Operations Management
Dr. Inderdeep Singh
Department of Mechanical & Industrial Engineering
Indian Institute of Technology, Roorkee

Lecture – 45
Master Production Scheduling (MPS)

[FL] Friends welcome to session 45 in our course on operations management and today we are going to wind up our discussion on this topic of production control with a discussion on master production scheduling. As you are aware that in production control there are four important functions that have to be met or that have to be considered that is loading, scheduling, sequencing, as well as expediting.

So, what we have to do? We have to manage our operations that are being done on the shop floor or within the organization for the best interest of our organization that is for optimal utilization of the resources that are at our disposal. We have seen in this week in the very first session we focused on production control, if you remember we have seen that 4 important functions have to be taken into account. We have understood that, what do we mean by loading, we have a number that comes from the demand forecast that is a number of products or items or equipment or sub assemblies that we have to produce.

So, once we have the number we have to load the various work centers with the type or the amount of work that has to be done by each work center. Similarly we have to load the employees that are available with us in order to satisfy the requirement or the demand that has been generated by the sales department. So, we have to load the things we load means that we have to assign the work to the individual work centers and the workforce available with us that comes under the loading.

Then we have to do the sequencing that how the machines will be operating on the various jobs that are coming to the machines, what will be the priority rule for assigning the jobs to the machines in sequencing we have tried to solve problems where only work once works, only one work center was there then we have try to solve a problem where n jobs and 2 machines are available then we have try to solve a problem where n jobs and 3 machines are available.

And today our last part of discussion in week 9 is focused on master production scheduling that we have a demand, we have a forecast, we know that how much has to be produced how we have to overall plan our production in such a way that we are able to meet the deadline, because the word schedule is coming in this; that means, that we have to schedule our operations in such a way that we are able to finally, meet the deadline.

So, all these four functions when done in unison that is in unity we can say the four functions of loading, sequencing, scheduling and expediting if we do focus on all these four functions or production control. We will be very easily able to achieve our overall objectives of operations management that will ensure that we are able to produce the desired quantity of material at that specific or desired time with a specific cost or that is a reasonable cost.

That is our overall objective and that we have to ensure and for to ensure that we have to focus on each work, for each person, each labor, who is working we have to focus on each machine, that we are using we have to focus on each manner, we have to focus on each machine, are and try to optimize the utilization of men and machines in order to achieve our overall objectives of operations management.

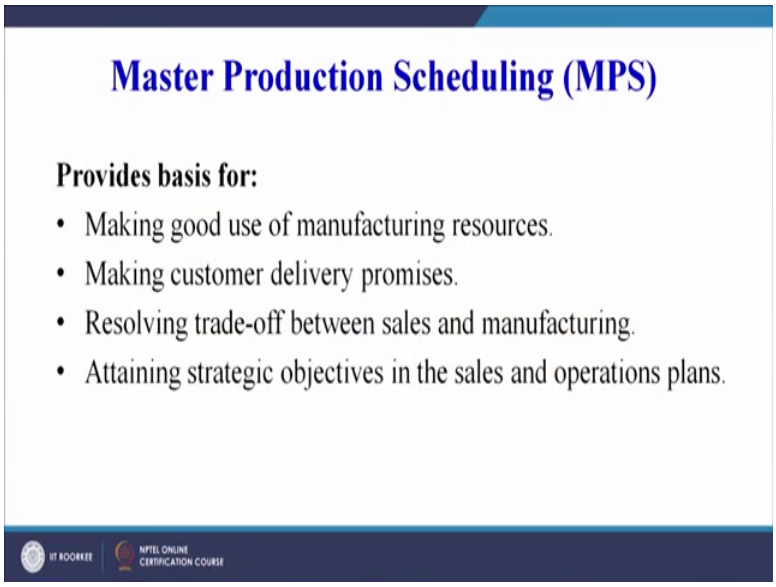
And we have try to solve problems where n jobs have to be assigned to 2 machines 3 machines in our previous session and today our focus will be on master production schedule, one thing I must address here that this master production schedule maybe at a higher level of management and our sequencing is at an operational level of management. So, maybe sometimes in organization or rather I must say most of the times all organizations will first have a master production schedule.

Then they will go to the individual sequencing, but in our discussion since we wanted to focus more on sequencing models and how to maybe try to solve problems of sequencing n number of jobs on different machines we are given more focus on sequencing, but in general we will see that master production schedule will be prepared at the higher level of management and once the master production schedule is available then we will next move to the sequence of various job or sequencing of various jobs on various machines or on different machines.

So, it is at a higher level as compared to the sequencing function. So, we will try to focus on master production scheduling today and try to understand that how this is helpful in

better management of the operations now in master production scheduling it provides the basis for making good use of manufacturing resources. Now, what are our manufacturing resources, as I have already taken two resources in the beginning of today's session.

(Refer Slide Time: 05:44)



That is manners; that is the number of person available with us or the number of skilled people available with us, unskilled people available with us, as well as the machines or equipment that is available with us. So, we have to optimize the utilization of men and machine in order to ensure profit for our organization, also making customer delivery promises because once we know that what is the demand, whatever our sales department has committed to the customers, we have to ensure that that commitment is honor that commitment is justified that commitment is met and master production schedule will help us to meet that commitment.

It will also help us to resolve tradeoff between sales and manufacturing as well as for attaining strategic objectives in the sales and operations plans. So, we will see that the master production schedule is a quite useful may be data or may be representation of data which will be helpful not only in better planning and execution of our manufacturing function, but also leading to the overall better productivity overall efficient and effective utilization of resources at our disposal. So, strategic objectives in sales and operation plan can also be utilized or can also be met using master production schedule.

Now, what is a master production schedule a master production schedule is a master level or top level schedule.

(Refer Slide Time: 07:26)

As I have already told once our master production schedule is ready then we go for optimization in terms of sequencing. So, it is a higher level of decision making or a strategic level of decision making. So, the master production schedule is a master level or top level schedule use to set the production plan in manufacturing facility.

So, it will work out a manufacturing plan for or a production plan may be for 15 days or a month or maybe 2 months that how what we have to produce which machine will work on which job and what is the time allocated for that job. So, that the overall target is met the overall target may be to produce maybe 500 components in 15 days. So, this is our target 500 components in 15 days, now what all operations are required for these 500 components or for each component. So, these operations will be scheduled in such a way that our overall target of 500 components in 15 days is met.

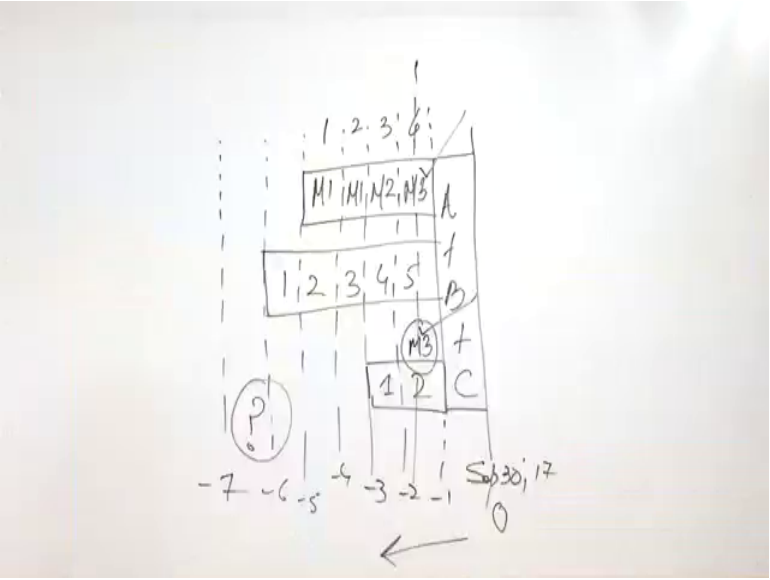
So, that complete picture depiction of when which machine will work on which particular sub component of this component or of this product will give us an overall view of the production plan that we have to follow in order to meet our target. It is usually a medium term production plan indicating the start of manufacturing in quantities and lead times for each article according to the demand and the company's capacity. So,

we can see here that what is the pull? The pull here is the demand and the demand has to be matched or mapped with the company's capacity.

So, these 2 are important things are important inputs for making a master production schedule. So, we must know that what is the demand in the market? What is the number of products that we have to produce? Also we must know what is our capacity? We have already had 2 sessions on capacity planning also. So, we know that what is our capacity, so; based on our capacity, based on the demand, that is available in the market or that is existing in the market we will plan our production accordingly.

So, it will be based on the quantities that we need to produce as well as the lead times lead times means the manufacturing lead time is that from the start of the manufacturing activity for that component to the end time that is the final time when the article is ready. So, that lead time will help us to plan our production because suppose we have to produce a particular article by a particular date I think I will try to explain it with the help of a figure.

(Refer Slide Time: 10:25)



We can see that now suppose this is our deadline that is suppose September 30, 17 this is our deadline. Now, we have to make a master production schedule and suppose there are 3 components that have to be assembled to get a final product. So, we know this is the assembly time may be one day. So, this is these are the number of days that we are calculating now suppose this is our day 0 when we have to finally, ensure the delivery

minus 1, minus 2, minus 3, minus 4, minus 5, minus 6 maybe we can have another day minus 7.

So, we are moving backwards from the date of delivery. So, suppose September 30 is the delivery date. So, we will see this is our assembly operation for A plus B plus C. So, all 3 components are being assembled on the last day that is one day is required maybe A may require we can see 4 days of operation day 1, 2, 3, and 4, 4 days are required for component A, maybe we can see 1, 2, 3, 4 and 5 days are required for component B.

Similarly, maybe C requires only 2 days of processing now we can do the calculation or see the manufacturing lead times for each of these sub components, that is sub component A, sub component B and sub component C and final assembly of A B and C. We can calculate using our master production schedule that when our production must start in order to meet this target of September 30th 2017 and accordingly we can come back and see that this was the time or this is the date by which our manufacturing of at least some component B must start so that we meet the target of September 30th.

So, that is basically we can see the lead use using the lead time, we can find out that how and when our production must start. So, the MPS is used to in particular to establish the materials requirement plan also. So, in our subsequent weeks we will also discuss the materials requirement planning MRP 1, MRP 2 and try to understand that how a master production schedule is an input to our materials requirement planning.

Now, schedule is known to us based on that whatever is the raw material required we have to order it at appropriate time. So, that whenever there is a need of the material we are not having a situation of a stock out that we need the material to start our production, but the material is not available. Now, how it can be automated it can be automated using a materials requirement planning system in which one of the inputs will be master production schedule; which will give us that when which material has required this will give us that when processing of which particular component has to start as we can see here that for component B when the production has to start for component A when the production has to start.

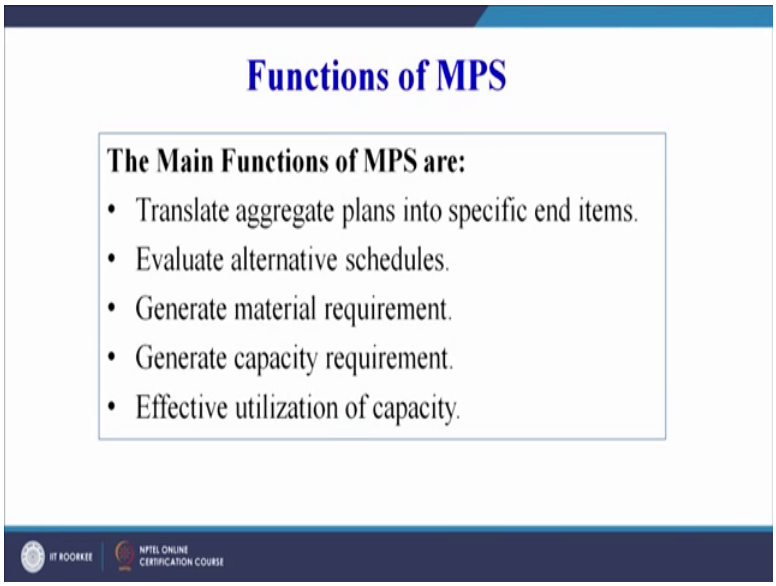
So, when we know that when the production has to start for a particular component what is the raw material required will be planned using a mass materials requirement planning system which we will cover towards the end of our discussion on operations

management. So, we can see the importance of master production schedule and here suppose for each component, we even know the machines that which machine is required for which particular component we can even check the conflict among the machines also for example, we can say that if we again look here.

Suppose we have machine 1 required, machine 2 and machine 3 we can also note down the machines required for various operations on component B, we can also note down the machines required for component C and suppose I say that machine 3 is also required for component C on this particular day. So, we can see that there is a conflict of machine 3 here and machine 3 here same day machines are required for 2 different components.

So, we can see that what is the capacity of machine 3 rather it can process both component A and component C on that particular given day that is may be on September 30th or not so, all that has to be taken into account. So, that is may be the beauty of this master production schedule we can even use it for resolving the conflicts among the machine utilization also the main functions of master production schedule are.

(Refer Slide Time: 16:08)



Translate the aggregate plans into specific end items know aggregate planning we have already seen in our previous discussion. So, those aggregate plans whatever we know that this particular demand has to be met by this particular production alternative. So, that aggregate demand can be or aggregate plan can be put into action using the master production schedule if you remember in aggregate plan we calculate that how of demand

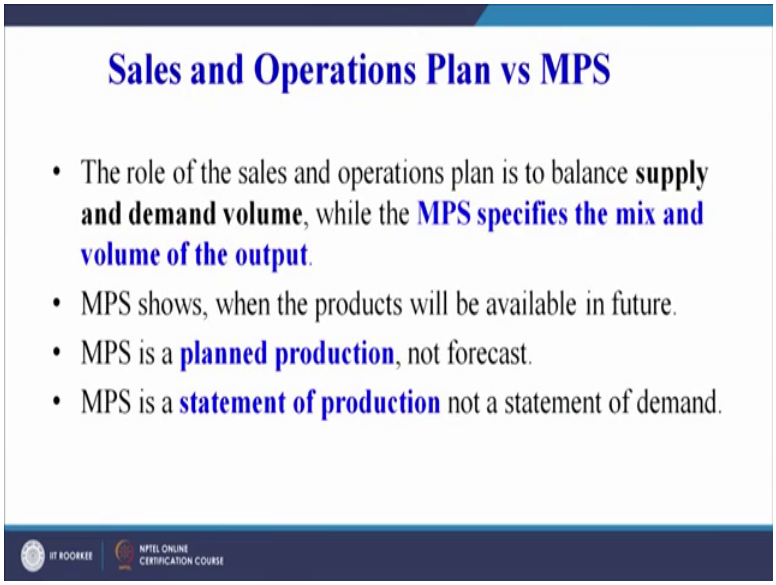
or the distribution of the demand among the various quarters or the distribution of demand among the various months of a year has to be satisfied.

So, once we have the data we have finalized our aggregate production plan we have to translate that demand now into actual action where we have to plan our shop floor operations in a way that we are able to satisfy that demand for that particular month. So, it will help us to translate that plan aggregate plan into specified end item. So, how the conversion will take place that is the actual actionable output of master production schedule it will it will evaluate the alternating schedules.

Now, we may have 3, 4 different alternatives possible or possibilities existing that this demand can be met using these 3 alternatives. So, it will help us to evaluate the alternatives, generate the material requirement in connection with the materials requirement planning system which we are still to cover. We will definitely cover it in our course generate the capacity requirement, effective utilization of capacity as I have already told in the beginning of beginning of today's session that our focus primarily is the effective and efficient utilization of all resources at our disposal.

So, master production schedule if we are using it will help us as I have tried to explain it will help us to use the resources available with us in the best possible manner. Now sales and operation plan versus master production schedule, now we can compare the 2 your sales and operations plan is different from the master production schedule.

(Refer Slide Time: 18:17)



Why because master production schedule is actually the plan that we are going to follow on our shop floor to meet the demand target or to meet the demand, but the role of sales and operations plan is to balance supply and demand volume. So, there will be a demand in the market so, they have to manage that whatever supply they have or whatever is being produced whether it is able to satisfy the demand or not while the MPS or the master production schedule specifies the mix and volume of the output.

So, the focus is primarily in terms of the number or the volume of products that can be produced in case of master production schedule. Master production schedule shows when the products will be available in future because we know we have done the calculations we know that by this date our master production schedule is helping us to find out that this many number of products will be ready. MPS is a planned production it is not a forecast. So, actually we are making use of the forecast for making our master production schedule it is not a forecast it is basically our plan that how we are going to meet the forecast or meet the demand which is existing in the market.

Master production schedule is a statement of production not a statement of demand. So, demand is certainly an input to the master production schedule, but it is not the statement of demand, it is you can say statement of production that how actually the demand will translate into the operations at the shop floor. So, that is basic objective of master production schedule.

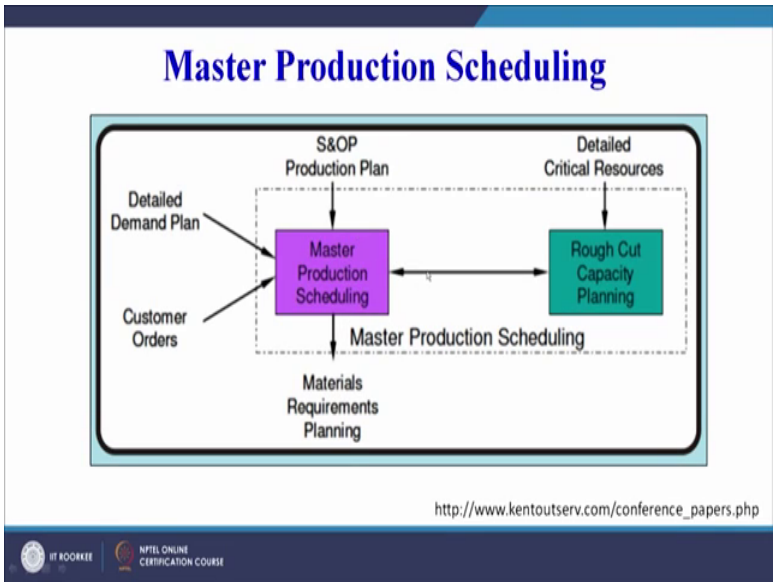
Now, what are the development phases of master production like suppose we have a demand data available with us from various sources, how that has to be translated into actionable production plans is basically the overall objective of preparing a master production schedule.

(Refer Slide Time: 20:28)

Now, MPS Development takes place in 3 phases. So, 3 stages or 3 phases are to be taken into account, the first one is development of the first version of master production schedule rough cut capacity planning to ensure that target production quantities are achievable. Now, target production quantities from where we are getting we are getting this from the demand data which is provided by the sales department. In case if the capacity is overloaded an insufficient sales and operations team revises the plan to develop a more viable version of master production schedule.

Now suppose there is more demand, but we do not have the capacity to produce that many number of components which can satisfy the demand. So, we have to reschedule the sales department has to enter into logical contracts, actionable contacts with the customer. So, that we are able to map our capacity with the demand there are the contracts that the company has with the vendors. So, that can be negotiated between the sales department and the customers. So, in 3 stages the master production schedule will be prepared. So, we can see with the help of a diagram here the master production schedule.

(Refer Slide Time: 21:45)



What are the inputs sales and operations department we have a production plan detailed demand plan is must be available with us customer orders. So, all these are the kind of inputs. So, master production schedule will be one of the inputs to the materials requirement planning system which we are definitely going to cover in our course on operations management in the subsequent weeks. So, at that time you must remember that, what is a master production schedule?

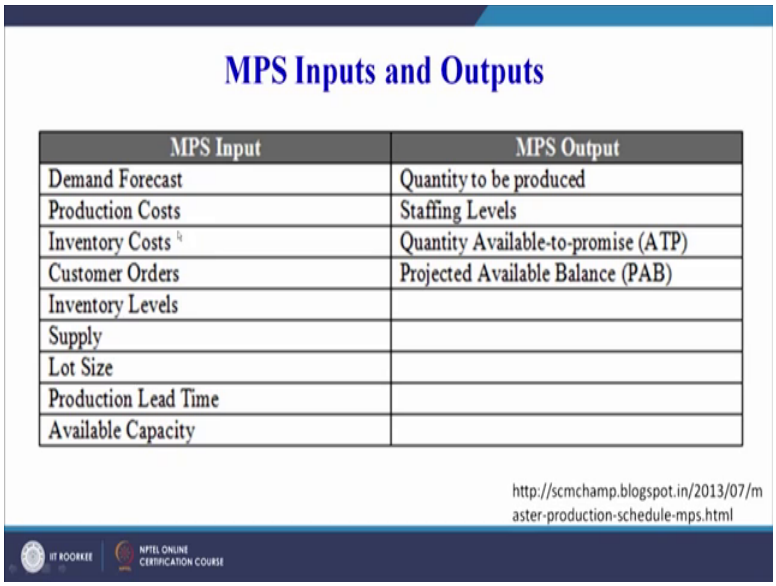
So, it is basically a production plan focused on the timely production of each and every component of the product so, that the product is delivered on the due date. So, our master production schedule will be an input to the materials requirement planning system. So, MPS we can see it is first tested the rough cut capacity planning is done. So, we know that what is the demand, how we can meet, it whether we are able to meet that demand with the existing capacity available with us if yes go ahead final MPS is issued or prepared.

On the contrary if suppose we do not have the capacity that we have checked up in the rough cut capacity planning stage we will look back to the sales department and try to re organize our demand or maybe re look at our demand data and try to figure out that how and maybe when we can supply the products that we are producing to our customers maybe the sales department can look at this and give a reasonable demand, not

reasonable maybe the actionable demand which can be translated into actual production with the existing capacity that is what is the different stages.

And finally, whatever demand has been agreed upon or whatever contracts have been agreed upon by the sales department with the probable customers that data will be given as an input data to the production department and based on that revised data master production schedule will be the may be formulated or it will be framed it will be again checked for the capacity constraints and limitations and if everything goes on fine the master production schedule will be issued and will be followed religiously in order to meet the specified demand.

(Refer Slide Time: 24:24)



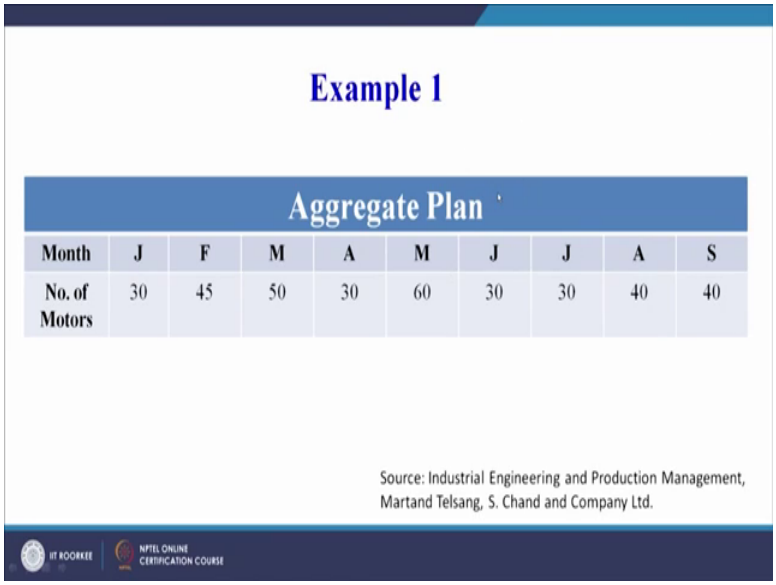
Now, what are the inputs we can see master production schedule demand forecast, production cost, inventory cost, customer orders, whatever are the inventory level. So, this inventory cost, inventory levels lot size all this will be used in our materials requirement planning also and these are the inputs and based on that MPS output will be quantity to be produced staffing levels because we know that who are the people; who are going to actually produce the product.

So, workforce management is also an output of master production schedule quantity to be produced is the most important output we know that by such and such date September 30th; this many number of components will be able to produce based on the master

production schedule then quantity available to promise projected available balance this is also the output that is going to help us for better management of our operation.

So, maybe each one of this point can be discussed with the help of an example, but considering the paucity of time I leave it for the learners to further enhance their knowledge in context of the master production schedule, but the basic idea I think is clear to all of the learners and we will try to reinforce this idea with the help of few examples.

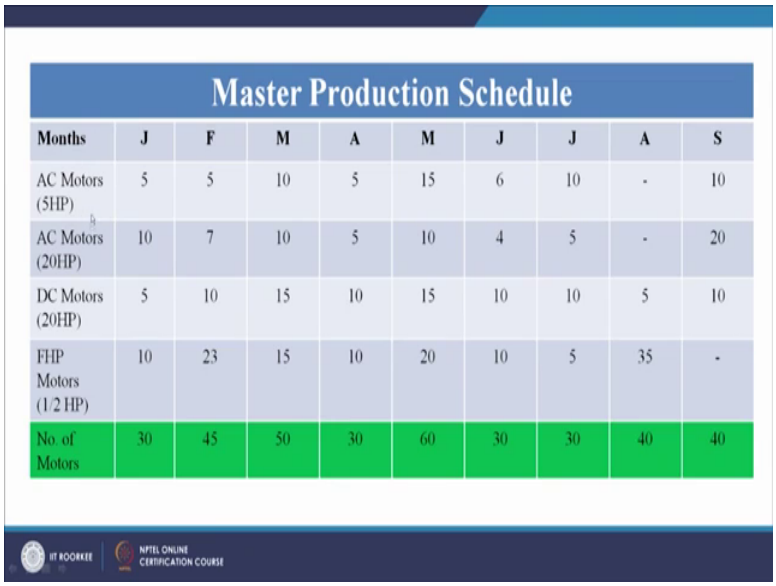
(Refer Slide Time: 25:46)



So, first example you can see the aggregate plan which we have already covered in week 6 is given here, in week 6 we have seen that what do we mean by aggregate planning and aggregate production planning. So, we have different months from January to September and numbers of motors are there which have to be produced for January 30, February 45 similar data is available.

So, this is the demand data which has to be satisfied by our planning or production planning department.

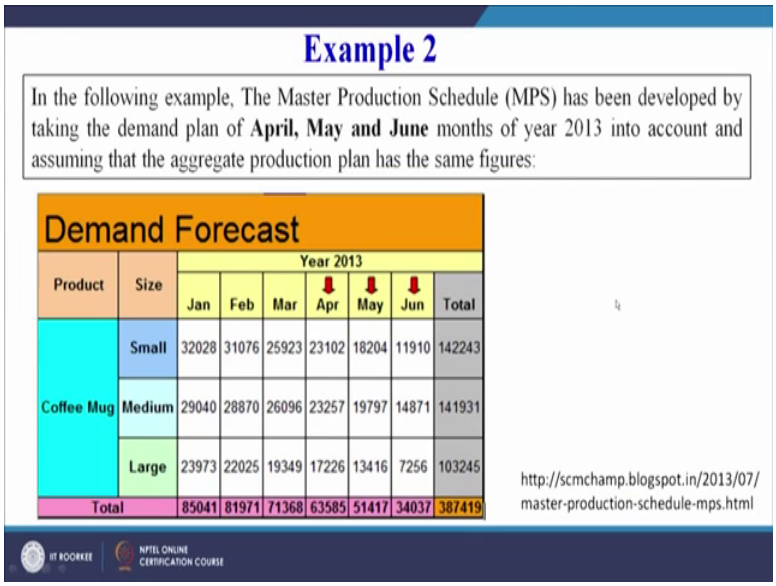
(Refer Slide Time: 26:21)



Now, we can see the master production schedule can be formulated like this within the motors also there are four different types of motors. So, we can see 30 is the total requirement which was there in the previous slide we can see for January 30 motors. So, here we can see 30 subdivided into 5 AC motors 5 hours per.

So, accordingly distribution is there now the master production schedule has given us a detailed idea that by January how many AC motors have to be produced or February how many AC motors have to be produced. So, this is our master production schedule which has to be followed in order to meet this overall monthly demand for the number of motors and is monthly data can further be subdivided into weekly data in order to better manage our operations.

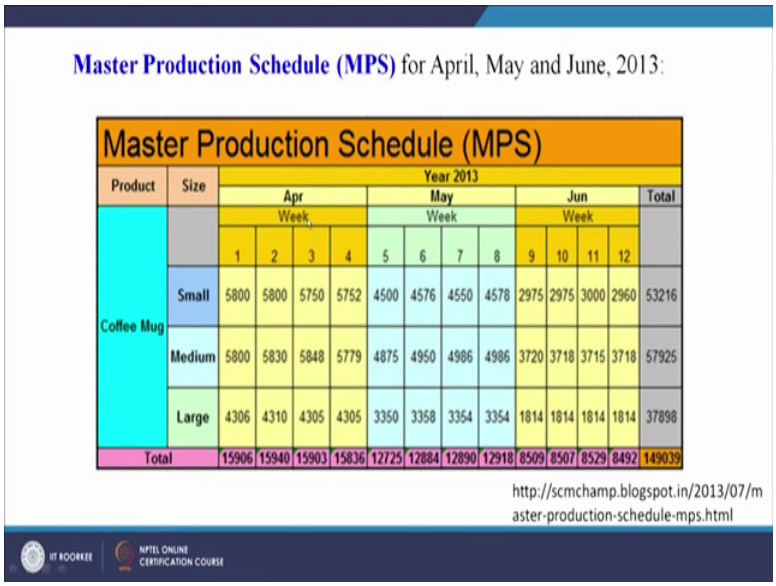
(Refer Slide Time: 27:12)



Now, we can take another example in the following example the master production schedule has been developed by taking the demand plan of April, May and June. So, we can see the demand forecast data is given and we are only considering April, May and June months of the year 2013 into accountant and assuming that the aggregate production plan has the same figure. So, we can see coffee mugs have to be produced the demand forecast is given 3 sizes small medium and large January, February, March this data is given that is the demand forecast data we are focusing on these things only April May and June.

So, what we can do here we can assign this values to our master production schedule and this can further this subdivided into weekly basis. So, that we have better management of our operations. So, coffee mug we can see in small quantity this much is required 23,102 is planned for month of April small coffee mugs, medium coffee mugs data is there and large coffee mugs data for all the 3 months is available.

(Refer Slide Time: 28:21)



So, we translate into weekly that April week 1, how many small mugs have to be produced for week 2, how many and week 3 how many and finally, week 4 and then similarly for the month of May and June and accordingly once we know the master production schedule we can see that, what will be the materials requirement? What will be the workforce requirement to achieve these targets?

So, this is the way we can represent our overall production plan in the form of a master production schedule in order to meet the demand forecasts which is existing in the market or the demand forecast which has been done by our sales and marketing department. So, basically you can see that once we have the number of products that we want to produce it can be easily translated into actionable production with the help of a master production schedule which will give us the timelines in which the various components or parts must be manufactured in order to meet the deadline or the product delivery date.

So, with this we close the session on master's production schedule and in the next week we will carry forward our discussion on this important topic of operations management

Thank you.