निर्माण प्रबंधन (Construction Management) के सिद्धांत

[Nirman prabandhan (Construction Management) ke Siddhant]

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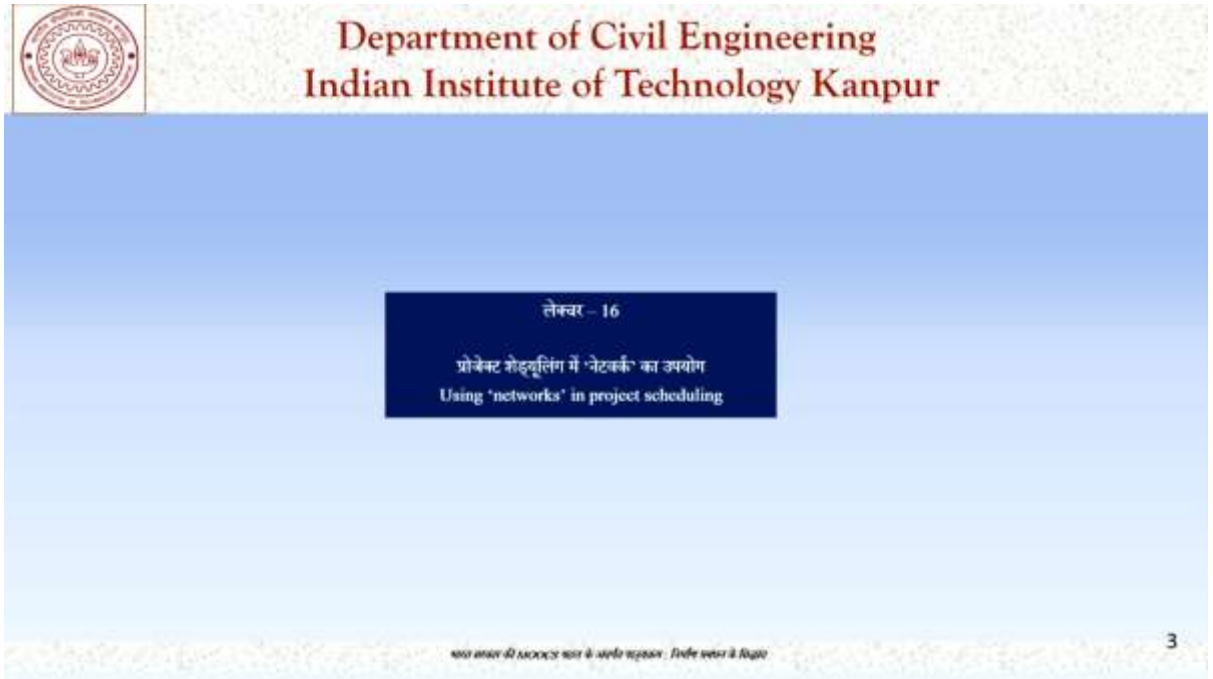
Lecture – 16

Project scheduling mein network ka upayog

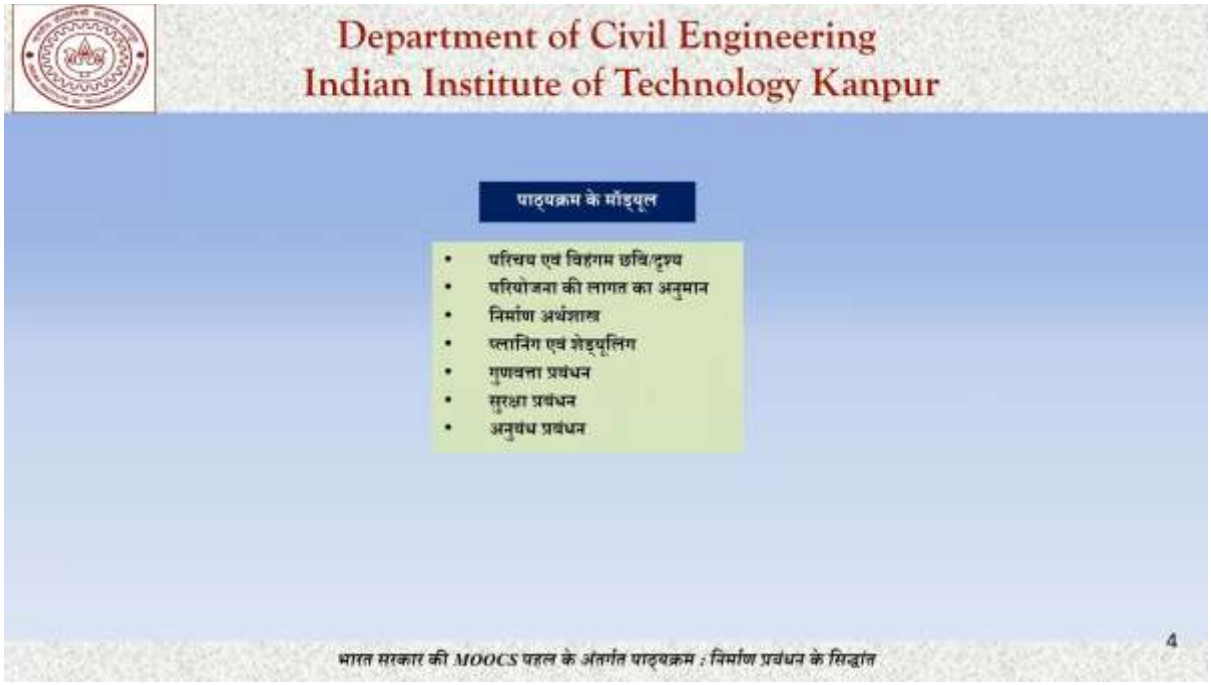
Namaskaar aur ek baar phir se svaagat hai Bhaarat sarakaar kee moocs pahal ke antargat paathyakram nirmaan prabandhan ke siddhaant (Principles of Construction Management) mein.

(Reference Time 00:24)



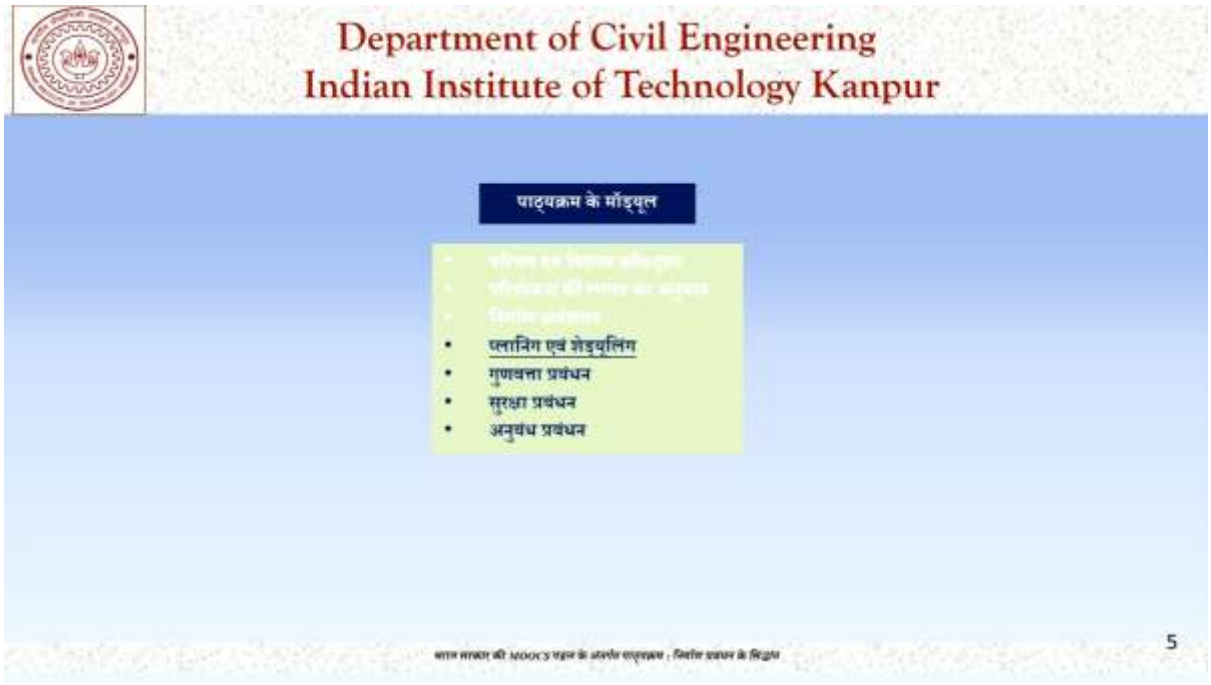
Aaj ham log lecture 16 par hain jisamen ki ham charcha karenge project scheduling mein network ka upayog.

(Reference Time 00:33)



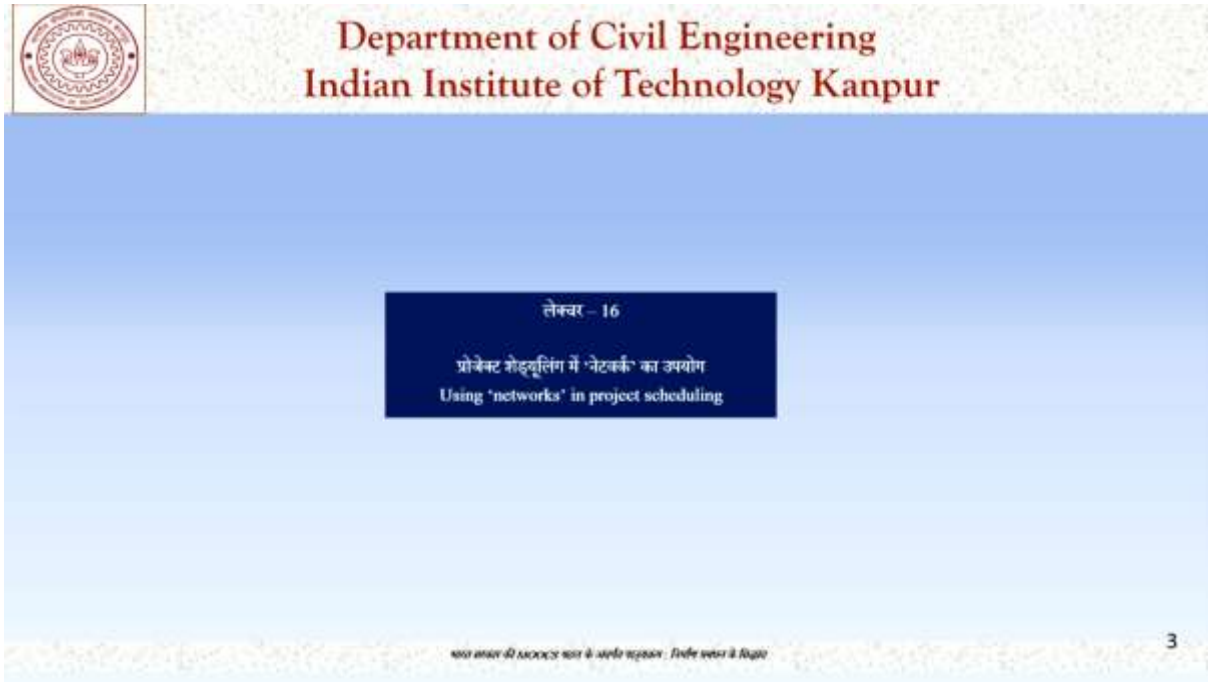
Isake pahale is poore paathyakram ke module ham aapako lagaataar dikhaate aa rahe hain.

(Reference Time 00:38)



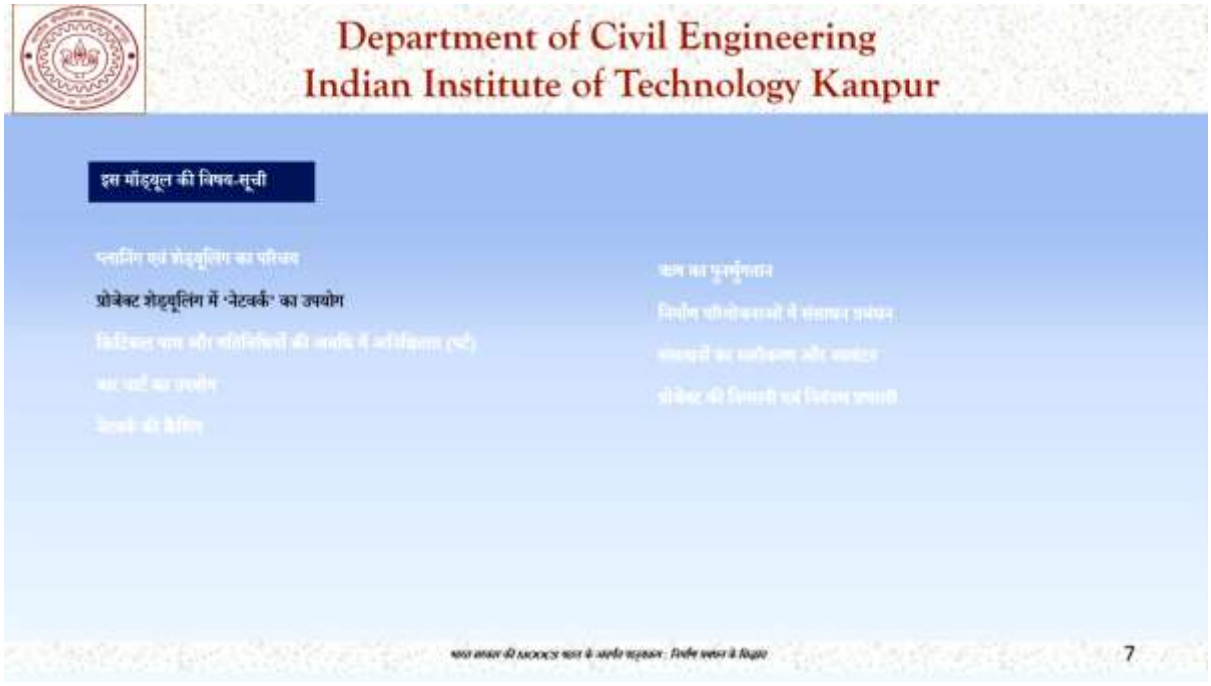
Aur pahale teen modules par charcha ho chukee hai aur pichhalee baar ham logon ne planning evan scheduling is module kee charcha shuroo kee thee.

(Reference Time 00:48)



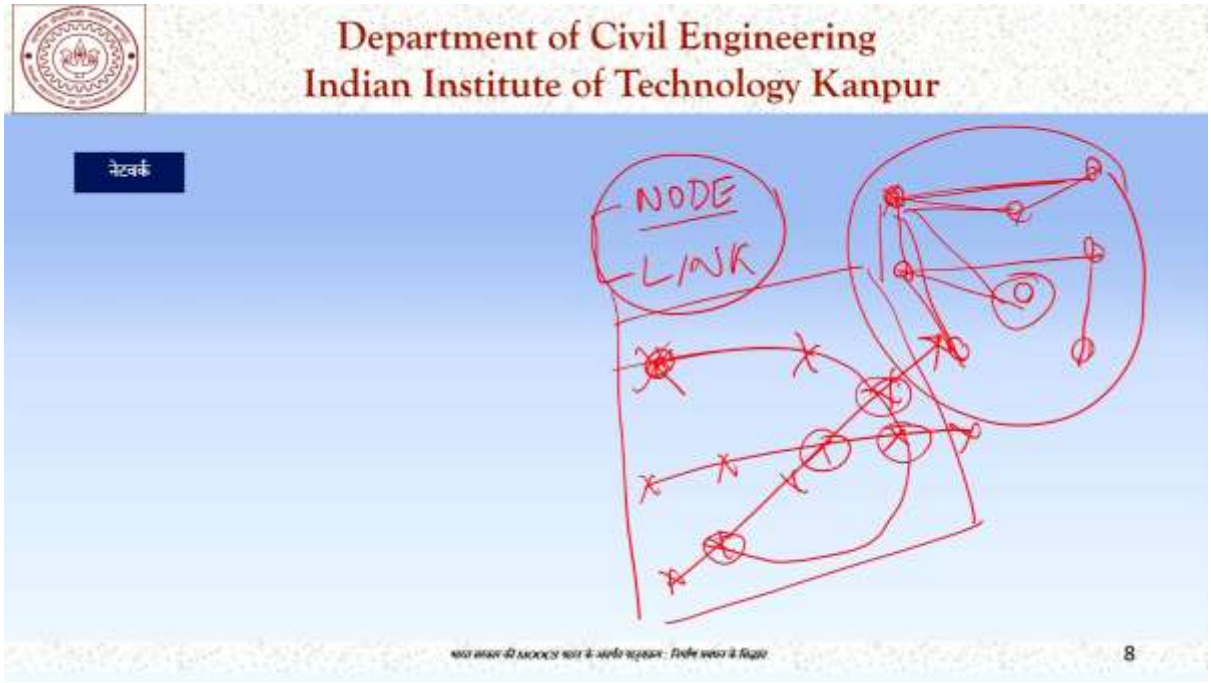
Aur is module kee vishay soochee bhee hamane pichhalee baar dikhaee thee. Planning evan scheduling ka parichay, project scheduling mein network ka upayog, critical path hoga aur gatividhiyon kee avadh mein anishchitata, bar chart ka upayog, network kee crashing ityaadi.

(Reference Time 01:03)



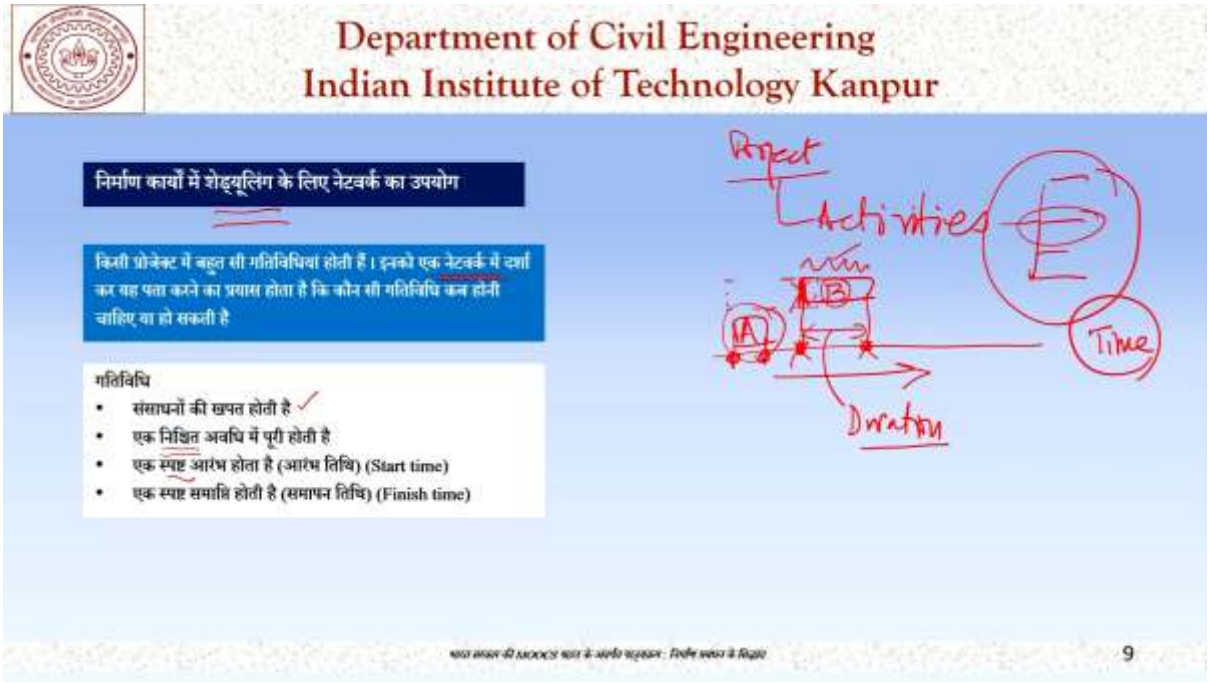
To aaj ham log charcha shuroo karenge project scheduling mein network ka upayog.

(Reference Time 01:09)



To pahalee baat yah aatee hai ki network kya hai? Ham aajakal tarah-tarah ke network kee baat karate hain: social network kee baat karate hain. Antat: usamen baat kya hai? Bahut saare log hain jo ki ek doosare se jude hue hain. Yah vyakti isase juda hua hai, isase juda hua hai; yah vyakti ho sakata hai isase juda hua hai isase juda hua hai aur isase bhee juda hua hai, yah vyakti maatr isase juda hua hai. To agar ham is tareeke se dekhen ki yah ek social network hai jisamen ki ek vyakti kuchh logon se juda hai kuchh logon se nahin juda hai arthaat ek vyakti yah aavashyak nahin ki vah sabhee logon se juda hua ho, to yah to huee social network kee baat. Ham baat karate hain railway network kee railway network ka kya matalab hai? Ki ek railway line yahaan se yahaan jaatee hai isamen kuchh station padate hain, doosaree railway line ho sakata hai yahaan se yahaan jae usamen kuchh station padate hain, ek aur railway line ho sakata hai jo ki aise jae aur usamen kuchh station aaenge jo ki yahaan par common hai. To is chitr ko jahaan par ki kuchh common point hote hain chaahe vah yah ho, chaahe vah yahaan vaale ho inako ham kah sakate hain node aur inako jodane vaalee yah jo lakeeren hain inako ham kah sakate hain link is node aur link se bane hue chitr ko kahate hain network. Ab is network kee paribhaasha ko dekhate hue hamako charcha yah karanee hai ki is baat ko ham nirmaan prabandhan mein construction management mein kis prakaar se upayog mein la sakate hain.

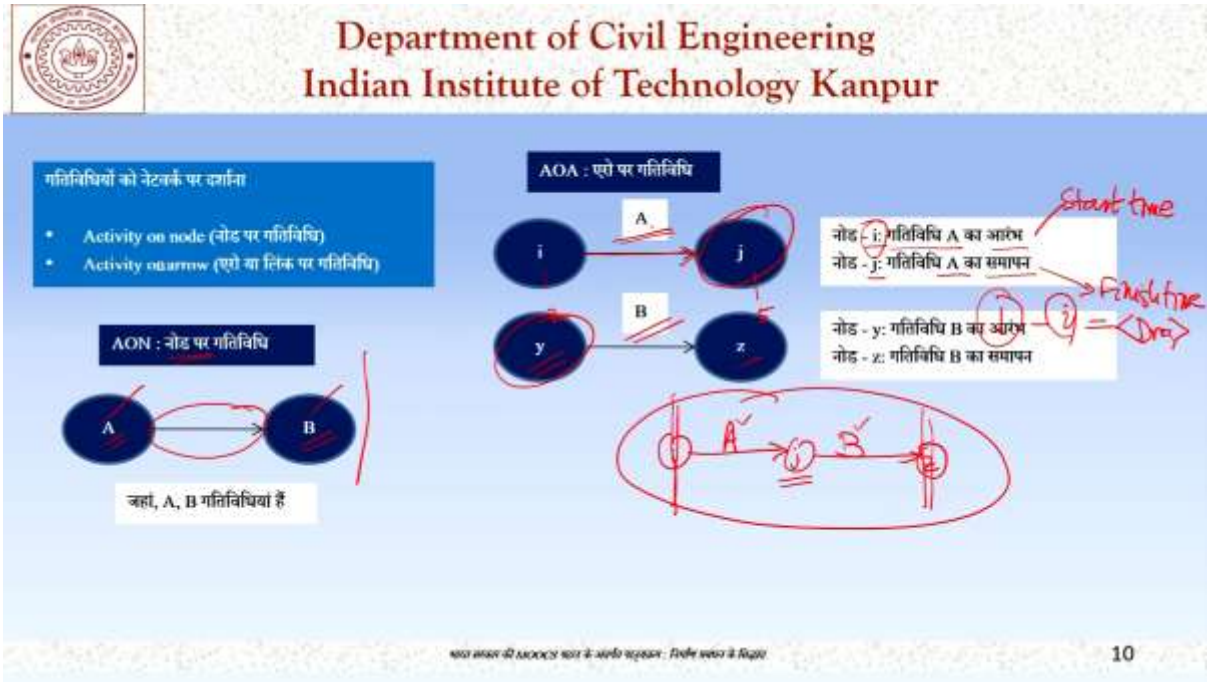
(Reference Time 03:08)



To nirmaan prabandhan mein jab ham baat karate hain scheduling ke lie network ka prayog kaise kiya jae? To hamako dhyaan mein rakhana chaahie ki kisee project mein bahut saaree gatividhiyaan hotee hain. Inako ek network mein darshaa kar yah pata karane ka prayaas hota hai ki kaun see gatividhi kab honee chaahie ya kab ho sakatee hai. To ham karate kya hai ki ham ek project mein tamaam gatividhiyon ko arthaat activities hamane boundary wall ka project dekha tha chhota sa project tha usamen tamaam gatividhiyon thee khudaee thee, PCC thee, concrete thee, foundation thee, columns, brick work tha ityaadi. To tamaam activities thee bahut saaree activities ab un activities ko ham ek network mein kaise darshaate hain? Is network ke maadhyam se phir ham yah pata karate hain ki amukh activity kab honee chaahie ya kab ho sakatee hai kyonki yah donon baaten alag hain. Dhyaan rahe ki ham jab scheduling kee baat karate hain to pratyaksh ya paroksh roop se samay arthaat time hamaare mastishk mein hamesha rahata hai. To samay ke saath kaun see activity kab honee chaahie kab ho sakatee hai arthaat agar hamaaree yah activity A hai yah activity B hai to kya ham yah jo B activity hai yah ham pahale shuroo kar sakate hain aur is prakaar khatm kar den. Kya yah aavashyak hai ki hamen A pahale hee karanee hai, in sab baaton kee charcha karane ke lie ya in baaton par vichaar karane ke lie ham network ka prayog karate hain. Gatividhi kya hotee hai? Gatividhi kee paribhaasha kya hai? Gatividhi mein sabase pahale yah dhyaan mein rakhana chaahie ki sansaadhanon kee khapat hotee hai arthaat activities consume resources. Sansaadhan kya ho sakate hain? Ho sakata hai usamen labor lagate ho, ho sakata hai usamen material lagata ho, machine lagegee to yah sab sansaadhan ek activity mein lagate hain. Saath hee saath vah activity ek nishchit avadhi mein pooree hotee hai. To yah nishchit avadhi kya ek patthar kee lakeer hai, kya ham kah sakate hain kee activity chaar din mein avashy pooree ho jaegee? Aisa bhee nahin hai kyonki pichhalee baar bhee hamane baat kee thee ki agar putaee ka ham udaaharan dete hain to ham yah kah sakate hain ki ek kamare mein ek had se adhik log kaam nahin kar sakate hain. Lekin saath hee saath yah bhee dhyaan mein rakhana chaahie ki gatividhi ke anusaar ek nyoonatam star bhee ho sakata hai sansaadhanon ka jo ki aavashyak hai. Agar 100 kilo ka vajan uthaana hai aur ek vyakti kee uthaane kee kshamata maatr 50 kilo hai, to hamen kam se kam do vyakti chaahie. Vahaan par ek vyakti chaahe jitane din bhee khada rahega vah 100 kilo ka vajan nahin utha sakata. Kahane ka arth kya hai

ki jab ham nishchit avadhi kee baat karate hain to ham yah maanate hain yah maan ke chalate hain ki haan agar ham kahate hain ki yah activity 4 din mein, 6 din mein, 4 haphte mein jis bhee avadhi mein ham sochen usamen pooree hogee to kaheen na kaheen ham yah bhee maanate hain ki usamen ham kitane sansaadhanan aavantit karenge. To agar ham sansaadhan tay kar dete hain to ham yah maan lete hain yah calculate karate hain ki vah avadhi kya hogee jisamen ki vah gatividhi pooree ho sake. Ek spasht aarambh jisako ki ham aarambh tithi kah sakate hain start time har gatividhi ka hota hai. Yahaan par ham yah maan sakate hain ki yah gatividhi jo hamane B maana hai vah samay mein is bindu par shuroo hogee. Saath hee saath is bindu mein samaapt hogee aur yah jo samay hai yah isaka duration ya avadhi hai. To har gatividhi mein sansaadhanon kee khapat hotee hai ek nishchit avadhi hotee hai jo ki ham maan kar chalate hain. Yah kaise nikaalee jaatee hai ya usaka aakalan kaise karate hain is par ham aage charcha karenge. To ek hee avadhi hotee hai aur har gatividhi ka ek bahut hee spasht start time aur end time hota hai. Jahaan jis prakaar hamane yahaan par dikhaaya hai A ka start time ye hai aur A ka finish time ye hai.

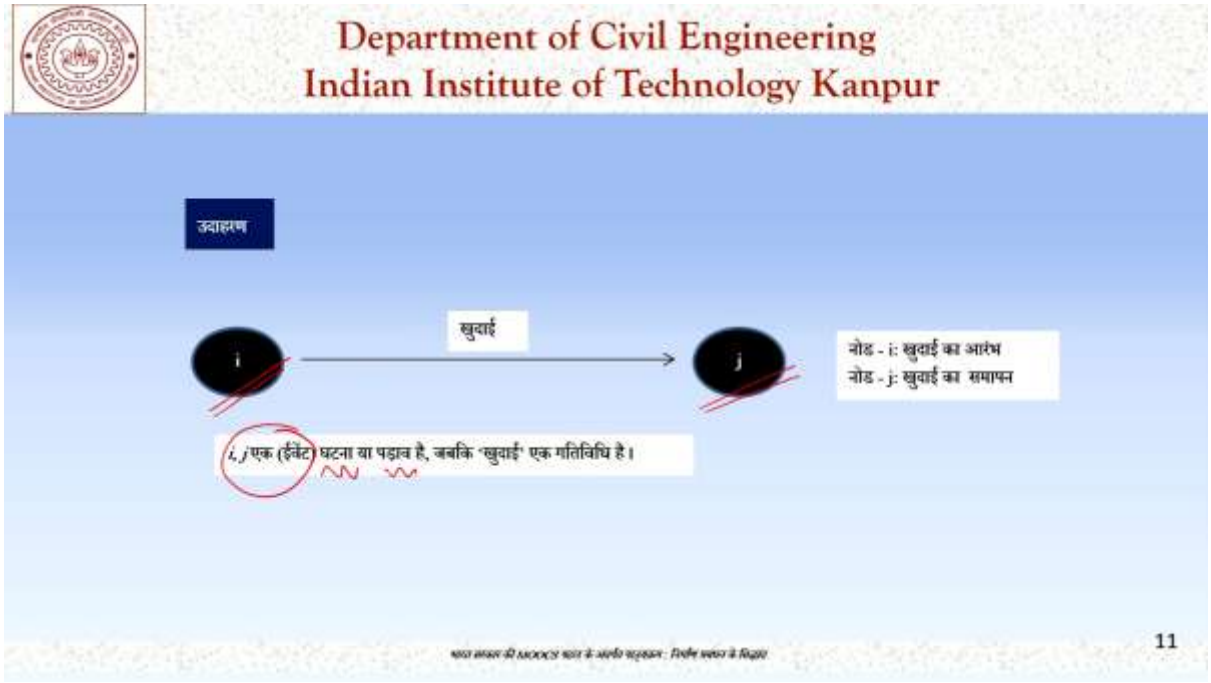
(Reference Time 07:51)



Ab ham baat karate hain gatividhiyon ko network par kis prakaar dikhaaya jaata hai ya dikhaaya ja sakata hai. To ek tareeka hai jisako ki ham kahate hain activity on node arthaat ek gatividhi ko ham node par dikhaenge. Doosara tareeka kya ho sakata hai? Activity on arrow, ham activity ya gatividhi ko arrow ya link par dikhaenge. Isaka udaaharan dekhate hain jab ham do gatividhiyon kee baat karate hain jaise A aur B ek project mein A aur B do gatividhiyaan hain us par agar ham activity A aur B ko node par dikhaate hain. Yahaan hamane dikhaaya hai A is node par hai aur B is node par hai aur inako jodate hue ye link hai lekin hamaaree gatividhi link par nahin hai node par hai. To yah chitran activity on node kahalaata hai. Yah chitran ham ek aur tareeke se kar sakate hain jabaki ham kahenge activity on arrow arthaat arrow par ham gatividhi dikhaenge. Arrow par gatividhi dikhaane ka matalab kya hua? Jo gatividhi A hai vah is link par darshaee gaee hai aur i aur j ye node hain, yah kis baat ke dyotak hain? I jo node hai vah gatividhi A ke aarambh ka dyotak hai arthaat ye isaka start time hai. Usee prakaar j is gatividhi ke samaapan ka dyotak hai jo ki hamane

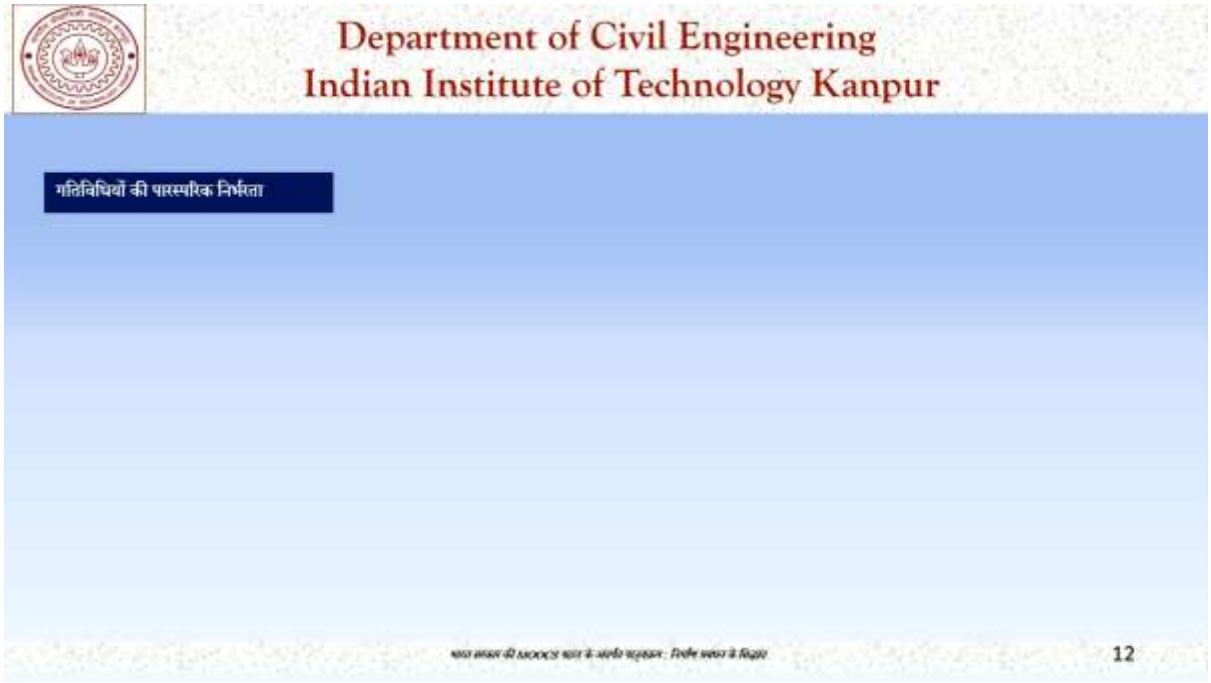
kaha finish time. To agar ham j jo bhee samay hai usamen se i ka jo bhee samay hai usako ham ghata dete hain to duration aa jaega. Agar yah 5 din hai, yah 2 din hai to a gatividhi kee avadhi 3 din huee. To is prakaar se jab ham gatividhi ko arrow par dikhaate hain to node darshaate hain us gatividhi ka start point aur end point. Ab kyonki hamaare project mein do activity theen A aur B to hamen ek aur link banaana padega jahaan par ki ham B ko dikhaenge aur yahaan par node honge y aur z. To y gatividhi B ka aarambh hai aur z B gatividhi ka samaapan ya ant. Ab baat aatee hai ki ham A aur B jab do activities khatm hogee tab project khatm hoga, to ab kya ham is prakaar se isako dikha sakate hain ki ham i se shuroo karen A gatividhi karen; j par pahunche aur yahaan se hee ham B shuroo kar den aur z par chale jaen. Arthaat hamane node j aur node y ko merged kar diya hai aur ek hee node dikhaaya hai tab hamaaree baat banatee. To is chitr ke maadhyam se ham kahate hain ki yah project activity on arrow hai, ij activity A hai, jz activity B hai aur project hamaara shuroo hoga i par aur ant hoga z par. Isake kuchh aur pahaloo bhee hain jis par ki ham abhee aage vichaar karenge.

(Reference Time 11:12)



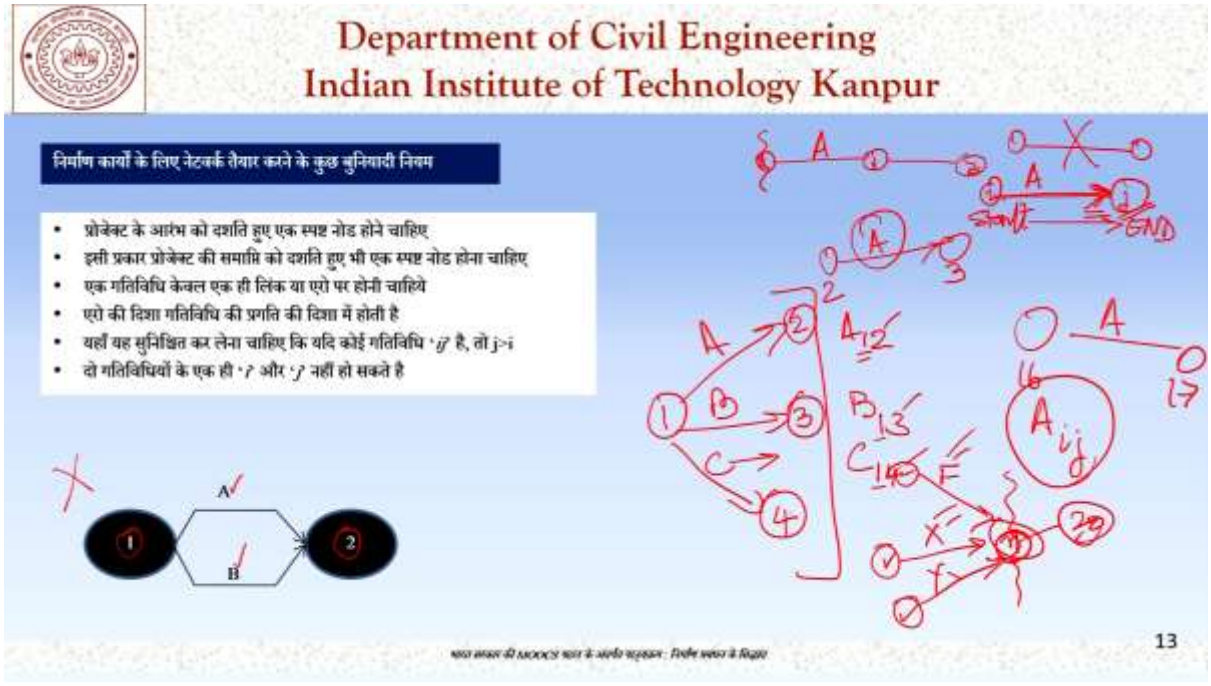
Ab ham ek udaaharan lete hain ki khudaee. Boundary wall kee baat thee khudaee kee baat hai jisamen ki ham neev kee khudaee kar rahe hain. Yah hamane liya node i aur node j ke beech mein, to node i hua khudaee ka aarambh; node j hua khudaee ka samaapan aur i aur j ek event hai ek ghatana hai jabaki khudaee ek gatividhi hai. In nodes ko ham kahate hain event arthaat ek ghatana ya padaav. Yah maatr gatividhi shuroo hone kee ghatana hai arthaat ghatana mein yah i aur j jo ghatanaen hain isamen sansaadhanon kee khapat nahin hotee hai. To nodes doo not consume resources, vah maatr is baat ka dyotak hain ki ek activity shuroo ho gaee usamen sansaadhan nahin lage activity mein saadhan lagate hain yah baat hamesha dhyaan mein rakhanee chaahie. Ek exception isamen banata hai vah hai dummy activity ka jisako ki abhee ham aage dekhenge.

(Reference Time 12:24)



Aage badhane se pahale ham log baat karen gatividhiyon kee paarasparik nirbharata. Kya hamaare project mein jitanee gatividhiyaan hain vah sab ek saath shuroo kee ja sakatee hai ya ek gatividhi khatm hone ke baad hee ya samaapt hone ke baad hee doosaree gatividhi ho sakatee hai yah hamen hamesha pata hona chaahie. Jaise khudaee hai, khudaee ke pahale sivaay isake ki hamako vah jameen saaph karanee hai ityaadi aur koee shaayad gatividhi karane kee aavashyakata nahin hai lekin brickwork ya chunaee karane se pahale hamaaree khudaee samaapt ho jaanee chaahie, hamaaree neev ka kaam samaapt ho jaana chaahie tabhee ham chunaee kar sakate hain. To isako ham kahenge nirbharata, kaun see gatividhi kis par nirbhar hai. Agar ham kisee classroom mein furniture daalana chaahate hain to pahale class room to ho. Agar ham building bana rahe hain school kee building bana rahe hain aur furniture daalana hai, to jab tak building nahin ban jaatee, jab tak usakee flooring nahin ho jaatee tab tak ham usamen furniture nahin daal sakate . Haan yah jaroor hai flooring ho jaane tak furniture ka ordar de sakate hain yah sunishchit kar sakate hain ki jaise hee hamaaree flooring aadi khatm ho hamaare paas furniture upalabdh ho aur ham usako turant daal sake. Is baat par vishesh dhyaan rakhana chaahie ki hamaaree gatividhiyon mein paarasparik nirbharata kya hai.

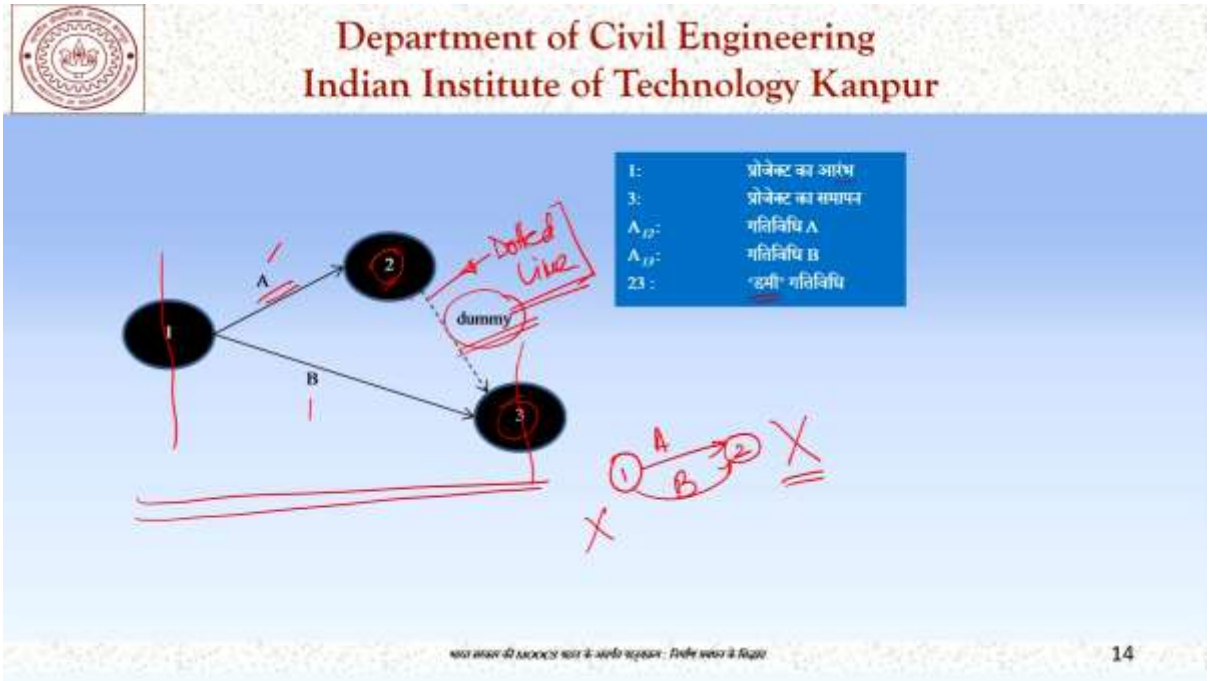
(Reference Time 13:54)



Nirmaan kaary ke lie jo ham network taiyaar karate hain to kuchh buniyaadee niyamon ka paalan karana chaahie. Kya hain vo niyam? Project ke aarambh ko darshaate hue ek spasht node hona chaahie. Pichhalee baar aapako dhyaan hoga hamane jab i, j aur z kee baat kee thee to yah project ka aarambh bhee tha, activity bhee aarambh tha activity A ka aarambh tha aur project ka aarambh tha. Lekin koee jarooree nahin hai ki project ke aarambh mein ek hee gatividhi shuroo ho, tamaam gatividhiyaan jo ki shuroo kee ja sakatee hain ho sakata hai ek saath shuroo ho. To kabhee-kabhee aavashyak hota hai ki ham gatividhiyon ke aarambh se hatakar project ke aarambh ka ek node rakhen. Isee prakaar project kee samaapti ko darshaate hue bhee ek spasht node hona chaahie. Ek gatividhi keval ek hee link ya arrow par honee chaahie. Yah nahin hona chaahie ki is node ke beech mein hamane gatividhi ko kaha A aur ye tha maan leejiye node 2, 3 aur yahee gatividhi kisee aur jagah par un network mein 16, 17 ke roop mein prakat ho jaaye, yah nahee hona chaahiye. Ek gatividhi keval ek hee link ya arrow par honee chaahie. Arrow kee disha gatividhi kee pragati kee disha mein hotee hai. Aapane dhyaan diya hoga ki do nodes ko jodate samay main maatr ek line ka prayog nahin kar raha hoon main ek arrow ka prayog kar raha hoon. Arthaat yah darshaata hai ki yah hamaara staart hai aur arrow ka discussion isakee yah jo disha hai vah staart se chalakar end kee or jaatee hai aur is baat ko dhyaan mein rakhate hue yah sunishchit karana chaahie ki yadi gatividhi i j hai to j i se adhik hai arthaat agar hamaara yah node i j yah hai yah gatividhi A hai jisako ki ham dikhaenge Aij ke roop mein to j i se adhik hona chaahie isaka ham ek udaaharan dikhaenge aapako tab yah baat aur bhee spasht ho jaegee. Do gatividhiyon ko ek hee i aur j asain nahin kiya ja sakata arthaat do gatividhiyon ke ek hee i aur j nahin ho sakate hain. Ek hee i ho sakate hain ek hee j ho sakata hai lekin donon ek sang do gatividhiyon ke nahin ho sakate. Jaise ki yahaan dikhaaya gaya hai yah representation sahee nahin hai. Ham A aur B in do gatividhiyon ko 1, 2 mein nahin darsha sakate. Yah jaroor ho sakata hai ki is node chaahe vah 1 ho, 2 ho jo bhee ho yahaan se tamaam gatividhiyaan shuroo hongee yah A ho sakatee hai yah B ho sakatee hai yah C ho sakatee hai yah sambhav hai lekin inaka jo ant hai gatividhiyon ka gatividhiyon ka samaapan A par samaapt hogee 2 par, B samaapt hogee 3 par, C samaapt hogee 4 par. To ham C ko dikhaenge see 1, 4 B ko dikhaenge 1, 3 aur A ko dikhaenge 1, 2. Hamako yah dhyaan mein rakhana chaahie ki yah 2, 3, 4 yah hamaare i

arthaat yahaan par ye 1 hai usase adhik hon. Yah ek maatr mathematical requirement hai kyonki hamen calculation karane mein aasaan kar deta hai. Saath hee saath yah bhee sambhav hai ki ek node par tamaam gatividhiyaan samaapt ho rahee ho. Agar maan leejie yah project ka ant hai, project in activities f, x, y se samaapt hota hai koee bhee node yahaan ho, f ka aarambh kaheen se bhee ho raha ho ho sakata hai yah node en par f, x aur y teenon samaapt hogee. Tab baat ye aatee hai ki ham kab maanenge ki ham end par pahunch gae hain. Ho sakata hai isako samaapt karane mein kuchh samay lage, isako samaapt karake yahaan pahunchane mein kuchh samay lage, y ko yahaan pahunchane mein kuchh samay lage tab inako kya value asain kee jaegee inamen samay kee kya value asain kee jaegee? Node kee value to ham de denge 20 de denge, 25 de denge jo bhee node kee sankhya aaegee ham de denge lekin us ghatana ke ghatit hone ke lie kya aavashyak hai is par ham abhee charcha karenge shaayad agale lecture mein.

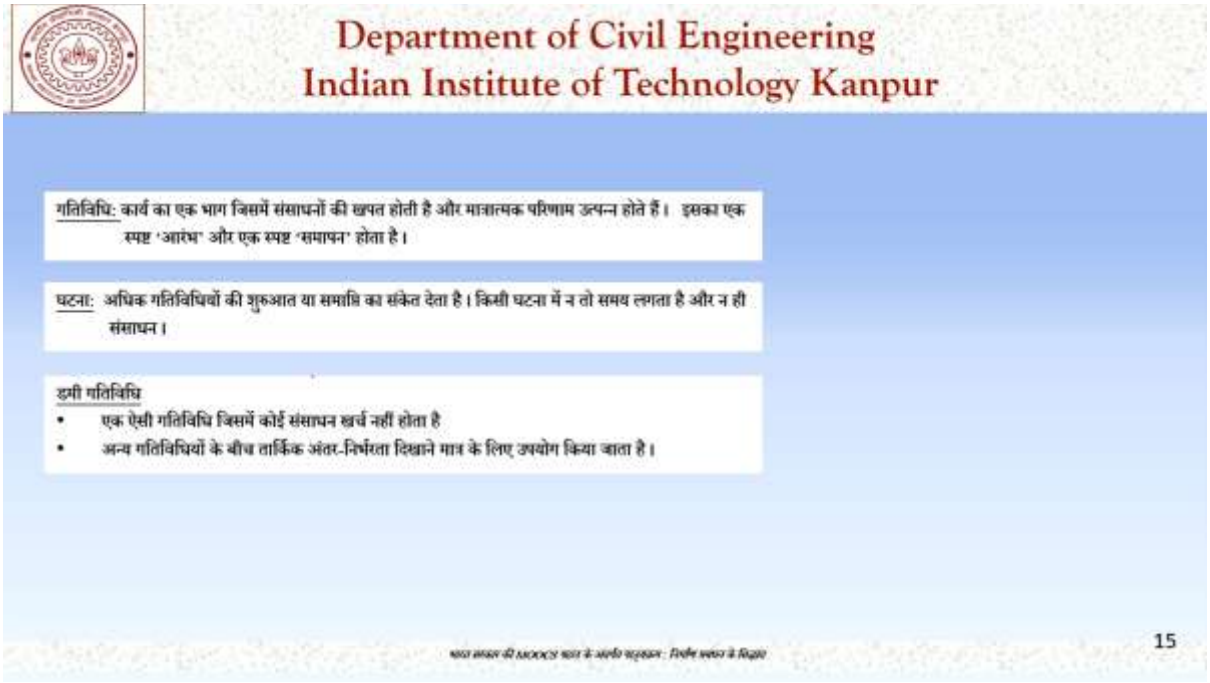
(Reference Time 18:56)



Ab baat aatee hai A aur B ke representation kee. Pichhalee slide mein hamane dekha ki ham do activities A aur B ko ek hee node 1 aur 2 mein dikhaaya gaya tha A aur B is prakaar represent nahin kar sakate hain. To hamen kya karana chaahie? Ham A ko 1, 2 ke roop mein yahaan par dikha den. 1 hamaara project ka aarambh hai; yahaan se 3 hamaare project ka samaapan hai. A 1, 2 hamaaree gatividhi A hai. B 1, 3 yah hamaaree gatividhi B hai aur 2, 3 yah ek dummy gatividhi hai. Is prakaar se A aur B donon gatividhiyon ke samaapt hone par hamaara project samaapt ho jaega. Yah representation galat tha isako hamane is roop mein reprecent kiya. Hamane B ka ant ya hamane B ka samaapan 2 se nikaalakar 3 mein kar diya aur 2 aur 3 ko ek dummy gatividhi se jod diya jisako ki hamane full line na dekar ek dotted line se darshaaya. Is dummy gatividhi mein koee bhee sansaadhan nahin lagenge kyonki sansaadhan maatr A aur B mein lagenge iseelie isako dotted lines se dikhaaya gaya hai isakee aavashyakata hamako kyon padee? Kyonki ham node 2 ko vibhaajit karake node 2 aur 3 mein karana chaahate the. To jo hamane node 2 ko maatr toda tab unake beech mein ek kaalpanik link established kar diya ya jod diya. To ek logical prakriya dikhaane ke lie is dummy gatividhi ka prayog kiya hai. Dummy gatividhi mein any gatividhiyon se hatakar kisee bhee

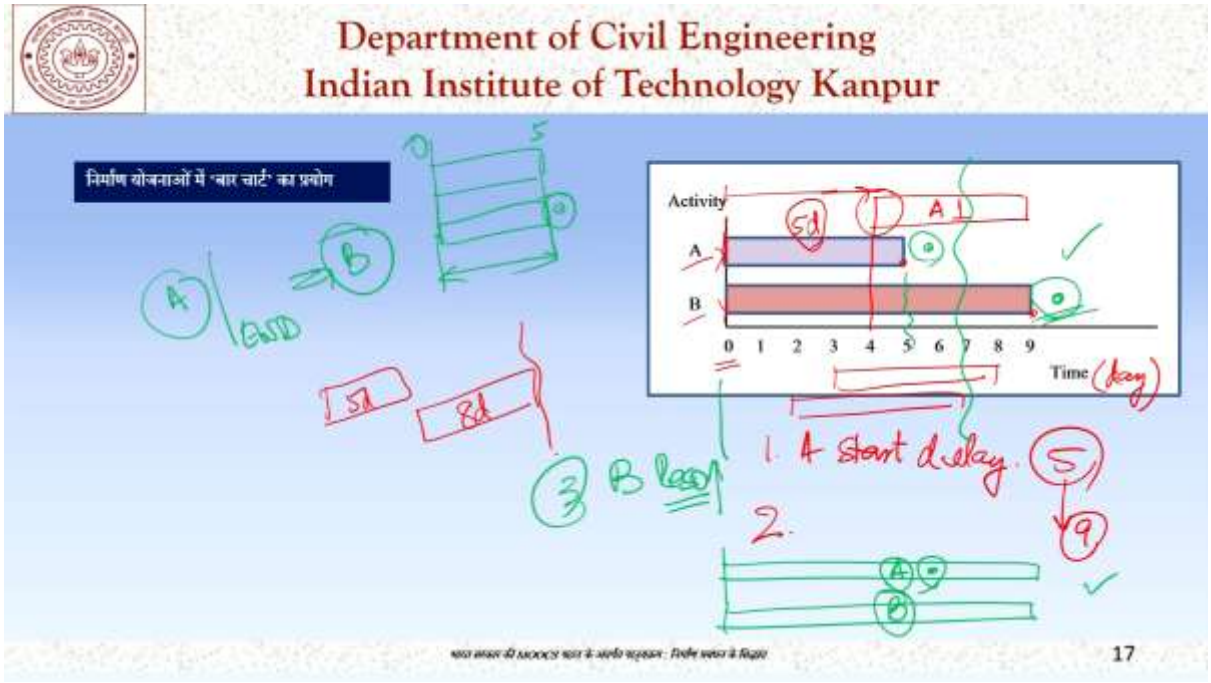
sansaadhan kee khapat nahin hotee hai. Ham log phir se gatividhi ghatana aur dummy gatividhi par vichaar karate hain.

(Reference Time 21:18)



Gatividhi kaary ka ek bhaag jisamen sansaadhanon kee khapat hotee hai aur maatraatmak parinaam utpann hote hain arthaat an activity should lead to quantitative results, koee na koee kaam khatm hona chaahie, samaapt hona chaahie vahaan par kuchh na kuchh complete hona chaahie usako ham kahate hain gatividhi. Isaka ek spasht aarambh aur ek spasht samaapan hota hai. Ghatana gatividhiyon kee shuruaat ya samaapti ka sanket dete hain. Har node ek ghatana hai, kisee bhee ghatana ya node mein na to samay lagata hai aur na hee any sansaadha. Aur jahaan tak dummy gatividhi ka savaal hai ek aisee gatividhi jisamen koee sansaadhan kharch nahin hota usamen koee khapat nahin hotee sansaadhan kee any gatividhiyon ke beech taarkik antar nirbharata dikhane maatr ke lie inaka upayog kiya jaata hai. To they are used only to show logical interdependence.

(Reference Time 22:14)



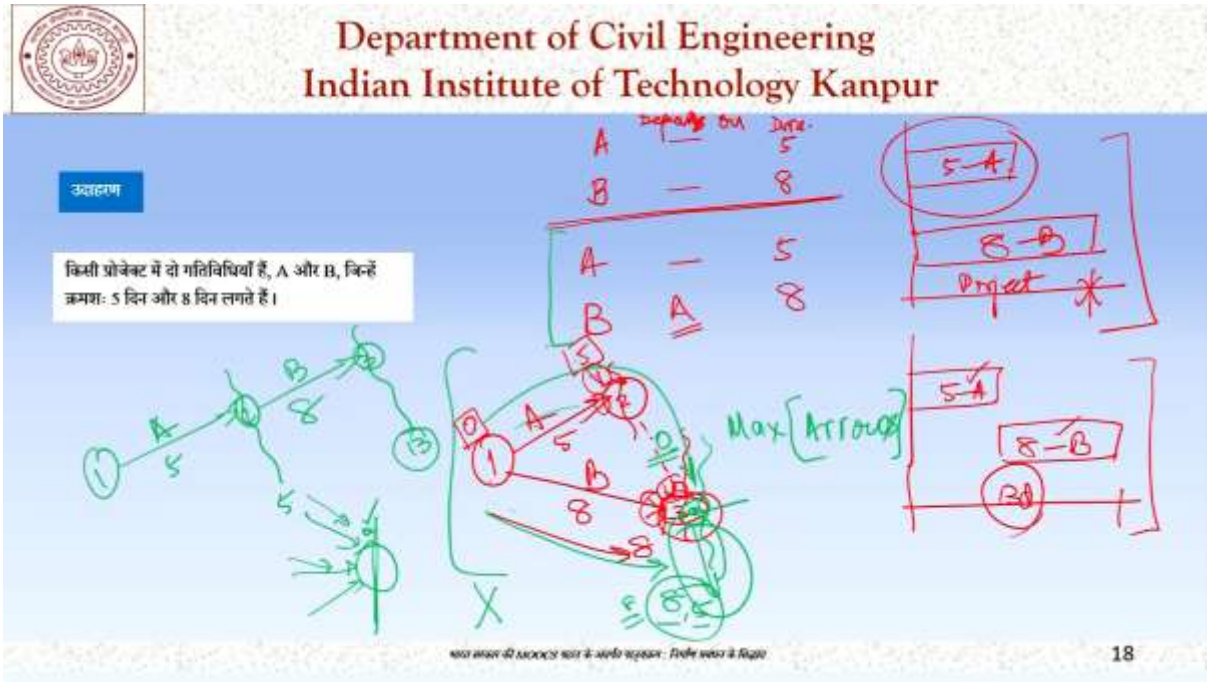
Aage badhate hain aur ham vichaar karate hain nirmaan yojanaon mein bar chart ka prayog. Bar chart par aage bhee charcha karenge lekin usaka introduction ya ek motee samajh abhee bhee develop karate hain. Yah chitr hai phir vahee activity A yah chitr hai ham activity A aur B kee baat kar rahe hain. Activity A aur B donon hee ek saath shuroo huee aur agar yah samay dinon mein diya gaya hai, to activity B 9 din mein khatm ho jaegee, activity A shaayad 5 din mein khatm ho jaegee aur yah donon shuroo ek saath ho rahee hai. Ab prashn yah hai ki hamaara project kab khatm hoga? Hamaara project agar usamen do hee gatividhiyaan hai A aur B to 9 par hee khatm hoga. Kyonki jab donon gatividhiyaan khatm hogee tabhee to project khatm hoga. Ab baat uthatee hai ki kya yah aavashyak hai ki gatividhi A zero par hee shuroo kar dee jae? Jabaki hamako pata hai ki isamen maatr 5 din lagane hain to hamaare paas kya vikalp hai? Pahala vikalp hai ki ham A ka start delay kar den. Hamako pata hai ki yah 5 din kee activity hai to agar ham isako 4 par bhee shuroo karenge to bhee ham isako 9 par samaapt kar lenge yah hamaara hai pahala vikalp arthaat A ko hamane delay kar diya usaka start delay kar diya. Yah jarooree nahin ki ham 4 se hee shuroo karen ham usako 3 se shuroo kar sakate hain to ho sakata hai 8 pe khatam kar den, ham 2 se shuroo kar sakate hain 7 pe khatm kar denge ityaadi, ham kuchh bhee kar sakate hain. Doosara vikalp ye ho sakata hai ki kya ham A mein jo sansaadhan hamane lagae the vah kam kar den aur jo 5 din mein activity ho rahee thee usako ham poore 9 din tak le jaen. Agar ham usako poore 9 din tak le jaate hain tab ham kar sakate hain ki theek hai to ham kah sakate hain ki A aur B dono saath mein shuroo hongee aur A mein bhee 9 din lagenge aur B mein bhee 9 din lagenge.

To is chitr mein aur is chitr mein phark kya hua? Ki A aur B dono hee 9 din lagenge lekin hamane is chitr ke comparison mein is chitr mein A mein lagae hue sansaadhan kam kar diye hain. Hamaare paas teesara vikalp kya hai? Ham is baat par vichaar karen ki kya ham B mein sansaadhanon ko jo hamaare resources hain unako badha den aur kisee prakaar se 5 dinon mein hee samaapt karane kee koshish karen, tab kya hoga? Ki donon activities A aur B ek sang shuroo hongee aur 5 par hee samaapt ho jaengee. To hamaare project completion kee avadhi 5 din ho jaegee lekin hamako karana kya pada? Jo sansaadhan hamane yahaan par

aavantit kie the unake comparison mein yahaan par hamako sansaadhan badhaane pade. Ham isaka combination bhee kar sakate hain ki A mein sansaadhan kam karen B mein sansaadhan badhaen aur is poore project ko 7 din mein samaapt karate hain. In sab baaton kee analysis (vishleshan) hee nirmaan ka prabandhan hai usaka management ki kis gatividhi mein kitane sansaadhan lagae jaen aur kab usako kiya jae.

Yah to baat thee yadi hamaaree activities A aur B jo gatividhiyaan hain A aur B donon ek saath shuroo ho sakate hain lekin agar A aur B mein paarasparik nirbharata ka sambandh hai arthaat yahaan tak charcha thee jabaki A aur B independent hai, vo ek doosare par nirbhar nahin hai. Ab agar yah baat aatee hai ki A aur B ek doosare par nirbhar hai ya ye kahen ki B A par nirbhar hai arthaat A ke samaapt hone ke baad hee ham B shuroo kar sakate hain, tab kya hoga? Ki pahale A hogee aur usake baad hee B kar sakate hain arthaat hamaare project kee duration ya usakee avadhi 5 din ye aur 8 din ye ho jaegee to hamaara project 13 din ka ho jaega.

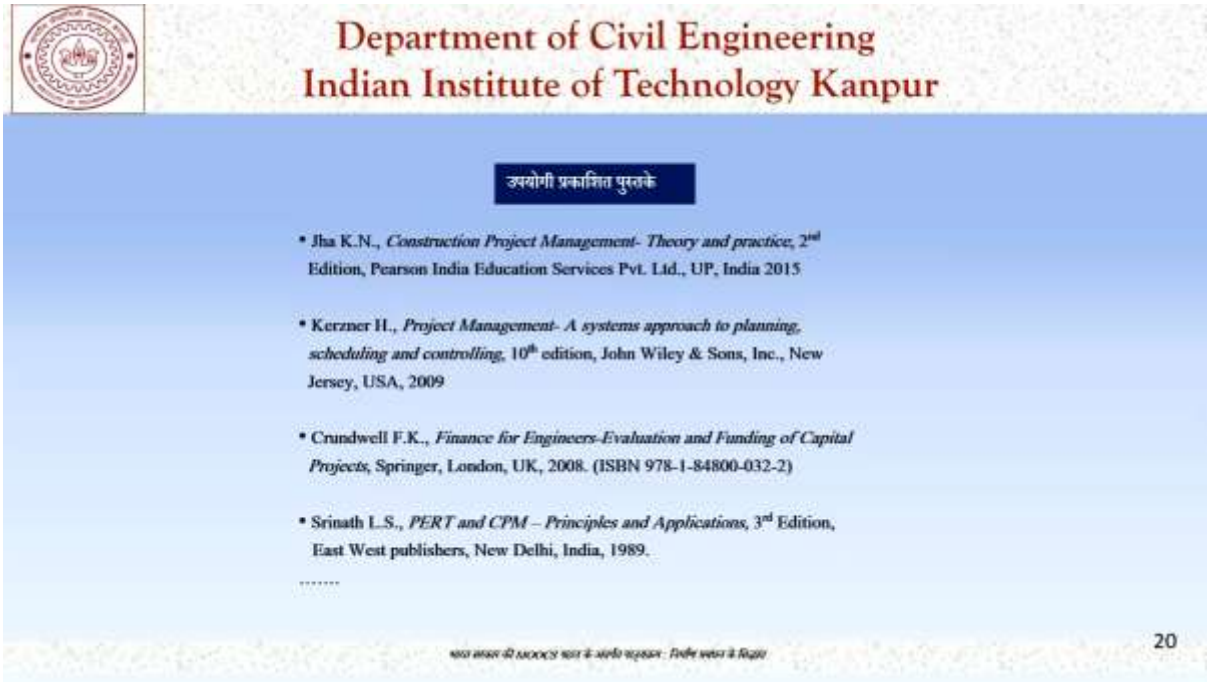
(Reference Time 27:03)



Ham ek udaaharan lete hain ki kisee project mein do gatividhiyaan A aur B jinhen kramashah 5 din aur 8 din lagate hain. Kuchh sansaadhanon ka aavantan hamane apane dimaag mein rakha ki us aavantan ke anusaar A mein 5 din aur B mein 8 din lagenge. To hamen taalika banaate hain ki A aur B aur yah likhate hain depends on arthaat A kisee par nirbhar hai kya? Ham agar kahate hain ki A kisee par nirbhar nahin hai B bhee kisee par nirbhar nahin hai arthaat A aur B donon ek saath shuroo kee ja sakatee hain. To baat aa jaegee jo pichhalee bar chart mein dikhaaya gaya tha arthaat isaka duration hamane likh liya 5 din ye hai aur 8 din yahaan par hai. To bar chart mein agar ham dekhenge to A is prakaar se hai 5 aur bhee hai 8 yah hamaara A hai aur yah hai B to hamaare project kee duration ho gaee 8 din. Kyonki 8 dinon ke baad hamaare donon activity samaapt ho jaenge. A kab shuroo karana hai, kab shuroo nahin karana hai is par hamaare paas ek option hai hamaare paas ek vikalp hai ek thodee bahut gunjaish hai ki ham A ko 3 din idhar-udhar kar sakate hain agar isamen thoda sa delay bhee ho raha hai to koee baat nahin. Hamen project monitoring kee drshtikon se kis

activity par adhik dhyaan dena chaahie, kya hamen A par dhyaan dena chaahie ya B par dhyaan dena chaahie? Spasht hai ki kyonki hamaare project kee avadhi B se gavarn ho rahee hai/B se control ho rahee hai isalie B par dhyaan dena bahut aavashyak hai. A par dhyaan shaayad kam diya ja sakata hai kyonki hamaare paas 3 din ka ek buffer hai, usako ham slag kahate hain aur usako apane calculation mein kis prakaar se lekar aate hain vah ham agale lecture mein dekhenge. Lekin agar yah sthiti na hotee aur yah hota ki haan A to kisee par nirbhar nahin hai lekin B A par nirbhar hai, tab yah 5 aur 8 kee kya sthiti banatee? Tab hota ki A 5 mein samaapt hogee aur B yahaan se shuroo hogee jab yah samaapt ho jaega kyonki B A par nirbhar hai. To agar ab yahaan par B shuroo hogee to hamaare project kee avadhi 13 din maanee jaegee ya 13 din hogee hee. Yahaan par agar criticality kee baat karen ki kin gatividhiyon ko hamen dhyaan dena hoga to A aur B donon hee critical hain ham kisee bhee gatividhi mein chook nahin sakate hain kyonki agar hamen project 13 din mein samaapt karana hai to hamen A bhee 5 din mein karanee hogee; B 8 din mein karanee hogee. Is sthiti mein hamaare paas A ko lekar ke thodee see gunjaish thee, yahaan par vah gunjaish hamaare paas nahin hai. Ab ham isako network mein kaise dikhaate hain? Hamane pahale dekha tha ki A is prakaar se aur B is prakaar se; to 1, 2, 3 to 1-2, 1-3 aur ye ho gaee dummy activity. Yah hamaara 5 din hai yah hamaara 8 din hai. To ham yah agar calculate karana chaahen ki ham node 2 par kis samay pahunchenge to node 2 par pahunchane vaale arthaat yahaan ke jo destineshan airoj hain vah ek hee hai, yahaan agar zero se shuroo karate hain to zero aur 5 jodakar ke 5 din mein pahunch jaenge. Yahaan par ham zero se 8 din mein to is route se pahunchenge lekin yahaan pahunchane ke lie destination arrows do hai ham is node 3 par pahunchane ke lie hamen yahaan se bhee pahunchana hai aur hamen yahaan se bhee pahunchana hai to yah hamaare do route hain 3 par pahunchane ke lie. To ham 3 par pahunch gae hain yah baat ya yah ghatana kab hogee? Yah tab hogee tab donon hee route se vahaan pahuncha ja sake arthaat maximum of arrows. To jo bhee yahaan se hamen 8 din lagenge, yahaan se hamen kitane din lagenge kyonki yahaan par to samay lagana nahin hai? To yahaan se pahunchane ke lie hamen 5 din lagenge in donon mein adhik kya hai 8 to arthaat is node par ham 8 par pahunchenge arthaat 8 din mein pahunchenge. Is baat kee charcha ham agale class mein ek aur udaaharan ke saath phir se karenge. Haan, jab nirbharata kee baat hogee tab yah chitr banega hee nahin kyonki isamen A aur B ko independent maana gaya hai. Jab nirbharata hogee tab ham kahenge A 5 din 1 se 2 aur B 8 din 2 se 3. To ab ham is node par pahunchenge 5 ko aur is node par pahunchenge 5 se shuroo karenge 8 jod denge to ham yahaan par pahunchenge 13 par. To yahaan par ganit aasaan ho jaatee hai. Jab tamaam nodes ek jagah milate hain aa kar ke tab ganit thodee mushkil ho jaatee hai hamen dekhana hota hai ki har route se yahaan pahunchane ka samay kya hai aur un sabhee samay mein se jo adhikatam hoga vah samay maana jaega yahaan par pahunchane ka.

(Reference Time 33:20)



To aaj kee charcha ham yaheen par samaapt karate hain aur ham aapako hamesha kee tarah kuchh upayogee pustaken dikhaana chaahate hain jo ki is module mein aur is paathyakram mein aapake lie upayogee siddh ho sakatee hain. Dhanyavaad! Jay hind! Namaskaar.