PES UNIVERSITY

PES University, Bengaluru

(Established under Karnataka Act No. 16 of 2013)

UE20MA101

FEBRUARY 2021: IN SEMESTER ASSESSMENT B Tech 1 SEMESTER
TEST – 1
UE20MA101 : Engineering Mathematics - I

Time: 2 Hrs	Answer All Questions	Max Marks: 60

1	a)	Test the convergence of the series whose nth term is given by $\sqrt{n^4+1}-\sqrt{n^4-1}$.	4 M
	b)	Discuss the convergence of the series $1+\frac{\alpha.\beta}{1.\gamma}x+\frac{\alpha.(1+\alpha).\beta.(1+\beta)}{1.2.\gamma(1+\gamma)}x^2+\frac{\alpha.(1+\alpha).(2+\alpha).\beta.(1+\beta).(2+\beta)}{1.2.3.\gamma.(1+\gamma).(2+\gamma)}x^3+\cdots\infty$	6 M
2	a)	Discuss the convergence of the series $\left(\frac{3}{4}\right)x+\left(\frac{4}{5}\right)^2x^2+\left(\frac{5}{6}\right)^3x^3+\cdots\infty,\ x>0$	4 M
	b)	Apply Cauchy integral test to discuss the nature of the series $\sum_{n=2}^{\infty}\frac{1}{n\,(logn)^p}$	6 M
3	a)	If $\theta=t^ne^{\frac{-r^2}{4t}}$ what value of n will make $\frac{1}{r^2}\frac{\partial}{\partial r}\left(r^2\frac{\partial\theta}{\partial r}\right)=\frac{\partial\theta}{\partial t}$?	4 M
	b)	If $u=x^3sin^{-1}\left(\frac{y}{x}\right)+x^4tan^{-1}\left(\frac{y}{x}\right)$ find the value of $x^2\frac{\partial^2u}{\partial x^2}+2xy\frac{\partial^2u}{\partial x\partial y}+y^2\frac{\partial^2u}{\partial y^2}+x\frac{\partial u}{\partial x}+y\frac{\partial u}{\partial y}$ at $x=1\,,y=1$.	6 M
4	a)	Find Taylor's expansion of $f(x,y)=cot^{-1}(xy)$ in powers of $(x+0.5)$ and $(y-2)$ up to second degree terms. Hence compute $f(-0.4,2.2)$ approximately.	6 M
	b)	A scope probe in the shape of ellipsoid $4x^2+y^2+4z^2=16$ enters the earth atmosphere and its surface begins to heat. After one hour the temperature at the point (x,y,z) on the surface is $T(x,y,z)=8x^2+4yz-16z+600$. Find the hottest point on the probe surface.	4 M
5	a)	Solve $y-cosx\frac{dy}{dx}=y^2(1-sinx)cosx$.	6 M
	b)	Prove that the system of confocal and coaxial parabolas $y^2=4a(x+a)$ is self-orthogonal. Here 'a' is the parameter.	4 M
6	a)	Solve $2px+tan^{-1}(xp^2)-y=0$.	6 M
	b)	Water at temperature $10^\circ c$ takes 5 minutes to warm up to $20^\circ c$ in a room at temperature $40^\circ c$. i) Find the temperature after 20 minutes. ii) When will the temperature be $25^\circ c$?	4 M

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MARCH 2021: IN SEMESTER ASSESSMENT B Tech 1 SEMESTER (Chemistry Cycle)

TEST – 2

UE20MA101 : Engineering Mathematics - I

Time: 90 Minutes	Answer All Questions	Max Marks: 40

1	a)	Solve $\frac{d^4x}{dt^4} = m^4x$.	4 M
	b)	Solve $(D^3 - D)y = 2x + 1 + 4cosx + 2e^x$.	6 M
2	a)	Solve by the method of variation of parameters $y'' - 2y' + 2y = e^x tanx$.	5 M
	b)	Solve $x^2\frac{d^2y}{dx^2} + 5x\frac{dy}{dx} + 3y = \frac{logx}{x^2}$.	5 M
3	a)	Show that $\int_0^\infty \frac{x^4}{1+x^6}dx \,.\, \int_0^2 (8 - x^3)^{-\frac{1}{3}}dx = \frac{2\pi^2}{9\sqrt{3}}$.	6 M
	b)	Prove that $\int_0^\infty e^{-ax}x^{m-1}sinbxdx = \frac{\Gamma(m)}{(a^2+b^2)^{\frac{m}{2}}} sinm\left(tan^{-1}\left(\frac{b}{a}\right)\right)$.	4 M
4	a)	Evaluate $\int x^3 J_0(x)\,dx$ in terms of J_0 and J_1.	4 M
	b)	Show that $J_o^2 + 2J_1^2 + 2J_2^2 + 2J_3^2 + \cdots = 1$.	6 M

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

Time: 3 Hrs	Answer All Questions	Max Marks: 100

1	a)	Prove that the series $1+\frac{1}{2}\frac{a}{b}+\frac{1.3}{2.4}\frac{a(a+1)}{b(b+1)}+\frac{1.3.5}{2.4.6}\frac{a(a+1)(a+2)}{b(b+1)(b+2)}+\cdots\infty$ is convergent if $a>0, b>0$ and $b > a+\frac{1}{2}$.	7 M
	b)	Examine the convergence or divergence of the series $1+\frac{2}{5}x+\frac{6}{9}x^2+\frac{14}{17}x^3+\cdots+\frac{2^{n+1}-2}{2^{n+1}+1}x^n+\cdots\infty\ (x>0)$	7 M
	c)	Test the convergence of the series $\sum\frac{[(n+1)x]^n}{n^{n+1}}$.	6 M
2	a)	If $(\sqrt{x}+\sqrt{y})cotu-x-y=0$, prove that $4x\frac{\partial u}{\partial x}+4y\frac{\partial u}{\partial y}+sin2u=0$.	4 M
	b)	If $u=f\left(\frac{y-x}{xy},\frac{z-x}{xz}\right), show\ that\ x^2\frac{\partial u}{\partial x}+y^2\frac{\partial u}{\partial y}+z^2\frac{\partial u}{\partial z}=0$.	4 M
	c)	Find the Taylor's expansion of $e^{ax}sinby$ about the origin upto third degree terms.	6 M
	d)	A tent of a given volume has a square base of side 2a, has its four-side vertical of length b and is surmounted by a regular pyramid of height h. Find the values of a and b interms of h such that the canvas required for its construction is minimum.	6 M
3	a)	Solve : $xsinx\frac{dy}{dx}+y(xcosx-sinx)=2$	7 M
	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 M
	c)	Solve: $y=2px+p^n$.	7 M
4	a)	Solve: $(D^2-4D+1)y=sin^2x+e^x+e^3x$	6 M
	b)	Solve the differential equation: $x^2\frac{d^2y}{dx^2}+x\frac{dy}{dx}-y=\frac{x^3}{1+x^2}$	7 M

	c)	A circuit consists of an inductance of 0.5 henrys, resistance of 6 ohms, capacitance of 0.02 farads and an e.m.f of voltage E=24sin10t. Find the charge and the current at time $t > 0$ given that the circuit carries no charge and no current at time t=0.	7 M
5	a)	Show that for $m, n > 0$ $\int_0^1 x^{m-1}\left(\log\frac{1}{x}\right)^{n-1} dx = \frac{\Gamma(n)}{m^n}$.	5 M
	b)	Show that for $m, n > 0$, $\int_{-a}^{a}(a+x)^{m-1}(a-x)^{n-1}dx = (2a)^{m+n-1}\beta(m,n)$.	5 M
	c)	Use Jacobi series to derive the Bessel's integral formula $J_n(x) = \frac{1}{\pi}\int_0^{\pi} cos(n\theta - xsin\theta)\, d\theta$ where n is a positive integer.	6 M
	d)	Evaluate $\int J_4(x)dx$.	4 M