ROLL NO. _____

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

## DipIETE – ET/CS (Current & New Scheme)

**Time: 3 Hours** | Jun-2018 | **Max. Marks: 100**

***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.**

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**Q.1 Choose the correct or the best alternative in the following:**a **(2×10)**

a. If $y = x^2 - \cos x - \frac{1}{x^2}$, then $\frac{dy}{dx}$ is,

**(A)** $x - \cos x + \frac{2}{x^3}$ **(B)** $2x - \sin x + \frac{2}{x^3}$

**(C)** $2x + \sin x - \frac{2}{x^3}$ **(D)** $2x + \sin x + \frac{2}{x^3}$

b. Let A and B be two matrices, then the relation $(AB)^n = A^n B^n$, if

**(A)** AB = BA **(B)** $AB \neq BA$

**(C)** A = B **(D)** $A^{-1} = B$

c. 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

**(A)** $\frac{dy}{dx} + Ax + By = 0$ **(B)** $\frac{dy}{dx} - Ax - By = 0$

**(C)** $\frac{d^2y}{dx^2} 2\frac{dy}{dx} + 2y = 0$ **(D)** None of these

d. 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

e. . If $\Delta = \begin{vmatrix} 2x-1 & x+7 & x+4 \\ x & 6 & 2 \\ x-1 & x+1 & 3 \end{vmatrix}$, then the value of $\Delta$ in the respect of x is equal to,

**(A)** 2, 3, 5
**(B)** 1, 3, 4
**(C)** 1, 2, 3
**(D)** 1, 2, 4

f. The order (O) and degree (D) of differential equation of $y\frac{d^2x}{d^2y} = y^2 + 1$ is

**(A)** O = 2, D = 1 **(B)** O= 0, D = 1
**(C)** O = 1, D = 1 **(D)** O = 1, D = 2

g. $\int \sin^2 x.\cos^2 x \, dx$ is equal to

**(A)** $\frac{1}{8}\left(x - \frac{\sin 4x}{4}\right) + c$ **(B)** $\frac{1}{8}\left(x + \frac{\sin 4x}{4}\right) + c$
**(C)** $\frac{1}{8}\left(x - \frac{\cos 4x}{4}\right) + c$ **(D)** $\frac{1}{8}\left(x + \frac{\cos 4x}{4}\right) + c$

h. The solution of the differential equation $\frac{dy}{dx} = xy^2 - xy$ is equal to

**(A)** $\log\frac{y-1}{y} = \frac{x^2}{2} + c$ **(B)** $\log\frac{y-1}{y} = x + 2 + c$
**(C)** $\log\frac{y+1}{y} = \frac{x^2}{2} + c$ **(D)** $\log\frac{y+1}{y} = x - 2 + c$

i. . If $y = \tan^{-1}\left(\frac{\cos x}{1+\sin x}\right)$ then $\frac{dy}{dx}$ is

**(A)** $-\frac{1}{2}$ **(B)** $\frac{1}{2}$
**(C)** 1 **(D)** –1

j. The equation of the line which makes intercepts –4 and 5 on the axis is:

**(A)** 4x + 5y + 20 = 0 **(B)** 4x – 5y + 20 = 0
**(C)** 5x – 4y + 20 = 0 **(D)** 5x + 4y + 20 = 0

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

**Q.2** a. Differentiate the following functions: **(8)**

(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. Find the equation of the tangent to the curve $x^2+2y=8$ which is perpendicular to the line $x-2y+1=0$. **(8)**

**Q.3** a. Evaluate $\int x\cos^3 x dx$ **(8)**

b. Evaluate $\int \frac{1}{\sqrt{x(1-2x)}}dx$ **(8)**

**Q.4** a. Apply Cramer's rule to solve the following system of linear equations:

$3x - 2y + 4z = 5$
$x + y + 3z = 2$
$-x + 2y - z = 1$ **(8)**

b. Show that

$$\begin{vmatrix} a & b & c \\ a^2 & b^2 & c^2 \\ b+c & c+a & a+b \end{vmatrix} = (b-c)(c-a)(a-b)(a+b+c)$$ **(8)**

**Q.5** a. Solve the differential equation $(x + y)\,dy + (x - y)\,dx = 0$ given that $y = 1$ when $x = 1$ **(8)**

b. Solve the differential equation $\frac{dy}{dx}+\frac{1+\cos 2y}{1-\cos 2x}=0.$ **(8)**

**Q.6** a. Find the term independent of x in the expansion of $\left(2x^2-\frac{1}{x}\right)^{12}$ **(8)**

b. Find three numbesı in A.P. whose sum is 21 and their product is 315. **(8)**

**Q.7** a. Prove that, $\cos 2A.\cos 2B + \sin^2(A-B) - \sin^2(A+B) = \cos(2A+2B)$ **(8)**

b. If $A+B+C=\pi$, prove that $\cot\frac{A}{2}+\cot\frac{B}{2}+\cot\frac{C}{2}=\cot\frac{A}{2}\cot\frac{B}{2}\cot\frac{C}{2}$ **(8)**

**Q.8** a. Find the equation of the lines through the origin and making an angle of $60^\circ$ with the line $x+y\sqrt{3}+3\sqrt{3}=0$ **(8)**

b. Find the area of the triangle formed by the lines $y=x$, $y=2x$ and $y=3x+4$ **(8)**

**Q.9** a. 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)**

b. Find the equation of the parabola with focus (3, -4) and the directrix $6x-7y+5=0$ **(8)**