Kafrelsheikh University
Faculty of Engineering
Physics & Engineering Mathematics Dept.
Year: 2nd Year (Elec.)

Subject: Engineering Mathematics (3)

Date: 20/6/2021
Time allowed: 3 hours
Full Marks: 90
Final-Term Exam: 4 pages

أجب عن جميع الأسئلة التالية بالورقة المخصصة لذلك (Bubble Sheet)

Q[1] Choose the correct answer from the following: [90 marks] [LOs: a1,a5,a10]

(1) The relation between Gamma and Beta function is

$(a)\beta(m,n)=\Gamma(m)\Gamma(n)$ $(b)\beta(m,n)=\dfrac{\Gamma(m)\Gamma(n)}{\Gamma(m+n)}$ $(c)\beta(m,n)=\dfrac{\Gamma(m)\Gamma(n)}{\Gamma(m.n)}$ $(d)\beta(m,n)=\dfrac{\Gamma(m+n)}{\Gamma(m)\Gamma(n)}$

(2) The Gamma function integral is defined as

$(a)\Gamma(n)=\int_0^\infty x^n e^{-x}dx$ $(b)\Gamma(n)=\int_0^\infty x^{n-1}e^{x}dx$ $(c)\Gamma(n)=\int_0^1 x^{n-1}e^{-x}dx$ $(d)\Gamma(n)=\int_0^\infty x^{n-1}e^{-x}dx$

$(3) I=\int_a^\infty e^{(2ax-x^2)}\,dx \Rightarrow$ $(a) I=\dfrac{e^{a^2}}{2}\pi$ $(b) I=\dfrac{e^{a^2}}{2}\sqrt{\pi}$ $(c) I=e^{a^2}\sqrt{\pi}$ (d) *None of these*

(4) The suitable substitution to make the integral $I=\int_0^\infty e^{-\sqrt[3]{x}}\,\sqrt{x}\,dx$ on Gamma function

$(a) t=\sqrt[3]{x}$ $(b) t=x$ $(c) t=\sqrt{x}$ (d) *None of these*

(5) The suitable substitution to make the integral $I=\int_0^\infty \dfrac{X^5}{5^X}\,dx$ on Gamma function

$(a) e^t=x$ $(b) e^t=x^5$ $(c) e^t=5^X$ $(d) t=x$

(6) Which of the following is the integral representing Beta function

$(a) 2\int_0^{\frac{\pi}{2}}(\sin\theta)^{2m-1}(\cos\theta)^{2n-1}\,d\theta$ $(b)\int_0^\infty x^{m-1}(1-x)^{n-1}\,dx$ $(c)\int_0^1 x^{m-1}(1-x)^{n-1}\,dx$ (d) *a* and *c*

$(7)\ I=\int_0^{\frac{\pi}{2}}\sin 2\theta\,\cos\theta\,d\theta \Rightarrow (a) I=\dfrac{3}{2}$ $(b) I=\sqrt{\pi}$ $(c) I=\dfrac{1}{2}$ $(d) I=\dfrac{2}{3}$

(8) The suitable substitution to make the integral $I=\int_0^1\sqrt{x^2(1-x^2)}\,dx$ on Beta *form is*

$(a) x(1-x^2)=y$ $(b) x^2=y$ $(c) x=y^2$ $(d) x=\sqrt{y}$

(9) Which of the following methods is used to find the real roots of the equations:
(a) False position (b) Bisection (c) Newton-Raphson (d) all of these

(10) The Newton-Raphson is also called:
(a) Tangent method (b) Secant Method (c) Chord method (d) Diameter method

(11) Which of the following methods is used to solve O.D.E.:
(a) Runge-Kutta (b) Euler's (c) a and b (d) None of these

انظر خلف الورقة

Manal

(12) In LU Decomposition : *if* $A=\begin{pmatrix}1 & -2 & 3\\ 2 & -5 & 12\\ 0 & 2 & -10\end{pmatrix}$, *Then* $L=......$

(a) $L=\begin{pmatrix}1 & 2 & 0\\ 0 & 1 & -2\\ 0 & 0 & 1\end{pmatrix}$ (b) $L=\begin{pmatrix}1 & -2 & 3\\ 0 & -1 & 6\\ 0 & 0 & 2\end{pmatrix}$ (c) $L=\begin{pmatrix}1 & 0 & 0\\ 2 & 1 & 0\\ 0 & -2 & 1\end{pmatrix}$ (d) *None of these*

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* In LU factorizatino: if the system is $\begin{pmatrix}1 & 6 & 2\\ -1 & -3 & -1\\ 2 & 12 & 5\end{pmatrix}\begin{pmatrix}x_1\\ x_2\\ x_3\end{pmatrix}=\begin{pmatrix}9\\ 17\\ -4\end{pmatrix}$, then

(13) (a) $U=\begin{pmatrix}1 & 6 & 2\\ 0 & 3 & 1\\ 0 & 0 & 1\end{pmatrix}$ (b) $U=\begin{pmatrix}1 & 0 & 0\\ 1 & 1 & 0\\ 2 & 0 & 1\end{pmatrix}$ (c) $U=\begin{pmatrix}1 & 0 & 0\\ 6 & 3 & 0\\ 2 & 1 & -1\end{pmatrix}$ (d) $U=\begin{pmatrix}1 & 1 & 2\\ 0 & 1 & 1\\ 0 & 0 & 1\end{pmatrix}$

(14) (a) $\begin{pmatrix}x_1\\ x_2\\ x_3\end{pmatrix}=\begin{pmatrix}-43\\ 16\\ 22\end{pmatrix}$ (b) $\begin{pmatrix}x_1\\ x_2\\ x_3\end{pmatrix}=\begin{pmatrix}-43\\ 16\\ -22\end{pmatrix}$ (c) $\begin{pmatrix}x_1\\ x_2\\ x_3\end{pmatrix}=\begin{pmatrix}-43\\ -16\\ -22\end{pmatrix}$ (d) $\begin{pmatrix}x_1\\ x_2\\ x_3\end{pmatrix}=\begin{pmatrix}43\\ 16\\ -22\end{pmatrix}$

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(15) In Curve fitting; find the suitable subistitution to convert the nonlinear equation: $y=ae^{bx}$ to a linear equation: $Y=A+BX$

(a) $\begin{cases}X=\ln x,\ Y=y\\ A=\ln a,\ B=b\end{cases}$ (b) $\begin{cases}Y=\ln y,\ X=e^{x}\\ A=\ln a,\ B=b\end{cases}$ (c) $\begin{cases}Y=\ln y,\ X=x\\ A=\ln a,\ B=b\end{cases}$ (d) None of these

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(16) In Curve fitting; find the suitable subistitution to convert the nonlinear equation: $y=\ln(a+bx)$ to a linear equation: $Y=A+BX$

(a) $\begin{cases}Y=e^{y},\ X=e^{x}\\ A=a,\ B=b\end{cases}$ (b) $\begin{cases}Y=e^{y},\ X=x\\ A=a,\ B=b\end{cases}$ (c) $\begin{cases}Y=\ln y,\ X=x\\ A=a,\ B=b\end{cases}$ (d) None of these

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* Fit the curve: $y=\dfrac{1}{m+n\cos\theta}$ to the following data

i	1	2	3
Θ_i	30	45	60
y_i	0.225	0.27	0.32

then ......

(17) *The values of m and n are* (a) $\begin{cases}m=0.2603\\ n=0.7215\end{cases}$ (b) $\begin{cases}m=1.28887\\ n=3.572n\end{cases}$ (c) $\begin{cases}m=3.5725\\ n=1.28887\end{cases}$ (d) None of these

(18) The mean square error is (a) ± 0.057427 (b) ± 5.57427 (c) ± 0.0057427 (d) None of these

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(19) Fit the striaght line that, the best fits the following data by least square method

x	1	2	3	4	5	6
y	2	4	7	9	12	14

(a) $y=0.6+2.45714x$ (b) $y=-0.6-2.45714x$ (c) $y=-0.6+2.45714x$ (d) None of these

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انظر الورقة الثانية

Manal

(20) In Curve fitting; find the suitable subistitution to convert

the nonlinear equation: $y = ab^x$ to a linear equation: $Y = A + BX$

$(a)\begin{cases} Y = \ln y,\ X = x \\ A = \ln a,\ B = \ln b \end{cases}$ $(b)\begin{cases} Y = y,\ X = \ln x \\ A =,\ B = b \end{cases}$ $(c)\begin{cases} Y = \ln y,\ X = \ln x \\ A = \ln a,\ B = \ln b \end{cases}$ (d) None of these

(21) **Find the solution of O.D.E.** $X' = AX$, **where eigen-values** $\lambda_1 \neq \lambda_2$ **and eigen-vectors** $\overline{v}_1$ *and* $\overline{v}_2$

$(a)\ x(t) = \alpha_1 \overline{v}_1 e^{\lambda_1 t} + \alpha_2 \overline{v}_2 e^{\lambda_1 t}$ $(b)\ x(t) = \alpha_1 \overline{v}_1 e^{\lambda_1 t} + \alpha_2 \overline{v}_2 e^{\lambda_2 t}$

$(c)\ x(t) = \alpha_1 \overline{v}_1 e^{\lambda_1 t} + \alpha_2 \overline{v}_1 e^{\lambda_1 t}$ (d) *None of these*

(22) **Find the solution of O.D.E.** $X' = AX$, **where eigen-values are complex conjugate** $\lambda = h \pm i\mu$ **and eigen-vectors** $\overline{v} = a + ib$

$a)\ x(t) = \alpha_1 e^{\mu t}[a\cosh t - b\sinh t] + \alpha_2 e^{\mu t}[a\sinh t + b\cosh t]$

$b)\ x(t) = e^{ht}[a\cos\mu t + b\sin\mu t] + e^{ht}[a\sin\mu t - b\cos\mu t]$

$c)\ x(t) = \alpha_1 e^{ht}[a\cos\mu t - b\sin\mu t] + \alpha_2 e^{ht}[a\sin\mu t + b\cos\mu t]$

$d)$ *none of these*

* **If the following O.D.E. is:** $X' = \begin{bmatrix} 6 & -13 \\ 1 & 0 \end{bmatrix} X,\qquad X(0) = \begin{bmatrix} 5 \\ 3 \end{bmatrix}$, Then

(23) *Eigen values are*: $(a)\begin{cases} \lambda_1 = 3 \\ \lambda_2 = 2 \end{cases}$ $(b)\ \lambda_{1,2} = 2 \pm i3$ $(c)\ \lambda_{1,2} = 3 \pm i2$ (d) *None of these*

(24) *Eigen vectors are*: $(a)\ X_{1,2} = \begin{bmatrix} 3 \\ 1 \end{bmatrix} \pm i \begin{bmatrix} 2 \\ 0 \end{bmatrix}$ $(b)\ X_{1,2} = \begin{bmatrix} 2 \\ 0 \end{bmatrix} \pm i \begin{bmatrix} 3 \\ 1 \end{bmatrix}$ $(c)\ X_{1,2} = \begin{bmatrix} 1 \\ 3 \end{bmatrix} \pm i \begin{bmatrix} 0 \\ 2 \end{bmatrix}$ (d) *None of these*

(25) The constants are: $(a)\begin{cases} \alpha_1 = 5 \\ \alpha_2 = 3 \end{cases}$ $(b)\begin{cases} \alpha_1 = 3 \\ \alpha_2 = -2 \end{cases}$ $(c)\begin{cases} \alpha_1 = 5 \\ \alpha_2 = -3 \end{cases}$ (d) *None of these*

(26) **If the function f(x) has a root in [a,b], when you use the method of false position to find its root, the equation is……..**

$(a)\ x_r = x_a - \dfrac{f(x_a)[x_b - x_a]}{f(x_b) - f(x_a)}$ $(b)\ x_r = x_b - \dfrac{f(x_b)[x_a - x_b]}{f(x_a) - f(x_b)}$

$(c)\ x_r = x_b + \dfrac{(x_b)[x_a - x_b]}{f(x_a) - f(x_b)}$ (d) *None of these*

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(27) **By using Secant method, find the root of** $f(x) = x - e^{-x}$ $in\ [0,1]$
(Correct to three decimal places).

$(a)\ x_{i+1} = 1.56714$ $(b)\ x_{i+1} = 0.56714$

$(c)\ x_{i+1} = 0.056714$ (d) *None of these*

(28) **How many steps dose the second order Runge-Kutta method use?**
(a) Two steps (b) Three steps (c) Fourth steps (d) One step

(29) **The following equation is used to solve O.D.E. by Runge-Kutta method**

$(a)\ y_n = y_{n+1} + \frac{1}{6}(k_1 + 2k_2 + 2k_3 + k_4)$ $(b)\ y_{n+1} = y_n + \frac{1}{4}(k_1 + 2k_2 + 2k_3 + k_4)$

$(c)\ y_{n+1} = y_n + \frac{1}{2}(k_1 + k_2)$ $(d)\ y_{n+1} = y_n + \frac{1}{6}(k_1 + 2k_2 + 2k_3 + k_4)$

(30) **Use Euler's method to approximate the solution for initial value problem**

$$y' = xe^{3x} - 2y, \quad 0 \le x \le 1, \quad y(0) = 0, \quad with\ \ h = 0.25$$

$(a)\ y(1) = 20.9213416$ $(b)\ y(1) = 12.009213416$

$(c)\ y(1) = 2.09213416$ $(d)\ y(1) = 0.09213416$

===== انتهت الأسئلة =====

With my best wishes → Dr. Manal El-said Ali

Manal