

SECOND SEMESTER DIPLOMA EXAMINATION IN ENGINEERING/  
TECHNOLOGY—OCTOBER, 2014

TECHNICAL MATHEMATICS – II  
(Common – Except DCP and CABM)

[Time : 3 hours

(Maximum marks : 100)

Marks

PART—A  
(Maximum marks : 10)

I Answer all questions. Each question carries 2 marks :

- Evaluate  $\lim_{\theta \rightarrow 0} \frac{\sin 6\theta}{\theta}$
- Find velocity and acceleration at time  $t$  of a particle moving according as  $S = t^2 + 2t + 1$ .
- What is the slope of a curve  $y = \sin x$  at  $x = \pi/2$ .
- Evaluate  $\int \sec^2 x \, dx$ .
- Evaluate  $\int_1^2 dx$ . (5×2=10)

PART—B  
(Maximum marks : 30)

II Answer any five questions. Each question carries 6 marks.

- Prove that (a)  $\int \operatorname{cosec} x \, dx = \log (\operatorname{cosec} x - \cot x) + C$ .  
(b)  $\int_0^{\pi/4} \tan x \, dx = \log \sqrt{2}$ .
- If  $y = x \cos x$ , show that  $y'' + y + 2 \sin x = 0$ .
- Find the area enclosed between one arc of the curve  $y = \sin x$  and the  $x$ -axis.
- A wire of length 'a' is cut into 2 parts which are bend in the form of a circle and a square. Show that the least value of the sum of the areas so formed is  $\frac{a^2}{4(\pi+4)}$ .
- Solve  $dy/dx + 2y \cot x = 3x^2 \operatorname{cosec}^2 x$ .
- The ellipse  $x^2/9 + y^2/4 = 1$  is rotated about the  $x$  axis. Find the volume of the solid formed.
- Evaluate (a)  $\lim_{x \rightarrow 1} \frac{2x+3}{x^2-3x+4}$  (b)  $\lim_{x \rightarrow a} \frac{x^{1/2} - a^{1/2}}{x^{1/3} - a^{1/3}}$  (5×6=30)

## PART—C

(Maximum marks : 60)

(Answer *one* full question from each unit. Each full question carries 15 marks)

## UNIT—I

- III (a) Differentiate  $\cos x$  using 1<sup>st</sup> principle method. 5
- (b) Find  $dy/dx$  if  $y = \frac{x^2 + 1}{\sqrt{x}}$  5
- (c) If  $y = \sin^{-1} x$ , show that  $dy/dx = 1/\sqrt{1-x^2}$ . 5

OR

- IV (a) Find  $dy/dx$  if  $x^2 y^2 = x^3 + y^3 + 3xy$ . 5
- (b) Find  $dy/dx$  if  $x = a(\cos t + t \sin t)$ ,  $y = a(\sin t - t \cos t)$ . 5
- (c) If  $y = a \cos(\log x) + b \sin(\log x)$ . Prove that  $xy'' + xy' + y = 0$ . 5

## UNIT—II

- V (a) Find turning values of  $y = 2(10x - x^2)$ . 5
- (b) A cylindrical can open at one end is to have a volume of  $64\pi \text{ cm}^3$ . Find the radius and height so that the metal used is a minimum. 5
- (c) Find equation of tangent and normal to  $y = x^2 + x + 1$  at (2,7). 5

OR

- VI (a) Find the values of  $x$  for which the tangent to the curve  $y = x/(1+x^2)$  will be parallel to the  $x$ -axis. 5
- (b) Find the maximum area of a rectangle whose perimeter is 1 units. 5
- (c) A spherical balloon is inflated with air such that its volume increases  $5 \text{ cc/sec}$ . Find the rate at which its curved surface is increasing when its radius is 7 cm. 5

## UNIT—III

## VII Evaluate

1.  $\int \left( \frac{2 + 3 \sin x}{\cos^2 x} \right) dx$ . 3
2.  $\int x^2 (x-1)^2 dx$  3
3.  $\int \tan^{-1} x dx$ . 4
4.  $\int_0^{\pi/2} \sin 3x \cos x dx$ . 5

OR

VIII Integrate :

- |                              |   |
|------------------------------|---|
| 1. $\int \sqrt{2x+3} \, dx.$ | 3 |
| 2. $\int x \cos x^2 \, dx.$  | 3 |
| 3. $\int \sin^3 x \, dx.$    | 4 |
| 4. $\int x^2 e^{-2x} \, dx.$ | 5 |

## UNIT—IV

- |   |   |
|---|---|
| IX (a) Solve $dy/dx = \frac{1+y^2}{1+x^2}.$   | 5 |
| (b) Find the area bounded by $y = x + \sin x$ , x axis and the ordinates at $x = 0, x = \pi/2.$ | 5 |
| (c) Find the volume of a sphere of radius r using integration.                                  | 5 |

OR

- |   |   |
|---|---|
| X (a) Solve $\frac{dy}{dx} + \sin x. y = \cos x.$               | 5 |
| (b) Find the area under the curve $y = x^2 + x$ and the x axis. | 5 |
| (c) Find the area enclosed between $y = x^2$ and $y = x + 2.$   | 5 |