Kafrelsheikh University
Faculty of Engineering
Physics & Engineering Mathematics Dept.
Year: Second Year-Electric. Subject: Engineering Mathematics (3)
Code : PHM1009

Date: 8-3-2021
Time allowed: 3 hours
Full mark: 90
Final Term Exam: 6 pages

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

Answer the following questions:

الامتحان عبارة عن ٦٠ نقطه اختيارى يجاب عنهم في ورقة الاختيار من متعدد ويجب تظليل دائره واحدة فقط هكذا ● وذلك عند تمام التاكد من الاجابة.

In the following $k = 0, \pm 1, \pm 2, \pm 3, \ldots$

All points are equal marks

1. **The function** $f(z) = |z|$ **is:**

   A) analytic for all z *B*) not analytic *C*) analytic for z=1 *D*) non of these

2. **The following is true except**

   A) all analytic functions are harmonic ones *B*) all harmonic funtions are analytic ones

   C) for harmonic functions $u_{xx} + u_{yy} = 0$ *D*) entire function is an analytic one for all z

3. **All the following functions are entire except:**

   A) e^z *B*) $\cosh z$ *C*) z^3 *D*) $\tan z$

4. **Which of the following is false?**

   A) $|e^z| = e^x$ *B*) $\arg(e^z) = y + 2k\pi$ *C*) $\overline{e^z} = e^{\bar{z}}$ *D*) $e^z = e^x(\sin y + i\cos y)$

5. **the function** $f(z) = z^3$ **has zero of order :**

   A) 1 *B*) 2 *C*) 3 *D*) 4

6. **In Laurent series of the function** $\dfrac{e^{2z}}{(z-1)^3}$ **about** $z = 1$**, the coefficient of** $\dfrac{1}{(z-1)^3}$ **is:**

   A) e^2 *B*) e *C*) $2e^2$ *D*) $2e$

7. **All the following are true for an analytic function at** z_0 **except**

   A) $u_x = v_y$ & $u_y = -v_x$ *B*) $ru_r = v_\theta$ & $rv_r = u_\theta$ *C*) f(z) is differentiable at z_0 *D*) f(z) is not contiuous at z_0

8. **The function** $f(z) = \dfrac{z+1}{z^2+1}$ **is:**

   A) continuous for all z. *B*) differentable for all z. *C*) continuous for all $z \neq \pm 1$. *D*) non of these.

9. **If a function is differentiable at** z_0 **then**

   A) it is continuous at z_0 *B*) it is not necessary to be continuous at z_0

   C) the limit at z_0 does not exist *D*) non of these

10. $\lim\limits_{z \to 0} \dfrac{\bar{z}}{z}$**, is**

    A) exists and equal 1 *B*) exists and equal 0 *C*) does not exist. *D*) non of these

11. **The value of** $Arg(z) + Arg(\bar{z})$ **is:**

    A) 0 *B*) π *C*) $\pi/2$ *D*) non of these

12. The real part of $(1+i)^n$ is:

$A)\ 2^{n/2}\cos\frac{n\pi}{4}$ $B)\ 2^n\cos n\pi$ $C)\ 2^{n/2}\cos n\pi$ $D)$non of these

13. The value of $\sqrt{3+4i}$ is:

$A)\ \sqrt{3+i}$ $B)\ 2+i$ $C)\ 2-i$ $D)\ \sqrt{3}+2i$

14. The value of $\left(\frac{\cos\theta+i\sin\theta}{\cos\theta-i\sin\theta}\right)^4$ is

$A)\ 0$ $B)\ 1$ $C)$ -1 $D)$non of these

15. If $\left|\frac{z-5i}{z+5i}\right|=1$, then $z=x+iy$ lie on:

$A)$ the real axis $B)$ the line $x=5$ $C)$ the line y=5 $D)$circle

16. The following statements are true except

$A)\ x=r\cos\theta$ $B)\ y=r\sin\theta$ $C)\ |z|=\sqrt{x^2+y^2}$ $D)\ |z|=z\bar{z}$

17. The following statements are true except :

$A)\ |z_1+z_2|\le|z_1|+|z_2|$ $B)\ |z_1-z_2|\le|z_1|-|z_2|$ $C)\ |z_1z_2|=|z_1||z_2|$ $D)\ \left|\frac{z_1}{z_2}\right|=\frac{|z_1|}{|z_2|}$

18. The principle value of $z=\ln 2$ is :

$A)\ \ln 2+\pi/2$ $B)\ \ln 2-i\pi/2$ $C)\ \ln 2+i\pi/2$ $D)\ \ln 2-\pi/2$

19. The value of $(2i)^i$ is :

$A)\ e^{-\frac{\pi}{2}-2k\pi}(\cos\ln 2+i\sin\ln 2)$ $B)\ e^{\frac{\pi}{2}+2k\pi}(\cos\ln 2+i\sin\ln 2)$

$C)\ e^{2k\pi}(\cos\ln 2+i\sin\ln 2)$ $D)\ e^{\frac{\pi}{2}}(\cos\ln 2-i\sin\ln 2)$

20. The nth root of z is :

$A)\ \sqrt[n]{r}(\cos\frac{\theta+2k\pi}{n}-i\sin\frac{\theta+2k\pi}{n})$ $B)\ (\cos\frac{\theta+2k\pi}{n}+i\sin\frac{\theta+2k\pi}{n})$

$C)\ (\cos\frac{\theta+2k\pi}{n}-i\sin\frac{\theta+2k\pi}{n})$ $D)\ \sqrt[n]{r}(\cos\frac{\theta+2k\pi}{n}+i\sin\frac{\theta+2k\pi}{n})$

21. e^z is periodic function of period:

$A)\ 2\pi$ $B)\ 2i\pi$ $C)\ \pi$ $D)\ i\pi$

22. $\int_c \tan z\,dz, C: |z|=2$ is:

$A)\ 2i\pi$ $B)\ 4i\pi$ $C)\ -4i\pi$ $D)\ 0$

23. The residue of $\frac{z^2}{z^2+a^2}$ at $z=ia$ is:

$A)ia/2$ $B)a/2$ $C)ia$ $D)a$

24. $\int_c \frac{z^2-z+1}{z+3}dz, C:|z|=2$ **is:**

$A)13$ $B)-13$ $C)7$ $D)$non of these

25. The function $\frac{\cot \pi z}{(z-a)^2}$ has :

$A)$ pole of order at z=a only $B)$ simple pole at z=k.

$C)$ simple pole at z=a only $D)$Non of these

26. The function x^3-3xy^2 is :

$A)$ harmonic function $B)$nonharmonic function

$C)$rational function $D)$non of these

27. The complex conjugate function of $u=\sin x \cosh y$ is :

$A)\sin x \sinh y$ $B)\cos x \sinh y$

$C)\cos x \cosh y$ $D)\cos x \sin y$

28. If a,b,c and d are real numbers, then $\frac{a+ib}{c+id}$ will be also real number if

$A)bc=ad$ $B)cd=ab$ $C)bc=-ad$ $D)$cd=−ab

29. The conjugate of $(1+i)^2$ is :

$A)(1-i)^{-2}$ $B)(1+i)^{-1}$ $C)-2i$ $D)2i$

30. The polar form of $(1-i)$ is :

$A)\sqrt{2}e^{i\pi/4}$ $B)\sqrt{2}e^{-i\pi/4}$ $C)e^{i\pi/4}$ $D)e^{-i\pi/4}$

31. The derivative of the logarithmic function is :

$A)z$ $B)1/z$ $C)e^z$ $D)1$

32. The equation $\cos z=5$ has:

A)no real or complex solution

B)an infinite number of complex solutions

C)exactly two distinct solutions

D)non of these

33. The value of $\int_C \cos z dz, C:|z|=1$ **, is**

$A)i\pi$ $B)4i\pi$ $C)2i\pi$ $D)0$

34. The residue of $e^{1/z}$ at $z=0$ is :

$A)0 \quad B)1 \quad C)-1 \quad D)i$

35. The analytical function $f(z)=\dfrac{z-1}{z^2+1}$ has singularities at

$A)1,-1 \quad B)1,-i \quad C)i,1 \quad D)i,-i$

36. The value of $\oint_C \dfrac{\cos \pi z}{(z+5)(z-3)}dz, C:|z|=1$, is

$A)0 \quad B)2\pi i \quad C)-\pi i/8 \quad D)\pi i/8$

37. The value of $\oint_C \dfrac{\sin z}{z}dz, C:|z|=1$, is

$A)0 \quad B)2\pi i \quad C)-2\pi i \quad D)\infty$

38. The value of $\oint_C \dfrac{1}{z^2+1}dz, C:\left|z-\dfrac{i}{2}\right|=1$, is

$A)-2\pi i \quad B)2\pi i \quad C)\pi \quad D)\tan^{-1}z$

39. The function $w=\ln(x^2+y^2)+i\tan^{-1}(\dfrac{y}{x})$ is not analytic at the point

$A)(1,1) \quad B)(0,1) \quad C)(1,0) \quad D)(0,0)$

40. The value of i^i , is

$A)e^{-\pi/2} \quad B)e^{\pi/2} \quad C)\pi/2 \quad D)1$

41. $\cos\phi$ can be represented as

$A)\dfrac{e^{i\phi}-e^{-i\phi}}{2i} \quad B)\dfrac{e^{i\phi}+e^{-i\phi}}{2} \quad C)\dfrac{e^{\phi}+e^{i\phi}}{2} \quad D)\dfrac{e^{\phi}+e^{\phi}}{2}$

42. For the function $w(z)=ze^{2z}, u(x,y)=$

$A)e^{2x}(x\cos 2y-y\sin 2y) \quad B)e^{2x}(x\cos 2y+y\sin 2y)$

$C)e^{2x}(y\cos 2y-x\sin 2x) \quad D)e^{2x}(x\cos 2y-y\sin 2x)$

43. $\cos iz =$

$A)\cosh z \quad B)-\cosh z \quad C)\sinh z \quad D)-\sinh z$

44. $|\cosh z|^2 =$

$A)\sinh^2 y+\cos^2 x \quad B)\sinh^2 x-\cos^2 y \quad C)\sinh^2 x+\cos^2 y \quad D)\sinh^2 y-\cos^2 x$

45. $\dfrac{d}{dz}\operatorname{sech}^{-1}z =$

$A)\dfrac{1}{z\sqrt{1-z^2}} \quad B)\dfrac{-1}{z\sqrt{1-z^2}} \quad C)\dfrac{-1}{z\sqrt{1+z^2}} \quad D)\dfrac{1}{z\sqrt{1+z^2}}$

46. $\frac{d}{dz}\cos^{-1} z =$

$A)\frac{1}{\sqrt{z^2-1}}$ $B)\frac{1}{\sqrt{1-z^2}}$ $C)\frac{-1}{\sqrt{z^2-1}}$ $D)\frac{-1}{\sqrt{1-z^2}}$

47. **The integration** $\int_{(0,0)}^{(2,4)} z\,dz$ **, along the straight line joining (0,0) to (2,4) , equals:**

$A)-6-8i$ $B)6+8i$ $C)6-8i$ $D)-6+8i$

48. **For any closed contour C , which of the following is true:**

$A)$If $f(z)$ is analytic, then $\oint_C f(z)dz = 0$.

$B)$If $\oint_C f(z)dz = 0$, then $f(z)$ must be analytic.

$C)$If $f(z)$ is analytic, then $\oint_C f(z)dz = 2\pi i \sum \text{Res}$.

$D)$ non of these

49. **The value of** $\oint_C \frac{e^{2z}}{(z+1)^4}dz$ **,** $C:|z|=2$ **, is**

$A)\frac{8\pi}{3}e^{-2}$ $B)\frac{8\pi i}{3}e^{2}$ $C)\frac{8\pi i}{3}e^{-2}$ $D)\frac{8\pi}{3}e^{2}$

50. **The Laurent series of** $\frac{\sin z}{z^5}$ **at** $z=0$**, the coefficient of the term** $\frac{1}{z}$ **is**

$A)\frac{-1}{3!}$ $B)1$ $C)-1$ $D)0$

51. **To evaluate** $\int_{-\infty}^{\infty} \frac{p(x)}{q(x)}dx$ **:**

$A)$the degree of $q(x)$ equals the degree of $p(x)$.

$B)$the degree of $p(x)$ must be greater than the degree of $q(x)$ at least by 2.

$C)$ the degree of $q(x)$ must be greater than the degree of $p(x)$ at least by 2.

$D)$ non of these

52. **To evaluate** $\int_0^{\infty} \frac{1}{(x^2+4)^2}dx$ **we use the contour:**

$A)$ semicircle in the lower half plane. $B)$unit circle.

$C)$ semicircle in the upper half plane $D)$ non of these.

53. To evaluate $\int_0^{\infty} \frac{1}{(x^2+4)^2} dx$ **we use that**

$A)\ z = e^{ix}$. $B)x = z$. $C)x = \cos z$ $D)$ non of these.

54. To evaluate $\int_0^{\infty} \frac{1}{(x^2+4)^2} dx$ **we calculate the residue at**

$A)-2i$ $B)2i, -2i$. $C)2i$ $D)$ non of these.

55. To value of $\int_0^{\infty} \frac{1}{(x^2+4)^2} dx$ **is**

$A)\pi/16$ $B)-\pi/32$ $C)\pi/32$ $D)-\pi/16$.

56. To evaluate $\int_0^{2\pi} \frac{d\theta}{5+\sin\theta}$ **:**

$A)$ semicircle in the upper half plane .

$B)$ semicircle in the lower half plane.

$C)$ unit circle.

$D)$ non of these.

57. To evaluate $\int_0^{2\pi} \frac{d\theta}{5+\sin\theta}$ **we use the substitution**

$A)\theta = z$. $B)z = e^{i\theta}$. $C)z = \sin\theta$ $D)$ non of these.

58. In the previous problem, after using suitable substitution, the value of $d\theta$ **is**

$A)d\theta = dz$. $B)d\theta = zdz$. $C)d\theta = dz/iz$ $D)$ non of these.

59. In the previous problem, after using suitable substitution, we calculate the residue at the point

$A)(-5-2\sqrt{6})$i . $B)-5+2\sqrt{6}$ $C)(-5+2\sqrt{6})i$ $D)$ non of these.

60. The value of $\int_0^{2\pi} \frac{d\theta}{5+\sin\theta}$ **is**

$A)\pi\sqrt{6}$. $B)\pi/\sqrt{6}$. $C)\pi/2\sqrt{6}$ $D)$ non of these.

With my best wishes
Dr. Samah El-Kholy

Samah