B.Tech. SEM -II (Chemical/ Civil/ Electrical/ Mechanical/ Production/ Computer/ Info. Tech./ Electronics / Bio Medical / E & TC) 2014 Course (CBCS) : SUMMER - 2019

SUBJECT : ENGINEERING MATHEMATICS - II

Day Wednesday — Time : 10.00 AM TO 01.00 PM

Date: 22/05/2019 — Max. Marks : 60

S-2019-2534

N. B. :

1) All questions are **COMPULSORY.**
2) Figures to the right indicate **FULL** marks.
3) Draw neat and labeled diagrams **WHEREVER** necessary.
4) Use of non-programmable calculator is **ALLOWED.**
5) Assume suitable data, if necessary.

Q. 1 a) Evaluate : $\frac{dy}{dx} = \sqrt{y - x}$ **(05)**

b) Evaluate: $\left(x^4 e^x - 2mxy^2\right) dx + \left(2mx^2y\right) dy = 0.$ **(05)**

OR

a) Evaluate: $\left(2x - y + 1\right) dy - \left(x + 2y + 3\right) dx = 0.$ **(05)**

b) Evaluate: $\sin y \frac{dy}{dx} = \cos x \cdot \left(2\cos y - \sin^2 x\right)$ **(05)**

Q. 2 a) A metal ball is heated to a temperature of 100^0 C and at time $t = 0$ it is placed in water which is maintained at 40^0 C. If the temperature of the ball is reduced to 60^0 C in 4 minutes, find the time at which the temperature of the ball is 50^0 C. **(05)**

b) The distance 'x' descended by a person falling by means of a parachute satisfies the differential equation $\left(\frac{dx}{dt}\right)^2 = k^2 \left(1 - e^{-2gx/k^2}\right)$ where k and g are constants and $x = 0$ when $t = 0$, show that $x = \frac{k^2}{g} \log \cosh \left(\frac{gt}{k}\right)$. **(05)**

OR

a) Show that the differential equation for the current i in an electrical circuit containing an inductance L and a resistance R in series and acted on by an electromotive force *Esinwt* satisfies the equation $L\frac{di}{dt} + Ri = E\sin wt$.
Find the value of the current at any time t, if initially there is no current in the circuit **(05)**

b) A pipe 10 cm in diameter contains steam at 100^0 C. It is covered with asbestos, 5 cm thick, for which k = 0.0006 and the outside surface is at 30^0 C. Find the amount of heat lost per hour from a metre long pipe. **(05)**

Q. 3 Find Fourier series for the function $f(x) = x - x^2$ in the interval $-l < x < l$. **(10)**

OR

a) Evaluate : $\int_0^{2a} x^{7/2}(2a - x)^{-1/2}\, dx$ **(05)**

b) Evaluate : $\int_0^1 (x \log x)^4\, dx$ **(05)**

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

b) show that: $\int_0^\infty e^{-x^2-2bx}\, dx = \frac{\sqrt{\pi}}{2} e^{b^2}[1 - erf(b)]$ **(05)**

OR

a) Trace the curve: $r = a(1 + \sin\theta)$ **(05)**

b) Show that : $\int_0^\infty \frac{\tan^{-1}(ax)}{x(1 + x^2)}\, dx = \frac{\pi}{2}\log(1 + a)$ **(05)**

Q. 5 a) Find the equation of the sphere, which passes through the points (1, 0, 0), (0, 2, 0), (0, 0, 3) and has its radius as small as possible. **(05)**

b) Obtain the equation of a right circular cone which passes through the point (2, 1, 3) with vertex (1, 1, 2) and axis parallel to the line **(05)**

$$\frac{x-2}{2} = \frac{y-1}{-4} = \frac{z+2}{3}$$

OR

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

b) Find the equation of the right circular cylinder whose guiding curve is $x^2 + y^2 + z^2 = 9,\ x - y + z = 3.$ **(05)**

Q. 6 Find the area common to the circles: **(10)**

$x^2 + y^2 = a^2$ and $x^2 + y^2 = 2ax.$

OR

Evaluate $\iiint z^2\, dx\, dy\, dz$ over the volume common to sphere $x^2 + y^2 + z^2 = a^2$ and $x^2 + y^2 = ax.$ **(10)**

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