Welding Process
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Introduction to the course

So in this course I am going to cover the welding processes and I am not going to discuss any methodology, there will not be any methodology, ok. No microstructure no (())(00:24) transmission. So I will be talk about the physics of welding processes. So the physics begin the heat generation and the heat source generation, the reaction, ok. So what mechanism the we generate heat and the pressure or both, heat and pressure, ok. That is what I am going to talk about it. So I will just show you the syllabus, what we are going to cover.

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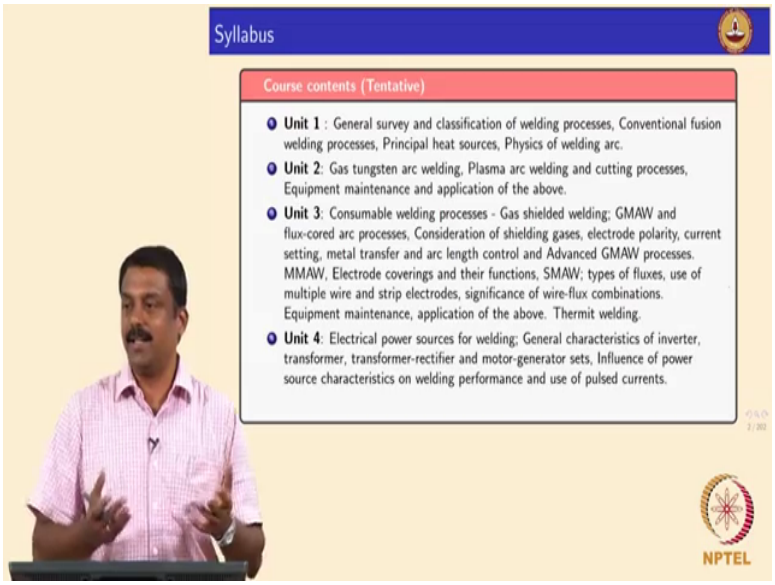

So we divided into you know 7 chapters, this course when we design this course welding processes course, ok. We are going to cover the entire spectrum of the welding processes that our commonly used for engineering applications, ok. So first we look at the classifications of the welding processes based on various the methodology we can classify welding processes and we also look at the heat source, the principles begin the heats generation.

So one of the very common most widely used welding processes arc welding processes and we will going to understand the what is arc? How we generate heat in the arc? So what is that actually happening inside the arc that generates heat? and we look at all the fundamental governing principles, ok. So what are the reactions that are happening inside the arc? Ok. So what are the rate controlling factors that can be influencing the heat generation in the arc?

So that is the first chapter, we will understand the physics begin the arc, ok. So then we move on to the actual processes then we will use that arc and we can strike an arc by various ways, ok. So we can used yeah non consume volt electrode or consume volt electrode or we can also use a plasma as well to generate heat.

So we will on to move each processes in unit by unit, the first unit physics of arc, we look we understand the physics of arc then we will move on to the second unit where we look a word, we study about the gas tungsten arc welding and then principles begin the gas tungsten arc welding and the application of this process, what are the rate controlling factors? What are the parameters which are going to affect the process stability? and so on and so forth and then the second after second unit, third unit is on consumable welding processes, so in gas tungsten arc welding the tungsten electrode is not melting where as I we can also strike an arc with unconsumable electrode.

So that processes are known as gas metal arc welding or manual metal arc welding or shielded metal arc welding, ok. And we look at the variants of this process and this process of consumable welding we also transfer the metal consumable to onto the wire pole or material, ok. So we also see how the process characteristic can change the metal transfer characteristic, ok metal transfer behavior again the principle begin what are the forces acting on metal and drop light when it detaches from the tip of the electrode, how we can manipulate the force so that we can change the shape of the drop light, ok.

And then how we can increase the productivity? For example by varying the parameters of welding and what are the optimum transfers characteristic to achieve best weld? So we are going to look at in third chapter about all this physics begin and the consumable welding processes and then fourth chapter is on power sources, so it is also important because we used power source to generate and current as well as the voltage and we also regulate these current and voltages for our own benefit.

So that we can stabilize the process, so we need to understand what is there inside the power source? so the power sources generate the parameters the heat generating parameters mainly current and voltage and of course we have a lot of modification to current power source and we can have a (())(04:31) that is my computer inside the power source. So that all the parameter is which are all important can be regulator.

So we look at a typical welding power source and the characteristic of an power source from early fifty is to the modern power sources which can have inbuilt microprocessor and (()) (04:52) controlling the welding parameters which are actually used for welding, ok.

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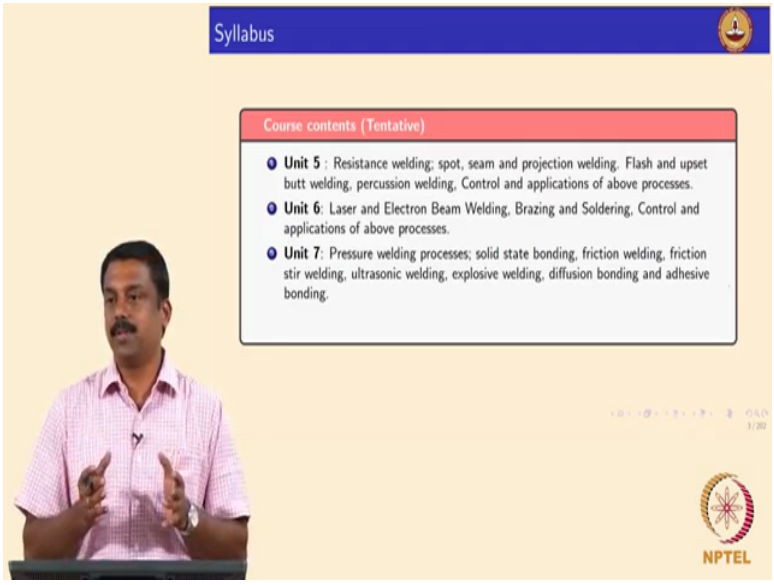

So upon looking at all these the background will also move to the other welding processes, for example resistance welding where we do not use arc, ok. So arc like an a the gas tungsten arc, gas material arc but we will used dual heating, ok. What is dual heating again? so when a current is passed on a conductor you can sit re apply it, ok dual heating. So we will use dual heating mechanism to weld to material, ok. So there are very commonly used welding processes that uses dual heating (start one the) start as a resistance welding, ok.

So there variance of resistance will help resistance spot, resistance seam and projections welding for example our flash butt welding, resistance upset welding again percussion welding and how these again the physics begin govern the heat generation of this process, right and how we can modify (agai) the parameters to achieve best weld. So that is we are going look at in chapter 5 and then chapter 6 about the processor which are very close to my heart, ok.

So I have been working on these processes on laser welding as well as electron beam welding again laser is also can be used as a heat source same as a electron beam, right but again it is not like an arc welding so where you can manipulate current and voltage. Laser welding it has his own characteristics, the power distribution of power in the beam and again we need to

understand the physics begin the optics, the laser optics to control to manipulate the welding parameters, ok.

And we will look at the again physics begin the laser welding, electron beam welding some of important factors that govern the stability of the process, we look at the forces again acting on these welding processes. How (these are) those for balanced when you are using these welding processes. So we will understand there governing mechanisms in achieving a good stabled well, ok.

And then last chapter we move on to the solid state welding processes where we do not really heat it up as high as you do it in arc welding or laser welding or resistance spot welding and you do it at a solid state slightly at a low temperature but not involving a liquid or melting, ok. So there are various processes that are (())(07:26) commercialize nowadays in solid state welding.

So for example the (ra) friction welding, friction stir welding and ultrasonic welding and explosive welding for example it is been there for quite some time it still the commercially (())(07:42) is still limited and you can also look at resistance diffusion bonding and adhesive bonding. So these is the all over for syllabus we are going to look at in this chapter. As I said no microstructure, no (())(04:52) transmission, no methodology.

So this course is design to give fundamentals of (())(08:02) the welding processes and this sees very basic suppose if you are even employed in some company and if a company uses welding process and we (())(08:14) look at how the process work and what are the physics begin you unless you are understand the fundamentals physics correct you cannot manipulate you cannot derive the advantage out of this process, ok.

So this is the objective of this course, the lining outcome is given welding process you need to understand, so what are the principles physics begin the heat generation or process generation? ok. How we can manipulate the parameters such a way that in this physics the governing fundamental can be manipulated and the forces can be balanced to achieve a good weld, so that is the objective of this course.

So you need to be able to tell the after this course so what welding process can be suitable for an given application because you know the again now you need to choose a welding process based on a your need is unless you understand how a process work you cannot never tell the

this process suitable or not or if other process suitable or not, ok it is clear. This we are going to talk about it, right.

Before going to in details so I will also tell the textbooks so which I am going to follow for this course.

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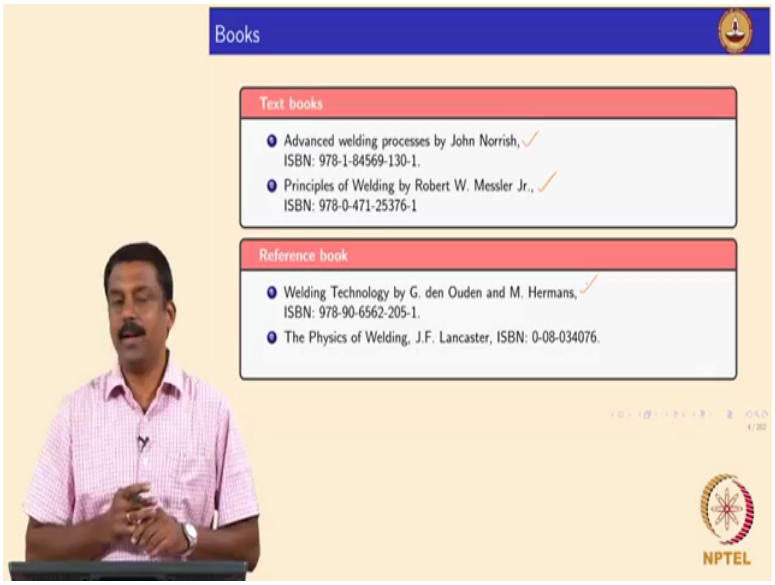

The main textbook I am going to follow is professor John Norrish book on advanced welding processes, so this book is available in our library and e copy is also available, right. So that is a textbook I am going to use for majority of the chapters except the last chapter the solid state welding processes because John does not like anything which does not involve liquid. So he never writes anything about solid state process, so for solid state welding process I will be using the book by Robert Messler the second one, a principles on welding, ok.

So these two are the textbooks I am going to use, right and the for first chapter the physics of welding arc. So that is very extensively covered in the third book welding technology again the e copy is available in our library, so you can follow that for the first chapter on physics of welding arc, ok. So again so these are all textbooks I am going to use and for lancaster book will also useful for understanding the physics of laser welding and physics of arc, ok.

So these four textbook is already available in our library and you can choose and then refer accordingly but if you attend the class regularly you do not need textbooks, you know you can always use my slides and if you have any question, you can always ask me.