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PES UNIVERSITY, BANGALORE

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

JULY 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 $\frac{\sqrt{2}-1}{3^3-1}+\frac{\sqrt{3}-1}{4^3-1}+\frac{\sqrt{4}-1}{5^3-1}+\cdots\cdots$	7
	b)	Test the convergence of the series $\frac{4}{3}+\frac{4\cdot7}{3\cdot5}+\frac{4\cdot7\cdot10}{3\cdot5\cdot7}+\cdots\cdots$	6
	c)	Discuss the nature of the series $\sum_{n=1}^{\infty}\frac{4\cdot7\cdot10\cdots\cdots(3n+1)}{n!}x^n$	7
2.	a)	If $x^y+y^x=c$, then what is $\frac{dy}{dx}$?	6
	b)	Expand $e^x log_e(1+y)$ in powers of x and y up to terms of third degree.	7
	c)	Find the minimum value of $f(x,y,z)=x^2+y^2+z^2$ subject to $xy+yz+zx=3a^2$.	7
3.	a)	Solve the differential equation $\frac{dy}{dx}+4xy+xy^3=0$.	7
	b)	Find the orthogonal trajectories of the family of curves $\left(r+\frac{k^2}{r}\right)cos\theta=a$, where a is the parameter.	7
	c)	Solve the non-linear differential equation $p^3+2xp^2-p^2y^2-2xy^2p=0$.	6
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 $\frac{d^2y}{dx^2}-y=\frac{2}{1+e^x}$ by using the method of variation of parameters.	7
	c)	Solve the differential equation $(2x+5)^2\frac{d^2y}{dx^2}-6(2x+5)\frac{dy}{dx}+8y=6x$.	6

5.	a)	Evaluate $\int_{-\frac{\pi}{4}}^{\frac{\pi}{4}}(cos\theta + sin\theta)^{\frac{1}{3}}d\theta$ using Beta and Gamma functions. Note that $\frac{1}{3}$ is the superscript of $(cos\theta + sin\theta)$ in the given integral.	6
	b)	Prove that $x[J_{v-1}(x) + J_{v+1}(x)] = 2vJ_v(x)$.	7
	c)	Prove that ${J_0}^2 + 2{J_1}^2 + 2{J_2}^2 + 2{J_3}^2 + \cdots\cdots\cdots = 1$.	7