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Reg. No. : ....

Name : ....

First Semester B.C.A. Degree Examination, January 2015
Career Related First Degree Programme under CBCSS
Group 2(b) : Complementary Course
MM 1131.9 : MATHEMATICS – I
(For 2013 Admission Onwards)

Time : 3 Hours Max. Marks : 80

All the first **10** questions are **compulsory**. These questions carry **one** mark **each**.
(10×1=10 Marks)

1. Find $\frac{dy}{dx}$, where $y = x^2 + 2 \sin 4x$.

2. Find $\frac{dy}{dx}$, when $y = \frac{x+1}{x^2+1}$.

3. State Lagrange's mean-value theorem.

4. Solve the equation $\frac{dy}{dx} = \frac{y}{x}$.

5. Find $L(t^4)$.

6. $L^{-1}\left(\frac{s}{s^2+a^2}\right) =$ __________?

7. Write down the statement of Wilson's theorem.

8. True or False : $9^2 \equiv 4 \pmod{11}$.

9. Find the real part and imaginary part of $\frac{(1+i)(4-i)}{(1+3i)}$.

10. Describe Markov process.

P.T.O.

Answer **any 8** questions from among the questions **11** to **22**. The questions carry **2** marks **each**. **(8×2=16 Marks)**

11. Find the n^{th} derivative of $\frac{1}{ax+b}$.

12. Find $\frac{dy}{dx}$, when $y = (3x + 4)^3 \sin 2x$.

13. Verify the Rolle's theorem for the function $f(x) = x^3 - 9x^2 + 24x - 20$ in the interval [2, 5].

14. Solve the equation $(D^2 - 3D - 10)y = 0$.

15. Find L (2 cos 4t + 3 cos t).

16. Find $L^{-1}\left(\frac{7s+4}{(s-2)(s+4)}\right)$.

17. Prove that 8^{th} power of any integer is of the form 17 m or 17m ± 1.

18. Given any prime number p, show that there exists a prime number q which is greater than p.

19. Separate into real and imaginary parts of sin (x + iy).

20. Show that $\cosh^2 x - \sinh^2 x = 1$.

21. Find a sine series for f(x) = k in $0 < x < \pi$.

22. Show that $u(x, y) = y^3 - 3x^2y$ is harmonic.

Answer **any 6** questions from the questions **23** to **31**. These questions carry **4** marks each. **(6×4=24 Marks)**

23. Determine the maxima and minima of $x^3 - 18x^2 + 96x + 4$.

24. Find $\frac{dy}{dx}$, when $y = (\sin x)^{\log x}$.

25. Solve the equation $(3D^2 + D - 14)y = 13e^{4x}$.

26. Find $L\left(\dfrac{\sin at}{t}\right)$.

27. Find $L^{-1}\left(\dfrac{s+3}{s^2 - 2s + 10}\right)$.

28 Separate into real and imaginary parts $\tan^{-1}(x + iy)$.

29. Find $\operatorname{Log}\left(\sqrt{3} + i\right)$.

30. Define the Euler's function $\varphi(n)$. Find $\varphi(120)$.

31. Solve the following problem graphically.

Maximize $z = 3x + 5y$

Subject to $2x + 5y \le 12$

$2x + 3y \le 8$

$x \ge 0;\ y \ge 0$

Answer **any 2** questions from among the questions **32** to **35**. These questions carry **15** marks **each**. **(2x15=30)**

32. If $y = a\cos(\log x) + b\sin(\log x)$, prove that $x^2y_2 + xy_1 + y = 0$ and $x^2y_{n+2} + (2n+1)xy_{n+1} + (n^2+1)y_n = 0$.

33. Solve the following differential equation using Laplace transformation $\dfrac{d^2y}{dx^2} - 3\dfrac{dy}{dx} + 2y = 4e^{3x}$ given $y(0) = -3$ and $y'(0)$.

34. a) Find the remainder when 2^{1000} is divided by 13.

b) Find all the values of $(-8i)^{1/3}$.

35. Determine the Fourier series expansion of $x + x^2$ in the interval $(-\pi, \pi)$.