

GGs Indraprastha University
Mid term-I
B.Tech. 1st semester
Engineering Mathematics-I
BS-111

Time: 1.5 Hr

Max. Marks: 30

Note: Attempt any five questions including question number 1. which is compulsory.

1. (a) If $u = x^2 - y^2$, $v = 2xy$ and $x = r \cos \theta$, $y = r \sin \theta$, find $\frac{\partial(u, v)}{\partial(r, \theta)}$. (2)

(b) Solve $\frac{y}{x} \frac{dy}{dx} = \sqrt{(1 + x^2 + y^2 + x^2 y^2)}$. (2)

(c) Solve $\left(\frac{e^{-2\sqrt{x}}}{\sqrt{x}} - \frac{y}{\sqrt{x}} \right) \frac{dx}{dy} = 1$. (2)

(d) Find integrating factor for $(xy^3 + y) dx + 2(x^2 y^2 + x + y^4) dy = 0$. (2)

(e) Solve $(D^4 - 4D^2 + 4)y = 0$. (2)

2. Transform the equation $\frac{\partial^2 u}{\partial x^2} + \frac{\partial^2 u}{\partial y^2} = 0$ into polar coordinates. (5)

3. Evaluate $\int_0^a \frac{\log(1 + ax)}{1 + x^2} dx$ and hence show that

$$\int_0^1 \frac{\log(1 + x)}{1 + x^2} dx = \frac{\pi}{8} \log_e 2.$$

(4+1)

4. Solve $(D^2 + a^2)y = \tan ax$. (5)

5. Solve by the method of variation of parameters.

$$\frac{d^2 y}{dx^2} - y = \frac{2}{1 + e^x}.$$

(5)

6. Solve in series the equation

$$x \frac{d^2 y}{dx^2} + \frac{dy}{dx} + xy = 0.$$

(5)