

**PSG COLLEGE OF ARTS & SCIENCE
(AUTONOMOUS)**

**BSc DEGREE EXAMINATION MAY 2026
(Third Semester)**

Branch - **MATHEMATICS WITH COMPUTER APPLICATIONS**

PARTIAL DIFFERENTIAL EQUATIONS AND FOURIER SERIES

Time: Three Hours

Maximum: 75 Marks

SECTION-A (10 Marks)

Answer **ALL** questions

ALL questions carry **EQUAL** marks

(10 × 1 = 10)

Question No.	Question	K Level	CO
1	Find the Partial Differential Equations by eliminating a and b from the equation $z = axe^y + \frac{1}{2}a^2e^{2y} + b$ is _____ a) $\frac{\partial z}{\partial y} = x\left(\frac{\partial z}{\partial y}\right) + \left(\frac{\partial z}{\partial x}\right)^2$ b) $\frac{\partial z}{\partial y} = x\left(\frac{\partial z}{\partial x}\right) + \left(\frac{\partial z}{\partial x}\right)^2$ c) $\frac{\partial z}{\partial y} = x\left(\frac{\partial z}{\partial x}\right) + \left(\frac{\partial z}{\partial y}\right)^2$ d) $\frac{\partial z}{\partial y} = x\left(\frac{\partial z}{\partial y}\right) + \left(\frac{\partial z}{\partial y}\right)^2$	K1	CO1
2	Find the solution of $zp = -x =$ _____. a) $x^2 + y^2 = \phi(y)$ b) $x^2 + z^2 = \phi(x)$ c) $x^2 + z^2 = \phi(y)$ d) $x^2 + y^2 = \phi(x)$	K2	CO1
3	Find the complete integral of $px + qy = pq$ a) $az = \frac{1}{2} + (ax + z)^2 + b$ b) $az = \frac{1}{2} + (ay + y)^2 + b$ c) $az = \frac{1}{2} + (ay + y)^2 + b$ d) $az = \frac{1}{2} + (ax + y)^2 + b$	K1	CO2
4	Find the complete integral of $q = -px + p^2$. a) $z = \frac{x^2}{4} \pm \frac{1}{2} \left[\frac{y}{2} \sqrt{(x^2 + 4a)} + 2a \log \{x + \sqrt{(x^2 + 4a)}\} \right] + ay + b$ b) $z = \frac{x^2}{4} \pm \frac{1}{2} \left[\frac{x}{2} \sqrt{(x^2 + 4a)} + 2a \log \{x + \sqrt{(x^2 + 4a)}\} \right] + ay + b$ c) $z = \frac{x^2}{4} \pm \frac{1}{2} \left[\frac{x}{2} \sqrt{(y^2 + 4a)} + 2a \log \{x + \sqrt{(y^2 + 5a)}\} \right] + ay + b$ d) $z = \frac{y^2}{4} \pm \frac{1}{2} \left[\frac{x}{2} \sqrt{(x^2 + 4a)} + \log \{x + \sqrt{(x^2 + 4a)}\} \right] + ay + b$	K2	CO2
5	The solution of $r = 6x$ is _____. a) $z = y^3 + x\phi_1(y) + \phi_2(y)$ b) $z = x^3 + x\phi_1(x) + \phi_2(x)$ c) $z = x^3 + x\phi_1(y) + \phi_2(y)$ d) $z = x^3 + x\phi_1(y)$	K1	CO3
6	The solution of $xys - qy = x^2$ is _____. a) $z = x^2 \log y + \{x\phi_1(y) + \phi_2(x)\}$ b) $z = x^2 \log x + \{x\phi_1(y) + \phi_2(x)\}$ c) $z = x^2 \log x + \{x\phi_1(y) + \phi_2(y)\}$ d) $z = y^2 \log y + \{x\phi_1(y) + \phi_2(x)\}$	K2	CO3
7	The value of $\cos n\pi = -1$ if n is _____. a) odd b) even c) 0 d) both odd and even	K1	CO4
8	If $f(x)$ is an odd function then $-f(-x) =$ _____. a) $-f(-x)$ b) $-f(x)$ c) $f(-x)$ d) $f(x)$	K2	CO4
9	$\frac{\partial u}{\partial t} = c^2 \frac{\partial^2 u}{\partial x^2}$ is called _____. a) Two dimensional wave equation b) One dimensional wave equation c) Two dimensional heat equation d) One dimensional heat equation	K1	CO5
10	$\frac{\partial u}{\partial t} = c^2 \left(\frac{\partial^2 u}{\partial x^2} + \frac{\partial^2 u}{\partial y^2} \right)$ is called _____. a) Two dimensional wave equation b) One dimensional heat equation c) Two dimensional heat equation d) One dimensional wave equation	K2	CO5

Cont...

SECTION - B (35 Marks)Answer **ALL** questions**ALL** questions carry **EQUAL** Marks (5 × 7 = 35)

Question No.	Question	K Level	CO
11.a.	Find the differential equation of all spheres of radius λ having centre in the xy plane.	K3	CO1
	(OR)		
11.b.	Solve $z(x+y)p + z(x-y)q = x^2 + y^2$.		
12.a.	Find a complete integral of $z^2(p^2z^2 + q^2) = 1$.	K3	
	(OR)		
12.b.	Find a complete and singular integral of $2xz - px^2 - 2qxy + pq = 0$.		
13.a.	Solve $t - xq = x^2$.	K3	CO3
	(OR)		
13.b.	Solve $p + r + s = 1$.		
14.a.	Explain about left hand limit, right hand limit and right hand derivatives.	K3	CO4
	(OR)		
14.b.	Find the fourier cosine series for $f(x) = x^2, 0 < x < \pi$		
15.a.	Discuss the steps for finding solutions by product method using of fourier series.	K4	CO5
	(OR)		
15.b.	Find the temperature $u(x, t)$ in a laterally insulated copper bar 80cm long if the initial temperature is $100\sin(\frac{3\pi x}{80})^\circ\text{C}$ and the ends are kept at 0°C . How long will it take for the maximum temperature in the bar to drop to 50°C ? First guess, then calculate. Physical data for copper: density 8.92g/cm^3 , specific heat $0.092\text{cal/(g}^\circ\text{C)}$, thermal conductivity $0.95\text{ cal/(cm sec}^\circ\text{C)}$		

SECTION -C (30 Marks)Answer **ANY THREE** questions**ALL** questions carry **EQUAL** Marks (3 × 10 = 30)

Question No.	Question	K Level	CO
16	Find the Partial Differential Equations of the set of all right circular cones whose axes coincide with z-axis.	K3	CO1
17	Find the complete integral of the equation $pxy + pq + qy = yz$.	K3	CO2
18	Solve $ys + p = \cos(x+y) - y\sin(x+y)$.	K5	CO3
19	A sinusoidal voltage $E\sin\omega t$, where t is time, is passed through a half-wave rectifier that clips the negative portion of the wave. Find the Fourier series of the resulting periodic function $u(t) = \begin{cases} 0 & \text{if } -L < t < 0 \\ E\sin\omega t & \text{if } 0 < t < L \end{cases}$	K4	CO4
20	Find the temperature in a laterally insulated bar of length L whose ends are kept at temperature 0 , assuming that the initial temperature is $f(x) = \begin{cases} x & \text{if } 0 < x < \frac{L}{2} \\ L-x & \text{if } \frac{L}{2} < x < L \end{cases}$	K4	CO5