**MADANAPALLEINSTITUTEOF TECHNOLOGY &SCIENCE**

(UGC-AUTONOMOUS INSTITUTION)

Affiliated to JNTUA,Ananthapuramu&ApprovedbyAICTE,NewDelhi

NAAC Accredited with A+ Grade, NIRF India Rankings 2024 - Band: 201-300 (Engg.)

NBA Accredited - B.Tech. (CIVIL, CSE, ECE, EEE, MECH, CST), MBA& MCA

Assignment 1 Submission Details

AY-2024-25

SUBJECT CODE: 23CHE102

SUBJECT NAME : Chemistry

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| **NameoftheStudent** | GUNTHAKAL ANIL |
| **Roll. No.** | 24691A0413 |
| **Year/Sem/Sec** | **I /II/ECE-A** |
| **AssignmentNo.** | **I** |

1. Outline the postulates of quantum Mechanics.

* *A few postulates for a one-dimensional (x coordinate) moving system underpin the formulation of quantum mechanics or wave mechanics for the wave mechanical treatment of an atom's structure.*

*Postulate 1 :*

*The wave function (x, t) describes a system's physical state at time t.*

*Postulate 2 :*

*For all x values, the wave function (x, t) and its first and second derivatives (d/dx) are continuous, finite, and of a single value. Additionally, the (x, t) wave function is normalized, i.e.,*

*Postulate 3:*

*A Hermitian operator can be used to represent the physical observable quantity. If an operator meets the following requirements, it is said to be Hermitian.*

*ʃ Ψi\*A^Ψj dx=ʃ Ψj(A^Ψi)\* dx*

* *where 𝜳𝒊 ∗ and 𝜳j are the wave functions that represent the quantum system's physical state, such as that of a particle, atom, or molecule.*

*Postulate 4 :*

*The operator equation's eigen values, ai, are the permitted values of an observable A.*

*𝐴^𝚿𝑖 = 𝑎𝑖𝚿𝑖*

*• An eigen value equation is the name given to this equation. Here, Â is the*

*operator for the observable (physical quantity) and 𝜳 is the eigen function of Â*

*with eigen value a.*

* *An example of an eigen value equation that can also be represented as is the Schrodinger equation. 𝐻^𝚿=𝐸𝚿*

*• Where, Ĥ is the Hamiltonian or energy operator, 𝜳 is the eigen function of Ĥ with eigen value E.*

*Postulate 5 :*

*The relation provides the operator-corresponding average value (or expectation value) of an observable A. =*

* *Where, in accordance with postulate 2, the and function is normalized*

*Postulate 6:*

*By converting classical expressions into operators and writing them in terms of the variables, the observable-corresponding quantum mechanical operators are constructed.*

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| *SI.NO* | *Observable Name* | *Observable Symbol* | *Operator Symbol* | *Operator Operation (1-D)* |
| *1* | *Position* | *x* | *X^* | *Multiply by x* |
| *2* | *Momentum* | *P* | *P^* |  |
| *3* | *Kinetic Energy* | *T* | *T^* |  |
| *4* | *Potential Energy* | *V* | *V^* | *Multiply by v(x)* |
| *5* | *Total Energy* | *E* | *H^* | *+V(x)* |

*H^=Hamiltonian Operator*

*Postulate 7:*

*The wave function 𝜳 (x, t) is a solution of the time dependent Schrodinger equation*

*𝐻^ 𝜓(𝑥,𝑡 )=𝑖ℏ𝜕𝜓(𝑥,𝑡)/𝜕𝑡*

*Where H^ is the Hamiltonian operator of the system.*

1. *Construct and explain electrostatic double layer capacitor (EDLC)*

* *Electrostatic Double-Layer Capacitors (EDLCs), also referred to as Ultracapacitors or using electrostatic interactions at the interface, supercapacitors store energy.*
* *Forming an electric double layer between an electrode and an electrolyte.*
* *In contrast to batteries, which rely on chemical reactions, they have two electrodes*

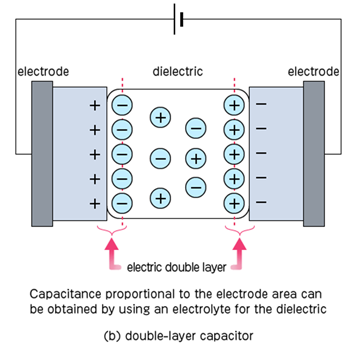
*=> A separator and an electrolyte that enable rapid charging and discharging.*

*=> The electrodes are separated by a separator.*

*=> Carbon electrodes or their derivatives with a double-layer electrostatic charge*

*that is much higher These supercapacitors employ capacitance.*

* *Electrostatic double-layer capacitors have a number of advantages over conventional capacitors.*
* *A range of charge separation from 0.3 to 0.8 nm. Regeneration of energy, "momentary voltage" applications include "drop compensation device" and "energy leveling."*

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* *Electrostatic interactions between two conducting electrodes with high specific surface areas per volume, like activated carbons, form the basis of EDLC's operation.*
* *After being immersed in an electrolyte, these electrodes are separated by a separator. Using a power source, the electrical double-layer, a complex molecular-ionic structure with a thickness of about 1–2 nm, acts as a dielectric and prevents charge transfer during polarization.*
* *This causes electronic and ionic charges to be separated spatially at the interface.*