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Applicable Research methodology in the research field of Physics

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Abstract
Research work is carried out to discover the mysteries of nature and to design technology through the well-defined method. Research methodology is a systematic way to find the scientific solution of any problem. Basic thing required for research work is that the available resources should be utilized in full capacity. Simultaneously analysis of available data and new recorded data should also be done wisely. Now a days, research work is an integral part of the higher education. Exploring specific topic which is required for the benefit of the present society should be considered as the basis of the selection of research work. After this proper mechanism should be required to carry out research work. Therefore, it is compulsory for each researcher to have knowledge about research methodology used in the area of particular interest. In this paper research methodology used for experimental research work and theoretical research work in the area of physics has been discussed. The techniques and devices used for the development of advanced structural material are also mentioned in this paper.

Keywords: Research methodology, experimental, theoretical, techniques used.

1. Introduction
Human mind has power to think, to analyze, to generate new ideas and then to work accordingly to provide better technologies for the betterment of human life. Generation to generation, this process continues which uplifts living status of the society. Now it is the time to think deeply about the procedure through which new technological development is achieved.
In physics, various methods are used to carry out the research work. There are two main classes: Fundamental research and applied research. These are again classified as qualitative, quantitative and mix research methods for which survey based, theoretical procedures, experimental research work, statistical approaches, simulation etc are used.
Experimental research requires various equipments and measuring devices which are also developed by developing new techniques based on available theoretical knowledge.
Research methodology [1-2] is defined as the study of methods by which knowledge is gained. It provides complete picture of the work plan of research. In this case the work plan for the experimental and theoretical research work is provided.

2. Methodology
Planning of research [3] is the first and most important part to complete the research task in given time period. So many software is also available to conduct research work on the basis of available experimental data through which researcher can achieve information for unknown variable. Figure 1 shows the flow chart showing main steps involved in experimental and theoretical research.

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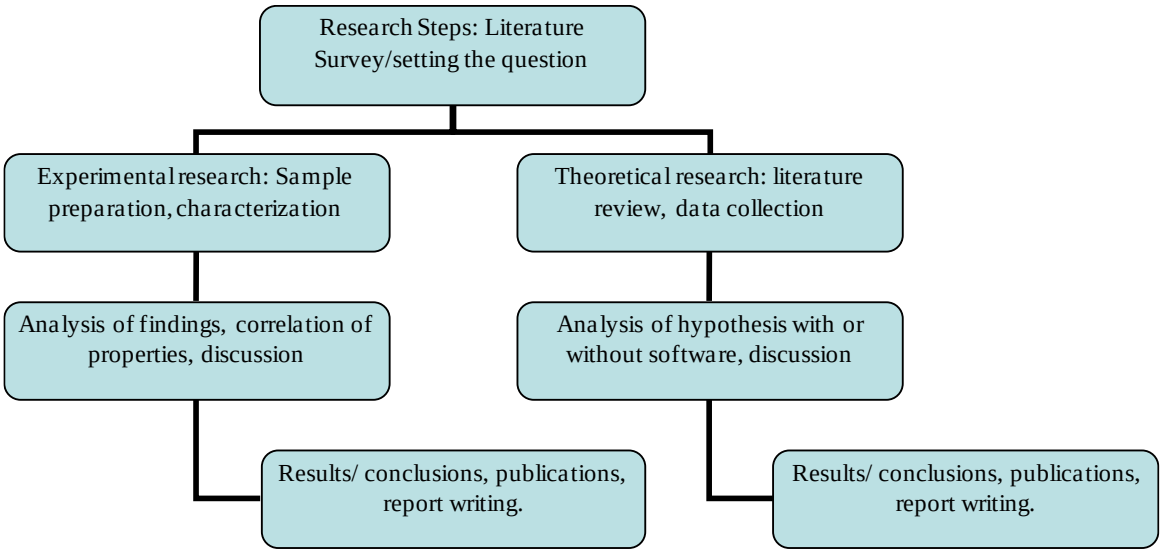

Fig. 1: Flow chart showing important steps involved in experimental and theoretical research.

Generally, in experimental and theoretical research following steps of research methodology are adopted:

1. Selection of topic/problem/question related to current issue and available information/ literature survey /review for it, are the essential part of the research work. Now a days the internet and connected data bases play an important role for this part. This is required in both experimental and theoretical research.
2. Selection/ collection of raw material is required in experimental research only. Chemicals, agents, binders, raw material required to develop different form of material as per the need of the question are required to be collected before the starting of the experimental research work. In some experimental work special type of experimental setup is required for which technical engineering expertise is required.
3. Preparation/ development of samples having dimensions as per requirement of testing methods/ characterization are required using recommended procedures in experimental research.
4. Next step in experimental research is the characterization/ testing of samples prepared/ collected for mechanical properties, physical properties, chemical properties, micro-structural properties etc.
5. Analysis of the results is expected in both type of research experimental as well as theoretical. Sometimes advice of subject experts is required to analyze the findings of the experiments.
6. Correlation of the various properties obtained during characterization in the experimental method i.e. mechanical properties to micro structural properties etc. is required.
7. Research findings should be presented before the experts of the field to validate it. Then publishing of the findings of the research work through journals or newsletters to get it certified to make available for the future researcher is very important.

It is also important to understand the proper methodology to carry out the research work. For larger goal, team of scientists, engineers, technologists, analyzers work together in collaboration to construct experimental setup and to meet the required results.

3. Research techniques useful in the physics

Large number of equipments and techniques are used in research work for the measurement of the properties and characterization of the material. These days Information Communication Technology (ICT) is also integral part of research work. Internet system is used by the researcher for literature review which provides instant information and up to date information related to the field of interest. Internet system also helps in data collection as and when required. American society for testing and Materials (ASTM) provides international methods which are used for the measurement of physical properties and material characterization. Measurements of dimensions, density, porosity, hardness are done through standard methods. X-Ray spectroscopy is a powerful tool which provides information of crystalline nature of given sample and type of substance available in sample under observation.

The optical microscopy is used in characterization of structure and anisotropy of the material. For the characterization of structural material; transmission electron microscopy (TEM), scanning electron microscopy (SEM), TA-4000Thermal analyzer system, dynamic contact angle (DCA-322), Instron UTM-4411[4] and several other devices, equipment and techniques are also used. In this TEM provides images of the structure at very high resolution than the SEM. In TEM electrons passes through the sample then image of sample is obtained. Very thin sample is required for TEM that is why sample preparation especially for brittle material is very difficult task for it. Thermal analyzer is used to record the behavior of material during heat treatment and after the heat treatment. DCA is used to study the surface behavior of the material with some other material during contact. Instron UTM -4411 is used to understand the fracture behavior of the material under loading condition.

Each area of research work has some special limitations to work. It is not necessary that every theory, each technique and information in the topic of research is useful for a particular problem. There is no shortcut to success in the research work. Therefore, continuous goal-oriented work is required with patience. Year wise time schedule is also required to reach the specific goal. Writing skills for the scientific articles [5] to present and publish research result is

also important to know for a researcher. Finally compiling all results related to a particular topic/problem obtained during research work to prepare the research report/ dissertation/ thesis is required. Which is required to have introduction, techniques used, important findings of the work, discussion, analysis, applications, conclusions and references.

4. Conclusions

In physics, it is considered that to get a novel result is a matter of luck, but if someone spends several decades in working and in thinking deeply about the subject then it will lead to good idea which will further lead to the novel result. Research methodology provides direction to achieve the correct results. Therefore, continuous and well-planned research work is required with proper research methodology.

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6. References

1. Singh Y.K. and Bajpai, R.B., Research methodology techniques and trends, APH Publishing Corporation House, 2008.
2. Kothari, C.R., Research methodology: methods and techniques, Wiley Eastern, New Delhi, 1985.
3. Bhome, S., Research methodology, Himalaya Publishing house, Mumbai, 2013.
4. Dwivedi Hariom, Studies on the role of interface in the development of carbon/ carbon composites, Ph.D. Thesis, 2002.
5. Cargill, M. O' Connor, P., Writing scientific research articles, Wiley- Blackwell, 2009.