

**4E2137**

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

Total Printed Pages : **4****4E2137****B. Tech. (Sem. IV) (Main) Examination, June/July - 2013****Petroleum****4PE1 Mathematics - IV (Common with EC)**Time : **3 Hours**][Total Marks : **80**[Min. Passing Marks : **24**

*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. NIL2. NIL**UNIT - I**

1 (a) Find the missing term in the following table

 $x \rightarrow 0 \quad 1 \quad 2 \quad 3 \quad 4$  $y \rightarrow 1 \quad 3 \quad 9 \quad - \quad 81$ 

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(b) Find the form of the function given by the following table

 $x \rightarrow 0 \quad 1 \quad 2 \quad 3 \quad 4 \quad 5$  $y \rightarrow -5 \quad 1 \quad 9 \quad 25 \quad 55 \quad 105$ 

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(c) The area  $A$  of a circle of diameter  $d$  is given for the following values $d \rightarrow 80 \quad 85 \quad 90 \quad 95 \quad 100$  $A \rightarrow 5026 \quad 5674 \quad 6362 \quad 7088 \quad 7854$ 

Calculate the area of circle of diameter 105.

8

**OR**

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1

[Contd...

- 1 (a) Using Stirling formula to find  $f(35)$  from the table

$x \rightarrow$	20	30	40	50
$y \rightarrow$	512	439	346	243

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- (b) Using Lagrange's interpolation formula, find the value of  $y$  for  $x=9.5$  from table

$x \rightarrow$	7	8	9	10
$y \rightarrow$	3	1	1	9

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### UNIT - II

- 2 (a) Find  $f'(1.5)$  using following data

$x \rightarrow$	1.5	2	2.5	3	3.5	4
$y \rightarrow$	3.375	7	13.625	24	38.875	59

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- (b) Using Euler's modified method, obtain a solution of

$$\frac{dy}{dx} = x + |\sqrt{y}|, y(0) = 1 \text{ for the range } 0 \leq x \leq 0.4 \text{ in steps of } 0.2.$$

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### OR

- 2 (a) Using Simpson's " $\frac{1}{3}$ " rule, integrate,  $\int_1^{1.04} f(x) dx$  from following data

$x \rightarrow$	1	1.01	1.02	1.03	1.04
$f(x) \rightarrow$	3.953	4.066	4.182	4.300	4.421

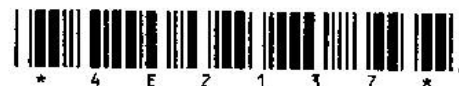
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- (b) Apply fourth order Runge-Kutta method to

$$\frac{dy}{dx} = 3x + \frac{1}{2}y, y(0) = 1$$

to determine  $y(0.1)$  correct to four decimal places.

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### UNIT - III

- 3 (a) Derive the result of generating function for Bessel function  $J_n(x)$ . 8
- (b) For Legendre's function, show that
- (i)  $P_n(1) = 1$
- (ii)  $P_n(-x) = (-1)^n P_n(x)$  8

OR

- 3 (a) For Bessel function, show that
- $$\left[ J_{-\frac{1}{2}}(x) \right]^2 + \left[ J_{\frac{1}{2}}(x) \right]^2 = \frac{2}{\pi x}$$
- 8
- (b) State and prove orthogonal properties of Legendre's function. 8

### UNIT - IV

- 4 (a) There are 3 true coins and 1 false coin with 'head' on both sides. A coin is chosen at random and tossed 4 times. If 'head' occurs all the 4 times, what is the probability that the false coin has been chosen and used ? 8
- (b) Fit a binomial distribution for given data :
- |                 |   |    |    |    |   |   |   |
|-----------------|---|----|----|----|---|---|---|
| $x \rightarrow$ | 0 | 1  | 2  | 3  | 4 | 5 | 6 |
| $f \rightarrow$ | 5 | 18 | 28 | 12 | 7 | 6 | 4 |
- 8

OR

- 4 (a) Two cards are drawn at random with replacement from a box which contains 4 cards numbered 1, 1, 2 and 2. If X denotes the sum of the numbers shown on the two cards, find the expected value of X. 8
- (b) Compute the coefficient of correlation between x and y, using the following data :
- |                 |   |    |    |    |    |    |
|-----------------|---|----|----|----|----|----|
| $x \rightarrow$ | 1 | 3  | 5  | 7  | 8  | 10 |
| $y \rightarrow$ | 8 | 12 | 15 | 17 | 18 | 20 |
- 8



UNIT - V

- 5 (a) Find the extremals of functional

$$\int_0^{\pi/2} \left[ (y''')^2 - (y')^2 + (x)^2 \right] dx;$$

given that  $y(0) = 1, y'(0) = 0,$

$$y(\pi/2) = 0, y'(\pi/2) = -1$$

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- (b) Find the curve through two points  $(x_1, y_1)$  and  $(x_2, y_2)$  which when rotated about the  $x$  axis, gives minimum surface area.

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OR

- 5 (a) Derive Euler's equation.

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- (b) Find the extremals of functional

$$\int_0^{\pi/2} \left[ (y')^2 + (z')^2 + 2yz \right] dx;$$

given that  $y(0) = 0, y(\pi/2) = 1$

$$z(0) = 0, z(\pi/2) = -1$$

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