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PES UNIVERSITY

PES UNIVERSITY, BANGALORE

(Established Under Karnataka Act 16 of 2013) **UE21MA141A**

March 2022: END SEMESTER ASSESSMENT (ESA) B. TECH I SEMESTER

UE21MA141A – ENGINEERING MATHEMATICS - I

Time: 3 Hours **Answer All Questions** **Max Marks: 100**

1.	a)	Test the convergence of the series $\frac{1^2}{4^2}+\frac{1^2.5^2}{4^2.8^2}+\frac{1^2.5^2.9^2}{4^2.8^2.12^2}+\cdots\cdots$	7
	b)	Test the convergence of the series $\sum\frac{n^2-1}{n^2+1}\cdot x^n$	7
	c)	Discuss the convergence of the series $\sum\left[\frac{1}{n}\cdot tan\left(\frac{1}{n}\right)\right]$	6
2.	a)	If $x^xy^yz^z=c$, find the value of $\frac{\partial^2 z}{\partial x\partial y}$ at $x=y=z$.	6
	b)	If $f(x,y)=tan^{-1}\left(\frac{y}{x}\right)$, find the approximate value of $tan^{-1}\left(\frac{0.9}{1.1}\right)$ to four decimal places using Taylor series up to second degree.	7
	c)	If x,y,z are the length of the perpendiculars dropped from any point P to the three sides of a triangle of constant area A, find the minimum value of $x^2+y^2+z^2$.	7
3.	a)	Solve the differential equation $(ylogx-2)ydx=xdy$.	7
	b)	Find the orthogonal trajectories of the family of curves $\frac{x^2}{a^2}+\frac{y^2}{b^2+\lambda}=1$, where λ is a parameter.	6
	c)	Solve the non-linear differential equation $y=x+2tan^{-1}p$.	7
4.	a)	Solve the initial value problem $\frac{d^3y}{dx^3}+3\frac{d^2y}{dx^2}-4y=0, y(0)=1;$ $y'(0)=0;\ y''(0)=\frac{1}{2}$.	7
	b)	Solve the differential equation $\frac{d^2y}{dx^2}-y=2(1-e^{-2x})^{-\frac{1}{2}}$ by using the method of variation of parameters. CF=	6
	c)	Solve the differential equation $x^3\frac{d^3y}{dx^3}-3x\frac{dy}{dx}+3y=16x+9x^2logx,\ x>0$.	7

5.	a)	Prove that $\int_0^1 x^m(1-x^p)^n\,dx = \frac{1}{p}\beta\left(\frac{m+1}{p}, n+1\right)$ and hence evaluate the integral $\int_0^1 x^{\frac{3}{2}}(1-\sqrt{x})^{\frac{1}{2}}\,dx$. Here, $\sqrt{x}$ is the square root of x.	7
	b)	Prove that $x[J_{v-1}(x) + J_{v+1}(x)] = 2vJ_v(x)$.	6
	c)	If α and β are distinct roots of the equation $J_n(ax) = 0$, prove that $\int_0^a x\,J_n(\alpha x)J_n(\beta x)dx = 0.$	7