

Dr. Babasaheb Ambedkar Technological University's  
Institute of Petrochemical Engineering, Lonere -Raigad  
MID SEMESTER EXAMINATION - MARCH 2018

Sem. II (All Courses)

Subject: Applied Mathematics (DMA 1201)

Marks: 30

Date: 15 March 2018

Time: 12.30 - 2.00 p.m.

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Q.I) Solve any **FIVE** of the following. (10)

1) If  $f(x) = x^2 + 6x + 10$ , find the value of  $f(2) + f(-2)$ .

2) If  $f(x) = a^x$ , show that  $f(m+n) = f(m)f(n)$ .

3) Evaluate:  $\lim_{x \rightarrow 0} \frac{\sqrt{1+x} + \sqrt{1-x}}{x+1}$ .

4) Evaluate:  $\lim_{x \rightarrow 0} \frac{\sin 5x}{\tan 4x}$ .

5) Find  $\frac{dy}{dx}$  if  $y = x^3 - \sin x + 2$ .

6) Find  $\frac{dy}{dx}$  if  $y = x \log x$ .

Q.II) Solve any **FOUR** of the following. (20)

1) State whether the function  $f(x) = x^4 - 5x^2 + x \sin x$  is even or odd.

2) Evaluate :  $\lim_{x \rightarrow 0} \frac{\sqrt{1+x} - \sqrt{1-x}}{x}$ .

3) Find  $\frac{dy}{dx}$  if  $y = \frac{1 + \log x}{1 - \log x}$ .

4) Differentiate  $x^x$  with respect to  $x$ .

5) Evaluate:  $\int \left( \frac{1}{49 - 4x^2} - \frac{1}{x\sqrt{x^2 - 25}} \right) dx$ .

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Dr. Babasaheb Ambedkar Technological University's  
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End Semester Examination - April 2018

Sem. II (All Courses)                      Subject: Applied Mathematics (DMA 1201)  
Marks: 70                                      Date: 27 April 2018                      Time: 3 Hours

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- Note :** 1) Question No. 1 is compulsory.  
2) Attempt any **FIVE** questions from Question No. 2 to Question No. 7.  
3) Necessary data is given in the respective questions. If such data is not given, it means that the knowledge of that data is a part of examination.  
4) If some part or parameter is noticed to be missing, you may appropriately assume and mention it clearly.
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Q.1) Solve any **Five** of the following: (10)

a) Find the value of a, if  $f(x) = ax + 10$  and  $f(1) = 13$ .

b) Evaluate:  $\lim_{x \rightarrow 6} \frac{x^3 - 216}{x - 6}$ .                      c) Evaluate:  $\int \frac{dx}{4 - x^2}$ .

d) Find the value of k if  $\int_0^1 (3x^2 + 2x + k) dx = 0$ .

e) State the order and degree of a differential equation  $x^2 \left( \frac{d^2 y}{dx^2} \right)^2 + y \left( \frac{dy}{dx} \right)^3 + x^2 = 0$ .

f) Find  $L(e^{3t} \sin 2t)$ .

Q.2) a) If  $f(x) = \tan x$ , show that  $f(x + y) = \frac{f(x) + f(y)}{1 - f(x)f(y)}$ . (4)

b) If  $f(x) = \sin^{-1} x$  and  $\phi(x) = \sin x$ , show that  $f[\phi(x)] = \phi[f(x)]$ . (4)

c) Evaluate:  $\lim_{x \rightarrow 1} \frac{x^2 - 7x + 6}{x^2 - 4x + 3}$ . (4)

Q.3) a) Evaluate:  $\lim_{x \rightarrow 0} \frac{\cos 5x - \cos 3x}{x^2}$ . (4)

b) Evaluate:  $\lim_{x \rightarrow \infty} \left( \frac{x+3}{x+2} \right)^x$ . (4)

c) Find  $\frac{dy}{dx}$  if  $x = at^2$  and  $y = 2at$ . (4)

Q.4) a) Find  $\frac{dy}{dx}$  if  $x^{2/3} + y^{2/3} = a^{2/3}$ . (4)

b) Divide 70 into two parts so that the sum of their squares is minimum. (4)

c) Evaluate:  $\int \frac{dx}{\cos^2 x \sin^2 x}$ . (4)

Q.5) a) Evaluate:  $\int \frac{\sin \sqrt{x}}{\sqrt{x}} dx$ . (4)

b) Evaluate:  $\int e^x \frac{(x+2)}{(x+3)^2} dx$ . (4)

c) Evaluate:  $\int_0^3 \frac{\sqrt{3-x}}{\sqrt{x} + \sqrt{3-x}} dx$ . (4)

Q. 6) a) Form the differential equation by eliminating arbitrary constants from the relation  $y = A \sin x + B \cos x$ . (4)

b) Solve the differential equation:  $\sin x \cos y dy + \sin y \cos x dx = 0$ . (4)

c) Solve the differential equation:  $\frac{dy}{dx} + y \cot x = \cos x$ . (4)

Q.7) a) Find  $L(3 \cos 6t - 5 \sin 6t)$ . (4)

b) Solve the differential equation  $\frac{dx}{dt} + x = 3$ ,  $x(0) = 2$  by Laplace Transform. (4)

c) A person fires 10 shots at target. The probability that any shot will hit the target is  $\frac{3}{5}$ . Find the probability that the target is hit exactly 5 times. (4)

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Marks: 70

Date: 27 April 2018

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**Note :** 1) Question No. 1 is compulsory.

2) Attempt any **FIVE** questions from Question No. 2 to Question No. 7.

3) Necessary data is given in the respective questions. If such data is not given, it means that the knowledge of that data is a part of examination.

4) If some part or parameter is noticed to be missing, you may appropriately assume and mention it clearly.

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Q.1) Solve any **Five** of the following: (10)

a) If  $f(x) = \log x$ , show that  $f\left(\frac{m}{n}\right) = f(m) - f(n)$ .

b) Evaluate:  $\lim_{x \rightarrow 2} \left( \frac{x}{x-2} - \frac{4}{x^2-2x} \right)$ .

c) Find  $\frac{dy}{dx}$  if  $y = x^2 \sin x$ .

d) Evaluate:  $\int e^x (\sin x + \cos x) dx$ .

e) Find the integrating factor of a differential equation  $\frac{dy}{dx} + y \cot x = \cos x$ .

f) Find  $L(6 - \sin 2t)$ .

Q. 2) a) Determine whether the function  $f(x) = \log\left(x + \sqrt{x^2 + 1}\right)$  is even or odd. (4)

b) Find  $f(t)$  if  $f(x) = \frac{2x+5}{3x-4}$  and  $t = \frac{5+4x}{3x-2}$ . (4)

c) Evaluate:  $\lim_{x \rightarrow 2} \frac{x^5 - 32}{x^3 - 8}$ . (4)

Q.3) a) Evaluate:  $\lim_{x \rightarrow 0} \left( \frac{3 \sin x + 4x}{7x - 2 \tan x} \right)$ . (4)

b) Evaluate:  $\lim_{x \rightarrow 0} \frac{5^x - 4^x}{\tan 2x}$ . (4)

c) Find  $\frac{dy}{dx}$  if  $y = e^x (\sin x + \cos x)$ . (4)

Q.4) a) Find  $\frac{dy}{dx}$  if  $y = \frac{1 - \cos 2x}{\sin 2x}$ . (4)

b) Find the radius of curvature of the curve  $y = \log(\sin x)$  at  $x = \pi/2$ . (4)

c) If  $f'(x) = \frac{1}{x} + \frac{1}{1+x^2}$ , and  $f(1) = \frac{\pi}{4}$ , find  $f(x)$ . (4)

Q.5) a) Evaluate:  $\int \frac{x+1}{x^2+2x+7} dx$ . (4)

b) Evaluate:  $\int x \sec^2 x dx$ . (4)

c) Find the area bounded by the curve  $y = 2x - x^2$  and the  $x$  - axis. (4)

Q.6) a) Verify that  $y = mx$  is a solution of  $(x^2 - 1) \left( \frac{dy}{dx} \right)^2 - 2xy \frac{dy}{dx} + (y^2 + m^2) = 0$ . (4)

b) Solve the differential equation :  $1 + \frac{dy}{dx} = \operatorname{cosec}(x+y)$ . (4)

c) Solve the differential equation:  $\cos^2 x \frac{dy}{dx} + y = \tan x$ . (4)

Q.7) a) State First Shifting Property and find  $L(e^{2t}t^3)$ . (4)

b) Find  $L^{-1} \left[ \frac{1}{s(s+4)} \right]$ . (4)

c) A company manufactures electric motors. The probability of an electric motor is defective is 0.01. What is the probability that a sample of 300 electric motors will contain exactly 5 defective motors? [Given  $e^{-3} = 0.0498$ ] (4)

ALL THE BEST