# निर्माण प्रबंधन (Construction Management) के सिद्धांत

**[Nirman prabandhan (Construction Management) ke Siddhant]**

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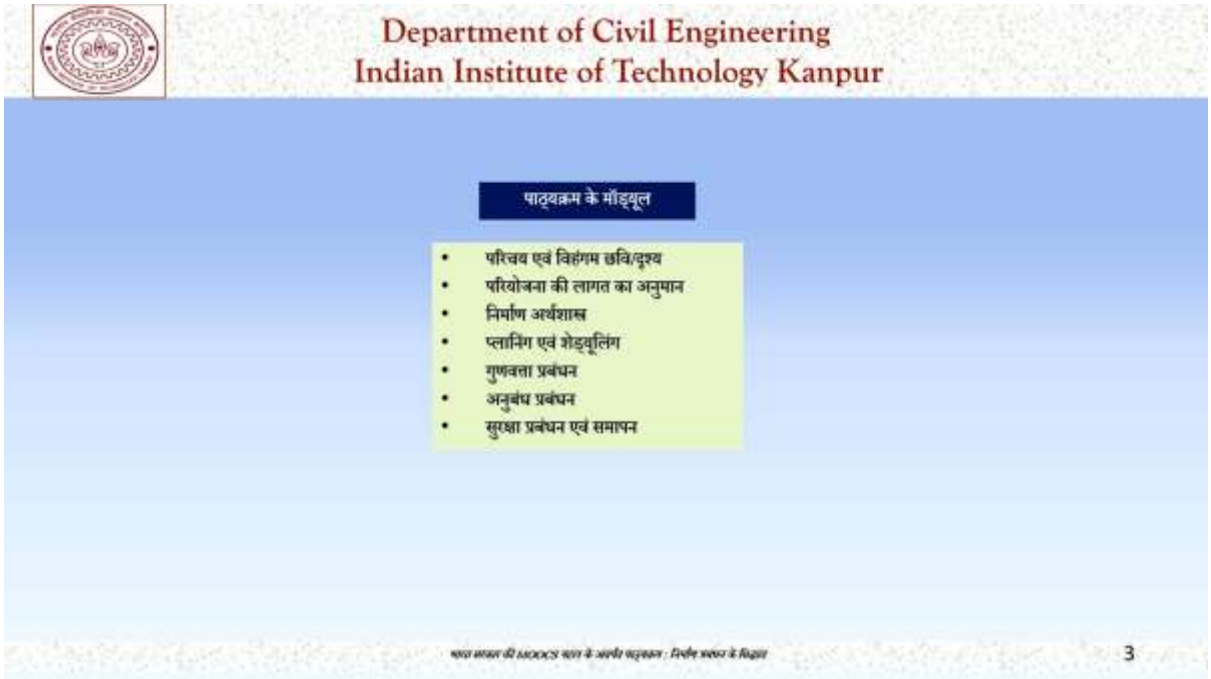
**Lecture – 42**

**Samaapan**


Namaskaar aur svaagat hai aapaka Bharat sarakaar kee MOOCS pahal ke antargat paathyakram "Nirmaan Prabandhan ke Siddhaant (Principals of Construction Management)".

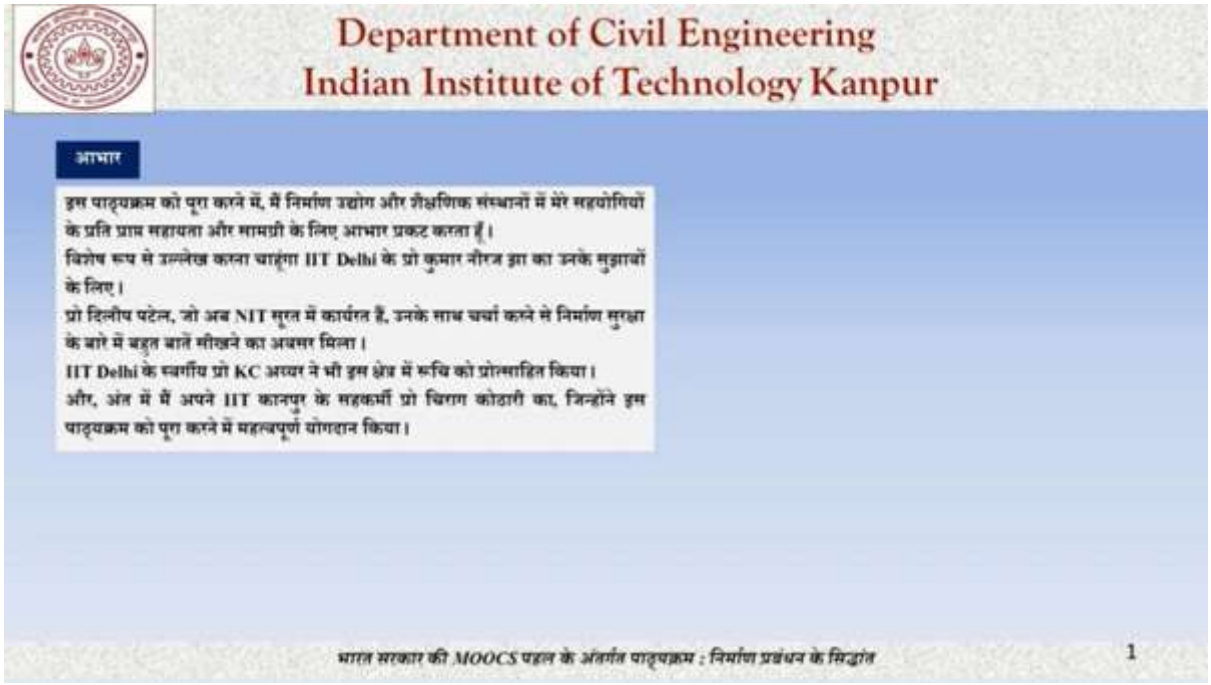
**(Reference Time 00:23)**




Is paathyakram mein hamane in modules par charcha kee ek vihangam chhavi evan drshy jisamen ki hamane nirmaan prakriya ke vibhinn pahaluon ko dekha. Pariyojana kee laagat ka

anumaan, nirmaan arthashaastr; planning evan scheduling; gunavatta, anubandh evan suraksha prabandhan aur aaj ham log samaapan arthaat ek aise lecture par hain jahaan par ki ham is poore module ko sankshipt roop se dekhane kee koshish karenge.

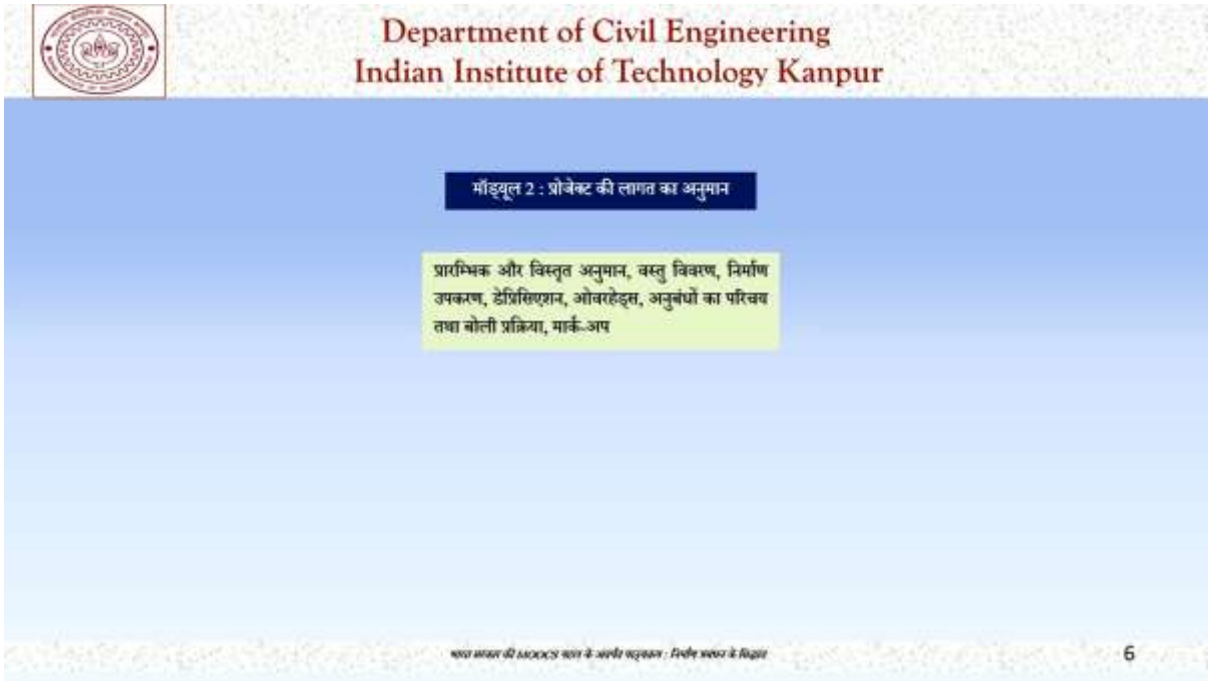
**(Reference Time 00:51)**




Is antim lecture mein aage badhane se pahale main apana aabhaar prakat karana chaahoonga tamaam logon ke prati. Is paathyakram ko poora karane mein bahut se logon ne mujhe help kiya hai. Main nirmaan udyog aur shaikshik sansthaanon mein mere sahayogiyon ke prati praapt sahaayata aur saamagree ke lie unaka aabhaar prakat karata hoon vishesh roop se ullekh karana chaahoonga IIT Delhi ke Prof. Kumar Neeraj Jha ka, unake sujhaavon ke lie; Prof. Dileep Patel jo ab NIT soorat mein kaaryarat hain unake saath charcha karane se nirmaan suraksha ke baare mein bahut see baaten seekhane ka avasar mila. IIT Delhi ke svargeey Prof. K. C. Iyer ne bhee is kshetr mein ruchi ko protsaahit kiya. Main unako shraddhaanjali deta hoon aur naman karata hoon. Aur ant mein main apane IIT Kanpur ke sahakarmee Prof. Chirag Kothari ka jinhonne is paathyakram ko poora karane mein mahatvapoorn yogadaan diya, unaka dhanyavaad karata hoon. Mere saath jo meree team thee Tanya aur Priyanka jinhonne ki Hindi mein slide banaane aur unako orgnaize karane mein meree madad kee main unaka bhee dhanyavaad deta hoon. Aur NPTEL ke tamaam log jinhonne ki bahut saaree steps mein recording se lekar editing se lekar uploading mein hamaare saath jude rahe unako sabhee ko dhanyavaad.

**(Reference Time 02:15)**

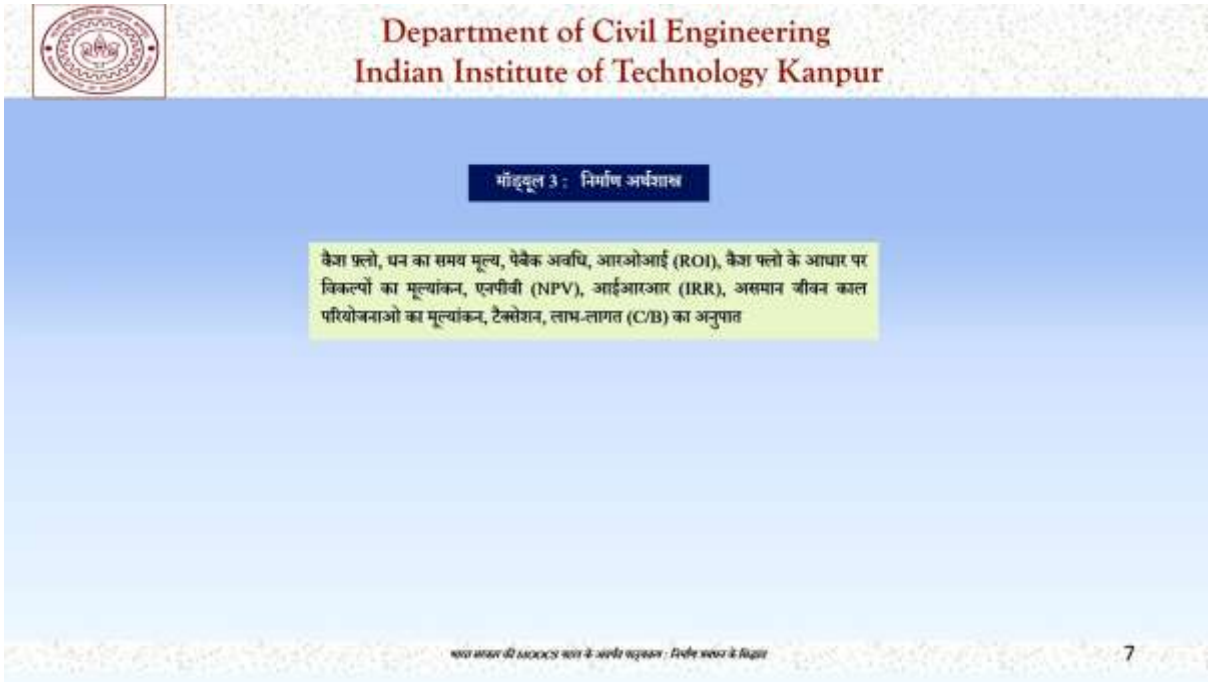

To aaiye aage badhate hain. Hamane module 1 kee jab charcha kee thee to yah kaha tha ki ham hitadhaarak arthaat stakeholders, nirmaan pariyojana kee visheshataen aur unake charan pariyojana, prabandhak kee bhoomika, nirmaan pariyojanaon kee multi-disciplinary pragati aur sansaadhan, in baaton par vichaar karenge aur hamane udaaharan ke roop mein ek metro system ko liya tha jahaan par ki mechanical, electrical aur civil yahaan tak kee computer science, data science aadi tamaam specializations ke logon ka sahayog hamen chaahie hota hai ek saphal metro chalaane ke lie. To yah hamaara uddeshy tha ki ham ek badee pariyojana kee parikalpana kaise karate hain, usako design karate hain phir usake nirmaan kaary mein hamako kin baaton ka dhyaan rakhana hota hai aur jo nirmaan prabandhak hota hai usako kin-kin baaton ka gyaan hona chaahie ya kam-se-kam ek working knowledge honee chaahie.
**(Reference Time 03:20)**




Agala module hamaara tha project kee laagat ka anumaan. Kisee bhee pariyojana mein kaee karod aur kabhee-kabhee to kaee 100 karod kee laagat aatee hai to yah aavashyak hai ki ham

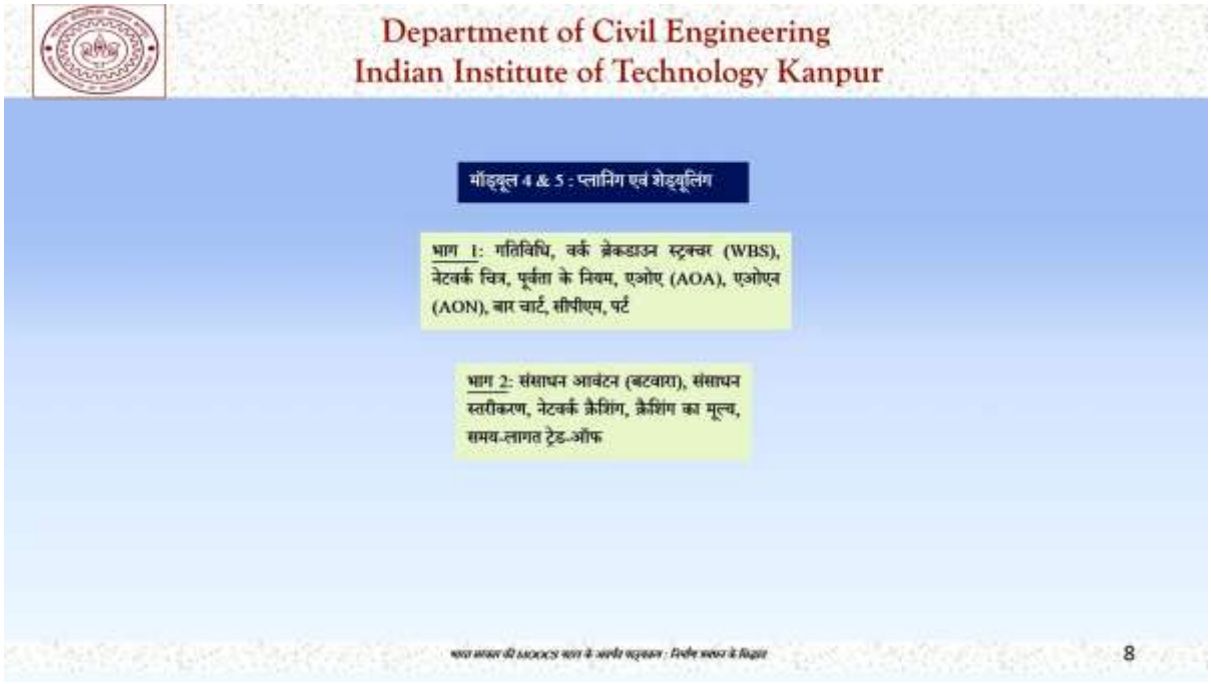
pariyojana shuroo karane se pahale hee pariyojana kee laagat ka anumaan lagae. Laagat ka anumaan lagaane ke lie praarambhik aur vistrt anumaan, vastu vivaran, nirmaan upakaran, depreciation, overheads, anubandhon ka parichay tatha bolee prakriya evan mark-up. Yah sab kuchh keywords the jin par ki hamane charcha kee. Hamane is baat ko bhee dekha ki project kee laagat ka anumaan client kee or se aur thekedaar kee or se alag-alag cheejon ko mahatv dete hue kiya jaata hai. Har vyakti apanee taraph se apane najarie se laagat ka anumaan lagaata hai.

**(Reference Time 04:08)**



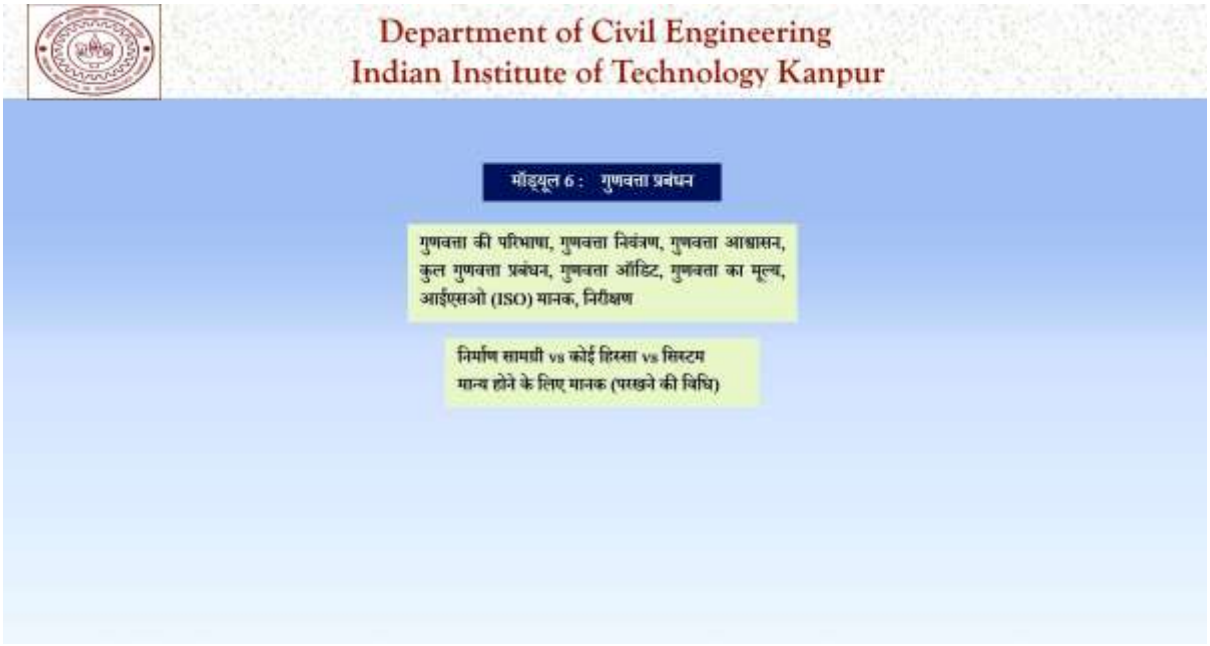

Module 3 jo ki nirmaan arthashaastr tha. Nirmaan arthashaastr mein hamane cash flow, dhan ka samay mooly arthaat time value of money, pay back avadhi, ROI, cash flow ke aadhaar par vikalpon ka moolyaankan NPV, IRR aur asamaan jeevan kaal pariyojanaon ka moolyaankan, taxation, laabh laagat ka anupaat arthaat cost benefit ratio aadi kee charcha kee.

**(Reference Time 04:35)**



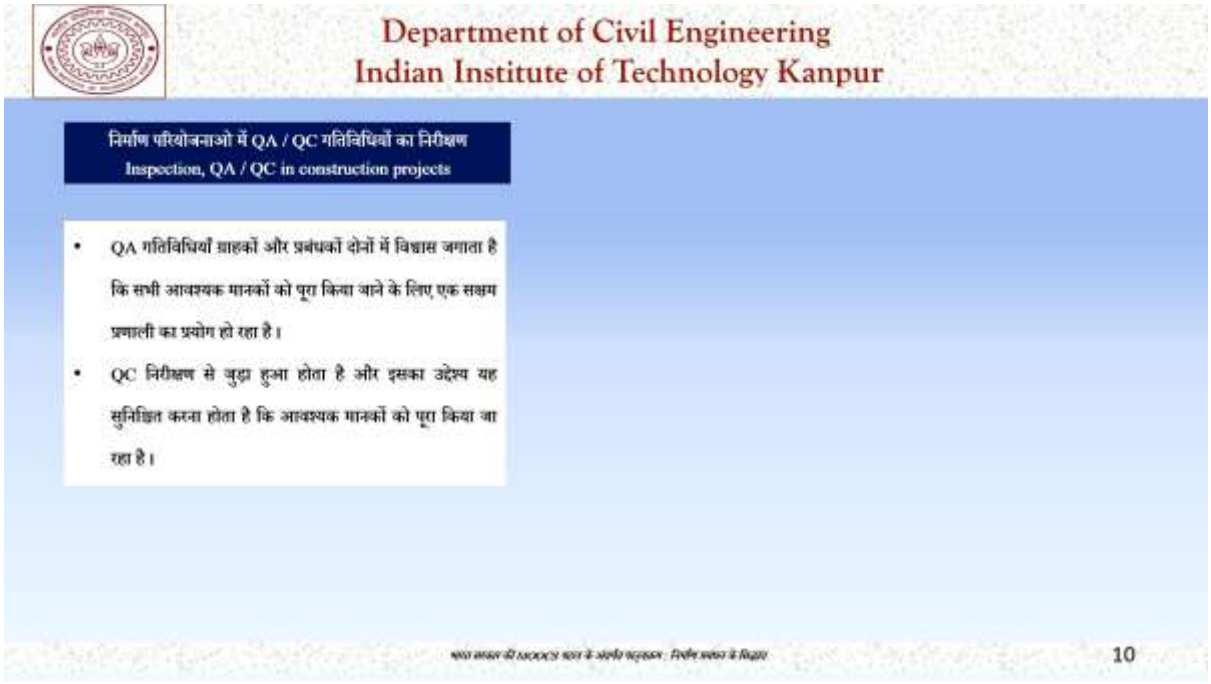

Module 4 aur 5 planning aur scheduling ke vibhinn pahaluon par vichaar karane ke lie lagae gae. Isamen bhaag-1 tha gatividhi, work Breakdown Structure (WBS), network chitr, poorvata ke niyam, AOA, AON arthaat activities on arrow aur activities on node, bar chart, CPM aur PERT paddhatiyon se kis prakaar yah aakalan lagaaya jaata hai ki ek pariyojana ko poora karane ke liye kitana kam-se-kam samay lagega . Kin gatividhiyon ko adhik closely monitor kiya jaana chaahiye. Kaun see activities critical hain aur phir hamane doosare bhaag mein sansaadhan ka aavantan ya batavaara, sansaadhan stareekaran, network crashing, crashing ka mooly aur samay laagat trade-off, in baaton par charcha kee. Kaheen charcha thodee see detail mein huee aur kaheen par charcha bahut hee sankshipt roop se huee. Hamane ye bhee dekha ki jo network ham ek baar banaate hain vah ek basis hota hai usee ke aadhaar par ham tamaam aur gatividhiyon kee planning karate hain aur ho sakata hai ki sansaadhanon ko thoda sa idhar-udhar karane se activities ko shrunk kiya ja sake, jis activity ke liye hamane normal resources allocation ya normal sansaadhan aavantan ke aadhaar par yah maana tha ki isamen 5 haphte lagenge agar ham usamen kuchh sansaadhan badha dete hain to ho sakata hai vah activity 3 dinon mein pooree kee ja sakee lekin kya usake cost implications honge? Agar cost implications hote hain to kya overall cost phir bhee kam kee ja sakatee hai kyonki hamane dekha cost ke do component hote hain, direct cost aur indirect cost. In dono ko jodakar jab dekha jaata hai to kabhee-kabhee hota hai ki direct cost badh jaane par bhee indirect cost kyonki kam ho jaatee hai isaliye pariyojana kee overall cost kam kee ja sakatee hai. To in baaton ko hamane planning aur scheduling mein module 4 aur 5 mein dekha.

**(Reference Time 06:48)**



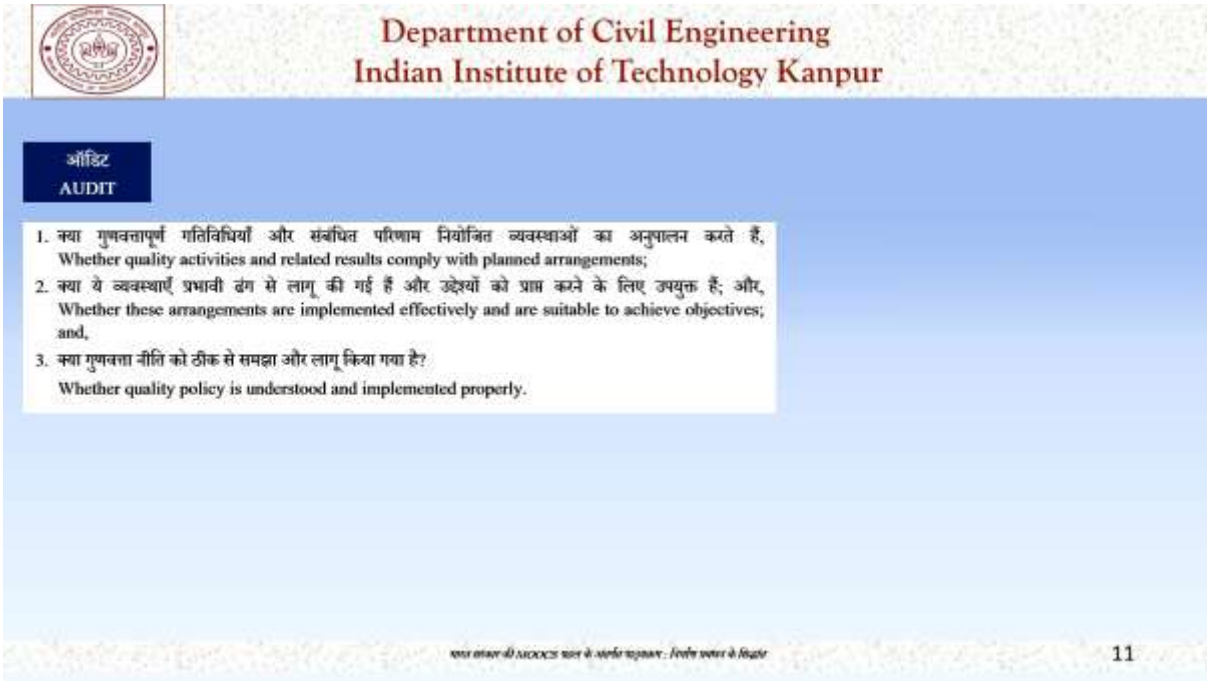

Jo module 6 tha, vah devoted tha gunavatta prabandhan ke lie. Isakee shuruaat huee thee ek homework se. Hamane aapase kaha tha kee gunavatta prabandhan ka tamaam literature jo pichhale 30 saalon mein ikattha hua hai vah manufacturing industry se aaya hai, to hamako yah tay karana chaahie ki hamaara utpaad kya hai, hamaara product kya hai nirmaan udyog ka product kya hai? Ho sakata hai vah bridge ho, ho sakata hai vah ek 100 km lambee ya 500 km lambee sadak ho ya ek building ho, to us utpaad kee gunavatta sunishchit karane ke lie hamen kya-kya kadam uthaane chaahie? To hamaaree charcha gunavatta kee paribhaasha, gunavatta niyantran, gunavatta aashvaasan, kul gunavatta prabandhan, gunavatta audit, gunavatta ka mooly, ISO maanak aur nireekshan in keywords ko lekar aage badhee. Phir hamane dekha ki ek utpaad kee final quality sunishchit karane ke lie nirmaan saamagree arthaat jo ro material hamane use kiya usakee gunavatta, kuchh components bane unakee gunavatta aur antatah poore system kee gunavatta is baat ko ensure karane ke lie (sunishchit karane ke) hamen har kadam par yah ensure karana hota hai ki quality ke maanak poore hon aur yah baat tay karane ke lie kee maanak poore hote hain hamen parakhane kee vidhi arthaat nireekshan is par vishesh dhyaan dena hota hai.

**(Reference Time 08:30)**



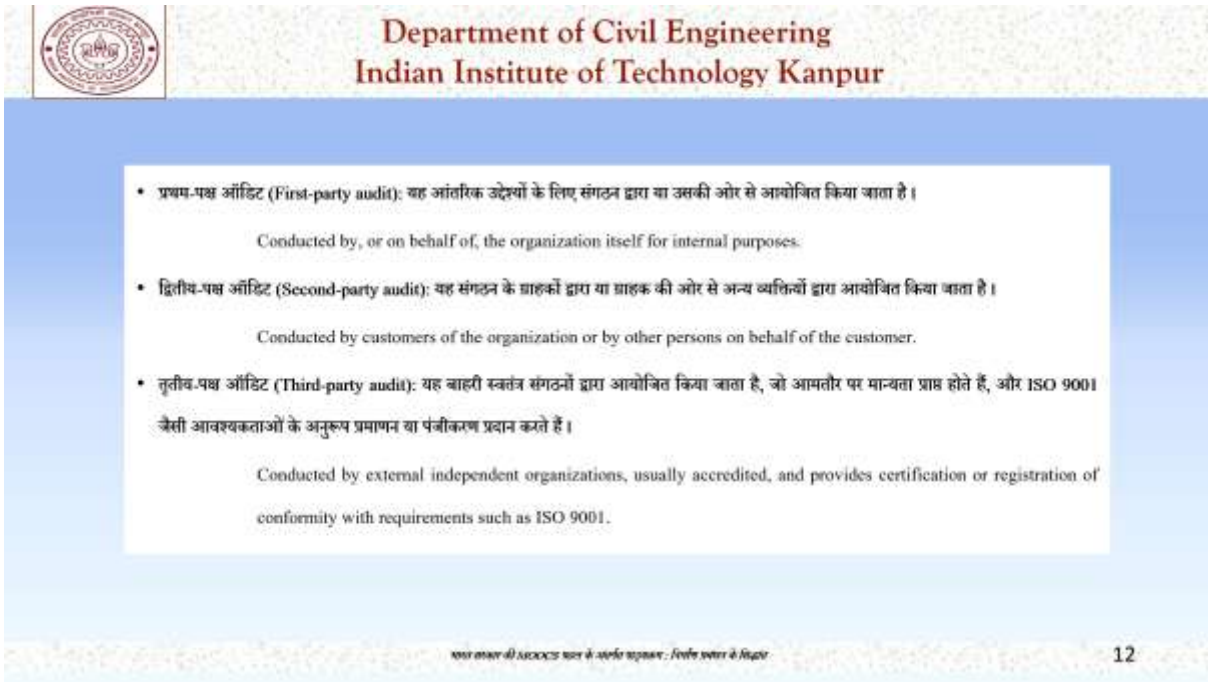

Agale module par jaane se pahale kuchh tippanee main karana chaahoonga inspection, quality assurance aur quality control in construction projects arthaat nirmaan pariyojanaon mein quality assurance aur quality control kee paribhaasha ek baar phir se aapake saath doharaana chaahata hoon. Quality assurance gatividhiyaan graahakon aur prabandhako donon mein vishvaas jagaatee hain ki sabhee aavashyak maanakon ko poora kiya jaane ke lie ek saksham pranaalee ka prayog ho raha hai, A proper system is in place to ensure that proper quality can be assured. Yah assurance graahakon, consumers aur prabandhako, managers sabhee ko honee chaahie, yah uddeshy hota hai quality assurance ka. Jabaki quality control ya gunavatta niyantran nireekshan se juda hua hota hai aur isaka uddeshy hota hai yah sunishchit karana ki aavashyak maanakon ko poora kiya ja raha hai, to nireekshan quality control ka part hai aur usaka ek robust system in place hai, vidyamaan hai is baat ko assures karata hai quality assurance ka system.

**(Reference Time 09:46)**



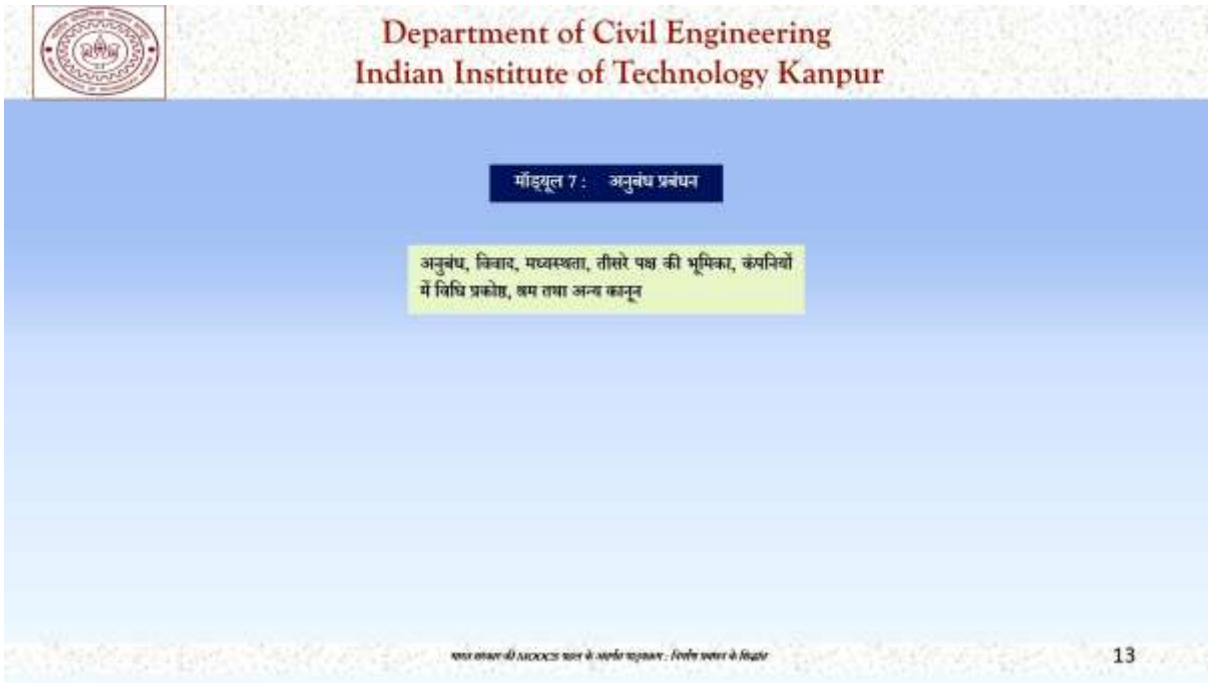

Gunavatta par charcha samaapt karane se pahale main kuchh charcha karana chaahata hoon audit shabd ke oopar. Gunavatta se sambandhit gatividhiyaan aur sambandhit parinaam niyojit vyavasthaon ka anupaalan karate hain. Is baat ko tay karana audit ka ek part hota hai. Kya yah vyavasthaen prabhaavee dhang se laagoo kee gaee hain aur uddeshyon ko praapt karane ke lie upayukt hain tatha kya gunavatta neeti ko theek se samajha aur laagoo kiya gaya hai? Yadyapi kisee bhee organization mein quality sunishchit karane ke lie quality engineers kaaryarat hote hain quality inspectors kaaryarat hote hain lekin kya jo pranaalee in ples hai vah vaakee mein, vaastav mein theek se kaam kar rahee hai is baat ko tay karane ke lie audit arthaat ek independent (svatantr) tantr bhee hota hai. Vah yah tay karata hai ki kya gunavatta gatividhiyaan aur sambandhit parinaam niyojit vyavasthaon ka anupaalan karate hain, kya yah vyavasthaen prabhaavee dhang se laagoo hain, uddeshyon ko praapt karane ke lie upayukt hain, aur kya gunavatta neeti kee theek samajh oopar se lekar neeche tak sabhee ko hai. Yah baat quality ke sambandh mein likhee gaee hai kintu yah baat safety, legal issues, ishyooj, planning, expenditure control sabhee mein laagoo hotee hai. Aap mein se jo log kaam karate hain unako pata hai ki audit aksar account se juda hota hai ki jo paise kharch kie ja rahe hain vah sahee tareeke se kharch kie ja rahe hain isake lie har organization mein ek audit vibhaag hota hai. Yahaan par ham accounts ke audit kee baat nahin kar rahe hain ham quality ke audit kee baat kar rahe hain.

**(Reference Time 11:44)**




Audit ke sambandh mein ham baat karate hain kabhee-kabhee first party audit (pratham paksh audit) kee, jahaan par ki aantarik uddeshyon ke liye sangathan dvaara ya usakee or se hee ek aayojan kiya jaata hai. The first party audit is conducted by or on behalf of the organization itself. Koee bhee organization apane hee tantr ko audit karata hai taaki internally kam se kam aantarik roop se ho yah pata chal sake ki haan, jo system mainne rakhe hain vah vaastav mein kaam kar rahe hain. Isake against second party audit bhee hota hai, yah sangathan ke graahakon dvaara ya graahakon kee or se any vyaktiyon dvaara aayojit kiya jaata hai. Aur phir hota hai third party audit, yah baaharee svatantr sangathanon dvaara aayojit kiya jaata hai jo ki aamataur par maanyata praapt hote hain aur ISO 9001 jaisee aavashyakataon ke anuroop pramaanan aur panjeekaran pradaan karate hain.

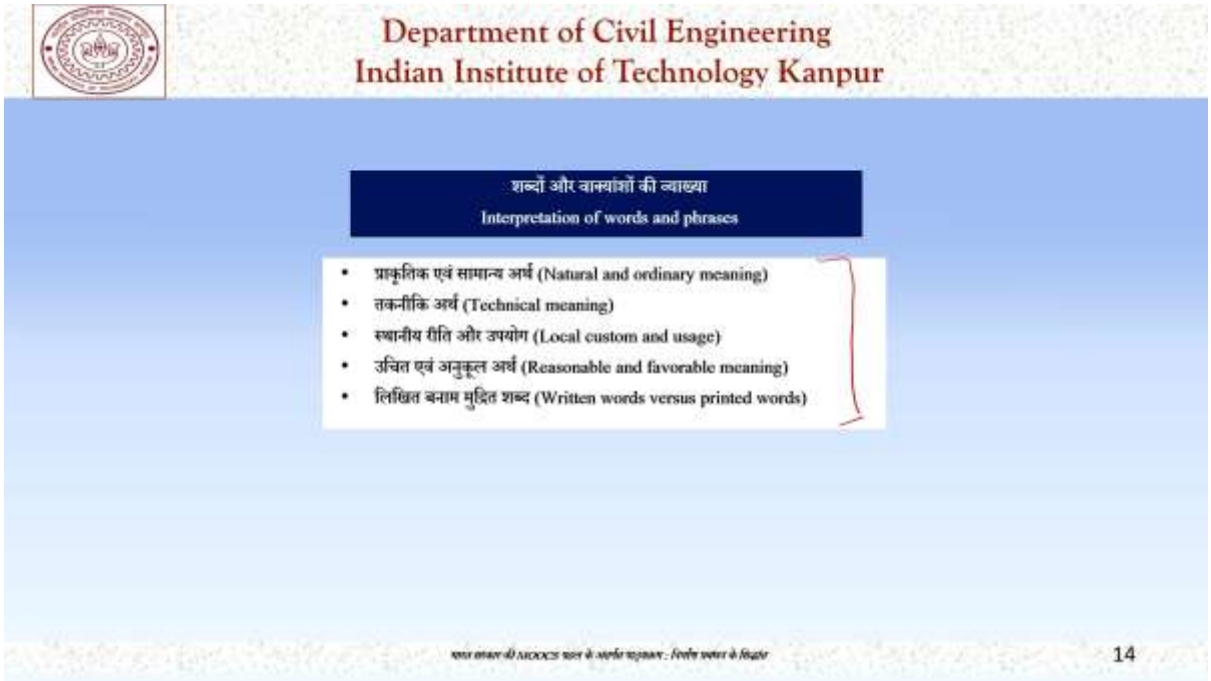
**(Reference Time 12:48)**




Isake baad baat huee anubandh prabandhan kee, yah hamane cover kiya module 7 mein, jahaan par ki hamane anubandh, vivaad, madhyasthata, teesare paksh kee bhoomika,

companiyon mein vidhi prakoshth, shram tatha any kaanoonon ke baare mein ek sankshipt charcha kee. Is module mein yah uddeshy nahin tha ki aap ek vakeel ban jae ya aap ek safety engineer ban jae ya aap ek quality control inspector ban jae, uddeshy yah tha ki ek nirmaan prabandhak ke role mein aapako in pahaluon ke baare mein kuchh jaanakaaree avashy honee chaahie. Yah course ek tareeke se students ke lie directed tha taaki ve log apanee professional life mein construction management ko aur achchhee tareeke se samajh saken, usake lie taiyaar hon.

**(Reference Time 13:46)**




Anubandh prabandhan kee charcha samaapt karane se pahale main aapake saath shabdon aur vaakyaanshon kee vyaakhya is par kuchh charcha avashy karana chaahoonga. Praakrtik evan saamaany arth (natural and ordinary meaning), takaneekee arth (technical meaning), sthaaneey reeti aur upayog (local custom and usage), uchit aur anukool arth (reasonable and favourable meaning), likh it banaam mudrit shabd (Written shabd versus printed shabd). Yah tamaam baaten kisee bhee shabd ya phrase ke lie tab mahatvapoorn ho jaatee hain jab vah ek anubandh ka part hai. Use anubandh mein kis uddeshy se yah baat likhee gaee hai is baat ko jaanana aavashyak hota hai. To letter and spirit aaph lo kee jab baat hotee hai, to letter to jo shabd hai vah hai usako likhate samay spirit kya thee, usako likhate samay kya vah spirit un words mein express kee gaee, is baat par hee bahut saare vivaad kendrit ho jaate hain ki likha to yah hai lekin jo likhana chaahate the vah yah nahin tha. Vaheen par interpretation aaph words end phrase bahut hee mahatvapoorn ho jaata hai. Agalee kuchh slides ke maadhyam se main kuchh niyam jinako ki dhyaan mein rakhakar aur yadi maamala nyaayaalay tak nahin bhee jaata hai to usake interpretation karate samay usakee vyaakhya karate samay ek site engineer ko kin baaton ka dhyaan rakhana chaahie is par charcha karenge.

**(Reference Time 15:20)**

अनुबंध को (पूरा) पढ़ा जाना चाहिए

मौलिक रूप से, दोनों पक्षों के अभिप्राय को जानने के लिए एक अनुबंध को समग्र रूप से समझा या पढ़ा जाना चाहिए। Fundamentally, a contract must be construed as a whole to gather the intention of the parties.

व्याख्या को दो चरणों वाली प्रक्रिया के रूप में देखा जा सकता है: Interpretation may be looked as a two stage process:

- यह निर्धारित करना कि कौन से दस्तावेज अनुबंध का हिस्सा हैं, determine which document(s) are a part of the contract,
- इसे अनुबंध के प्रत्येक प्रावधान को यथासंभव प्रभावी बनाना चाहिए ताकि एक-दूसरे के साथ सामंजस्य बैठाया जा सके और विसंगतियों (inconsistencies) को दूर किया जा सके। it must give effect so far as practicable to each of the contract provisions so as to bring them into harmony with each other and to reconcile inconsistencies.
- किसी भी विसंगति की स्थिति में दिए गए अग्रता या प्रधानता के क्रम को ध्यान में रखें। Take into account the order of precedence indicated in the event of any discrepancy/inconsistency.



Anubandh ko poora padha jaana chaahie arthaat maulik roop se donon pakshon ke abhipraay ko jaanane ke lie ek anubandh ko samagr roop se samajha ya padha jaana chaahie. The document of the contract should be read as a whole, ek sentence ya ek vaaky anubandh se hata karake padhane kee koshish nahin kee jaanee chaahie. Vyaakhya karate samay neeche dee gaee teen baaton ka dhyaan rakhana chaahie. Pahalee baat to yah hai ki yah nirdhaarit kiya jae ki kaun se dastaavej anubandh ka hissa hain, doosaree baat ise anubandh ke pratyek praavadhaan ko yathaasambhav prabhaavee banaana chaahie taaki ek doosare ke saath saamanjasy baithaaya ja sake aur visangatiyaan door kee ja sake aur ant mein kisee bhee visangati kee sthiti mein die gae agrata ya pradhaanata ke kram ko dhyaan mein rakha jae.

**(Reference Time 16:16)**



शब्द बनाम आंकड़े (फिगर्स) (Words versus figures)

– किसी अनुबंध में प्रदर्शित होने वाले शब्दों और अंकों के बीच यदि कोई विसंगति या अंतर होता है, तो शब्दों में लिखे अंक मान्य होंगे। In the event of any discrepancy between words and figure appearing in a contract agreement, the words will prevail.

हटाए गए शब्द बनाम परिवर्तन (Deleted words versus alterations)

– अनुबंध पर हस्ताक्षर करने से पहले किए गए विलोपन (या डिलीशन) नहीं माने जावेंगे। अनुबंध पर हस्ताक्षर होने के बाद किए गए परिवर्तन बाध्यकारी हैं। इसलिए अनुबंध को व्याख्या के उद्देश्य से संशोधित रूप में पढ़ा जाना चाहिए। Deletions made before the contract is signed are not to be considered and alterations made after signing the contract are binding. The contract is therefore to be read as amended for the purpose of interpretation.

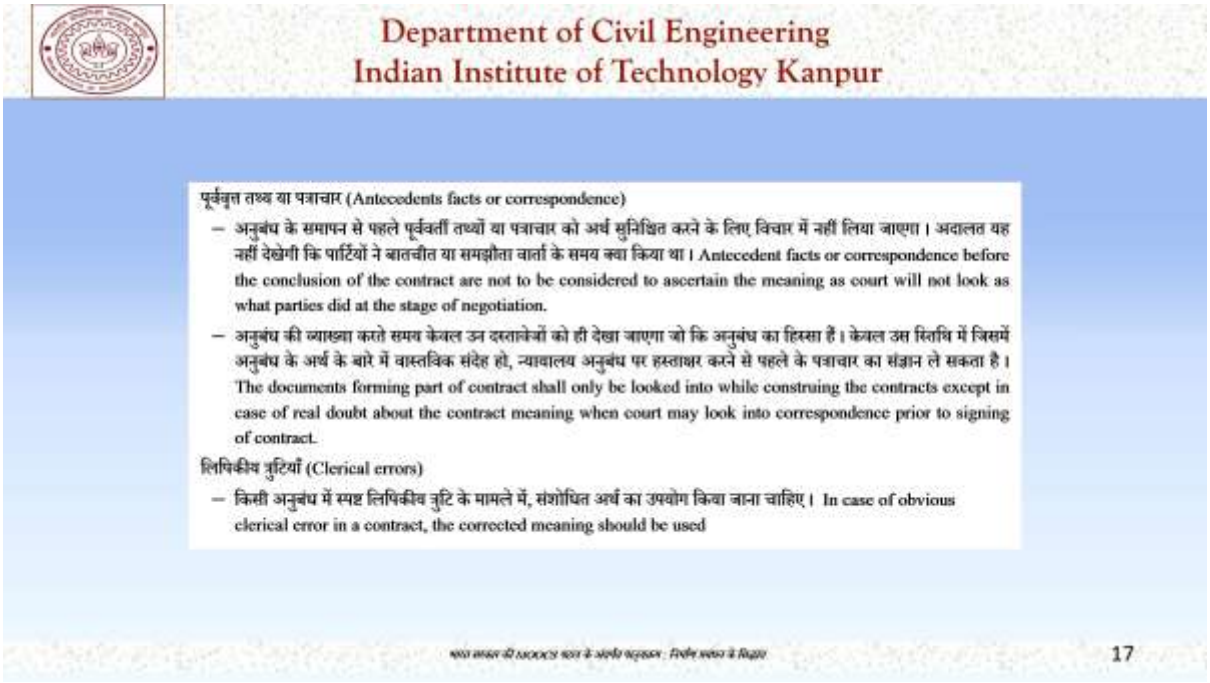
सामान्य बनाम अनुबंध के विशिष्ट प्रावधान (General versus specific provision of the contract)

– यदि किसी अनुबंध में एक ही बात के बारे में सामान्य और विशेष दोनों प्रावधानों में चर्चा की गयी है, तो विशेष प्रावधान प्रभावी होंगे। If an agreement contains both general and special provisions relating to the same thing, special provision will prevail.

Phir baat aatee hai shabd banaam aankade (figures) mein die gae values kee. Kisee anubandh mein pradarshit hone vaale shabdon aur ankon mein yadi visangati ya antar hota hai to shabdon mein likhe gaye ank maany honge.

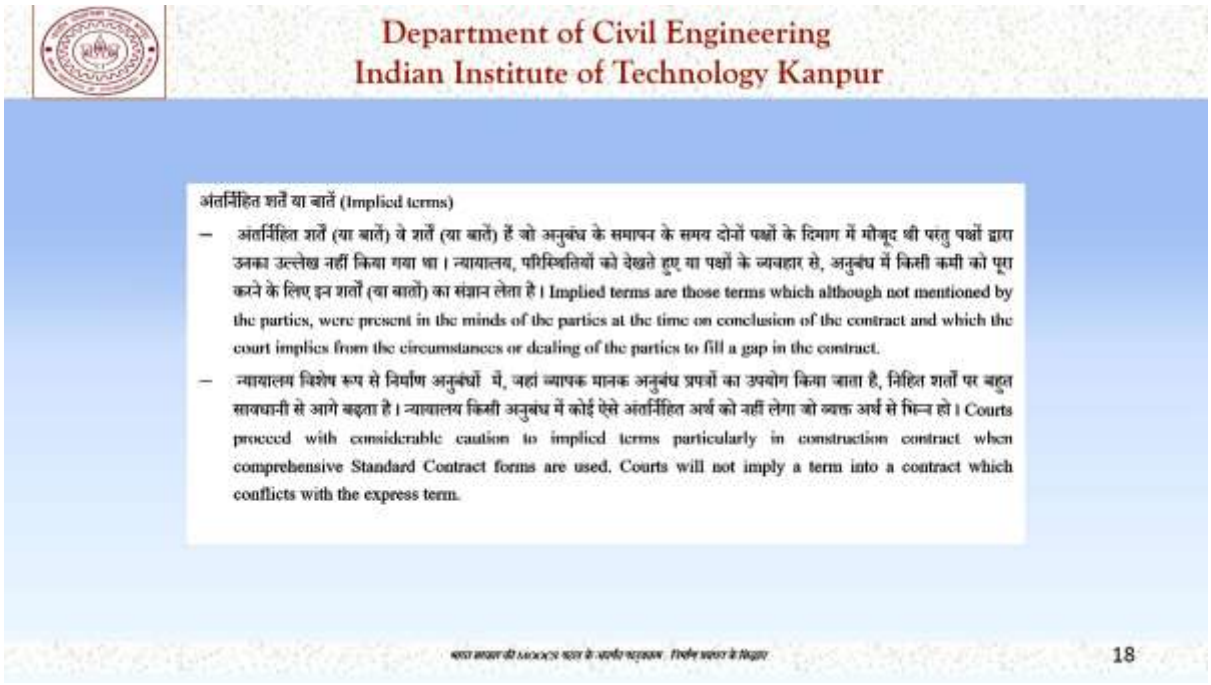
Hatae gae shabd banaam parivartan (Deleted shabd versus alterations). Anubandh par hastaakshar karane se pahale kie gae vilopan ya deletions nahin maane jaenge. Anubandh par hastaakshar hone ke baad kie gae parivartan baadhy honge. Isalie anubandh ko vyaakhya ke uddeshy se sanshodhit roop mein hee padha jaata hai jo puraane deletions hain vo deleted rahenge lekin baad mein agar deletions kiya gaya hai to vah maany nahin hoga.

**(Reference Time 17:22)**



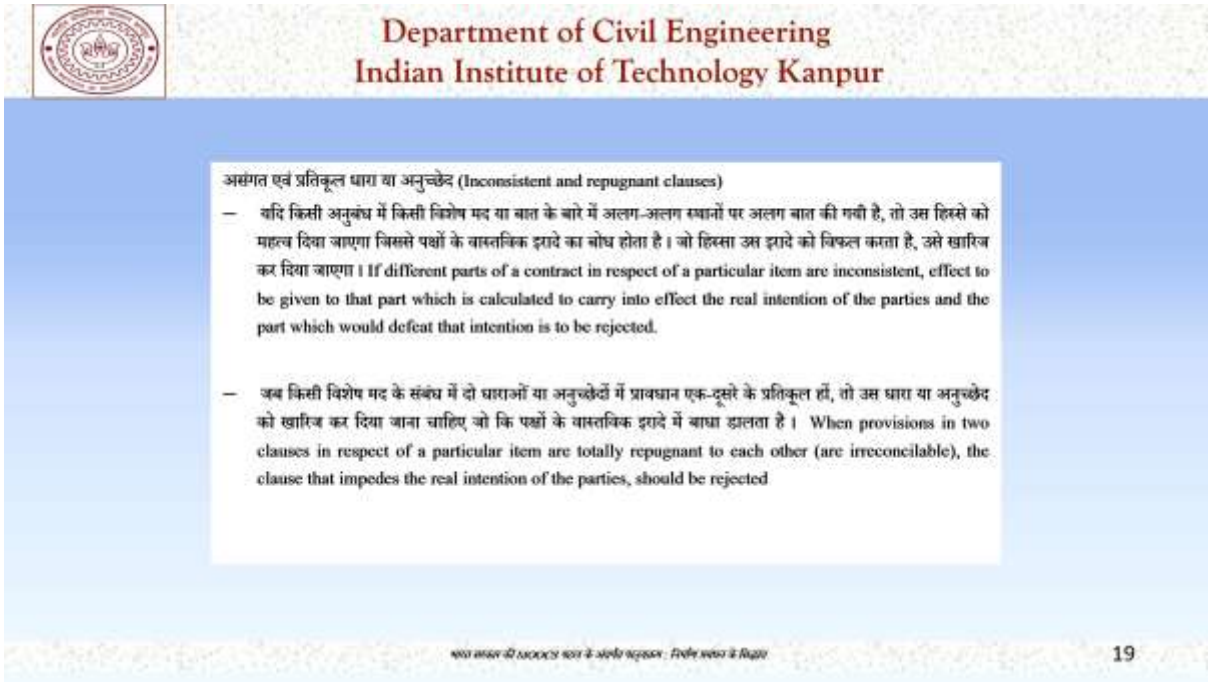

Saamaany banaam anubandh ke vishisht praavadhaan (General versus Specific Provisions in the Contract). Yadi kisee anubandh mein ek hee baat ke baare mein saamaany aur vishesh donon praavadhaanon mein charcha kee gaee hai to vishesh praavadhaan prabhaavee maane jaenge. Antecedent facts aur correspondence arthaat poorvavrtt tathy ya patraachaar anubandh ke samaapan ya hastaakshar ke pahale poorvavartee tathyon ya patraachaar ko arth sunishchit karane ke lie vichaar mein nahin liya jaega arthaat vah patraachaar anubandh ka ek bhaag nahin hota hai. Adaalat ya nyaayaalay yah nahin dikhegee ki partiyon ne baatacheet ya samajhauta vaarta ke samay kya kiya tha. Samajhauta vaarta ya negotiations jab chal rahe the vah anubandh hastaakshar hone ke pahale kee baat hai, antat: jo hastaaksharit anubandh hai vah hee maany hoga. To usake pahale hue patraachaar kee koee vaidhata nahin hotee. Anubandh kee vyaakhya karate samay keval un dastaavejon ko hee dekha jaega jo ki anubandh ka hissa hain keval us sthiti mein jisamen ki anubandh ke arth ke baare mein vaastavik sandeh ho, nyaayaalay anubandh par hastaakshar karane se pahale ke patraachaar ka sangyaan le sakata hai. Haan, lipikeey trutiyaan ya clerical errors jo bhee hotee hain unako errors ke roop mein maana ja sakata hai. Kisee anubandh mein spasht roop se yadi koee lipikeey truti hai to sanshodhit arth ka upayog kiya jaata hai.

**(Reference Time 18:43)**



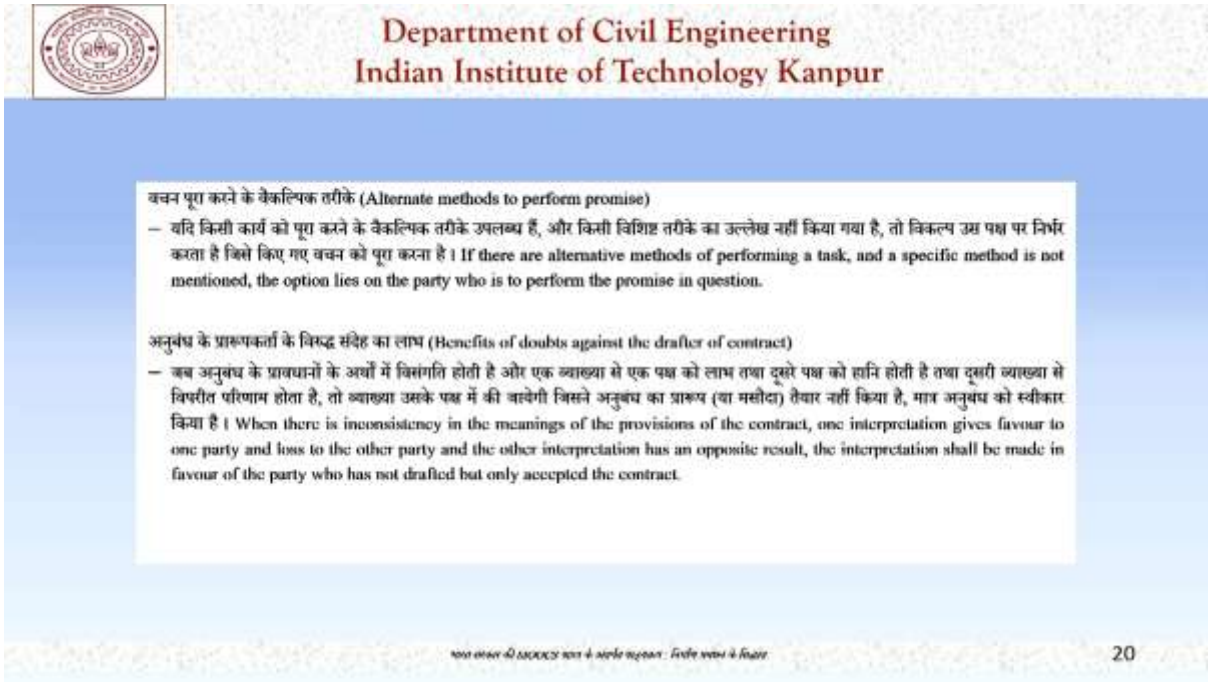

Implied terms (antar nihit sharten ya baaten), anubandh prabandhan mein ek aur tarm kabhee-kabhee sunane mein aata hai vah antarnihit sharte ya baaten. Yah implied terms kya hote hain? Ve sharten ya baaten hain jo anubandh ke samaapan ke samay donon pakshon ke dimaag mein maujood thee parantu pakshon dvaara unaka ullekh anubandh mein spasht roop se nahin kiya gaya ya pratyaksh roop se nahin kiya gaya, lekin yah maana gaya ki yah to maatr samajh liya gaya ki donon logon ne kuchh samajha hai lekin usako likha nahin. Nyaayaalay paristhitiyon ko dekhate hue ya pakshon ke vyavahaar se anubandh mein kisee kamee ko poora karane ke lie in sharton ya baaton ka sangyaan letee hai. To jo paroksh roop se donon logon ke mastishk mein jo baaten thee yadyapi vah hastaakshar hone ke samay kisee kaaran se anubandh mein nahin likhee gaee lekin agar yah pratyaksh ho jaata hai, tay ho jaata hai yah bilkul obvious ho jaata hai yah to raha hee hoga, tab nyaayaalay unaka sangyaan le sakatee hai. Lekin nyaayaalay vishesh roop se nirmaan anubandhon mein jahaan vyaapak maanak anubandh prapatron ka prayog kiya jaata hai nihit sharton arthaat implied meanings par bahut hee saavadhaanee se aage badhatee hai. Nyaayaalay kisee anubandh mein aise antarnihit arth ko nahin lena chaahegee jo kee vyakt arth se bhinn ho.

**(Reference Time 20:29)**



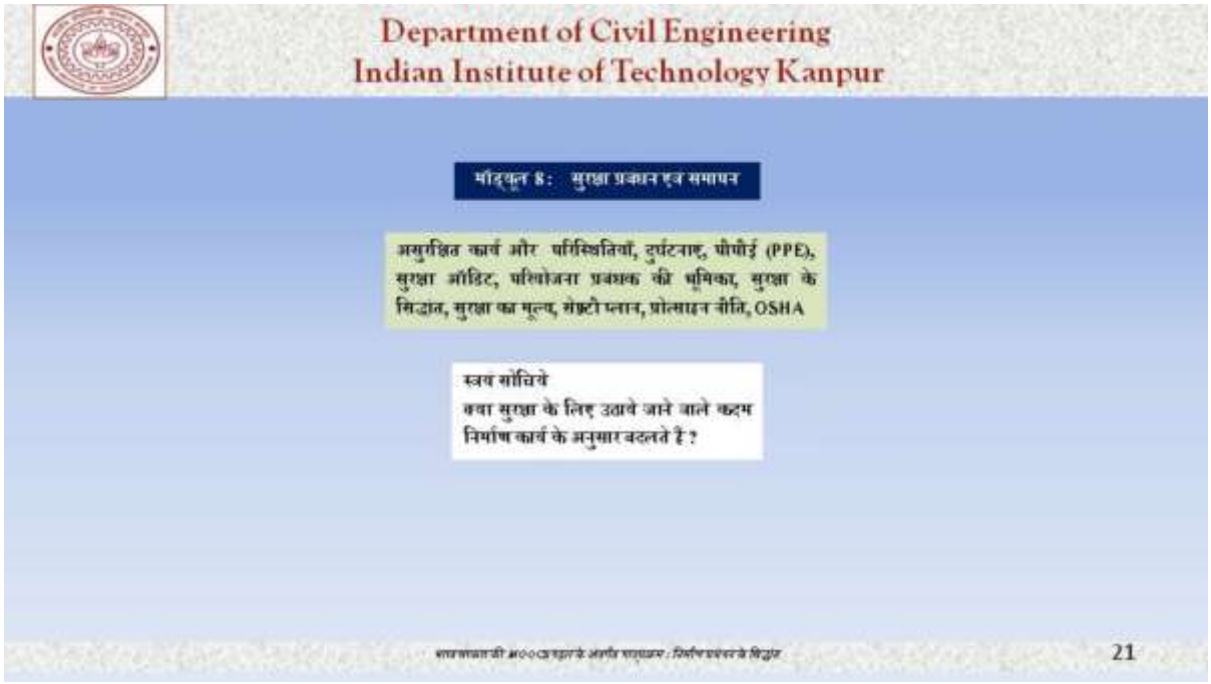

Asangat evan pratikool dhaara ya anuchchhed (In consistent and Repugnant Clauses) yadi anubandh mein kisee vishesh mat ya baat ke baare mein alag-alag sthaanon par alag-alag baat kee gaee hai, to us hisse ko mahatv diya jaega jisase pakshon ke vaastavik iraade ka bodh hota hai jo hissa is iraade ko viphal karata hai use nirast kar diya jaega. Jab kisee vishesh madhy ke sambandh mein do dhaaraon ya anuchchhedon mein praavadhaan ek doosare ke pratikool hon to us dhaara ya anuchchhed ko nirast kiya jaana chaahie jo ki pakshon ke vaastavik iraade mein baadha daalata hai, kahane ka arth yah hai kee vyaakhya karate samay yah dhyaan mein rakhana chaahie ki donon pakshon ka iraada kya tha intention kya tha aur us intention ko pa oora karane ke lie yadi alag-alag jagahon par alag-alag baat kee gaee hai to vah baat maany hai jo ki us intention ke prati positive hai us direction mein jaatee hai us intention ko viphal karane kee baat nirast kar dee jaegee, to intention pradhaan hota hai interpretation karate samay.

**(Reference Time 21:41)**



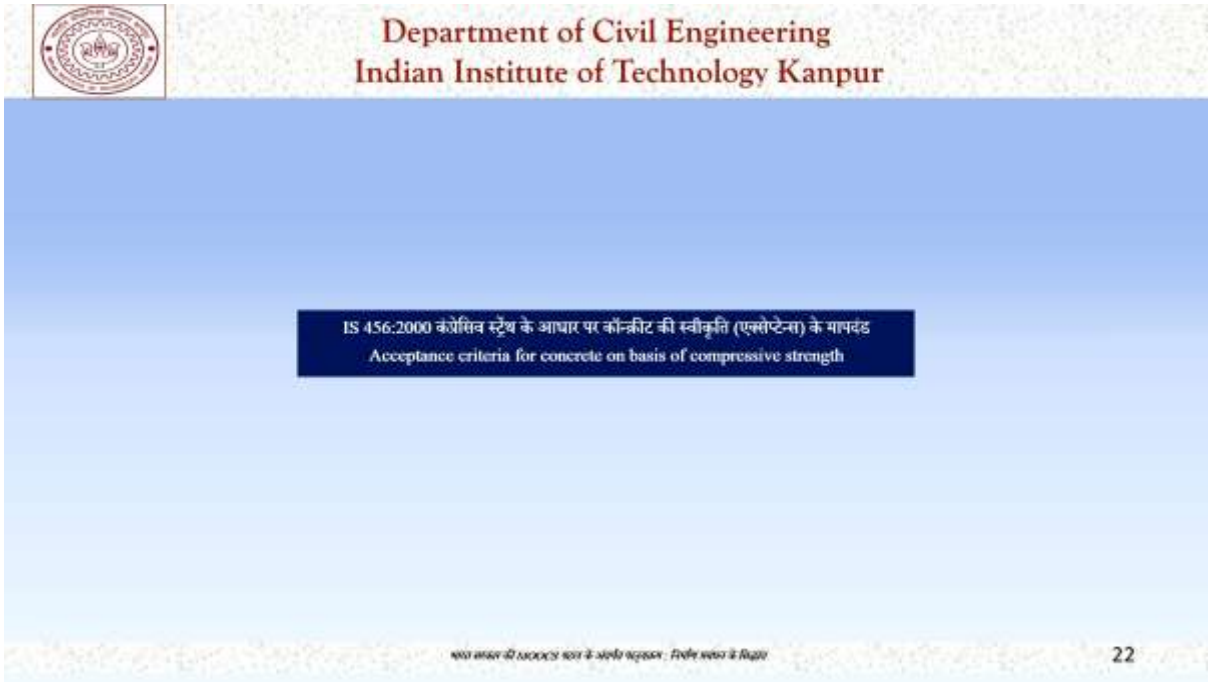

Vachan poora karane ke vaikalpik tareeke. Kisee nirmaan kaaryon mein vishesh roop se kisee bhee kaary ko poora karane ke vaikalpik tareeke maujood hote hain aur kisee vishesh tareek ka ullekh na kiye jaane ke case mein vikalp us paksh par nirbhar karata hai jise ki vachan poora karana hai. To jise kaary karana hai vah svatantr hota hai kis tareeke se kaary kiya jae yah tay karane ke lie. Yadi use kaary karane ke tareeke ko anubandh mein likha nahin gaya hai, to agar tunnel kee lining karanee hai aur likha nahin gaya hai ki kis tareeke se lining karanee hai to jo lining kar raha hai usake haath mein yah svatantrata hogee ki ham is prakaar se lining karenge aur is prakaar se nahin karenge. Haan, svatantrata avashy hai lekin usaka ek plan usako client ko dikha karake usaka approval avashy lena hota hai. Anubandh kee vyaakhya mein sandeh ka laabh (benefit of doubt). Yadi anubandh ke praavadhaanon ke arthon mein visangati hotee hai aur ek vyaakhya se ek paksh ko laabh hota hai aur doosare paksh ko haani hotee hai tatha doosaree vyaakhya se vipareet parinaam hota hai to vyaakhya us paksh mein maanee jaegee jisane anubandh ka praaroop taiyaar nahin kiya hai maatr anubandh ko sveekaar kiya hai. Yadyapi anubandh mein hastaakshar karate samay donon hee paksh hastaakshar karate hain lekin 99 percent cases mein balki 99.9 percent cases mein ek paksh anubandh ka praaroop taiyaar karata hai aur doosara paksh maatr us par hastaakshar kar deta hai. To yadi vyaakhya karate samay ek interpretation se ek vyakti ko (ek paksh) ko laabh hota hai aur doosare interpretation se doosare paksh ko laabh hota hai to laabh us paksh ko pahunchaaya jaata hai jisane kee maatr hastaakshar kie hain, jisane kee anubandh ka praaroop taiyaar nahin kiya hai.

**(Reference Time 23:59)**



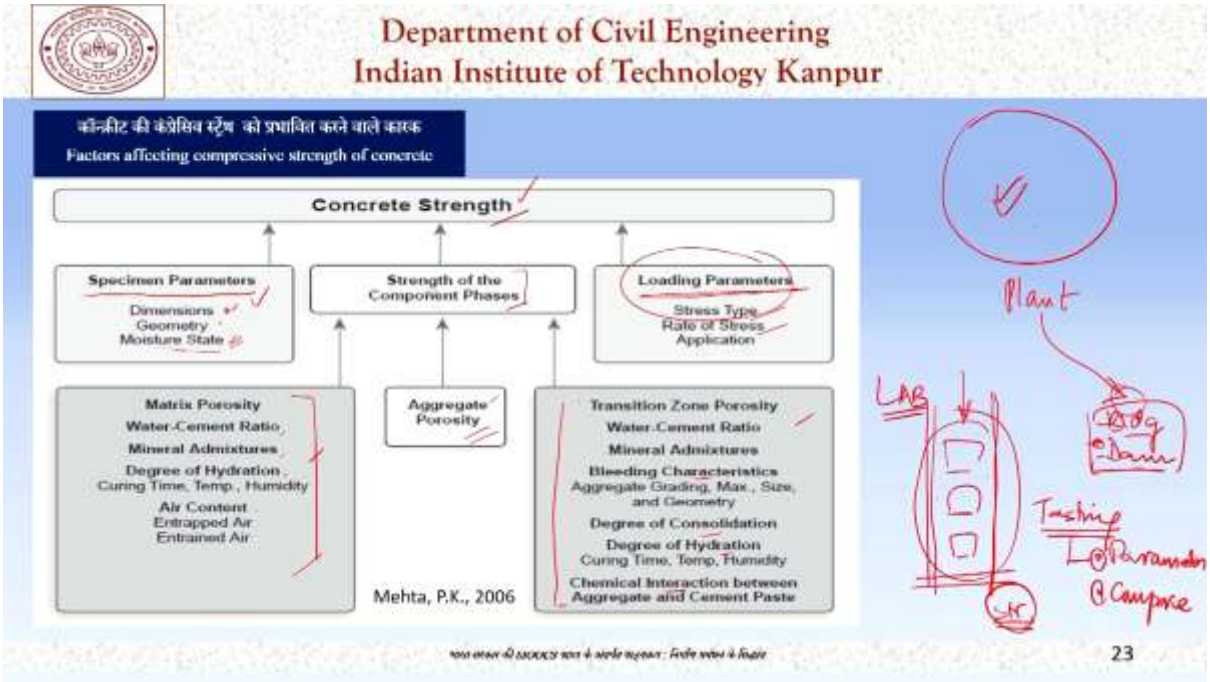

Yahaan tak to charcha thee is paathyakram mein cover kie gae 8 modals kee.

**(Reference Time 24:04)**



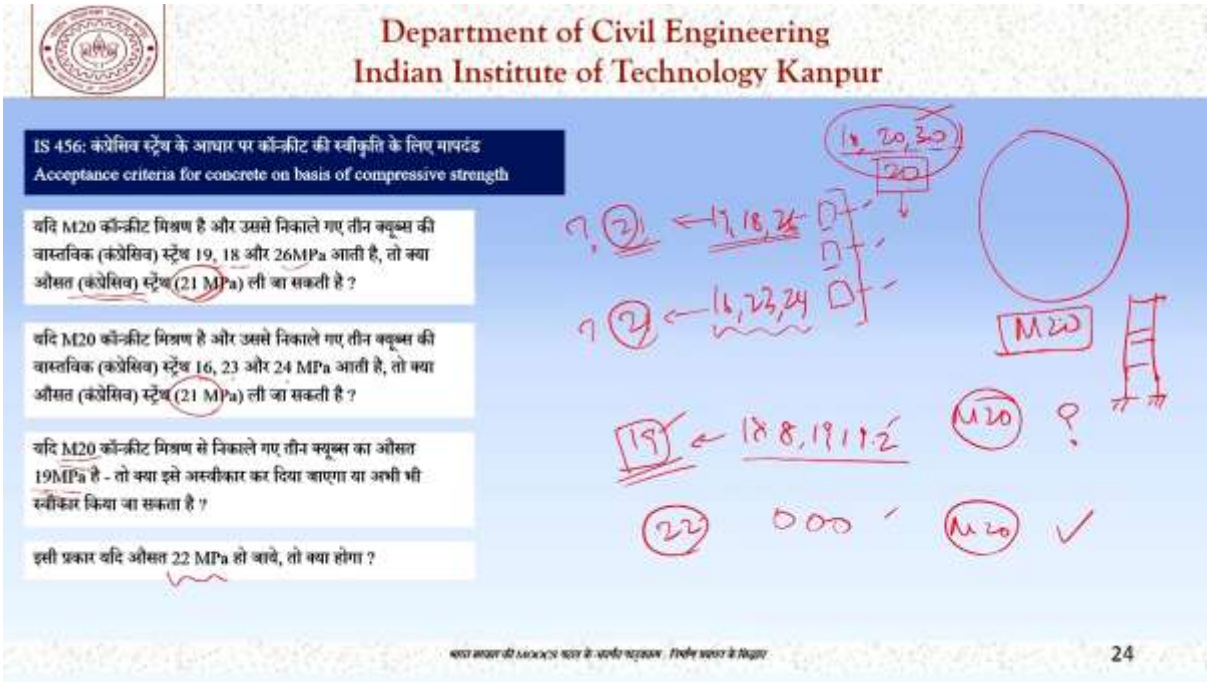

Paathyakram samaapt karane se pahale compressive strength ke aadhaar par concrete kee sveekrti (acceptance) ke maapadand is baat par main vishesh dhyaan aakarshit karana chaahata hoon aur sankshipt charcha karana chaahata hoon. Yah charcha IS 456 2000 mein die gae praavadhaanon ke aadhaar par hai aur meree vyaktigat vyaakhya hai. Is par aap svayan vichaar karie aur samajhane kee koshish karie kee kya yah vyaakhya sahee hai ya isake kuchh any interpretation ho sakate hain?

**(Reference Time 24:38)**



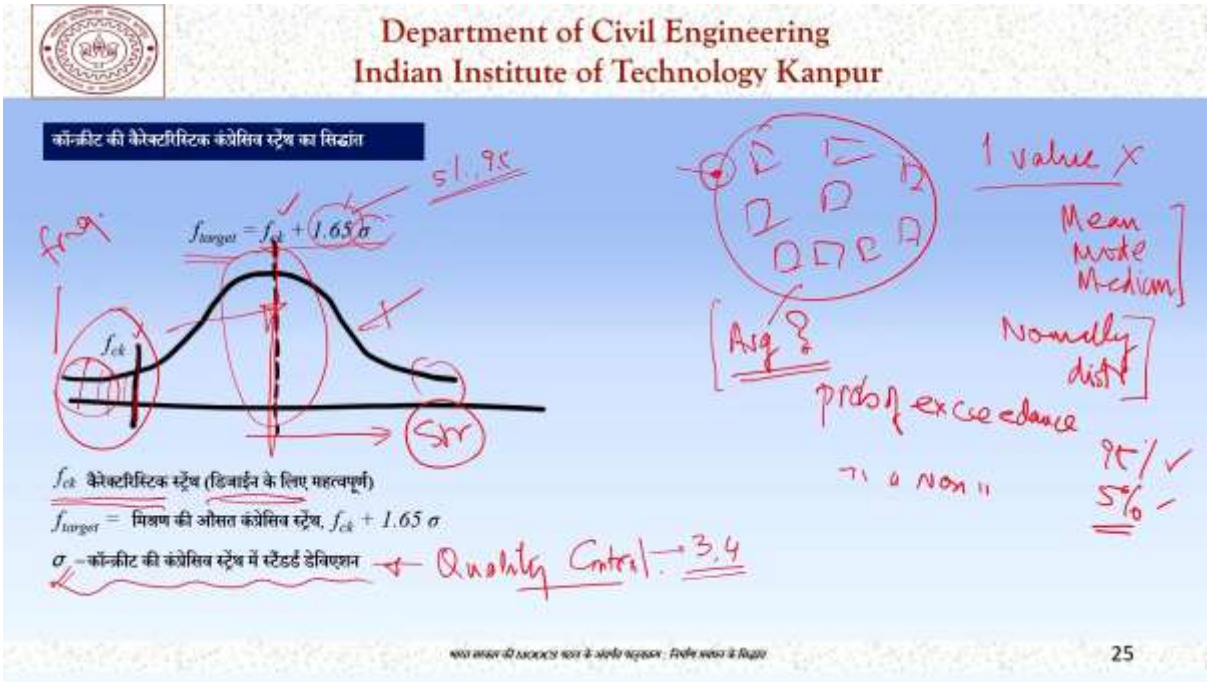

To pahalee baat to yah hai ki antatah concrete kee compressive strength kin kaarakon se nirdhaarit hotee hai main Mehta jee kee kitaab concrete se liya hai aur isamen diya gaya hai ki concrete kee strength specimen ke parameter arthaat kis prakaar ka specimen main use karata hoon, usake dimensions kya hai usakee geometry kya hai aur usakee moisture state kya hai? Hamaara concrete ka cube hai ya cylinder hai vah 10 divided by 20 hai ya 15 into 15 into 15 hai ya 15 into 30 hai vah cylinder ya cube curing pond se nikaalane ke baad kaise rakha gaya hai kitanee der rakha gaya hai aur usamen kitana moisture hai. Phir baat aatee hai constituent phases kee apanee strength ke baare mein. Isako ham teen tareeke se dekh sakate hain yah tamaam factors matrix kee porosity jo kee water cement ratio, mineral admixture, degree of hydration, curing time, temperature humidity, air content, in sab baaton par nirbhar karatee hai. Phir baat aatee hai aggregate kee porosity kee aur usake saath baat hotee hai transition zone porosity, bleeding characteristics, consolidation, hydration, chemical interaction tamaam baaton kee aur antatah loading parameters arthaat ham jo specimen lete hain jinamen kee in tamaam baaton ke aadhaar par ek mishran taiyaar kiya gaya aur us mishran ko kis prakaar ham test karate hain usamen ham kis prakaar ka load lagaate hain kis rate par lagaate hain in sab baaton se determine hotee hai compressive satrenth. Concrete kee strength kee charcha karate samay yah hamesha dhyaan mein rakhiega ki jo concrete ham apane ready mix concrete plant se laate hain usako ham apanee building mein apane bridge mein ya apane dam mein use kar lete hain. Is building mein, dam mein ya bridge mein jo concrete aayee usakee strength kya thee usako ham test karate hain kuchh specimens lekar. Yah specimens ham apanee lab mein test karate hain. Ham apanee building ya dam se liya gaya specimen adhikaanshat: test nahin karate arthaat ham yah maanate hain ki yah strength yahaan par jo strength aa rahee hai usaka ek representative hai isake lie yah aavashyak hai ki yah jo concrete hamane liya hai ya yahaan par use hone vaale concrete ke samaan hon ek hee ho aur saath hee saath usaka jo vaataavaran hai jis temprechar mein jis conditions mein vah cure ho rahee hai vah usake saath hee ho aapako dhyaan hoga ki testing ke samay jab ham quality kee charcha kar rahe the tab hamane charcha kee thee do baaton kee thee ki testing ka ek uddeshy hota hai parameters ko tay karana aur doosara hota hai parameters ko compare karana to ham ek standard conditions mein concrete kee testing karate hain aur un standard conditions mein jo strength aatee hai vah ham maan lete hain ki is concrete kee strength thee aur yah concrete yahaan par building mein use huee. Yah larger picture jab aap samajh jaate hain tab ham aage badhate hain acceptance criteria kee or.

**(Reference Time 28:32)**




Aur balki acceptance criteria kee or badhane se pahale kuchh prashn aapase poochhana chaahata hoon yadi m20 concrete mishran hai ek mix hai jo kee m20 designated hai use nikaale gae teen cubes kee vaastavik compressive strength 19, 18 aur 26 MPa aankee jaatee hai to kya ek ausat strength ke roop mein ham 21 MPa ka prayog kar sakate hain ham 18, 19 aur 26 ka yadi ausat nikalenge to sambhavat: 21 aa jaega lekin kya 21 ham vaastav mein is concrete ka compressive strength le sakate hain? Doosara prashn thoda badala hua pahaloo hai jahaan par ki strength 19, 18 aur 26 na hokar ke 16, 23 aur 24 aa gaee to kya yahaan par bhee ham 21 ka ausat strength le sakate hain? Baat ho rahee hai yah concrete tha ek large (badee) quantity yahaan par, ek badee quantity concrete kee thee aur usase hamane yah teen cube lie in teen cubes kee strength 18, 19 aur 26 aaee aur doosare case mein 16, 23 ya 24 aaee to kya isaka ausat 21 liya ja sakata hai. Yah vichaar karane kee baat hai. Hamen sochana yah hota hai ki ausat jab ham lete hain ham kyon lete hain ham ausat tab lete hain jab in teenon values mein bahut adhik antar na ho tab to ausat lena uchit hai yah statistics ka siddhaant hai. Agar ham 10, 20 aur 30 ka ausat le lenge to 20 avashy aa jaega. Kya yah 20 is sample kee expected value ya true value ko represent karata hai is baat ke lie maanakon mein yah ensure karane ke lie kaha gaya hai yah nishchit karane ke lie kaha gaya hai ki ausat tab leejie jabaki in teenon values mein bahut adhik phark na ho ab bahut adhik phark na ho isaka ek quantitative meaning hona chaahie aur vah main chhodata hoon philahaal aapake lie. Concrete kee acceptance se hee juda ek aur prashn hai ki yadi m20 concrete ke lie nikaale gae teen cubes ka ausat 19 MPa aa jaata hai internal inconsistency kee baat nahin hai yahaan par ho sakata hai valuej 18.8, 19 aur 19.2 hon jinaka ki ausat ham 19 report kar rahe hain ab yah 19, m20 concrete ke lie kya acceptable ho sakatee hai aur haan agar yahee ausat 22 aa jae to yahaan par jo teenon values hain vah is prakaar se hon ki usakee ausat 22 ho jae to kya m20 concrete ke lie yah maany ho jaegee in baaton par ek nyaayasangat aur tarkasangat vichaar hona chaahie taaki ham acceptance kar sake taaki ham yah nirdhaarit kar sake ki kaun se sample acceptable hain kya hamaaree concrete jo hamaare maanakon ke anusaar maangee gaee hai hamane agar kaha hai ki is building mein m20 concrete lagaee jaegee to in concretes mein kaun see concrete acceptable hai aur kaun see concrete acceptable nahin hai is baat kee charcha honee hai.

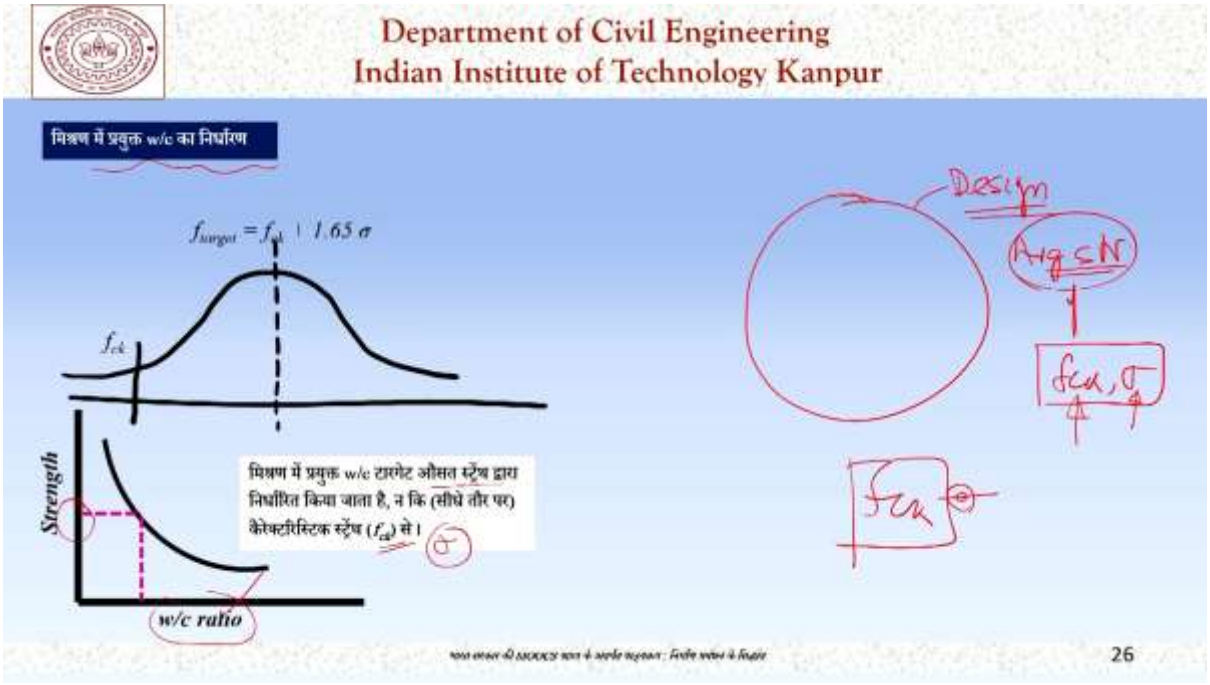
**(Reference Time 32:16)**




Isake lie yah aavashyak hai ki ham concrete kee characteristic compressive strength ka siddhaant phir se dekh len ham yah maanakar chalate hain ki agar concrete ke kaee sample test kie jaenge to vibhinn kaaran hain ki usamen ek hee value nahin aaegee ham ek hee value nahin paenge ham usamen ek variation paenge jo ki is prakaar se hoga kuchh kaam bahut kam honge kuchh jyaada honge aur kuchh aise honge jo ki bahut adhik honge statistics mein ham teen parameters kee baat karate hain mean, mode aur medium ab yahaan par unakee charcha karana to mushkil hai lekin aap sab is baat ko samajh rahe honge agar ham concrete kee strength ko normally distributed maanate hain ki agar ham ek large sample lete hain aur kaee jagahon se sample lekar usakee ek strength nikaalate hain to hamako ek normally distributed curve milega yahaan par is axis par hamaaree compressive strength hai aur is axis par frequency of occurrence hai is curve ke aadhaar par characteristic strength (fck) paribhaashit kee gaee hai jo kee design ke lie bahut hee mahatvapoorn hotee hai aur yah vo strength maanee gaee jisamen ki probability of accidents 95 percent hai arthaat probability of non accidents maatr 5 percent hai to agar ham bahut saare sample lete hain to vah value jisakee ki exceed hone kee probability arthaat determined compressive strength kee value ka fck se adhik hona is baat kee probability 95 percent ho aur usakee is strength se kam hone kee probability maatr paanch percent ho us strength ko ham kahate hain characteristics strength. Isake aadhaar par design kiya jaata hai concrete kee characteristics to fck ho gaee lekin jab concrete ka mishran banata hai vah to yah hai is concrete ke mishran kee characteristics strength fck ho isake lie isakee average strength kya honee chaahie isakee ausat strength kya honee chaahie. Average strength to yahaan par hai jab ham bahut saare sample test karate hain to ausat to yahaan par hai 95 percent probability ke accidents kee value yahaan par hai to F target arthaat target mean strength jisake ki aadhaar par ham mishran ke tamaam parameters ko tay karate hain usako ham nikaalate hain fck plus 1.65 sigma. Yah sigma kya hai? Sigma hai concrete kee compressive strength mein standard deviation. Yah hamaare quality control par nirbhar karata hai agar hamaara quality control concrete ke nirmaan ka quality control bahut achchha hai to hamaara sigma kam hoga lekin agar hamaara quality control utana strong nahin hai to sigma adhik hoga to yah maanate hue ki hamaara quality control ek sarten leval ka hoga ham shuruaat mein sigma kee ek value chaahe vah 3 MPa ho ya 4 MPa ho yah maanakar chalate hain yah maanakon mein diya hua hota hai. Sigma pata

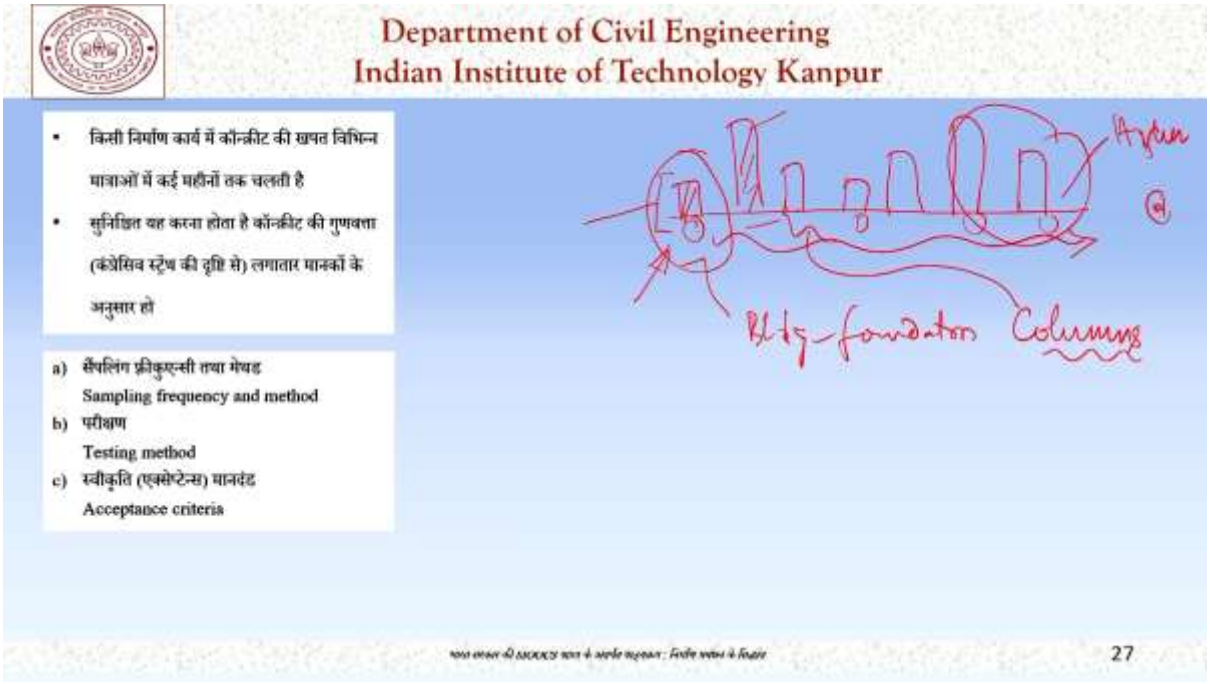
chal gaya fck hamen pata hai aur yah 1.65 ka factor aa raha hai hamaare 5 percent ya 95 percent yahaan par jo ham probability kee baat kar rahe hain vahaan se yah factor aa raha hai 1.65. To hamaaree target strength nirdhaarit ho jaatee hai.

**(Reference Time 36:31)**



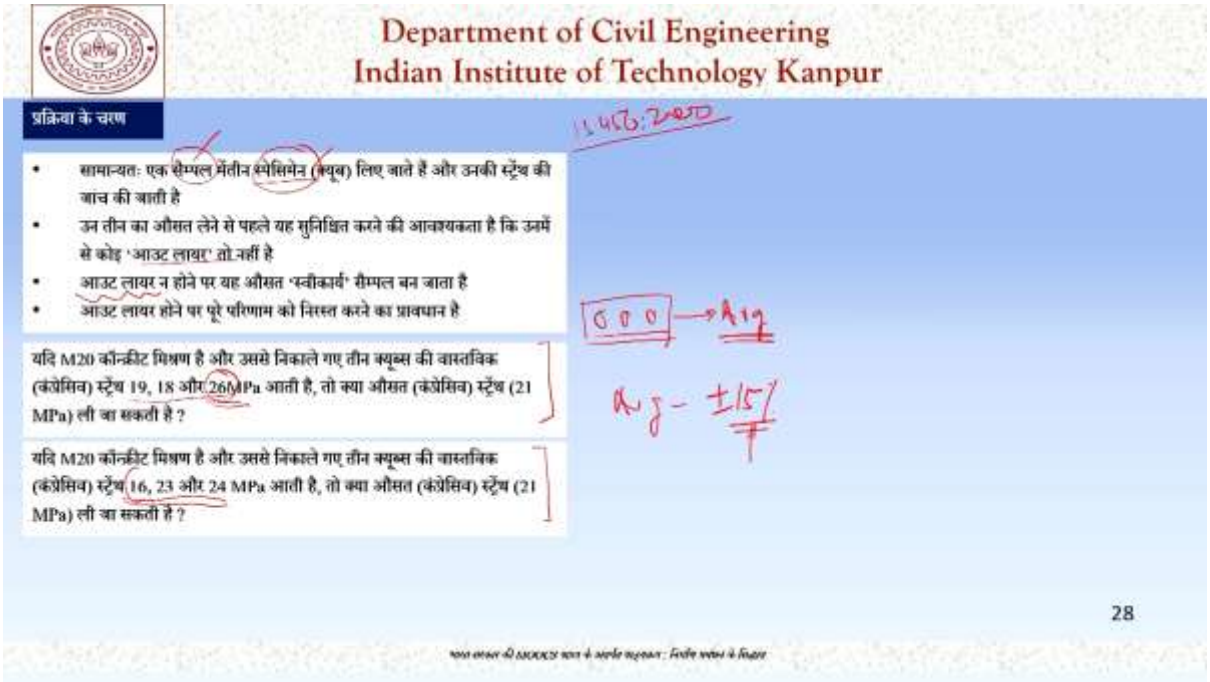

Aur target st renth nirdhaarit ho jaane ke baad ham use target strength ke aadhaar par water cement ratio tatha any parameters tay karate hain to ham mishran mein prayukt hone vaale water cement ratio aadi target ausat strength dvaara nirdhaarit karate hain na ki seedhe taur par characteristics strength fck se aur fck ke alaava ham sigma ko apanee soch mein jodate hain aur use target strength nikaalate hain aur water cement ratio aadi nirdhaarit karate hain. To sankshep mein ek baar phir se samajh len ki ham is concrete ka jo design hai material perspective se ham design karate hain ek average strength ke aadhaar par aur vah average strength aatee hai characteristics strength aur sigma ke aadhaar par to acceptance criteria tay karate samay hamen dekhana yah hai ki jo concrete hamane ek fck value ko lekar apanee building mein, apane dam mein, apane bridge mein lagaane kee baat kee hai vah kya un maanakon ko poora karatee hai lekin us concrete ka design fck hee nahin balki sigma ko jodakar kiya gaya hai aur usakee ausat strength average strength hai na ki characteristics strength.

**(Reference Time 38:00)**



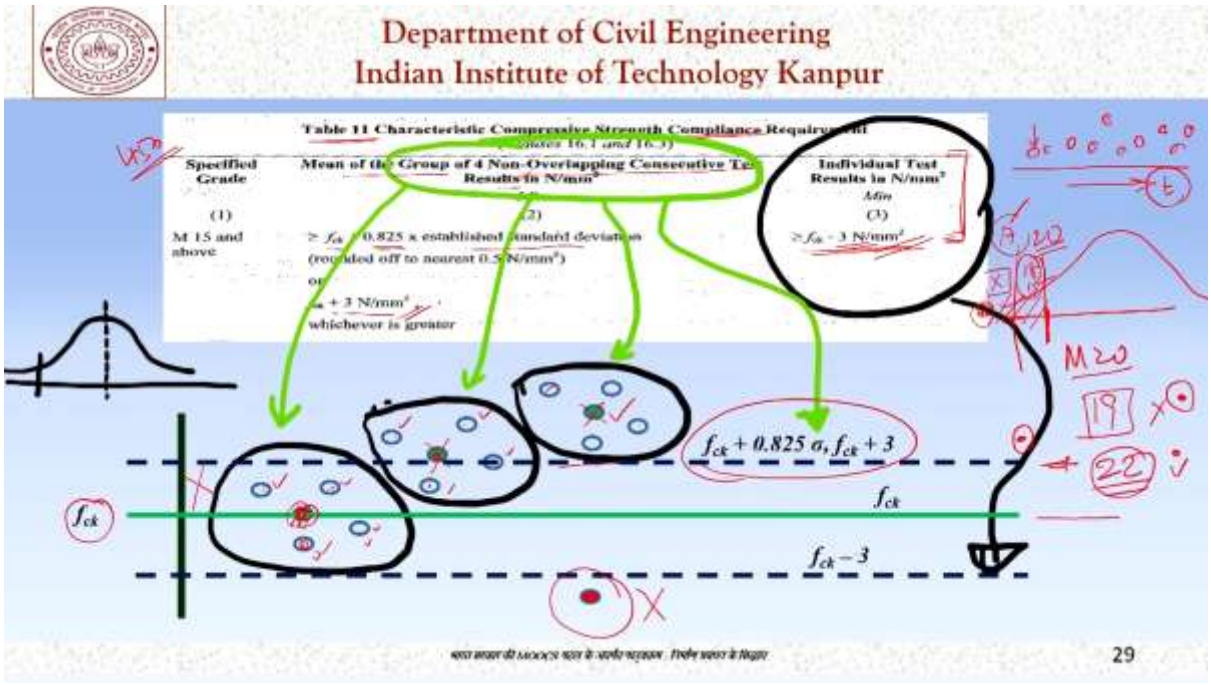

Aaiye aage badhate hain yah dhyaan mein rakhen ki kisee nirmaan kaary mein concrete kee khapat vibhinn maatraon mein kaee maheeno tak hotee rahatee hai kaee maheeno tak kabhee kam kabhee jyaada tamaam concrete prayog karate hain kaee maheeno tak ham thodee ya adhik concrete prayog karate rahate hain sunishchit yah karana hai ki concrete kee gunavatta compressive strength kee drshti se lagaataar maanakon ke anusaar ho to chaahe vah yahaan par ho, chaahe vah yahaan par ho, chaahe vah yahaan par ho, yahaan par ho, kaheen bhee kisee bhee samay concrete kee gunavatta us samay tay karake aage badhana hota hai aap samajh hee gae honge ki jab ham yahaan kee baat kar rahe hain concrete kee shuruaat kee tab ho sakata hai ham buildings kee foundation kee baat kar rahe hain, ho sakata hai jo ham yahaan kee baat kar rahe hon to ham shuruaat kee columns kee baat kar rahe hain neeche vaale storage mein use hone vaale columns kee baat kar rahe hain jab ham yahaan par aa jaate hain to ham haee restorage mein columns/slabs, beam jo bhee hai unakee baat kar rahe hain to ham yahaan par pahunchane ke baad ham yah nahin kah sakate hain ki yahaan par jo concrete use huee vah hamaare maanakon ke anusaar nahin thee to jab ham chaahe yahaan par ho chaahe yahaan par ho chaahe kaheen bhee concrete ke sample lete hain hamen kin baaton ko dhyaan mein rakhana chaahie sampling frequency and method. Hamen kitane sample lene hain kis prakaar se lene hain agar concrete kee maatra kam hai to ham kam sample len concrete kee maatra adhik hai to adhik sample len yah baat bhee maanakon mein dee huee hotee hai kis prakaar se unaka pareekshan hoga aur kis prakaar se sveekrti ya acceptance ke kya maanadand honge.

**(Reference Time 39:53)**




To ek baar phir se prakriya ke charan ya steps jinako hamen follow karana chaahie ham aapako dikhaate hain saamaanyatah ek sample mein teen specimen cube lie jaate hain aur unakee strength kee jaanch kee jaatee hai to ham do shabdon ka prayog kar rahe hain specimen aur sample. Ek sample mein teen specimen hote hain un teenon ka ausat lene se pahale yah sunishchit karane kee aavashyakata hai ki unamen koee outlier to nahee hai. Outlier na hone kee sthiti mein yah sveekaary sample ban jaata hai. Sveekaary sample banane ke baad hee ham us par vah test lagaate hain ki ham is sample ko expect karen ya na karen quality ke aadhaar par. Outlier na hone kee sthiti mein yah ausat sveekaary sample ban jaata hai. Isake baat yah baat aatee hai ki sveekaary sample hamaare maanakon ko poora karata hai ya nahee. Outlier hone par poore parinaam ko nirast karane ka praavadhaan hai. Yah praavadhaan IS 456 2000 ke anusaar hai. Yah steps ISO 456 2000 ke anusaar hain. Aur ek baar phir se jab ham ek example lenge tab main samajhata hoon ki aapako aur bhee clear ho jaayega. Jahaan tak outliers kee baat hai yah udaaharan aur yah udaaharan ye dono phir se ek baar aapako dikhaata hoon ki yahaan par kya ham is 26 ko outlier maan sakate hain? Kya ham yahaan par 16 ko outlier maan sakate hain? Jab hamane pichhalee baar is slide par charcha kee thee hamane kaha tha ki teen volumes ka average tab lena chaahiye jab ki isamen bahut adhik variation na ho yah variation hona ya na hona hee outlier ka siddhaant hai.s Ab inamen se koee outlier hai ya nahee yah tay karane ke liye IS 456 mein maanak diya hua hai ki agar average se plus minus 15 percent se adhik kee individual value aatee hai to ham usako outlier maanenge lagaataar is paathyakram mein is baat par jor diya gaya hai ki siddhaant ek hota hai aur jab usako quantify karate hain tab maanak aa jaate hain to outlier nahin hona chaahie ek siddhaant hai kisako outlier maana jaega yah maanak mein diya hua hai. Is 456 mein 15 percent kaha gaya hai agar ham is par operate karen ya is par operate karen to ya outlier aata hai ya nahin aata hai yah aap svayan tay kar sakate hain.

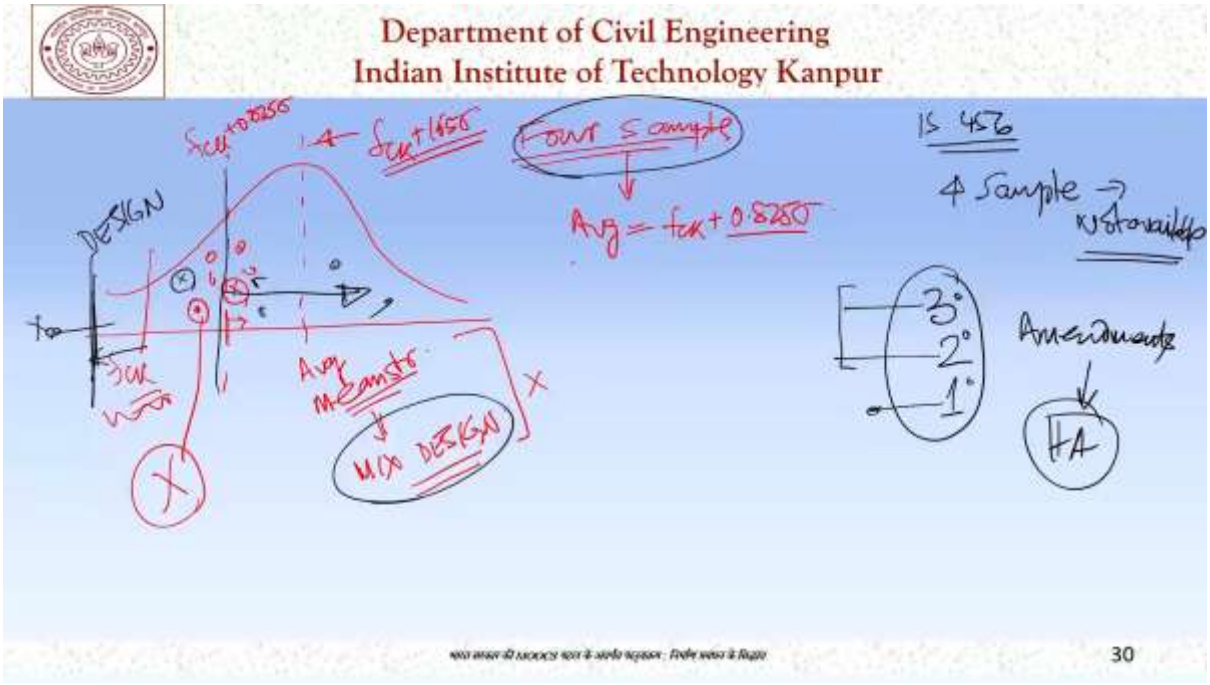
**(Reference Time 42:41)**




Ab ham aate hain vaastav mein characteristics strength kee compliance requirement par. 456 mein kis prakaar yah nirdhaarit kiya jae ki koee bhee concrete acceptable hai ya nahin. Usake do test die gae hain, ek hai mean of group of 4 non-overlapping conclusive test. Jab hamaara nirmaan kaary kaee dinon tak chalata hai aur tamaam sample hamaare paas vibhinn times par aate hain, to tay yah karana hota hai ki kya hamaaree concrete lagaataar maanakon ko satisfy kar rahee hai ya nahin kar rahee hai. Usake lie kaha gaya hai ki ham ek sample ke aadhaar par nirnay nahin karenge. Ham chaar sample ko lekar yahaan par die gae 1, 2, 3, 4 in chaar samples ko jo ki non overlapping ho aur conclusive hon. Unaka average lenge aur tab tay karenge ki in chaar samples dvaara represented concrete acceptance criteria ko meet karatee hai ya nahin ya yah chaaron sample acceptable hain ya nahin. Usake lie kaha yah gaya hai ki yah mean kitana ho? Fck plus.825 standard deviation aur fck plus 3 ya 4 nyootans par mm square. To fck jo ki hamaaree characteristics strength kee line hai ek ham line isake oopar yahaan par kheenche jo kee fck plus .825 sigma ya fck plus 3 jo bhee adhik hai, yah line kheenche to yah ausat is line ke oopar aana chaahie. Arthaat kyonki yah value jis prakaar se dikhaee gaee hai yah is line ke neeche hai, to yah sample unacceptable ho jaega ya concrete hamaare maanakon ko satisfy nahin karatee. Usee prakaar agar ham ye chaar sample dekhate hain aur inaka ausat inaka ausat yahaan par aa raha hai, to yah sample acceptable hai. Dhyaan rahe ki individual samples kee jahaan tak baat hai yah donon sample fck ke adhik the yah donon sample fck se kam to the lekin phir bhee inamen ganana huee. Individual samples kee jahaan tak baat hai yah bhee kaha gaya hai ki individual samples fck minus 3 ya fck minus .825 sigma aadi se kam nahin hone chaahie. Statistics mein to kah diya gaya ki yahaan par 5 percent sample aa sakate hain isaka yah arth kadaapi nahin hai ki un paanch percent mein kuchh values is fck se bahut door ho jae, bahut door na ho isakee kya paribhaasha hai vah yahaan par diya gaya minus 3. Arthaat agar m20 concrete kee baat ho rahee hai to 17 MPa se kam concrete clearly un-acceptable ho jaegee, lekin 18 ya 19 kee concrete sample ke roop mein maany hai lekin totally money hai ya nahin yah tab tay kiya ja sakata hai jabaki any samples ko saath mein lekar group of 4 ko dekha jae aur vah average liya jae. To us drshtikon se yah do sample fck se adhik the yah donon sample fck se kam the kintu is line ke oopar the jo ki hamaaree minimum requirement hai. Yah sample jo kee fck minus 3 ke neeche hai yah to sarvatha unacceptable hai. Yah donon acceptable to the lekin jab chaaron ka average liya gaya to yah sabhee sample an acceptable ho gae. Yahaan par yah sample individually fck se

oopar tha yah sample sab fck se oopar hain lekin mahatv is average ka hai. Yahaan par obvious hai yah chaaron sample is line ke oopar hai to isaka average bhee is line ke oopar hoga aur yah sample acceptable hoga. To ham aasha karate hain ki jo chaar prashnon kee baat hamane shuroo mein kee thee ki agar hamane m20 concrete mein ek sample 19 MPa ka aa gaya, to kya isako ham sire se nirast kar den unacceptable ghoshit kar den? Nahin, yah ham nahin kar sakate kyonki yah fck -3 se to adhik hai isee ke saath agar usakee strength 22 bhee aa gaee, to bhee ham isako maany nahin kar sakate hain yadyapi fck se adhik hai. Kyonki yah fck plus 3 se adhik nahin hai.

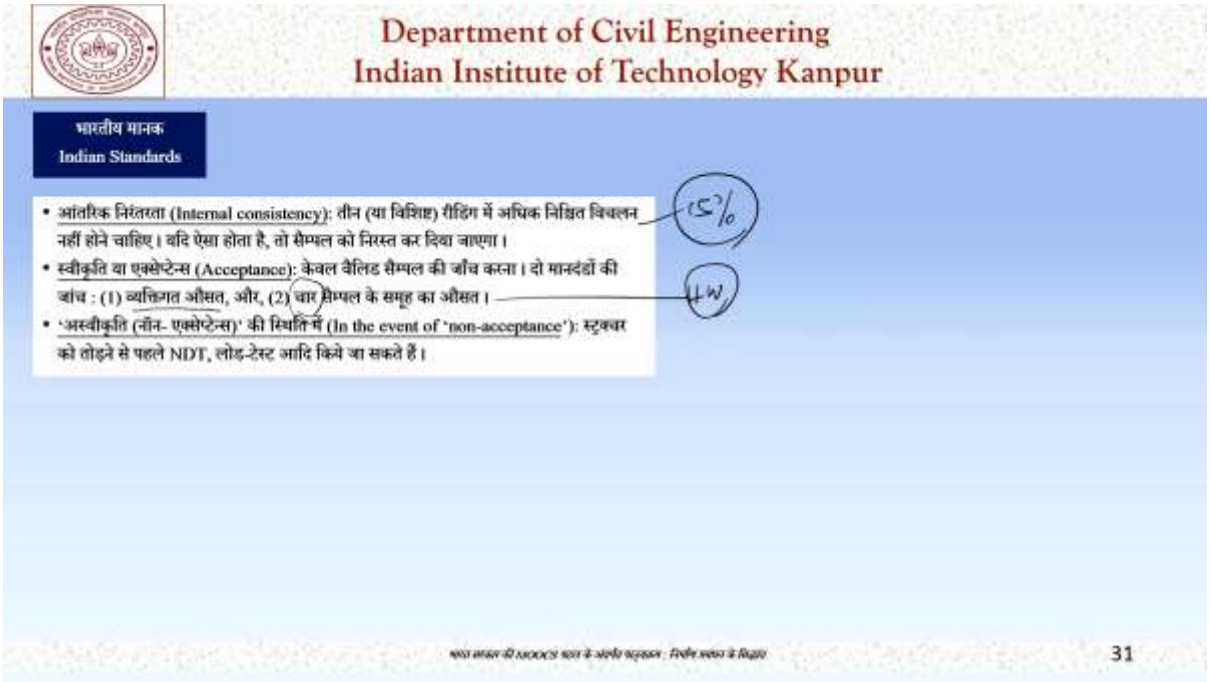
**(Reference Time 47:47)**




Is pooree charcha ko ham ek alag najarie se bhee dekh sakate hain. Hamane yah dekha ki ek normal distribution ko lekar ke hamane characteristic strength fck ko paribhaashit kiya. Isake aadhaar par hamane ek average strength lee jisako ki hamane mean strength kaha aur isake anusaar hamane mix ko design kiya. Jo concrete ka mishran tha vah hamane average strength par design kiya, lekin jab gunavatta prabandhan kee baat huee concrete kee strength ke acceptance kee baat huee sveekrt kee baat huee tab hamane isaka sangyaan nahin diya hamane fck aadhaar par sabhee maanak nirdhaarit kiye. Hamane yah kaha ki 4 samples aur unaka mean ya unaka average (ausat) vah kitana hona chaahie; fck plus.825 sigma . Yah average jo hamaara tha yah tha fck plus 1.65 sigma. In donon kee agar ham to na karate hain hamaara jo sveekrti ka maanak hai vah yah kah raha hai ki yah line hai fck plus.825 sigma kee yahaan par yah chaar sample aaenge aur yadi inaka average is line se idhar hai to hamen yah sveekaary hai lekin agar in chaar ka ausat is line ke idhar kee taraph hai to yah hamen sveekaar nahin hai. Yah ek paksh hai jo ki hamako pooree picture dikhaata hai concrete mixed design, characteristic strength aur acceptance criteria kee. Fck hamaaree design value hai, target means strength yahaan ham mix design karate hain aur yahaan par ek line rakhate hain jisamen ki ham kahate hain ki chaar samples ka ausat use idhar hona chaahie vah kaheen bhee ho sakata hai yahaan ho, yahaan ho, yahaan ho kaheen bhee ho lekin idhar nahin ho sakata aur jahaan tak individual samples ka savaal hai vah individual sample bhee fck se ek had se adhik neeche nahin ho sakate. Yah ek sankshipt roop mein hamaare acceptance criteria kee samaree nahee hai. Haan ek baat aur hai ki IS 456 mein agar hamaare paas chaar sample upalabdh nahin hai kisee bhee kaaran se chaar sample hamaare paas upalabdh nahin hai tab

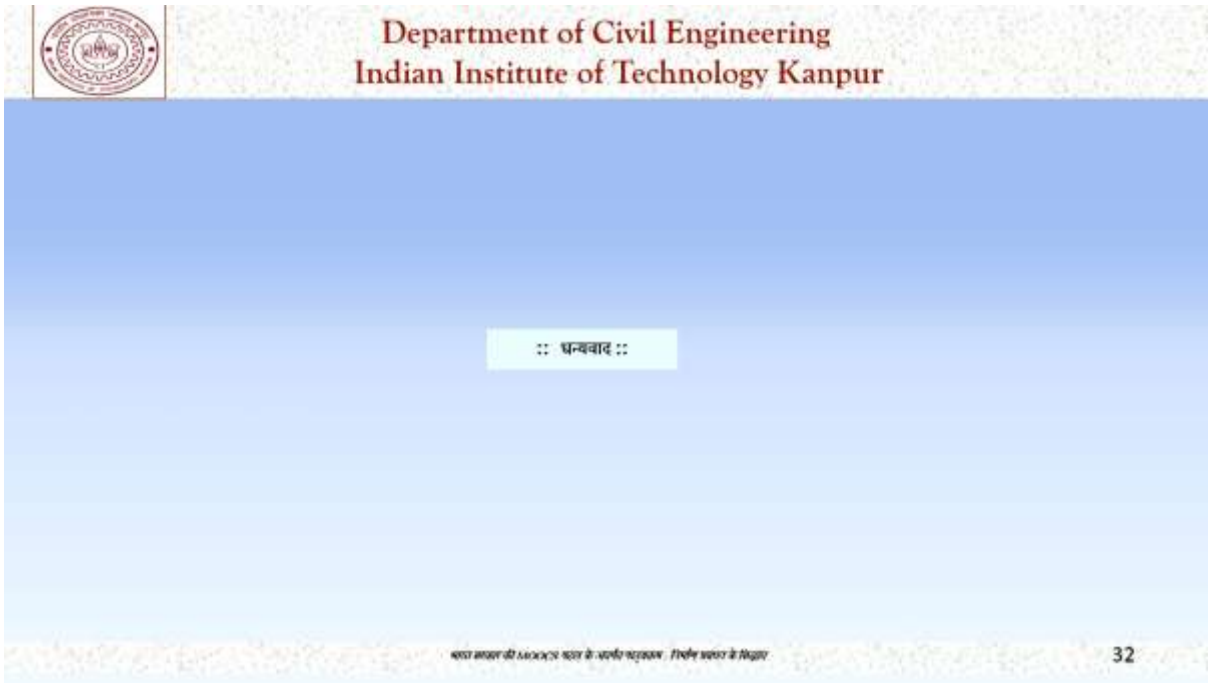
hamako kya karana chaahie? Isake baare mein bhee guideline upalabdh hai ki agar teen sample hain, do sample hain, ek sample hai to us sthiti mein isamen ausat hoga, isamen ausat hoga aur ek sample hone par ausat ka koee savaal nahin uthata yah ausat kahaan hone chaahie isake baare mein is 456 ke amendments mein charcha kee gaee hai. Yah charcha amendments mein hai aur main aapako homework ke roop mein yah assign kar raha hoon. Aap is 456 ke amendments ko dekhen aur samajhane kee koshish karen ki jo chaar sample ke lie sveekrti kee criteria die gae hain unako kis prakaar se modify kiya gaya hai yadi chaar sample upalabdh nahin hai aur maatr teen do ya kisee-kisee case mein agar maatr ek sample hee upalabdh hai tab.

**(Reference Time 51:26)**




Aaj kee charcha samaapt karane se pahale aantarik nirantarata (consistency) teenon specimens kee reading mein adhik bikharaav nahin hona chaahie. Vahaan par 15 percent kee jo limit dee gaee hai usakee charcha huee. Sveekrti acceptance criteria ke do maanak hain vyaktigat ausat, vyaktigat ausat matalab ek sample mein teen readings ka ausat chaar sample ke samooh ka ausat hamane use par charcha kee aur saath mein homework hua ki agar hamaare paas yah chaar sample upalabdh nahin hai aur maatr teen hee sample hain, do sample hai ya ek sample hai. Aur sveekrti ya non acceptance ke case mein kya karana chaahie vahaan par hamen concrete ko todane se pahale non-destructive testing ya load test ka praavadhaan kiya gaya hai. Yah hamaare vishesh charcha thee concrete ke acceptance criteria ko lekar. Hamane is charcha ko joda isalie kyonki concrete hamaare nirmaan ke kshetr mein bahut adhik use hone vaala ek padaarth hai aur usakee sveekrti ke criteria samajhana ham sabhee logon ke lie bahut hee aavashyak hai.

**(Reference Time 52:37)**




Aur isee ke saath yah lecture aur yah module aur saath hee saath yah paathyakram bhee samaapt hota hai mujhe aasha hai ki aapako is paathyakram mein kuchh seekhane ko mila hoga aur main aapako aapake bhavishy ke lie shubhakaamanaen dete hue, dhanyavaad deta hoon. Dhanyavaad namaskaar.