I. Multiple Choice Questions.

1. The solution of $\dfrac{dx}{dy} + \dfrac{x}{y} = -x^2$ is   [b]

(a) $\dfrac{1}{y} = cx - x\log x$ (b) $\dfrac{1}{x} = cy + y\log y$ (c) $\dfrac{1}{x} = cx + x\log y$ (d) $\dfrac{1}{y} = cx + x\log y$

2. The solution of $\dfrac{dy}{dx} + 1 = e^{x+y}$ is   [a]

(a) $e^{-(x+y)} + x + c = 0$ (b) $e^{-(x+y)} - x + c = 0$ (c) $e^{x+y} + x + c = 0$ (d) $e^{x+y} - x + c = 0$

3. The solution of the differential equation $xy^2\, dy - (x^3 + y^3)dx = 0$ is   [b]
(a) $y^3 = 3x^3 + c$ (b) $y^3 = 3x^3\log(cx)$ (c) $y^3 = 3x^3 + \log(cx)$ (d) $y^3 + 3x^3 = \log(cx)$

4. Which of the following is an exact differential equation   [d]

(a) $\dfrac{dy}{dx} + ys\sec x = \tan x$ (b) $p^2 + 2py\cot x = y^2$ (c) $x - yp = ap^2$ (d) $(x2 - 2xy - y2)dx =$

5. The condition for exactness for exact differential equation is   [a]

(a) $\dfrac{\partial M}{\partial y} = \dfrac{\partial N}{\partial x}$ (b) $\dfrac{\partial y}{\partial M} = \dfrac{\partial x}{\partial N}$ (c) $\dfrac{\partial M}{\partial x} = \dfrac{\partial N}{\partial y}$ (d) $\dfrac{\partial x}{\partial M} = \dfrac{\partial y}{\partial N}$

6. Integrating factor of $d\left(\dfrac{1}{xy}\right)$ [c]

(a) $\dfrac{xdy + ydx}{x^2 y2}$ (b) $\dfrac{-xdy - ydx}{x^2 y2}$ (c) $\dfrac{-xdy + ydx}{x^2 y2}$ (d) $\dfrac{xdy - ydx}{x^2 y2}$

7. If $Mx - Ny \neq 0$ in $Mdx + Ndy = 0$ then the required integrating factor is   [d]

(a) $Mx + Ny$ (b) $\dfrac{1}{Mx + Ny}$ (c) $Mx - Ny$ (d) $\dfrac{1}{Mx - Ny}$

8. Simultaneous differential equations can be solved using   [c]
(a) Lagrange's multipliers method   (b) Grouping method
(c) Both (a) and (b)   (d) Neither (a) nor (b)

9. _____ differential equations are mostly used in Physics and Engineering   [a]
(a) Exact   (b) Linear   (c) Clairauts   (d) None

10. $Pdx + Qdy + Rdz = 0$ is form of _____ equation   [d]
(a) Linear differential   (b) Homogeneous   (c) Clairauts   (d) Total differential

11. The differential equation $p^2 + 2py\cot x = y^2$ is solvable for   [c]
(a) x   (b) y   (c) p   (d) None of the above

12. The general solution of Clairaut's equation is   [a]
(a) $y = cx + f(c)$ (b) $y = cx + f'(c)$ (c) $y = cx + f''(c)$ (d) None of the above

13. If the equation $F\left(\dfrac{dy}{dx}, \dfrac{y}{x}\right) = 0$ is solvable for $\dfrac{y}{x}$ then   [b]

(a) $\dfrac{dx}{x} = \dfrac{f'(p)dp}{p + f(p)}$ (b) $\dfrac{dx}{x} = \dfrac{f'(p)dp}{p - f(p)}$ (c) $\dfrac{dx}{x} = \dfrac{f(p)dp}{p + f'(p)}$ (d) $\dfrac{dx}{x} = \dfrac{f(p)dp}{p - f'(p)}$

14. Which of the following equations represents law of natural growth?   [b]
(a) $A(t) = Ce^{-kt}$ (b) $A(t) = Ce^{kt}$ (c) $A(t) = Ce^{-k/t}$ (d) $A(t) = Ce^{k/t}$

15. If the division of reproducing cells is very slow with respect to time, then   [a]
(a) $\dfrac{dV}{dt} = (ke^{-at})V$ (b) $\dfrac{dV}{dt} = (e^{-at}V)$ (c) Either (a) or (b)   (d) Niether (a) nor (b)

16. The half life 'H' of a radioactive substance obtained from two measurements $y = y(t_1)$ and $y = y(t_2)$ is   [d]

(a) $H = \dfrac{(t_2 + t_1)\log 2}{\log(y_1 y_2)}$ (b) $H = \dfrac{(t_2 + t_1)\log 2}{\log\left(\frac{y_1}{y_2}\right)}$ (c) $H = \dfrac{(t_2 - t_1)\log 2}{\log(y_1 y_2)}$ (d) $H = \dfrac{(t_2 - t_1)\log 2}{\log\left(\frac{y_1}{y_2}\right)}$

17. The equation for determining the age of fossil is A(t) =   [c]
(a) (Initial amount) $e^{\frac{0.693147181}{T}t}$ (b) (Initial amount) $e^{\frac{0.693147181}{t}T}$
(c) (Initial amount) $e^{\frac{-0.693147181}{T}t}$ (d) (Initial amount) $e^{\frac{-0.693147181}{t}T}$

18. If the amount is compounded continuously per annum then effective interest rate is,   [a]
(a) $e^r - 1$ (b) $e^r + 1$ (c) e^{r-1} (d) e^{r+1}

19. The orthogonal trajectories of r = 2acos θ is   [b]
(a) r = 2c sec θ (b) r = 2c sin θ (c) r = 2c cot θ (d) r = 2c cosec θ

20. The amount compounded annually per annum is given as   [d]
(a) A = p(1-r)t   (b) A = p(1+r)t   (c) A = p(1-r)^t (d) A = p(1+r)^t

II. Fill in the blanks.
1. The solution of differential equation of the form f(x)dx + g(y)dy = 0 is $\int f(x)dx + \int g(y)dy = 0$
2. The equation $\frac{dy}{dx} = \frac{y^2-x^2}{2xy}$ is a <u>Humogeneous differential equation</u>
3. The integrating factor of $\frac{dy}{dx} - \frac{y}{x} = logx$ is $\frac{1}{x}$
4. An equation of the form $\frac{dy}{dx} + py = Qy^n$ is known as <u>Bernoulli's equation</u>
5. Exact differential equation is also known as <u>Total differential equation</u>
6. A given differential equation can be converted in to a exact differential equation by multiplying with a <u>integrating factor</u>
7. Exact differential equation is in the form of <u>Mdx + Ndy = 0</u>
8. Integrating factor of d$\left(\frac{e^x}{y}\right) = \frac{ye^xdx - e^xdy}{y^2}$
9. $\frac{ydx - xdy}{y^2}$ is integrating factor of <u>d$\left(\frac{x}{y}\right)$</u>
10. If an exact differential equation is homogenous, then integrating factor is $\frac{1}{Mx+Ny}$ if Mx +Ny$\neq$0
11. The differential equation of the form y = xf$_1$(p)+f$_2$(p) is known as <u>langrang's equation</u>
12. The Clairaut's equation of the form is <u>y = px + f(p)</u>
13. The general solution of p = log(px-y) is <u>c = log(cx-y)</u>
14. The rate of disintegration proportional to the amount A is $\frac{dA}{dt} = -kA$
15. Gompertzian relation is given as <u>$V_0e^{\frac{k}{a}(1-e^{-at})}$</u>
16. During the decay, uranium 238 is converted into <u>Radium 226</u>
17. Half life of carbon-14 is <u>5568 years</u>
18. The amount compounded continuously per annum is <u>A = Pe^n</u>
19. The curve intersecting every member of family of curves at α $\neq \frac{\pi}{2}$ is called as <u>oblique trajectory</u>
20. The orthogonal trajectories for the family of circles is <u>family of straight lines</u>

Short Answers.
1. Define differential equation?
2. Define order of differential equation?
3.Define Homogenous Differential Equation ?
4. Define Linear differential equation ?
5. Define Total differential equation ?
6.Define first order but not of first degree differential equation ?
7. Define Clairaut's Equation ?
8. Define orthogonal trajectory of family of curves?
9. Find the solution of $\frac{dy}{e^y} = \frac{dx}{e^x}$?
10. Find the integrating factor of $\frac{dx}{dy} = \frac{x}{y} + 2y^2$?