



Name :

Roll No. :

Invigilator's Signature :

CS / B.TECH (ME/PE/AUE) / SEM-3 / M-303 / 2010-11

2010-11

MATHEMATICS

Time Allotted : 3 Hours

Full Marks : 70

The figures in the margin indicate full marks.

*Candidates are required to give their answers in their own words
as far as practicable.*

GROUP – A

(Multiple Choice Type Questions)

1. Choose the correct alternatives for any *ten* of the following :

$$10 \times 1 = 10$$

- i) If $f(z) = u(x, y) - iv(x, y)$ is analytic, then $f'(z)$ equals to

a) $\frac{\partial u}{\partial x} - i \frac{\partial u}{\partial y}$

b) $\frac{\partial u}{\partial x} + i \frac{\partial v}{\partial y}$

c) $\frac{\partial v}{\partial y} - i \frac{\partial v}{\partial x}$

d) none of these



- ii) Consider the differential equation $xy'' + 2y' + xy = 0$.
Then $x = 0$ is
- an ordinary point
 - singular point but not a regular singular point
 - a regular singular point
 - none of these.
- iii) Give an LPP to maximize $Z = -5x_2$ subject to
 $x_1 + x_2 \leq 0, 0 \cdot 5$, $x_1 \times 5x_2 \geq 0$ and $x_1 \geq 0$, $x_2 \geq 0$, using
graphical method we have
- no feasible solution
 - unbounded solution
 - unique optimum solution
 - multiple optimum solution.
- iv) Which of the following is not correct ?
- It is not necessary for the aggregate demand to equal to be the aggregate supply in a transportation problem
 - An unbalanced transportation problem must be converted into a balanced problem before solving it
 - The cost element in a dummy row / column shall always be taken equal to zero
 - It is possible that in some cases both, dummy source and dummy destination may be required to convert an unbalanced transportation problem into a balanced one.

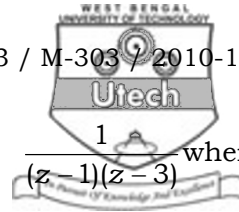
- a) πi
- b) $2\pi i$
- c) $-\pi i$
- d) $2\pi i.$

- GROUP – B**

Answer any *three* of the following. $3 \times 5 = 15$

- $$\left(\frac{\partial^2}{\partial x^2} + \frac{\partial^2}{\partial y^2}\right) |f(z)|^2 = 4 |f'(z)|^2.$$

3. Evaluate $\int_C \frac{e^{2z}}{(z+1)^4} dz$, $C: |z| = 3$.



4. Find the Taylor's series expansion of $\frac{1}{(z-1)(z-3)}$ when $0 < |z-1| < 2$.

5. Prove that $\frac{d}{dx} \{x^{-n} J_n(x)\} = -x^{-n} J_{n+1}(x)$

6. Solve the wave equation $\frac{\partial^2 u}{\partial t^2} = c^2 \frac{\partial^2 u}{\partial x^2}$ given that $u(0, t) = 0$
 $u(x, 0) = f(x)$ and $\frac{\partial u(x, 0)}{\partial t} = 0$ where $0 < x < 1$.

GROUP - C

(Long Answer Type Questions)

Answer any *three* of the following. $3 \times 15 = 45$

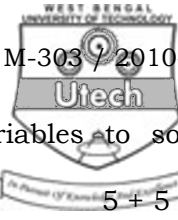
7. a) Obtain series solution of the equation

$$(1+x^2)y'' + xy' - y = 0.$$

- b) Express $f(x) = x^4 + 3x^3 - x^2 + 5x - 2$ in terms of Legendre's polynomials. $8 + 7$

8. a) Solve : $(mz - ny)p + (nx - ly)q = (ly - mx)$

- b) Solve : $(D^2 - DD' + D' - 1)z = \cos(x + 2y)$



- c) Use the method of separation of variables to solve $\frac{\partial u}{\partial x} = 2 \frac{\partial u}{\partial t} + u$ where $u(x, 0) = 6e^{-3x}$. 5 + 5 + 5

9. a) If $u - v = (x - y)(x^2 + 4xy + y^2)$ and $f(z) = u + iv$ is an analytic function of $z = x + iy$, find $f(z)$ in terms of z .

- b) Prove that $J_{-\frac{1}{2}}(x) = \sqrt{\frac{2}{\pi x}} \cos x$ 8 + 7

10. a) Find the optimal solution of the Transportation problem.

- b) Find the alternative optimal solution (if any) :

	D ₁	D ₂	D ₃	D ₄	Capacities
O ₁	1	2	1	4	30
O ₂	3	3	2	1	50
O ₃	4	2	5	9	20
Demands	20	40	30	10	

8 + 7

11. a) Solve by Big M – method

$$\text{Max } Z = x_1 + 2x_2 + 3x_3 - x_4$$

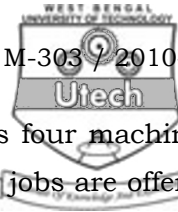
s.t.

$$x_1 + 2x_2 + 3x_3 = 15$$

$$2x_1 + x_2 + 5x_3 = 20$$

$$x_1 + 2x_2 + x_3 + x_4 = 10$$

$$x_1, x_2, x_3, x_4 \geq 0$$



- b) The owner of a small machine shop has four machines available to assign jobs for the day. Five jobs are offered with expected profit for each machine on each machine on each job which are as follows :

		Jobs				
Machines		A	B	C	D	E
	1	62	72	50	111	82
	2	71	84	61	73	59
	3	87	92	111	71	81
	4	48	64	87	77	80

Find by using the assignment method, the assignment of machines to the job that will result in a maximum profit which job should be declined. 15

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