

12. Solve $(D^2 - 6D + 9)y = 0$. CO1 [K₃]
 13. Apply Euler's method to find $y(0.1)$ at $y' = x + y$, $y(0) = 1$. CO1 [K₂]
 14. Write a note on periodic functions. CO2 [K₂]
 15. Define Linear programming problem. CO2 [K₁]
 16. Define Type I and II error CO4 [K₂]
 17. Find the Laplace transform of e^{at} CO2 [K₄]
 18. Write down the indicial equation of $2xy'' + (x + 1)y' + y = 0$. CO1 [K₃]
 19. Write down the Bessel's and Legendre's differential equation. CO1 [K₃]
 20. State Polya lemma CO4 [K₁]

PART C (6 x 5 = 30 Marks)

21. In an experiment on immunization of cattle from tuberculosis the following results were obtained. CO4 [K₃]

	Affected	Unaffected
Inoculated	15	85
Not Inoculated	25	75

Examine the effect of vaccine in controlling the incidence of the disease. (Use $\alpha = 0.05$)

22. Solve $y'' + 4y = \tan 2x$ CO1 [K₂]
 23. Find the Laplace transform of the rectangular wave given by CO2 [K₃]

$$f(t) = \begin{cases} 1; 0 < t < b \\ -1; b < t < 2b \end{cases}$$

 24. Solve the following L.P.P graphically CO2 [K₃]

Max $Z = 100x_1 + 40x_2$
 Subject to $5x_1 + 2x_2 \leq 1000$, $3x_1 + 2x_2 \leq 900$, $x_1 + 2x_2 \leq 500$
 and $x_1, x_2 \geq 0$.

25. Solve the following differential equation by power series method $y'' + y = 0$. CO1 [K₃]
 26. State and prove Burnside lemma CO4 [K₃]

Answer any FOUR Questions

PART D (4 x 10 = 40 Marks)

27. Using Laplace transform, Solve the following IBVP: CO1 [K₄]

PDE : $u_t = u_{xx}$, $0 < x < l$, $t > 0$

BCs : $u(0, t) = u(l, t) = 0$, $t > 0$

ICs : $u(x, 0) = \sin \pi x$, $u_t(x, 0) = -\sin \pi x$ $0 < x < l$.

28. The contents of urns I, II & III are as follows 1 white, 2 black & 3 red balls. 2 5 CO1 [K₄]

- a) white, 1 black & 1 red and 4 white, 5 black and 3 red balls respectively. One urn is chosen at random & two balls are drawn from it. They happen to be white & red. What is the probability that they come from urns I.
- b) Using R.K.method of fourth order, find $y(0.8)$ correct to 4 decimal places if $y' = y - x^2$, $y(0.6) = 1.7379$ with $h = 0.1$. 5 CO1 [K4]

29. Use Simplex to solve the LPP CO2 [K3]

$$\text{Max } Z = 4x_1 + 10x_2$$

subject to

$$2x_1 + x_2 \leq 50, 2x_1 + 5x_2 \leq 100, 2x_1 + 3x_2 \leq 90 \quad \text{and } x_1, x_2 \geq 0.$$

30. Derive the Bessel's function. CO1 [K4]

31. The figures in the following 5x5 Latin Square are the numbers of the engines E_1, E_2, E_3, E_4 & E_5 tuned up by mechanics M_1, M_2, M_3, M_4 & M_5 ran with gallon of fuel A, B, C, D and E. CO4 [K4]

	E_1	E_2	E_3	E_4	E_5
M_1	A31	B24	C20	D20	E18
M_2	B21	C27	D23	E25	A31
M_3	C21	D27	E25	A29	B21
M_4	D21	E25	A33	B25	C22
M_5	E21	A37	B24	C24	D20

Use the level of significance $\alpha = 0.01$ to test

- (i) the null hypothesis H_0 that there is no difference in the performance of the five engines
- (ii) H_0 that the persons who tuned up these engines have no effect on their performance
- (iii) H_0 that the engines perform equally well with each of the fuels.
