RV Educational Institutions
RV College of Engineering
Autonomous Institution Affiliated to Visvesvaraya Technological University, Belagavi
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RVCE22BAI054

# DEPARTMENT OF MATHEMATICS

| Course: Fundamentals of Linear Algebra, Calculus and statistics | CIE-II (QUIZ & TEST) | Maximum marks: 10+50=60 |
|---|---|---|
| Course code: 22MA11C | First semester 2022-2023<br>Chemistry Cycle<br>Branch: AI, BT, CD, CS, CY, IS, SPARK-C | Time: 1:00PM-3:00PM<br>Date: 21-02-2023 |

***Instructions to students***:

1. *Answer **all** questions.*
2. ***Part A** must be answered in the **first two pages** of the answer book only.*

| Q.No | PART- A (Quiz) | M | BT | CO |
|---|---|---|---|---|
| 1.1 | The coefficient of $x^2$ in the Maclaurin series expansion of $e^{-\left(\frac{x}{3}\right)}$ is _____. | 2 | L1 | 1 |
| 1.2 | If $z = x\sin(y) + y\cos(x)$ then $\frac{\partial^2 z}{\partial x \partial y}$ =_____. | 2 | L1 | 1 |
| 1.3 | Total differential of the function $u = x^3 e^y z^2$ is _____. | 2 | L2 | 2 |
| 1.4 | The critical point of the function $f(x,y) = x^2 + 2x + 9y - 3y^2 + 5$ is _____. | 2 | L1 | 1 |
| 1.5 | If $x = u\sin(v)$ and $y = u\cos(v)$ then $\frac{\partial(u,v)}{\partial(x,y)}$ =_____. | 2 | L2 | 2 |

| Sl. No. | PART -B | M | BT | CO |
|---|---|---|---|---|
| 1 | Obtain the Maclaurin series expansion of $\log_e(1+e^x)$ up to the term containing $x^4$ and hence deduce the expansion of $\frac{1}{e^{-x}(1+e^x)}$. | 10 | L2 | 2 |
| 2. (a) | Find the value of $n$ so that the equation $V = r^n(3\cos^2(\theta) - 1)$ satisfies the relation $\frac{\partial}{\partial r}\left(r^2\frac{\partial V}{\partial r}\right) + \frac{1}{\sin(\theta)}\frac{\partial}{\partial \theta}\left(\sin(\theta)\frac{\partial V}{\partial \theta}\right) = 0$. | 06 | L2 | 1 |
| 2. (b) | Find $\frac{du}{dx}$ for $u = \log_e(x^2 + y^2)$, where $x^3 + y^3 + 5xy = 19$. | 04 | L2 | 2 |
| 3. (a) | Using chain rule express $\frac{\partial w}{\partial r}$ and $\frac{\partial w}{\partial s}$ in terms of $r$ and $s$ if $w = x + 2y + z^2$, $x = \frac{r}{s}$, $y = r^2 + \log_e(s)$, $z = 2r$. | 06 | L2 | 2 |
| 3. (b) | The pressure $P$ (in kilopascals), volume $V$ (in liters), and temperature $T$ (in kelvins) of a mole of an ideal gas are related by the equation $PV = 8.31T$. Find the rate at which the pressure is changing when the temperature is 300K and increasing at a rate of 0.1K/s and the volume is 100L and increasing at a rate of 0.2L/s. | 04 | L3 | 4 |
| 4 | Find the shortest and longest distance from the point $P(1,2,-1)$ to the sphere $x^2 + y^2 + z^2 = 24$ using Lagrange's multiplier method. | 10 | L3 | 3 |
| 5 | If $u = x + y + z$, $uv = y + z$ and $uvw = z$ then find $J = \frac{\partial(u,v,w)}{\partial(x,y,z)}$ and $J' = \frac{\partial(x,y,z)}{\partial(u,v,w)}$. Also show that $JJ' = 1$. | 10 | L3 | 3 |

BT-Blooms Taxonomy, CO-Course Outcomes, M-Marks

| Marks Distribution | Particulars | | CO1 | CO2 | CO3 | CO4 | L1 | L2 | L3 | L4 | L5 | L6 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Test+Quiz | Max Marks | 12 | 24 | 20 | 04 | 06 | 30 | 24 | -- | -- | -- |