**PVP 14**

Code: CE1T1, ME1T1, CS1T1, IT1T1, EE1T1, EC1T1, AE1T1

**I B. Tech - I Semester – Regular / Supplementary Examinations**
**November 2017**

# ENGINEERING MATHEMATICS - I
**(Common for all Branches)**

Duration: 3 hours Max. Marks: 70

PART – A

Answer ***all*** the questions. All questions carry equal marks

11 x 2 = 22 M

1.

a) Solve $(x^2 - ay)dx = (ax - y^2)\, dy$.

b) State Newton's law of cooling.

c) Express $e^x$ as powers of $x$.

d) State Rolle's theorem.

e) Find the particular integral of $(D^2 - 1)y = e^{2x}$.

f) Evaluate $\int_0^1 \int_x^{\sqrt{x}} (x^2 + y^2)\, dy\, dx$.

g) Show that $div\, \vec{r} = 3$

h) Show that $curl(grad\, \varphi) = \bar{0}$.

i) Using Green's theorem, find the area of the ellipse $x = a\cos\theta, y = b\sin\theta, 0 \le \theta \le 2\pi$.

j) Write the normal equations of a straight line $y = ax + b$.

k) Calculate $\Gamma\left(-\frac{3}{2}\right)$.

## PART – B

Answer any ***THREE*** questions. All questions carry equal marks.

3 x 16 = 48 M

2.a) Show that the family of con-focal conics $\frac{x^2}{a^2+\lambda}+\frac{y^2}{b^2+\lambda}=1$ is selforthogonal. Where $\lambda$ is parameter. 8 M

b) Solve: $(D^2-2D+1)y = xe^x \sin x$. 8 M

3.a) Using Lagrange's mean value theorem, prove that

$$\frac{b-a}{1+b^2} < \tan^{-1} b - \tan^{-1} a < \frac{b-a}{1+a^2}.$$

Hence deduce that $\frac{\pi}{4}+\frac{3}{25} < \tan^{-1}\frac{4}{3} < \frac{\pi}{4}+\frac{1}{6}$.

Given that 0<a<b<1. 8 M

b) A rectangular box open at the top is to have volume 32 cubic feet. Find the dimensions of the box requiring least material for its construction. 8 M

4.a) Calculate $\iint r^3 \, dr \, d\theta$ over the area included between the circles $r = 2\sin\theta$ and $r = 4\sin\theta$. 8 M

b) Change the order of integration in $I = \int_0^{4a} \int_{\frac{x^2}{4a}}^{2\sqrt{ax}} dy\,dx$ and hence evaluate. 8 M

5. a) Find the directional derivative of $\varphi = x^2 y + 4xz^2$ at the point $(1, -2, 1)$ in the direction of the vector $2i - j - 2k$.
8 M

b) Use divergence theorem to evaluate $\iint_S \vec{F} \cdot \hat{n} \, ds$ where $\vec{F} = 4xi - 2y^2 j + z^2 k$ and **'S'** is the surface of the cylinder $x^2 + y^2 = 4, Z = 0 \; and \; Z = 3$ 8 M

6. a) By the method of least squares find the equation of the straight line that best fits the following data. 8 M

| | | | | | |
|---|---|---|---|---|---|
| x | 1 | 2 | 3 | 4 | 5 |
| Y | 14 | 27 | 40 | 55 | 68 |

b) Define Beta and Gamma functions, then show that $\beta(m,n) = \frac{\Gamma(m)\Gamma(n)}{\Gamma(m+n)}$. 8 M