Manufacturing Systems Technology

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Module – 08

Lecture – 43

Hello and welcome come to this module 43 of Manufacturing Systems Technology course. Today we will be talking and discussing about a very, very modern concept in the area of manufacturing, which is also known as just in time manufacturing or the lean manufacturing. Basically, this system of manufacturing really evolved from the sort of oxidant you can say and you know, you can sort of tag it to all the Japanese manufacturing starting from the Toyota production system onwards.

It has in fact; found it is way into the world of manufacturing to be a system, which is more or less with minuscule amount of inventory. And there are several utilities of a such a system, one of them is that the moment you say minimum inventory you reduce costs in terms of you know lesser damages, lesser, let us say wastage of material. And the costs that are involved are very, very huge magnitude wise and therefore, definitely this form of manufacturing has added value to the whole manufacturing systems technology arena.

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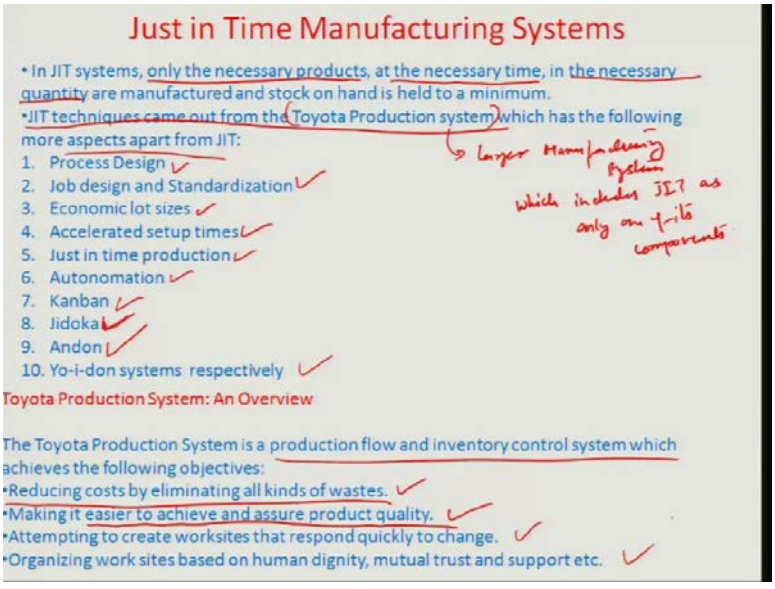

So, let us talk about the just in time manufacturing or the lean manufacturing. So, as the

name suggests, the JIT or the Just In Time really refers to that, what are the products and what are the only necessary products; that is one component of this manufacturing. And also it involves that, what is the necessary time for which this product has to be there in place and how much of this product is really needed.

So, there are three aspects here, what is the product, what is the necessary most important item at a particular place and how much time would it need for reaching that item to that particular place and then, the third is how much quantity is involved in terms of how much item would reach that place. So, it is essentially it is a requirement driven, that supposing in a production process you have several sub assemblies, which are getting assembled finally, into a main product.

So, the question that arises here is that, what is really the sub assembly, which is needed at the station of fitment of that sub assembly into the final assembly, at what time this assembly can be prepared and send and in what quantity it can be send. And then, you try to manage the only necessary from the waste, you know or over stocking situation that would arise, because of reasons, which we really can control. So, it is really a philosophy that, how lean you can operate in terms of supplying your materials at different parts of the production system.

So, that overall the product, which is made is with whatever is necessary gets delivered at the right time at the right place, so on, so forth. So, having said that, having said the overall feature; obviously, the JIT came out of the TPS or the Total Production System and it has the following aspects apart from, you know JIT the total production system; obviously, is a much larger manufacturing system, which includes JIT as only one of it is components. There are many other things or many other aspects of this TPS, which can be studied in great details.

In fact, it has shown a different kind of manufacturing you know, where the idea is that whatever is produced at a particular work centre should be the correctly produced part, meeting the full engineering specification without any quality issues or you know, without any issues related to defective parts being produced etcetera. So, what they assume is a, so tight control of the practices in assembly or in let us say product manufacture, that the non conformance part is by and large eliminated of the system whenever we are talking about such a system.

So, what are those aspects of TPS, which are very, very prominent. One is process design

aspect, so we will probably look into this aspect in little bit. We will also look at job design and standardization aspect. The question of economic lot sizes, because when we are trying to produce at a certain given station and we producing things related to machine, which has larger setup time. So; obviously, you cannot have situation of a one material by one material movement, you will have to have a lot by lot movement and there is also a sizing of the lot, which will give you the most economic condition or situation.

Obviously, accelerated setup times, that is another very important aspect of the Toyota production system. And then, one of the components I had already mentioned is the Just In Time production, the JIT production, which is also going to be a sort of a main focus of study in this particular topic. Then, we will discuss concepts like autonomation, which is little bit different than automation, so it is more like sort of a fool proofing kind of a system.

We will talk about Kanban, which is actually the central sort of works keen, which is put in place to have this leanness in the manufacturing or leanness in the supply of materials of various stages of the manufacturing. We will talk about some other terms, which are mostly Japanese like Jidoka, which is basically a system of lights, battery of lights, which are initiated in some of the assembly lines, etcetera or some of the product manufacturing centers indicate the problems at various levels of the product assembly or product manufacture.

Then there is this Andon system, which is very, very important. It is basically again a system, which will indicate whether the problem is of greater severity or lesser severity and then, Yo-i-don systems, which are mostly related to the sub assemblies etcetera. So, these are the different aspects of TPS that will probably discuss before we get started with the actually the JIT manufacturing or the Just In Time or lean manufacturing.

So, if you look at the Toyota production system, it is really a production flow and inventory control system and it achieves the following advantage objectives. One is that, it tries to reduce the costs by eliminating all kind of wastes and it makes it easier to achieve and assure product quality; obviously, the wastage factor is reduced. Then, you can easily sort of say that you know the product quality will go up, because now you are handing lesser amount of loads and you are automatically killing those loads, which were unnecessary or burdensome to a particular work station.

And, so because of that now lot of time is saved, because of the additional burden has been removed. And, so that particular time can be more productively towards thinking or planning or implementing the quality in the work existing in that particular work station. So, that is one of the reasons, why it can make it easier to achieve and assure the product quality. Obviously; you attempt to create works sites that respond very quickly to the changes, because just because I am saying that it is quite lean system in terms of whatever is needed is supplied and nothing beyond the problems associated in the flow patterns across the whole system become a big obstacle or a hindrance towards this lean manufacturing.

And therefore, some over stocking is necessary at different places to adjust for these variable levels. So, one way of looking it as a system is to sort of increase the overstocking at centers and another way which is the more straight forward ways can we sort of you know manipulate the flow or the process in a manner. So, that it is very, very smooth and these disturbances in the flows sell dome happen. So, basically all the sub systems, which emerge out of you know such issues like for examples let us say talking about the maintenance sub system, which is also a sub set of the manufacturing process or again, you know the routine inspection of the equipment etcetera, which is involved in the manufacturing.

These have to be made in a more dedicated sense, so that you can avoid those causes of troubles which really would lead to the system stall at different places and hinder the smooth flow of the system. So, going in the downward integrated manner you can do all these management in units and that is actually what the TPS or the Total Production System, which is you that how you do all these process is as unison. So, that there is a good and standard flow across the various wings of the process of the product development, so that it can happen immediately you know without much hindrances.

So; obviously, there has to be a mutual trust and dignity between the people, who are responsible for running the system. And, so therefore, the whole system is based more on mutual respect and human dignity. So, that is one very important issue that you have to consider while dealing with the Toyota production system. So, having set that this is in fact, some of the objectives which the TPS meets.

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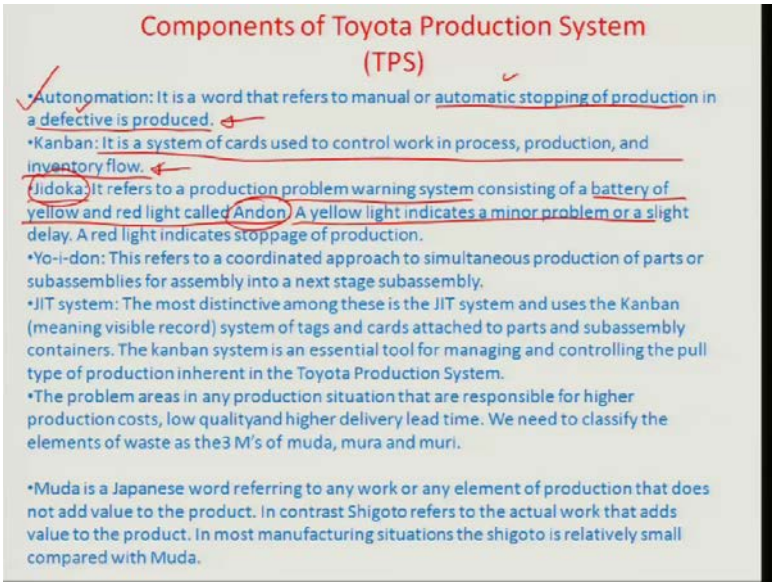

And, so if you look at the different components of the of the Toyota production system I already told you about sort of autonomation, which is actually not really automation, but it is a system, where in automatic system lines stopping or automatic stopping of production will happen if there is a defective, which is produced. Let us say for example, we are talking about a car assembly.

So, for example, you are mounting the wheel nut for an automotive assembly and then, you have to torque the wheel nut before the assembly moves ahead and you know you have a torque range in place, which actually creates a fool proofing that you have torque. So, basically autonomation aspect of a line would be related to supposing there is a RFID system, where if there is a torque created it will change the counter by 1. So, that the line keeps on moving and if there is no change in that counter the line automatically stop.

This kind of a system can be called as an autonomation systems there is several such interventions at various places which are more related to fool proofing of the processes, where the most essential and we call that the probably the shifty related processes related to an automotive product or any other product. So, those are the operations, which have to be fool proof that if the operation is not performed and accidentally left over, then the line automatically stops.

So, therefore, the moment there is a defective produced and defective can be the product defect or it can be something related to the process defect also automatically there would be a stoppage in the assembly line. So, that is a one part autonomation the other part

other aspect is Kanban; obviously, it is a pull based system we are talking about and I will talk about these in great details in the later sections, where. we will try to estimate deterministically or problestically the Kanban level for a particular system.

But, you have to understand one thing that this is a system, where there is an information flow in the reverse direction and the production flow in the forward direction and some of the information is responsible for the production to happen. So, for example, if there are a series of stations in assembly line from station 1 to station 10 and there is an information flow coming from station 10, which actually further proceeds all the way to the customer, who is the person who takes that assembly may be the, the next stage of the producer etcetera next stage of the product etcetera.

So, there is a requirement generated from that customer end and this requirement is initiated as an information flow from station 10 to station 1 and the way that the information flows is exactly the way that the production sort of keeps on happening of the product flows. So, the product pattern and the information pattern a flow or more or less the similar. So, the Kanban really is component, which is important for that information flow to happen and it is actually a card, which is having a description of what is the quantity and what is the material, what is the quantity in and what is the sort of a you know lead time that would be needed for the deliver ability at a certain work station.

So, that is what the Kanban suffices, so; obviously, the production flow or let us talk about inventory flow will only happen as dictated by the Kanban card and nothing beyond. So, whatever quantity is needed from the succeeding stage would be supplied to the succeeding stage by the preceding stage only when the preceding stage gets a information card that, so much is needed. So, that kind of reduces the overall inventory level; obviously, if there are flow it is balances, then it creates overall stoppage or overall you know disturbing disturbances in the whole process also if there is a defect produce that a particular station, then again there would be a flow disturbances of this type.

So, by and large the TPS system is such that it does not let this defect production happen and that kind of gives you a far out reach of the quality level, because of the constraints imposed on the production process, because of just the lean flow of the material. So, in a way there are many, many added benefits, which would automatically happen, because of this lean inventory, which you probably may not realize, but in a intangible way may

hit upon the process at some particular point of time.

So, Kanban is a system of cards now, used to control the work in process production and inventory flow. In fact, we will design the systems for optimal inventory levels and Kanbans and determine the number of Kanbans accordingly, then again there is a terms Jidoka it is basically referring to a problem warning system. So, where ever there is a product assembly going on if there is some kind of a hindrance to a certain process or there is some kind of a problem at a certain portion of the assembly product assembly it should indicate it then and there that there is a problem.

Because; obviously, when you are talking about such a leanness we cannot wait for the information of that leanness to arrive at you know the decision making authority, who would actually translate that into the product flow etcetera by may be over sanctioning the inventory or something. So, therefore, you have to have a system in place where there is a immediate warning signals, which comes up as soon there is a defect.

So, supposing you are talking about a car assembly, so at the various sub system levels in the assembly there may be different portions of the assembly dedicated to different fitments you know of the car there can be the interiors of the car fitted at one place or the under body components fitted in another place or even the final components in the inspection at another place. So, all these different sub systems or sections will have a warning system and whenever there is a problem related to the tooling or problem related to the material flow or the problem related to the manpower or any other issue or even of the misfitment that has to be indicated.

And this indication happens through the Jidoka system, which is actually also battery of yellow and red lights is also called Andon by the Y Andon is a term which represents the light and the sound signal which comes up and. So, there are two classifications here if you are having yellow light it indicates a minor problem without, which the process can still go on and if there is a very critical problem, which leads to the stoppage of the line that is indicated by a red signal.

So. In fact, what people aim for typically is that how this red signal or the red light can be eliminated; obviously, the yellow light when it comes signifies that you should attend immediately to the call of the concerned personal who is deputed at that particular place of the assembly because if you do not do that then it may lead to a red light eventually. So, it is a for warning kind of a system to a line stoppage and that line stoppage needs to

be avoided by all means because that is a production loss to the whole system of the whole company.

So, that is how this whole Jidoka system has been designed and, so efficient that it really pulls out all the bottle necks and projects it directly to the decision making authorities as to these are the responsible causes. In fact, record of all these Andons and their time durations are made and being investigated on a case by case bases as to what went wrong and then, counter measure plan if you can really if you want to really do the typical to the real essence of the Toyota production system. So, I would like to close on here this particular module and may be just start with some of the other remaining concepts like Yo-i-don JIT system etcetera in the next lecture.