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BME-015

01121

BACHELOR OF TECHNOLOGY IN MECHANICAL ENGINEERING (COMPUTER INTEGRATED MANUFACTURING)

Term-End Examination

December, 2013

BME-015 : ENGINEERING MATHEMATICS-II

Time : 3 hours *Maximum Marks : 70*

Note : *Attempt **any ten** questions. All questions carry equal marks. Use of calculator is **permitted**.*

1. Test the following series for convergence. 7

$$\frac{x}{1.2}+\frac{x^2}{2.3}+\frac{x^3}{3.4}+\frac{x^4}{4.5}+\ldots\ldots\infty$$

2. Discuss the convergence of the series 7

$$x+\frac{2^2x^2}{2!}+\frac{3^3x^3}{3!}+\frac{4^4x^4}{4!}+\frac{5^5x^5}{5!}+\ldots\ldots\infty$$

3. A function is defined by : 7

$$f(x)=\begin{cases}\pi+x & -\pi<x<0\\ \pi-x & 0<x<\pi\end{cases}$$

$f(x+2\pi)=f(x)$

Obtain the fourier series.

4. A function $f(x)$ is defined over the interval $0 < x < \pi$ by 7

$$f(x) = \begin{cases} x & 0 < x < \frac{\pi}{2} \\ \pi - x & \frac{\pi}{2} < x < \pi \end{cases}$$

for the range $x = 0$ to $x = \pi$, determine the fourier sine series.

5. Find the real number x and y, so that $z_1 = z_2$, where 7

$z_1 = 3x + 5yi$; $z_2 = 2y + (3x + 3)i$

6. Evaluate the following integrals 7

$\int_c z^2 \, dz$ where C is the arc of the circle $|z| = 2$ from

$\theta = 0$ to $\theta = \frac{\pi}{3}$

7. If $2\cos\theta = x + \frac{1}{x}$ and $2\cos\phi = y + \frac{1}{y}$, show that 7

one of the values of $x^m \, y^n + \frac{1}{x^m \, y^n}$ is

$2\cos(m\theta + n\phi)$.

8. If tan log $(x+iy) = a+ib$, where $a^2+b^2 \neq 1$, show that tan log $(x^2+y^2) = \dfrac{2a}{1-a^2-b^2}$. 7

9. Show that the polar form of Cauchy - Riemann equations are 7

$$\frac{\partial u}{\partial r} = \frac{1}{r}\frac{\partial v}{\partial \theta}; \qquad \frac{\partial v}{\partial r} = -\frac{1}{r}\frac{\partial u}{\partial \theta}$$

Deduce that $\dfrac{\partial^2 u}{\partial r^2} + \dfrac{1}{r}\dfrac{\partial u}{\partial r} + \dfrac{1}{r^2}\dfrac{\partial^2 u}{\partial \theta^2} = 0$

10. Find the bilinear transformation which maps 1, i, -1 to 2, i, -2 respectively. 7

11. Prove that $\int_c \dfrac{1}{z-a}\,dz = 2\pi i$ where C is the circle $|z-a| = r$. 7

12. Solve $\dfrac{\partial^2 z}{\partial x^2} + \dfrac{\partial^2 z}{\partial x \partial y} - 6\dfrac{\partial^2 z}{\partial y^2} = y \cos x$ 7

13. Solve $(y+z)\,p - (x+z)\,q = x-y$. 7

14. Solve : **7**

$(D^2 - 5D + 6)\ y = e^x \cos 2x.$

15. Solve : **7**

$\sec^2 y \frac{dy}{dx} + x \tan y = x^3.$