1. Introduction:

The carpentry is one of the most an ancient and popular employment in India. From the archaeological evidence, it was verified that in India the wood culture is as ancient as the civilization of Indus Valley (2300 B.C. -1750 B.C.). In ancient time, people of India used wood in their day to day life as making to daily household utensils. Many types of occupational health hazard were noted in carpentry related industrial task. From the very beginning century carpenters are facing recession on their occupation. Most of time carpentry industry was in recession because of the market values of the product and with this availability of several types of metallic produces in reasonable price. Apart from those reason some others reasons also hampered the market of carpentry industry some of them are contemporary designed technologically upgraded products. For such kind of occurrence, huge numbers of workers of carpentry industry were migrated. From the end 19^{th} century, occupation of the carpenters was generally unorganized and restricted within the bunch of departed workers. From the mid half of the 20^{th} century, the carpentry industry started take off from the phase cluster. In Different Places of southern part of West Bengal state, e.g., Medinipur (Purba and Paschim) Bankura, Purulia, etc., the workers opened their carpentry shop within the cluster which lead to increasing terrific zeal of the employees of carpentry workshop as well as the creative people of their area. Those workers gives enthuse to other surrounding people and create team and carpentry firms were on the rise.

As per report of India Government Industrial Plan 1956, establishment of District Industry Centers proposed to provision and facilities for the expansion of small and medium scale industries can be reflected as a positive stride in the contextual of industrial growth

consequence of the country. From commencement of 1990 ahead, the Indian economy is countersigning of commendable act in the trade of wooden stuffs and other metallic stuffs. According to the report of industrial data (2016) by UNIDO's (United Nations Industrial Development Organization), throughout 2015 India climbed up into the 3rd positions and turn out to be 6th supreme industrial country in the world (UNIDO, 2015).

In Indian industrial context, making of wooden furniture is usually done at home based small and medium scale (SMS) trades. Wooden stuffs manufacturing clusters found in different states like West Bengal, Orissa, Assam, Utter Pradesh, Rajasthan etc. in India and globally found in Nepal, China, Sri Lanka, Thailand, Pakistan and so on (SISI, Cuttack cluster, Balakati report, 2005-2006). It is a kind of manufacturing industry where most of the time the efficiency of making wooden stuffs had been taken over from previous generation. Accurate number of workers who were involved in carpentry work in our country and also in globally was not known but it might be assumed that a huge percentage of people were attached with this industry.

The present work has been carried out in West Bengal state in India. In this state a significant percentage of population choose carpentry as their occupation. They perform their task laterally with numerous health disabilities which were arouse in them due to the emblematic task load. But most of the time unfortunately they could not revive themselves from their usual health problems as they are not economically well established. Due to those problems people escape from the carpentry job and choose other profession for improvement of their life.

A large number of people of our country are involved in small and medium scale of industries. A vast number of people selected carpentry task as their occupation. Most of them are belonging to the unorganized sector. Mainly they work in small sized carpentry workshops

and are involved in different kinds of furniture manufacturing and construction works. Small and medium wood craft workshops have grown up in different urban and rural area of the country. As most of the workshops or industries have no proper work environment, the carpenters, while doing their job, are exposed to varied types of work related hazards including environmental, physiological and postural stresses. Adopting adverse posture for a longer duration is one of the occupational problems for a carpenter. For example, inappropriate grasping of hand tool may leads to strenuous posture causing occupational hazards in a carpenter.

Salik and Ozcan (2004) stated that when the musculoskeletal disorder is developed from the work related event it is known as Work related musculoskeletal disorders (WRMSDs). Despite from the normalcy WRMSDs are very common health hazards among industrial workers. Jinadu (1987) reviled that hazards related to construction site are eight times more dangerous than that of others manufacturing work site. Work related MSD hampered the daily lifestyle , reduced the efficiency of the worker, diminished productivity, and caused longer the time of work, enhanced the retractably or disability in work procedure and as a whole affect the entire construction industry. One of the most common causes of loss of productivity, (Meerding et al., 2005) functional impairments (Le et al.,2006) and permanent disability (Brenner and Ahern, 2000) in construction site are musculoskeletal disorders (MSDs). Every small or medium construction industry requires different kinds of hand tools for various construction related works. As considered carpentry work as industrial work, this industry has also required some hand tools to fulfill their work. But most of those hand tools are conventional type and are lacking of ergonomic features. As the design of those hand tools were not considered with ergonomic approach, there was incompatibility between those tools and users. Such incompatibility can be minimized by redesigning the hand tools with ergonomic intervention.

A good workstation is necessary for the carpentry task. But it was observed that the conventional workstation was unorganized and the dimensions of the physical components of the workstation may not be matched with the anthropometric characteristics of the carpenters. Such mismatch may be related to the poor work posture of the carpenters and the akward posture may relate to the job associated disorder and ultimately affect the productivity of the industry. Intervention with Ergonomic approach can reduce most of those difficulties. Majority of the workers were from untrained background they were not aware of proper work procedure, as well as proper work posture and health problems related to this work. Training and awareness program about ergonomic check points can recover the work and productivity. Improper posture during the time of work lead to work related disorder that's finally affects the entire productivity. So that keeping in mind about all the difficulties of carpenters during performing their job, an ergonomic intervention has much necessity to relief the carpenters from their hazardous task.

Most of the workers in carpentry who were selected for this present study were local resident. In every working day, usually the workers report to their duties at morning and departed back to their residence after finishing of their tasks. From Monday to Friday, total five days in a week, the carpenters carry out their job for manufacturing wooden stuffs and devote single day for delivering of wooden stuffs to the venders on Saturday. Workers enjoy Sunday as day off. Throughout the year the carpenters performed their work, except during illness. The carpenters are not well paid. They are not paid salary on monthly basis rather they are paid according to their work performance and share of daily production in the workshop. In some of the workshops the workers are paid daily wage basis depending on their work skill. Majority of the workers had no other option for earning like cultivation or any others job. The qualities of living of the carpenters were very poor as they are not paid for sufficient wages.

1.1 Rationale of this study:

(i) In this present research, carpenters may undergo from various type of job related strains. The relevant aspects may possibly be connected to the incorrect work method, unfamiliar capability of workload, unusual work postures, working environs, mental strains and many more hazardous issues. Furthermore, the work associated pressures may feasibly also have particular sound effects on the physique of the carpenters. Some or other of these hazardous issues lead to WMSD. These hassles can be assessed by determining of physiological and biomechanical parameters. Adoption of ergonomic approaches may be helpful to recover it.

(ii) In the carpenter's workshop, too much of wooden dust are produced which pollutes the work place. Severe or toxic pulmonary obstruction may be introduced from the over acquaintance wooden dust in the workplace. Hence, the carpenters may have pulmonary disability. As per report of Occupational Safety and Health, extreme exposure to dust of 50 mg/ m^3 provocatively initiated the risk of occupational pulmonary disease of the worker throughout regular life suspense (OSHA, 2016). The pulmonary function test of the carpenter is required to be conducted to assess their respiratory efficiency and state of pulmonary dysfunction.

(iii) The carpenters have to work with high physical workload. Further they are exposed to hot and humid condition in the workshop almost throughout the year which imposes additional physiological stress on them. The physiological stress can be evaluated by monitoring working heart rate as well as assessing cardiovascular stress index.

(iv) The socioeconomic status of the carpenter was not very good and this may the reason for suffering from nutritional insufficiency. The nutritional insufficiency may affect their work performance. Hence, it is needed to evaluate the nutritional status of the carpenters.

(v) As the carpenters have to adopt different unusual working posture like, forward bending, stooping, squatting, twisting, etc throughout the working period, they may have

postural stress also. For that reason, analysis of posture of the carpenters is obligatory in this research work.

(vii) The carpenters accomplish lengthy vigorous repetitive jobs. Several types of hand operating tool are used by the carpenters during manufacturing of wooden stuffs. The hand tools used by the carpenters may not be suitable for them. The unfriendly intended tools which were used by the carpenters may enforce biomechanical strain which converted to work associated MSD. Evaluation of biomechanical features and anthropometric measurements of the carpenters are the pragmatic discipline that helps to evaluate the physiological abilities and restrictions of users at workshop. Hence, research on carpentry job requires getting anthropometric database and biomechanical parameters largely intended for hand operated tools and projection of job patterns. This are-

1. Aimed at the exact job, chose the appropriate tool to be made.
2. Hand handling apparatus or tools must have attached a suitable anti skating grip at the holding part of the tool.
3. Imperfect or damaged apparatuses must be evaded.

Carpenters required hand tools more or less every moment of their task execution. Hand tools are indispensable for performing carpenters manufacturing operations. As the hand tool frequently used by the carpenters and if the design of hand operating tool is not appropriate for the user or not fitting to the best for users then it manipulates the production in workshop as well as effect the health of the users. Most of time risk factors in workplace associated with poor design of hand handling tool and direct causes of musculoskeletal disorder of the users. Assortment or manufacturing of appropriate hand using tool design is vital as it helps to diminish expenditures allied with job related physical problems, in addition to higher up the work competence, eminence and production. These threats comprise difficult postures,

magnificent static burden into the upper edges of the body resultant in painfulness and exhaustion, punishing burden on lenient tissues of fingers and palm. Thus, tools used by the hand must fit well to the user, not only the task but also equipment has to be designed to strengthen and spread, variety, power, and efficacy of the limbs incorporated in particular job. The tools should design in such a way that it must be fitted well to the users or becomes users' friendly. During the use of hand tool, the mainly grievance is about that the holding part of the tool which used to forces the user to twist the wrist and other related joint angles. Unusual movements of hand may consequences to joint compassion and obscurity in sustaining and holding on a tool.

For designing or modification of hand tool, a sound knowledge in anthropometric parameters is very important. It helps to correlate with the body dimensions of the subjects. The measurements of anthropometric parameters must be well-matched to the bodily measurement of the equipment. In majority cases of tool designing 5^{th} or 95^{th} percentile values of different physical magnitude are used. Including with this, a particular clearance value is too significant whenever it is necessary. In designing of tools clearance value is important for garments wear by the workers, perfect griping and protection.

In the present research study, carpenters are found to use different types of tool to execute the tasks but one of the most frequent tools which are used by the carpenters is the chisel. The Chisel is most commonly used for shaping as well as decorating the wooden stuff. Chisels are made locally in carpentry workshop without introducing any ergonomic principle on those designs. Those types of ill designed chisel influence the work related hazards in the carpentry tasks. Therefore, there is a large extent of ergonomic intervention is required to modify the existing conventional type of chisels of carpenters. An effort should be made to appraise conventional design of chisel to recognize the disadvantages and redesign the existing chisel

incorporating anthropometric parameters of the workers in addition to their choice and performance pattern during operation of chisel. The most abundant disadvantage of the existing conventional type of chisel is feeling uneasiness during holding it and lack of suitable grip of the handles. Efforts ought to be done to solve these troubles.

The carpenters had to perform three types of main tasks, viz., chiseling, sawing and planning. Some of the carpentry tasks did not require any specific type of workstation; they can perform their tasks on the floor of the workshop. But for performing planning task they required a working table where they have to place the wooden object and do their job. The usual workshop had no specific type of workstation. Different workshops possess workstation of different heights for executing planning job. No specific measures of the working table were found. In addition no ergonomic approach was incorporated in the workstation design. Working with such workstation might affect health of the carpenters as well as productivity. Ergonomic intervention is required to solve these problems.

Therefore, it is obvious from the preceding discussion that carpentry work is a necessary activity for furniture manufacturing and other tasks relating to the construction industry. So many people are engaged in this type of unorganized sector and they get their earnings from it. In India, carpenters have been disregarded for technical exploration from the ergonomic aspects. With this, there are notable numbers of injuries or hazards and considerable morbidity were observed in the carpentry industry. As a large number of families dependent on this occupation, elimination of this profession is not possible; rather the work condition should be improved in a scientific approach. Therefore, a methodical examination in this field with respect to this work, tools, and work place surroundings are obligatory to be carrying out to recognize the extent of the tribulations and to advocate the probable corrective actions for the tasks of carpenters.