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**BME-015**

# B.Tech. MECHANICAL ENGINEERING (COMPUTER INTEGRATED MANUFACTURING)

01378

## Term-End Examination

## June, 2015

## BME-015 : ENGINEERING MATHEMATICS – II

*Time : 3 hours* *Maximum Marks : 70*

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

**1.** Discuss the convergence or divergence of the series $\sum_{n=1}^{\infty} \left\{ \sqrt{n^4+1} - \sqrt{n^4-1} \right\}$. 7

**2.** Test the series for convergence or divergence $\frac{1}{1\cdot 2\cdot 3} + \frac{3}{2\cdot 3\cdot 4} + \frac{5}{3\cdot 4\cdot 5} + \ldots$ 7

**3.** Find the Fourier series for the function f(x) in the interval $(-\pi, \pi)$, where

$$f(x) = \begin{cases} \pi + x, & -\pi < x < 0 \\ \pi - x, & 0 < x < \pi \end{cases}$$ 7

4. Find a series of cosines of multiple of x which will represent x sin x in the interval $(0, \pi)$. 7

5. If $2\cos\alpha = x + \frac{1}{x}$, $2\cos\beta = y + \frac{1}{y}$, prove that one of the values of $x^m y^n + \frac{1}{x^m y^n}$ is $2\cos(m\alpha + n\beta)$. 7

6. Find the modulus and principal argument of $\frac{1+2i}{1-(1-i)^2}$. 7

7. Determine the analytic function $f(z) = u + iv$, if $u = x^3 - 3xy^2 + 3x^2 - 3y^2 + 2x + 1$. 7

8. Find the Laurent's expansion of the function $f(z) = \frac{7z-2}{(z+1)z(z-2)}$ in the annulus $1 < |z+1| < 3$. 7

9. Prove that

$$\int_{-\infty}^{\infty} \frac{dx}{(x^2+b^2)(x^2+c^2)^2} = \frac{\pi(b+2c)}{2bc^3(b+c)^2},$$

where $b > 0, c > 0$. 7

10. For the conformal transformation $w = z^2$, show that

(a) coefficient of magnification at $z = 2 + i$ is $2\sqrt{5}$,

(b) the angle of relation at $z = 2 + i$ is $\tan^{-1}(0{\cdot}5)$. 7

11. Show that the differential equation

$(e^x \sin y - 2y \sin x)\,dx + (e^x \cos y + 2 \cos x)\,dy = 0$

is exact and hence find its general solution. 7

12. Use the method of variation of parameters to find a particular solution of

$$y'' + 2y' + y = e^{-x} \log x.$$ 7

13. Solve the differential equation

$$(D^2 + 2D + 5)\,y = e^{-x} \cos 2x.$$ 7

14. Find the general solution of the equation

$$yzp + zxq = xy.$$ 7

15. Solve $u_{xx} - u_y = 0$ by separation of variables. 7