

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
Date: 22/05/2019

Time : 10.00 AM TO 01.00 PM
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: $(x^4 e^x - 2mxy^2) dx + (2mx^2 y) dy = 0$. (05)

OR

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

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

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

b) The distance 'x' descended by a person falling by means of a parachute satisfies the differential equation $\left(\frac{dx}{dt}\right)^2 = k^2 (1 - e^{-2gx/k^2})$ 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 $E \sin wt$ satisfies the equation $L \frac{di}{dt} + Ri = E \sin wt$. (05)

Find the value of the current at any time t, if initially there is no current in the circuit

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

P. T. O.

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: $x^2 y^2 = a^2 (y^2 - x^2)$ (05)

b) show that: $\int_0^{\infty} e^{-x^2 - 2bx} dx = \frac{\sqrt{\pi}}{2} e^{b^2} [1 - \operatorname{erf}(b)]$ (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 $\frac{x-2}{2} = \frac{y-1}{-4} = \frac{z+2}{3}$ (05)

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)

$$x^2 + y^2 = a^2 \text{ and } x^2 + y^2 = 2ax.$$

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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