```
Sub Macro2()
'
' Macro2 Macro
' current (I=dQdtI = \frac{dQ}{dt}), where the derivative of charge with respect to time gives the cur
rent.
' "&chr(10)&"       · Integral Function (?f(x,y)dx\int f(x, y) dx):
'
End Sub
Sub Macro3()
'
' Macro3 Macro
' · Integral Function (?f(x,y)dx\int f(x, y) dx):
'
End Sub
Sub Macro4()
'
' Macro4 Macro
' Calculating the total energy in a capacitor (W=?V dQW = \int V \, dQ) or the area under the voltage-
time graph for evaluating work done.
'
End Sub
Sub Macro5()
'
' Macro5 Macro
' : $$W = \int_0^Q V \, dQ$$
' "&chr(10)&"       § Here, WW represents the energy stored, VV is voltage, and QQ is charge. Integrat
ion helps calculate the energy based on the charge distribution.
' "&chr(10)&"       o Inductors: $$V = L \frac{dI}{dt
'
End Sub
Sub Macro6()
'
' Macro6 Macro
' Rate of Change in Current: $$I = \frac{dQ}{dt}$$
' "&chr(10)&"       § This derivative links the charge flowing through a conductor over time to the cu
rrent.
' "&chr(10)&"       o Voltage in Changing Magnetic Fields (Faraday's Law): $$\mathcal{E}
'
End Sub
Sub Macro7()
'
' Macro7 Macro
' 1. Junior-Level Focus:
' "&chr(10)&"       o Electrical Trade Theory (N1-N3):
' "&chr(10)&"       § Covers foundational concepts like safety precautions, DC theory, conductors, and
 wiring systems.
' "&chr(10)&"       § Practical applications i
'
End Sub
Sub Macro8()
'
' Macro8 Macro
' 1. Voltage Across a Capacitor: $$V(t) = \frac{1}{C} \int i(t) \, dt + V_0$$
' "&chr(10)&"       o Application: Determines voltage V(t)V(t) across a capacitor, where i(t)i(t) is t
he current, CC is capacitance, and V0V_0 is the initial voltage.
'
End Sub
Sub Macro9()
'
' Macro9 Macro
' 2. Total Energy Stored in an Inductor: $$E = \frac{1}{2} L \int i^2(t) \, dt$$
' "&chr(10)&"       o Application: Calculates energy in an inductor, where LL is inductance and i(t)i(
t) is current.
'

'
End Sub
Sub Macro10()
'
' Macro10 Macro
' 3. Charge in a Circuit: $$Q = \int I(t) \, dt$$
' "&chr(10)&"       o Application: Finds the total electric charge QQ flowing through a circuit over t
ime, based on current I(t)I(t).
```

```
'
End Sub
Sub Macro11()
'
' Macro11 Macro
' 1. Current in a Capacitor: $$I(t) = C \frac{dV(t)}{dt}$$
' "&chr(10)&"       o Application: Relates the rate of change of voltage to the current flowing throug
h a capacitor.
' "&chr(10)&"       2. Electromotive Force (Faraday’s Law): $$\mathcal{E}
'
End Sub
Sub Macro12()
'
' Macro12 Macro
' Circuit Analysis:
' "&chr(10)&"       o Use integrals and derivatives to analyze RLC circuits and measure power dissipat
ion.
' "&chr(10)&"       · Measuring Instruments:
' "&chr(10)&"       o Apply calculus to calibrate and interpret readings
'
End Sub
Sub Macro13()
'
' Macro13 Macro
' Circuit Analysis:
' "&chr(10)&"       o Use integrals and derivatives to analyze RLC circuits and measure power dissipat
ion.
' "&chr(10)&"       · Measuring Instruments:
' "&chr(10)&"       o Apply calculus to calibrate and interpret readings
'
End Sub
Sub Macro14()
'
' Macro14 Macro
' 1. Junior-Level Roles: Maintenance technician, soldering specialist, or assistant in electrical inst
allations.
' "&chr(10)&"       2. Senior-Level Roles: Electrical engineer, system designer, or project manager ov
erseeing large-scale installations and
'
End Sub
Sub Macro1()
'
' Macro1 Macro
' · Derivative Function (f'(x, y)):
' "&chr(10)&"       o Derivatives measure the rate of change of a function, essential for analyzing va
rying electrical quantities like current (I), voltage (V), and resistance (R).
' "&chr(10)&"       o Example in
'


End Sub
Sub Macro15()
'
' Macro15 Macro
' ?f(x)g'(x)dx=f(x)g(x)-?g(x)f'(x)dx.\int f(x) g'(x) dx = f(x) g(x) - \int g(x) f'(x) dx.
' "&chr(10)&"       · Example: Integrate ?xexdx\int x e^x dx:
' "&chr(10)&"       1. Set f(x)=xf(x) = x and g'(x)=exg'(x) = e^x.
'
End Sub
Sub Macro16()
'
' Macro16 Macro
'
' "&chr(10)&"       f'(x)=1,g(x)=ex.f'(x) = 1, \quad g(x) = e^x.
' "&chr(10)&"       3. Apply the formula:
' "&chr(10)&"
' "&chr(10)&"       ?xexdx=xex-?exdx=xex-ex+C.\int x e^x dx = x e^x - \int e^x dx = x e^x - e^x + C.
'
    Selection.MoveDown Unit:=wdLine, Count:=19
End Sub
Sub Macro17()
'
' Macro17 Macro
'
```

```
' "&chr(10)&"       f'(x)=1,g(x)=ex.f'(x) = 1, \quad g(x) = e^x.
' "&chr(10)&"       3. Apply the formula:
' "&chr(10)&"
' "&chr(10)&"       ?xexdx=xex-?exdx=xex-ex+C.\int x e^x dx = x e^x - \int e^x dx = x e^x - e^x + C.
'
End Sub
Sub Macro18()
'
' Macro18 Macro
'
' "&chr(10)&"       ?sin?2(x)dx=?12dx-?cos?(2x)2dx=x2-sin?(2x)4+C.\int \sin^2(x) dx = \int \frac{1}{2}
 dx - \int \frac{\cos(2x)}{2} dx = \frac{x}{2} - \frac{\sin(2x)}{4} + C.
' "&chr(10)&"       3. Completing the Square:
' "&chr(10)&"       o Transform qu
'
End Sub
Sub Macro19()
'
' Macro19 Macro
'
' "&chr(10)&"       o Example: Integrate ?1x2+6x+10dx\int \frac{1}{x^2 + 6x + 10} dx.
' "&chr(10)&"       § Complete the square: x2+6x+10=(x+3)2+1x^2 + 6x + 10 = (x + 3)^2 + 1.
' "&chr(10)&"       § Use the formula for inverse tangent:
' "&chr(10)&"
'
End Sub
Sub Macro20()
'
' Macro20 Macro
'
' "&chr(10)&"       2(x+3)3?Ax+3+B(x+3)2+C(x+3)3.\frac{2}{(x+3)^3} \to \frac{A}{x+3} + \frac{B}{(x+3)^
2} + \frac{C}{(x+3)^3}.
' "&chr(10)&"       · Case 2: Two Recursive Factors:
' "&chr(10)&"
' "&chr(10)&"       5x(x-1)2(2x-5)?A(x-1)+B(x-1)2+C
'
End Sub
Sub Macro21()
'
' Macro21 Macro
' 5x(x-1)2(2x-5)?A(x-1)+B(x-1)2+C(2x-5).\frac{5x}{(x-1)^2 (2x-5)} \to \frac{A}{(x-1)} + \frac{B}{(x-1)
^2} + \frac{C}{(2x-5)}.
'
End Sub
Sub Macro22()
'
' Macro22 Macro
' 5x(x-1)2(2x-5)?A(x-1)+B(x-1)2+C(2x-5).\frac{5x}{(x-1)^2 (2x-5)} \to \frac{A}{(x-1)} + \frac{B}{(x-1)
^2} + \frac{C}{(2x-5)}.
'
End Sub
Sub Macro23()
'
' Macro23 Macro
'
' "&chr(10)&"       A=?01[(x+2)-x2]dx=?01(-x2+x+2)dx.A = \int_0^1 [(x+2) - x^2] dx = \int_0^1 (-x^2 +
x + 2) dx.
' "&chr(10)&"       Compute:
' "&chr(10)&"
' "&chr(10)&"       ?01(-x2+x+2)dx=[-x33+x22+2x]01=-13+12+2=136.\int_0^1 (-x^2 + x + 2)
'
End Sub
Sub Macro24()
'
' Macro24 Macro
'
' "&chr(10)&"       V=p?ab[f(x)]2dx.V = \pi \int_a^b [f(x)]^2 dx.
' "&chr(10)&"       · Shell Method:
' "&chr(10)&"
' "&chr(10)&"       V=2p?abxf(x)dx.V = 2\pi \int_a^b x f(x) dx.
'


'
```

```
End Sub
Sub Macro25()
'
' Macro25 Macro
' 1. Formula:
' "&chr(10)&"       \[ V = \pi \int_0^1 (x2)2 dx = \pi \int_0^1 x^4 dx. \]
' "&chr(10)&"       2. Compute:
' "&chr(10)&"       \[ V = \pi \left[\frac{x5}{5}\right]_01 = \frac{\pi}{5}. \]
'
End Sub
Sub Macro26()
'
' Macro26 Macro
' x2=4-x2  ?  2x2=4  ?  x=±2.x^2 = 4 - x^2 \implies 2x^2 = 4 \implies x = \pm\sqrt{2}.
' "&chr(10)&"       Intersection points are (2,2)(\sqrt{2}, 2) and (-2,2)(-\sqrt{2}, 2).
'
End Sub
Sub Macro27()
'
' Macro27 Macro
'
' "&chr(10)&"       A=?-22[(4-x2)-x2]dx=?-22(4-2x2)dx.A = \int_{-\sqrt{2}}^{\sqrt{2}} [(4 - x^2) - x^2
] dx = \int_{-\sqrt{2}}^{\sqrt{2}} (4 - 2x^2) dx.
' "&chr(10)&"       Compute:
' "&chr(10)&"       \[ A = [4x - \frac{2x3}{3}]_{-\sqrt{2}}{\
'
End Sub
Sub Macro28()
'
' Macro28 Macro
'
' "&chr(10)&"       x¯=?abx[f(x)-g(x)]dx?ab[f(x)-g(x)]dx.\bar{x} = \frac{\int_a^b x [f(x) - g(x)] dx}{
\int_a^b [f(x) - g(x)] dx}.
' "&chr(10)&"       · Example: For y=x2y = x^2, find x¯\bar{x} over [0,1][0, 1]:
' "&chr(10)&"
' "&chr(10)&"
'
End Sub
Sub Macro29()
Attribute Macro29.VB_Description = "Compute numerator:

            \r\n
                                                                                              \r\n
        ?01x3dx=x44|01=14.\\int_0^1 x^3 dx = \\frac{x^4}{4} \\big|_0^1 = \\frac{1}{4}.

                                            \r\n            Compute denominator:

                                        \r\n _
                        \r\n            ?01x2dx=x33|01=13."
'
' Macro29 Macro
' Compute numerator:
' "&chr(10)&"
' "&chr(10)&"       ?01x3dx=x44|01=14.\int_0^1 x^3 dx = \frac{x^4}{4} \big|_0^1 = \frac{1}{4}.
' "&chr(10)&"       Compute denominator:
' "&chr(10)&"
' "&chr(10)&"       ?01x2dx=x33|01=13.
'
End Sub
Sub Macro30()
Attribute Macro30.VB_Description = "                                                              \r\n
          Ix=?ab[f(x)]2dx.I_x = \\int_a^b [f(x)]^2 dx.

              \r\n            2. Moment of Inertia:

          \r\n            o For solids:
                                                                                                    \r
\n
                                                                                \r\n           I=?abx
2[f(x)]dx.I = \\int_a^b x^2 [f(x)] dx. _

  \r\n"
'
```

```
' Macro30 Macro
'
' "&chr(10)&"        Ix=?ab[f(x)]2dx.I_x = \int_a^b [f(x)]^2 dx.
' "&chr(10)&"        2. Moment of Inertia:
' "&chr(10)&"        o For solids:
' "&chr(10)&"
' "&chr(10)&"        I=?abx2[f(x)]dx.I = \int_a^b x^2 [f(x)] dx.
'


'
End Sub
Sub Macro31()
'
' Macro31 Macro
' : Find the area between y=x2y = x^2 and y=4-x2y = 4 - x^2 over x=-2x = -\sqrt{2} to x=2x = \sqrt{2}:
' "&chr(10)&"
' "&chr(10)&"        A=?-22[(4-x2)-x2]dx=?-22(4-2x2)dx.A = \int_{-\sqrt{2}}^{\sqrt{2}} [(4 - x^2) - x^2
] dx = \int_{-\sqrt{2}}
'
End Sub
Sub Macro32()
'
' Macro32 Macro
' Polar form representation (modulus r=x2+y2r = \sqrt{x^2 + y^2} and argument ?=tan?-1(y/x)\theta = \t
an^{-1}(y/x)) is crucial for simplifying multiplications and divisions.
'
End Sub
Sub Macro33()
'
' Macro33 Macro
' o Formula: D=ad-bcD = ad - bc.
' "&chr(10)&"        o Example Calculation: If D=[63-23]D = \begin{bmatrix} 6 & 3 \\ -2 & 3 \end{bmatri
x}, then:
' "&chr(10)&"
' "&chr(10)&"        D=(6·3)-(3·-2)=18+6=24.D = (6 \cdot 3) - (3 \cdot -2) = 18
'
    Selection.MoveDown Unit:=wdLine, Count:=22
End Sub
Sub Macro34()
'
' Macro34 Macro
' D=[abcdefghi],D = \begin{bmatrix} a & b & c \\ d & e & f \\ g & h & i \end{bmatrix},
' "&chr(10)&"        the determinant is:
' "&chr(10)&"
' "&chr(10)&"        D=a(ei-fh)-b(di-fg)+c(dh-eg).D = a(ei - fh) - b(di - fg) + c(dh - eg).
'
End Sub
Sub Macro35()
'
' Macro35 Macro
' D=[abcdefghi],D = \begin{bmatrix} a & b & c \\ d & e & f \\ g & h & i \end{bmatrix},
' "&chr(10)&"        the determinant is:
' "&chr(10)&"
' "&chr(10)&"        D=a(ei-fh)-b(di-fg)+c(dh-eg).D = a(ei - fh) - b(di - fg) + c(dh - eg).
'
End Sub
Sub Macro36()
'
' Macro36 Macro
'
' "&chr(10)&"        o Using conjugates, divide (3+2i)(3 + 2i) by (1-i)(1 - i): Multiply numerator and
denominator by (1+i)(1 + i):
' "&chr(10)&"        \[ \frac{(3+2i)}{(1-i)} = \frac{(3+2i)(1+i)}{(1-i)(1+i)} = \frac{3+3i+2i+2i2}{1+12
} = \frac{1+5i}{2}. \]
'
End Sub
Sub Macro37()
'
' Macro37 Macro
'
' "&chr(10)&"        o Convert z=3+4iz = 3 + 4i: Modulus: r=32+42=5r = \sqrt{3^2 + 4^2} = 5. Argument:
?=tan?-1(43)53.1°\theta = \tan^{-1}(\frac{4}{3}) \approx 53.1^\circ. Polar Form: z=5(cos?53.1°+isin?53
.1°)z = 5(\cos 53.1^\circ + i\sin 53.1^\circ).
```

```
'
    Selection.MoveDown Unit:=wdLine, Count:=132
    Selection.MoveUp Unit:=wdLine, Count:=36
End Sub
Sub Macro38()
'
' Macro38 Macro
'
' "&chr(10)&"       o Convert z=3+4iz = 3 + 4i: Modulus: r=32+42=5r = \sqrt{3^2 + 4^2} = 5. Argument:
?=tan?-1(43)53.1°\theta = \tan^{-1}(\frac{4}{3}) \approx 53.1^\circ. Polar Form: z=5(cos?53.1°+isin?53
.1°)z = 5(\cos 53.1^\circ + i\sin 53.1^\circ).
'
End Sub
Sub Macro39()
'
' Macro39 Macro
' o x3?3x2x^3 \to 3x^2, 5x2?10x5x^2 \to 10x, -x?-1-x \to -1, 7?07 \to 0.
' "&chr(10)&"       2. Result: dydx=3x2+10x-1\frac{dy}{dx} = 3x^2 + 10x - 1.
'

'
    Selection.MoveDown Unit:=wdLine, Count:=31
End Sub
Sub Macro40()
'
' Macro40 Macro
'
' "&chr(10)&"       (x+y)3=x3+3x2y+3xy2+y3.(x + y)^3 = x^3 + 3x^2y + 3xy^2 + y^3.
' "&chr(10)&"       3. Differentiation from First Principles:
' "&chr(10)&"       o Define dydx\frac{dy}{dx} as:
' "&chr(10)&"
' "&chr(10)&"       lim?h?0f(x+
'
End Sub
Sub Macro41()
Attribute Macro41.VB_Description = "o Let u=2xu = 2x, then:

                    \r\n

\r\n            ddx[sin?(u)]=cos?(u)·dudx.\\frac{d}{dx}[\\sin(u)] = \\cos(u) \\cdot \\frac{du}{dx}.

                                                            \r\n            Substituting u=2xu = 2x:

                                                                \r\n
                                                \r\n            ddx[s
'
' Macro41 Macro
' o Let u=2xu = 2x, then:
' "&chr(10)&"
' "&chr(10)&"       ddx[sin?(u)]=cos?(u)·dudx.\frac{d}{dx}[\sin(u)] = \cos(u) \cdot \frac{du}{dx}.
' "&chr(10)&"       Substituting u=2xu = 2x:
' "&chr(10)&"
' "&chr(10)&"       ddx[s
'
    Selection.MoveDown Unit:=wdLine, Count:=71
End Sub
Sub Macro42()
'
' Macro42 Macro
' o Integrate ?xndx\int x^n dx:
' "&chr(10)&"
' "&chr(10)&"       ?xndx=xn+1n+1+C(if n?-1).\int x^n dx = \frac{x^{n+1}}{n+1} + C \quad (\text{if } n
 \neq -1).
' "&chr(10)&"       2. Trigonometric Integration:
' "&chr(10)&"       o Exa
'
    Selection.MoveDown Unit:=wdLine, Count:=150
End Sub
Sub Macro43()
'
' Macro43 Macro
'
' "&chr(10)&"       · Power Rule: If f(x)=xnf(x) = x^n, then f'(x)=n·xn-1f'(x) = n \cdot x^{n-1}. Exam
```

```
ple: f(x)=x3  ?  f'(x)=3x2f(x) = x^3 \implies f'(x) = 3x^2.
' "&chr(10)&"       · Constant Rule: If f(x)=cf(x) = c, where cc is constant, then f'(x)=0f'(x) = 0. E
xam
'
End Sub
Sub Macro44()
'
' Macro44 Macro
' 2. Advanced Rules
' "&chr(10)&"       For more complex functions:
' "&chr(10)&"       · Product Rule: If f(x)=u(x)·v(x)f(x) = u(x) \cdot v(x), then f'(x)=u'(x)·v(x)+u(x
)·v'(x)f'(x) = u'(x) \cdot v(x) + u(x) \cdot v'(x). Example: f(x)=x·sin?(x)  ?
'
End Sub
Sub Macro45()
'
' Macro45 Macro
' Real-World Example
' "&chr(10)&"       Let’s calculate the derivative of f(x)=3x2+5x+2f(x) = 3x^2 + 5x + 2, representing
velocity in an engineering context:
' "&chr(10)&"       1. Differentiate each term:
' "&chr(10)&"       o 3x2  ?  6x3x^2 \
'
    Selection.MoveDown Unit:=wdLine, Count:=145
End Sub
Sub Macro46()
'
' Macro46 Macro
' o The limit describes the value a function approaches as the input gets close to a specific point. N
otation: lim?x?af(x)\lim_{x \to a} f(x).
' "&chr(10)&"       o Example: Find lim?x?2(x2-4)\lim_{x \to 2} (x^2 - 4):
' "&chr(10)&"
'
End Sub
Sub Macro47()
'
' Macro47 Macro
'   o Forms like 00\frac{0}{0} are resolved by simplifying the function or applying L’Hôpital’s rule (
if allowed).
' "&chr(10)&"       4. Continuity
' "&chr(10)&"       1. Definition:
' "&chr(10)&"       o A function f(x)f(x) is continuous at x=a
'
End Sub
Sub Macro48()
'
' Macro48 Macro
'
' "&chr(10)&"
' "&chr(10)&"       x=-4±42-4(2)(-6)2(2)=-4±16+484=-4±644.x = \frac{-4 \pm \sqrt{4^2 - 4(2)(-6)}}{2(2)
} = \frac{-4 \pm \sqrt{16 + 48}}{4} = \frac{-4 \pm \sqrt{64}}{4}.
' "&chr(10)&"       3. Simplify:
' "&chr(10)&"
'
End Sub
Sub Macro49()
'
' Macro49 Macro
'
' "&chr(10)&"       vr=vA2+vB2=402+302=1600+900=2500=50 km/h.v_r = \sqrt{v_A^2 + v_B^2} = \sqrt{40^2 +
 30^2} = \sqrt{1600 + 900} = \sqrt{2500} = 50 \, \text{km/h}.
' "&chr(10)&"       2. Shortest Distance:
' "&chr(10)&"       o If both cars are moving tow
'
    Selection.MoveDown Unit:=wdLine, Count:=53
End Sub
Sub Macro50()
'
' Macro50 Macro
' A ball is projected horizontally from a height of 5 m5 \, \text{m} with an initial velocity of 10 m/
s10 \, \text{m/s}. Calculate the time of flight and range:
' "&chr(10)&"       1. Time of Flight: Using h=12gt2h = \frac{1}{2} g t^2, solve:
'
```

```
End Sub
Sub Macro51()
'
' Macro51 Macro
'
' "&chr(10)&"       5=12·9.8·t2  ?  t=109.8I.01 s.5 = \frac{1}{2} \cdot 9.8 \cdot t^2 \implies t = \sq
rt{\frac{10}{9.8}} \approx 1.01 \, \text{s}.
' "&chr(10)&"       2. Range: Horizontal distance: x=v·tx = v \cdot t:
' "&chr(10)&"
'
End Sub
Sub Macro52()
'
' Macro52 Macro
' A wheel rotates at 10 rad/s10 \, \text{rad/s} with an angular acceleration of 2 rad/s22 \, \text{rad
/s}^2. Find the angular displacement after 5 s5 \, \text{s}:
' "&chr(10)&"       1. Use:
' "&chr(10)&"
' "&chr(10)&"       ?=?t+12at2.\t
'
    Selection.MoveDown Unit:=wdLine, Count:=26
End Sub
Sub Macro53()
'
' Macro53 Macro
' F=ma=1000·2=2000 N.F = ma = 1000 \cdot 2 = 2000 \, \text{N}.
'
    Selection.MoveDown Unit:=wdLine, Count:=35
End Sub
Sub Macro54()
'
' Macro54 Macro
' F=ma=1000·2=2000 N.F = ma = 1000 \cdot 2 = 2000 \, \text{N}.
'
    Selection.MoveDown Unit:=wdLine, Count:=27
End Sub
Sub Macro55()
'
' Macro55 Macro
' 1. Use F=P·AF = P \cdot A:
' "&chr(10)&"
' "&chr(10)&"       A=p·(0.52)2=0.196 m2,A = \pi \cdot \left(\frac{0.5}{2}\right)^2 = 0.196 \, \text{m
}^2,
' "&chr(10)&"
' "&chr(10)&"       F=500·0.196=98.1 kN.F = 500 \cdot 0.196 = 9
'
    Selection.MoveDown Unit:=wdLine, Count:=27
End Sub
Sub Macro56()
'
' Macro56 Macro
' Example: A steel rod with L=2 mL = 2 \, \text{m} and cross-sectional area A=0.01 m2A = 0.01 \, \text
{m}^2 stretches by ?L=0.002 m\Delta L = 0.002 \, \text{m}. Find the stress if E=2·105 MPaE = 2 \cdot 1
0^5 \, \text{MPa}:
' "&chr(10)&"       1. Strain:
'
End Sub
Sub Macro57()
'
' Macro57 Macro
' 2. Stress:
' "&chr(10)&"
' "&chr(10)&"       s=E·?=2·105·0.001=200 MPa.\sigma = E \cdot \epsilon = 2 \cdot 10^5 \cdot 0.001 = 2
00 \, \text{MPa}.
'

'
End Sub
Sub Macro58()
'
' Macro58 Macro
' A gas at 1 atm1 \, \text{atm} and 300 K300 \, \text{K} has a volume 2 m32 \, \text{m}^3. Find its fi
nal volume if the pressure is halved:
```

```
' "&chr(10)&"       1. Using Boyle’s Law (P1V1=P2V2P_1 V_1 = P_2 V_2):
' "&chr(10)&"
'
    Selection.MoveDown Unit:=wdLine, Count:=32
End Sub
Sub Macro59()
'
' Macro59 Macro
' A gas at 1 atm1 \, \text{atm} and 300 K300 \, \text{K} has a volume 2 m32 \, \text{m}^3. Find its fi
nal volume if the pressure is halved:
' "&chr(10)&"       1. Using Boyle’s Law (P1V1=P2V2P_1 V_1 = P_2 V_2):
' "&chr(10)&"
'
    Selection.MoveDown Unit:=wdLine, Count:=24
End Sub
Sub Macro60()
Attribute Macro60.VB_Description = "1. Angular Velocity:

                    \r\n

\r\n            ?=at=4·3=12 rad/s.\\omega = \\alpha t = 4 \\cdot 3 = 12 \\, \\text{rad/s}.

                                                    \r\n            2. Work Done:

                                        \r\n _
                        \r\n            W=12I?2=12·2·122=144 J.W = \\"
'
' Macro60 Macro
' 1. Angular Velocity:
' "&chr(10)&"
' "&chr(10)&"       ?=at=4·3=12 rad/s.\omega = \alpha t = 4 \cdot 3 = 12 \, \text{rad/s}.
' "&chr(10)&"       2. Work Done:
' "&chr(10)&"
' "&chr(10)&"       W=12I?2=12·2·122=144 J.W = \
'
End Sub
Sub Macro61()
'
' Macro61 Macro
'
' "&chr(10)&"       P=Q·?P?,P = \frac{Q \cdot \Delta P}{\eta},
' "&chr(10)&"       where Q=0.5/60 m3/sQ = 0.5/60 \, \text{m}^3/\text{s}, ?P=2×106 Pa\Delta P = 2 \tim
es 10^6 \, \text{Pa}, and assume ?=0.85\eta = 0.85:
' "&chr(10)&"
'
End Sub
Sub Macro62()
'
' Macro62 Macro
'
' "&chr(10)&"       A=p·(0.025)2=1.96×10-3 m2.A = \pi \cdot (0.025)^2 = 1.96 \times 10^{-3} \, \text{m
}^2.
' "&chr(10)&"       2. Stress:
' "&chr(10)&"
' "&chr(10)&"       s=FA=800001.96×10-34.08×107 Pa.\sigma = \frac{F}{A} = \frac{80000}{1.96
'
End Sub
Sub Macro63()
'
' Macro63 Macro
'   Advanced Example: A gas undergoes an isothermal expansion from P1=3 atm,V1=2 m3P_1 = 3 \, \text{at
m}, V_1 = 2 \, \text{m}^3 to V2=5 m3V_2 = 5 \, \text{m}^3. Calculate the work done:
' "&chr(10)&"
' "&chr(10)&"       W=P1V1ln?(V2V1),W = P_1
'
    Selection.MoveDown Unit:=wdLine, Count:=173
End Sub
Sub Macro64()
'
' Macro64 Macro
' Z=R2+(XL-XC)2,Z = \sqrt{R^2 + (X_L - X_C)^2},
' "&chr(10)&"       where XL=2pfLX_L = 2\pi fL and XC=12pfCX_C = \frac{1}{2\pi fC}.
' "&chr(10)&"       · Use phasor diagrams to analyze voltage and current relationships.
```

```
' "&chr(10)&"        · Pow
'
End Sub
Sub Macro65()
'
' Macro65 Macro
' o Resistance (RR) = 10 O10 \, \Omega,
' "&chr(10)&"       o Inductive Reactance (XLX_L) = 15 O15 \, \Omega,
' "&chr(10)&"       o Capacitive Reactance (XCX_C) = 5 O5 \, \Omega:
' "&chr(10)&"
' "&chr(10)&"       Z=R2+(XL-XC)2=102+(15
'
End Sub
Sub Macro66()
'
' Macro66 Macro
'
' "&chr(10)&"       Z=R2+(XL-XC)2=102+(15-5)2=100+100=14.14 O.Z = \sqrt{R^2 + (X_L - X_C)^2} = \sqrt{1
0^2 + (15 - 5)^2} = \sqrt{100 + 100} = 14.14 \, \Omega.
' "&chr(10)&"       General Assessment Guidelines
' "&chr(10)&"       1. Practical Applications:
'
    Selection.MoveDown Unit:=wdLine, Count:=61
End Sub
Sub Macro67()
'
' Macro67 Macro
' Z=R2+(XL-XC)2,XL=2pfL,XC=12pfC.Z = \sqrt{R^2 + (X_L - X_C)^2}, \quad X_L = 2\pi fL, \quad X_C = \fra
c{1}{2\pi fC}.
' "&chr(10)&"       3. Resonance:
' "&chr(10)&"       o Achieved when XL=XCX_L = X_C. Use:
' "&chr(10)&"
'
    Selection.MoveDown Unit:=wdLine, Count:=24
End Sub
Sub Macro68()
'
' Macro68 Macro
'
' "&chr(10)&"       Example Problem: A convection heater operates with 2 kW2 \, \text{kW}. Find the en
ergy used in 5 hours5 \, \text{hours}:
' "&chr(10)&"
' "&chr(10)&"       E=P·t=2·5=10 kWh.E = P \cdot t = 2 \cdot 5 = 10 \, \text{kWh}.
'
    Selection.MoveDown Unit:=wdLine, Count:=21
End Sub
Sub Macro69()
'
' Macro69 Macro
' Example Problem: An LED lamp uses 10 W10 \, \text{W} and operates for 4 hours/day4 \, \text{hours/da
y}. Calculate energy consumption in one month:
' "&chr(10)&"
' "&chr(10)&"       E=P·t·days=10·4·30=1.2 kWh.E = P \cdot t \cdot \text{days}
'
    Selection.MoveDown Unit:=wdLine, Count:=28
    Selection.MoveUp Unit:=wdLine, Count:=37
    Selection.Copy
End Sub
Sub Macro70()
'
' Macro70 Macro
' Module 4: Programmable Logic Controllers (PLCs)
' "&chr(10)&"       Key Topics:
' "&chr(10)&"       · Define PLCs, their components, and their programming languages (e.g., ladder log
ic).
' "&chr(10)&"       Practical Insights: PLC applications
'
    Selection.MoveDown Unit:=wdLine, Count:=23
    Selection.Copy
End Sub
Sub Macro71()
Attribute Macro71.VB_Description = "
                  \r\n              o Calculate back emf:
```

```
              \r\n
                                                                                                 \r\n
          Eb=V-IaRa.E_b = V - I_aR_a.
                                                                                                     \r
\n            2. Motor Torque:
                                                                                                 \r\n
          o Use: _
                                                                                 \r\n

                                                             \r\n            T=kIa?.T = k I_a \\ph"
'
' Macro71 Macro
'
' "&chr(10)&"       o Calculate back emf:
' "&chr(10)&"
' "&chr(10)&"       Eb=V-IaRa.E_b = V - I_aR_a.
' "&chr(10)&"       2. Motor Torque:
' "&chr(10)&"       o Use:
' "&chr(10)&"
' "&chr(10)&"       T=kIa?.T = k I_a \ph
'
    Selection.MoveDown Unit:=wdLine, Count:=17
    Selection.Copy
End Sub
Sub Macro72()
'
' Macro72 Macro
' Example Problem: Find the torque of a DC motor with Ia=10 AI_a = 10 \, \text{A}, ?=0.02 Wb\phi = 0.0
2 \, \text{Wb}, and k=1k = 1:
' "&chr(10)&"
' "&chr(10)&"       T=kIa?=1·10·0.02=0.2 Nm.T = k I_a \phi = 1 \cdot 10 \cdot 0.02 = 0.2 \, \tex
'
    Selection.MoveRight Unit:=wdCharacter, Count:=1
    Selection.MoveDown Unit:=wdLine, Count:=26
    Selection.Copy
End Sub
Sub Macro73()
'
' Macro73 Macro
'
' "&chr(10)&"       S=ns-nrns,ns=120fP.S = \frac{n_s - n_r}{n_s}, \quad n_s = \frac{120f}{P}.
' "&chr(10)&"       Example Problem: For a motor with f=50 Hzf = 50 \, \text{Hz} and P=4P = 4, calcula
te synchronous speed:
' "&chr(10)&"
'
    Selection.MoveDown Unit:=wdLine, Count:=31
    Selection.Copy
End Sub
Sub Macro74()
'
' Macro74 Macro
'
' "&chr(10)&"       Example Problem: A transformer has Pcore=200 WP_{core} = 200 \, \text{W} and Pcopp
er=300 WP_{copper} = 300 \, \text{W}. Calculate efficiency when delivering Pout=1000 WP_{out} = 1000 \
, \text{W}:
' "&chr(10)&"
' "&chr(10)&"       ?
'
    Selection.MoveDown Unit:=wdLine, Count:=20
    Selection.Copy
End Sub
Sub Macro75()
'
' Macro75 Macro
'
' "&chr(10)&"       · System earthing for safety and fault detection.
' "&chr(10)&"       · Earthing networks and neutral conductor importance.
' "&chr(10)&"       Practical Insights: Proper earthing prevents hazards such as electric shocks and e
nsures f
'
    Selection.MoveDown Unit:=wdLine, Count:=39
    Selection.MoveUp Unit:=wdLine, Count:=1
```

```
    Selection.MoveDown Unit:=wdLine, Count:=25
    Selection.Copy
End Sub
Sub Macro76()
'
' Macro76 Macro
'
' "&chr(10)&"       Enhanced Example: A geyser thermostat heats 50 kg50 \, \text{kg} of water from 25°
C25^\circ \text{C} to 80°C80^\circ \text{C}. Find the energy required if the specific heat capacity of
 water is 4200 J/kg°C4200 \, \text{J/kg}^\circ\text{C}:
'
    Selection.MoveDown Unit:=wdLine, Count:=22
    Selection.Copy
End Sub
Sub Macro77()
'
' Macro77 Macro
'
' "&chr(10)&"       E=50·4200·55=11,550,000 J or 11.55 MJ.E = 50 \cdot 4200 \cdot 55 = 11,550,000 \, \
text{J} \, \text{or} \, 11.55 \, \text{MJ}.
' "&chr(10)&"       Module 3: Lighting Systems
' "&chr(10)&"       Expanded Example: A compact f
'
    Selection.Copy
    Selection.Copy
End Sub
Sub Macro78()
'
' Macro78 Macro
' Expanded Example: A compact fluorescent lamp operates at 15 W15 \, \text{W} for 10 hours/day10 \, \t
ext{hours/day}. Calculate energy consumption for 30 days30 \, \text{days}.
' "&chr(10)&"       Solution:
' "&chr(10)&"       1. Daily Energy:
'
End Sub
Sub Macro79()
'
' Macro79 Macro
' Edaily=P·t=15·10=150 Wh.E_{\text{daily}} = P \cdot t = 15 \cdot 10 = 150 \, \text{Wh}.
' "&chr(10)&"       2. Monthly Energy:
' "&chr(10)&"
' "&chr(10)&"       Emonthly=150·30=4500 Wh=4.5 kWh.E_{\text{monthly}} = 150 \cdot 30 = 4500 \,
'
    Selection.Copy
End Sub
Sub Macro80()
'
' Macro80 Macro
' Advanced Torque Calculation: A DC motor draws Ia=15 AI_a = 15 \, \text{A} with a magnetic flux of ?=
0.03 Wb\phi = 0.03 \, \text{Wb}. Find the armature torque if k=1.2k = 1.2.
' "&chr(10)&"       Solution:
' "&chr(10)&"       1. Torque:
'
    Selection.Copy
End Sub
Sub Macro81()
'
' Macro81 Macro
' T=kIa?=1.2·15·0.03=0.54 Nm.T = k I_a \phi = 1.2 \cdot 15 \cdot 0.03 = 0.54 \, \text{Nm}.
' "&chr(10)&"       Module 6: Alternating Current Machines
' "&chr(10)&"       Speed Analysis Example: For a three-phase induction motor with f=60 Hzf = 60 \,
'
    Selection.Copy
End Sub
Sub Macro82()
'
' Macro82 Macro
'
' "&chr(10)&"       ns=120fP=120·604=1800 RPM.n_s = \frac{120f}{P} = \frac{120 \cdot 60}{4} = 1800 \,
\text{RPM}.
' "&chr(10)&"       2. Rotor Speed:
' "&chr(10)&"
' "&chr(10)&"       nr=ns(1-S)=1800(1-0.05)=1710 RPM.n_r = n_s (1 - S) = 1800 (
```

```
'
    Selection.MoveDown Unit:=wdLine, Count:=198
    Selection.Copy
End Sub
Sub Macro83()
'
' Macro83 Macro
' Promotional Mark: 40% ICASS + 60% Exam marks (minimum 40% required for exam qualification).
' "&chr(10)&"       Exam Setup:
' "&chr(10)&"       · Duration: 3 hours.
' "&chr(10)&"       · Closed book, formula sheet included.
'
    Selection.Copy
End Sub
Sub Macro84()
'
' Macro84 Macro
'
' "&chr(10)&"       o Application: 30-40%.
' "&chr(10)&"       o Analysis/Evaluation: 20-25%.
' "&chr(10)&"       Mark Allocation by Module
' "&chr(10)&"       Module  Weighting (%)
' "&chr(10)&"       Principles of Electricity   30
'

'
    Selection.MoveDown Unit:=wdLine, Count:=43
    Selection.Copy
End Sub
Sub Macro85()
Attribute Macro85.VB_Description = "                                                                    \r\n
          B=µI2pr,B = \\frac{\\mu I}{2 \\pi r},

      \r\n            where µ\\mu is permeability.

          \r\n            3. Inductance in DC Circuits:

              \r\n            o Find inductance:

          \r\n _
                                                                                                    \r\n
          L=N2µAl,L "
'
' Macro85 Macro
'
' "&chr(10)&"       B=µI2pr,B = \frac{\mu I}{2 \pi r},
' "&chr(10)&"       where µ\mu is permeability.
' "&chr(10)&"       3. Inductance in DC Circuits:
' "&chr(10)&"       o Find inductance:
' "&chr(10)&"
' "&chr(10)&"       L=N2µAl,L
'
    Selection.MoveDown Unit:=wdLine, Count:=65
    ActiveWindow.ActivePane.VerticalPercentScrolled = -103
    Selection.Copy
End Sub
Sub Macro86()
'
' Macro86 Macro
'
' "&chr(10)&"       To calculate the energy dissipated in resistive circuits over time, use:
' "&chr(10)&"
' "&chr(10)&"       E=?0TP(t) dt,P(t)=I(t)2R.E = \int_0^T P(t) \, dt, \quad P(t) = I(t)^2 R.
' "&chr(10)&"       Example: A resistor
'
    Selection.Copy
End Sub
Sub Macro87()
'
' Macro87 Macro
'
' "&chr(10)&"       1. Substitute I(t)I(t):
' "&chr(10)&"
```

```
' "&chr(10)&"       E=?02(4sin?(pt))2·5 dt=5?0216sin?2(pt) dt.E = \int_0^2 (4 \sin(\pi t))^2 \cdot 5 \
, dt = 5 \int_0^2 16 \sin^2(\pi t) \, dt.
' "&chr(10)&"       2. Simplify using sin?2(x)=
'
    Selection.Copy
End Sub
Sub Macro88()
Attribute Macro88.VB_Description = "
          \r\n            3. Solve:
                                                                                                    \r
\n
                                                                                \r\n            ?021 d
t=2,?02cos?(2pt) dt=0.\\int_0^2 1 \\, dt = 2, \\quad \\int_0^2 \\cos(2\\pi t) \\, dt = 0.

                                              \r\n            Thus:

                          \r\n _

          \r\n            E=40·2=80 J.E "
'
' Macro88 Macro
'
' "&chr(10)&"       3. Solve:
' "&chr(10)&"
' "&chr(10)&"       ?021 dt=2,?02cos?(2pt) dt=0.\int_0^2 1 \, dt = 2, \quad \int_0^2 \cos(2\pi t) \, d
t = 0.
' "&chr(10)&"       Thus:
' "&chr(10)&"
' "&chr(10)&"       E=40·2=80 J.E
'
    Selection.Copy
End Sub
Sub Macro89()
'
' Macro89 Macro
' dVdt=IC,where I=VR.\frac{dV}{dt} = \frac{I}{C}, \quad \text{where } I = \frac{V}{R}.
' "&chr(10)&"       Example: For V(t)=50exp?(-t/RC) VV(t) = 50 \exp(-t/RC) \, \text{V}, calculate the
rate of voltage drop at t=2 st = 2 \, \text{s} given R=10 OR = 1
'
    Selection.Copy
End Sub
Sub Macro90()
'
' Macro90 Macro
' 1. Differentiate V(t)V(t):
' "&chr(10)&"
' "&chr(10)&"       dVdt=ddt(50exp?(-t/(10·0.01)))=50·-10.1exp?(-t/0.1).\frac{dV}{dt} = \frac{d}{dt} \
left( 50 \exp(-t/(10 \cdot 0.01)) \right) = 50 \cdot -\frac{1}{0.1} \exp(-t/0.1).
'
    Selection.Copy
End Sub
Sub Macro91()
'
' Macro91 Macro
' Magnetic flux through a coil with NN turns is:
' "&chr(10)&"
' "&chr(10)&"       F=?B dA,\Phi = \int B \, dA,
' "&chr(10)&"       where BB is the magnetic field strength.
' "&chr(10)&"       Example: A uniform magnetic field B=0.02
'
    Selection.MoveDown Unit:=wdLine, Count:=22
    Selection.Copy
End Sub
Sub Macro92()
'
' Macro92 Macro
'
' "&chr(10)&"       A=0.1·0.1=0.01 m2.A = 0.1 \cdot 0.1 = 0.01 \, \text{m}^2.
' "&chr(10)&"       2. Flux:
' "&chr(10)&"
' "&chr(10)&"       F=B·A=0.02·0.01=2×10-4 Wb.\Phi = B \cdot A = 0.02 \cdot 0.01 = 2 \times 10^{-4} \,
 \text{Wb}.
'
```

```
    Selection.MoveDown Unit:=wdLine, Count:=27
    Selection.Copy
End Sub
Sub Macro93()
'
' Macro93 Macro
'
' "&chr(10)&"       Z=R2+(XL-XC)2,XL=2pfL,XC=12pfC.Z = \sqrt{R^2 + \left( X_L - X_C \right)^2}, \quad
X_L = 2\pi f L, \quad X_C = \frac{1}{2\pi f C}.
' "&chr(10)&"       Example: Find dZdf\frac{dZ}{df} for R=50 OR = 50 \, \Omega, L=0.1 HL = 0.1 \
'
    Selection.MoveDown Unit:=wdLine, Count:=23
    ActiveWindow.ActivePane.VerticalPercentScrolled = -124
    Selection.Copy
End Sub
Sub Macro94()
'
' Macro94 Macro
'
' "&chr(10)&"       Vout(t)=RC·dVindt=(1×103·10×10-6)·10·2pcos?(2pt).V_{out}(t) = RC \cdot \frac{dV_{i
n}}{dt} = (1 \times 10^3 \cdot 10 \times 10^{-6}) \cdot 10 \cdot 2\pi \cos(2\pi t).
' "&chr(10)&"
' "&chr(10)&"       Vout(t)=0.2pcos?(2pt) V.V_{o
'
    Selection.MoveDown Unit:=wdLine, Count:=19
    Selection.Copy
End Sub
Sub Macro95()
'
' Macro95 Macro
' Vout(t)=1RC?Vin(t) dt.V_{out}(t) = \frac{1}{RC} \int V_{in}(t) \, dt.
' "&chr(10)&"       Example: For Vin(t)=5t VV_{in}(t) = 5t \, \text{V}, find Vout(t)V_{out}(t) with R=
2 kOR = 2 \, \text{k}\Omega, C=100 µFC = 100 \, \mu\text{F}.
'
    Selection.Copy
End Sub
Sub Macro96()
Attribute Macro96.VB_Description = "\r\n                1. Integrate VinV_{in}:

                                    \r\n

                \r\n            ?Vin(t) dt=?5t dt=5t22.\\int V_{in}(t) \\, dt = \\int 5t \\, dt = \\fr
ac{5t^2}{2}.
                                                                            \r\n            2. Calcula
te Vout(t)V_{out}(t):
                                                                                \r\n _
                                                        "
'
' Macro96 Macro
'
' "&chr(10)&"       1. Integrate VinV_{in}:
' "&chr(10)&"
' "&chr(10)&"       ?Vin(t) dt=?5t dt=5t22.\int V_{in}(t) \, dt = \int 5t \, dt = \frac{5t^2}{2}.
' "&chr(10)&"       2. Calculate Vout(t)V_{out}(t):
' "&chr(10)&"
'
    Selection.MoveDown Unit:=wdLine, Count:=23
    Selection.Copy
End Sub
Sub Macro97()
'
' Macro97 Macro
' Rs=Vsupply-VzenerIzener.R_s = \frac{V_{supply} - V_{zener}}{I_{zener}}.
' "&chr(10)&"       Power Dissipation in the Zener:
' "&chr(10)&"
' "&chr(10)&"       P=Vzener·Izener.P = V_{zener} \cdot I_{zener}.
' "&chr(10)&"       Example
'
    Selection.Copy
End Sub
Sub Macro98()
Attribute Macro98.VB_Description = "
                          \r\n          1. Series Resistance:
```

```
                      \r\n

  \r\n            Rs=15-5.60.05=188 O.R_s = \\frac{15 - 5.6}{0.05} = 188 \\, \\Omega.
                                              \r\n           2. Power Dissipation:

                                          \r\n _

                          \r\n            P=5.6·0."
'
' Macro98 Macro
'
' "&chr(10)&"       1. Series Resistance:
' "&chr(10)&"
' "&chr(10)&"       Rs=15-5.60.05=188 O.R_s = \frac{15 - 5.6}{0.05} = 188 \, \Omega.
' "&chr(10)&"       2. Power Dissipation:
' "&chr(10)&"
' "&chr(10)&"       P=5.6·0.
'
    Selection.MoveDown Unit:=wdLine, Count:=28
    Selection.Copy
End Sub
Sub Macro99()
'
' Macro99 Macro
'   f0=12pLC.f_0 = \frac{1}{2\pi\sqrt{LC}}.
' "&chr(10)&"       Example: For L=5 mHL = 5 \, \text{mH} and C=200 μFC = 200 \, \mu\text{F}, calculat
e f0f_0:
' "&chr(10)&"
' "&chr(10)&"       f0=12p5×10-3·200×10-6.f_0 = \frac{1}{2\pi\sqrt{5 \
'
    Selection.MoveDown Unit:=wdLine, Count:=83
    Selection.Copy
End Sub
Sub Macro100()
'
' Macro100 Macro
'
' "&chr(10)&"       Calculate the rate of change of input voltage dVdt\frac{dV}{dt}, capacitance (CC),
 resistance (RR), and time constant for an RC integrator given:
' "&chr(10)&"       · R=2 kOR = 2 \, \text{k}\Omega,
' "&chr(10)&"       · C=50 μFC = 5
'
    Selection.Copy
End Sub
Sub Macro101()
Attribute Macro101.VB_Description = "1. Time Constant:

            \r\n
                                                                                              \r\n
        t=RC=2×103·50×10-6=0.1 s.\\tau = RC = 2 \\times 10^3 \\cdot 50 \\times 10^{-6} = 0.1 \\, \\tex
t{s}.
                                                                   \r\n           2. Rate of Change:

                                                               \r\n _
                                                \r\n           dV"
'
' Macro101 Macro
' 1. Time Constant:
' "&chr(10)&"
' "&chr(10)&"       t=RC=2×103·50×10-6=0.1 s.\tau = RC = 2 \times 10^3 \cdot 50 \times 10^{-6} = 0.1 \
, \text{s}.
' "&chr(10)&"       2. Rate of Change:
' "&chr(10)&"
' "&chr(10)&"       dV
'
    Selection.Copy
End Sub
Sub Macro102()
'
' Macro102 Macro
'
```

```
' "&chr(10)&"       Calculation Example: If R=100 OR = 100 \, \Omega, L=0.1 HL = 0.1 \, \text{H}, and
Vin(t)=20sin?(10t)V_{in}(t) = 20 \sin(10t), calculate:
' "&chr(10)&"       1. Time Constant:
' "&chr(10)&"
' "&chr(10)&"       t=LR=0.1100=0.0
'
    Selection.MoveDown Unit:=wdLine, Count:=29
    Selection.Copy
End Sub
Sub Macro103()
'
' Macro103 Macro
' Analysis Using Complex Numbers:
' "&chr(10)&"       In an RLC circuit:
' "&chr(10)&"       1. Impedance:
' "&chr(10)&"
' "&chr(10)&"       Z=R+j(XL-XC),XL=?L,XC=1?C.Z = R + j(X_L - X_C), \quad X_L = \omega L, \quad X_C =
\frac{1}{\o
'
    Selection.Copy
End Sub
Sub Macro104()
'
' Macro104 Macro
'   Z=R+j(XL-XC),XL=?L,XC=1?C.Z = R + j(X_L - X_C), \quad X_L = \omega L, \quad X_C = \frac{1}{\omega
C}.
' "&chr(10)&"       2. Power Factor:
' "&chr(10)&"
' "&chr(10)&"       cos??=R|Z|.\cos\phi = \frac{R}{|Z|}.
' "&chr(10)&"       E
'
    Selection.Copy
End Sub
Sub Macro105()
'
' Macro105 Macro
'
' "&chr(10)&"       Example:
' "&chr(10)&"       For R=10 OR = 10 \, \Omega, L=0.05 HL = 0.05 \, \text{H}, C=20 µFC = 20 \, \mu\tex
t{F}, and f=1 kHzf = 1 \, \text{kHz}:
' "&chr(10)&"       1. Calculate XLX_L and XCX_C:
' "&chr(10)&"
'
    Selection.Copy
End Sub
Sub Macro106()
'
' Macro106 Macro
'
' "&chr(10)&"       Z=R2+(XL-XC)2=102+(314-8)2306 O.Z = \sqrt{R^2 + (X_L - X_C)^2} = \sqrt{10^2 + (314
 - 8)^2} \approx 306 \, \Omega.
' "&chr(10)&"       Resonance in RLC Circuits
' "&chr(10)&"       Key Formulas:
' "&chr(10)&"       1. Resonance Fr
'
    ActiveWindow.ActivePane.VerticalPercentScrolled = -147
    Selection.MoveDown Unit:=wdLine, Count:=1
    Selection.Copy
End Sub
Sub Macro107()
'
' Macro107 Macro
' Industrial Electronics N4 syllabus focuses on building a strong foundation in electrical and electro
nic principles through key modules like Network Theorems, Alternating Current Theory, Electronic Power
 Control, and others. Here's a breakdown of the core
'
    Selection.MoveDown Unit:=wdLine, Count:=31
    Selection.Copy
End Sub
Sub Macro108()
'
' Macro108 Macro
'
```

```
' "&chr(10)&"        ?Iin=?Iout.\sum I_{\text{in}} = \sum I_{\text{out}}.
' "&chr(10)&"        2. Second Law (Voltage Law):
' "&chr(10)&"        o The sum of voltage drops in a closed loop equals the sum of EMFs:
' "&chr(10)&"
'
    Selection.Copy
End Sub
Sub Macro109()
'
' Macro109 Macro
'
' "&chr(10)&"        ?V=0.\sum V = 0.
' "&chr(10)&"        Example: For a loop with V1=10 VV_1 = 10 \, \text{V}, R1=2 OR_1 = 2 \, \Omega, and
 R2=3 OR_2 = 3 \, \Omega:
' "&chr(10)&"        1. Apply Kirchhoff's Voltage Law:
' "&chr(10)&"
'
    Selection.MoveDown Unit:=wdLine, Count:=20
    Selection.Copy
End Sub
Sub Macro110()
'
' Macro110 Macro
' o Any linear circuit can be simplified to a single voltage source (VthV_{th}) and a series resistanc
e (RthR_{th}).
' "&chr(10)&"        2. Steps:
' "&chr(10)&"        o Remove the load.
' "&chr(10)&"        o Calculate VthV_{th} across the open t
'
    Selection.Copy
End Sub
Sub Macro111()
'
' Macro111 Macro
' o Determine RthR_{th} by deactivating all sources (replace voltage sources with short circuits and c
urrent sources with open circuits).
' "&chr(10)&"        Example: For a circuit with Vs=12 VV_s = 12 \, \text{V}, R1=4 OR_1 = 4 \, \Omega,
and R2=6 OR_2
'
    Selection.MoveDown Unit:=wdLine, Count:=33
    Selection.Copy
End Sub
Sub Macro112()
'
' Macro112 Macro
' Example: For Rth=10 OR_{th} = 10 \, \Omega, calculate maximum power if Vth=20 VV_{th} = 20 \, \text{
V}:
' "&chr(10)&"
' "&chr(10)&"        Pmax=Vth24Rth=2024·10=10 W.P_{\text{max}} = \frac{V_{th}^2}{4R_{th}} = \frac{20^2}
{4 \cdot 10} = 10 \,
'
    Selection.Copy
End Sub
Sub Macro113()
'
' Macro113 Macro
'
' "&chr(10)&"        Z=R+j(XL-XC),XL=?L,XC=1?C.Z = R + j(X_L - X_C), \quad X_L = \omega L, \quad X_C =
\frac{1}{\omega C}.
' "&chr(10)&"        · Parallel Circuit:
' "&chr(10)&"
' "&chr(10)&"        1Z=1R2+(1XC-1XL)2.\frac{1}{Z} = \sqrt{\frac{1}{R
'
    Selection.Copy
End Sub
Sub Macro114()
'
' Macro114 Macro
' Example: For R=10 OR = 10 \, \Omega, L=0.1 HL = 0.1 \, \text{H}, C=10 µFC = 10 \, \mu\text{F}, and f
=50 Hzf = 50 \, \text{Hz}:
' "&chr(10)&"        1. Inductive Reactance:
' "&chr(10)&"
' "&chr(10)&"        XL=2pfL=2p·50·0.1=31.4 O.X_L =
```

```
'
    Selection.MoveDown Unit:=wdLine, Count:=38
    Selection.Copy
End Sub
Sub Macro115()
'
' Macro115 Macro
' 2. Bandwidth:
' "&chr(10)&"
' "&chr(10)&"       BW=frQ,Q=?rLR.BW = \frac{f_r}{Q}, \quad Q = \frac{\omega_r L}{R}.
' "&chr(10)&"       Example: For L=0.5 HL = 0.5 \, \text{H}, C=20 μFC = 20 \, \mu\text{F}, and R=10 ΩR
 = 10 \, \Omega:
'
    Selection.Copy
End Sub
Sub Macro116()
'
' Macro116 Macro
'
' "&chr(10)&"
' "&chr(10)&"       fr=12p0.5·20×10-650.33 Hz.f_r = \frac{1}{2\pi\sqrt{0.5 \cdot 20 \times 10^{-6}}} \
approx 50.33 \, \text{Hz}.
' "&chr(10)&"       2. Quality Factor:
' "&chr(10)&"
' "&chr(10)&"       Q=?rLR=2p·50
'
    Selection.MoveDown Unit:=wdLine, Count:=59
    Selection.Copy
End Sub
Sub Macro117()
Attribute Macro117.VB_Description = "\r\n               3.1 Semiconductor Diode
                                    \r\n            1. Diode Equation:
                                \r\n            o Forward current:
                            \r\n
        \r\n            I=Is·(eqVkT-1),I = I_s \\cdot \\left(e^{\\frac{qV}{kT}} - 1\\right), _
                                                        \r\n            whe"
'
' Macro117 Macro
'
' "&chr(10)&"       3.1 Semiconductor Diode
' "&chr(10)&"       1. Diode Equation:
' "&chr(10)&"       o Forward current:
' "&chr(10)&"
' "&chr(10)&"       I=Is·(eqVkT-1),I = I_s \cdot \left(e^{\frac{qV}{kT}} - 1\right),
' "&chr(10)&"       whe
'
    Selection.Copy
End Sub
Sub Macro118()
'
' Macro118 Macro
'
' "&chr(10)&"       Example Calculation: Given Is=10-12 AI_s = 10^{-12} \, \text{A}, V=0.7 VV = 0.7 \,
 \text{V}, T=300 KT = 300 \, \text{K}:
' "&chr(10)&"       1. Compute:
' "&chr(10)&"
' "&chr(10)&"       I=10-12·(e1.6×10-19·0.71.38×10-23·30
'
    Selection.Copy
End Sub
Sub Macro119()
'
' Macro119 Macro
'
' "&chr(10)&"       I=10-12·(e1.6×10-19·0.71.38×10-23·300-1).I = 10^{-12} \cdot \left(e^{\frac{1.6 \ti
mes 10^{-19} \cdot 0.7}{1.38 \times 10^{-23} \cdot 300}} - 1\right).
' "&chr(10)&"       2. Result:
' "&chr(10)&"
' "&chr(10)&"       I0.001
```

```
'
    Selection.MoveDown Unit:=wdLine, Count:=20
    Selection.Copy
End Sub
Sub Macro120()
'
' Macro120 Macro
' 3.2 Electronic Power Control Devices
' "&chr(10)&"       · SCR (Silicon Controlled Rectifier):
' "&chr(10)&"       o Conducts when triggered by a gate signal, and blocks when reversed.
' "&chr(10)&"       · DIAC:
' "&chr(10)&"       o Bidi
'
    Selection.MoveDown Unit:=wdLine, Count:=35
End Sub
Sub Macro121()
Attribute Macro121.VB_Description = "Transformer Ratios:

                    \r\n            · Voltage Ratio:

                \r\n
                                                                                                   \r\n
            Vs=Vp·NsNp.V_s = V_p \\cdot \\frac{N_s}{N_p}.

                \r\n            · Current Ratio: _
                \r\n
                                                                                                   \r\n
            Is=Ip·NpNs."
'
' Macro121 Macro
' Transformer Ratios:
' "&chr(10)&"       · Voltage Ratio:
' "&chr(10)&"
' "&chr(10)&"       Vs=Vp·NsNp.V_s = V_p \cdot \frac{N_s}{N_p}.
' "&chr(10)&"       · Current Ratio:
' "&chr(10)&"
' "&chr(10)&"       Is=Ip·NpNs.
'
    Selection.Copy
End Sub
Sub Macro122()
'
' Macro122 Macro
'
' "&chr(10)&"       Is=Ip·NpNs.I_s = I_p \cdot \frac{N_p}{N_s}.
' "&chr(10)&"       Example Calculation: Given Np=300N_p = 300, Ns=100N_s = 100, and Vp=240 V RMSV_p =
 240 \, \text{V RMS}:
' "&chr(10)&"       1. Secondary Voltage:
' "&chr(10)&"
'
    Selection.Copy
End Sub
Sub Macro123()
'
' Macro123 Macro
'       RF=(VACVDC)2-1.RF = \sqrt{\left(\frac{V_{AC}}{V_{DC}}\right)^2 - 1}.
' "&chr(10)&"       2. Full-Wave Rectifier:
' "&chr(10)&"       o Utilizes both cycles, reducing ripple.
' "&chr(10)&"       Efficiency:
' "&chr(10)&"
'
    Selection.Copy
End Sub
Sub Macro124()
Attribute Macro124.VB_Description = "
          \r\n
                                                                                             \r\n
      ?=PDCPAC.\\eta = \\frac{P_{DC}}{P_{AC}}.

          \r\n            Module 5: Amplifiers

      \r\n            Transistor Amplifier Configurations
```

```
                  \r\n            1. Common Emitter (CE): _

                  \r\n            "
'
' Macro124 Macro
'
' "&chr(10)&"
' "&chr(10)&"       ?=PDCPAC.\eta = \frac{P_{DC}}{P_{AC}}.
' "&chr(10)&"       Module 5: Amplifiers
' "&chr(10)&"       Transistor Amplifier Configurations
' "&chr(10)&"       1. Common Emitter (CE):
' "&chr(10)&"
'
    Selection.Copy
End Sub
Sub Macro125()
'
' Macro125 Macro
'
' "&chr(10)&"       1. AM Signal Equation:
' "&chr(10)&"
' "&chr(10)&"       m(t)=Ac(1+macos??mt)cos??ct,m(t) = A_c(1 + m_a \cos \omega_m t) \cos \omega_c t,
' "&chr(10)&"       where mam_a: modulation index, AcA_c: carrier amplitude, ?c\ome
'
    Selection.Copy
End Sub
Sub Macro126()
'
' Macro126 Macro
'
' "&chr(10)&"       2. FM Signal Equation:
' "&chr(10)&"
' "&chr(10)&"       f(t)=cos?(?ct+ßsin??mt),f(t) = \cos (\omega_c t + \beta \sin \omega_m t),
' "&chr(10)&"       where ß\beta: modulation index.
'
    Selection.Copy
End Sub
Sub Macro127()
'
' Macro127 Macro
' · Demodulation:
' "&chr(10)&"       o Reverse process to recover original information from modulated signals.
' "&chr(10)&"       o Methods include envelope detection (AM) and phase-lock loops (FM).
' "&chr(10)&"       2. Antenna Systems
'
    Selection.MoveDown Unit:=wdLine, Count:=89
    Selection.Copy
End Sub
Sub Macro128()
'
' Macro128 Macro
' Advanced Calculations in Signal Modulation
' "&chr(10)&"       1. Amplitude Modulation (AM):
' "&chr(10)&"       The transmitted AM signal is given by:
' "&chr(10)&"
' "&chr(10)&"       m(t)=Ac[1+macos?(?mt)]cos?(?ct),m(t) = A_c [1
'
    Selection.MoveDown Unit:=wdLine, Count:=27
    Selection.Copy
End Sub
Sub Macro129()
'
' Macro129 Macro
'
' "&chr(10)&"       · mam_a: Modulation index, calculated as ma=AmAcm_a = \frac{A_m}{A_c},
' "&chr(10)&"       · ?c=2pfc\omega_c = 2\pi f_c: Carrier angular frequency,
' "&chr(10)&"       · ?m=2pfm\omega_m = 2\pi f_m: Message angular frequency.
'
    Selection.Copy
End Sub
Sub Macro130()
'
' Macro130 Macro
```

```
'
' "&chr(10)&"        Example Calculation: For Ac=5 VA_c = 5 \, \text{V}, Am=2 VA_m = 2 \, \text{V}, fc=
100 kHzf_c = 100 \, \text{kHz}, fm=1 kHzf_m = 1 \, \text{kHz}:
' "&chr(10)&"        1. Modulation Index:
' "&chr(10)&"
' "&chr(10)&"        ma=AmAc=25
'
    Selection.Copy
End Sub
Sub Macro131()
'
' Macro131 Macro
' 2. AM Signal Equation:
' "&chr(10)&"
' "&chr(10)&"        m(t)=5[1+0.4cos?(2p·1000t)]cos?(2p·100000t).m(t) = 5 [1 + 0.4 \cos(2\pi \cdot 1000
 t)] \cos(2\pi \cdot 100000 t).
' "&chr(10)&"        2. Frequency Modulation (FM):
'
    Selection.Copy
End Sub
Sub Macro132()
'
' Macro132 Macro
'
' "&chr(10)&"        Example Calculation: For ?f=5 kHz\Delta f = 5 \, \text{kHz}, fm=1 kHzf_m = 1 \, \t
ext{kHz}, and Ac=10 VA_c = 10 \, \text{V}:
' "&chr(10)&"        1. Modulation Index:
' "&chr(10)&"
' "&chr(10)&"        ß=?ffm=50001000=5.\b
'
    ActiveWindow.ActivePane.VerticalPercentScrolled = -173
    Selection.Copy
End Sub
Sub Macro133()
'
' Macro133 Macro
' o Testing electrical wiring.
' "&chr(10)&"        o Fault-finding in electrical machines.
' "&chr(10)&"        o Renewable energy system maintenance.
' "&chr(10)&"        5. Practical Career Applications
' "&chr(10)&"        · Learners apply s
'
    ActiveWindow.ActivePane.VerticalPercentScrolled = -173
    Selection.Copy
End Sub
Sub Macro134()
'
' Macro134 Macro
'
' "&chr(10)&"        Key Role: Integrals help analyze energy storage, system behavior over time, and po
wer distribution in circuits.
' "&chr(10)&"        · Energy Stored in Capacitors: $$ E = \frac{1}{2} C V^2 $$ Example: For a capacito
r with C=10µFC = 10 \m
'
    Selection.Copy
End Sub
Sub Macro135()
'
' Macro135 Macro
'
' "&chr(10)&"        · Total Energy in a Time Period (AC Systems): Calculate energy consumption using:
$$ E = \int P(t) \, dt $$. If P(t)=5sin?(2pt)P(t) = 5 \sin(2\pi t), solve: $$ E = \int_0^{1} 5 \sin(2\
pi t) \, dt. $$
' "&chr(10)&"        2. Derivative Calc
'
    Selection.Copy
End Sub
Sub Macro136()
'
' Macro136 Macro
'
' "&chr(10)&"        · Induced Voltage in Inductors: Voltage across an inductor is: $$ V(t) = L \frac{d
i(t)}{dt}. $$ Example: With L=5HL = 5H and i(t)=t2i(t) = t^2: $$ V(t) = 5 \times \frac{d(t^2)}{dt} = 1
```

```
0t. $$ At \( t = 2s, V(2) = 10 \times 2 = 20V. $$
'
    Selection.MoveDown Unit:=wdLine, Count:=102
    Selection.Copy
End Sub
Sub Macro137()
'
' Macro137 Macro
'
' "&chr(10)&"        · Resistance Testing:
' "&chr(10)&"       o Verifying earth resistance must ensure values below 2 O, calculated using Ohm's
law: $$ R = \frac{V}{I} $$
' "&chr(10)&"        · Insulation Resistance:
' "&chr(10)&"       o This should exceed
'
End Sub
Sub Macro138()
'
' Macro138 Macro
'
' "&chr(10)&"       o Verifying earth resistance must ensure values below 2 O, calculated using Ohm's
law: $$ R = \frac{V}{I} $$
' "&chr(10)&"        · Insulation Resistance:
' "&chr(10)&"       o This should exceed 1 MO, confirming isolation standards
'
    Selection.MoveDown Unit:=wdLine, Count:=57
End Sub
```