

F.Y. Diploma : Sem. II  
[AE/CH/FG/ME/PT/PG]  
**Applied Mathematics**  
Prelim Question Paper



Time: 3 Hrs.]

[Marks : 70]

- Instructions :**
- (1) All Questions are Compulsory.
  - (2) Answer each next main Question on a new page.
  - (3) Illustrate your answers with neat sketches wherever necessary.
  - (4) Non Programmable pocket calculator is allowed.
  - (5) Programmable pocket calculator is not allowed.
  - (6) Figures to the right indicate full marks.
  - (7) Mobile Phone, Page and any other Electronic Communication devices are not permissible in Examination Hall.

1. Attempt any **FIVE** of the following : [10]

- (a) Define Even and odd functions.
- (b) If  $f(x) = x^3 - 3x^2 + 5$ , find  $f(0) + f(3)$
- (c) Find  $\frac{dy}{dx}$  if  $y = e^x \tan^{-1} x$
- (d) Evaluate  $\int x \sin x \, dx$
- (e) Evaluate  $\int \frac{1}{1 + \cos 2x} \, dx$
- (f) Find the area bounded by the curve  $y = x^3$ ,  $x$  axis and the ordinates  $x = 1$ ,  $x = 3$
- (g) Three unbiased coins are tossed. What is the probability of getting exactly two heads.

2. Attempt any **THREE** of the following : [12]

- (a) Find  $\frac{dy}{dx}$  if  $x^2 + y^2 - xy - 2x + 5y - 6 = 0$  at  $(1, 2)$
- (b) If  $x = a \cos^3 \theta$ ,  $y = b \sin^3 \theta$ , find  $\frac{dy}{dx}$  at  $\theta = \frac{\pi}{4}$
- (c) If  $I_1$  and  $I_2$  be the currents and  $R_1$  and  $R_2$  be two resistances in parallel to the total current  $I = I_1 + I_2$  which is constant. Then the heat developed in a circuit is given by  $H = \frac{1}{J} (I_1^2 R_1 t + I_2^2 R_2 t)$ . Show that heat developed in a circuit is minimum if  $I_1 R_1 = I_2 R_2$  where  $R_1, R_2, t, J$  are constants.
- (d) A beam is bent in the form of the curve  $y = 2 \sin x - \sin 2x$ . find the radius of curvature at  $x = \frac{\pi}{2}$

3. Attempt any **THREE** of the following : [12]

- (a) Find the equation of tangent & normal to the curve  $x^2 + 3xy + y^2 = 5$  at  $(1, 1)$
- (b) If  $e^y = y^x$  prove that  $\frac{dy}{dx} = \frac{(\log y)^2}{\log y - 1}$ .
- (c) Find  $\frac{dy}{dx}$  if  $y = x^{\sin x} + (\tan x)^x$
- (d) Evaluate :  $\int \frac{(\tan^{-1} x)}{1 + x^2} \, dx$

4. Attempt any **THREE** of the following :

[12]

- (a) Evaluate :  $\int \frac{e^x(x+1)}{\cos^2(xe^x)} dx$
- (b) Evaluate :  $\int \frac{dx}{5+4\cos x}$
- (c) Evaluate :  $\int x \cdot \tan^{-1} x \, dx$
- (d) Evaluate :  $\int \frac{\cos x}{(2+\sin x)(3+\sin x)} dx$
- (e) Evaluate :  $\int_{\pi/6}^{\pi/3} \frac{dx}{1+\sqrt[n]{\cot x}}$

5. Attempt any **TWO** of the following :

[12]

- (a) Find the area between the parabola  $y^2 = 4x$  and  $x^2 = 4y$
- (b) (i) Form a Differential Equation for  $y = A \sin mx + B \cos mx$
- (ii) Solve :  $\frac{dy}{dx} + \frac{y}{x} = \sin x$
- (c) The quantity of charge of coulombs passes through a conducting wire during small interval of time  $t$  sec is given by  $\frac{dq}{dt} = i$ , where  $i$  is current in ampere. If  $i = 10 \sin 100t$  and that  $q = 0$ ,  $t = 0$ . Find the charge at time  $t$ .

6. Attempt any **TWO** of the following :

[12]

- (a) (i) In sampling a large number of parts manufactured by a machine, the mean number of defective in a sample of 20 is 2. Out of 1000 such samples. How many would be expected to contain atleast 3 defective parts.
- (ii) Assuming that 2 in 10 industrial accidents are due to fatigue. Find the probability that exactly 2 out of 8 accidents will be due to fatigue.
- (b) In a test of 2000 electric bulbs, it was found that the life of particular make was normally distributed with average life of 2040 hours and standard deviation of 60 hours. Estimate the number of bulbs likely to burn for
- (a) between 1920 hours and 2160 hours
- (b) more than 2150 hours
- Given  $A(2) = 0.4772$ ,  $A(1.83) = 0.4664$
- (c) The number of road accidents met with by taxi drivers follow Poisson Distribution with mean 2. Out of 5000 taxis in the city. Find number of drivers.
- (i) Who do not meet with accident
- (ii) Who met with an accident more than 3 times given :  $e^{-2} = 0.1353$

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**Paper Discussion Schedule for: F.Y. Diploma Sem. -II**

| Date         | Day    | Timing            | Centre                           |
|--------------|--------|-------------------|----------------------------------|
| 8 April 2018 | Sunday | 9 a.m. to 11 a.m. | Dadar ,Borivali, Nerul and Thane |
| 8 April 2018 | Sunday | 3 p.m.to 5 p.m.   | Kalyan                           |