

2. (a) The differential equation

$$\frac{d^2x}{dt^2} + 2k\frac{dx}{dt} + n^2x = 0,$$

where k is constant and k < n represents the damped harmonic oscillations of a particle. Solve the differential equation and show that the ratio of amplitude of any oscillation to its preceeding one is constant.

[4]

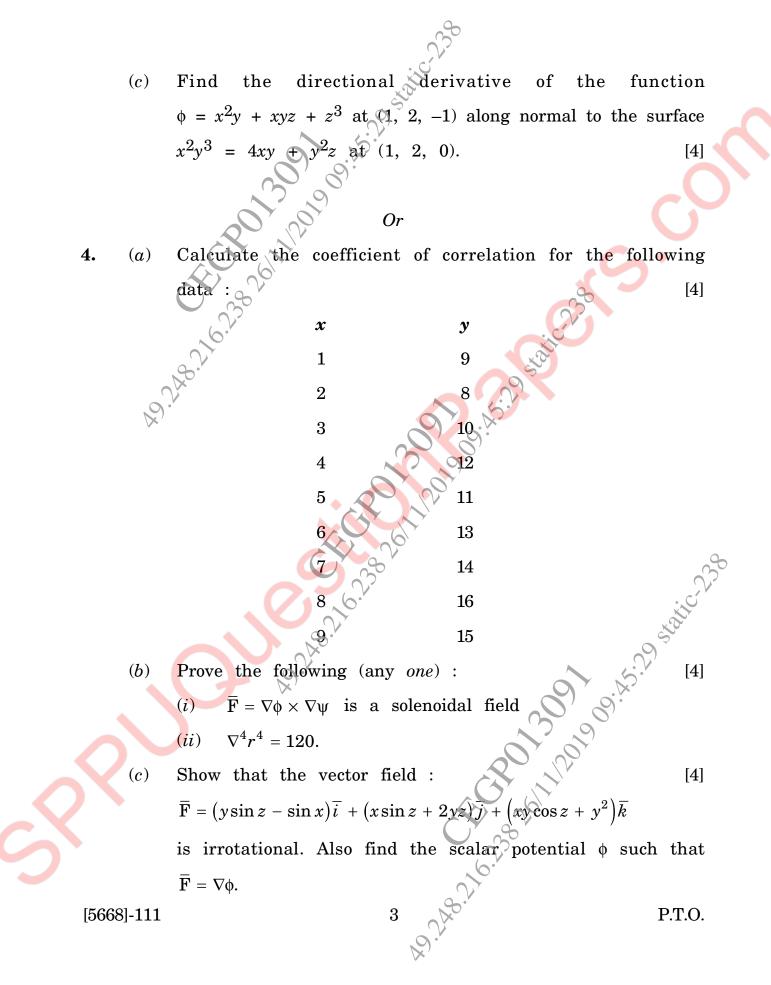
[4]

- (b) Solve any one of the following : (i) $L\left[e^{-2t}t\sin 2t\right]$ (ii) $L^{-1}\left[\frac{s+3}{(s+4)(s-8)}\right]$.
- (c) Solve the following differential equation by using Laplace transform method : [4]

where x(0) =

- 3. (a) The first four moments of a distribution about 2 are 1, 2.5,
 5.5 and 16. Calculate first four moments about the mean.
 Also obtain the coefficient of skewness (β₁) and coefficient of kurtosis (β₂). [4]
 - (b) In a town, 10 accidents took place in a span of 50 days.
 Assuming that the number of accidents per day follows Poisson distribution, find the probability that there will be : [4]
 - (i) at least 3 accidents in a day
 - (ii) at least 2 accidents in a day.





5. (a) Find the work done in moving a particle in the field [5]

$$\vec{F} = y\vec{v}, xzj + zyk$$

along the curve
 $x = 2(t + \sin t), y = 2(1 - \cos t), z = 2t$
in xy plane from $t = -\pi$ to $t = \pi$.
(b) Use divergence theorem for
 $\vec{F} = 2xzi + yzj + z^2k$
over upper half of the sphere $x^2 + y^2 + z^2 = a^2$.
(c) By using Stokes' theorem, evaluate :
 $\int_{C} \left[e^x dx + 2ydx + dz\right]$
where C is the curve $x^2 + y^2 = 4$, $z = 2$.
6. (a) Using Green's theorem evaluate :
 $\int_{C} \left[(x^2 + 2y)dx + (4x + y^2)dy\right]$
where C is the boundary of the region bounded by $y = 0$,
 $y = 2x$, and $x + y = 3$.
(b) By using Gauss divergence theorem evaluate .
 $\int_{S} \vec{r} \cdot \hat{n} ds$
over the closed surface of the sphere of unit radius.
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