

M. Tech.-I (Civil-Hydraulic Engineering) (CBCS – 2015 Course) :
SUMMER - 2019

SUBJECT : COMPUTATIONAL METHODS IN HYDRAULIC ENGINEERING

Day : Tuesday
Date : 21/05/2019

Time : 11.00 AM TO 02.00 PM
Max. Marks : 60

S-2019-3371

N.B.

- 1) All questions are **COMPULSORY**.
- 2) Figures to the right indicate **FULL** marks.
- 3) Answer to both the sections should be written in **SAME** Answer book.
- 4) Use of non-programmable calculator is allowed.

SECTION – I

Q.1 a) If $f(z)$ is an analytic function with constant modulus, show that $f(z)$ is constant. **(05)**

b) Find analytic function $f(z) = u(r, \theta) + iv(r, \theta)$ such that **(05)**
 $v(r, \theta) = r^2 \cos 2\theta - r \cos \theta + 2$.

OR

a) Show that the polar form of Cauchy-Riemann equation are **(05)**
$$\frac{\partial u}{\partial r} = \frac{1}{r} \frac{\partial v}{\partial \theta}, \frac{\partial v}{\partial r} = -\frac{1}{r} \frac{\partial u}{\partial \theta}$$

b) Determine the analytic function whose real part is $\frac{y}{x^2 + y^2}$. **(05)**

Q.2 a) Show that under the transformation $w = \frac{z-i}{z+i}$, real axis in the z -plane is mapped into the circle $|w|=1$. Which portion of the z -plane corresponds to the interior of the circle. **(05)**

b) Find the transformation which maps the semi-infinite strip of width π bounded by the lines $v=0, v=\pi$ and $u=0$ into the upper half of the z plane. **(05)**

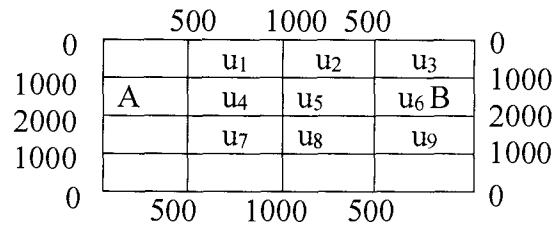
OR

a) Show that under the transformation $w = \frac{1}{z}$, circle $x^2 + y^2 - 6x = 0$ is transformed into a straight line in the w -plane. **(05)**

b) Evaluate : $\int_C \frac{e^{2z}}{(z+1)^4} dz$, where C is $|z|=4$. **(05)**

P.T.O.

- Q.3** Solve the elliptic equation $u_{xx} + u_{yy} = 0$ for the square mesh of figure with (10) boundary values as shown.



OR

- a)** Classify the following equations: (04)

i) $u_{xx} + 4u_{xy} - u_x + 2u_y = 0.$

ii) $x^2u_{xx} + (1 - y^2)u_{yy} = 0, -\infty < x < \infty, -1 < y < 1$

- b)** Solve by Relaxation method, the equations: (06)

$9x - 2y + z = 50$

$x + 5y - 3z = 18$

$-2x + 2y + 7z = 19$

SECTION - II

- Q.4 a)** Fit a straight line $y = a + bx$ to the following data by method of least squares. (04)

x:	0	1	3	6	8
y:	1	3	2	5	4

- b)** Evaluate $\int_0^6 \frac{dx}{1+x^2}$ by using **i)** Simpson's 1/3rd rule **ii)** Simpson's 3/8 rule. (06)

OR

- a)** Fit a second degree parabola to the following data: (05)

x:	1929	1930	1931	1932	1933	1934	1935	1936	1937
y:	352	356	357	358	360	361	361	360	359

- b)** Use Trapezoidal rule to evaluate $\int_0^1 x^3 dx$ considering five sub-intervals. (05)

- Q.5 a)** Calculate the first four moments of the following distribution about the mean. (06)

x:	0	1	2	3	4	5	6	7	8
f:	1	8	28	56	70	56	28	8	1

Also evaluate β_1 and β_2 .

- b)** If $r_{12} = 0.25$, $r_{13} = 0.35$, and $r_{23} = 0.45$, then find $R_{2,13}$. (04)

OR

- a)** The two regression equations of the variables x and y are $x = 19.13 - 0.87y$ (05) and $y = 11.64 - 0.50x$ find **i)** mean of x 's and y 's. **ii)** Correlation coefficient between x and y .

- b)** Ten participants in a contest are ranked by two judges as follows: (05)

x:	1	6	5	10	3	2	4	9	7	8
y:	6	4	9	8	1	2	3	10	5	7

Calculate the rank correlation coefficient.

- Q.6 a)** Three machines M_1, M_2 and M_3 produce identical items. Of their respective output 5% and 4% and 3% of items are faulty. On a certain day M_1 has produced 25% of the total output, M_2 has produced 30% and M_3 the remainder. An item selected at random is found to be faulty. What are the chances that it was produced by the machine with the highest output? (05)
- b)** A random variable x has the following probability function. (05)

x:	0	1	2	3	4	5	6	7
P(x):	0	k	2k	2k	3k	k^2	$2k^2$	$7k^2+k$

- i)** Find value of k **ii)** Evaluate $p(x < 6)$, $p(x \geq 6)$

OR

- a)** If the probability of a bad reaction from a certain injection is 0.001, (05) determine the chance that out of 2,000 individuals more than two will get bad reaction.
- b)** A die was thrown 60 times and the following frequency distribution was (05) observed:

faces:	1	2	3	4	5	6
f_0 :	5	6	4	7	11	7

Test whether the die is unbiased

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