Sub Code: **BSM-160**

B. Tech.
Year: I Semester: II
Minor Test Examination (2024-25)
Title of Subject: Engineering Mathematics II

Time: 2 Hr. Max Marks: 30

Note: Attempt ALL questions.

Q1.	Attempt any three parts of the following.	Marks	CO	BL	PO	PI Code
a)	Solve using the method of variation of parameter $x^2\frac{d^2y}{dx^2}+x\frac{dy}{dx}-y=x^2e^x$.	4	1	3	1	1.1.1
b)	State and prove the orthogonality of Legendre's polynomials.	4	2	3	1	1.1.1
c)	Solve $x^2y''-(x^2+2x)y'+(x+2)y=x^3e^x$.	4	1	3	1	1.1.1
d)	Using method of Frobenius, obtain the series solution in power of x for $x\frac{d^2y}{dx^2}+\frac{dy}{dx}-y=0$.	4	2	3	1	1.1.1
Q2.	Attempt any three parts of the following.					
a)	Solve, $\frac{d^2y}{dx^2}-2x\frac{dy}{dx}+(x^2+2)y=e^{\frac{1}{2}(x^2+2x)}$.	3	1	3	1	1.1.1
b)	Solve, $\frac{d^2y}{dx^2}-2\frac{dy}{dx}+2y= e^x\tan x$.	3	1	3	1	1.1.1
c)	Solve $(D^2+2D+1)y=\frac{e^{-x}}{x^2}+3^x+\cos(2x-1)$.	3	1	2/3	1	1.1.1
d)	Solve the simultaneous differential equation: $\frac{dx}{dt}+\frac{dy}{dt}-2y=2\cos t-7\sin t$, $\frac{dx}{dt}-\frac{dy}{dt}+2x=4\cos t-3\sin t$.	3	1	2/3	1	1.1.1
Q3.	Attempt any three parts of the following.					
a)	Prove that $x^2J_n''=(n^2-n-x^2)J_n+xJ_{n+1}$, where n is positive integer.	3	2	3	1	1.1.1
b)	Show that $\frac{d}{dx}(J_n^2+J_{n+1}^2)=2(\frac{n}{x}J_n^2-\frac{n+1}{x}J_{n+1}^2)$.	3	2	3	1	1.1.1
c)	Prove that $\int_{-1}^{1}xP_n P_n'=\frac{2n}{2n+1}$ and $\int_0^{2\pi}\sqrt{\pi x}\,J_{\frac{1}{2}}(2x)dx=1$.	3	2	2/3	1	1.1.1
d)	Show that $\int_{-1}^{1}(1-x^2)P_m'P_n'dx=\begin{cases}0, & m\neq n\\ \frac{2n(n+1)}{2n+1}, & m=n\end{cases}$	3	2	2/3	1	1.1.1

Sub Code: BSM-160

B. Tech.
Year: I Semester: II
Even Semester 2024-2025
Subject Name: Engineering Mathematics-II

Max Marks: 50

Time: 3 Hr.

Note: Attempt All questions.

Q. No.	Question	Marks	CO	BL	PO	PI Code
Q1	**Attempt any five parts of the following.**					
a)	Solve. $(D^2 - 4)y = \cosh(2x - 1) + 3^x$.	2	1	3	1	1.1.1
b)	Solve. $(x^2D^2 - 3xD + 4)y = x^2\ given\ y(1) = 1, y'(1) = 0$.	2	1	3	1	1.1.1
c)	Solve, $x^2\frac{d^2y}{dx^2} + x\frac{dy}{dx} + y = logx\ sin(logx)$.	2	1	3	1	1.1.1
d)	Solve. $\frac{d^2y}{dx^2} - 2x\frac{dy}{dx} + (x^2 + 2)y = e^{\frac{1}{2}(x^2+2x)}$.	2	1	3	1	1.1.1
e)	Apply power series method to solve $y'' - y = x$.	2	1	3	1	1.1.1
f)	Show that, $\int_{-1}^{1} xP_nP_{n-1}dx = \frac{2n}{4n^2-1}$.	2	3	3	1	1.1.1
g)	Prove that $\lim_{x\to 0}\frac{J_n(x)}{x^n} = \frac{1}{2^n\Gamma(n+1)}$.	2	3	3	1	1.1.1
Q2.	**Attempt any two parts of the following.**					
a)	Solve: $(mz - ny)p + (nx - lz)q = lx - my$ and $(D^2 + 6DD' + 9D'^2)z = 6x + 2y + e^{2x+y}$.	5	2	3	1	1.1.1
b)	Using Lagrange's method, find the general solution of the following P.D.E. $x(y^2 + z)p - y(x^2 + z)q = z(x^2 - y^2)$.	5	2	3,4	1,2	1.1.2
c)	Find the general integral of the PDE $(2xy - 1)p + (z - 2x^2)q = 2(x - yz)$ and the integral which passes through the lines $x = 1, y = 0$.	5	2,4	3,4	1,2	1.1.1
Q3.	**Attempt any two parts of the following.**					
a)	Solve: $r + 5s + t = \frac{1}{y-2x}$ $and\ (D - D')^2z = x + \phi(x + y)$.	5	2	3	1	1.1.1
b)	Solve: $s + p - q = z + xy$ and $(D - 3D' - 2)^3z = 6e^{2x}\sin(y + 3x)$.	5	2	3	1	1.1.1
c)	Use Charpit's method to find the complete integral of following P.D.E. $(p^2 + q^2)x = pz$.	5	2	3	1	1.1.1
Q4.	**Attempt any two parts of the following.**					
a)	State and prove convolution and hence find $L^{-1}\left\{\frac{s^2}{(s^2+a^2)^2}\right\}$.	5	5	2, 3	1	1.1.1
b)	Prove that $L\left\{\frac{F(t)}{t}\right\} = \int_s^\infty f(s)ds$. Evaluate $L\left\{e^{-t}\int_0^t \frac{\sin t}{t}dt\right\}$.	5	5	2, 3	1	1.1.1
c)	Solve $ty'' + y' + 4ty = 0$ using Laplace transform, where $y(0) = 3, y'(0) = 0$.	5	4,5	3	1,2	1.1.2
Q5.	**Attempt any two parts of the following.**					
a)	Solve using Laplace transform: $(D - 2)x + 3y = 0, 2x + (D - 1)y = 0$, where $x(0) = 8, y(0) = 3$.	5	5	3	1	1.1.2
b)	Evaluate i. $L^{-1}\left\{\log\left(1 + \frac{1}{s^2}\right)\right\}$. ii. $L^{-1}\left\{\frac{s+8}{s^2+8s+5}\right\}$.	5	5	3	1	1.1.1
c)	Evaluate i. $\int_0^\infty te^{-2t}cost\ dt$ ii. $L\{t^2\cos at\}$.	5	5	3	1	1.1.1

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