

B.Tech. SEM -II (2007 Course) (All Branches) : SUMMER - 2019
SUBJECT : ENGINEERING MATHEMATICS - II

Day Wednesday
Date 22/05/2019

Time 10.00 AM TO 01.00 PM
Max. Marks : 80

S-2019-2955

N. B. :

- 1) **Q. No. 1 and Q. No. 5 are COMPULSORY.** Out of the remaining attempt **ANY TWO** questions from each section.
- 2) Figures to the right indicate **FULL** marks.
- 3) Answer to both the sections should be written in **SAME** Answer book.
- 4) Use of non programmable **CALCULATOR** is allowed.
- 5) Assume suitable data if necessary.

SECTION – I

Q.1 a) Find the cylindrical coordinates of the point $(-1, 2, 7)$. **[04]**

b) Form the differential equation whose general solution is $(x - h)^2 + (y - k)^2 = c^2$. **[05]**

c) The distance x descended by a parachute satisfies the equation $u \frac{du}{dx} = g \left(1 - \frac{u^2}{k^2} \right)$ where u is velocity, k and g are constants. **[05]**

If $u = 0$ and $x = 0$ at time $t = 0$, show that $\frac{gx}{k^2} = \log \cosh \left(\frac{gt}{k} \right)$.

Q.2 Solve **ANY THREE** of the following: **[13]**

a) $(3x^2y^4 + 2xy)dx + (2x^3y^3 - x^2)dy = 0$.

b) $(y^2 + 2yx^2)dx + (2x^3 - xy)dy = 0$.

c) $(1 + \log xy)dx + \left(1 + \frac{x}{y} \right)dy = 0$.

d) $x \frac{dy}{dx} + 3y = x^4 e^{1/x^3} y^3$.

Q.3 a) A steam pipe 20 cm in diameter is protected with a covering 7 cm thick for which coefficient of thermal conductivity $k = 0.0003$ cal/cm. deg. sec. steady state. Find the heat loss per hour through a meter length of the pipe, if the internal surface of the pipe is at 180°C and the outer surface of the covering is at 30°C . **[05]**

b) Find the current I in the circuit having resistance R and condenser of capacity C in series with e.m.f $E \sin t$. **[04]**

c) Water at temperature 70°C cools in 6 minutes to 50°C in a room of temperature 20°C . Find the temperature of water after 12 minutes. **[04]**

Q.4 a) Find the equation of the sphere passing through $(1, 0, 0)$, $(0, 1, 0)$, $(0, 0, 1)$ and having least possible radius. **[05]**

b) Find the equation of the right circular cone whose vertex is $(1, 2, 3)$, axis has direction ratios $2, -1, 2$ and semi-vertical angle 45° . **[04]**

c) Find the equation of the cylinder whose generators are parallel to the line $\frac{x}{1} = \frac{y}{-2} = \frac{z}{3}$ and guiding curve is ellipse $x^2 + 2z^2 = 1$, $y = 3$. **[04]**

P.T.O.

SECTION – II

Q.5 a) Solve: $\int_0^a \int_0^x \frac{\sin y \, dx \, dy}{(5 \cos y - 4) \sqrt{(a-x)(x-y)}}.$ [05]

b) Trace the curve $r = a \cos 5\theta.$ [05]

c) Find cosine series for $\sin x$ in the interval $0 < x < \pi.$ [04]

Q.6 a) If $I_n = \int_{\pi/4}^{\pi/2} \cot^n \theta \, d\theta,$ prove that $I_n = \frac{1}{n-1} - I_{n-2},$ hence evaluate $\int_{\pi/4}^{\pi/2} \cot^6 \theta \, d\theta.$ [05]

b) Evaluate: $\int_0^1 \frac{dx}{\sqrt{x \log \frac{1}{x}}}.$ [04]

c) Obtain half range sine series to represent [04]

$$f(x) = \begin{cases} x & 0 \leq x \leq \frac{\pi}{3} \\ \frac{\pi-x}{3} & \frac{\pi}{3} \leq x \leq \pi \end{cases}$$

Q.7 a) Prove: $\int_0^{\infty} e^{-bx} \frac{\sin x}{x} \, dx = \cot^{-1} b$ [05]

b) Find: $\frac{d}{dt} \operatorname{erf}(\sqrt{t}).$ [04]

c) Trace the curve $ay^2 = x^2(a-x)$ [04]

Q.8 a) Evaluate $\iint_R x \, dx \, dy,$ where $R: y = x^2, y = x.$ [05]

b) Find the volume of paraboloid of revolution $x^2 + y^2 = 2z$ cut off by the plane $z = 2.$ [04]

c) Find the area lying between the curve $y = 4x - x^2$ and $y = x.$ [04]

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