15. (a) (i) Solve $(D^2 + 4D + 5)\,y = ex + x^3 + \cos 2x + 1$. (8)

(ii) Solve $\frac{dx}{dt} \frac{dy}{dt} + 2y = \cos 2t$, $\frac{dx}{dt}$ $2x + \frac{dy}{dt} \sin 2t$ (8)

Or

(b) (0 Solve $x^2 \frac{d2}{dx^2}$ $\frac{dy}{dx}$ 4- 'V = (⁻7c in 12 (8)

(ii) • Solve y" – 4y' + 4y (x + 1) $e^{2}r$ by the method of variation of parameters. (8)

5. State the fundamental theorem of calculus.

6. If f is continuous and $\int_0^4 f(x)dx = 10$, find $\int_0^2 f(2x)\,dx$

7. Evaluate $\int_1^{\ln 8} \int_0^{\ln y} e^{x''}\,dx\,dy$.

8. Change the order of integration in $\int_0^{y_2} \int_{y^2}^{y} f(x, y)\,dx\,dy$.

9. Solve $(D' + i.)y = 0$.

10. Transform the equation $xy'' + .y.' + 1 = 0$ into a linear equation with constant coefficients.

PART B — (5 x 16 = 80 marks)

11. **(a) (i)** Guess the value o± the limit (i.f it exists) for the function lire $\frac{\text{era}}{x}$ by evaluating the function at the given numbers x = ± 0.5; ±.0.1, ± 0,01, ± 0.001, ± 0.0001. (correct to six. decimal places) (6)

(ii) Fcir the function $f(x)$. $2 + 2x^2 - x^4$, find, the intervals of increase or decrease, local maximum and minimum values, the intervals of concavity and the inflection points. (10)

or

(h) (i) Find the values of a and b that make f continuous on $(-\infty, \infty)$

$$f(x) = \begin{cases} \frac{x^3 - 8}{x - 2}, & \text{if } x \neq 2 \\ ax^2 + bx + 3, & \text{if } 2 \leq x < 3 \\ 2x - a + b, & \text{if } x \geq 3 \end{cases}$$ (8)

(ii) Find the derivative of $f(x) = \cos^{-1}\frac{b + a\cos x}{a + b\cos x}$ (4)'

(iii) Find y' for $\cos(xy) = 1 + \sin y$. (4)