B.Tech. MECHANICAL ENGINEERING (COMPUTER INTEGRATED MANUFACTURING)

01905

Term-End Examination

December, 2014

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. Show that the series

   "$\frac{1.2}{3^2.4^2} + \frac{3.4}{5^2.6^2} + \frac{5.6}{7^2.8^2} + \ldots\ldots\ldots$ converges ." 7

2. Discuss the convergence or divergence of the series

   $$1 + \frac{2^p}{2!} + \frac{3^p}{3!} + \frac{4^p}{4!} + \ldots\ldots\ldots$$ 7

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

4. Find the Fourier series to represent f(x), where 7

$$f(x) = \begin{cases} x & \text{for} \quad 0 < x < 1 \\ 0 & \text{for} \quad 1 < x < 2 \end{cases}$$

5. Find the modulus and principal argument of 7

$$\frac{(1+i)^2}{1-i}$$

6. Show that the function u is harmonic and find the conjugate function for $u = 2x - 3x^3 + 9xy^2$. 7

7. Simplify $\dfrac{(1+i)^6\,(1-i\sqrt{3})^4}{(1-i)^6\,(1+i\sqrt{3})^4}$. 7

8. Find the values of $\displaystyle\int_c \frac{e^z}{z^2+1}\,dz$, if c is a unit circle with centre at 7

(a) $z = i$;

(b) $z = -i$

9. Prove that $\displaystyle\int_0^\infty \frac{\cos mx}{a^2+x^2}\,dx = \frac{\pi}{2a}e^{-ma}$, $m \geq 0$. 7

10. Find the bilinear mapping that maps the points $z_1 = \infty$, $z_2 = i$, $z_3 = 0$ into the points $w_1 = 0$, $w_2 = i$ and $w_3 = \infty$. 7

11. Solve the differential equation 7

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

12. Use the method of variation of parameter to obtain a particular solution of 7

$$y'' + y = \tan x, \quad 0 < x < \pi/2.$$

13. Find the series solution on of the equation 7

$$2x^2y'' - xy' + (1 + x)y = 0$$

14. Solve the partial differential equation 7

$$\left(\frac{\partial}{\partial x} - \frac{\partial}{\partial y}\right)^2 u = e^{x+2y}$$

15. Solve Laplace's equation in rectangle with $u(0, y) = 0$, $u(a, y) = 0$, $u(x, b) = 0$ and $u(x, 0) = f(x)$. 7
