



9. For the function  $f(x, y) = x^2 - y^2$  defined on  $R^2$ , then the point (0,0)

A) a local max. B) a local min. C) both local max. and min. D) neither local min. nor local max.

10. The line integral  $\int (3x^2 + y^2)dx + (2xy + 1)dy$  from the (0,0) to (1,1) along the curve  $y = x^2$  equals

- A) 0      B) 1      C) 2      D) 3

11. The domain of definition of the function  $f(x, y) = \cos^{-1}(x^2 + y^2)$ , is

- A)  $\phi$       B)  $R^2$       C) on and inside a circle of radius 1.      D) none of these

12. The integrating factor of the D.E.  $x \ln x \frac{dy}{dx} + y = 2 \ln x$  is:

- A)  $x \ln x$       B)  $\ln x$       C)  $2x \ln x$       D) none of these

13. The solution of the D.E.  $x \ln x \frac{dy}{dx} + y = 2 \ln x$  is:

- A)  $y = \ln x + c$       B)  $y = c \ln x$       C)  $y \ln x = \ln x + cx$       D) none of these

14. The general solution of the D.E.  $(1+x)ydx + (1-y)x dy = 0$  is:

- A)  $xy = ce^{y-x}$       B)  $x+y = ce^{xy}$       C)  $x-y = ce^{xy}$       D) none of these

15. The D.E.  $x dx - y dy = 0$  represents a family of

- A) circles      B) ellipse      C) hyperbolas      D) none of these

16. For the D.E.  $x \frac{dy}{dx} - my = x^3$  the integrating factor is  $\frac{1}{x^4}$ . The value of m is:

- A) -4      B) -3      C) 2      D) 4

17. The solution of the D.E.  $\frac{dy}{dx} = e^{x-y} + x^2 e^{-y}$  is:

- A)  $e^y = e^x + x^3 + c$       B)  $3e^y = 3e^x + x^3 + c$   
 C)  $e^{-y} = e^x + x^3 + c$       D)  $3e^{-y} = 3e^x + x^3 + c$

18. The solution of the D.E.  $(x+y)^2 \frac{dy}{dx} = a^2$  is:

- A)  $y - x = a \tan\left(\frac{y-c}{a}\right)$       B)  $y + x = a \tan\left(\frac{y-c}{a}\right)$   
 C)  $y + x = c \tan\left(\frac{y-a}{c}\right)$       D)  $y - x = c \tan\left(\frac{y-a}{c}\right)$



The following questions measure ILOs a1, b1, b7, c1 and c7

Answer the following questions:

الامتحان عبارة عن سوالين :

السؤال الاول ٢٠ نقطه اختيارى يجاب عنهم فى ورقة الاختيار من متعدد الموجوده فى اخر كراسة الاجابه ويجب تظليل دائرة واحدة فقط هكذا وذلك عند تمام الناكم من الاجابه .  
 السؤال الثاني مقالى يجاب عنه فى اول كراسة الاجابه .

### Question 1: (60 Marks)

1. If  $z = f(x + ay) + g(x - ay)$ , then:

A)  $\frac{\partial^2 z}{\partial y^2} = a^2 \frac{\partial^2 z}{\partial x^2}$       B)  $\frac{\partial^2 z}{\partial y^2} = -a^2 \frac{\partial^2 z}{\partial x^2}$       C)  $\frac{\partial^2 z}{\partial x^2} = a^2 \frac{\partial^2 z}{\partial y^2}$       D)  $\frac{\partial^2 z}{\partial x^2} = -a^2 \frac{\partial^2 z}{\partial y^2}$

2. If  $u = \tan^{-1}\left(\frac{x+y}{\sqrt{x+y}}\right)$ , then  $xu_x + yu_y =$

A)  $2\sin 2u$       B)  $\sin 2u$       C)  $0.5\sin 2u$       D)  $0.25\sin 2u$

3. If  $z = f(u,v)$ ,  $u = x^2 - 2xy - y^2$  and  $v = a$ , then:

A)  $(x+y)z_x = (y-x)z_y$       B)  $(x-y)z_x = (x+y)z_y$   
 C)  $(y-x)z_x = (x+y)z_y$       D)  $(x+y)z_x = (y-x)z_y$

4. If  $u = yf\left(\frac{y}{x}\right)$ , then  $x^2u_{xx} + 2xyu_{yx} + y^2u_{yy} =$

A) 2      B) 1      C) 0      D) -1

5. If  $u = \sin\left(\frac{y}{x}\right)$ , then u is :

- A) homogenous of degree 0      B) homogenous of degree 1  
 C) nonhomogeneous      D) Non of these

6. If  $z = uv$ ,  $u^2 + v^2 - x - y = 0$  and  $u^2 - v^2 + 3x + y = 0$ , then  $\frac{\partial z}{\partial x}$  equals:

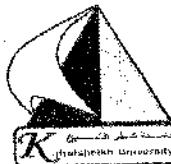
A)  $\frac{2u^2 - v^2}{2uv}$       B)  $\frac{3u^2 + v^2}{2uv}$       C)  $\frac{2u^2 + v^2}{3uv}$       D)  $\frac{u^2 - 2v^2}{3uv}$

7. If  $x = ar \cos \theta$ ,  $y = br \sin \theta$ , then  $\frac{\partial(x,y)}{\partial(r,\theta)} =$

A) r      B) abr      C) 1/r      D) ab/r

8. If  $f(x,y) = x^4 + x^2y^2 + y^4$ , then  $\frac{\partial^2 f}{\partial x \partial y}$  equals

A)  $2x^2 + 12y^2$       B)  $12x^2 + 2y^2$       C)  $4xy$       D)  $4(x+y)$



**19. The particular solution for the D.E.  $(D^2 + 2D + 1)y = 4\sin 2x$  is :**

- A)  $y_p = \frac{-4}{25}(2\cos 2x + \sin 2x)$       B)  $y_p = \frac{-4}{25}(-2\cos 2x - \sin 2x)$   
 C)  $y_p = \frac{-4}{25}(4\cos 2x + 3\sin 2x)$       D)  $y_p = \frac{4}{25}(2\cos 2x - \sin 2x)$

**20. The particular solution for the D.E.  $(D^3 + D)y = 5^x$  is :**

- A)  $y_p = \frac{5^x}{(\ln 5)^3 + \ln 5}$       B)  $y_p = \frac{5^x}{(\ln 5)^5 - \ln 5}$       C)  $y_p = \frac{3^x}{\ln 3^5 + \ln 3}$       D)  $y_p = \frac{3^x}{\ln 3^5 - \ln 3}$

**21. The particular solution for the D.E.  $\frac{d^2y}{dx^2} + 4\frac{dy}{dx} + 3y = e^{-3x}$  is :**

- A)  $y_p = \frac{xe^{3x}}{2}$       B)  $y_p = \frac{xe^{-3x}}{2}$       C)  $y_p = \frac{e^{-3x}}{-2}$       D)  $y_p = \frac{xe^{-3x}}{-2}$

**22. The general solution of the D.E.  $y'' + y = 0$  is:**

- A)  $c_1 e^x + c_2 e^{-x}$       B)  $c_1 + c_2 x$       C)  $c_1 \cos x + c_2 \sin x$       D) non of these

**23. The solution of the D.E.  $(D+1)y = \sin e^x$  is:**

- A)  $y = \cosec x + ce^x$       B)  $y = e^x \cosec x + c$       C)  $ye^x + \cosec x = c$       D) non of these

**24. For the D.E.  $L(D)y = 0$ , the roots of the auxiliary equation are  $\pm i, \pm i$ , then the solution of this D.E. is:**

- A)  $y = (c_1 + c_2 x) \sin x + (c_3 + c_4 x) \cos x$       B)  $y = (c_1 x + c_2 x^2) \sin x + (c_3 x + c_4 x^2) \cos x$   
 C)  $y = (c_1 + c_2 x)e^x + (c_3 + c_4 x)e^{-x}$       D)  $y = c_1 + c_2 x + c_3 \sin x + c_4 \cos x$

**25. For the D.E.  $L(D)y = 0$ , the roots of the auxiliary equation are  $\pm i, \pm i$ , then the D.E.  $L(D)y = 0$  is:**

- A)  $y'' + y = 0$       B)  $y^{(4)} - y = 0$       C)  $y^{(4)} + y = 0$       D)  $y^{(4)} + 2y'' + y = 0$

**26. Laplace Transform of the function  $f(t) = \frac{\cos t}{t}$  is :**

- A)  $\frac{s}{s^2 + 1}$       B)  $\frac{1}{s^2 + 1}$       C)  $\frac{\pi}{2} - \tan^{-1} s$       D) Non of these

**27. Laplace Transform of the unit step function  $u(t-2)$  is :**

- A)  $\frac{e^{-2s}}{s}$       B)  $\frac{e^{2s}}{s}$       C)  $\frac{e^{-s}}{s+2}$       D)  $\frac{e^s}{s-2}$



**28 . Laplace Transform of the function  $f(t) = e^{-2t} \cos 3t$  is :**

A)  $\frac{s - 2}{(s - 2)^2 + 9}$       B)  $\frac{s + 2}{(s + 2)^2 + 9}$       C)  $\frac{1}{(s + 2)^2 + 9}$       D)  $\frac{1}{(s - 2)^2 + 9}$

**29. Inverse Laplace Transform of  $\frac{1}{s(s+1)}$  is :**

A)  $0.5 - 0.5e^{-t}$       B)  $1 + e^{-t}$       C)  $1 - e^{-t}$       D) Non of these

**30. Laplace Transform of the function  $f(t) = \sin 7t \cos t$  is :**

A)  $\frac{7}{s^2 + 49} + \frac{s}{s^2 + 1}$       B)  $\frac{4}{s^2 + 64} - \frac{3}{s^2 + 36}$   
 C)  $(\frac{7}{s^2 + 49})(\frac{s}{s^2 + 1})$       D)  $\frac{8}{s^2 + 64} + \frac{6}{s^2 + 36}$

### **Question 2: (40 Marks)**

1. Expand in Maclurin series the function  $f(x, y) = \cos(x + y)$ .

2. Can  $f(0,0)$  be defined so that  $f(x, y)$  is continuous at  $(0,0)$  when:

$$f(x, y) = \frac{\sin(x^2 + y)}{x + y}.$$

3. Find the orthogonal trajectories of  $r = c \sin \theta$ .

4. Find the solution of the following differential equation:

i)  $y'' + 4y = \sec 2x$  .

ii)  $y' = \sqrt{1 - (\frac{y}{x})^2} + (\frac{y}{x})$ .

5. Find Laplace transform for  $f(t) = u(t - \pi) \sinht \sin t$  .

6. Find the solution of the following differential equation using Laplace transform:

$$y'' + y' - 4y = 2e^t, \quad y(0) = y'(0) = 0.$$

With my best wishes  
 Dr. Samah El-Kholy