Hello everyone myself, Miss Shubhra Bhende from Government College of Arts, Science and Commerce, Kepem, assistant professor.
Program: Bachelor of Science, Second year subject botany Semester 3 course code 103. Course title, plant anatomy and Embryology. Title of the unit embryo and endosperm seed structure.Module name, endosperm types and functions. Outline of the module introduction, types of endosperm, functions of endosperm. Learning outcomes defines the endosperm, Lists the different types of endosperm. Recalls the functions of endosperm. Describes the different types of endosperms.
Now, introduction to endosperm types and its function. Endosperm is the most common nutritive tissue which is used for the development of the embryo in angiosperm. It is a product of fertilization and it is usually triploid after fertilization. It is formed by the fusion product of polar nuclei, and the second male gamete and is called as primary endosperm nucleus which later gives rise to different types of endosperm tissue. Exceptions are there that is in Orchidaceae, Podostemaceae, Trapaceae, We don't get endosperm tissue. Now we will see the development of the endosperm. Here we have the image of embryo sac wherein there are different parts which are labeled. We can see antipodal cells over here. This is polar, nuclear and central cell. There's a egg apparatus and synergids. It's followed by filiform apparatus.Now these are structures of embryos sec where the male gametes are going to enter and then fertilization is going to take place. Now the development of the endosperm it is occurring through triploid cell. That means that it is a fusion of secondary male gamete. First male gamete is going to fuse with the egg and the secondary male gamete is going to fuse with the polar nuclei and form secondary nucleus. No secondary nucleus is formed by the two polar nuclei to form primary endosperm nucleus. Endospermic cells may be diploid (water lily) or polyploid (up to 15n) form. That is in water Lily and triploid or polyploid it is up to 15. Now these are the exceptions, but usually it is triploid cell. Now, depending upon the endosperm, whether it is present or not, there are different types of seeds that is exalbuminous or non endospermic seeds and albuminous or endospermic seeds. In exalbuminous we have the example of peas, beans and gram, whereas in the second category we had the example of maize, caster bean and coconut. Now the endosperm, the primary endosperm nucleus, which is formed after the triploid cell then, depending upon the primary and the sperm nucleus, how it is dividing, we can categorize the endosperm into three different types. First is nuclear endosperm, second is cellular endosperm and and 3rd is hellobial endosperm. Now in the next coming slides we will see in detail each of these three endosperm types. The first one is nuclear endosperm. This is more common than hellobial and cellular endosperm. Now what happens in nuclear endosperm is here we can see primary endosperm nucleus when it undergoes division. That is, it is going to give rise to different cell neither of any of the division is followed by wall formation. So it is going to result in a condition wherein you will have many nuclei which are freely suspended in the central cell. Here we can see that none of the nuclei they are having cell walls so the major characteristic of nuclear endosperm is in neither of any divisions.They are not followed by wall formation and this condition it may persist. Until it is consumed by the developing embryo, or it may become cellular, becomes cellular means the further divisions may be followed by wall formation. The example of nuclear endosperm is coconut, areca nut and etc. Now these are the images sometimes in nuclear endosperm we see haustorium. Now what is haustoria here we can see that free nucelar haustorium in *Lomatia* plant or haustorium means they are outgrowths of the endosperm, their hair like structures which are formed attached to the endosperm. And the second one is ***Grevillea robusta***. Now we move on to the second endosperm that is cellular endosperm, apart from nucelar

endosperm cellular endosperm, it has got a characteristic that is here there is no free nuclear stage that means that as the primary endosperm nucleus, it goes on dividing each cell after a division, it is followed by wall formation so you can see finally, when the endosperm is formed each cell is having a cell wall on its side. So the presence of haustoria in this particular endosperm is more common. It is largely restricted to dicots, but in monocots you will find it in Araceae family. Now the third one is the **helobial** endosperm. Now it is restricted to monocots only examples. We can see *Eremurus*, *Muscari*, *Echium* Now here in Helobial endosperm what happens is that the primary endosperm nucleus it moves to the chalazal end where it undergoes division and forms a larger micropylar chamber. You can see over here the larger micropylar chamber and a smaller chalazal chamber, after which in the micropylar chamber the divisions which are occurring they are not followed by the wall formation, whereas in the chalazal chamber, the divisions which occur, they are followed by wall formation. So here helobial endosperm it is a combination of both cellular and nuclear. Ruminate endosperm. Now this is not a separate category because there are only three types of endosperm.That is, we have already seen before. Now here ruminate means it is an endosperm which is dissected by the ingrowth of the seed coat, whatever abnormalities, are caused because of the seed coat it gives rise to a different tissue apart from endosperm. That is because of the in growth caused by the seed coat. Now the it is caused by the activity of seed coat due to the infoldings of the seed code, or it may be by endosperm itself. The second type is found in Annonaceae, Aristolochiaceae, Myristicaceae. Now rumination in Myristica is by its own activity that is where the endosperm begin to increase in the volume of seed, it soon absorbs the nucellus and comes in contact with the seed coat. Further, irregular growth of the inner surface of the seed coat makes endosperm, ruminate, ruminate means the ingrowth, which are caused by the seed coat or by the endosperm itself. Now, the functions of the endosperm, the main function of the endosperm, is food reserve. It provides food for the developing embryo as well as food for humans. Now the embryonic growth by supplying nutrients, protecting the embryo, controlling the embryo growth by acting as a mechanical barrier during the seed development and germination, it contains food reserves such as starch, but in some cases they may contain fats too, for example castor. It consists of hormones like cytokinin which help in cell differentiation processes. Coconut water is one of the examples of liquid endosperm which has got very high, importance or more important in human life. These are the references.
Thank you.