

**3E1416**

Roll No. : \_\_\_\_\_

Total Printed Pages : **4**

**3E1416**

**B. Tech. (Sem. III) (Main / Back) Examination, February - 2012**  
**Automobile Engg.**

**3AE6 Advanced Engineering Mathematics (Common for ME / PI)**

Time : 3 Hours]

[Total Marks : 80

[Min. Passing Marks : 24

**Instructions to Candidates :**

Attempt any **five questions** selecting **one question** from each **unit**. All questions carry **equal marks**. Schematic diagrams must be shown wherever necessary. Any data you feel missing suitably be assumed and stated clearly. Units of quantities used/calculated must be stated clearly.

Use of following supporting material is permitted during examination.  
(Mentioned in form No. 205)

1.       NIL      

2.       NIL      

**UNIT - I**

1 (a) Find the Fourier series for the function  $f(x) = x + x^2$  in the interval  $-\pi < x < \pi$ . Hence show that

$$\frac{\pi^2}{6} = 1 + \frac{1}{2^2} + \frac{1}{3^2} + \dots$$

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(b) Obtain the expansions for  $y$  from the following table upto the first harmonic :

$x:$	0	1	2	3	4	5
$y:$	9	18	24	28	26	20

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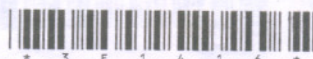
**OR**

1 (a) Find half-range cosine series for the function

$$f(x) = \begin{cases} kx & 0 \leq x \leq \ell/2 \\ k(\ell - x) & \ell/2 \leq x \leq \ell \end{cases}$$

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[Contd...

- (b) A tightly stretched string with fixed end points  $x=0$  and  $x=l$  is initially in a position given by

$$y = y_0 \sin^3 \frac{\pi x}{l}$$

It is released from rest from this position. Find the displacement  $y(x, t)$ .

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### UNIT - II

- 2 (a) Find the inverse Laplace transform of  $\log \frac{s+2}{s+1}$ .

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- (b) Use Laplace transform to solve

$$\frac{d^2 y}{dt^2} + 9y = \cos 2t$$

given that  $y(0)=1$  and  $y\left(\frac{\pi}{2}\right)=-1$ .

OR

- 2 (a) Apply convolution theorem to obtain

$$L^{-1} \left[ \frac{s^2}{(s^2+4)(s^2+9)} \right]$$

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- (b) Use Laplace transform to solve  $\frac{d^3 y}{dt^3} - 3\frac{d^2 y}{dt^2} + 3\frac{dy}{dt} - y = t^2 e^t$ ,

given that  $y(0)=1$ ,  $y'(0)=0$  and  $y''(0)=-2$ .

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### UNIT - III

- 3 (a) Find the value of  $J_{5/2}(x)$  in terms of sine and cosine of  $x$ .

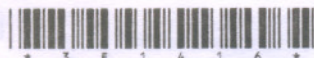
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- (b) Show that

$$\int_{-1}^1 x P_n(x) P_{n-1}(x) dx = \frac{2n}{(2n-1)(2n+1)}$$

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OR



- 3 (a) Show that

$$\frac{d}{dx} [xJ_n(x)J_{n+1}(x)] = x[J_n^2(x) - J_{n+1}^2(x)]$$

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- (b) Use Rodrigue's formula to evaluate  $P_4(x)$  and  $P_5(x)$ .

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### UNIT - IV

- 4 (a) (i) Define the operators  $\Delta$ ,  $\nabla$ ,  $\delta$  and  $E$  and show that  $\Delta = E\nabla$ .

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- (ii) Find the real root of the equation  $x^3 - 5x - 3 = 0$  by Newton Raphson Method, correct upto four places of decimal.

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- (b) Given that

$x:$	0.0	0.2	0.4	0.6	0.8
$y:$	0.399	0.391	0.368	0.333	0.290

Evaluate  $y(0.25)$ ,  $y(0.45)$  and  $y(0.65)$ .

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OR

- 4 (a) (i) Use Regula-falsi method to solve  $x^3 - 3x - 5 = 0$  correct upto four places of decimal.

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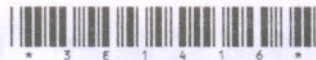
- (ii) Find  $(\Delta - \nabla)x^2$ , where  $h$  is the interval of differencing.

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- (b) Use Lagrange's interpolation formula, to find  $y$  in terms of  $x$ , for the given table :

$x:$	1	2	4	5
$y:$	8	24	44	50

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## UNIT - V

- 5 (a) Solve the given system of equations

$$20x + y - 2z = 17$$

$$3x + 20y - z = -18$$

$$2x - 3y + 20z = 25$$

using Gauss - Seidel iterative method.

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- (b) Given that :

$x:$	0	0.1	0.2	0.3	0.4	0.5	0.6
$f(x):$	0	1.2	4.9	11.2	20.2	32.0	46.7

Calculate  $f'(x)$  at  $x=0.1$ , at  $x=0.3$  and at  $x=0.5$ .

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OR

- 5 (a) Evaluate  $\int_0^1 \frac{1}{1+x^2} dx$  using,

(i) Trapezoidal rule,

(ii) Simpson's  $\frac{1}{3}$ rd rule and

(iii) Simpson's  $\frac{3}{8}$ th rule.

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- (b) Use Runge-Kutta fourth order method to solve  $\frac{dy}{dx} = x + y^2$  to

obtain  $y(0.2)$  and  $y(0.4)$ , given that  $y=1$  when  $x=0$ .

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