Question Bank for II-internal

Part-1

1. Examine the function $f(x,\ y) = x^4 + y^4 - 2x^2 + 4xy - 2y^2$ for extreme values.
2. Discuss the maxima and minima of $f(x,\ y) = x^3 + y^3 - 3x - 3y + 20$.
3. Find the points on which the function

   $f(x,\ y) = x^3 + 3xy^2 - 15x^2 - 15y^2 + 72x$ is extreme.
4. Show that $f(x,\ y) = x^3 + y^3 - 3xy + 1$` is minimum at $(1,\ 1)$.
5. Show that $f(x,\ y) = x^3 + 3xy^2 - 3x^2 - 3y^2 + 4$` is maximum at $(0,\ 0)$.

Part2

1. Solve $(x^2 - 4xy - 2y^2)dx + (y^2 - 4xy - 2x^2)dy = 0$.
2. Solve $\left(xy^2 - e^{1/x^3}\right)dx - x^2ydy = 0$
3. Solve $(4xy + 3y^2 - x)dx + x(x + 2y)dy = 0$.
4. Solve $\frac{dy}{dx} + x\sin 2y = x^3\cos^2 y.$
5. Solve $\frac{dy}{dx} + y = \frac{x}{y}$.
6. Solve $\frac{dy}{dx} + \frac{y}{x} = y^2$.
7. Find the orthogonal trajectories of the family of curves $r(1 + \cos\theta) = 2a.$
8. Find the orthogonal trajectories of the family of curves $r = 4a\sec\theta\tan\theta.$
9. Find the orthogonal trajectories of the family of curves $x^2 - y^2 = c^2.$
10. An object is heated to $300^\circ C$ and allowed to cool in a room with air temperature $80^\circ C$. After 10 min the temperature of the object is $250^\circ C$.
    What will be its temperature after 20 min?
11. A bottle of mineral water at a room temperature of $72^\circ F$ is kept in a refrigerator where the temperature is $44^\circ F$. After half an hour water cooled to $61^\circ F$.
    What is the temperature of the mineral water in another half an hour?
12. A hot body cools in air at a rate proportional to the temperature of the body and that of surrounding air. If the air is maintained at $40^\circ C$ and the body cools from $80^\circ C$ to $50^\circ C$ in 10 min. Find the temperature of the body in 30 min.
13. Solve $y\left(\frac{dy}{dx}\right)^2 + (x - y)\frac{dy}{dx} - x = 0.$
14. Solve $xyp^2 - (x^2 + y^2)p + xy = 0.$

15. Solve $p^2 + 2p\cosh x + 1 = 0$.

16. Find general solution and singular solution of $p = \sin(y - xp)$.

17. Find general solution and singular solution of $y = px - \sqrt{1 + p^2}$

18. Find general solution and singular solution of $p = \log(px - y)$.

Part3.

1. Solve $(D^3 - 6D^2 + 11D - 6)y = e^{2x} + e^{-2x}$.
2. Solve $(D^2 + 2D + 3)y = \cos 2x$.
3. Solve $\frac{d^2y}{dx^2} - 4y = 3^x + e^{3x} - e^{-2x}$.
4. Solve $\frac{d^2y}{dx^2} + 4\frac{dy}{dx} - 12y = e^{2x} - 3\sin 2x$.
5. Solve $(D^2 + 2D)y = x^2 + x$.
6. Solve $(D - 2)^2 y = 8(e^{2x} + x^2)$

Question paper pattern

Part1		
1 (4 Marks)	Or	2 (4 Marks)
Part2		
3 a. (4 Marks) b. (4 Marks) c. (4 Marks)	Or	4 a. (4 Marks) b. (4 Marks) c. (4 Marks)
Part3		
5 (4 Marks)	Or	6 (4 Marks)