DR. BABASAHEB AMBEDKAR TECHNOLOGICAL UNIVERSITY, LONERE RAIGAD-402 103.

Semester Examination – May - 2019

Branch: First year B. Tech.(ALL) Semester: I

Subject with Code: Engg. Math-I (BTMA101)

Time: 3 hrs. Date: 14/05/2019 Max. Marks: 60

Instructions to Students:

(1) All questions are compulsory.
(2) Use of non-programmable calculator is allowed.
(3) Figures to right indicate full marks.
(4) Illustrate your answer with neat sketches, diagram etc. whatever necessary.
(5) If some part or parameter is noticed tobe missing you may appropriately assume it and should mention it clearly.

Q.1 Attempt any three from the following: 4 X 3 = 12

(a) Reduce the following matrix into normal form & find its rank

$$\begin{bmatrix} 1 & 2 & -1 & 3 \\ 3 & 4 & 0 & -1 \\ -1 & 0 & -2 & 7 \end{bmatrix}$$

(b) Test the consistency & solve

$$4x - 2y + 6z = 8\,;$$

$$x + y - 3z = -1\,;$$

$$15x - 3y + 9z = 21.$$

(c) Find the Eigen values & Eigen vectors of the following matrix

$$\begin{bmatrix} 4 & 6 & 6 \\ 1 & 3 & 2 \\ -1 & -4 & -3 \end{bmatrix}$$

(d) Find A^{-1} by using Cayley-Hamilton Theorem

Where $A = \begin{bmatrix} 2 & -1 & 1 \\ -1 & 2 & -1 \\ 1 & -1 & 2 \end{bmatrix}$

Q.2 Attempt any three from the following: 4 X 3 = 12

(a) If $u = \log(x^3 + y^3 + z^3 - 3xyz)$ then prove that

$$\left(\frac{\partial}{\partial x} + \frac{\partial}{\partial y} + \frac{\partial}{\partial z}\right)^2 u = -\frac{9}{(x+y+z)^2}\ .$$

(b) If $f(u)$ is a homogeneous function of degree n in x & y, then show that

$$x^2\frac{\partial^2 u}{\partial x^2}+2xy\frac{\partial^2 u}{\partial x\partial y}+y^2\frac{\partial^2 u}{\partial y^2}=G(u)\,[\,G'(u)-1\,]\quad \text{where } G(u)=n\frac{f(u)}{f`(u)}.$$

(c) Verify Euler's theorem for $u=\frac{x^2+y^2}{x+y}$.

(d) If $z=f(u,v)$ where $u=lx+my \text{ and } v=ly-mx$, then show that

$$\frac{\partial^2 z}{\partial x^2}+\frac{\partial^2 z}{\partial y^2}=(l^2+m^2)\left(\frac{\partial^2 z}{\partial u^2}+\frac{\partial^2 z}{\partial v^2}\right).$$

Q.3 Attempt any three from the following: 4 X 3 = 12

(a) Show that $J.J'=1$ If $x=e^u cosv$ & $y=e^u sinv$.

(b) Expand $f(x,y)=\sin(xy)$ in the powers of $(x-1)$ & $(y-\frac{\pi}{2})$ by using Taylor's Theorem.

(c) Discus the maxima & minima of $xy(a-x-y)$.

(d) If $u=\frac{a^3}{x^2}+\frac{b^3}{y^2}+\frac{c^3}{z^2}$ where $x+y+z=1$, then find the stationary values by using Lagrange's method of multipliers.

Q.4 Attempt any three from the following: 4 X 3 = 12

(a) Evaluate $\int_0^4 x^3\sqrt{4x-x^2}\,dx$.

(b) Trace the curve $y^2(4-x)=x(x-2)^2$.

(c) Trace the curve $r=a\cos(2\theta)$.

(d) Trace the curve $x=a(t+sint)$

$y=a(1-cost)$.

Q.5 Attempt any three from the following: 4 X 3 = 12

(a) Change the order of integration & evaluate it

$$\int_0^1\int_y^1 x^2e^{xy}\,dx\,dy.$$

(b) Change to polar co-ordinates & evaluate it

$$\int_0^{2a}\int_0^{\sqrt{2ax-x^2}}(x^2+y^2)\,dx\,dy$$

(c) Evaluate $\int_{-1}^1\int_0^z\int_{(x-z)}^{(x+z)}(x+y+z)dx\,dy\,dz$.

(d) Find the area outside the circle $r=a$

& inside the cardioide $r=a(1+cos\theta)$.

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