M. Tech.-I (Civil-Hydraulic Engineering) (CBCS – 2015 Course) :
WINTER - 2018
SUBJECT : COMPUTATIONAL METHODS IN HYDRAULIC ENGINEERING

Day : Friday | **W-2018-3106** | Time : 11.00 AM TO 02.00 PM
Date : 07/12/2018 | Max. Marks : 60

N.B.:

1) All questions are **COMPULSORY**.
2) Figures to the right indicate **FULL** marks.
3) Use of non programmable **CALCULATOR** is allowed.
4) Answers to both the sections should be written in **SEPARATE** answer books.

SECTION – I

Q.1 If $f(z)$ is a harmonic function of z, show that **[10]**

$$\left\{\frac{\partial}{\partial x}|f(z)|\right\}^2+\left\{\frac{\partial}{\partial y}|f(z)|\right\}^2=|f'(z)|^2$$

OR

a) Let $f(z)=u(x,y)+iv(x,y)$ be an analytic function. If $u=3x-2xy$, then find v and express f(z) in terms of z. **[05]**

b) Show that the function $e^x(\cos y+i\sin y)$ is an analytic function, find its derivative. **[05]**

Q.2 **a)** Find the image of $|z-3i|=3$ under the mapping $w=1/z$. **[05]**

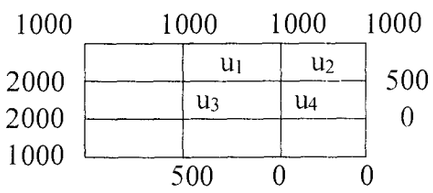
b) Evaluate $\oint\frac{z^2+1}{z^2-1}$, where C is circle $|z|=3/2$. **[05]**

OR

a) Find the transformation that maps the semi-infinite strip $u=b$, $u=-b$, $v=0$ in w-plane into the upper half of z-plane. **[05]**

b) Evaluate $\int_c\frac{e^{-z}}{(z+2)^5}dz$, where C is circle $|z|=3$. **[05]**

Q.3 Given the values of $u(x,y)$ on the boundary of the square in figure, evaluate the function $u(x,y)$ satisfying the Laplace equation $\nabla^2u=0$ at the pivotal points of this figure **[10]**



OR

a) Solve by Jacobi's iteration method, the equations **[06]**

$20x+y-2z=17,$
$3x+20y-z=-18$
$2x-3y+20z=25$

b) Classify the following equations: **[04]**

i) $(x+1)u_{xx}-2(x+2)u_{xy}+(x+3)u_{yy}=0$

ii) $y^2u_{xx}+u_{yy}+u_x^2+u_y^2+7=0$

P.T.O.

SECTION – II

Q.4 **a)** Describe how to fit second degree curve $y = a + bx + cx^2$ using least square principle. **[05]**

b) Evaluate $\int_0^6 \frac{dx}{1+x^2}$ by Trapezodial rule. **[05]**

OR

a) Using method of least squares, fit a curve of the form $y = ab^x$ to the following data: **[05]**

x	2	3	4	5	6
y	144	172.8	207.4	248.8	298.5

b) Evaluate by Simpson's 1/3rd rule , $\int_0^1 e^{-x^2}$ taking ten intervals. **[05]**

Q.5 **a)** The two regression lines are: **[05]**

$5x - 6y = -90$

$15x - 8y = 130$

Find : **i)** mean values of x's and y's.

ii) coefficient of correlation

b) If $r_{12} = 0.6$, $r_{23} = 0.35$ and $r_{31} = 0.4$ then find $R_{3.12}$. **[05]**

OR

a) The first four moments about the working mean 28.5 of a distribution are 0.294, 7.144, 42.409 and 454.98. Calculate the moments about the mean. Also evaluate β_1, β_2. **[05]**

b) Find the rank correlation coefficient from the following data: **[05]**

x	56	42	72	36	63	47	55	49	38	42	68	60
y	147	125	160	118	149	128	150	145	115	140	152	155

Q.6 **a)** In a bolt factory, machines A, B and C manufacture 25%, 35% and 40% of the total. Of their output 5%, 4% and 2% are defective bolts. A bolt drawn at random from the product and is found to be defective. What is the probability that it was manufactured by machine B? **[05]**

b) Find the mean and variance of Binomial distribution. **[05]**

OR

a) A certain screw making machine produces on average of 2 defective screws out of 100 and packs them in boxes of 500. Find the probability that a box contains 15 defective screws. **[05]**

b) A set of five similar coins is tossed 320 times and the result is: **[05]**

No. of heads	0	1	2	3	4	5
Frequency	6	27	72	112	71	32

Test the hypothesis that the data follow a Binomial distribution

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