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| CLO1 (C3, PLO1) | COGNITIVE ASSESSMENT  (20 %) |  |
| CLO2 (P4, PLO5) | PSYCHOMOTOR ASSESMENT  (80 %) |  |
|  | TOTAL MARKS  (100%) |  |

**\*Refer to Rubric**

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| **1** | **LEARNING OUTCOMES (LO):**    1. Apply the simulation results for the various types of simulation analysis based on the electronic circuit theory and operations  (C3, PLO1) |
| **2** | **OBJECTIVE :**  Analyse the simulation for the various types of simulation analysis based on the electronic computer aided design concept, circuit theory and operation. |
| **3** | **THEORY :**    **Dc Source**  Dc source is energy source that capable of delivering a constant voltage across a load.  DC  Figure 2.1 : Dc Source Symbol  **Resistor Circuit Analysis**            Figure 2.2 : Dc Source Symbol        RA  RB    **Transistor (Command Emitter)**  +    Figure 2.3 : Command Emitter |

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| **4** | **EQUIPMENT / TOOLS / SOFTWARE :**   1. PC workstation 2. Related software |
| **5** | **PROCEDURE :** **PART A**  Construct the circuit in Figure 2.4 in your e-cad software.  Value of components:  R1=15k  R2=3k  R3=8k  R4=20k  V1=10V  V2=10V    Figure 2.4 : Schematic Diagram 1    To do a dc setup, click on ***Analysis\Setup*** icon. Check the ***Enable*** box for DC Sweep. Key in the attributes for the dc source as shown below:    Swept Var Type : Voltage Source  Name : V1  Sweep Type : Linear  Start Value : 0  End Value : 10  Increment : 5    On ***DC Sweep*** windows, click the ***nested sweep***. Key in the attributes of the secondary source as shown below:    Swept Var Type : Voltage Source  Name : V2  Sweep Type : Linear  Start Value : 0  End Value : 10  Increment : 5  Print the circuit that you have construct. |

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|  | Insert ***VPRINT1*** into the circuit to determine the voltage drop at single nodes and ***VPRINT2*** to determine the voltage drop between two nodes (parallel to R1, R2, R3 and R4).    Save the schematic as ***Lab2a.sch***. Run the simulation by choosing the ***F11*** button or ***Analysis\Simulate*** or click the ***simulation icon***.    Click ***View Simulation Output File*** on the left menu. Information is a report of DC analysis for the circuit.    Base on Circuit 1, insert ***IPROBE*** and ***Viewpoint*** component to determine current flow and voltage drop as shown below. Save the schematic as ***Lab2b.sch***. Run the simulation process (probe). Back to schematics to get the output for current and voltage. |

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|  | **PART B**  Construct the circuit in figure 2.5 in your e-cad software. Print the circuit that you have construct.    Figure 2.5 : Schematic Diagram 2    From the results of Bias Point Detail analysis, get the value of Ic, IB, dc, VBE and VCE from PSpice output file.    (Click ***View Simulation Output File*** on the left menu. Information is a report of DC analysis for the circuit). |
| **6** | **RESULT :**  **PART A**  Run the simulation for Figure 2.4, then write your result in Table 1.    Table 2.1 : Simulation result   |  |  |  | | --- | --- | --- | | Resistor | Voltage across every resistor (V) | Current that flows in each resistor (I) | | R1 |  |  | | R2 |  |  | | R3 |  |  | | R4 |  |  |     **PART B**  Run the simulation for Figure 2.5, then write your result in Table 2.    Table 2.2 : Simulation result |

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|  | |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | | IB (mA) | IC(mA) | IE (mA) | dc | VBE | VCE | |  |  |  |  |  |  |     **Part 1 a**    **\*\* 02/13/24 08:23:37 \*\*\*\* Evaluation PSpice (Nov 1999) \*\*\*\*\***  **\* C:\Users\Administrator\Documents\chong kheng chen F1043\lab 2 part a.sch**  **\*\* CIRCUIT DESCRIPTION**  **\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\***  **\* Schematics Version 9.1 - Web Update 1**  **\* Tue Feb 13 08:23:33 2024**  **\* Analysis setup \***  **.OP**  **\* From [PSPICE NETLIST] section of pspiceev.ini:**  **.lib "nom.lib"**  **.INC "lab 2 part a.net"**  **\*\* INCLUDING "lab 2 part a.net" \*\***  **\* Schematics Netlist \***  **V\_v1 b d 10V**  **R\_R4 0 d 20k**  **V\_V2 a 0 10V**  **R\_R2 a b 3k**  **R\_R1 a d 15k**  **R\_R3 0 b 8k**  **\*\* RESUMING "lab 2 part a.cir" \*\***  **.INC "lab 2 part a.als"**  **\*\* INCLUDING "lab 2 part a.als" \*\***  **\* Schematics Aliases \***  **.ALIASES**  **V\_v1 v1(+=b -=d )**  **R\_R4 R4(1=0 2=d )**  **V\_V2 V2(+=a -=0 )**  **R\_R2 R2(1=a 2=b )**  **R\_R1 R1(1=a 2=d )**  **R\_R3 R3(1=0 2=b )**  **\_ \_(b=b)**  **\_ \_(d=d)**  **\_ \_(c=0)**  **\_ \_(a=a)**  **.ENDALIASES**  **\*\* RESUMING "lab 2 part a.cir" \*\***  **.probe**  **.END**  **\*\* 02/13/24 08:23:37 \*\*\*\* Evaluation PSpice (Nov 1999) \*\*\*\*\***  **\* C:\Users\Administrator\Documents\chong kheng chen F1043\lab 2 part a.sch**  **\*\* SMALL SIGNAL BIAS SOLUTION TEMPERATURE = 27.000 DEG C**  **\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\***  **NODE VOLTAGE NODE VOLTAGE NODE VOLTAGE NODE VOLTAGE**  **( a) 10.0000 ( b) 8.9855 ( d) -1.0145**  **VOLTAGE SOURCE CURRENTS**  **NAME CURRENT**  **V\_v1 -7.850E-04**  **V\_V2 -1.072E-03**  **TOTAL POWER DISSIPATION 1.86E-02 WATTS**  **\*\* 02/13/24 08:23:37 \*\*\*\* Evaluation PSpice (Nov 1999) \*\*\*\*\***  **\* C:\Users\Administrator\Documents\chong kheng chen F1043\lab 2 part a.sch**  **\*\* OPERATING POINT INFORMATION TEMPERATURE = 27.000 DEG C**  **\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\***  **JOB CONCLUDED**  **TOTAL JOB TIME .02**  **Part 1 b**    **\*\* 02/13/24 08:35:50 \*\*\*\* Evaluation PSpice (Nov 1999) \*\*\*\*\***  **\* C:\Users\Administrator\Documents\chong kheng chen F1043\lab 2 part a2.sch**  **\*\* CIRCUIT DESCRIPTION**  **\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\***  **\* Schematics Version 9.1 - Web Update 1**  **\* Tue Feb 13 08:35:50 2024**  **\* Analysis setup \***  **.OP**  **\* From [PSPICE NETLIST] section of pspiceev.ini:**  **.lib "nom.lib"**  **.INC "lab 2 part a2.net"**  **\*\* INCLUDING "lab 2 part a2.net" \*\***  **\* Schematics Netlist \***  **V\_v1 b d 10V**  **R\_R4 0 d 20k**  **R\_R3 0 b 8k**    **.PRINT TRAN V([b])**    **.PRINT TRAN V([d],[0])**    **.PRINT TRAN V([b],[0])**    **.PRINT TRAN V([a],[b])**  **V\_V2 a 0 10V**  **R\_R2 a b 3k**  **R\_R1 a d 15k**    **.PRINT TRAN V([a],[d])**  **\*\* RESUMING "lab 2 part a2.cir" \*\***  **.INC "lab 2 part a2.als"**  **\*\* INCLUDING "lab 2 part a2.als" \*\***  **\* Schematics Aliases \***  **.ALIASES**  **V\_v1 v1(+=b -=d )**  **R\_R4 R4(1=0 2=d )**  **R\_R3 R3(1=0 2=b )**  **V\_V2 V2(+=a -=0 )**  **R\_R2 R2(1=a 2=b )**  **R\_R1 R1(1=a 2=d )**  **\_ \_(b=b)**  **\_ \_(d=d)**  **\_ \_(c=0)**  **\_ \_(a=a)**  **.ENDALIASES**  **\*\* RESUMING "lab 2 part a2.cir" \*\***  **.probe**  **.END**  **\*\* 02/13/24 08:35:50 \*\*\*\* Evaluation PSpice (Nov 1999) \*\*\*\*\***  **\* C:\Users\Administrator\Documents\chong kheng chen F1043\lab 2 part a2.sch**  **\*\* SMALL SIGNAL BIAS SOLUTION TEMPERATURE = 27.000 DEG C**  **\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\***  **NODE VOLTAGE NODE VOLTAGE NODE VOLTAGE NODE VOLTAGE**  **( a) 10.0000 ( b) 8.9855 ( d) -1.0145**  **VOLTAGE SOURCE CURRENTS**  **NAME CURRENT**  **V\_v1 -7.850E-04**  **V\_V2 -1.072E-03**  **TOTAL POWER DISSIPATION 1.86E-02 WATTS**  **\*\* 02/13/24 08:35:50 \*\*\*\* Evaluation PSpice (Nov 1999) \*\*\*\*\***  **\* C:\Users\Administrator\Documents\chong kheng chen F1043\lab 2 part a2.sch**  **\*\* OPERATING POINT INFORMATION TEMPERATURE = 27.000 DEG C**  **\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\***  **JOB CONCLUDED**  **TOTAL JOB TIME 0.00**  **Part 1 c**    **\*\* 02/13/24 09:17:09 \*\*\*\* Evaluation PSpice (Nov 1999) \*\*\*\*\***  **\* C:\Users\Administrator\Documents\chong kheng chen F1043\lab 2 parta 3 new.sch**  **\*\* CIRCUIT DESCRIPTION**  **\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\***  **\* Schematics Version 9.1 - Web Update 1**  **\* Tue Feb 13 09:17:06 2024**  **\* Analysis setup \***  **.OP**  **.OP**  **\* From [PSPICE NETLIST] section of pspiceev.ini:**  **.lib "nom.lib"**  **.INC "lab 2 parta 3 new.net"**  **\*\* INCLUDING "lab 2 parta 3 new.net" \*\***  **\* Schematics Netlist \***  **V\_v1 b $N\_0001 10V**  **V\_V2 $N\_0002 0 10V**  **R\_R1 $N\_0003 $N\_0001 15k**  **R\_R2 $N\_0004 b 3k**  **R\_R3 0 $N\_0005 8k**  **R\_R4 0 $N\_0006 20k**  **v\_V3 $N\_0002 $N\_0003 0**  **v\_V4 $N\_0002 $N\_0004 0**  **v\_V5 $N\_0005 b 0**  **v\_V6 $N\_0006 $N\_0001 0**  **\*\* RESUMING "lab 2 parta 3 new.cir" \*\***  **.INC "lab 2 parta 3 new.als"**  **\*\* INCLUDING "lab 2 parta 3 new.als" \*\***  **\* Schematics Aliases \***  **.ALIASES**  **V\_v1 v1(+=b -=$N\_0001 )**  **V\_V2 V2(+=$N\_0002 -=0 )**  **R\_R1 R1(1=$N\_0003 2=$N\_0001 )**  **R\_R2 R2(1=$N\_0004 2=b )**  **R\_R3 R3(1=0 2=$N\_0005 )**  **R\_R4 R4(1=0 2=$N\_0006 )**  **v\_V3 V3(+=$N\_0002 -=$N\_0003 )**  **v\_V4 V4(+=$N\_0002 -=$N\_0004 )**  **v\_V5 V5(+=$N\_0005 -=b )**  **v\_V6 V6(+=$N\_0006 -=$N\_0001 )**  **\_ \_(b=b)**  **\_ \_(c=0)**  **.ENDALIASES**  **\*\* RESUMING "lab 2 parta 3 new.cir" \*\***  **.probe**  **.END**  **\*\* 02/13/24 09:17:09 \*\*\*\* Evaluation PSpice (Nov 1999) \*\*\*\*\***  **\* C:\Users\Administrator\Documents\chong kheng chen F1043\lab 2 parta 3 new.sch**  **\*\* SMALL SIGNAL BIAS SOLUTION TEMPERATURE = 27.000 DEG C**  **\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\***  **NODE VOLTAGE NODE VOLTAGE NODE VOLTAGE NODE VOLTAGE**  **( b) 8.9855 ($N\_0001) -1.0145 ($N\_0002) 10.0000**  **($N\_0003) 10.0000 ($N\_0004) 10.0000**  **($N\_0005) 8.9855 ($N\_0006) -1.0145**  **VOLTAGE SOURCE CURRENTS**  **NAME CURRENT**  **V\_v1 -7.850E-04**  **V\_V2 -1.072E-03**  **v\_V3 7.343E-04**  **v\_V4 3.382E-04**  **v\_V5 -1.123E-03**  **v\_V6 5.072E-05**  **TOTAL POWER DISSIPATION 1.86E-02 WATTS**  **\*\* 02/13/24 09:17:09 \*\*\*\* Evaluation PSpice (Nov 1999) \*\*\*\*\***  **\* C:\Users\Administrator\Documents\chong kheng chen F1043\lab 2 parta 3 new.sch**  **\*\* OPERATING POINT INFORMATION TEMPERATURE = 27.000 DEG C**  **\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\***  **JOB CONCLUDED**  **TOTAL JOB TIME 0.00**    **Part b 1**    **\*\* 02/13/24 08:44:48 \*\*\*\* Evaluation PSpice (Nov 1999) \*\*\*\*\***  **\* C:\Users\Administrator\Documents\chong kheng chen F1043\LAB2 PART B.sch**  **\*\* CIRCUIT DESCRIPTION**  **\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\***  **\* Schematics Version 9.1 - Web Update 1**  **\* Tue Feb 13 08:44:48 2024**  **\* Analysis setup \***  **.OP**  **\* From [PSPICE NETLIST] section of pspiceev.ini:**  **.lib "nom.lib"**  **.INC "LAB2 PART B.net"**  **\*\* INCLUDING "LAB2 PART B.net" \*\***  **\* Schematics Netlist \***  **Q\_Q1 $N\_0002 $N\_0001 $N\_0003 Q2N2222**  **V\_V1 $N\_0004 0 9V**  **R\_RB $N\_0001 $N\_0004 100k**  **R\_RC $N\_0002 $N\_0004 470**  **R\_RE 0 $N\_0003 1.2k**  **\*\* RESUMING "LAB2 PART B.cir" \*\***  **.INC "LAB2 PART B.als"**  **\*\* INCLUDING "LAB2 PART B.als" \*\***  **\* Schematics Aliases \***  **.ALIASES**  **Q\_Q1 Q1(c=$N\_0002 b=$N\_0001 e=$N\_0003 )**  **V\_V1 V1(+=$N\_0004 -=0 )**  **R\_RB RB(1=$N\_0001 2=$N\_0004 )**  **R\_RC RC(1=$N\_0002 2=$N\_0004 )**  **R\_RE RE(1=0 2=$N\_0003 )**  **.ENDALIASES**  **\*\* RESUMING "LAB2 PART B.cir" \*\***  **.probe**  **.END**  **\*\* 02/13/24 08:44:48 \*\*\*\* Evaluation PSpice (Nov 1999) \*\*\*\*\***  **\* C:\Users\Administrator\Documents\chong kheng chen F1043\LAB2 PART B.sch**  **\*\* BJT MODEL PARAMETERS**  **\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\***  **Q2N2222**  **NPN**  **IS 14.340000E-15**  **BF 255.9**  **NF 1**  **VAF 74.03**  **IKF .2847**  **ISE 14.340000E-15**  **NE 1.307**  **BR 6.092**  **NR 1**  **RB 10**  **RC 1**  **CJE 22.010000E-12**  **MJE .377**  **CJC 7.306000E-12**  **MJC .3416**  **TF 411.100000E-12**  **XTF 3**  **VTF 1.7**  **ITF .6**  **TR 46.910000E-09**  **XTB 1.5**  **CN 2.42**  **D .87**  **\*\* 02/13/24 08:44:48 \*\*\*\* Evaluation PSpice (Nov 1999) \*\*\*\*\***  **\* C:\Users\Administrator\Documents\chong kheng chen F1043\LAB2 PART B.sch**  **\*\* SMALL SIGNAL BIAS SOLUTION TEMPERATURE = 27.000 DEG C**  **\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\***  **NODE VOLTAGE NODE VOLTAGE NODE VOLTAGE NODE VOLTAGE**  **($N\_0001) 6.2597 ($N\_0002) 6.8298**  **($N\_0003) 5.5739 ($N\_0004) 9.0000**  **VOLTAGE SOURCE CURRENTS**  **NAME CURRENT**  **V\_V1 -4.645E-03**  **TOTAL POWER DISSIPATION 4.18E-02 WATTS**  **\*\* 02/13/24 08:44:48 \*\*\*\* Evaluation PSpice (Nov 1999) \*\*\*\*\***  **\* C:\Users\Administrator\Documents\chong kheng chen F1043\LAB2 PART B.sch**  **\*\* OPERATING POINT INFORMATION TEMPERATURE = 27.000 DEG C**  **\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\***  **\*\* BIPOLAR JUNCTION TRANSISTORS**  **NAME Q\_Q1**  **MODEL Q2N2222**  **IB 2.74E-05**  **IC 4.62E-03**  **VBE 6.86E-01**  **VBC -5.70E-01**  **VCE 1.26E+00**  **BETADC 1.69E+02**  **GM 1.76E-01**  **RPI 1.02E+03**  **RX 1.00E+01**  **RO 1.62E+04**  **CBE 1.10E-10**  **CBC 6.03E-12**  **CJS 0.00E+00**  **BETAAC 1.80E+02**  **CBX/CBX2 0.00E+00**  **FT/FT2 2.41E+08**  **JOB CONCLUDED**  **TOTAL JOB TIME .02** |
| **7** | **DISCUSSION :**  ……………………………………………………………………………………………………  ……………………………………………………………………………………………………  ……………………………………………………………………………………………………  ……………………………………………………………………………………………………  ……………………………………………………………………………………………………  ……………………………………………………………………………………………………  ……………………………………………………………………………………………………  ……………………………………………………………………………………………………  ……………………………………………………………………………………………………  ……………………………………………………………………………………………………  …………………………………………………………………………………………………....  ……………………………………………………………………………………………………  ……………………………………………………………………………………………………  ……………………………………………………………………………………………………  ……………………………………………………………………………………………………  ……………………………………………………………………………………………………  …………………………………………………………………………………………………… |

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| **8** | **CONCLUSION :**  …………………………………………………………………………………………………….  …………………………………………………………………………………………………….  …………………………………………………………………………………………………….  …………………………………………………………………………………………………….  …………………………………………………………………………………………………….  …………………………………………………………………………………………………….  …………………………………………………………………………………………………….  …………………………………………………………………………………………………….  …………………………………………………………………………………………………….  …………………………………………………………………………………………………….  …………………………………………………………………………………………………….  …………………………………………………………………………………………………….  …………………………………………………………………………………………………….  …………………………………………………………………………………………………….  …………………………………………………………………………………………………….  …………………………………………………………………………………………………….  …………………………………………………………………………………………………….  …………………………………………………………………………………………………….  …………………………………………………………………………………………………….  ……………………………………………………………………………………………………. |

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| **PRACTICAL WORK 1 : DC ANALYSIS** | | | |  |  |  |  |
|  | **MATRIX NUMBER** | |  | **NAME** |  |  |
| **A** |  | |  |  |  |  |
| Course Learning  Outcomes(CLO)/  Learning Domain Cluster (CLS) | | Circuit | Skills / Aspects | Very Poor | Satisfactory | Very Good | Marks |
| 1 | 2 | 3 |
| CLO 1 : Apply the simulation results for the various types of simulation analysis based on the electronic circuit theory and operations.    CLO 2: Construct the simulation and the PCB layout for digital and analogue circuits using a schematic capture software.    CLS 1: Knowledge  & Understanding    CLS3a : Practical  skill | | PART A    2.4 | Edit title block: Student able to edit the title block correctly. | Able to edit the title block correctly with assistance. | Good to edit the  title block  correctly with minimum assistance. | Excellent to edit the  title block effectively. | /3 |
| Draw circuit: Student able to draw the circuit same as given. | Able to draw the circuit with assistance. | Good to draw  the circuit  moderately with minimum assistance. | Excellent to draw  the circuit effectively. | /3 |
| Simulation setting: Student able to set simulation settings correctly. | Able to set all the simulation settings correctly with assistance. | Good to set all the simulation settings correctly with minimum assistance. | Excellent to set all the simulation settings correctly and effectively. | /3 |
| Results : Student able to obtain the reading/values for voltage drop and current flow. | Able to obtain the values for voltage drop and current flow correctly with assistance. | Good to obtain the values for voltage drop and current flow  correctly with minimum  assistance | Excellent to obtain the values for voltage drop and current flow correctly and effectively. | /3 |
|  | |  |  |  | /12 |
| PART  B    2.5 | Edit title block: Student able to edit the title block correctly. | Able to edit the title block correctly with assistance. | Good to edit the title block correctly with minimum assistance. | Excellent to edit the  title block effectively. | /3 |
| Draw circuit: Student able to draw the circuit same as given. | Able to draw the circuit with assistance. | Good to draw  the circuit  moderately with minimum assistance. | Excellent to draw  the circuit effectively. | /3 |
| Simulation setting: Student able to set simulation settings correctly. | Able to set all the simulation settings correctly with assistance. | Good to set all the simulation settings correctly with minimum assistance. | Excellent to set all the simulation settings correctly and effectively. | /3 |
| Results : Student able to obtain the reading for the desired values in the circuit. | Able to obtain the reading for the desired values correctly with assistance | Good to c obtain the reading for the desired  values orrectly with minimum assistance | Excellent to obtain the reading for the desired values correctly and effectively. | /3 |
|  | |  |  |  | /12 |

# PRACTICAL SKILLS PSYCHOMOTOR ASSESMENT - (80%)

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| **NO.** | **STUDENT’S NAME** | **PART A**  **(2.4)** | **PART B**  **(2.5)** | **Total:** | **80%** |
|  |
|  |  |  |  | **(24 marks)** |  |
| **A** |  | /12 | /12 | /24 | /80 |

# PRACTICAL WORK COGNITIVE ASSESSMENT - (REPORT 20%)

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| **PART A** | **PART B** | **Discussion** | **Conclusion** | **TOTAL** | **20**  **%** |
| /8 | /6 | /10 | /10 | /34 | /20 |

# TOTAL MARKS

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| --- | --- | --- | --- | --- |
| **NO.** | **STUDENT’S NAME** | **COGNITIVE**  **ASSESSMENT**  **(20 %)** | **PSYCHOMOTOR**  **ASSESMENT**  **(80 %)** | **Total:** |
| **(100 %)** |
| **A** |  | /20 | /80 | /100 |