



- Notes :
1. Assume suitable data wherever necessary.
 2. Use of calculator, normal distribution table, significance table is permitted.
 3. Use of pen Blue/Black ink/refill only for writing the answer book.

1. If $\frac{\partial^2 y}{\partial t^2} = a^2 \frac{\partial^2 y}{\partial x^2}$ represents the vibrations of a string of length L , fixed at both ends; find the solution with the conditions $y(0, t) = 0$, $y(L, t) = 0$
 $y(x, 0) = y_0 \sin \frac{\pi x}{L}$ and $\left(\frac{\partial y}{\partial t}\right)_{t=0} = 0$. 13

OR

2. A 10 cm long bar with insulated sides is initially at 100°C . Starting at $t = 0$, the ends are held at 0°C . Find the temperature distribution in the bar at the time t . 13
3. a) If $F(z) = u + iv$ be analytic function of $z = x + iy$ and $u - v = (x - y)(x^2 + 4xy + y^2)$ find $F(z)$. 6
- b) Prove that : $(1 + \cos \theta + i \sin \theta)^n = 2^n \cos^n \frac{\theta}{2} \cdot \left[\cos \frac{n\theta}{2} + i \sin \frac{n\theta}{2} \right]$. 4
- c) Prove that : $\tan h^{-1} x = \sin h^{-1} \left(\frac{x}{\sqrt{1-x^2}} \right)$. 4

OR

4. a) Find P such that the function $F(z)$ expressed in polar co-ordinates as $F(z) = r^2 \cos 2\theta + ir^2 \sin p\theta$ is analytic. 5
- b) Find in the form $a + ib$, the expression $\cos^{-1} \left(\frac{3i}{4} \right)$. 5
- c) Prove that : $\log \left(\frac{a+ib}{a-ib} \right) = 2i \tan^{-1} \left(\frac{b}{a} \right)$. 4
5. a) Using Newton - Raphson method evaluate to two decimal figures, the root of the equation $e^x = 3x$, lying between 0 and 1. 6

- b) Evaluate $\int_0^6 \frac{dx}{1+x^2}$ by Trapezoidal rule, with $h = 1$. 7

OR

6. a) Use Newton's forward formula to find the value of $f(1.2)$, if 6

x	1	1.4	1.8	2.2
f(x)	3.49	4.82	5.96	6.5

- b) Find the value of $\cos(1.747)$ using the values given in table below : 7

x	1.70	1.74	1.78	1.82	1.86
y	0.9916	0.9857	0.9781	0.9691	0.9584

where $y = \sin x$ <http://www.sgbauonline.com>

7. a) Use graphical method to find the solution of LPP : 6

Minimize $f(x) = -3x_1 + 2x_2$

Subject to $0 \leq x_1 \leq 4$

$1 \leq x_2 \leq 6$

$x_1 + x_2 \leq 5$

- b) Use simplex method, to solve the LPP : 7

Minimize $f(x) = -6x_1 - 4x_2$

Subject to $2x_1 + 3x_2 \leq 30$

$3x_1 + 2x_2 \leq 24$

$x_1 + x_2 \geq 3$

with $x_1 \geq 0, x_2 \geq 0$.

OR

8. a) Define the terms and explain in brief : 6

i) Convex Set

ii) Basic feasible solution

- b) Use simplex method, to solve the LPP : 7

Maximize $Z = x_1 + 2x_2 + x_3$

Subject to $2x_1 + x_2 - x_3 \leq 2$

$2x_1 - x_2 + 5x_3 \leq 6$

$4x_1 + x_2 + x_3 \leq 6$

with x_1, x_2, x_3 are non negative.

9. a) Calculate the mean and standard deviation for the following data : 6

size of items	6	7	8	9	10	11	12
Frequency	3	6	9	13	8	5	4

- b) A car hire firm has two cars which it hires out day by day. The number of demands for a car on each day is distributed as a poisson distribution with mean 1.5. Calculate the proportion of days on which neither car is used and the proportion of days on which some demand is refused. 7

OR

10. a) Ten percent of screws produced in certain factory turn out to be defective. Find the probability that in a sample of 10 screw chosen at random (i) exactly two, (ii) at the most two (iii) at least two screws will be defective. 7
- b) The life of army shoes is normally distributed with mean 8 months and S.D. of 2 months. If 5000 pairs are issued how many pair would be expected to need replacement after 12 months? 6
11. a) If a sample of 50 tires of certain brand has a mean life of 32,000 km and a S.D. of 4,000 km can the manufacturer claim that the true mean life of such tires is greater than 30,000 km? set up and test corresponding hypothesis at a 5% level, assuming normality. 7
- b) Find the equations of the lines of regression for the following data : 7

x	2	4	5	6	8	11
y	18	12	10	8	7	5

OR

12. a) A cubical die was thrown 9000 times and 1 or 6 was obtained 3120 times. Can the deviation from expected value lie due to fluctuations of sampling? 6
- b) Distinguish between parameter and statistic. 4
- c) What are types of sampling? 4

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