निर्माण प्रबंधन (Construction Management) के सिद्धांत

[Nirman prabandhan (Construction Management) ke Siddhant]

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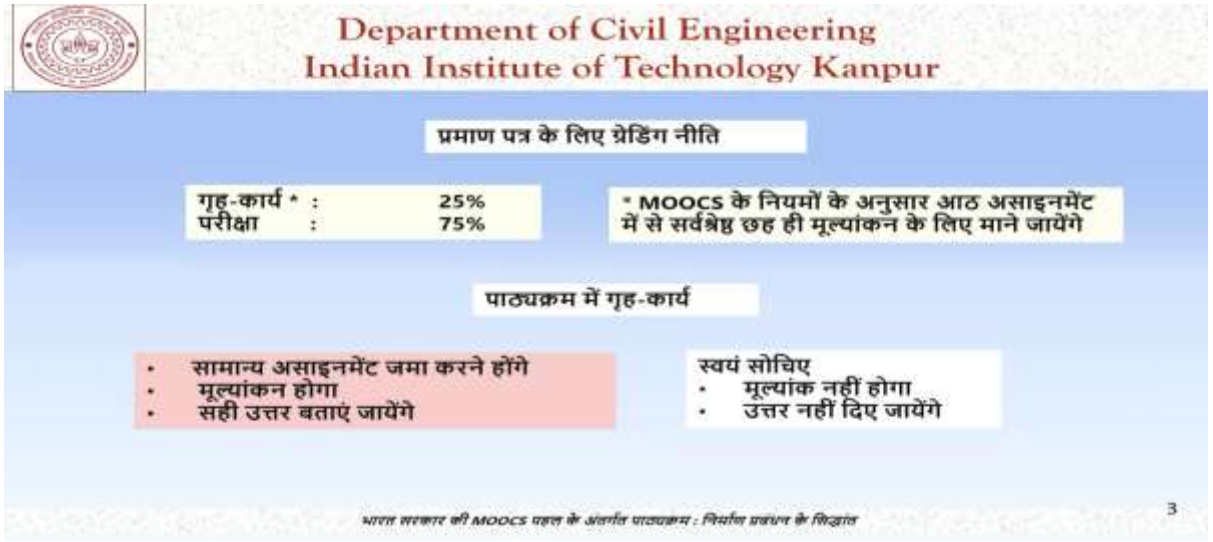
Lecture – 1

Paathyakram ka parichay

Namaskaar! Jay hind! Bhaarat sarakaar ki mooks pahal ke antargat, is paathyakram jisaka naam hai nirmaan prabandhan ke siddhaant mein aapaka svaagat hai. Yah pahala lecture hai. Mera naam Sudhir Mishra aur main civil engineering vibhaag IIT Kanpur mein kaaryarat hoon. Yah lecture kuchh varsh pahale banae gae Principles of Construction Management par aadhaarit hai aur bahut saree slaids aur content vahaan se liya gaya hai. Kuchh udaaharan, kuchh eksapleneshan jode jaenge.

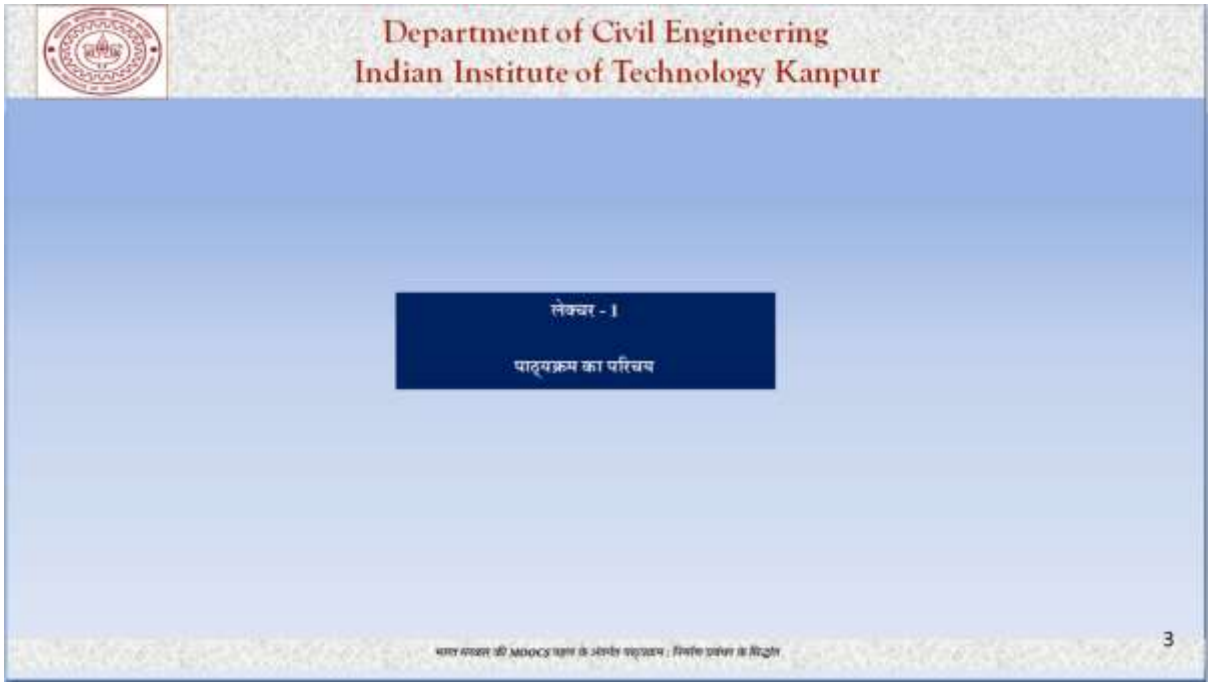
(Reference Time 00:54)



Aaiye aage badhate hain aur aapako bataate hain ki is course mein pramaanpatr paane ke lie grading ki neeti kya hogee? Grh kaary die jaenge. 8 grah kaary honge joki online honge, aapako submit karane honge. Unaka moolyaankan hoga sahee uttar aapako batae jaenge.

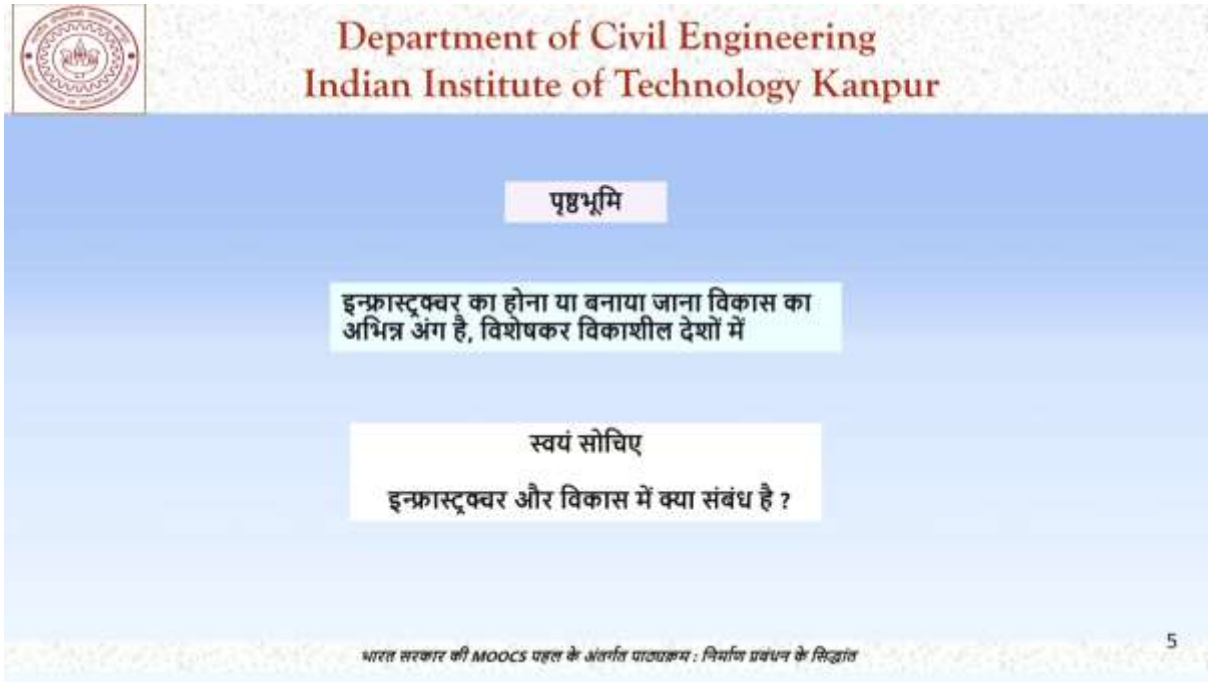
Agar koi vivaad hota hai aapako lagata hai ki aapka answer sahi hai to us par charcha ho sakatee hai. Agar usamen hamaaree taraph se koi truti huee hai to ham usako theek karenge. Pareeksha hogee is course ke ant mein usamen 75% weightage pareeksha ka hoga, 25% grh kaary ka hoga aur grh kaaryon mein moocs ke niyamon ke anusaar 8 assignment mein se sarvashreshth 6 hee moolyaankan ke lie lie jaenge. Paathyakram mein jo grhakaary honge vah siddhaant: do prakaar ke honge. Ek to saamaany assignment honge jinaka ki moolyaankan hoga online assignment aapako upload honge usaka aap answer denge aur usamen number die jaenge. Chaahen 10 mein se die jaen ya 20 mein se die jaen jo bhi hoga. Aur ek alag tareeke se assignment honge joki main kahata hoon svayan sochie (food for thought) un prashnon par moolyaankan nahin hoga, na aapase kaha jaega ki aap usako submit kijie. Haan koshish ham yah karenge ki un prashnon par bhi lecture ke dauraan charcha avashy ho taaki ek sochane ka tareeka hai, jo soch hai us par aap vichaar kar saken.

(Reference Time 02:31)



To ham log chalate hain pahale lecture ki or jisamen ki ham paathyakram ka parichay denge.

(Reference Time 02:34)

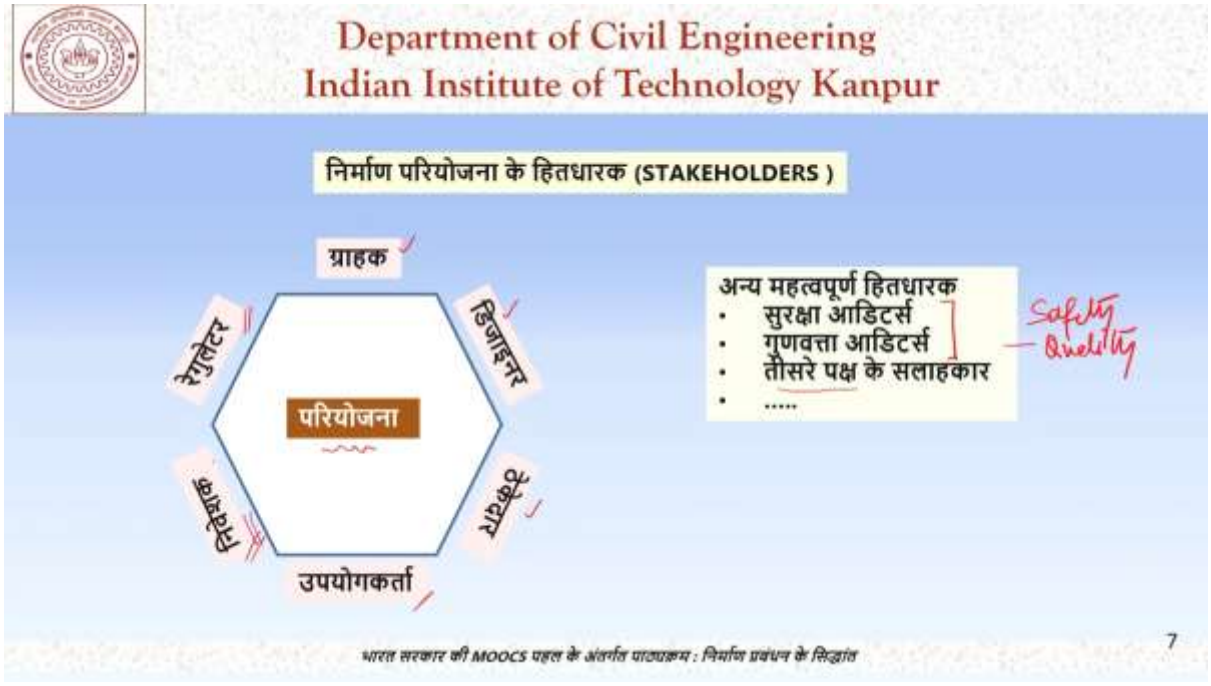


Sabase pahalee baat yah hai ki infrastructure ka hona ya banaaya jaana vikaas ka ek abhinn ang hai. Visheshakar vikaasasheel deshon ke lie. Kya aapane kabhi socha hai ki infrastructure aur vikaas mein kya sambandh hai? Kahana ham ye chaahate hain ki ham bahut saare deshon ke baare mein sunate hain visheshakar paashchaaty dashon mein america, europe, japan, singapore mein ki ye vikasit desh hain. Yahaan par infrastructure bahut hee vikasit hai to kya infrastructure pahale aaya aur usase desh ka vikaas hua ya desh vikasit the isalie vah infrastructure ka vikaas kar sake? Is prashn ka uttar main abhi nahin doonga. Aap sochie aur us par vichaar kijie apane man mein, sochie ki kya jab ham kahate hain ki infrastructure ka hona ya banaaya jaana vikaas ka ek abhinn ang hai visheshakar vikaasasheel deshon ke lie to jo vikaasasheel desh hain vah apana infrastructure banaane mein jute hue hain usamen bhaarat bhi hai. Is beech mein bahut pahal ki ja rahee hai ki hamaare yahaan infrastructure sudrdh ho chaahen, vo sadken hon, chaahe havaeeadde hon, chaahe health ho kisee bhi kshetr mein infrastructure par ek bahut bada focus hai, bahut poonjee lagaee ja rahee hai sarakaar laga rahee hai, public partnership ho rahee hai usase poonjee lagaee ja rahee hai. Kya yah infrastructure ka hona vikaas ke lie ek prerequisite hai? Kya bina infrastructure ke vikaas nahin ho sakata? In baaton par vichaar karana hoga. Main samajhata hoon aap log thoda sa sochiega.

(Reference Time 04:19)

Khair jahaan tak is course ka savaal hai main aapako bataana chahunga ki kisee bhi badee pariyojana mein vistrt nirmaan kaary ek abhin ang hota hai. Yahaan par do shabdon ka prayog kiya gaya hai: ek hai pariyojana aur doosara hai nirmaan pariyojana. Pariyojana prabandhan aur nirmaan prabandhan in shabdon ko aapas mein jodakar bhi dekha ja sakata hai aur alag-alag bhi dekha ja sakata hai. Han, hmari koshish hogee ki is course mein ham is par dhyaan den aur main aage bataoonga ki is course mein dhyaan kendrit rahega nirmaan prabandhan par, lekin nirmaan prabandhan ka pariyojana prabandhan se kya sambandh hai us par ham log vichaar karate hue chalenge aur agale lecture mein shaayad ek udaaharan dekar ke is antar ko spasht karoonga. Kisee bhi badee pariyojana ke baare mein baat karen chaahe vo sadak ho, railway lain ho, havaee adda ho ya audyogik nirmaan ho (refinery, kaarakhaane), kisee bhi prakaar ke bade udyog unaka nirmaan, koi bhi baat ho usamen nirmaan kaary aavashyak hai, nirmaan avashy karana hota hai. Jab ham nirmaan ki baat karate hain to yah bhi bahut mahatvapoorn hai ki ham samajh len ki vah nirmaan ek vibhaag se sambandhit nahin hota. Jab ham vibhaag ki baat karate hain to ham baat kar rahe hain civil engineering, mechanical engineering, electrical engineering kya nirmaan kaary mein civil engineers ka kaam hota hai? Nahin. Kya mechanical engineers ka kaam nahin hota? Hota hai. Aajakal ki pariyojanaon mein vishesh roop se har kshetr ke engineers milajul kar ek team banaakar nirmaan mein bhaag lete hain. Yah baat samajhana chaahie ki jo prabandhak hota hai use moolat: kisee bhi kshetr ka gyaan ho chaahe vo civil engineer ho, chaahe vo mechanical engineer ho nirmaan prabandhak ke taur par any vibhaagon ki jaanakaaree, unake baare mein gyaan hona aavashyak hai. Ab agar ham sochate hain railway ke baare mein, to railway line banaana, pul banaana yah shaayad civil engineer ka kaam hai lekin us par jo train chalatee hai, jo engine chalate hain vah to mechanical engineering hai. Usako urja dene ke lie jo traction ki line lagaee jaatee hai vah to electrical engineering mein aatee hai. To yah kah paana ki ham railway ka infrastructure vikasit karenge isake lie aavashyak hai ki ham civil engineer, mechanical engineer, electrical engineer sab log milakar ek team banaen, ek doosare ki aavashyakataon ko samajhen aur nirmaan mein aage badhen.

(Reference Time 07:17)



Kisee bhi nirmaan pariyojana mein hitdhaarak (stakeholder) kaun hain? Agar ham is chitr ko dekhen to graahak matalab client ki us nirmaan pariyojana ka owner hai, maalik hai jaise ki indian railways, highway authority of india yah log rail ka infrastructure ya sadak infrastructure ko own karate hain. Antath thode din ke lie koee doosara own karata hai, nahin karata hai vah alag baat hai, lekin antat: ek organization ya ek vyakti aisa ho jo ki us pariyojana mein banae gae utpaad ko own kare, usakee jimmedaaree le. Yah aavashyak nahin hai ki jo owner hai usako us pariyojana ke nirmaan ke sambandh mein yah nirmaan ke samay jo bhi jaanakaaree chaahie hotee hai vah sab jaanakaaree usake paas in-house upalabdh ho, vo ek designer kee seva le sakata hai. NHAI hai, railway hai vah kah sakate hain ki bhaee hamako yahaan se yahaan tak railway line banaanee hai, hamako yahaan se yahaan tak sadak banaanee hai isako design kar deejie. To koee designer hai jo ki us kshetr ka visheshagy hai vo unako help kar sakata hai ya unakee madad kar sakata hai vah design bana kar de sakata hai. Design banaane ke baad baaree aatee hai, thekedaaron kee jo ki un designs ke anusaar nirmaan kaary karate hain. Nirmaan kaary field par hota hai. Jab ham mechanical engineering kee baat karate hain to nirmaan kaary factory mein hota hai. To agar ham kahate hain ki hamen is tareeke kee coach bana do, to vah coach factory mein banaee jaegee aur coach lekar ke vo hamaaree site par aa jaegee. Jab hamaaree railway line taiyaar ho jaegee. Usake baad aatee hai baaree upabhokta ya upayogakarta kee jo ki user hai. Sadak par ham log sabhi chalate hain gaadee chalaate hain railway mein sab saphar karate hain, havaee jahaaj mein saphar karate hain to ham log usake user hain. Ham logon kee aavashyakataon ke anusaar hee unako dhyaan mein rakhate hue hee jo designer hai usako design karata hai aur kyonki design kiya gaya hai us tareeke se, to thekedaar usee tareeke se usako banaata hai. Ab aajakal ke paripekkshy mein niveshakon kee bhumika bhi badhatee ja rahee hai. Kuchh varsh pahale tak infrastructure kshetr mein itana nivesh adhik hota hai ki usako kar paane ka boota sarakar ke paas hee tha. Laakhon-karodon rupaye ka nivesh sirph sarakaar hee kar sakatee thee kintu dheere-dheere yah baat badal rahee hai. Sarakaar logon ko ismen jodana chaahatee hai, logon ka matalab individual citizens, individual parties vah bhi ho sakate hain, nahin to bade business houses vo bhi ho sakate hain. To sarakaar kah rahee hai ki niveshak alag ayen jo ki infrastructure ko banaane mein saamane aaen chaahe vo airports ho, chaahe vah sadake hon,

railway mein vo baat abhi kam hai lekin dheere-dheere usakee baat bhi shuroo ho rahee hai. Jab niveshak aa jaate hain to yah baat aatee hai ki pariyojana kee laagat kya hogee? Kab kitana paisa chaahie? Kya vah paisa vaapas aaega? Kab aaega? Kis dar par aaega? Us par byaaj hoga ya nahin hoga? In sab baaton ko dhyaan mein rakhana niveshako ka kaam hai. Niveshak yah prashn poochhate hain aur un prashnon ka uttar dena chaahe graahak ho, chaahe vah designer ho usaka kartavy hota hai. Phir aate hain regulator, regulator arthaat vo agencies ya vo sansthaen jo ki poore game par agar aap isako ek khel ke tareeke se dekhen to vo ye dekhate hain ki har jagah par niyamon ka paalan ho raha hai. Jo design kiya ja raha hai vo maanakon ke anusaar hai. Jo nirmaan ho raha hai vo maanakon ke anusaar hai. Upabhoktaon ke hiton kee raksha ho rahee hai, nivesh mein hera-pheree nahin ho rahee hai. Yah kaam regulator ka hai.

Inke alaava anya mahatvapoorn hitadhaarak bhi hain: suraksha auditor, gunvatta auditor, teesre paksh ke salaahakaar, suraksha matalab safety. To safety audit karana ye yah dekhe rahana kee safety ke niyam pure ho rahe hain. Construction jo ho raha hai vah safe hai. Vahaan par durghatanaen nahin hogee. Yah durghatanaen kam kee ja sake, shram kaanoon ka paalan ho raha hai. Gunvatta arthaat quality par koee compromise nahin hai. Is baat ko dekhane ke lie independent agencies ya auditors aksar kisee bhi pariyojana mein shaamil hote hain. Usee prakaar se teesare paksh ke salaahakaar bhi hote hain jo ki ek independent vyoo (ek alag drshtikon) prastut karate hain, saamane rakhate hain. To jo designer hota hai usake design ko jo vet karata hai ki haan yah design theek hai to unako ek tareeke se ham teesara paksh kah sakate hain.

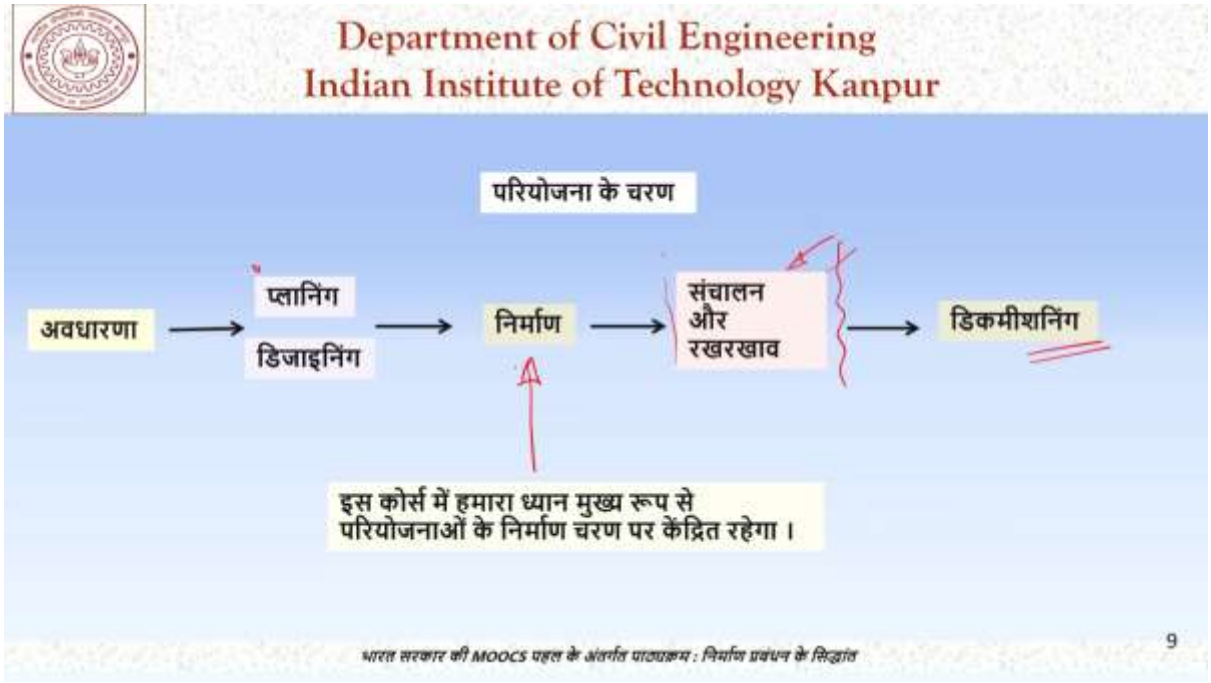
(Reference Time 12:51)

Aaiye ab chalate hain pariyojanaon ke baare mein. Pratyek nirmaan pariyojana adviteey ya unique hotee hai kyonki sthaaneey paristhitiyon mein bhinnata. Ek sadak jab ham yahaan se lekar yahaan banaate hain A se lekar B tak aur chaahe design vahee ho lekin agar ham kisee doosaree jagah ch se lekar D tak banaayenge. To usamen sthaaneey paristhitiyon chaahe vo vahaan kee mittee ho, vahaan ka vaataavaran ho, vahaan ka taapamaan ho hoga. Usase

nirmaan kaary par phark padata hai is baat ko dhyaan mein rakhana designer ka, nirmaanakarta ka aur sabaka dharm hai aur sab log karate bhee hain. To islie har pariyojana apane mein adviteey hotee hai (unique hotee hai). Nirmaan mein shaamil logon aur upakaranon mein bhinnata- nirmaan arthaat construction mein upakaran use hote hain, upakaranon ka prayog hota hai. Kabhee ham concrete ka jab istemaal karate hain to ham pamp karate hain, kabhee ham usako belt conveyor se lekar jaate hain. Jo log nirmaan kaary mein jude hain vo alag hote hain unakee samajh alag hotee hai par in sab cheejon se bhee har pariyojana unique ho jaatee hai. Saamagree kee gunvatta mein bhinnata- pariyojanaon mein prayog mein laane vaalee saamagree adhikaanshat: praakrtik hotee hai (natural materials). To jo natural materials hota hai usamen bhinnata hotee hai. Udaaharan ke taur par concrete- concrete ham gittee, cement, maurang, paanee se banaate hain lekin gittee har jagah kee alag hotee hai. To yah kahana ki concrete ek see hai, ek star par theek hai lekin ek star par usamen hone vaalee bhinnata ko hamaare sangyaan mein hona chaahie. Prabandhak ko pata hona chaahie ki jo main pichhale site par ya pichhale project mein karake aaya hoon usako yahaan par vaise-ka vaisa copy nahin kiya ja sakata hai. Ham pariyojanaon ke ek any pahaloo par chalate hain. Nirmaan pariyojanaen - infrastructure se judee nirmaan pariyojanaon mein bahut badee maatra mein poonjee maanav sansaadhan saamagree even upakaran aadi ka nivesh hota hai. Saath-hee-saath pariyojana ko soche jaane se lekar design hone tak aur phir poora karane tak kee avadhi kai varshon tak kee ho sakatee hai. Kahane ka matalab yah hai ki agar hamane kaha ki theek hai A se B tak sadak banaee jaegee to pahale to yah vichaar aaega phir us par ham kuchh thoda sa aur gahan vichaar karenge, thoda plan karenge. To jab ham consept par aate hain vahaan se planning karate hain aur phir usaka construction karate hain. To is pooree prakriya mein kai varsh bhee lag jaate hain.

Main aapako ek svayam sochie ka grhakaary dena chaahata hoon, aap kisee bhee badee pariyojana mein chaahe vah Delhi Metro ho, chaahe vah Kolkata Metro ho ya Chenab Bridge ho ya fir Bandra Worli Sea Link ho. In pariyojanaon ke baare mein jaanakaaree haasil karen aur dekhen ki unakee parikalpana kab kee gai? Unaka design kab kiya gaya aur nirmaan kaary mein kitana samay laga? Jab aap yah karenge tab aapako lagega ki haan yah poora discussion infrastructure banaane ka discussion, nirmaan ka discussion usmen samay ka bahut bada yogadaan hota hai.

(Reference Time 16:55)



Ham log chalate hain pariyojanaon ke charanon par. Isakee charcha abhee ho rahee thee ki avadhaarana hai usakee parikalpana hai sabase pahale hamane ye kiya. Phir usake baad hamane planning kee, usako design kiya, phir usake baad hamane usaka nirmaan kiya aur nirmaan ke baad ham pahunchate hain sanchaalan aur rakharakhaav (operation and maintenance) kee sthiti mein. Is sthiti mein ham us pariyojana ka upayog kar sakate hain, jaise sadak ban gayee hai ham us par chal sakate hain aur isake baad kya hota hai? Isake baad ek stage aatee hai ek charan hai decommissioning ka. Kisee bhee pariyojana kee ek service life hotee hai jaiseki 50 saal, 60 saal, 100 saal aur usake baad owner ke lie yah aavashyak ho jaata hai ki ham usako decommission karen aur ek naee sadak banaayen, naya pul banaayen, naee phaiktree banaayen us phaiktree ko pooree tareeke se redesign karen aur ya usaka eksapainshan karen kuchh bhee karen. To yah decommissioning vaalee stage bhee hamako apane planning kee stage mein sochanee hotee hai. Dheere-dheere yah soch bhee hamaare designer ke mastishk mein aatee ja rahee hai ki service life pooree kee pooree ek sang dekhee jae. Na sirph nirmaan ke ant tak, na sirph sanchaalan aur rakharakhaav ke ant tak, balki usakee decommissioning ke samay bhee kya hoga. Usako kaise ham haindal karenge, jo saamaan nikalega, jo malava nikalega usaka kya hoga? To jo life cycle cost sustainability jab is tareeke kee baaten hotee hain to is poore cycle par vichaar karana aavashyak hai. Is course mein hamaara dhyaan mukhy roop se pariyojanaon ke nirmaan charan par hee kendrit rahega. Yah mainne pahale bhee kaha tha aur agale lecture mein ek udaaharan ke maadhyam se main is baat ko aur bhee spasht karoonga.

(Reference Time 18:53)

To ham log chalate hain paathyakram ke modules par. Is paathyakram ko kin bhaagon mein vibhaajit kiya gaya hai aur usamen kya sambandh hai? Ham sabase pahale is baat par vichaar karenge ki pariyojana kya hai? Usakee ek vihangam chhavi, ek 30000 pheet se havaee jahaaj se jab aap chalate hain jo neeche dekhate hain to aapako bahut saara detail nahin dikhaee deta hai lekin bahut saaree cheejen dikhaee detee hai ham us baat kee analogy lekar aage badhenge aur pariyojana ka ek vihangam drshy dekhenge ki usamen kya-kya pahaloo hain jo ki hamako nirmaan prabandhak ke taur par, pariyojana prabandhak ke taur par pata hone chaahie.

Usake baad ham chalenge pariyojana kee laagat ka anumaan. Chaahe sadak ho, chaahe vah rail ho, chaahe havaee adda ho aakhirakaar usamen kitana paisa lagega, kya vah paisa vaapas aaega? Aaega to kab aaega? Kya hamaare lie vah phaayademand hai? Kya hamako usase phaayada hoga ya nahin hoga? Sarakaar ke vyay karate samay yah baat hotee hai ki saamaajik laabh kya hoga (social benefit), kya hoga? Lekin agar ek poonjeepati kaheen par nivesh kar raha hai to saamaajik laabh ke saath-saath vah apana laabh bhee dekhega ki kya hamaaree company ko hamaare shareholders ko ham javaab-dehee jab hotee hai, to ham unako kya uttar denge? Hamane itana paisa lagaaya tha hamako isamen kya mila? Yah bahut hee aavashyak hai ki pariyojana ke har charan mein aane vaalee laagat, usase aane vaale revenue ka hame gyaan ho. Taaki ham apane shareholders ko usake baare mein bata sake. Isase judee huee baat hai nirmaan arthashaastr kee hai. To kya aaj jo hamaare paas 100 rupaye hain, 1000 rupaye hain unakee kal kya value hogee? Nirmaan arthashaastr ka ek pahaloo hamaare upakaranon se juda hota hai ki ham ek equipment ko, ek machine ko 1 karod kee ya 10 karod kee khareedate hain aur vah 4 saal chalatee hai. Us 4 saal ke baad hamen machine badalanee hai, to usamen kya economic considerations hai; usamen kya baat hamen pata honee chaahie? Kis tareeke se ham usako handle karenge isake baare mein bhee thodee bahut charcha is course mein kee jaegee.

Planning and scheduling is baat par hamane paroksh roop se do-chaar baar charcha kee abhee. Ki kisee bhee pariyojana mein tamaam gatividhiyaan hotee hain aur har gatividhi (har activity) ka karane ka ek samay hota hai, usako poora karane ke lie ek avadhi hotee hai.

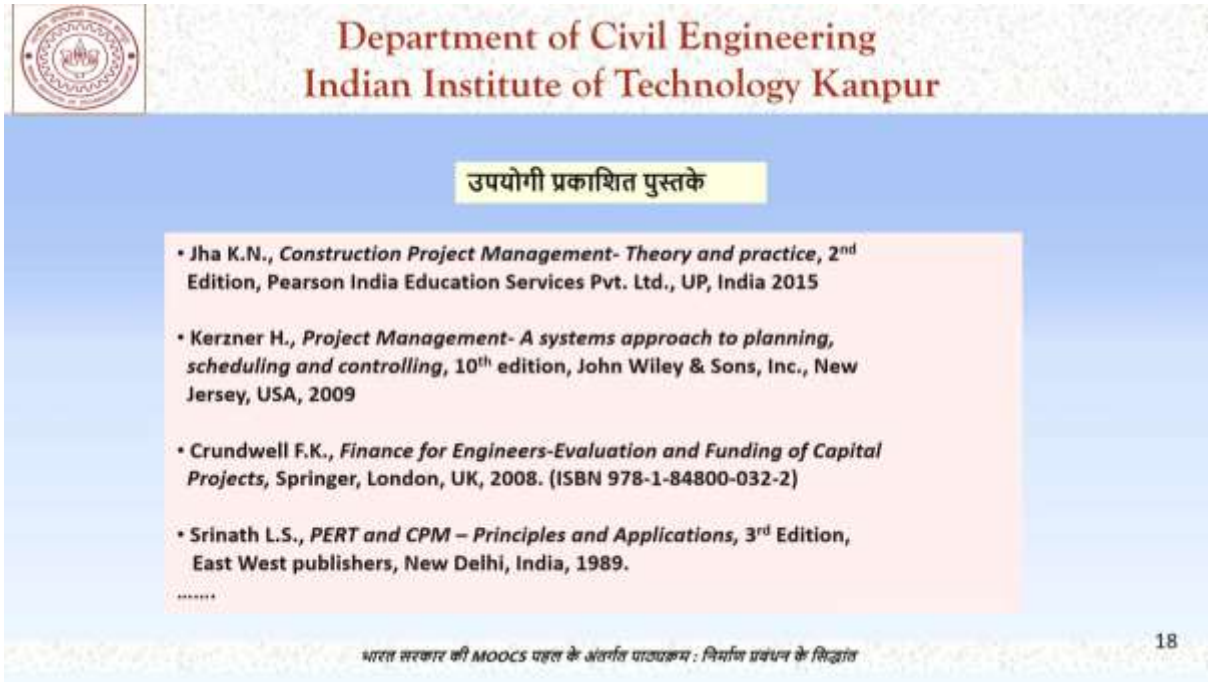
Nirnay karana ki is gatividhi ko kab shuroo kiya jae, kab tak samaapt kiya jae taaki any gatividhiyaan prabhaavit na ho is baat ko scheduling kahate hain. Is par ham log charcha karenge kis tareeke se ham log isako kar sakate hain, kaise kee jaatee hai, kaise component ko use karake ham isako aur vaigyaanik roop se aur reliable bana sakate hain. Yah baat vishesh roop se tab bahut mahatvapoorn ho jaatee hai jabaki gatividhiyaan ek din mein ya do din mein samaapt nahin ho rahee hai. Vo pariyojana ya nirmaan kaary kai maheene, kabhee-kabhee to kai saal chalata hai, tab yah tay kar paana ki theek hai hamako 2 saal baad yah cheej chaahie hogee? Udaaharan ke taur par aap ek building banaane chalate hain. To aapako usamen lift lagaanee hai lekin lift aapako turant to nahin chaahie jab pooree building ban jaegee tab aapko lift lagaenge lekin lift kee laagat aapako pahale se pata honee chaahie, ki 2 saal baad hamen lift chaahie hogee, 6 maheene baad hamen lift chaahie hogee yah baat aatee hai planning and scheduling ke antargat. \

Gunavatta prabandhan, quality control, quality management yah bahut hee aavashyak hai vishesh roop se is tareeke ke nirmaan kaary mein jo ki kai dashak chalega aur usamen agar shuroo mein hee defect hain, usakee gunavatta theek nahin hai quality kharaab hai to aaj pata nahin chalega lekin 10 saal baad, 15 saal baad usakee performance kharaab ho jaegee. Is baat ko dhyaan rakhate hue gunavatta prabandhan par vishesh dhyaan diya jaata hai.

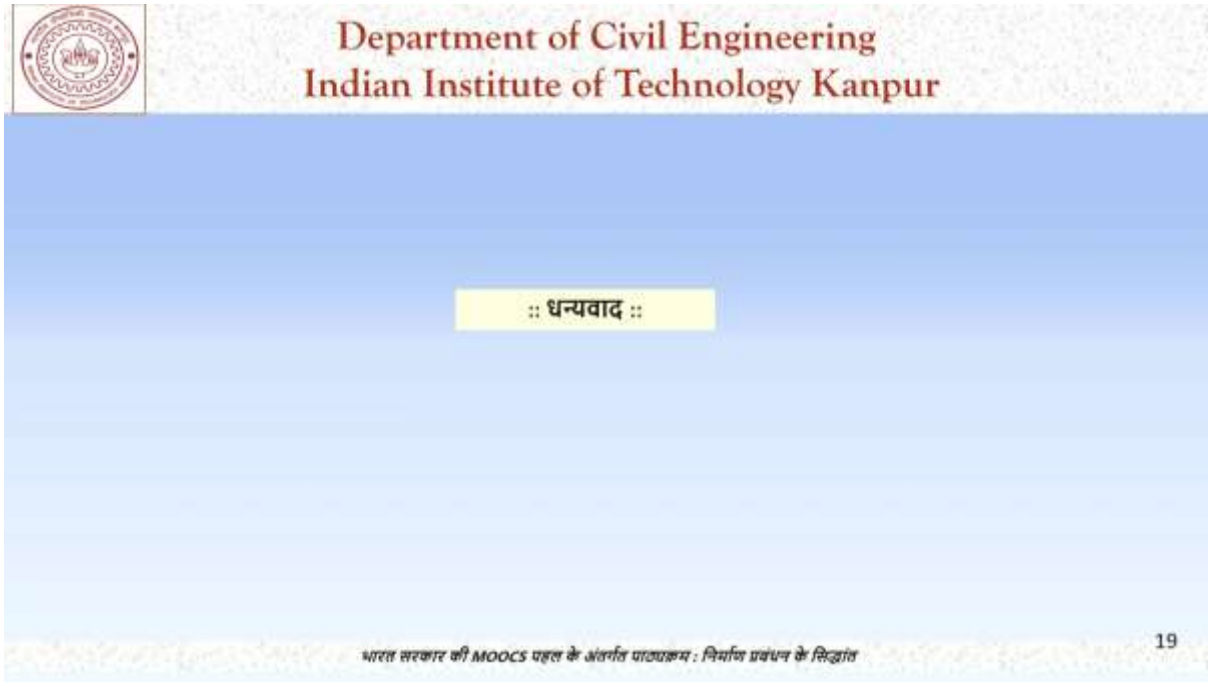
Suraksha prabandh - nirmaan kaary ek tareeke se hazard hai. Nirman site par durghatanaayen hotee hain. Koshish hamen yah karanee chaahie ki vahaan par durghatanaen na ho. Har nirmaan kaary mein kis tareeke kee durghatanaen ho sakatee hain, durghatanaon ko bachaana, karmachaariyon ko choten na lage yah ensur karana, equipment ko kshati na ho yah ensur karana yah sab aata hai suraksha prabandhan mein. Suraksha prabandhan ka ek aur pahaloo hai labor laws (shramik kaanoon). Jo bhee shramik hamaare saath kaam karate hain chaahe vah kisee bhee star par hon unake adhikaar, unakee dekharekh ke lie tamaam kaanoon bane hue hote hain. To jo pariyojana prabandhak hai (nirmaan prabandhak hai) usako inakee jaanakaaree bhee honee chaahie aur yah baat ki charcha hum log karenge suraksha prabandhan ke antargat.

Ant mein ham log charcha karenge anubandh prabandhan kee arthaat contract management. Nirmaan kaaryon mein do parties, teen party jo bhee log hain vah ek doosare se ek anubandh ke maadhyam se jude hote hain. Us anubandh mein us contract mein yah likha hota hai ki har party kya karegee, kab karegee aur vah karane ke lie usako kya muaavaza milega (kya compensation) milega. To har cheez likhee nahin ja sakatee aur isee baat ko lekar vivaad ho jaate hain aur un vivaadon se deal karana, vivaad na ho is tareeke ka anubandh likhana yah aata hai anubandh prabandhan mein. To yah ek overall perspective hai hamaare paathyakram ka.

(Reference Time 25:04)



Is sookshm parichay ke saath main aaj ka lecture yahaan samaapt karana chaahoonga. Kuchh upayogee prakaashit pustaken is slide mein dee huee hai. In pustakon ko hee ham is paathyakram mein kaaphee had tak follow karenge.



Aur aaj hamaare saath judane ke liye dhanyavaad! Jay hind. Ham aapase phir milenge agale lecture mein jabaki ham har module ke baare mein thodee aur detail mein charcha karenge. Namaskaar!