdx+ye^ydy=0.$	7 M
	b)	Find the orthogonal trajectories of the family of curves $r=4asec\theta tan\theta$.	6 M
	c)	Solve: $y=xp^2+p$.	7 M
4	a)	Solve: $(D-1)^2(D^2+1)y=e^x+sin^2\frac{x}{2}$	6 M
	b)	Solve the differential equation: $x^2\frac{d^2y}{dx^2}-4x\frac{dy}{dx}+6y=x^4sinx$	7 M

	c)	At time $t > 0$, an e.m.f of voltage $E = E_O(1 - cost)$, where E_O is a constant is applied to an LRC circuit for which $L = R = C = 1$. Initially there is no charge or current in the circuit. Find the charge and current at time $t > 0$.	7 M
5	a)	Evaluate $\int_0^\infty (x^2 + 4)e^{-2x^2} dx$.	5 M
	b)	Show that $\int_0^{\pi/2} tan^p\theta d\theta = \frac{\pi}{2} sec\frac{p\pi}{2}$ and indicate the restriction on the values of p.	5 M
	c)	Prove that $J_{-n}(x) = (-1)^n J_n(x)$ where n is a positive integer.	5 M
	d)	Evaluate $\int x^{-1} J_4(x) dx$ interms of J_0 and $J_{1.}$	5 M