Home Assignment - 1

Q: 1 What are the following terms :- Discovery, Research, Invention, Innovation, Novelty, Creativity, hence distinguish blw them with suitable example.

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i) Discovery :- The act of finding something that already exists in nature but was previously unknown or observed.

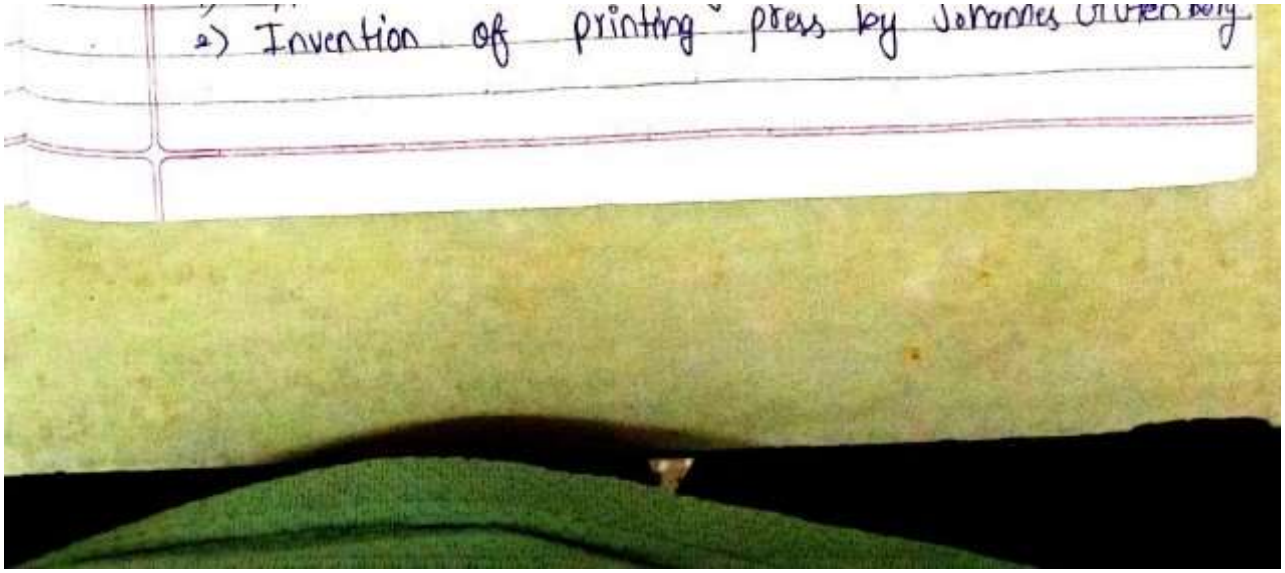
* Examples:-
1) Isaac Newton discovered Gravity, Gravity already existed, Newton defined it.
2) Discovery of structure of DNA by Watson and Crick (double helix model)
3) Discovery of the existence of exoplanets (Planets outside our solar system)

ii) Research :- A systematic investigation or study to establish facts, gathes new information or solve problems. It can involve experimenting, analyzing data and drawing conclusions

* Example :- 1) Conducting research on the efficiency of vaccine for covid-19.
2) Scientists understanding effects of drug on body.

iii) Invention :- The creation of something entirely new that did not exist before, often as a result of combining discoveries or new insights.

Example :-
1) Thomas edison inventing bulbs



and
vity :- The ability to think ou
generate original ideas, often
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and generate original ideas, often involving
imagination and originality. Creativity underpins
inventions and innovations.

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Examples:-
1) A student brainstorming unique solution to complex
research plays an
Knowledge solving
Its impacts are
societal progress
Individuals
example
in each
problems
on
R
ustify the impact of Research on
Socioeconomic development with

The process of improving on
invent or idea to create value,
it more effective, user friendly
#Example:-
1) D electric vehicle (Tesla enhancing
t technology)
2) Introduction to I platforms replacing DVDs,
TVs.
applying
iv) Innovation
evelopment of
roduction cas
tio OT

opti by making
or marketable.
pa
something

Novelty:- The quality of being new, original or unique. In a technical ~~sense~~ sense, it refers to

agement

side the box

Example:-
1) Foldable phones by Samsung
2) Smartwatches with health mon system.

previously known
or used

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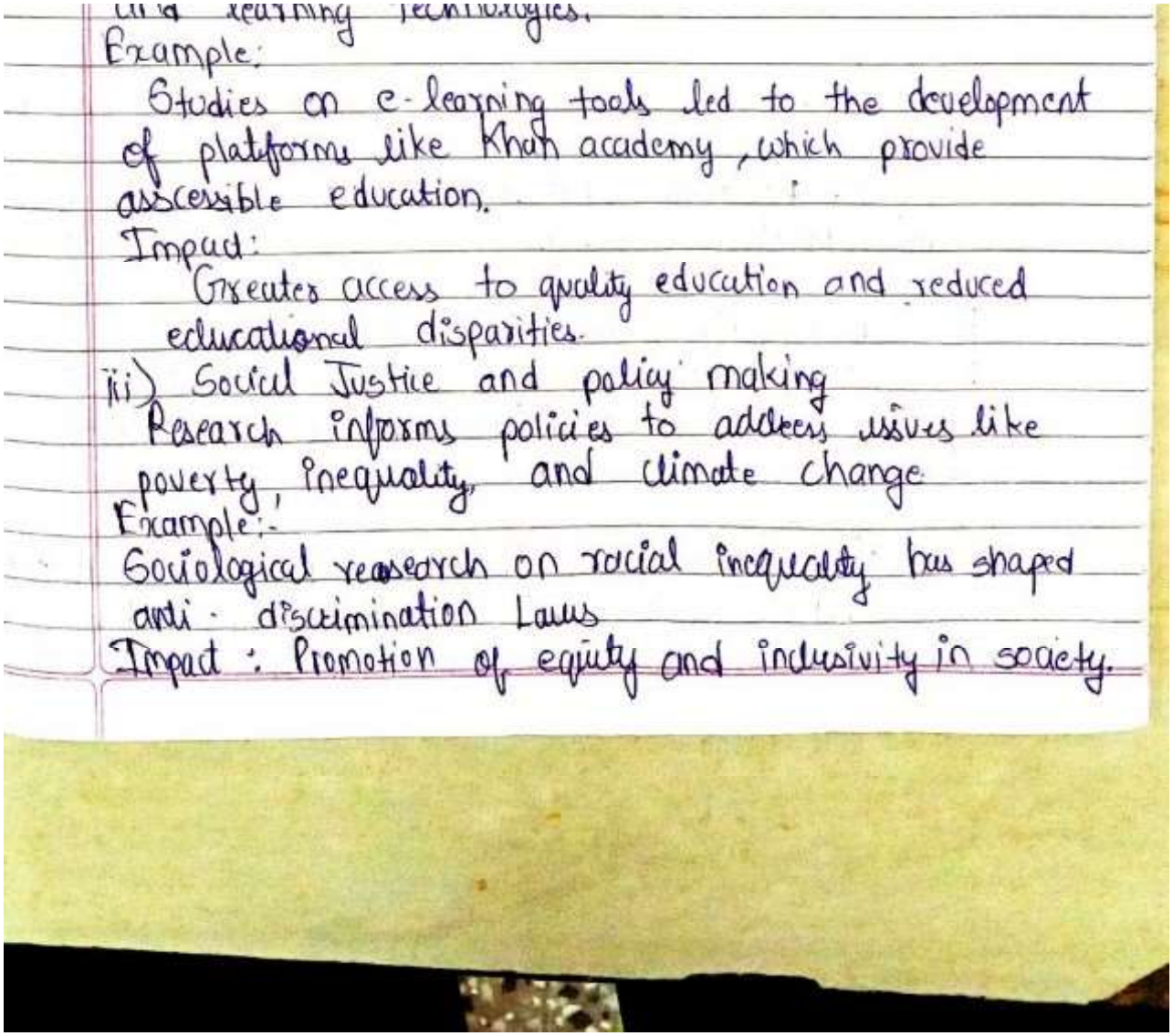
b) i) Impact on Society:-
Research influences society by improving quality of life, fostering understanding, and addressing challenges.

ii) Improving Health and Well-being:
Research leads to medical advancements, improved healthcare systems and solution for diseases.
Example:-
Development of Vaccines, such as those for Covid-19, has saved millions of lives and curbed pandemics.
Impact:
Reduced mortality rates, improved public health, and increased life expectancy

ii) Enhancing Education and Awareness
Research in education has improved teaching methodologies


and learning technologies.
Example:
Studies on e-learning tools led to the development of platforms like Khan academy, which provide accessible education.
Impact:
Greater access to quality education and reduced educational disparities.
iii) Social Justice and policy making
Research informs policies to address issues like poverty, inequality, and climate change.
Example:-
Sociological research on racial inequality has shaped anti-discrimination Laws
Impact: Promotion of equity and inclusivity in society.

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fosters

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produc ty efficiency.

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Im :

Transition to sustainable
of environmental damage
green industries.

ii) Economic Growth through innovation.
Research leads to the creation of new products and industries.
Example:-
Development of industry, which underpins
modern electronics.
Impact - Boost to GDP, new markets
interconnected

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2. Impact

i) Technological

Research

innovation a

tivi and

jobs

progress.

developers

Examples:

Advances

for data

Impact :

Sources

Skills Development.

for skilled professional in scien

ntists, AI researchers and

Research in renewable energy has led to cost effective solar and wind echnologies

In artificial intelligence have created role scientists, AI researches and develope

drives economic growth,

innovation, boosting national

improving

Example:

fuels

and

global

and

Semiconductor

energy sources, research, and job creation in energ reduct esearch

Improved empolyment opportunities and skill diversification

v) Addressing Global challenges
Research helps tackle pressing global issues like climate change, poverty, resource scarcity.
Example:
Studies on agricultural technologies, such as drought-resistant crops, have boosted food ~~scarcity~~ security
Impact: Strengthned economies in developing nations and reduced poverty.

Q.3 Justify the important role of Research components such as tools, techniques like mathematical modelling, Algorithms and domains with example

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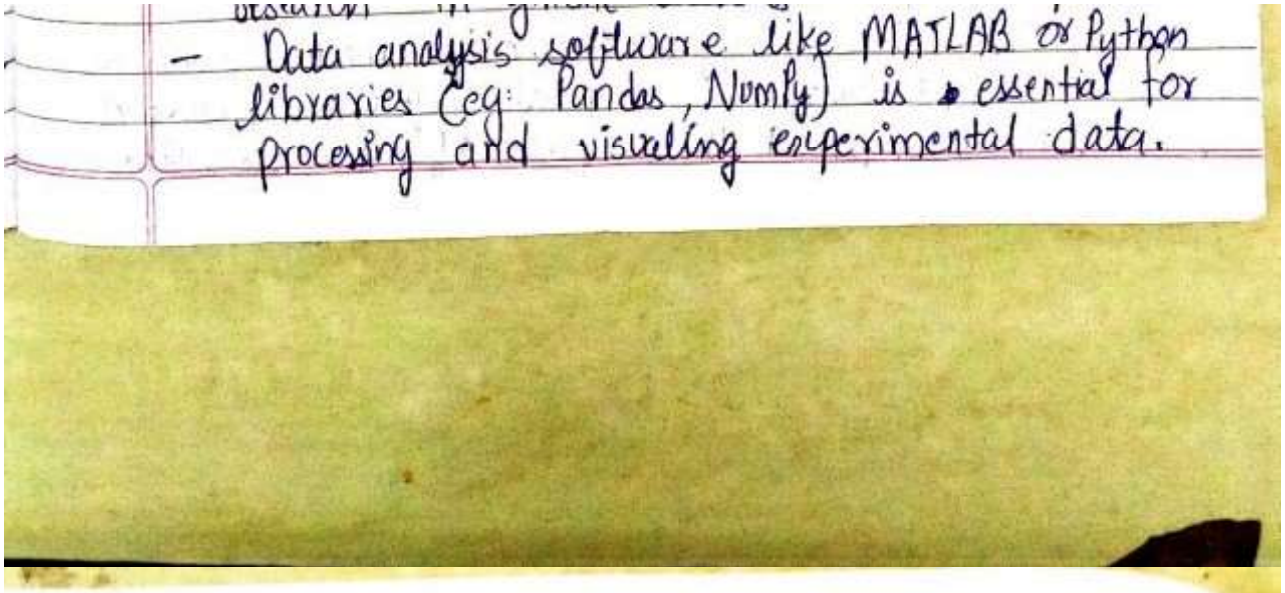
1. Tools
Tools include software, hardware and methologies that faciliate data collection, analysis and experimentation.
Role:
- Enhance accuracy and efficiency in research processes.
- Enable handling of complex data sets or systems.
- Provide repeatability and scalibility in experiments
Examples:
-In genomics, tools like CRISPR-CAS9 allow precise gene editing, enabling ground breaking research in genetic disorders and therapies

- Data analysis software like MATLAB or Python libraries (eg: Pandas, Numpy) is essential for processing and visualing experimental data.



2. Techniques

Techniques are systematic methods employed to conduct research and including data collection, analysis or experimental procedures.

Role

- Ensure consistent and reliable results.
- Enable researchers to explore phenomena at different scales and perspectives.
- Adapt to multidisplinary challenges by combining methods from various fields.

Example:

- Machine learning techiques like clustering or neural networks are widely used in fields such as computer vision for object recognition or in medical Imaging for detecting tumours
- Survey methodologies are crucial in social science for gathering large scale data about

human behaviours or opinions.

3. Mathematical modelling
Mathematical models use equations and computations simulations to represent real world systems.
Role
- Provide insights into systems that are too complex for direct experimentation.
- Predict future trends and outcomes under various scenarios.
- Facilitate optimization and decision-making.
Example:
- In epidemiology, mathematical models such as SEIR (Susceptible Exposed, Infectious, Recovered) Models predict the spread of diseases like

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Covid-19. and guide public health interventions.

- In engineering, finite element modeling (FEM) simulate stress and strain on materials, aiding in designing safer structures

4. Algorithm :
Algorithm are step - by -step procedures for solving problems are performing tasks.
Role
- Automate repetative tasks and ~~progress~~ process large-scale data efficiently.
- Solve optimization problems and enable real-time decision - making.
- Form the backbone of computational research and artificial intelligence applications.
Examples :
-Sorting algorithms like Quicksort are fundamental in computer science for organizing data in databases.
- Pathfinding algorithms like A* (A-star) are crucial in robotics and navigation systems for route optimization.

5. Domains knowledge
Domain knowledge refers to the understanding of the specific area of application, including its principles, challenges, and context.
Role :
- Guide like selection of appropriate tools, techiques, and models
- Ensures research outcomes are relevant and applicable

to real world problems

- In climate science, domain knowledge about atmospheric dynamics is crucial for creating accurate climate models.
- In healthcare, understanding disease mechanisms allows researchers to design targeted therapies by using tools like AI - based drug discovery