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BME-015

00591

BACHELOR OF TECHNOLOGY IN MECHANICAL ENGINEERING (COMPUTER INTEGRATED MANUFACTURING)

Term-End Examination

December, 2010

BME - 015 : ENGINEERING MATHEMATICS-II

Time : 3 hours *Maximum Marks : 70*

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

1. Test the convergence or divergence of the series **7**

$$\sum_{n=1}^{\infty}\left[\sqrt{(n^2+1)}-n\right]$$

2. Test for convergence or divergence of the series **7**

$$\sum_{n=1}^{\infty}\frac{4.7....(3n+1)}{1.2...n}\,x^n$$

3. For a function $f(x)$ defined by **7**

$f(x) = |x|\,,\ -\pi\,,\ -\pi < x < \pi,$

obtain a fourier series.

4. Prove that **7**

$$x^2 = \frac{\pi^2}{3} + 4 \sum_{n=1}^{\infty} (-1)^n \frac{\cos nx}{n^2} \quad -\pi < x < \pi,$$

Hence show that $\sum \frac{1}{n^2} = \frac{\pi^2}{6}$,

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

show that one of the value of

$x^m y^n + \frac{1}{x^m y^n}$ is $2\cos(m\theta + n\phi)$.

6. If $\tan \log (x + iy) = a + ib$, **7**

where $a^2 + b^2 \neq 1$, show that

$$\tan \log (x^2 + y^2) = \frac{2a}{1 - a^2 - b^2}$$

7. 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 $\frac{\partial^2 u}{\partial r^2} + \frac{1}{r} \frac{\partial u}{\partial r} + \frac{1}{r^2} \frac{\partial^2 u}{\partial \theta^2} = 0$

8. Find the bilinear transformation which maps the points $Z = 1, i, -1$ into the points $\omega = 2, i, -2$ respectively. 7

9. Expand $f(Z) = \dfrac{1}{(Z-1)(Z-2)}$ in the region $|Z|>2$ 7

10. Determine the poles of the following functions and the residue at each pole : 7

$$\frac{Z^2 + 1}{Z^2 - 2Z}$$

11. The number N of bacteria in a culture grew at a rate proportional to N. The value of N was initially 100 and increased to 332 in one hour. What would be the value of N after 1½ hours ? 7

12. Solve 7

$$\tan y \frac{dy}{dx} + \tan x = \cos y \cos^2 x$$

13. Solve $(mz - ny)\, p + (nx - lz) qw = ly - mx$ 7

14. Solve $\dfrac{\partial^2 Z}{\partial x^2} + 3\dfrac{\partial^2 Z}{\partial x \partial y} + 2\dfrac{\partial^2 Z}{\partial y^2} = x + y$ 7

15. Find the solution of **7**

$$\frac{\partial^2 u}{\partial x^2} = h^2 \frac{\partial u}{\partial t}$$

for which $u(0, t) = u(l, t) = 0$

$u(x, 0) = \sin \frac{\pi x}{l}$ by method of variables separation.
