

**B.Tech. SEM -II (Chemical/ Civil/ Electrical/ Mechanical/ Production/
Computer/ Info. Tech./ Electronics / Bio Medical / E & TC) 2014
Course (CBCS) : WINTER - 2018
SUBJECT: ENGINEERING MATHEMATICS - II**

Day: Tuesday
Date: 13/11/2018

W-2018-2269

Time: 10.00 AM TO 01.00 PM
Max Marks. 60

N.B. :

- 1) All questions are **COMPULSORY**.
- 2) Figures to the right indicate **FULL** marks.
- 3) Assume suitable data, if necessary.

Q.1 a) Solve: $x \frac{dy}{dx} + \frac{y^2}{x} = y$ **(05)**

b) Solve: $(x y^2 + 2x^2 y^3) dx + (x^2 y - x^3 y^2) dy = 0$ **(05)**

OR

Q.1 a) Solve: $\left(\frac{e^{-2\sqrt{x}}}{\sqrt{x}} - \frac{y}{\sqrt{x}} \right) \frac{dx}{dy} = 1$ **(05)**

b) Solve: $\frac{dy}{dx} + x \tan(y-x) = 1$ **(05)**

Q.2 a) A body at temperature 100°C is placed in a room whose temperature is 20°C and cools to 60°C in 5 minutes. Find its temperature after a further interval of 3 minutes. **(05)**

b) A steam pipe 20cm in diameter is protected with a covering 6cm thick for which the coefficient of thermal conductivity is $k = 0.0003 \text{ cal/cm deg sec}$. steady state. Find the heat loss per hour through a meter length of the pipe, if the surface of the pipe is at 200°C and outer surface of the covering is at 30°C . **(05)**

OR

Q.2 a) The equation of electromotive force in terms of current i for an electrical circuit having resistance R and a condenser of capacity C , in series, is **(05)**

$E = Ri + \int \frac{i}{C} dt$. Find the current i at any time t , when $E = E_0 \sin wt$.

b) A particle is moving in a straight line with an acceleration $k \left(x + \frac{a^4}{x^3} \right)$ directed forwards origin. If it starts from rest at a distance a from the origin, prove that it will arrive at origin at the end of time $\frac{\pi}{4\sqrt{k}}$. **(05)**

Q.3 If $f(x) = \begin{cases} \pi x, & 0 \leq x \leq 1 \\ \pi(2-x), & 1 \leq x \leq 2 \end{cases}$ period 2, **(10)**

Show that in the interval $0 \leq x \leq 2$, $f(x) = \frac{\pi}{2} - \frac{4}{\pi} \sum_{n=0}^{\infty} \frac{1}{(2n+1)^2} \cos(2n+1)\pi x$

OR

P.T.O.

Q.3 a) Evaluate: $\int_0^{\pi} x \sin^7 x \cos^4 x \, dx$ (05)

b) Prove that: $\int_0^1 \frac{dx}{\sqrt{x \log \frac{1}{x}}} = \sqrt{2\pi}$ (05)

Q.4 a) Trace the curve: $y^2(a^2 - x^2) = a^3x$ (05)

b) Prove that: $\int_0^1 \frac{x^a - 1}{\log x} \, dx = \log(1+a); a \geq 0$ (05)

OR

Q.4 a) Prove that: $\operatorname{erfc}(-x) + \operatorname{erfc}(x) = 2$ (05)

b) Trace the curve: $r^2 = a^2 \cos 2\theta$ (05)

Q.5 a) Find the equation of the sphere passing through: $(1, 0, -1), (2, 1, 0), (1, 1, -1)$ and $(1, 1, 1)$ (05)

b) Obtain the equation of guiding curve given by $x^2 - 2y^2 + z^2 = 4, x - y + z = 3$ (05)

OR

Q.5 a) A sphere of constant radius r passes through the origin and meets the co-ordinate axes in A, B, C. Show that the locus of centered of the triangle ABC is sphere of $9(x^2 + y^2 + z^2) = 4r^2$. (05)

b) Find the equation of the right circular cylinder of radius 2 whose axis is the line $\frac{x-1}{2} = \frac{y-2}{1} = \frac{z-3}{2}$ (05)

Q.6 Show that: $\int_0^1 \int_x^{\frac{1}{x}} \frac{y \, dx \, dy}{(1+xy)^2(1+y^2)} = \frac{\pi-1}{4}$ (10)

OR

Q.6 Evaluate $\iiint \frac{dx \, dy \, dz}{\sqrt{1-x^2-y^2-z^2}}$ taken throughout the volume of the sphere $x^2 + y^2 + z^2 = 1$ in the positive octant. (10)

* * * * *