DR. BABASAHEB AMBEDKAR TECHNOLOGICAL UNIVERSITY,

LONERE – RAIGAD - 402 103

SEMESTER EXAMINATION: DECEMBER – 2018

Course: B. Tech (All Branches) **Semester: I**
Subject with Subject Code: Engineering Mathematics – I (BTMA101)
Date: 11/12/2018 **Marks: 60** **Time: 3 Hrs.**

Instructions to the Students:-

1. *Each question carries 12 marks.*
2. ***All** the questions are compulsory.*
3. *Illustrate your answers with neat sketches, diagram etc., wherever necessary.*
4. *If some part or parameter is noticed to be missing, you may appropriately assume it and should mention it clearly.*

(Marks)

Q.1. Attempt any three **(12)**

(a) Verify the Cayley-Hamilton theorem for the matrix $A = \begin{bmatrix} 1 & 0 & -2 \\ 2 & 2 & 4 \\ 0 & 0 & 2 \end{bmatrix}$hence find the A^{-1}

(b) For what values of $\boldsymbol{\lambda}$ and μ the equations $2x + 3y + 5z = 9, 7x + 3y - 2z = 8, 2x + 3y + \lambda z = \mu$ have (i) no solution (ii)a unique solution or (iii) an infinite number of solutions.

(c) Use Gauss-Jordan method to find the inverse of the matrix $A = \begin{bmatrix} 2 & 1 & -1 \\ 0 & 2 & -1 \\ 5 & 2 & -3 \end{bmatrix}$

(d) Find the rank of a matrix A by reducing it to normal form, where $A = \begin{bmatrix} 1 & -12 & 3 \\ 4 & 1\ 0 & 2 \\ 0 & 31 & 4 \\ 0 & 10 & 2 \end{bmatrix}$

Q.2. Attempt any three **(12)**

(a) If $z(x+y) = x^2 + y^2$ show that $\left(\frac{\partial z}{\partial x} - \frac{\partial z}{\partial y}\right)^2 = 4\left(1 - \frac{\partial z}{\partial x} - \frac{\partial z}{\partial y}\right)$

(b) If u $sin^{-1}\sqrt{\frac{x^2+y^2}{x+y}}$, Show that $x^2\frac{\partial^2 u}{\partial x^2} + 2xy\frac{\partial^2 u}{\partial x \partial y} + y^2\frac{\partial^2 u}{\partial y^2} = \frac{1}{4}tanu[tan^2 u - 1]$

(c) $If u = x^2 + y^2, v = 2xy \wedge z = f(u,v)$ then show that x.$\frac{\partial z}{\partial x} - y.\frac{\partial z}{\partial y} = 2\sqrt{u^2 - v^2}.\frac{\partial z}{\partial u}$

(d) If u= x log xy, where $x^3 + y^3 + 3xy = 1, Find\ \frac{du}{dx}$

Q.3. **Attempt any two** **(12)**

(a) $x = \sqrt{vw}, y = \sqrt{uw}, z = \sqrt{uv}$and $u = rsin\theta cos\emptyset, v = rsin\theta sin\emptyset, w = rcos\theta$ then find $\frac{\partial(x,y,z)}{\partial(r,\theta,\emptyset)}$

(b) Expand $f(x,y) = e^x cosyat\left(1,\frac{\pi}{4}\right)$ using Taylor's theorem

(c) Divide 24 into three parts such that the continued product of the first square of the second and cube of the third may be maximum.

Q.4 **Attempt any three** **(12)**

(a) Evaluate $\int_0^\infty \frac{t^2}{(1+t^2)^{\frac{7}{2}}} dt$

(b) Trace the curve $x = a(\theta + sin\theta), y = a(1 + cos\theta)$

(c) Trace the curve $y^2(2a - x) = x^3$

(d) Trace the curve $r = 1 + 2cos\theta$

Q.5. **Attempt any two** **(12)**

(a) Change the order of integration and evaluate

$$\int_0^a \int_{\frac{x^2}{a}}^{2a-x} xy.dx.dy$$

(b) Change to polar co-ordinates and evaluate

$$\int_0^4 \int_{\frac{y^2}{4}}^{y} \frac{x^2 - y^2}{x^2 + y^2} dx.dy$$

(c) Find the area included between the curves $y = x^2 - 6x + 3 \wedge y = 2x - 9$ by double integration

---

4452706A15C42C8064EA682DAFD90B7D