15314

**Third Semester B.Sc. Degree Examination, Nov./Dec. 2017**
**MATHEMATICS – VI**
**Paper – 3.2 : Real Analysis (Old)**

Time : 3 Hours                                                                 Max. Marks : 60

***Instruction :*** *Answer **all** the Sections.*

SECTION – A

Answer **any ten** of the following : **(2×10=20)**

1. Verify Roll's theorem for the function $f(x) = x^2 - 6x + 8$ in the interval [2, 4].
2. Verify Lagrange's Mean value theorem for $f(x) = (x - 1)(x - 2)(x - 3)$ in [0, 4].
3. Evaluate $\lim\limits_{x \to 0} \frac{x - \log(1+x)}{1 - \cos x}$.
4. Evaluate $\lim\limits_{x \to 0} \operatorname{cosec} x - \cot x$.
5. Expand $e^x$ by means of Maclaurin's expansion.
6. If f(x) is a real valued bounded function defined on [a, b] and $P \in f[a, b]$ then $U(p, -f) = -L(P, f)$.
7. Evaluate $\int_0^{\pi/2} e^x(\sin x + \cos x)\,dx$.
8. State first Mean value theorem.
9. Show that $\int_C y^2dx + 2xydy$ is independent of the path.
10. Evaluate $\int_0^1 \int_0^2 (x + y)dydx$.

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11. Evaluate $\int_0^1 \int_0^2 \int_1^2 x^2yz\,dxdydz$.

12. Evaluate $\int_C (3x+y)dx + (2y-x)dy$ along the curve $y = x^2 + 1$ from (0, 1) and (3, 10).

SECTION – B

Answer **any two** of the following : **(2×5=10)**

13. State and prove Cauchy's Mean value theorem for differential calculus.

14. Expand the function $e^{\sin x}$ up to the term containing $x^4$ by Maclaurin's expansion.

15. Evaluate $\lim_{x\to 0}\left(\frac{1}{x^2} - \frac{1}{x\tan x}\right)$.

SECTION – C

Answer **any three** of the following : **(3×5=15)**

16. A bounded function f(x) defined on [a, b] is Riemann integrable on [a, b] iff for each $\varepsilon > 0, \exists$ a partition P on [a, b] such that $0 < U(P, f) - L(P, f) < \varepsilon$.

17. Show that the function $f(x) = 3x + 1$ is integrable on [1, 2] and $\int_1^2 (3x+1)dx = \frac{11}{2}$.

18. If $f, g \in R[a, b]$ and there exist $\lambda > 0$ such that $|g(x)| \geq \lambda\ \forall x \in [a, b]$, then $\frac{f}{g} \in R[a, b]$.

19. Using the substitution $x = \pi - t$ show that $\int_0^\pi x\,\phi(\sin x)dx = \frac{\pi}{2}\int_0^\pi \phi(\sin x)dx$.


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## SECTION – D

Answer **any three** of the following : **(3x5=15)**

20. Evaluate $\iint_D \frac{x^2y^2}{x^2+y^2}\,dxdy$ where D is the annular region between the circles $x^2 + y^2 = 2$ and $x^2 + y^2 = 1$.

21. Evaluate $\int_0^1 \int_x^1 (x^2+y^2)\,dydx$ by changing the order of integration.

22. Find the volume of the sphere $x^2 + y^2 + z^2 = a^2$.

23. Find the surface area of the cylinder $x^2 + y^2 = 4$ cut by the cylinder $x^2 + z^2 = 4$.



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