ROLL NO. \_\_\_\_\_

Code: DE51/DC51/DE101/DC101 Subject: ENGINEERING MATHEMATICS-I

## **Diplete – ET/CS (Current & New Scheme)**

Time: 3 Hours

JUNE 2015

Max. Marks: 100

 $(2 \times 10)$ 

PLEASE WRITE YOUR ROLL NO. AT THE SPACE PROVIDED ON EACH PAGE IMMEDIATELY AFTER RECEIVING THE QUESTION PAPER.

NOTE: There are 9 Questions in all.

- Question 1 is compulsory and carries 20 marks. Answer to Q.1 must be written in the space provided for it in the answer book supplied and nowhere else.
- The answer sheet for the Q.1 will be collected by the invigilator after 45 minutes of the commencement of the examination.
- Out of the remaining EIGHT Questions answer any FIVE Questions. Each question carries 16 marks.
- Any required data not explicitly given, may be suitably assumed and stated.

## Q.1 Choose the correct or the best alternative in the following:

- a. The value of  $\frac{\lim}{\theta \to 0} \frac{\sin a\theta}{\sin b\theta}$ , where a and b are fixed non zero real numbers, is
- (A) 1 (B)  $\frac{a}{b}$ (C)  $\frac{-a}{b}$ (D) None of these b. The value of  $\frac{d}{dx}(\log_a x)$  is (A)  $\frac{1}{x}$ (B)  $\frac{-1}{x}$ (C)  $\frac{\log_a e}{x}$ (D) None of these c. The value of  $\int_{0}^{1} x e^x dx$  is (A) 1 (B) 2

d. If A= diag. (2, 5, -3), B = diag. (-1,6,4), then the value of 3A - 4B + 4I is

( <b>A</b> ) diag. (12, 7, -13)	<b>(B)</b> diag. (-1, 1, 1)
( <b>C</b> ) diag. (0, 1, 0)	( <b>D</b> ) None of these

e. The differential equation of the family of curves  $y = e^x (A \cos x + B \sin x)$ , where A and B are arbitrary constants, is

(C) None of these

**(C)** -2

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- (A)  $\frac{dy}{dx} + Ax + By = 0$ (**B**)  $\frac{dy}{dx} - Ax - By = 0$ (C)  $\frac{d^2 y}{dr^2} 2\frac{dy}{dr} + 2y = 0$ (D) None of these
- f. Three arithmetic means between 3 and 19 are
  - (A) 1, 2, 3 **(B)** 7, 11, 15 (C) 5, 7, 11 (**D**) None of these
- g. If  $\sin A = \frac{3}{5}$  and  $\cos B = \frac{9}{41}$  where  $0 < A < \frac{\pi}{2}$ ,  $0 < B < \frac{\pi}{2}$  then the value of cos (A-B) is

(A) 
$$\frac{106}{107}$$
 (B)  $-\frac{156}{205}$   
(C)  $\frac{156}{205}$  (D) None of these

h. The angle between the pair of line represented by  $x^2 - 5xy + 4y^2 + 3x - 4 = 0$ is

(A) 
$$45^{\circ}$$
 (B)  $\tan^{-1}\left(\frac{3}{5}\right)$   
(C)  $\sin^{-1}\left(\frac{1}{3}\right)$  (D) None of these

i. If (-1, 2) and (4, -3) are the coordinates of the end points of the diameter of any circle, then the equation of circle is

(A) $x^2 + y^2 - 3x + y - 10 = 0$	<b>(B)</b> $x^2 + y^2 = a^2$
(C) $x^2 + y^2 + 2gx + 2fy + c = 0$	( <b>D</b> ) None of these

j. The equation of tangent to the parabola  $y^2 = 9x$  at (4,6) is

$(A) \ 9x - 12y + 36 = 0$	<b>(B)</b> $x + y + a = 0$
(C) $4x+3y-34=0$	( <b>D</b> ) None of these

## Answer any FIVE Questions out of EIGHT Questions. Each question carries 16 marks.

**Q.2** a. Differentiate the following functions:  
(i) 
$$x^n e^x \log_e x$$
(ii)  $\cos ec^{-1} \left( \frac{x^2 + 1}{x^2 - 1} \right) + \cos^{-1} \left( \frac{x^2 - 1}{x^2 + 1} \right)$ 
  
b. If  $y = \sin(m \sin^{-1} x)$ , then prove that

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$$y = \sin(m \sin^{-1} x)$$
, then prove that  
 $(1 - x^2)y_{n+1} = (2n+1)xy_{n+1} + (n^2 - m^2)y_n.$ 
(8)

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Q.3 Evaluate  
a. 
$$\int \frac{\sin x}{\sin(x-a)} dx$$
 (8)  
b.  $\int_{0}^{\frac{\pi}{2}} \cos^{7} x dx$  (8)

b. Find the adjoint of the matrice A, where

$$\mathbf{A} = \begin{bmatrix} 1 & -1 & 2 \\ 2 & 3 & 5 \\ -2 & 0 & 1 \end{bmatrix}$$
(8)

Q.5 a. How many arrangements can be made with the letters of the word MATHEMATICS? In how many of them vowels are together? (8)

b. Find the middle terms in the expansion of 
$$\left(3x - \frac{x^3}{6}\right)^7$$
. (8)

**Q.6** a. Find the equation of the ellipse, whose foci and eccentricity are  $(\pm 2,0)$  and  $\frac{1}{2}$ . (8)

- b. Find the equation to the circle, which passes through the point (-2, 4) and through the points in which the circle  $x^2 + y^2 2x 6y + 6 = 0$  is cut by the line 3x + 2y 5 = 0. (8)
- Q.7 a. Find the equation of the line which passes through the point (3,4) and the sum of its intercepts on the axes is 14. (8)
  - b. Find the area of a triangle whose vertices are A (3,2), B (11,8) and C (8,12).(8)
- **Q.8** a. Find the differential equation of all circles in xy plane. (8)
  - b. Solve the differential equation  $\frac{dy}{dx} + \frac{1 + \cos 2y}{1 \cos 2x} = 0.$  (8)
- **Q.9** a. Prove that  $\cos 80^{\circ} \cos 60^{\circ} \cos 40^{\circ} \cos 20^{\circ} = \frac{1}{16}$  (8)
  - b. If  $A + B + C = \pi$ , Prove that  $\sin 2A + \sin 2B + \sin 2C = 4 \sin A \sin B \sin C$  (8)