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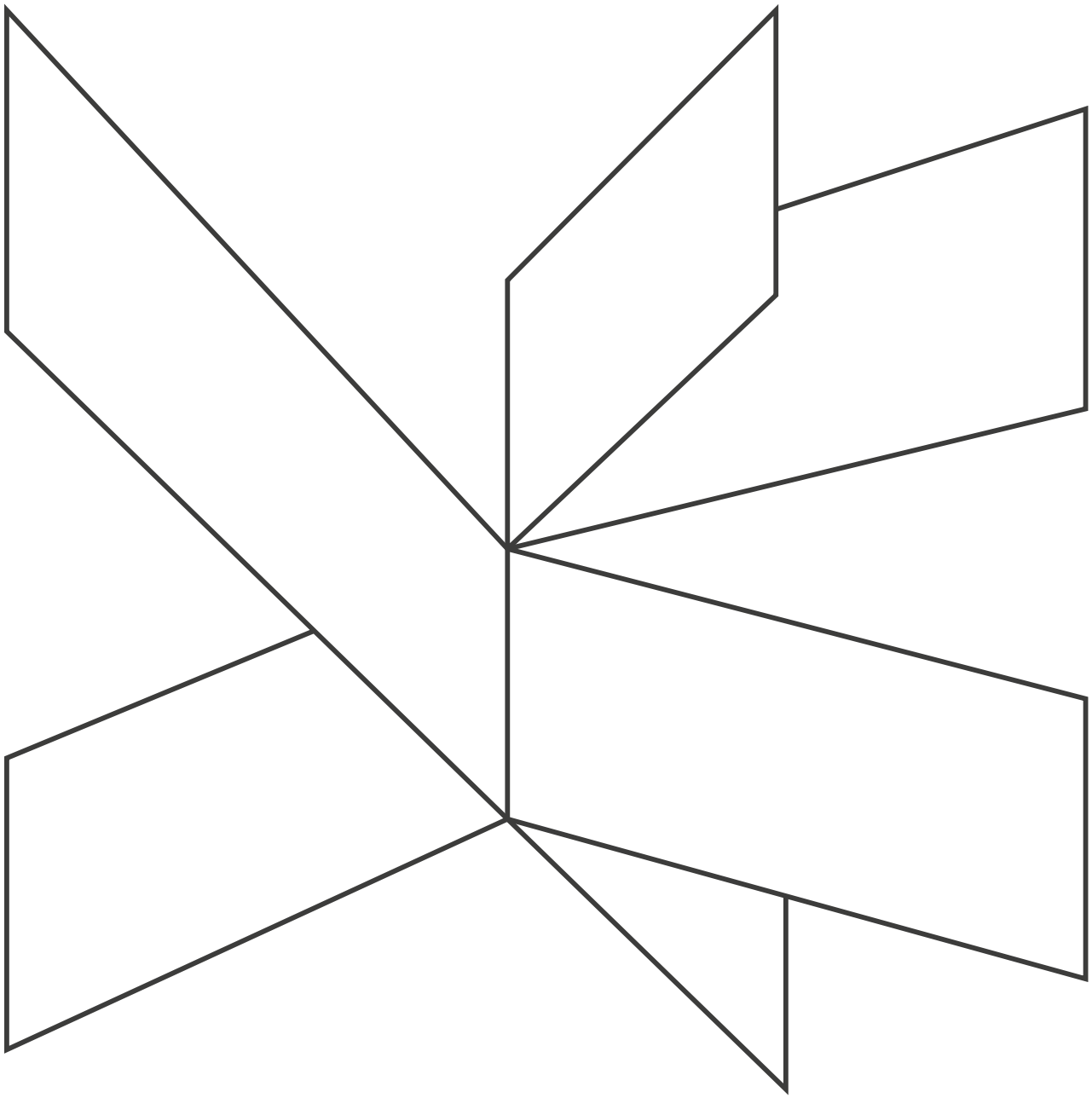
VIA University College

Studieordning
VIA Forsyningsingeniør



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Diplomingeniøruddannelsen i Forsyningsteknik i vand, spildevand og fjernvarme

1 Grundlag og ikrafttræden

Nærværende studieordning har virkning fra den 1. februar 2016 for studerende, der er optaget på VIA Forsyningsingeniør.

Studieordningen er udarbejdet i henhold til følgende bekendtgørelser:
- Nr. 527 af 21.06.2002 om diplomingeniøruddannelsen
- Nr. 1521 af 16.12.2013 om erhvervsakademi- og professionsbacheloruddannelser – alene §18
- Nr. 85 af 26.01.2016 om adgang til erhvervsakademi- og professionsbacheloruddannelser
- Nr. 1519 af 16.12.2013 om prøver og eksamen i grundlæggende erhvervsrettede uddannelser
- Nr. 114 af 03.02.2015 om karakterskala og anden bedømmelse.

Endvidere henvises til uddannelsens kursusbeskrivelser, materiale på studienet som fx retningslinjer vedr. projektarbejde samt Studieadministrationens regler og vejleding om eksamen, eksamenssnyd og klager ift. eksamen.

2 Målet for uddannelsen

Diplomingeniøruddannelsen i Forsyningsteknik i vand, spildevand og fjernvarme ved VIA University College, Teknisk-Merkantil Højskole (TMH) er en afrundet uddannelse og har ifølge bekendtgørelsen til formål at kvalificere de studerende til nationalt og internationalt at varetage erhvervsfunktioner indenfor forsyningsbranchen. Nedenfor ses uddannelsens overordnede læringsmål opdelt på viden, færdigheder og kompetencer.

Viden
En dimittend i forsyningsteknik skal:
- have opnået viden om teori og praksis samt udbredte teknologier og processer indenfor forsynings-branchen som helhed og i en af specialiseringerne indenfor vand-, spildevand-, og fjernvarmeforsyning i særdeleshed.
- kunne forstå og reflektere over teorier, metode og praksis og disses egnethed i forskellige situationer inden for forsyningsområdet.
- have opnået viden om forsyningsbranchens rammevilkår og sektorlovgivning samt kende områdets udbuds- og entrepriseret.

Færdigheder
En dimittend i forsyningsteknik skal:
- kunne anvende metoder og redskaber indenfor de tre forsyningsområder samt anvende de færdigheder, der knytter sig til beskæftigelse inden for forsyningsområdet.
- kunne vurdere teoretiske og praktiske problemstillinger samt begrunde og vælge relevante løsningsmodeller
- kunne formidle faglige problemstillinger og løsningsmodeller til såvel fagfæller som ikke-specialister (herunder forsyningskunder, samarbejdspartnere og offentligheden)
- kunne planlægge, realisere og styre tekniske og teknologiske anlæg og herunder være i stand til at inddrage samfundsmæssige, økonomiske, miljø- og arbejdsmiljømæssige konsekvenser i løsningen af tekniske problemer.

Kompetencer
En dimittend i forsyningsteknik skal:
- gennem studiet have opnået kompetencer til at kunne håndtere komplekse og udviklingsorienterede situationer i studie- og arbejdsmæssige sammenhænge
- kunne indgå i samarbejds- og ledelsesmæssige funktioner og sammenhænge med en professionel tilgang sammen med mennesker, der har forskellig faglig, uddannelsesmæssig, sproglig og kulturel baggrund
- kritisk kunne tilegne sig ny viden inden for relevante ingeniørmæssige områder og identificere egne læringsbehov samt strukturere egen læring i forskellige læringsmiljøer
- kunne beskrive, formulere og formidle problemstillinger og resultater i en videnskabelig sammenhæng samt være i stand til at anvende videnskabelige metoder. Endvidere skal de være i stand til at anvende resultater af national og international forsknings-, forsøgs- og udviklingsarbejde

VIA har som yderligere målsætning, at uddannelsens dimittender skal være i stand til at arbejde selvstændigt og udvikle færdigheder inden for områderne Vandforsyning, Spildevandsforsyning og Varmeforsyning.

Målet for uddannelsen er endvidere, at de studerende erhverver sig forudsætninger for videreuddannelse, herunder masteruddannelse og særlige kandidatuddannelser.

Modenhedsniveauer på uddannelsen

Niveau 1:	0.-1. studieår:	**Introduktionsfasen** – Styret undervisning med konfrontationsundervisning i 12 uger, konsulenttilbud i enkelte fag samt enkelte kurser.
Niveau 2:	1.-2. studieår:	**Fordybelsesfasen** – Undervisning i 12 uger samt enkelte temakurser.
Niveau 3:	2.-3½. studieår:	**Specialiseringsfasen** – Undervisning med ca. 50 % konfrontation i 12 uger og resten med vejleder/igangsætter. Undervisningen kan være meget individuel.

3 Generelt om uddannelsen

Der er optag af nye studerende hvert år i august.

Uddannelsen er normeret til 7 semestre (3½ år) og består af følgende, der beskrives nærmere i kapitel 5:
- En grundlæggende ingeniørdel (grunddel), der omfatter 1.-4. semester
- En specialiseringsdel, der omfatter 6. og 7. semester
- Et halvt års integreret praktik (Ingeniørpraktik), som er placeret på 5. semester.

Studerende med en relevant erhvervsuddannelse kan fritages for den integrerede praktik, se afsnit 3.2.6 og kapitel 8.

For studerende, der ikke har de relevante erhvervsmæssige forudsætninger, er der indlagt 5 ugers kurser med værkstedspraktik (se afsnit 3.2.5). Studerende med en relevant erhvervserfaring eller erhvervsuddannelse fritages for denne værkstedspraktik. Afgørelsen af, om den studerende besidder de relevante erhvervsmæssige forudsætninger, foretages på baggrund af en individuel vurdering.

Uddannelsen er opbygget af et antal kurser, der hver for sig har som mål at give de studerende en helhed af faglige kvalifikationer inden for en nærmere fastsat tidsramme. Kursustyperne er nærmere beskrevet i afsnit 3.2.

I studiet vil der blive inddraget resultater af nationale og internationale forsknings-, forsøgs- og udviklingsarbejder, der er relevante for professionen og egnede til eksemplarisk at bidrage til at udvikle og anvende ny professionel viden.

Fra 6. semester undervises på engelsk, idet alle studerende på Forsyningsingeniøruddannelsen og den tilsvarende engelsksprogede Supply Engineering samlæses.
Derudover kan der, i tilfælde af små holdstørrelser, forekomme samlæsning på engelsk fra 1. semester.

3.1 Kursustilmelding

Hvert semester afholdes informationsmøde angående kursusvalg på 6. og 7. semester. Umiddelbart herefter skal de studerende foretage tilmelding via selvbetjening. Øvrige semestre tilmeldes automatisk samtlige kurser på det følgende semester.

I følgende tilfælde kan der foretages omvalg:
- Hvis et forudsætningskursus ikke bestås eller godkendes ved eksamen.
- Hvis et valgkursus ikke har fået nok tilmeldinger og derfor må aflyses.
- Hvis skemalægningen umuliggør deltagelse på et kursus. Skemaet bør tjekkes hurtigst muligt omkring semesterstart.

Et kursus, der ikke er bestået/godkendt ved eksamen, skal som udgangspunkt følges i det kommende semester. Der skal derfor også foretages tilmelding til dette kursus.

3.2 Kursustyper

Et kursus kan have et omfang fra 5 til 20 point. Uddannelsen er normeret til at omfatte 60 point pr. år. En fuldført uddannelse har derfor et omfang af 210 point. Pointtildelingen svarer til ECTS-systemets pointtildeling (Se bilag 1).

ECTS er et fælles europæisk pointsystem, som angiver arbejdsbyrden og det tidsmæssige omfang af et studieelement – men ikke elementets sværhedsgrad.

1 ECTS svarer til en arbejdsindsats på 27,5 timer. Et studieår á 60 ECTS svarer således til 1.650 timers arbejde for den studerende.

Kurserne kan kategoriseres indenfor følgende hovedgrupper, der beskrives nærmere i de følgende afsnit:
- Obligatoriske kurser
- Obligatoriske specialekurser
- Valgkurser
- Temakurser
- Værkstedspraktik
- Integreret praktik (ingeniørpraktik)
- Semesterprojekter på 1.–4. semester
- Tværfagligt projekt på 6. semester
- Bachelorprojekt på 7. semester.

For hvert kursus er der udarbejdet en beskrivelse, der oplyser om
- Kursets formål
- Kursets indhold
- Kursets læringsmål (viden og færdigheder)
- Undervisningsform og aktiviteter
- Forudsætninger for at følge kurset
- Evalueringsform
- ECTS point

Specielt om forudsætninger
Hvis det er oplyst i kursusbeskrivelsen, at et kursus er en forudsætning, betyder det, at kurset skal være bestået efter reglerne i studieordningen, før det efterfølgende kursus kan følges.

Hvis forudsætningen er, at et kursus skal være fulgt, betyder det, at den studerende skal have været tilmeldt kurset og deltaget i eksamen eller godkendelsesprocedure min. én gang.

Det er muligt at søge dispensation til at følge et kursus, selvom forudsætningerne ikke er opfyldt. Se endvidere afsnit 9.

3.2.1 Obligatoriske kurser

Alle kurser på 1.-4. semester er obligatoriske kurser. Kurserne er fælles for alle studerende på Forsynings-ingeniøruddannelsen.

De obligatoriske kurser på 1-4 semester afsluttes med en godkendelse eller en eksamen, hvilket vil fremgå af oversigterne i Kapitel 4. Kurserne kan indgå i semesterprojektet.

Tværfagligt projekt (TFP) på 6. semester samt bachelorprojekt (PRO) på 7. semester er også obligatoriske.

3.2.2 Obligatoriske specialekurser

På 6. og 7. semester findes 2 obligatoriske specialekurser inden for hver af de tre specialiseringer i vand, spildevand og fjernvarme. En af betingelserne, for at opnå en specialebetegnelse, er, at de obligatoriske specialekurser på 6. og 7. semester er bestået.

3.2.3 Valgkurser

På 6. og 7. semester kan der vælges i alt tre valgkurser. Der kan vælges frit blandt de udbudte valgkurser på den enkelte specialeretning og på VIAs øvrige ingeniørretninger - dog ikke kurser, hvor indholdet i det væsentligste består af stof fra den studerendes tidligere studieforløb. Et eventuelt kursusvalg fra en anden retning skal derfor godkendes af uddannelseslederen på forsyningsingeniøruddannelsen, idet det skal påses, at de valgte kurser udgør et stigende fagligt niveau.

3.2.4 Temakurser

På grunddelen er der på de 3 første semestre indlagt et mindre antal temakurser, der indgår som delelementer i semesterprojekterne. Formålet med disse temakurser er at styrke den studerendes færdigheder i udførelse af projektarbejder og dokumentation af disse gennem introduktion af diverse hjælpeværktøjer.

Første del af kurserne indeholder studieteknik samt projektmetodiske emner. Den studerende introduceres her for den projektorienterede studieform og opnår færdigheder med hensyn til formulering af projekter og

disses output. Ligeledes trænes færdigheder i litteratursøgning samt indhentning af øvrigt kildemateriale. Specielt dyrkes projektets faseforløb fra idé til realisering med henblik på at lette projektbeskrivelse og -afgrænsning. Der introduceres værktøjer til planlægning af projektforløbet.
Temakurserne introducerer endvidere det videnskabsteoretiske begreb for den studerende. Ved denne inddragelse styrkes den studerendes evner med hensyn til valg af videnskabelig metode i projektarbejderne, evnen til kritisk holdning til baggrundsdata og øvrigt kildemateriale, samt perspektivering af projektets løsninger. Her vil ligeledes begreber som etik, validitet og reliabilitet defineres. Ligeledes trænes den studerendes evne til udformning af projektarbejdets synopse og derved styrkes de kommunikative evner i forhold til rekvirent eller modtagergruppe.

Som en naturlig fortsættelse af den videnskabsteoretiske validering af kildedata introduceres den studerende ligeledes gennem temakurserne for begrebet kvalitetssikring, der indgår som et naturligt element i ethvert projektarbejde. Forståelse af begrebet kvalitet som en målbar størrelse øves ved gennemgang af værktøjer til gransknings- og kontrolforanstaltninger i forbindelse med projektarbejder.

Temakurserne er indlagt i studiet med planlagt teoretisk progression, der samtidig afspejler stigende progression i kvalitetskravene til projektarbejderne gennem semestrene.

Se endvidere oversigterne i afsnit 4.1.

3.2.5 Værkstedspraktik

Studerende, der efter individuel vurdering ikke har de nødvendige praktiske forudsætninger for at gennemføre uddannelsen, er der indbygget 5 ugers obligatorisk værkstedspraktik, der afvikles sideløbende med den grundlæggende ingeniørdel.

Værkstedspraktikken er opdelt i følgende 5 enheder (se bilag 6):
PWS FI1 Virksomhedsbesøg
PWS FI2 Landmåling
PWS FI3 Svejsning og VVS
PWS FI4 Jordforurening, laboratorie aktiviteter og feltarbejde.
PWS FI5 Byggepladsbesøg

Aktiviteterne gennemføres på de forsyningsselskaber, som VIA har samarbejde med, på eksterne værksteder, VIA's egne værksteder og laboratorier, som byggepladsbesøg og som feltarbejde med praktiske øvelser og undersøgelser. Endvidere indgår en lang række besøg på forsyningsvirksomheder og hos rådgivere og producenter.

Der gives bedømmelsen bestået/ikke bestået. Rapportering og aktiv deltagelse danner grundlag for godkendelsen af værkstedspraktikken. For yderligere beskrivelse af værkstedspraktikken se bilag 6.

3.2.6 Ingeniørpraktik

Ingeniørpraktikken omfatter 1 semester á 30 ECTS-point (min. 20 uger). Den er placeret på 5. semester og afvikles som en lønnet praktikperiode i en privat eller offentlig virksomhed i Danmark eller udlandet.

Der gives bedømmelsen godkendt/ikke godkendt.

Det faglige indhold udformes som ingeniørassistentarbejde på basis af de 4 første semestres indlærte viden.

Følgende forudsætninger skal være opfyldt, før ingeniørpraktikken kan påbegyndes:
- Alle kurser på 1.-3. semester skal være bestået/godkendt.
- Kurserne på 4. semester skal være fulgt.
- Studieprojektet på 4. semester skal være bestået.
- 5 ugers værkstedspraktik skal være bestået (for studerende uden relevante erhvervsmæssige forudsætninger).

Studerende med relevant uddannelse eller erhvervserfaring inden for forsyningsområdet kan vælge at søge fritagelse for ingeniørpraktik og værkstedspraktik. Nærmere regler herom fremgår af meriterings-bestemmelserne i kapitel 10.

3.2.7 Semesterprojekt

Semesterprojektet på hhv. 1.–4. semester opfattes som den centrale enhed på det enkelte semester. Semesterprojektet og det emne, der behandles i projektet ligger til grund for den faglige opbygning af semestret, sådan at den studerende gennem semestret opnår den viden og de færdigheder og kompetencer, som de skal bruge for at udarbejde projektet.

Hvert semesterprojekt omfatter 10 ECTS.
- 1. semesters projekt (SPJ FI1). For indhold og opbygning henvises til afsnit 4.1.1.
- 2. semesters projekt (SPJ FI2). For indhold og opbygning henvises til afsnit 4.1.2.
- 3. semesters projekt (SPJ FI3). For indhold og opbygning henvises til afsnit 4.1.3.
- 4. semesters projekt (SPJ FI4). For indhold og opbygning henvises til afsnit 4.1.4.

Projektet skal dokumenteres i form af en rapport indeholdende projektgrundlag, løsningsbeskrivelse, beregninger, tegninger m.v.
Rapporten skal udarbejdes i en form og et omfang, så det ved bedømmelsen giver overskuelighed, idet det ikke kan forventes, at alle detaljer gennemgås af eksaminator og censor.

Såfremt rapporten er en gruppeopgave, skal det i øvrigt klart fremgå, hvem der har skrevet hvilke afsnit i rapporten.

De studerende arbejder i grupper á 2–4 personer og eksamineres i projektet ved en mundtlig gruppeprøve med individuel bedømmelse.

3.2.8 Tværfagligt projekt

På 6. semester udfører de studerende et tværfagligt projekt (IDP FI1) á 10 ECTS-point. De studerende skal arbejde i grupper á min. 3 personer og vælger selv emnet for deres projekt.

Projektet skal dokumenteres i form af en rapport indeholdende projektgrundlag, løsningsbeskrivelse, beregninger, tegninger m.v.
Rapporten skal udarbejdes i en form og et omfang, så det ved bedømmelsen giver overskuelighed, idet det ikke kan forventes, at alle detaljer gennemgås af eksaminator og censor.

Såfremt rapporten er en gruppeopgave, skal det i øvrigt klart fremgå, hvem der har skrevet hvilke afsnit i rapporten.

De studerende eksamineres i projektet ved en mundtlig gruppeprøve med individuel bedømmelse.

3.2.9 Bachelorprojekt

På 7. semester udføres et bachelorprojekt (PRO FI1) á 20 ECTS. Bachelorprojektet udarbejdes i grupper á min. 3 personer. Uddannelseslederen kan dog i ekstraordinære tilfælde dispensere fra denne regel.

Betingelserne for at begynde på bachelorprojektet er, at den studerende har bestået 1.- 6. semesters kurser (eller kurser af et omfang på i alt 180 point, inkl. ingeniørpraktikken med 30 point).

Bachelorprojektet omfatter en selvstændig eksperimentel, empirisk og/eller teoretisk behandling af en praktisk problemstilling i tilknytning til uddannelsens centrale emner. Bachelor projektet skal dokumentere den studerendes evne til at anvende ingeniørmæssige teorier og metoder inden for et fagligt afgrænset emne. Bachelorprojektet skal desuden afspejle den studerendes evne til at udtrykke sig fagligt og struktureret indenfor sit fag.

Projektet skal dokumenteres i form af en rapport indeholdende projektgrundlag, løsningsbeskrivelse, beregninger, tegninger m.v.
Rapporten skal udarbejdes i en form og et omfang, så det ved bedømmelsen giver overskuelighed, idet det ikke kan forventes, at alle detaljer gennemgås af eksaminator og censor.

Såfremt rapporten er en gruppeopgave, skal det i øvrigt klart fremgå, hvem der har skrevet hvilke afsnit i rapporten.

De studerende eksamineres i projektet ved en mundtlig prøve/gruppeprøve med individuel bedømmelse.

4 Uddannelsens indhold og opbygning

4.1 Den grundlæggende ingeniørdel

Den grundlæggende ingeniørdel (grunddelen) omfatter uddannelsens første 4 semestre og indeholder obligatoriske kurser og semesterprojekter, der tilsammen har et omfang af 30 point pr. semester svarende til i alt 120 point. Det faglige indhold i grunddelen er i stikord vist i oversigterne senere i dette afsnit.

Udover de fagspecifikke kurser indgår der desuden en række temakurser på 1.–3. semester, beskrevet i afsnit 3.2.4.

Hvert semester er opbygget omkring et centralt fagligt tema indenfor forsyningsområdet. De enkelte fag på det pågældende semester understøtter faglig dette tema og leder frem til semesterprojektet, indenfor det enkelte tema:

- 1. semester: Jord og vand
- 2. semester: Klima og miljø
- 3. semester: Byggemodning
- 4. semester: Forsyning og distribution

De studerende skal bl.a. indøve præsentationsteknikker i såvel skreven tekst som tale. De studerendes stave- og formuleringsevne vil indgå i bedømmelsen af semesterprojekterne men også på specialedelen ved bedømmelse af de tværfaglige projekter og bachelorprojektet. En dårlig stave- og formuleringsevne medfører således, at karakteren påvirkes i negativ retning. VIA kan dispensere fra ovennævnte krav for studerende, der dokumenterer en relevant specifik funktionsnedsættelse.

På den grundlæggende ingeniørdel indgår IT som pædagogisk metode. Målet er, at IT skal understøtte de studerendes læreprocesser og deres forståelse af de ingeniørfaglige muligheder, der fx ligger i anvendelsen af modellering, simulering m.m.

4.1.1 1. semester

Det overordnede tema for 1. semester er ”Jord og vand”.

Der gennemføres et projektarbejde, hvor der fokuseres på planlægning, optegning og præsentation med tidssvarende virkemidler af et mindre anlægsprojekt i jord. Projektarbejdet gennemføres ved etablering af projektgrupper, der i samarbejde og med støtte fra deltagelse i undervisning og temakurser i de enkelte faglige discipliner, behandler problemstillingerne i det foreliggende tema.

Der er som udgangspunkt opstillet fælles overordnede læringsmål for alle studerende i semesteret. Disse er beskrevet under afsnittet ”Læringsmål”.

4.1.1.1 Semestrets læringsmål

Viden:
Ved udgangen af 1. semester skal den studerende have:
- Opnået en grundlæggende forståelse for geologi og jord og vandets kredsløb, herunder vandets strømning i jord.
- Opnået en faglig forståelse af de almindelige begreber for anlægsprojekter og anlægsarbejde og herunder specielt anlægsarbejder i jord
- Opnået en basal viden om forsyningsområdet, de tre forsyningsarter, deres forsyningsledninger og branchen som helhed.
- Tilegnet sig basale matematiske værktøjer til beregning af simple problemstillinger i forbindelse med anlægsarbejder.

Færdigheder:
Ved udgangen af 1. semester skal den studerende kunne:
- Anvende de mest gængse principper indenfor anlægsprojektering, planlægning, fastlæggelse af aktiviteter, projektbeskrivelse og ressourceplanlægning
- Fastlægge og beregne installationer i rør i jorden for vand, spildevand og fjernvarme
- Indøve og opnå erfaring med gruppe-samarbejde, rapportskrivning og præsentationsteknik.

Kompetencer:
Ved udgangen af 1. semester skal den studerende:
- kunne bruge den opnåede viden og de færdigheder, der er opnået i løbet af semestret, til i samarbejde med andre studerende at kunne planlægge, projektere og udføre mindre anlægsprojekter i jord, herunder at kunne foreslå anvendelige løsninger i forhold til de tre forsyningsarters ledninger.

4.1.1.2 Semestrets indhold og form

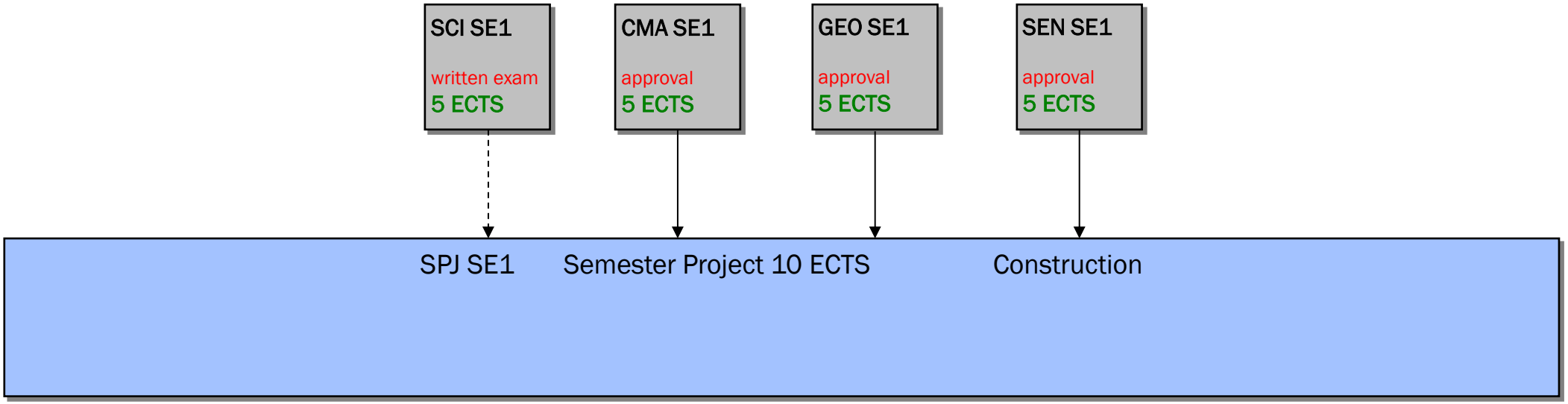
Det overordnede tema for semestret er ”Jord og vand”. Den studerende opnår gennem semestrets kurser viden om jorden og vandets strømning i jord samt anlægsprojekter og ledningsarbejder i jord.

Projektarbejdet vil omhandle et anlægsarbejde i jord og der skal i projektet udarbejdes projektmateriale til et mindre anlægsprojekt. Gennem udførelse af projektet skal discipliner som gruppe-samarbejde, rapportskrivning og præsentationsteknik indøves.

4.1.1.3 Den enkeltfaglige undervisning

Den enkeltfaglige undervisning behandler regler, teorier, metoder og tekniker indenfor hver sit specifikke faglige felt. De faglige oplæg er fordelt over de første 12 uger af semesteret. De enkelte fagområder beskrives særskilt i det følgende samt i bilag 2.

1. Semester – Supply Engineering



SCI 1
Science 1

- Limits
- Differentiation
- Trigonometric functions
- Exponential functions
- Integration
- Vectors in space
- Vector functions

CMA 1
Construction Management

- Drainage systems
- Drain installation
- Pressure lines
- Environmental conditions
- Materials and design
- Assembly methods
- Planning
- Geometric design
- Cross design

GEO 1
Geology and Water

- Basic geology
- Geological processes
- Rock types
- Sediments
- Basic engineering geology
- Physical properties of soil and water
- Strength of soils
- Water cycle
- Groundwater flow
- Capillary rise
- Groundwater table
- Field observations

SEN 1
Supply Engineering

- Business conditions
- Players
- Organisation
- Scope
- Water sources
- Drinking water treatment
- Sewer systems
- Wastewater treatment
- District heating plants
- Energy sources
- Pipe network systems
- Supply plans

TOP S11
Theme Course 1.1
Literature search, search methods and knowledge databases

Lecturer:
Librarians

Evaluation:
Approval

Scope:
2 lessons of 45min each.

TOP S13
Theme Course 1.2
Science for engineers

Basic science:
- What is science?
- The scientific process

Scientific theories and methods in engineering:
- Report (academic) Writing
- System of reference
- Source criticism

Lecturer:
Regner Bæk Hessellund

Evaluation:
Approval

Scope:
10 lessons of 45min each.

TOP S15
Theme Course 1.5
The project's output

- Outline of Project documentation
- Drawing comprehension
- Common principles of drawing (drawing levels and numbers)

Lecturer:
Karsten Völcker

Evaluation:
Approval

Scope:
2 lessons of 45min each.

SPJ 1
Semester Project Construction

- Planning and design
- Infrastructural constructions in open land
- Constructive analysis
- Reporting, presentation

Valid from August 2015 /rev. 28.04.2015

4.1.2 2. semester

Det overordnede tema for 2. semester er ”VVM screening ”.

Der gennemføres et projektarbejde, hvor der skal udføres en VVM screening for et mindre anlæg. Projektarbejdet gennemføres ved etablering af projektgrupper, der i samarbejde og med støtte fra deltagelse i undervisning og temakurser i de enkelte faglige discipliner, behandler problemstillingerne i det foreliggende tema.

De enkelte projektgrupper bearbejder og udfærdiger selv deres projektformulering, men der er i projekterne visse mindstekrav med hensyn til omfang og bearbejdning af de faglige elementer, der indgår i semesteret. Disse mindstekrav fremgår senere i dette skrift.

Der er som udgangspunkt opstillet fælles overordnede læringsmål for alle studerende i semesteret. Disse er beskrevet under afsnittet ”Læringsmål”.

4.1.2.1 Semestrets læringsmål

Viden
Ved udgangen af 2. semester skal den studerende have:
- Opnået viden om miljølovgivning og planloven og de faglige elementer, der indgår i en VVM screening i forbindelse med et mindre anlægsprojekt
- Tilegnet sig viden om databehandling og anvendelsen af geografiske informationssystemer til anvendelse i en VVM screening.

Færdigheder
Ved udgangen af 2. semester skal den studerende kunne:
- Anvende indlært viden til løsning af konkrete projekter og vurderinger af virkning på miljøet
- Omsætte viden om databehandling og geografiske informationssystemer til praktisk projektmæssig anvendelse i forbindelse med vurderinger af virkning på miljøet
- Planlægge og gennemføre praktiske projektarbejder og formidle projektresultater til rekvirenten

Kompetencer
Ved udgangen af 2. semester skal den studerende:
- Kunne bruge den opnåede viden og de færdigheder, der er opnået i løbet af semestret til ved hjælp af moderne IT værktøjer og i samarbejde med andre studerende at udføre en dokumenteret vurdering af virkninger på miljøet for et mindre anlægsprojekt, herunder virkning på grundvand og recipienter.

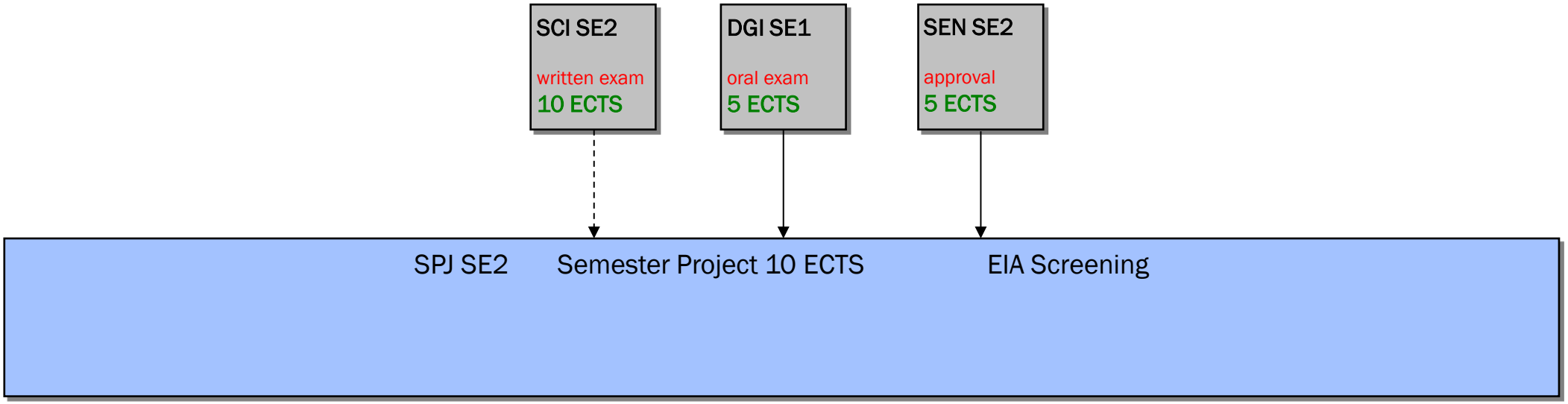
4.1.2.2 Semestrets indhold og form

Det overordnede tema for dette semester er VVM og VVM screening og undervisningen vil omhandle de faglige emner, der skal benyttes i denne type opgave. Undervisningen vil dels give en indføring i miljø og planlovgivningen, som regulerer store dele af forsyningsvirksomheden og dels bibringe den studerende en basal viden om de fagområder, som har betydning, herunder grundvand, recipienter, m.v. Desuden vil den studerende bibringes de IT færdigheder mht. databehandling og geografiske informationssystemer, som er grundlaget for vigtige dele af arbejdet med forsyningsvirksomhed.

4.1.2.3 Den enkeltfaglige undervisning

Den enkeltfaglige undervisning behandler regler, teorier, metoder og teknikker indenfor hver sit specifikke faglige felt. De faglige oplæg er fordelt over de første 12 uger af semesteret. De enkelte fagområder beskrives særskilt i det følgende samt i bilag 3.

2. Semester – Supply Engineering



SCI 2
Science 2

- Application of integration
- Matrixes and matrix algebra
- Linear equation systems
- Polar coordinates
- Complex numbers
- Ordinary differential equations of the 1st and 2nd order
- First-order separable equations
- Particle kinematics
- Particle kinetics
- Work and energy
- Steady flow of a fluid stream
- Newton's second law
- Basic thermodynamics
- Ideal gasses and reversible processes
- Second law of thermodynamics
- Entropy
- Heat transfer
- Heat exchangers

DGI 1
Data and GIS

- XML data
- Relational databases
- SQL
- Data processing
- GIS
- Digital maps
- Geodata
- MapInfo
- Vector map
- Raster map

SEN 2
Supply Engineering

- Environmental legislation
- Planning legislation
- Groundwater
- Nature
- Water environment
- Climate
- Climate change in supply engineering

TOP S21
Theme Course 2.1
Project methodology for engineers

- Intro to the development of a problem formulation
- Project description and synopsis
- project methodology
- Study Technique

Assignment:
- Develop a project description at your own project.

Lecturer:
Regner B. Hessellund and the team lecturers.

Evaluation:
Approval based on presence in class. Is also a part of the project examination.

Scope:
2 x 4 lessons of 45min. each.

TOP S25
Theme Course 2.5
MicroStation

- Basic MicroStation
- Start-up and layer management.
- Lines and arcs.
- Text and dimensions.
- Adjustments and offset.
- Map processing.
- Drawing of the cross sections and details.
- Cell libraries
- Setup a drawing and plot to pdf.

Lecturer:
Katrine Steenbach

Evaluation:
Approval based on presence in classes Is also a part of the project examination.

Scope:
4 x 2 lessons of 45 min. each + self-study

SPJ 2
Semester Project
EIA Screening

- EIA Screening
- Legislation in Denmark and the EU
- GIS systems
- Data and data processing
- Data analysis.

Valid from February 2016 /rev. 05-01-2016

4.1.3 3. semester

Det overordnede tema for 3. semester er ”Byggemodning og anlægsarbejde”.

Der gennemføres et projektarbejde, hvor der fokuseres på byggemodning med hensyn til vand-, spildevands- og fjernvarmeledninger. Projektarbejdet gennemføres ved etablering af projektgrupper, der i samarbejde og med støtte fra deltagelse i undervisning og temakurser i de enkelte faglige discipliner, behandler problemstillingerne i det foreliggende tema.

Der er som udgangspunkt opstillet fælles overordnede læringsmål for alle studerende i semesteret. Disse er beskrevet under afsnittet ”Læringsmål”.

4.1.3.1 Semestrets læringsmål

Viden
Ved udgangen af 3. semester skal den studerende have:
- Opnået en grundlæggende forståelse for ingeniørgeologi og geoteknik med hovedfokus på arbejder i jord og åbne udgravninger.
- opnået viden om planlægning og projektering, omkostninger forbundet med byggemodning og byggeprojekter og økonomi på byggeprojektet.
- Opnået en basal viden om hydraulik og ledningsnet.

Færdigheder
Ved udgangen af 3. semester skal den studerende kunne:
- Planlægge og projektere under hensyntagen til økonomi i projektet og omkostninger ved jordarbejde.
- Kunne beregne simple hydrauliske forhold i ledningsnet for de tre typer forsyningsledninger og under hensyntagen til områdets topografi udføre beregninger af ledningernes placering og udformning.
- Kunne projektere føringsveje for vand-, varme- og afløbsinstallationer med hensyntagen til alle installationers pladsbehov
- Kunne anvende IT-værktøjers ved projektering, modellering og udførelse

Kompetencer
- Ved udgangen af 3. semester skal den studerende:
- kunne anvende den tilegnede viden og de færdigheder, der er opnået i løbet af semestret til ved hjælp af moderne IT værktøjer og i samarbejde med andre studerende at udføre et byggemodningsprojekt med projektering af forsyningsledninger og under hensyntagen til projekt økonomi og omkostninger ved jordarbejde.

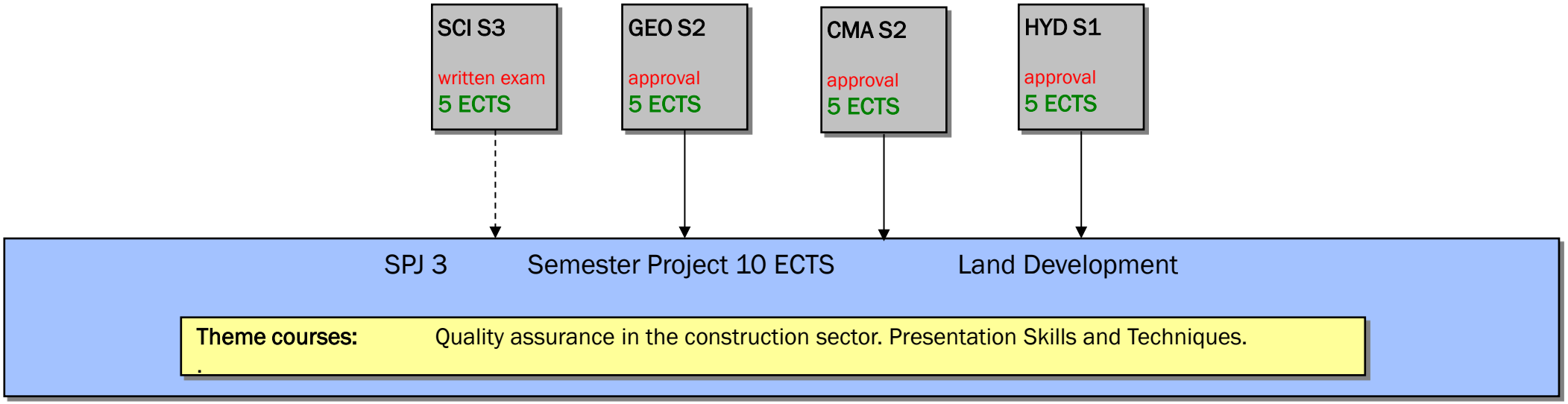
4.1.3.2 Semestrets indhold og form

Det overordnede tema for dette semester er ”Byggemodning” og undervisningen vil omhandle de faglige emner, der skal erhverves for at kunne udføre et byggemodningsprojekt. Undervisningen vil dels give en indføring i ingeniørgeologi og geoteknik med fokus på arbejder i jord og herunder åbne udgravninger og dels bibringe den studerende en basal viden om anlægsprojektets økonomi og de omkostninger, der er forbundet med arbejde i jord samt sætte de studerende i stand til at foretage simple hydrauliske beregninger. Desuden vil den studerende bibringes de IT færdigheder, som er centrale i forbindelse med udførelse af byggemodningsprojekter.

4.1.3.3 Den enkeltfaglige undervisning

Den enkeltfaglige undervisning behandler regler, teorier, metoder og tekniker indenfor hver sit specifikke faglige felt. De faglige oplæg er fordelt over de første 12 uger af semesteret. De enkelte fagområder beskrives særskilt i det følgende samt i bilag 4.

Draft - 3. Semester – Supply Engineering



SCI 3
Science 3

- Chemical bonding theory
- Chemical thermodynamics
- Equilibrium
- Kinetics
- Solutions
- Carbonate system
- Oxidation/reduction
- Instrumental analysis.

GEO 2
Engineering Geology and Geotechnique

- Danish soil types
- Groundwater
- Uplift problems
- Groundwater lowering
- Open cast work
- Stresses
- Uplift
- Slope stability.

CMA 2
Construction Management and Economy

- Structural design and management
- Statical systems
- Project and design methodology
- Basic principles of precast concrete drawings
- Risk management
- Earthworks and economy
- Soil classification
- Mass calculation
- Soft ground work
- Soil quality criteria
- Accounts analysis
- Cash budgeting
- The A – L –method
- Human resources

HYD 1
Hydraulic 1

- Bernoulli's Equation
- Energy Equation
- Pressure loss
- Colebrook & Whites formula
- Bretting's Formulas

TOP S31
Theme Course 3.1
Quality assurance in the construction sector.

Quality assurance as a system in the design and execution in the build environment.
Assignment:

- Quality assessment of own design work
- Develop contract quality material on a single building part

Lecturer:
Regner B. Hessellund

Evaluation:
Approval

Scope:
2 x 2 lessons of 45min each.

TOP S33
Theme 3.3
Presentation Skills and Techniques

- Recipient Screening
- Selecting media
- Planning the project presentation (script)

Lecturer:
Regner B. Hessellund

Evaluation:
Approval

Scope:
2 lessons of 45min each.

SPJ 2
Semester Project
Land Development

- Land development in urban areas
- Planning and project designing
- Infrastructural facilities
- Problem statement
- Project description
- Collection and procession of data
- Design

Valid from August 2015 /rev. 26.01.2014

4.1.4 4. semester

Det overordnede tema for 4. semester er ”Analyse af et forsyningsområde”.

Der gennemføres et projektarbejde, hvor der fokuseres på at analysere planmæssige forhold, registrering og analyse af ledningsnet og udarbejdelse af grundlag for at kunne foretage prognoser med hensyn til forbrug og forsyningsmuligheder. Projektarbejdet gennemføres ved etablering af projektgrupper, der i samarbejde og med støtte fra deltagelse i undervisning og temakurser i de enkelte faglige discipliner, behandler problemstillingerne i det foreliggende tema.

Der er som udgangspunkt opstillet fælles overordnede læringsmål for alle studerende i semesteret. Disse er beskrevet under afsnittet ”Læringsmål”.

4.1.4.1 Semestrets læringsmål

Viden
Ved udgangen af 4. semester skal den studerende have:
- Opnået en grundlæggende forståelse for forsyningssektorens rammevilkår og sektorlovgivning samt entreprise og udbudsret for forsyningsvirksomheder
- Tilegnet sig viden om materialer og de produkter, der kan anvendes i forbindelse med anlæg af forsyningsledninger.
- Opnået en grundlæggende forståelse for ledningsnet registrering og strømning i henholdsvis åbne rør under påvirkning af gravitation og i lukkede rør under påvirkning af tryk. Desuden viden om fjernvarmeledninger og strømning under termisk påvirkning.

Færdigheder
Ved udgangen af 4. semester skal den studerende kunne:
- foretage en sammenstilling og analyse af data for et forsyningsområde, herunder ledningsnet.
- foretage et fagligt og økonomisk begrundet valg af materialer og produkter i forbindelse med planlægning og udbud af anlæg af forsyningsledninger
- kunne forstå og anvende regler og bestemmelser i rammevilkår og sektorlovgivning i forbindelse med udarbejdelse af prognoser og analyser af et forsyningsområde
- kunne anvende IT-værktøjers ved registrering og modellering af ledninger
- analysere og anvende data indhentet fra praktiske øvelser og beregninger
- opstille, beskrive og fortolke de indsamlede data herunder udvikle egne kompetencer
- beskrive og udarbejde en rapport indeholdende præsentationsmateriale og fremlægge og præsentere selve projektmaterialet

Kompetencer
Ved udgangen af 4. semester skal den studerende:
- kunne anvende den tilegnede viden og de færdigheder, der er opnået i løbet af semestret til ved hjælp af moderne IT værktøjer og i samarbejde med andre studerende at udføre en analyse af et forsyningsområde og på baggrund af viden om rammevilkår og sektorlovgivning at kunne foretage velbegrundede prognoser for området.

4.1.4.2 Semestrets indhold og form

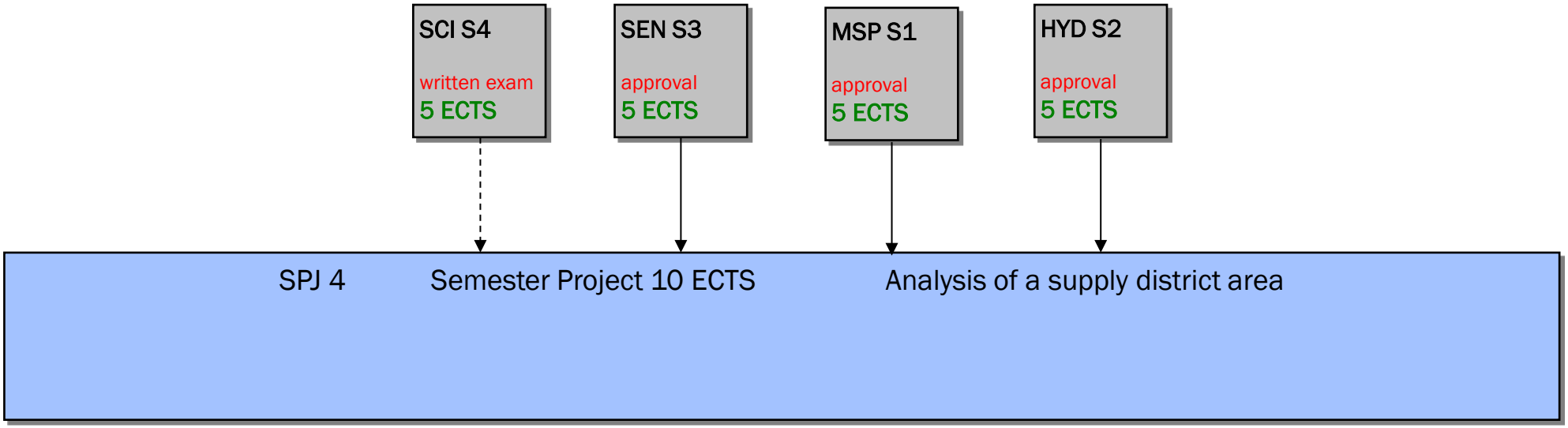
Det overordnede tema for dette semester er ”Forsyning og distribution” og undervisningen vil omhandle de faglige emner, der skal erhverves for at kunne udføre en analyse af et forsyningsområde. Undervisningen vil dels give en indføring i forsyningssektorens rammevilkår og sektorlovgivningen og dels bibringe den studerende en basal viden om hydraulik samt materialer og produkter på ledningsnettet.

Desuden vil den studerende bibringes de IT færdigheder, som er centrale i forbindelse med udførelse af analysearbejdet. Gennem udarbejdelse af en analyse, der omfatter dataindsamling, behandling af data og analyse, skal den studerende opøve færdigheder i planlægning, problemformulering, projektbeskrivelse, dataindsamling og behandling.

4.1.4.3 Den enkeltfaglige undervisning

Den enkeltfaglige undervisning behandler regler, teorier, metoder og tekniker indenfor hver sit specifikke faglige felt. De faglige oplæg er fordelt over de første 12 uger af semesteret. De enkelte fagområder beskrives særskilt i det følgende samt bilag 5.

Draft - 4. Semester – Supply Engineering



SCI 4
Science 4

- MATLAB®
- Introduction to matrix manipulations
- Introduction to the statistics toolbox
- Import of data
- Descriptive statistics
- Data presentation
- Data comparison
- Correlation
- Linear regression analysis

SEN 3
Supply Engineering 3

- National and international framework for supply engineering
- Sectorial legislation
- Benchmarking
- Planning
- Procurement,
- Tender evaluation
- AB92

MSP 1
Material science and products

- Porosity
- Density
- Strength
- Stiffness/rigidity
- Thermal expansion
- Steel
- Plastic
- Concrete
- Corrosion
- Degradation
- Laboratory exercises

HYD 2
Hydraulic 2

- Gravity flow
- Pressure flow
- Flow and temperature
- Rainwater- , wastewater- and combined pipe systems
- Water supply systems
- District heating pipe systems
- Longitudinal profiles
- Registration of pipe systems in GIS

SPJ S4
Semester Project Analysis of a supply district area

- Supply district areas
- Legislation and municipality planning
- Consumer patterns
- Supply potential
- Forecasting

Valid from August 2015 /rev. 30.01.2014

4.2 Praktikophold

Formålet med praktikopholdet er udvikling af ingeniørmæssige og personlige færdigheder gennem deltagelse i konkrete opgaver i en virksomhed.

Ingeniørpraktikken omfatter 1 semester á 30 ECTS-point (min. 20 uger). Den er placeret på 5. semester og afvikles som en lønnet praktikperiode i en privat eller offentlig virksomhed.

Praktikken afvikles i løbet af ét semester. Omfanget er svarende til 30 ECTS eller 825 timers studenterarbejde. Praktikperioden er minimum 20 ugers arbejde på fuld tid. Selve praktikarbejdet udgør ca. 740 timer og afrapportering mv. af praktikforløbet til skolen ca. 85 timer.

4.2.1 Læringsmål for praktikophold

Viden:
Den studerende skal tilegne sig indsigt i praktisk forekommende ingeniøropgaver inden for de respektive uddannelser og derved:
- Udvikle professionel kompetence med basis i uddannelsens/professionens erhvervsforhold og kompetencebehov.
- Opnå viden om, hvordan ingeniørmæssige opgaver kan løses i praksis og derved få erfaring i, hvordan den indlærte teori kan finde anvendelse i aktuelle opgaver.
- Erhvervelse af gode arbejdsvaner - herunder udvikle samarbejds-, analytiske og kreative evner samt udvikle sans for helheder gennem direkte engagement i ingeniørfaglige opgaver.
- Indlevelse i ledelses-, organisations- og arbejdsforhold.
- Træning i systematisk at formulere indsamlede erfaringer og data i en rapport.

Færdigheder:
Efter ingeniørpraktikken skal den studerende kunne:
- Fremme forståelse og motivation for den resterende del af studiet.
- Skabe basis for udvikling af personlige kompetencer med henblik på den fremtidige karriere.
- Starte opbygning af personlige/faglige netværk.

Kompetencer:
Den studerende skal efter endt praktikophold:
- Kunne arbejde selvstændigt samt indgå i tværfaglige grupper ved løsning af praktiske, ingeniørmæssige problemer samt tage ansvar for egen læring.
- Have kendskab til den sociale, tekniske og forretningsmæssige kontekst for ingeniørarbejde samt indblik i virksomhedernes ledelses-, organisations- og arbejdsforhold.
- Kunne planlægge og gennemføre ingeniørarbejde ud fra fagets forudsætninger og krav og være i stand til at dokumentere sit arbejde
- Kunne omsætte tekniske forskningsresultater, naturvidenskabelig og teknisk viden til praktisk anvendelse ved udviklingsopgaver og ved løsning af tekniske problemer.
- Kunne planlægge, realisere og styre tekniske og teknologiske anlæg og herunder være i stand til at inddrage samfundsmæssige, økonomiske, miljø og arbejdsmiljømæssige konsekvenser i løsningen af tekniske problemer.

4.3 Specialisering på 6. -7. semester

Specialedelen omfatter uddannelsens 6. og 7. semester og indeholder kurser, der tilsammen har et omfang af 30 point pr. semester, svarende til i alt 60 point.

Den studerende kan vælge at specialisere sig indenfor følgende fagområder:
- Vandforsyning
- Spildevandsforsyning
- Fjernvarmeforsyning

Hver specialisering består af to obligatoriske kurser berammet til henholdsvis 5 og 10 ECTS, et tværfagligt projekt berammet til 10 ECTS, tre valgfrie kurser på hver 5 ECTS og et bachelorprojekt på 7. semester berammet til 20 ECTS.

Der er for det enkelte speciale opstillet en række læringsmål, som skal gøre den studerende i stand til at varetage et job som forsyningsingeniør efter endt specialisering.

Læringsmål for specialerne er præsenteret i det nedenstående.

4.3.1 Specialisering indenfor vandforsyning

På specialiseringen på 6. – 7- semester indenfor vandforsyning følges to obligatoriske kurser i vandforsyning; Water Supply 1 (WSU SE1) og Water Supply 2 (WSU SE2).

På Water Supply 1, der er berammet til 10 ECTS, følges grundvandet fra boringen på kildepladsen, ind på vandværket og gennem vandbehandlingen her. På Water Supply 2 følges vandet fra vandværket, gennem ledningsnettet og ud til forbrugerne.

På 6. semester udfører de studerende et tværfagligt projekt (IDP FI1) berammet til 10 ECTS-point. De studerende skal arbejde i grupper á min. 3 personer og vælger selv emnet for deres projekt. De studerende eksamineres i projektet ved en mundtlig gruppeprøve med individuel bedømmelse.

De studerende kan vælge i alt tre af en række valgfag og kan således specialisere sig yderligere indenfor fagområder som grundvand, mikrobiologi, anlægsarbejder i byer og herunder no-dig løsninger, projektledelse og organisationsteori. Alle valgfagene er berammet til 5 ECTS.

På 7. semester udføres et bachelorprojekt (PRO FI1), der er berammet til 20 ECTS. Bachelorprojektet omfatter en selvstændig eksperimentel, empirisk og/eller teoretisk behandling af en praktisk problemstilling i tilknytning til uddannelsens centrale emner. Bachelorprojektet skal dokumentere den studerendes evne til at anvende ingeniørmæssige teorier og metoder inden for et fagligt afgrænset emne. Bachelorprojektet skal desuden afspejle den studerendes evne til at udtrykke sig fagligt og struktureret indenfor sit fag.

En oversigt over opbygningen af 6. – 7. semester fremgår af følgende samt bilag 7.

subject to changes

Draft - 6/7 semester – Bachelor of Supply Engineering – Water Supply

Compulsory courses for specialisation in Water Supply

- **WSU S1** – approval – 10 ECTS
- **WSU S2** – approval – 5 ECTS

Interdisciplinary project– IDP S1 – 10 ECTS

Bachelor project – PRO S1 – 20 ECTS

Elective courses compulsory for specialisation in Water Supply (15 ECTS points)

- **GCH S1** – approval – 5 ECTS
- **GFT S1** – approval – 5 ECTS
- **GME S1** – approval – 5 ECTS
- **GMO S1** – approval – 5 ECTS
- **GMP S1** – approval – 5 ECTS
- **MBT S1** – approval – 5 ECTS
- **OTG S1** – approval – 5 ECTS
- **PMA S1** – approval – 5 ECTS
- **RCW S1** – approval – 5 ECTS
- **TTN S1** – approval – 5 ECTS

WSU 1
Water Supply 1

- Water supply systems
- Ground water and surface water sources
- Resource protection
- Sustainable water resource management
- Hydrology and hydrogeology
- Water chemistry
- Drinking water treatment processes
- Pump technology
- Energy optimisation.

WSU 2
Water Supply 2

- Network structure
- Pressurized pipe networks
- Network modeling
- Pumps
- Computerized network modeling tools
- Integration with GIS

GCH 1
Groundwater Chemistry

- Chemical composition of groundwater
- Geology and its influence on the chemistry
- Toxicology
- Drinking water criteria
- Data management
- Acid/base
- Redox theory
- Water analyses

GFT 1
Groundwater Flow and Well Testing

- Steady and non-steady flow in porous media
- well test analysis
- conceptual groundwater models
- drilling and completion of groundwater wells
- design of well sites
- evaluation of contamination
- risk of aquifers.

GME 1
Geophysical Methods

- Planning
- Geophysical planning
- Well logs
- Geophysical investigations

GMO 1
Groundwater Modelling

- Hydrogeology
- groundwater flow processes
- numerical methods for groundwater modelling
- conceptual model development
- introduction to groundwater modelling software
- model calibration
- practical examples

GMP 1
Groundwater Mapping and Protection

- Groundwater mapping
- Groundwater protection
- Legislation
- Administration
- Planning
- Abstraction permits
- Water plans
- Groundwater monitoring

MBT 1
Microbiology and Toxicology

- Microbial growth, biotransformation
- Engineered microbial processes
- Pathogenicity
- Instrumental analysis
- Exposure
- Dose/response
- End-points

OTG 1
Organisation Theory and Governance

- Organisational sociology
- Governance in organisations
- Project organisations and management
- Organisational culture
- Learning organisations

PMA 1
Project Management

- Project management
- Project group organization
- Leadership in project groups
- Meeting management
- Cooperation and conflict management
- Communication
- SWOT analyses
- Stakeholder analysis
- Personal development

RCW 1
Planning and Execution of Road Construction Works in Urban Areas

- Authorities
- Pipe owners
- relocation of traffic
- Planning of road construction processes

TTN 1
Trenchless Technology and No Dig

- Trenchless Technologies (TT)
- No Dig
- Project Management in No Dig/TT
- Planning and Operation of No Dig/TT installations
- Environmental and Climate Emission perspectives

Valid from August 2015 /rev. 30.01.2014

4.3.1.1 Læringsmål for specialisering i Vandforsyning

Viden:
Efter endt uddannelse skal en vandforsyningsingeniør:
- have opnået en udviklingsbaseret viden om forsyningsområdets praksis og anvendte teorier og metoder
- have erhvervet sig en grundlæggende viden om forsyningsområdet, dets rammevilkår og sektorlovgivningen
- have et solidt branchekendskab og kunne forstå praksis, anvendt teori og metode
- være i stand til at reflektere over forsyningsområdets praksis og anvendelse af teori og metode
- have forståelse for og kunne identificere nye problemstillinger
- kunne beskrive, formulere og formidle professionsorienterede problemstillinger og handlemuligheder
- kunne analysere professionsfaglige problemstillinger teoretisk og reflektere over praksis
- selvstændigt kunne strukturere egen læring

Færdigheder:
Efter endt uddannelse skal en vandforsyningsingeniør kunne:
- anvende og vurdere forskellige metoder og redskaber indenfor forsyningsområdet
- mestre de færdigheder der knytter sig til beskæftigelse indenfor vandforsyningsområdet
- vurdere praksisnære og teoretiske problemstillinger
- kunne begrunde og vælge relevante løsningsmodeller
- anvende og være fortrolig med den nyeste viden inden for vandforsyningsområdet
- anvende og være fortrolig med de nyeste redskaber og computerprogrammer inden for de valgte fagområder
- demonstrere indsigt i centrale discipliner, teorier, metoder og begreber inden for professionen
- fremkomme med løsningsforslag på komplekse problemer
- anvende passende værktøjer til planlægning af procesaktiviteternes tids- og ressourceforbrug
- opstille projektbeskrivelse for forskellige projekttyper og udføre den nødvendige projektledelse- og planlægning
- forstå og anvende almene virksomhedsøkonomiske teorier og værktøjer
- opstille kalkulationer på anlægsprojekter
- udarbejde aktivitetsplaner, kontoplaner, timefordelingslister og betalingsplaner
- foretage budgetændringer, udfærdige mellemkalkulations- og slutrapporter
- kunne planlægge og kalkulere udførelse af ledningsarbejder

Kompetencer:
Efter endt uddannelse skal en vandforsyningsingeniør være i stand til:
- at kunne håndtere og løse komplekse og udviklingsorienterede situationer
- selvstændigt at kunne indgå i fagligt og tværfagligt samarbejde
- udvise personlig integritet og handle inden for rammerne af en professionel etik
- kunne identificere egne læringsbehov og udvikle egen viden, færdigheder og kompetencer i relation til professionen
- at være forandringsparat og udviklingsorienteret
- at mestre praktiske redskabsfærdigheder med henblik på udøvelse af erhvervsfunktionen
- samarbejde og kommunikere både inden for og uden for eget fagområde
- arbejde professionelt inden for fagområdet.

4.3.2 Specialisering indenfor spildevandsforsyning

På specialiseringen på 6. – 7. semester indenfor spildevandsforsyning følges to obligatoriske kurser i spildevandsforsyning; Waste Water Supply 1 (WW SE1) og Waste Water Supply 2 (WWS SE2).

På Waste Water Supply 1, der er berammet til 5 ECTS, følges spildevandet fra forbrugeren gennem ledningsnettet og ind på rensningsanlægget.

På Waste Water Supply 2 følges spildevandet gennem rensningsanlægget og de processer, der foregår her indtil udledning til recipienter.

På 6. semester udfører de studerende et tværfagligt projekt (IDP FI1) berammet til 10 ECTS-point. De studerende arbejder i grupper á min. 3 personer og vælger selv emnet for deres projekt. De studerende eksamineres i projektet ved en mundtlig gruppeprøve med individuel bedømmelse.

De studerende kan vælge i alt tre af en række valgfag og kan således specialisere sig yderligere indenfor fagområder som klimatilpasning, renovering af spildevandsledninger, mikrobiologi, slam og biogas, anlægsarbejder i byer og herunder no-dig løsninger, projektledelse og organisationsteori. Alle valgfagene er berammet til 5 ECTS.

På 7. semester udføres et bachelorprojekt (PRO FI1), der er berammet til 20 ECTS. Bachelorprojektet omfatter en selvstændig eksperimentel, empirisk og/eller teoretisk behandling af en praktisk problemstilling i tilknytning til uddannelsens centrale emner. Bachelorprojektet skal dokumentere den studerendes evne til at anvende ingeniørmæssige teorier og metoder inden for et fagligt afgrænset emne. Bachelorprojektet skal desuden afspejle den studerendes evne til at udtrykke sig fagligt og struktureret indenfor sit fag.

En oversigt over opbygningen af 6. – 7. semester fremgår af følgende samt bilag 7.

subject to changes

Draft - 6/7 semester – Bachelor of Supply Engineering – Waste Water Supply

Compulsory courses for specialisation in Waste Water Supply

- **WWS S1** – approval – 5 ECTS
- **WWS S2** – approval – 10 ECTS

Interdisciplinary project– IDP S1 – 10 ECTS

Bachelor project – PRO S1 – 20 ECTS

Elective courses compulsory for specialisation in Waste Water Supply (15 ECTS points)

- **CAF S1** – approval – 5 ECTS
- **EPW S1** – approval – 5 ECTS
- **MBT S1** – approval – 5 ECTS
- **OTG S1** – approval – 5 ECTS
- **PMA S1** – approval – 5 ECTS
- **RCW S1** – approval – 5 ECTS
- **RSS S1** – approval – 5 ECTS
- **SST S1** – approval – 5 ECTS
- **TTN S1** – approval – 5 ECTS

WWS 1
Waste Water Supply 1

- Rain
- Rainwater pipes
- Wastewater pipes
- Combined pipes
- Basins
- CSOs (Combined Sewer Overflows)
- Hydraulic analysis
- Back water
- Flooding
- Pollution,
- Mike Urban

WWS 2
Waste Water Supply 2

- Waste Water treatment plant
- Legislation
- Processes on the waste water plant
- Sludge and sludge treatment
- Dimensioning and design of systems
- Pumps and valves
- Advanced control systems
- Security of supply
- Economy at the waste water plant
- Benchmarking
- Hygiene
- Working environment

CAF 1
Climate Adaption and Flood Analysis

- Climate change
- Rain water
- Green roofs
- Infiltration basins
- Open channels
- Flooding
- Mike Urban
- Mike 21
- Mike Flood

EPW 1
Energy and Energy Production at the Waste Water Plant

- Energy content in sludge
- Biogas production from sludge
- Sludge incineration
- Pre-treatment methods

MBT 1
Microbiology and Toxicology

- Microbial growth, biotransformation
- Engineered microbial processes
- Pathogenicity
- Instrumental analysis
- Exposure
- Dose/response
- End-points

OTG 1
Organisation Theory and Governance

- Organisational sociology
- Governance in organisations
- Project organisations and management
- Organisational culture
- Learning organisations

PMA 1
Project Management

- Project management
- Project group organization
- Leadership in project groups
- Meeting management
- Cooperation and conflict management
- Communication
- SWOT analyses
- Stakeholder analysis
- Personal development

RCW 1
Planning and Execution of Road Construction Works in Urban Areas

- Authorities
- Pipe owners
- relocation of traffic
- Planning of road construction processes

RSS 1
Rehabilitation of Sewage Systems

- MOUSE programme
- TV inspection
- Sewer rehabilitation
- Hydraulic modelling
- Hydraulic profiles
- DAS programme
- Access databases
- Operation
- Maintenance

SST 1
Waste Water Sludge and Sludge Treatment

- Sewage sludge
- Sludge stabilization
- Sludge dewatering
- Final disposal

TTN 1
Trenchless Technology and No Dig

- Trenchless Technologies (TT)
- No Dig
- Project Management in No Dig/TT
- Planning and Operation of No Dig/TT installations
- Environmental and Climate Emission perspectives

Valid from August 2015 /rev. 30.01.2014

4.3.2.1 Læringsmål for specialisering i Spildevandsforsyning

Viden:
Efter endt uddannelse skal en forsyningsingeniør med speciale i spildevand:
- have opnået en udviklingsbaseret viden om forsyningsområdets praksis og anvendte teorier og metoder
- have erhvervet sig en grundlæggende viden om forsyningsområdet, dets rammevilkår og sektorlovgivningen
- have et solidt branchekendskab og kunne forstå praksis, anvendt teori og metode
- være i stand til at reflektere over forsyningsområdets praksis og anvendelse af teori og metode
- have forståelse for og kunne identificere nye problemstillinger
- kunne beskrive, formulere og formidle professionsorienterede problemstillinger og handlemuligheder
- kunne analysere professionsfaglige problemstillinger teoretisk og reflektere over praksis
- selvstændigt kunne strukturere egen læring

Færdigheder:
Efter endt uddannelse skal en forsyningsingeniør med speciale i spildevand kunne:
- anvende og vurdere forskellige metoder og redskaber indenfor forsyningsområdet
- mestre de færdigheder der knytter sig til beskæftigelse indenfor forsyningsområdet
- vurdere praksisnære og teoretiske problemstillinger
- kunne begrunde og vælge relevante løsningsmodeller
- anvende og være fortrolig med den nyeste viden inden for spildevandsområdet
- anvende og være fortrolig med de nyeste redskaber og computerprogrammer inden for de valgte fagområder
- demonstrere indsigt i centrale discipliner, teorier, metoder og begreber inden for professionen
- fremkomme med løsningsforslag på komplekse problemer
- anvende passende værktøjer til planlægning af procesaktiviteternes tids- og ressourceforbrug
- opstille projektbeskrivelse for forskellige projekttyper og udføre den nødvendige projektledelse- og planlægning
- forstå og anvende almene virksomhedsøkonomiske teorier og værktøjer
- opstille kalkulationer på anlægsprojekter
- udarbejde aktivitetsplaner, kontoplaner, timefordelingslister og betalingsplaner
- foretage budgetændringer, udfærdige mellemkalkulations- og slutrapporter
- kunne planlægge og kalkulere udførelse af ledningsarbejder

Kompetencer:
Efter endt uddannelse skal en forsyningsingeniør med speciale i spildevand være i stand til:
- at kunne håndtere og løse komplekse og udviklingsorienterede situationer
- selvstændigt at kunne indgå i fagligt og tværfagligt samarbejde
- udvise personlig integritet og handle inden for rammerne af en professionel etik
- kunne identificere egne læringsbehov og udvikle egen viden, færdigheder og kompetencer i relation til professionen
- at være forandringsparat og udviklingsorienteret
- at mestre praktiske redskabsfærdigheder med henblik på udøvelse af erhvervsfunktionen
- samarbejde og kommunikere både inden for og uden for eget fagområde
- arbejde professionelt inden for fagområdet

4.3.3 Specialisering indenfor fjernvarmeforsyning

På specialiseringen på 6. – 7- semester indenfor fjernvarmeforsyning følges to obligatoriske kurser i fjernvarmeforsyning; District Heating Supply 1 (DHS SE1) og District Heating Supply 2 (DHS SE2).

På District Heating Supply 1, der er berammet til 10 ECTS, undervises i energiproduktionen på værket, processerne og teknologierne. Desuden undervises i udvidet termodynamik.

På District Heating Supply 2 undervises der i ledningsnet og distributionen til forbrugerne.

På 6. semester udfører de studerende et tværfagligt projekt (IDP FI1) berammet til 10 ECTS-point. De studerende arbejder i grupper á min. 3 personer og vælger selv emnet for deres projekt. De studerende eksamineres i projektet ved en mundtlig gruppeprøve med individuel bedømmelse.

De studerende kan vælge i alt tre af en række valgfag og kan således specialisere sig yderligere indenfor fagområder som varmepumpe teknologi og kølingssystemer, bæredygtige energiformer, smartgrid systemer, strategisk energiplanlægning, geotermisk modellering, anlægsarbejder i byer og herunder no-dig løsninger, projektledelse og organisationsteori. Alle valgfagene er berammet til 5 ECTS.

På 7. semester udføres et bachelorprojekt (PRO FI1), der er berammet til 20 ECTS. Bachelorprojektet omfatter en selvstændig eksperimentel, empirisk og/eller teoretisk behandling af en praktisk problemstilling i tilknytning til uddannelsens centrale emner. Bachelorprojektet skal dokumentere den studerendes evne til at anvende ingeniørmæssige teorier og metoder inden for et fagligt afgrænset emne. Bachelorprojektet skal desuden afspejle den studerendes evne til at udtrykke sig fagligt og struktureret indenfor sit fag.

En oversigt over opbygningen af 6. – 7. semester fremgår af følgende samt bilag 7.

subject to changes

Draft - 6/7 semester – Bachelor of Supply Engineering – District Heating

Compulsory courses for specialisation in District Heating

- **DHS S1** approval 10 ECTS
- **DHS S2** approval 5 ECTS

Interdisciplinary project– IDP S1 – 10 ECTS

Bachelor project – PRO S1 – 20 ECTS

Elective courses compulsory for specialisation in District Heating (15 ECTS points)

- **GTM S1** approval 5 ECTS
- **HPC S1** approval 5 ECTS
- **OTG S1** approval 5 ECTS
- **PMA S1** approval 5 ECTS
- **RCW S1** approval 5 ECTS
- **SMG S1** approval 5 ECTS
- **STE S1** approval 5 ECTS
- **STS S1** approval 5 ECTS
- **SUE S1** approval 5 ECTS
- **TTN S1** approval 5 ECTS

DHS 1
District Heating Supply 1

- District heating supply and district heating plants
- Energy sources
- Sustainable energy
- Smart grid
- Strategic energy planning
- Machine and process technology
- Electricity markets
- Extended thermodynamics
- Combustion technology
- Data and data management
- Work environment
- Water treatment
- Energy optimization
- Pumps and pump technology

DHS 2
District Heating 2

- Distribution network
- Optimization of distribution systems
- Customer installations
- Pumps and pump control
- Temperature optimization
- Dimensioning of pipes
- Pipe system modeling
- Tension and expansion

GTM 1
Geothermal Modelling

- Thermal properties
- heat conduction
- heat advection
- mechanical heat dispersion
- steady state flow
- transient flow
- numerical modeling
- finite difference and element methods
- calibration

HPC 1
Heat Pump Technology and Cooling Techniques

- Refrigeration cycle
- Legislation
- Heat pumps
- Heat pump types
- Cooling
- Heat recovery
- District heating and cooling
- Smart grid

OTG 1
Organisation Theory and Governance

- Organisational sociology
- Governance in organisations
- Project organisations and management
- Organisational culture
- Learning organisations

PMA 1
Project Management

- Project management
- Project group organization
- Leadership in project groups
- Meeting management
- Cooperation and conflict management
- Communication
- SWOT analyses
- Stakeholder analysis
- Personal development

RCW 1
Planning and Execution of Road Construction Works in Urban Areas

- Authorities
- Pipe owners
- relocation of traffic
- Planning of road construction processes

SMG 1
Smart Grid Systems

- Smart grid
- Renewable energy
- Energy transmission
- Infrastructure security

STE 1
Strategic Energy Planning

- Strategic energy planning
- Post effectiveness
- Transition to sustainable energy
- Interaction between energy systems
- Transmission pipelines
- Multi-strand production technologies
- Environmental issues, modeling

STS 1
Shallow Geothermal Systems

- Borehole Heat Exchanger
- Heat Pump
- COP
- Thermal properties of geological materials
- Drilling and grouting techniques
- Design of shallow geothermal systems, calculations on efficiency.

SUE 1
Sustainable Energy

- Energy savings
- Shallow geothermal energy
- Heat pumps
- Thermal solar heating systems
- Combustion of biomass
- Feasibility study of energy investments

TTN 1
Trenchless Technology and No Dig

- Trenchless Technologies (TT)
- No Dig
- Project Management in No Dig/TT
- Planning and Operation of No Dig/TT installations
- Environmental and Climate Emission perspectives

Valid from August 2015 /rev. 30.01.2014

4.3.3.1 Læringsmål for specialisering i Fjernvarme

Viden:
Efter endt uddannelse skal en forsyningsingeniør med speciale i fjernvarme:
- have opnået en udviklingsbaseret viden om forsyningsområdets praksis og anvendte teorier og metoder
- have erhvervet sig en grundlæggende viden om forsyningsområdet, dets rammevilkår og sektorlovgivningen
- have et solidt branchekendskab og kunne forstå praksis, anvendt teori og metode
- være i stand til at reflektere over forsyningsområdets praksis og anvendelse af teori og metode
- have forståelse for og kunne identificere nye problemstillinger
- kunne beskrive, formulere og formidle professionsorienterede problemstillinger og handlemuligheder
- kunne analysere professionsfaglige problemstillinger teoretisk og reflektere over praksis
- selvstændigt kunne strukturere egen læring

Færdigheder:
Efter endt uddannelse skal en forsyningsingeniør med speciale i fjernvarme kunne:
- anvende og vurdere forskellige metoder og redskaber indenfor forsyningsområdet
- mestre de færdigheder der knytter sig til beskæftigelse indenfor fjernvarmeområdet
- vurdere praksisnære og teoretiske problemstillinger
- kunne begrunde og vælge relevante løsningsmodeller
- anvende og være fortrolig med den nyeste viden inden for fjernvarmeområdet
- anvende og være fortrolig med de nyeste redskaber og computerprogrammer inden for de valgte fagområder
- demonstrere indsigt i centrale discipliner, teorier, metoder og begreber inden for professionen
- fremkomme med løsningsforslag på komplekse problemer
- anvende passende værktøjer til planlægning af procesaktiviteternes tids- og ressourceforbrug
- opstille projektbeskrivelse for forskellige projekttyper og udføre den nødvendige projektledelse- og planlægning
- forstå og anvende almene virksomhedsøkonomiske teorier og værktøjer
- opstille kalkulationer på anlægsprojekter
- udarbejde aktivitetsplaner, kontoplaner, timefordelingslister og betalingsplaner
- foretage budgetændringer, udfærdige mellemkalkulations- og slutrapporter
- kunne planlægge og kalkulere udførelse af ledningsarbejder

Kompetencer:
Efter endt uddannelse skal en forsyningsingeniør med speciale i fjernvarme være i stand til:
- at kunne håndtere og løse komplekse og udviklingsorienterede situationer
- selvstændigt at kunne indgå i fagligt og tværfagligt samarbejde
- udvise personlig integritet og handle inden for rammerne af en professionel etik
- kunne identificere egne læringsbehov og udvikle egen viden, færdigheder og kompetencer i relation til professionen
- at være forandringsparat og udviklingsorienteret
- at mestre praktiske redskabsfærdigheder med henblik på udøvelse af erhvervsfunktionen
- samarbejde og kommunikere både inden for og uden for eget fagområde
- arbejde professionelt inden for fagområdet

5 Eksamensforhold, prøveformer og bedømmelse

5.1 Eksamensforhold

5.1.1 Tilmelding til eksamen

Tilmelding til undervisning medfører automatisk tilmelding til eksamen eller anden bedømmelse.

For nogle kurser skal visse betingelser være opfyldt, for at en studerende kan indstilles til eksamen.
Er disse ikke opfyldt, kan den studerende ikke deltage i eksamen, men det tæller et eksamensforsøg, jfr. afsnit 5.1.2.
Disse kriterier skal fremgå af kursusbeskrivelsen.

5.1.2 Afmelding af eksamen

En eksamen kan ikke afmeldes. Enhver begyndelse på en undervisningsaktivitet medfører jfr. afsnit 5.1.1. tilmelding til eksamen, og vil derfor udløse 1 eksamensforsøg.

Der gælder særlige regler i tilfælde af sygdom.

5.1.3 Særlige prøvevilkår

Der tilbydes særlige prøvevilkår til studerende med fysisk eller psykisk funktionsnedsættelse, til studerende med tilsvarende vanskeligheder samt til studerende med et andet modersmål end dansk, når institutionen vurderer, at dette er nødvendigt for at ligestille disse studerende med andre i prøvesituationen. Det er en forudsætning, at der med tilbuddet ikke sker en ændring af prøvens niveau.

Nærmere information om test for ordblindhed kan fås hos studievejlederen. Se også afsnit 5.4.

Ansøgning om særlige prøvevilkår fremsendes pr. mail til studiesekretæren, der vurderer ansøgningen evt. i samarbejde med underviser, studievejleder eller uddannelsesleder.

5.1.4 Sygdom eller anden dokumenteret grund

Ved sygdom eller anden dokumenteret grund, skal studiesekretæren omgående have besked.

Såfremt det indtræffer under en mundtlig eksamen, skal det meddeles til underviseren.

Såfremt det indtræffer under en skriftlig eksamen, skal eksamensvagten tilkaldes. Vagten noterer, at eksamen er afbrudt på grund heraf.

Ved sygdom skal den studerende søge læge – senest på eksamensdagen – og fremskaffe dokumentation for sygdommen, og denne skal fremsendes til studiesekretæren senest 14 hverdage efter eksamensdagen. Den studerende skal selv betale eventuelle omkostninger, der er forbundet med dokumentationen.

Ved ”anden dokumenteret grund” skal dette dokumenteres tilsvarende.

Kan fraværet ikke dokumenteres, vil det tælle som 1 forsøg.

5.1.5 Afvikling af eksamen

Eksamen afvikles i henhold til eksamensplanerne, der offentliggøres på uddannelsens studienet.
Planerne kan ændres løbende fx ved ændring af lokale eller i tilfælde af undervisers eller censors sygdom.

Detailplanerne/eksamensrækkefølgen planlægges af underviser eller semesteransvarlig.

Eksamensdagen kan starte kl. 8.00.
Undtagelsesvis kan eksamensdagen starte endnu tidligere. I disse tilfælde vil det altid være efter aftale med de studerende.

5.1.6 Eksamenssnyd og forstyrrende adfærd under eksamen

Ved eksamenssnyd forstås de tilfælde, hvor en eksaminand under en prøve
- skaffer sig uretmæssig hjælp eller
- giver anden eksaminand hjælp til besvarelse, eller
- benytter ikke tilladte hjælpemidler[1]

Eksaminanden skal ved aflevering af en skriftlig besvarelse med sin underskrift bekræfte, at opgaven er udfærdiget uden uretmæssig hjælp.[2] Underskriften kan være digital.

Særligt om eksamenssnyd ved plagiering
Plagieringen anses for eksamenssnyd, hvis den konstateres i en skriftlig opgavebesvarelse, som den studerende har indleveret til brug under en eksamen, og omfatter følgende situationer:
- Et skriftligt produkt, som er afleveret til bedømmelse eller er bedømt, f.eks. professionsbachelorprojektet
- Et skriftligt produkt, som skal være eller har været en del af eksaminationsgrundlaget til en mundtlig prøve, f.eks. et skriftligt arbejde, der afleveres som forudsætning for indstilling og deltagelse i prøven.
- Et skriftligt produkt, der er afleveret som forudsætning for indstilling og deltagelse i en prøve.

Hvornår foreligger der plagiering?
Der foreligger plagiering, når en studerende i en skriftlig opgavebevarelse forsøger at give det indtryk, at vedkommende er ophavsmand til en idé, tekst, opsætning eller lignende, selvom ophavsmanden faktisk er en anden.

Nærmere bestemt foreligger der plagiering, hvis en skriftlig opgavebesvarelse helt eller delvist fremtræder som produceret af den eller de studerende selv, selv om opgavebesvarelsen
1. omfatter identisk eller næsten identisk gengivelse af andres formuleringer eller værker, uden at det gengivne er markeret med anførselstegn, kursivering, indrykning eller anden tydelig markering med angivelse af kilden, herunder evt. sidetal eller lignende (afskrift). Jævnfør uddannelsens retningslinjer for udarbejdelse af skriftlige opgaver, nogle steder kaldet redaktionelle retningslinjer.
2. omfatter større passager med et ordvalg, der ligger så tæt på et andet værk eller lignendes formuleringer m.v., at man ved sammenligning kan se, at passagerne ikke kunne være skrevet uden anvendelse af det andet værk (parafrasering m.v.)
3. omfatter brug af andres ord eller idéer, uden at disse andre er krediteret på behørig vis (anden plagiering), eller
4. genbruger tekst og/eller centrale idéer fra egne tidligere bedømte eller publicerede arbejder uden iagttagelse af de ovenstående bestemmelser i nr. 1 og 3.

[1] Jf. Bek. Nr. 714 af 27/06/2012 (eksamensbekendtgørelsen) § 18, stk. 1

[2] Jf. eksamensbekendtgørelsen § 18, stk. 6

Særligt om forstyrrende adfærd ved afvikling af prøver
Uddannelsesinstitutionen har beføjelser til at bortvise en eksaminand fra en prøve, hvis eksaminanden udviser forstyrrende adfærd, fx hvis eksaminanden udviser støjende adfærd eller bryder uddannelsesinstitutionens ordensregler under eksamen. I mindre alvorlige tilfælde giver uddannelsesinstitutionen først en advarsel.[3] Eksamenstilsynet indberetter hændelsen til uddannelseslederen.

Indberetningen skal ske straks og uden unødig forsinkelse. Med indberetningen skal følge en skriftlig fremstilling af sagen, der omfatter de oplysninger, der kan identificere de indberettede personer, samt en kort redegørelse og den foreliggende dokumentation for forholdet. Er der tale om gentagelsestilfælde for én eller flere af de indberettede personer, skal dette oplyses.
Omkring sanktioner for forstyrrende adfærd, henvises til afsnit om "sanktioner".

Procedurer og sanktioner ved eksamenssnyd og forstyrrende adfærd

Hvem er forpligtet til at indberette?
Alle[4], der får formodning om eksamenssnyd, er forpligtet til at følge op på mistanken og – hvis formodningen opretholdes – at indberette sagen til uddannelseslederen.

Indberetning
Bestyrkes formodningen om eksamenssnyd, skal eksaminator og/eller censor indberette sagen skriftligt til uddannelseslederen for den pågældende uddannelse.[5] Eksaminator og/eller censor underretter samtidig den studerende om, at sagen er indberettet til uddannelseslederen. Hvis der ikke på indberetningstidspunktet allerede er meddelt en bedømmelse, foretages der ingen bedømmelse, og der noteres "Ikke afleveret" på karakterlisten.

Uddannelseslederen
Når uddannelseslederen modtager en indberetning om eksamenssnyd, skal han/hun beslutte enten at afvise sagen eller at fortsætte sagsbehandlingen.

Hvis uddannelseslederen beslutter at fortsætte sagsbehandlingen, sørger han/hun dels for at indhente eventuelt manglende dokumentation, dels for at indkalde den studerende til en samtale, hvor den studerende har mulighed for at forholde sig til indberetningen.

Indkaldelsen bilægges kopi af indberetningen og skal indeholde oplysning om, at samtalen vedrører en formodning om eksamenssnyd og om, at den studerende har ret til at møde med en bisidder ved samtalen. Bisidder kan under samtalen rådgive den studerende, men må ikke deltage i samtalen. Er det ikke muligt at afholde en sådan samtale, anvendes i stedet skriftlig kommunikation.

Afvises sagen af uddannelseslederen, foretages bedømmelse på almindelig vis, hvis der ikke allerede er foretaget en bedømmelse.

Sanktioner
På baggrund af indberetningen og samtalen træffer uddannelseslederen beslutning om, hvorvidt der er tale om eksamenssnyd samt om hvilken form for sanktion, der er aktuel over for den studerende.
Uddannelseslederen kan kun træffe beslutning om sanktion, hvis der efter hans/hendes opfattelse uden for enhver rimelig tvivl er tale om eksamenssnyd.

Forholdet indberettes til direktøren, hvis og kun hvis forholdet er så groft, at det vurderes at burde føre til en bortvisning fra uddannelsesinstitutionen. I alle øvrige tilfælde træffer uddannelseslederen selv afgørelse i sagen.

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[3] Jf. eksamensbekendtgørelsen § 18, stk. 3

[4] Alle er i denne forbindelse, Studieadministration, herunder eksamensvagter, vejleder/eksaminator, øvrige undervisere, ledelse, bibliotekar, censor og medstuderende.

[5] Jf. eksamensbekendtgørelsens § 18, stk. 2

Den endelige beslutning meddeles skriftligt til den studerende med kopi til indberetteren og studievejlederen samt lægges i den studerendes studiemappe.

Sanktionsformer
Såfremt det findes bevist, at der er tale om eksamenssnyd, anvendes én eller flere af følgende sanktioner:

- Advarsel
  Tildeling af en skriftlig eller mundtlig advarsel mod overtrædelser af reglerne.

- Bortvisning fra en skriftlig eksamen med tilstedeværelse på uddannelsesinstitutionen, hvis eksamensreglerne findes overtrådt.[6] Det indebærer, at den studerende registreres som 'udeblevet' fra den pågældende eksamen.

- Annullering af en skriftlig opgave
  Annulleringen omfatter den skriftlige opgave, hvorved der er konstateret eksamenssnyd. Annulleringen kan ske, uanset om der allerede er meddelt en bedømmelse. Den studerende noteres for at have brugt ét eksamensforsøg.[7] En gentaget udfærdigelse af en opgave med uretmæssig hjælp eller ikke tilladte hjælpemidler vil medføre permanent bortvisning fra den pågældende uddannelse.

- Bortvisning fra uddannelsen.
  Hvis forholdet udgør en grov eller gentagende eksamenssnyd, bortvises den studerende fra uddannelsesinstitutionen. Bortvisningen kan være tidsbegrænset eller permanent.[8] Bortvisningen indebærer, at den studerende i bortvisningsperioden er udelukket fra alle aktiviteter i VIA University College, herunder al deltagelse i undervisning og eksaminer. Ved en tidsbegrænset bortvisning registreres den studerende som havende orlov i bortvisningsperioden. Efter bortvisningsperioden genoptages den studerende automatisk som studerende ved den pågældende uddannelse i VIA.

Udover ovennævnte sanktioner kan det komme på tale at foretage politianmeldelse, hvis der er tale om civilretslige forhold.

5.1.7 Klager i forhold til eksamen

Der kan i henhold til Eksamensbekendtgørelsen[9] klages over et af følgende forhold:

- Eksaminationsgrundlaget, herunder prøvespørgsmål, opgave og i forhold til uddannelsens mål og krav
- Prøveforløbet
- Bedømmelsen

Klagen skal være skriftlig og begrundet, og indgives individuelt af den studerende senest 2 uger[10] efter, at bedømmelsen er bekendtgjort på sædvanlig måde (kan uddybes af den enkelte uddannelse).
Klagen sendes til uddannelseslederen, som herefter vil håndtere og vurdere klagen. Den studerende har, efter anmodning, krav på at få udleveret en kopi af den stillede opgave og en kopi af opgavebesvarelsen, hvis der er tale om en skriftelig prøve. [11] Som udgangspunkt forelægger uddannelseslederen klagen for de oprindelige bedømmere, dvs. eksaminator og censor. Bedømmerne har 2 uger til at komme med en faglig udtalelse til klagerens spørgsmål.

Klageren skal have lejlighed til at kommentere udtalelserne, og har en frist på 1 uge til at afgive kommentarer.

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[6] Jf. eksamensbekendtgørelsens § 18, stk. 2, 2. pkt.

[7] Jf. eksamensbekendtgørelsens § 18, stk. 5

[8] Jf. eksamensbekendtgørelsens § 18, stk. 4

[9] BEK. Nr. 714 af 27/06/2012 – Bekendtgørelse om prøver og eksamen i erhvervsrettede videregående uddannelser (eksamensbekendtgørelsen)

[10] 2 uger svarer til 14 kalenderdage.

[11] Eksamensbekendtgørelsens § 39, stk. 3

På baggrund af udtalelserne og kommentarerne afgør uddannelseslederen klagen. Afgørelsen skal være skriftlig og begrundet og kan have et af følgende udfald:

- tilbud om ny bedømmelse (ombedømmelse), dog ikke ved mundtlige prøver
- tilbud om ny prøve (omprøve) eller
- at klageren ikke får medhold i klagen.

Bedømmerne skal være enige, hvis uddannelseslederens afgørelse er, at klageren ikke får medhold.[12]

Så snart der er truffet en afgørelse, skal den studerende og bedømmerne meddeles herom. Resulterer afgørelsen i ny bedømmelse eller ny prøve, skal den studerende informeres om, at dette kan resultere i en lavere karakter.[13]

Ved ny bedømmelse eller ny prøve
Tilbud om ny bedømmelse eller ny prøve skal accepteres senest 2 uger efter, at meddelelse om afgørelsen er afgivet. Der er ikke mulighed for at fortryde sin accept. Hvis den studerende ikke accepterer inden fristens udløb, gennemføres der ikke en ny bedømmelse eller ny prøve.

Ny bedømmelse eller ny prøve skal finde sted snarest muligt. Er der udstedt et eksamensbevis, skal uddannelsesinstitutionen inddrage eksamensbeviset, indtil bedømmelsen foreligger, og eventuelt udstede et nyt eksamensbevis.[14]

Ved ny bedømmelse og ny prøve påsættes nye bedømmere.

Hvis det besluttes at foretage en ny bedømmelse eller ny prøve, gælder beslutningen alle eksaminander, hvis prøven lider af samme mangel, som den der klages over.

Særligt om ny bedømmelse
Ved ny bedømmelse skal bedømmerne have forelagt sagens akter: Opgaven, besvarelsen, klagen, de oprindelige bedømmeres udtalelser med den studerendes bemærkninger hertil samt institutionens henholdsvis Styrelsens afgørelse. Bedømmerne meddeler uddannelsesinstitutionen resultatet af den nye bedømmelse vedlagt en skriftlig begrundelse for bedømmelsen. Uddannelsesinstitutionen giver den studerende meddelelse om bedømmelsen og begrundelsen for bedømmelsen.

Anke af afgørelsen
Hvis den studerende er uenig i uddannelsesinstitutionens faglige afgørelse, kan denne ankes senest 2 uger efter, at klageren er gjort bekendt med afgørelsen. Anken skal være skriftlig og begrundet og sendes til uddannelseslederen, som herefter nedsætter et ankenævn.

Særligt om ankenævnet[15]
Uddannelseslederen nedsætter et ankenævn hurtigst muligt efter indgivelse af en anke. Der kan nedsættes permanente ankenævn. Uddannelsesinstitutionen afholder udgiften til ankenævn. Nævnet består af to beskikkede censorer, en eksaminationsberettiget lærer og en studerende inden for fagområdet.

Om udvælgelsen:

- Censorformanden for Censorkorpset, udpeger de to censorer. Censorformanden udpeger en af censorerne som formand for nævnet. Censorformanden kan udpege sig selv som censor eller som formand.
- Uddannelsesinstitutionen udpeger den eksaminationsberettigede lærer og den studerende.

Ankenævnets virksomhed er omfattet af forvaltningsloven, herunder om inhabilitet og tavshedspligt.

[12] Eksamensbekendtgørelsens § 43, stk. 2
[13] Eksamensbekendtgørelsens § 43, stk. 3
[14] Eksamensbekendtgørelsens § 44, stk. 1.
[15] Eksamensbekendtgørelsens § 46

For at ankenævnet kan være beslutningsdygtigt, skal alle nævnets medlemmer deltage i nævnets drøftelse og alle sagens akter være fremsendt til alle medlemmer. Drøftelsen kan foregå skriftligt, herunder elektronisk, hvis der er enighed blandt nævnets medlemmer om skriftlig behandling. Kan der ikke opnås enighed i ankenævnet, afsluttes drøftelsen ved et møde, hvor alle nævnets medlemmer skal være til stede.

Afsluttes drøftelsen med afstemning, og der er stemmelighed, er formandens stemme udslagsgivende. Bliver ankenævnet i forbindelse med behandlingen af anke opmærksom på fejl og mangler ved en prøve, orienteres uddannelsesinstitutionen herom, og uddannelsesinstitutionen træffer afgørelse om udbedring af fejl og mangler efter reglerne i eksamensbekendtgørelsens kapitel 9.[16]

Ankenævnets afgørelse
Ankenævnet træffer afgørelse på baggrund af det materiale, der lå til grund for uddannelsesinstitutionens oprindelige afgørelse.[17] Afgørelsen fra ankenævnet skal være skriftlig og begrundet, og kan resultere i et af følgende udfald:

- tilbud om ny bedømmelse (ombedømmelse), dog ikke ved mundtlige prøver
- tilbud om ny prøve (omprøve) eller
- at klageren ikke får medhold i klagen.

Ankenævnets afgørelse meddeles uddannelseslederen snarest muligt. Ved vintereksamen senest 2 måneder og ved sommereksamen senest 3 måneder efter, at anken er indgivet til lederen.

Kan anken ikke behandles inden for fristen, skal uddannelsesinstitutionen meddele klageren herom hurtigst muligt. Meddelelsen skal være begrundet og indeholde oplysning om, hvornår anken forventes færdigbehandlet. Når afgørelsen er truffet, giver uddannelseslederen hurtigst muligt den studerende meddelelse herom, og bedømmerne modtager en kopi af afgørelsen. Går afgørelsen ud på tilbud om ny bedømmelse eller ny prøve, skal den studerende informeres om, at den nye bedømmelse eller nye prøve kan resultere i en lavere karakter.

Ny prøve og ny bedømmelse sker efter reglerne i afsnittet ”Ved ny prøve og ny bedømmelse”.

Ankenævnets faglige afgørelse af sagen kan herefter ikke ankes yderligere.

Retlige spørgsmål[18]
Den studerende kan altid klage over retlige spørgsmål i afgørelser truffet i klage- og ankesager. Klagen skal indgives senest 2 uger efter afgørelsen er gjort den studerende bekendt.

Klagen skal sendes til den uddannelsesleder, som er leder for den pågældende studerendes uddannelse. Uddannelseslederen udfærdiger en udtalelse og sender herefter klagen med udtalelsen til Styrelsen for Videregående Uddannelser og uddannelsesstøtte.

[16] Eksamensbekendtgørelsens § 47

[17] Eksamensbekendtgørelsens § 48

[18] Eksamensbekendtgørelsens § 50

5.2 Prøveformer

Prøverne tilrettelægges som individuelle prøver og prøveformen skal sikre, at der foretages en individuel bedømmelse af de studerende.

I et projektarbejde, udarbejdet af flere studerende i fællesskab, vil de studerende eksamineres ved en mundtlig gruppeprøve på en sådan måde, at de sikres en individuel bedømmelse. Det er i disse tilfælde en betingelse, at den enkelte studerendes bidrag kan konstateres. Se også retningslinjer vedr. projektarbejde.

Bedømmelsen sker på grundlag af følgende prøveformer:
- Skriftlig eksamen
- Mundtlig eksamen
- Projekt med mundtlig fremlæggelse og eksamination
- Godkendelse efter nærmere angivne kriterier
- Deltagelse i praktik med løbende kommunikation og refleksion gennem Studienet.
- Kombinationer af ovenstående prøveformer.

Prøveformerne beskrives nærmere i de følgende afsnit, ligesom forhold og adfærd under de enkelte eksamensformer præciseres.

Prøveformen skal være fastsat inden kursusstart og fremgå af den dertil hørende kursusbeskrivelse. Ved skriftlig eksamen skal antallet af timer være fastlagt.

Det skal endvidere være oplyst, om der er betingelser for at deltage i prøve/eksamen. Specielt skal nævnes, at det på 1. – 4. semester er en betingelse for deltagelse i visse eksamener, at semesterprojektet er bestået. Endvidere kan eksamen i bachelorprojekt ikke gennemføres, før samtlige forudgående eksamener er bestået.

Prøveformen for de enkelte kurser fremgår endvidere
- for 1. – 4. semester af oversigterne i afsnit 4.1 samt bilag 1
- for 6. – 7. semester af oversigterne i kapitel 4.2 samt bilag 1

Generelt gælder det, at en eksamen gennemføres på samme sprog som undervisningen.

5.2.1 Skriftlig eksamen

Tid og sted
Tidspunkt fremgår af eksamensplanerne, der kan findes på Studienet - Forsyningsingeniør.

Hvis lokalet ikke fremgår af eksamensplanen, vil det på eksamensdagen fremgå af opslag eller infoskærme på Torvet.

De studerende skal møde i så god tid, at de kan være klar i lokalet 10 minutter før eksamen påbegyndes.

Kommer en studerende for sent, kan vedkommende kun deltage i eksamen, hvis eksamensvagten tillader det. Ved mere end 10 minutters forsinkelse, skal man henvende sig i studieadministrationen. Studiesekretæren afgør, evt. i samarbejde med uddannelseslederen, om den studerende må deltage i eksamen.

Adfærd
Mobiltelefon må ikke medbringes – eller den skal afleveres hos eksamensvagten inden eksamen begynder.

Eksamenslokalet må kun forlades i ledsagelse af eksamensvagten. Ved toiletbesøg skal det toilet, som vagten anviser, benyttes. Man må ikke gå udenfor, i kantinen eller andre steder. Rygning er ikke tilladt.

Der må ikke være kontakt mellem eksaminanderne under prøven. Enhver henvendelse må alene ske til eksamensvagten.

Den sidste halve time før prøvens afslutning skal der være absolut ro. Det betyder, at ingen må printe, pakke sammen eller forlade lokalet.

Hjælpemidler
Det fremgår af kursusbeskrivelsen, hvilke hjælpemidler der evt. ikke er tilladte. Dette omfatter også brugen af egen pc samt om netadgang er tilladt. Det er yderst sjældent, at netadgang er tilladt. Ved den mindste tvivl, bør underviseren kontaktes. Man må ikke låne hjælpemidler af andre i eksamenslokalet.

Lommeregner skal have egen strømforsyning og må ikke placeres, så andre kan se displayet.

Hvis der må anvendes pc, stiller skolen en printer til rådighed, men de studerende skal selv medbringe strømforsyning og forlængerledning. Det er de studerendes eget ansvar, at deres pc virker og at de forstår at anvende de nødvendige programmer. Går en pc ned, må prøven fortsættes uden. Det kan anbefales at tage regelmæssige sikkerhedskopier af arbejdet.

Såfremt man ikke anvender egen printer, skal man medbringe en tom usb-nøgle, så besvarelsen kan overføres til den pc, der er tilkoblet skolens printer. Besvarelsen skal omdannes til en pdf-fil inden overførslen. Man må ikke printe på en anden studerendes printer.

Opgavernes vægtning
Hvis der er angivet en vægtning ved de enkelte delopgaver, er både underviser og censor forpligtet til at anvende denne vægtning ved bedømmelsen.
Er der ikke anført en vægtning, vurderer underviser og censor selv, hvordan de enkelte opgaver skal vægtes. De behøver altså ikke være enige om vægtningen.

Papir
Såfremt besvarelsen skal afleveres på papir, vil de studerende få udleveret alt nødvendigt papir.
Får man brug for mere papir, kan eksamensvagten kontaktes ved håndsoprækning.

Der skal skrives navn, studienummer, dato, sidetal samt fag på omslag samt alle besvarelsens ark – både ved håndskrevne og printede besvarelser.

Der må ikke bruges rød skrift ved besvarelsen.

Digital eksamen
Såfremt besvarelsen skal afleveres digitalt i WISEflow, skal besvarelsen omdannes til en pdf fil. Vejledninger til WISEflow findes på Studienet. Vejledningerne bør læses i god tid inden eksamen!
Yderligere spørgsmål ang. WISEflow kan stille stil studieadministrationen

Aflevering
Ved aflevering før prøvetidens udløb skal eksamensvagten tilkaldes ved håndsoprækning.

Man må ikke aflevere i den sidste halve time før prøvens afslutning (Gælder ikke ved aflevering i WISEflow). Se nærmere i afsnittet om adfærd

Den studerende skal blive siddende, indtil vagten har kontrolleret alt materiale. I den forbindelse skal sidste side i afleveringen underskrives. Såvel opgavetekst som kladder skal afleveres.

Ved aflevering, når prøven er afsluttet, skal alle blive siddende på deres pladser uden at tale sammen, indtil eksamensvagten har indsamlet alle besvarelser.

Hvis en studerende ikke er færdig med besvarelsen, kan kladde og notater vedlægges, hvis der gøres opmærksom på det ved afleveringen. Censor afgør selv, om dette tæller med ved bedømmelsen.

De studerende er selv ansvarlige for, at alt afleveres i de respektive omslag.

5.2.2 Mundtlig eksamen

Tid og sted
Tidspunkt og lokale fremgår af eksamensplanen, der kan findes via uddannelsens studienet.

Detailplanen udfærdiges af underviseren. De studerende skal møde 15 minutter før, således at eksamen kan forløbe uden afbrydelse, hvis en anden studerende udebliver. Kommer man for sent, kan man kun deltage, hvis underviser og censor tillader det.

Gennemførelsen
Mundtlige eksamener er offentlige. Dog kan adgangen begrænses af pladshensyn. Det er endvidere muligt at bortvise enkeltpersoner for at opretholde ro og orden. Under voteringen må kun eksaminator og censor (samt evt. kommende eksaminatorer) være til stede.

Antallet af eksamensspørgsmål står i passende forhold til antal studerende, og spørgsmålene bør på rimelig måde dække pensum.

Ved prøvens begyndelse skal samtlige spørgsmål være fremlagt, og der må på intet tidspunkt under prøven være fremlagt færre end 3 spørgsmål. Den studerende trækker selv sit spørgsmål.

Underviseren foretager eksaminationen. Censor må kun stille uddybende spørgsmål.
Underviseren må normalt ikke standse eksaminationen, før censor har givet samtykke.

5.2.3 Projekteksamener

Tid og sted
Tidspunkt og lokale fremgår af eksamensplanen, der kan findes på uddannelsens studienet.

De studerende skal møde 15 minutter før, således at de kan være klar til at præsentere deres projekt, når eksaminationstiden starter.

Ved projekter, hvor der indgår flere fag i bedømmelsen, vil der typisk deltage en underviser for hvert fag. Dette gælder specielt fx på 1.–4. semester.

Eksamen vil foregå i et lokale med projektor. De studerende skal selv medbringe evt. pc.

Ca. ¼ af eksaminationstiden er afsat til præsentation af projektet.
Den følgende ½-del af tiden anvendes til individuel eksamination under hensyntagen til gruppens emnefordeling. Ved denne del af eksaminationen skal den enkelte studerende eksamineres på en sådan måde, at det sikres, at der kan foretages en individuel bedømmelse af den studerendes præstation.
Sidste ¼ anvendes til bedømmelse og individuel karaktergivning. Under voteringen er de studerende ikke til stede.

5.2.4 Godkendelse

En del kurser bedømmes uden eksamen. Som hovedregel kan man opnå resultatet godkendt eller ikke godkendt. På enkelte kurser på specialedelen (6. og 7. semester) kan man dog opnå en karakter. Se de enkelte kursusbeskrivelser.

Bedømmelsen sker ud fra kriterier, der er anført i kursusbeskrivelsen.
Kriterierne kan være flere af følgende:
- stillede opgaver/rapporter, der skal være rettidigt afleveret og godkendt med et tilfredsstillende resultat.
- tests, der ikke må have altafgørende betydning for godkendelsen.
- kursusarbejde(r)/cases, der skal være rettidigt afleverede og godkendt(e).
- studieaktivitet (fremmøderegistrering).

Det skal være muligt at bestå kurset ud fra flere kombinationsmuligheder af kriterier.
Ingen af kriterierne må vægtes så højt, at de alene kan afgøre, om den studerende består kurset.

80 % af de samlede kriterier skal være opfyldt.

Præcisering af det enkelte kursus vurderingskriterier vil fremgå af kursusmateriale på studienet.

Ved bedømmelsen skal der altid tages hensyn til kursets formål og delmål, dvs. hvad den studerende i henhold til kursusbeskrivelsen skal kunne efter kurset.

Godkendelsen kan i enkelte tilfælde være betinget af, om en eksamen i et andet kursus eller projekt er bestået.

5.3 Eksterne og interne prøver

Prøverne er enten interne eller eksterne. Ved interne prøver medvirker en censor udpeget af institutionen blandt lærerne på institutionen. Ved eksterne prøver er censor beskikket af Uddannelses- og Forsknings Ministeriet (UFM).

Mindst 1/3 af uddannelsen skal bestås gennem eksterne prøver.

Af bilag 1 fremgår det, om der anvendes interne eller eksterne censorer ved prøverne.

5.4 Bedømmelse og beståelseskrav

Der skelnes mellem følgende former for bedømmelse:
- Karakter efter 7-trins-skalaen
- Godkendt/ikke godkendt.

Ved eksamener, hvor karakteren ikke meddeles umiddelbart efter prøvens afslutning, vil tidspunktet for censurmødet/bedømmelsen fremgå af eksamensplanen. Resultatet vil fremgå af stads-selvbetjening. Det samme gælder resultatet af godkendelsesfag.

Kurser, hvor der er opnået bedømmelsen 02 eller derover i 7-trins-skalaen eller bestået/godkendt, kan ikke tages om.

Som en del af læringsmålet skal de studerende bl.a. indøve præsentationsteknikker i såvel skreven tekst som tale. De studerendes stave- og formuleringsevne vil derfor indgå i bedømmelsen af semesterprojekterne og på specialedelen ved bedømmelse af det tværfaglige projekt og bachelorprojektet. En dårlig stave- og formuleringsevne medfører således, at karakteren påvirkes i negativ retning. VIA kan dispensere fra ovennævnte krav for studerende, der dokumenterer en relevant specifik funktionsnedsættelse. Se også afsnit 5.1.3.

Karakter efter 7-trins-skalaen
I "Bekendtgørelse om karakterskala og anden bedømmelse" nr. 262 af 20. marts 2007 er der en række uddybende kriterier for, hvilke færdigheder der kræves for hver enkelt af de 7 forskellige karakterer efter 7-trins-skalaen. Se næste side.

I Bilag 8 er angivet vurderingskriterier for Forsyningsingeniøruddannelsen. Disse er tænkt som vejledende, hvorfor der kun er valgt at illustrere et udvalg af karakterer.
Vurderingskriterierne skal ses i sammenhæng med læringsmål (delmål) i kursusbeskrivelserne og karakterskalaen. Vurderingskriterierne fungerer som en præcisering af læringsmålene.

Godkendt/ikke godkendt
Bedømmelsen godkendt/ikke godkendt anvendes på kurser, hvor prøveformen er lærerens godkendelse af den studerendes undervisningsdeltagelse.

Se endvidere afsnit 5.2.4.

Ved bedømmelsen skal der altid tages hensyn til kursets formål og delmål, dvs. hvad den studerende i henhold til kursusbeskrivelsen skal kunne efter kurset.

5.5 Syge- og reeksamen samt genlæsning

Som hovedregel skal studievejleder altid kontaktes, hvis en eksamen ikke er bestået, eller en studerende har andre problemer i løbet af studiet.

Studievejleder kan hjælpe med afklaring af studieforløb og vejledning om den enkeltes muligheder (reeksamen, genlæsning af et kursus eller andet).

Syge- og reeksamen afholdes normalt ca. 14 dage efter den følgende semesterstart. Dette gælder også for studerende, der er dumpet en eksamen på det afsluttende semester.

En studerende kan højst gå til eksamen på samme kursus tre gange. Disse tre eksamensforsøg skal følge umiddelbart efter hinanden, dvs. 3 på hinanden følgende eksamener/reeksamener. I tilfælde af usædvanlige forhold kan uddannelseslederen give tilladelse til yderligere forsøg. Manglende opfyldelse af forudsætninger for deltagelse i eksamen, udeblivelse, udokumenteret sygdom og evt. bortvisning tæller med i forsøgene.

En studerende kan højst 3 gange deltage i en undervisning, der skal godkendes.
I tilfælde af usædvanlige forhold kan der søges om dispensation til yderligere forsøg. Se afsnit 10.

Uddannelseslederen kan tillade, at en studerende, der ikke har opnået godkendelse, aflægger en prøve (skriftlig eller mundtlig) i stedet for 2. eller 3. gang at deltage i undervisningen. I så fald beskikker ledelsen en censor blandt sine lærere. En opnået tilladelse til at aflægge prøve i stedet for at gentage et kursus, der skal godkendes, tæller som et forsøg af de i alt 3 tilladte.

Såfremt det ikke-godkendte kursus er en forudsætning for at følge kurser på det kommende semester, er det muligt at søge dispensation. Se afsnit 9.

Hvis en studerende dumper eller framelder en projekteksamen, kan vedkommende lave et nyt projekt i det følgende semester. Drejer det sig om tværfagligt projekt (TFP) eller bachelorprojekt (PRO), skal der vælges et nyt emne.

6 Tidsfrister samt andre vilkår og betingelser

6.1 Tidsfrister

For gennemførelsen af studiet gælder følgende tidsfrister:
- 1. og 2. semesters kurser skal være bestået senest efter 2 år.
- 3. og 4. semesters kurser skal være bestået senest efter 4 år.
- Selve diplomingeniøruddannelsen skal være bestået senest efter 7 år.
- Senest 1 år efter studiestart skal den studerende have bestået 1. årsprøven, jfr. afsnit 7.3.

Oplysning om regler ifm. SU kan fås på www.su.dk eller hos studieadministrationen.

6.2 Studiestartsprøven

Studerende med studiestart september 2015 eller senere skal deltage i og bestå en studiestartsprøve for at kunne fortsætte på uddannelsen. Prøven afholdes inden 1. oktober i startsemestret.

Prøven er med intern bedømmelse, og der gives bedømmelsen ”godkendt” eller ”ikke godkendt”.

Såfremt studiestartsprøven ikke godkendes, afholdes mundtlig omprøve senest 14 dage efter prøvens gennemførelse. Der gives ikke yderligere forsøg.

Denne studiestartsprøve er ikke omfattet af reglerne for klager over prøver.

Der kan gives dispensation fra prøvens tidsfrister, såfremt dispensationen er begrundet i sygdom, barsel eller usædvanlige forhold.

6.3 1. årsprøven

I henhold til Eksamensbekendtgørelsens bestemmelser omkring 1. årsprøven, gælder følgende:

1. årsprøven, der består af samtlige kurser på 1. semester, i alt 30 ECTS, skal være bestået senest 1 år efter studiestart. I modsat fald udmeldes den studerende fra uddannelsen.

Såfremt de ikke beståede kurser er en forudsætning for at følge kurser på 2. semester, er det muligt at søge dispensation efter rådgivning fra studievejleder. Se afsnit 9.

Uddannelseslederen kan dispensere fra ovenstående, såfremt det findes begrundet i usædvanlige forhold.

Vedrørende klageadgang henvises til afsnit 5.1.7.

6.4 Forudsætninger i studieforløbet

Udover de i afsnit 6.1 nævnte tidsfrister findes der, op gennem studiet, flere betingelser, der skal være opfyldt, for at den studerende kan fortsætte på det følgende semester:

Specielt gælder for:

3. semester: Deltagelse i kurser på 3. semester forudsætter, at samtlige kurser og projekt på 1. semester er bestået.

4. semester: Deltagelse i kurser på 4. semester forudsætter, at samtlige kurser og projekt på 2. semester er bestået.

5. semester Gennemførelse af praktikophold forudsætter, at samtlige kurser og projekter på 1.-4. semester er bestået.

6. semester Udførelse af projektarbejde (IDP) forudsætter, at samtlige kurser og projekter på 1.-4. semester er bestået.

7. semester: Udførelse af bachelorprojekt forudsætter, at den studerende har bestået 1.- 6. semesters kurser og projekter (i alt 180 point, inkl. ingeniørpraktikken).

Derudover kan der være forudsætninger for deltagelse i specifikke kurser, fx at et forudgående kursus indenfor samme emne skal være bestået. Se bilag 1 samt kursusbeskrivelserne.

Se afsnit 9 angående dispensationsmuligheder.

7 Udskrivning og genindskrivning

En studerendes indskrivning på uddannelsen bringes til ophør i følgende tilfælde:

- Uddannelsen er gennemført.
  Den studerende kan ikke senere søge optagelse på samme uddannelse.

- Den studerende melder sig ud.
  Evt. genoptagelse kan tidligst ske 5 måneder efter udskrivningen og aldrig midt i et semester.

- Uddannelsen kan ikke afsluttes. Dette begrundes i
- at studiestartsprøven ikke er bestået, jfr. afsnit 7.2
- at 1. årsprøven ikke er bestået, jfr. afsnit 7.4
- at alle eksamensforsøg er opbrugt, jfr. afsnit 6.5
- at den studerende i en sammenhængende periode på 1 år ikke har bestået mindst én prøve. jfr. adgangsbekendtgørelsens § 38
- at tidsfrister for gennemførelse af uddannelsen er overskredet, jfr. afsnit 7.1
  Evt. genindskrivning kan alene ske på grundlag af en konkret, faglig vurdering, hvor institutionen finder, at den pågældendes muligheder for at gennemføre uddannelsen er væsentligt forbedrede, eller hvis uddannelsens indhold er væsentligt ændret.

Genindskrives en studerende, kan bestående prøver ikke tages om, medmindre de er forældede som følge af uddannelsens regler eller ændringer af studieordning.

Hvis eksamensforsøg er opbrugt, kan institutionen give den studerende tilladelse til nye eksamensforsøg efter reglerne for den pågældende uddannelse.

8 Meriteringsbestemmelser

Studerende har pligt til at oplyse om gennemførte uddannelseselementer fra en anden dansk eller udenlandsk videregående uddannelse, der må antages at kunne give merit.
Ud fra en faglig vurdering træffes der i hvert enkelt tilfælde afgørelse om, hvorvidt der kan opnås merit.
Det formelle adgangskrav skal være opfyldt.

Ingeniørpraktik
Studerende med en faglig uddannelse inden for det forsyningsmæssige uddannelsesområde kan efter individuel vurdering fritages for den i afsnit 3.2.6 nævnte ingeniørpraktik. Ansøgning herom sendes til uddannelseslederen.

Studieophold i udlandet
Studerende, der efter aftale med uddannelseslederen har studeret ved et udenlandsk universitet eller en ingeniørskole, får meriteret bestående studieenheder efter individuel behandling.

Følgende forudsætninger skal være opfyldt:
- Studieopholdet må ikke resultere i en forlængelse af studiet.
- Studieopholdet skal normalt være placeret på 6. og/eller 7. semester.
- Uddannelseslederen skal forhåndsgodkende det nærmere specificerede studieophold, som skal svare til et eller to semestre.
- Studieopholdet forudsættes bestået efter gæsteinstitutionens eksamensregler. Om nødvendigt kan den studerende vælge at deltage i reeksamen, hvis gæsteinstitutionen har en sådan.

Den studerende har efter endt studieophold pligt til at dokumentere det godkendte studieopholds gennemførte uddannelseselementer.

Såfremt studieopholdet kun bestås delvist, foretager uddannelseslederen en forholdsmæssig meritering heraf. Den studerende må herefter supplere sit studieforløb med tilvalgskurser - valgt inden for ingeniøruddannelsernes samlede udbud - og projekter i nødvendigt omfang.

9 Dispensationsmuligheder

Når der foreligger usædvanlige forhold, kan uddannelsesleder dispensere fra de regler i studieordningen, som alene er fastsat af VIA jfr. bek. nr. 527 af 21. juni 2002 om diplomingeniøruddannelsen.

En dispensationsansøgning skal fremsendes snarest muligt på mail til uddannelseslederen og senest 1 uge før semestrets første undervisningsdag.

Ansøgningen skal som minimum indeholde:
- Hvad ønskes der dispensation til (deltagelse, yderligere forsøg o.a.)
- Hvilken bestemmelse ønskes der dispensation fra (forudsætning, opbrugt forsøg o.a.)
- Årsag til ansøgningen.
- Navn, studienummer

Ved tvivlsspørgsmål eller ønske om anden vejledning henvises til uddannelsens studievejleder.

10 Orlovsbestemmelser

Det er muligt at få orlov fra studiet i henhold til bestemmelserne i adgangsbekendtgørelsen.

Følgende er gældende:
- Orlov gives normalt kun i hele semestre. (fx barsel og sygdom kan være undtagelsen).
- Der kan normalt ikke søges orlov, før 1. års prøven er bestået.
- Under orlov betragtes man som ikke-studerende i relation til SU.
- Ansøgning skal ske via e-mail til uddannelseslederen.
- Ved særlige grunde kan der gives orlov i maksimalt 4 semestre i alt.
- Efter endt orlov har den studerende ikke krav på at fortsætte uddannelsen efter samme studieordning, som var gældende før orloven.

11 Titel og udstedelse af diplom

11.1 Titel

Dimittender, der har gennemført studiet efter denne studieordning, er berettiget til at anvende titlen *Diplomingeniør* med retningsbetegnelsen Professionsbachelor som diplomingeniør i forsyningsteknik i vand, spildevand og fjernvarme.

Den engelske titel er Bachelor of Engineering in Supply Engineering, Water, Waste Water and District Heating.

Der er endvidere mulighed for at opnå følgende specialebetegnelser:

Specialebetegnelsen i Vandforsyning kræver at:
- de obligatoriske specialekurser er godkendte eller bestået
- der er opnået mindst 15 ECTS-point blandt valgkurser indenfor Vandforsyning.

Specialebetegnelsen i Spildevandsforsyning kræver at:
- de obligatoriske specialekurser er godkendte eller bestået
- der er opnået mindst 15 ECTS-point blandt valgkurser indenfor Spildevandsforsyning.
-

Specialebetegnelsen i Fjernvarmeforsyning kræver at:
- de obligatoriske specialekurser er godkendte eller bestået
- der er opnået mindst 15 ECTS-point blandt valgkurser indenfor fjernvarmeforsyning.

Uden specialebetegnelse:
Det er muligt at vælge et individuelt studieforløb uden specialebetegnelse.

Der kan også vælges kurser fra andre ingeniørretninger.

Eventuelle forudsætninger for deltagelse på kurser skal være opfyldt.

11.2 Diplom

Efter endt uddannelse udsteder VIA University College et diplom med angivelse af titel, retningsbetegnelse og evt. specialebetegnelse. Desuden oplyses om delelementernes omfang i ECTS-point samt resultatet af de opnåede bedømmelser. Diplomet indeholder endvidere oplysning om emnerne for det tværfaglige projekt på 6. semester og bachelorprojektet. Endelig angives det, på hvilket adgangsgrundlag dimittenden er optaget på uddannelsen.

Som bilag til beviset udstedes endvidere et engelsksproget Diploma Supplement, der beskriver uddannelsen samt giver oplysninger om institutionen og om dennes og uddannelsens placering i det danske uddannelsessystem.

Ved afbrudt uddannelse udsteder VIA bevis for beståede elementer.

Bilag i studieordningen:

Bilag 1	Oversigt hele uddannelsen
Bilag 2	Kursusoversigt med læringsmål for 1. semester
Bilag 3	Kursusoversigt med læringsmål for 2. semester
Bilag 4	Kursusoversigt med læringsmål for 3. semester
Bilag 5	Kursusoversigt med læringsmål for 4. semester
Bilag 6	Værkstedspraktik
Bilag 7	Kursusoversigt med læringsmål for 6. – 7. semester
Bilag 8	Vurderingskriterier

Kontaktoplysninger:

Uddannelsesleder	Ove Steen Nielsen	oven@viauc.dk,	8755 4247
Studievejleder	Jessie Duus	jdu@viauc.dk,	8755 4315
Studiesekretær	Louise Norup Christiansen	horsens.studyadm.eng@via.dk	8755 4309

Bachelor of Supply Engineering
Courses / prerequisites – evaluation and ECTS-credits.

CONTENT BELOW:

PREREQUISITES
COURSE SHORT CODE EVALUATION
CREDITS ects = ECTS POINT
EXAMINATION X = EXTERNAL EXAMINER
I = INTERNAL EXAMINER

Updated 23-08-2015

													ECTS CREDITS
1	General admission requirements **SCI SE1** written exam 5 ects X	General admission requirements **CMA SE1** approval 5 ects	General admission requirements **GEO SE1** approval 5 ects	General admission requirements **SEN SE1** approval 5 ects								1st semester courses **SPJ SE1** oral exam 10 ects I	**30**
2	SPJ SE1 SCI SE1 **SCI SE2** written exam 10 ects I	SPJ SE1 **DGI SE1** approval 5 ects	SPJ SE1 SEN SE1 **SEN SE2** approval 5 ects									2nd semester courses **SPJ SE2** oral exam 10 ects X	**30**
3	SPJ SE2 SCI SE2 **SCI SE3** written exam 5 ects X	SPJ 2 CMA SE1 **CMA SE2** approval 5 ects	SPJ SE2 GEO SE1 **GEO SE2** approval 5 ects	SPJ 2 SCI 1, SCI 2 **HYD SE1** approval 5 ects								3rd semester courses **SPJ SE3** oral exam 10 ects X	**30**
4	SPJ SE3 SCI SE3 **SCI SE4** written exam 5 ects X	SPJ SE3 HYD SE1 **HYD SE2** approval 5 ects	SPJ SE3 **MSP SE1** approval 5 ects	SPJ SE3 SEN SE2 **SEN SE3** approval 5 ects								4th semester courses **SPJ SE4** oral exam 10 ects X	**30**
5	SPJ SE4 passed/attended **WPL SE1** (Work Placement) approval												**30**
6 + 7	SPJ SE4 **CAF SE1** approval 5 p.	SPJ SE4 **DHS SE1** approval 5 p.	SPJ SE4 **DHS SE2** approval 5 p.	SPJ SE4 **EPW SE1** approval 5 p.	SPJ SE4 **GCH SE1** approval 5 p.	SPJ SE4 **GFT SE1** approval 5 p.	SPJ SE4 **GME SE1** approval 5 p.	SPJ SE4 **GMO SE1** approval 5 p.	SPJ SE4 **GMP SE1** approval 5 p.	SPJ SE4 **GTM SE1** approval 5 p.	SPJ SE4 **HPC SE1** approval 5 p.	SPJ SE4 **IDP SE1** oral exam 10 p. X	**30** + **30**
	SPJ SE4 **MBT SE1** approval 5 p.	SPJ SE4 **OTG SE1** approval 5 p.	SPJ SE4 **PMA SE1** approval 5 p.	IDP SE1 **PRO SE1** oral exam 20 p. X	SPJ SE4 **RCW SE1** approval 5 p.	SPJ SE4 **RSS SE1** approval 5 p.	SPJ SE4 **SMG SE1** approval 5 p.	SPJ SE4 **SST SE1** approval 5 p.	SPJ SE4 **STE SE1** approval 5 p.	SPJ SE4 **STS SE1** approval 5 p.	SPJ SE4 **SUE SE1** approval 5 p.	SPJ SE4 **TTN SE1** approval 5 p.	

One ECTS is equivalent to an average workload for a student in about 27-28 hours incl. preparation, participation, writing assignments and exams.

CMA SE1 Construction Management
Keywords: Drainage systems, drain installation, pressure lines, environmental conditions, materials and design, assembly methods, planning, geometric design, cross design

Credits: 5 ECTS

Learning goals:

Knowledge:
The aim is to give students a basic understanding of installations in soil, road construction and civil engineering. The course should enable the student to design and plan a simple road construction project.
After completion of the course the student must have gained knowledge of
• Design of drainage systems in soil
• Basic terms in urban infra-structural facilities
• Planning of roads and paths in urban areas
• Design and planning of cross-section with supply installation.
Common road projects in connection with developments and access roads to residential and industrial areas as well as matching paths and parking places.

Skills:
After completion of the course the student must be able to
• Split a process into activities and estimate their time consumption
• Draw out process bindings for the activities
• Pick and analyse appropriate planning tools and apply these
• Carry out resource planning and document this
• Project minor roads and crusting works in urban areas
• Plan and execute development plans
• Dimension pavements using reference tables
• Dimension water piping, water piping and common pipes
• Distinguish between different materials and design of wells, pipes, fittings and assembly methods
• Prepare proposals for drainage systems in soil from buildings and paved areas.
• Know the environmental justification for the design and location of drainage systems.

Competences:
After completion of the course the student must be able to: Design and construct roads for land development. Assess time schedule and price calculation for roads and supply installation for the area.

Topics:
Road Building in Urban Areas
• Planning in urban areas
• Planning and road codes
• Geometric design of roads and paths in urban areas
• Cross design in urban areas Construction Management and Planning
• The necessity of planning
• Planning tools
• Time and resource planning
• IT-tools for planning (Microsoft Project)
• Project planning
• Basic economic calculation

Resources:
Textbook: Information will be given during the course
• Code of the Road: Information will be given during the course
supplementary literature:
Will be uploaded to Study-net in due time during the module.

Prerequisites:
General admission requirements

Assessment:

Approval on basis of several of the following criteria:
- Given assignments/reports, which must be handed in on time and approved with a satisfactory result,
- Tests, which must not have a crucial importance for the approval,
- Course work/cases, which must be handed in on time and approved,
- Study activity (attendance registration).

It must be possible to pass the course from multiple combinations of the criteria. None of the criteria must be weighted so high that they alone can decide whether the student passes the course. 80% of the overall criteria must be fulfilled.
Specification of each course valuation criteria will be clear from course material on study net.

GEO SE1 Geologi and Water
Keywords: Geology, geological processes, rocks and sediments, engineering geology, properties of soil and water, water cycle, groundwater flow, groundwater table, field observations, climate changes.

Credits: 5 ECTS

Learning goals:

Knowledge:
The course aims is to give students an introduction to geology, hydrology, the water cycle and climate changes.
Following completion of the course, the student has knowledge of:
• Basic geology and soils
• Basic engineering geology and strength and stability of soils
• Basic hydrology
• The water cycle
• Aspects of climate and climate changes

Skills:
Following completion of the course the student must be able to:
• identify different Danish sediment types in the field and interpret their depositional environment and age
• Apply relevant existing data to describe the geological, hydrological and climatic conditions
• Perform field work such as hand drillings and infiltration tests and interpret data from them
• account for the different components of the water cycle and the basic principles of groundwater flow in confined and unconfined aquifers
• Identify climatic challenges and evaluate seepage capacity and possibilities
• Explain the challenges related to soil mechanics and groundwater flow that are connected to open excavations.

Competences:
After the course, the student will be able to apply knowledge and skills to:
• Interpret relevant geological, climatic and hydrological data and maps for Denmark using GIS tools for a description of the geological, climatic and hydrological conditions.
• Obtain and use data in combination with existing knowledge to assess an area's geology, climatic and hydrological conditions and potential challenges in relation to construction work and climate.

Topics:
• Basic Geology: Geological processes, deposition environments and deposition mechanisms, rock types and sediments
• Basic Engineering geology: Physical properties of soil and groundwater and strength properties of soil, field observations and methods
• Water on Earth; Oceans, atmospheric water, glaciers, surface water and groundwater
• Water cycle: Evaporation, precipitation, groundwater and groundwater flow, aquifers, darcy's law, hydraulic conductivity, hydraulic head, field observations and methods, wells and piezometers
• Climate: Climate and climate changes, infiltration tests

Resources:
• Engineering Geology In Denmark, Inga Sorensen
• Additional notes from lectures
• Data and information from Danish and international websites

Prerequisites:
General admission requirements.

Assessment:

Approval on basis of the following criteria:
• Given assignments/reports, which must be handed in on time and approved with a satisfactory result
• Tests, which must not have a crucial importance for the approval
• Course work/cases, which must be handed in on time and approved

• Study activity (attendance registration)
It must be possible to pass the course from multiple combinations of the criteria.
None of the criteria must be weighted so high that they alone can decide whether the student passes the course.
80% of the overall criteria must be fulfilled.
Specification of each course valuation criteria will be clear from course material on study net.

SCI SE1 Science 1
Keywords: Differentiation, trigonometric functions, exponential functions, Integration, vectors in space, vector functions, differential equations

Credits: 5 ECTS

Learning goals:

Knowledge:
The course aims to enable participants to understand and apply basic mathematical concepts within selected topics in the mathematical analysis.
The course aims to enable participants to understand and apply basic concepts in selected topics in mathematical analysis, linear algebra and spacious vector geometry. Furthermore the course aims to provide the student with the ability to read and interpret technical literature that uses mathematics.

Skills:
After the course, students should be able to:
• Describe and understand selected transcendental functions.
• Describe and understand the branch of calculus that is involved in differentiation and limits for functions of one variable including various uses thereof.
• Describe and recognize the branch of calculus that deals with integration of functions of one variable and various uses thereof.
• Analyse space and perform calculations based on vector operations.
The course includes IT as a pedagogical method. The goal is that IT must support students' learning processes and their understanding of the engineering opportunities in the application of modelling and simulation.

Competences:
After the course, students should be able to:
• Describe and understand selected transcendental functions.
• Describe and understand the branch of calculus that is involved in differentiation and limits for functions of one variable including various uses thereof.
• Describe and recognize the branch of calculus that deals with integration of functions of one variable and various uses thereof.
• Analyse space and perform calculations based on vector operations.
The course includes IT as a pedagogical method. The goal is that IT must support students' learning processes and their understanding of the engineering opportunities in the application of modelling and simulation.

Topics:
• Differentiation
• Trigonometric functions
• Exponential Functions
• Integration
• Vectors in space
• vector functions
• Differential equations (Introduction)

Resources:
Thomas, Finney, Weir, Giordano: Thomas Calculus, latest edition, Addison-Wesley
• N. Tornskjold: Matematisk formelsamling for adgangskursus, 2. udgave, Erhvervsskolernes Forlag, 1996 (Danish students only)
The teaching is based on student possessing a calculator that can perform operations corresponding to Ti-89 or a PC with mathematical software that can perform operations similar to Math-Cad.

Prerequisites:
General admission requirements.

Assessment:
Written exam with an external censor

SEN SE1 Supply Engineering 1
Keywords: Business conditions, organization, distribution system, drinking water treatment, sewer systems, wastewater treatment, district heating plants, energy sources, pipe network systems, water and heat consumption

Credits: 5 ECTS

Learning goals:

Knowledge:
To give the student a basic understanding of the three supply branches,- water supply, waste water supply and district heating supply in terms of organisational structure, legislation, stakeholders, main technical elements and main technical challenges.
After completion of the course, the student has knowledge about the organization of the supply sector in Denmark and other European countries, basic knowledge about the main technical elements of the three types of utilities , water,- waste water and district heating companies and basic knowledge about water consumption, heat consumption and amount/composition of water and storm water .

Skills:
After completion of the course, the student must be able to:
Describe the typical organisation of a utility and explain the interaction between stakeholders.
Describe the main technical elements of each of the three supply branches and explain their interdependency.
Describe the contents of a supply plan and the process of acquiring data for the plan.

Competences:
After completion of the course, the student will be able to apply knowledge and skills to:
Plan changes in a utility that involves the main stakeholders.
Evaluate the main consequences of changes in existing technology or supply structure.
In broad terms set up a work schedule for supply plan. Participate in waste water planning and management/optimisation of waste water systems.

Topics:
Supply companies business structure, obligations and privileges. General technical knowledge about the main elements of each utility and the interaction of these elements.
Presentation of the main stakeholders in each of the utilities.

Resources:
Literature is not yet determined.

Prerequisites:
General admission requirements.

Assessment:

Approval on basis of the following criteria:
• Given assignments/reports, which must be handed in on time and approved with a satisfactory result
• Tests, which must not have a crucial importance for the approval
• Course work/cases, which must be handed in on time and approved
• Study activity (attendance registration)
It must be possible to pass the course from multiple combinations of the criteria. None of the criteria must be weighted so high that they alone can decide whether the student passes the course. 80% of the overall criteria must be fulfilled. Specification of each course valuation criteria will be clear from course material on study net.

SPJ SE1 Semester project 1 - Soil and Water
Keywords: Planning and design, water distribution, heating distribution, sewer system, waste water plant, infrastructural constructions in urban area, constructive analysis, geotechnical properties of soil, hyd

Credits: 10 ECTS

Learning goals:

Knowledge:

The students must obtain an understanding of planning and design of infrastructural constructions, with pipe in urban area and furthermore, basic understanding for they must be skilled in the execution of projects within this area.

Skills:
To show understanding of the entire project complexity
• To use the gained theoretical knowledge in practical activities
• To analyse and use data gathered from practical activities and calculations
• To set up, describe and interpret the collected data, including the development of individual competencies
• To describe and complete a report, including presentation material
• To present the project material
The course includes IT as a pedagogical method. The purpose is to support the students' learning processes and their understanding of the engineering opportunities, which is part of e.g. the use of modelling, simulation etc.

Competences:
After completion of the course the student must be able to:
Design and plan pipe systems for a minor urban area.
Design and construct roads for land development.
Assess time schedule and price calculation for roads and supply installation for the area.
Have a basic understanding for geotechnical terms.

Topics:
The content is described in details in the project courses:
SEN SE1, CMA SE1 and GEO SE1.
Based on project and supply material for an infrastructural construction in urban area, construction technical and constructive analysis of the project will be conducted with the purpose of setting up alternate solutions and synthesis.

Resources:

Prerequisites:
The students must participate in the applicable courses and the requirements of the project work must be met.

Assessment:
Oral examination with an external or internal examiner.
Evaluation of the project will be based on presentation and conversation about the project work at an oral exam with an internal examine.
Project description must be duly handed in and approved in order to register for exam in the semester project. The project courses are included in the semester project with different weighting.

DGI SE1 Data and GIS
Keywords: Geodata. Geographical Information Systems. Webservices. Database management. SQL. Thematic maps.

Credits: 5 ECTS

Learning goals:

Knowledge:
To provide the students with knowledge to access maps and relevant data from the internet and to handle, organize and analyse these data together with local data and measurements in Geographical Information Systems (GIS).
The student will obtain knowledge about
• Use of GIS and digital maps in daily life.
• Software for GIS such as MapInfo and QGIS
• Geodata and available public databases
• Database structures and how to create and maintain databases
• Use of SQL including geographical SQL
• Webservices including WMS and WFS
• Different coordinate systems and projections
• Design of thematic maps with relevant legends
• Exchange of data between different systems and software
• Conflict analysis between different sectors and topics
• Documentation of information shown on maps

Skills:
After completion of the course the student must be able to:
• Use GIS software such as MapInfo and QGIS
• Edit and change existing databases and maps
• Create new databases with given info from the supply industry
• Perform SQL queries and calculations in MapInfo and QGIS
• Perform buffer analysis, overlays and other spatial analysis
• Access and evaluate geodata from public databases
• Design thematic maps with relevant legends and documentation
• Import and export of map data and attributes between relevant software
• Identify projections and coordinate systems on given maps

Competences:
At the end of this course the student should be competent to use GIS as a tool in any projects where different kind of themes and data have to be shown on digital maps. The competences include knowledge of availability of spatial data and any other kind of information relevant for the supply sector.

Topics:
• Geographical Information Systems
• Relation databases
• Spatial SQL
• Raster maps and vector maps.
• Coordinate systems and projections.
• Webservices
• Geodata and open geographical basisdata
• Geocoding
• Georeferencing
• Buffer analysis and map overlay
• Thematic maps
• Metadata

Resources:
• Digital compendium with 24 lessons and associated problems to solve.

• Files with maps and other data.
• Video instructions
• Collection of relevant internet links
• Conolly, Thomas and Begg, Carolyn: Database Systems (5th edition). Harlow, 2010, Pearson Education. ISBN: 987-0-321-52306-8.

Prerequisites:

SPJ SE1

Assessment:

For full-degree students:
Approval on basis of several of the following criteria:
• Given assignments/reports, which must be handed in on time and approved with a satisfactory result,
• Tests, which must not have a crucial importance for the approval,
• Course work/cases to be handed in on time and approved,
• Study activity (attendance registration).
It must be possible to pass the course from multiple combinations of the criteria. None of the criteria must be weighted so high that they alone can decide whether the student passes the course. 80% of the overall criteria must be fulfilled. Specification of each course evaluation criteria will be clear from course material on study net.

For exchange students:
Grading on basis of several of the criteria mentioned above.

SCI SE2 Calculus and Linear algebra, Particle Dynamics, Basic Thermodynamics
Keywords: Calculus and Linear algebra, Particle Dynamics, Basic Thermodynamics.

Credits: 10 ECTS

Learning goals:

Knowledge:
The student will obtain knowledge of the basic theory within Calculus and Linear algebra, Particle Dynamics, Basic Thermodynamics and be able to perform elementary dynamic and thermal calculations.
Furthermore, the purpose is to enable the student to read
The student shall:
• Obtain knowledge about application of integration, Matrixes and matrix algebra, Determinants, Linear equation systems, Polar coordinates, Complex numbers, Ordinary differential equations of the 1st and 2nd order.
• Obtain an understanding of the principles of plane dynamics of particles. The student must be capable of using mathematical methods for solving plane dynamics problems.
• Describe, construct and interpret a thermodynamic system. Apply and understand the main laws and fundamental concepts of thermodynamics. Calculate processes for ideal gas and real substances. Calculations for heat exchangers / heat transmission.

Skills:
Analyse a particle dynamic system and/or a thermodynamic system and select relevant theory so the student is able to calculate variables and main capacities for the system.

After completing the course the student will be:
• Able to solve simple technical problems on the basis of fundamental dynamic or thermodynamic laws.
• Familiar with different techniques of stating and solving dynamic or thermodynamic problems.
• Capable of reading and interpreting technical literature in which mathematical terms are used.

Competences:
After completion of the course the student must be able to:
Have a basic understanding for Calculus and Linear algebra, Particle Dynamics and Thermodynamics.
Use their skills and knowledge to study more advanced Calculus, Algebra, Dynamics and Thermodynamic courses on the Supply Engineering education.

Topics:
Application of integration, matrixes and matrix algebra, linear equation systems, polar coordinates , complex numbers, ordinary differential equations of the 1st and 2nd order.
Kinematics of a particle, kinetics of a particle, work and energy, steady flow of a fluid stream.
The basis of thermodynamics, ideal gases and reversible processes, the second law of thermodynamics and entropy, real substances, heat transfer/heat exchangers.

Resources:
• Thomas, Finney, Weir, Giordano: Thomas´ Calculus, newest edition, Addison-Wesley.
• Downloads from the study net.
• R. C. Hibbeler: Engineering Mechanics – Dynamics – SI Edition, Prentice Hall. Latest edition.
• Lauritsen/Gundtoft/Bredahl Eriksen: Thermodynamics, notes.

The teaching is based on the student having a PC with software able to perform operations corresponding to MathCad, and that the student independently acquaints themselves with the use of this.
The teaching is based on the use of MathCad.

Prerequisites:

SCI SE1; SPJ SE2

Assessment: There will be a 4 hours written examination with internal or external examiner in the dynamics and thermodynamics part. Condition for entering this examination is that the mathematics part is approved: All mandatory tests must be attended and all mandator

SEN SE2 Supply Engineering 2
Keywords: Environmental legislation, planning legislation, groundwater, nature, water environment, climate and climate change, AutoCad

Credits: 5 ECTS

Learning goals:

Knowledge:
To provide students with knowledge of environmental legislation, preparation of and conducting an Environmental Impact Assessment (EIA). Furthermore the students will obtain knowledge about water environment, climate, climate change in supply engineering
The course will give the student knowledge of the main juridical conditions and terms and give them a thorough overview of the national and international legislation and regulation in Denmark, the EU, and internationally. Furthermore the student will obtain knowledge concerning preparation of and conducting an EIA.

Skills:
After completion of the course the student must be able to:
• Structure and carry out an EIA analysis
• Carry out data collection and relevant analyses for an EIA
• Be able to perform an EIA using different legislation and processes for national, regional (e.g. the EU), or international circumstances.
• Used AutoCad

Competences:
After the course, the student will be able to apply knowledge and skills to:
• Interpret relevant geological, climatic and hydrological data and maps for Denmark using GIS tools for planning and conducting of an EIA screening.
• Obtain and use data in combination with existing knowledge to assess an area in relation to planning and conducting of an EIA screening.
• Enhance the student's ability to participate in the daily work of planning and operating within the contracting, consulting or public corporation in terms of knowledge of the juridical and legal framework for the company.

Topics:
Supply Engineering 2 is providing the students with knowledge which makes them capable of fulfilling the requirements in the semester project 2 in terms of data collection and analysis within the field of planning, environmental issues including protection of groundwater, nature, water environment and the climate including knowledge of climate changes. The course is divided into four overall clusters covering the above objectives:
• Environmental and Planning Legislation
• Environmental Impact Assessment (EIA)
• Climate
• AutoCad
The above content will be contextualised into concrete case studies and assignments preparing for semester project 2, which includes an Environmental Impact Assessment (EIA)

Resources:
Digital available written lessons with related questions. Assignments based on given cases and information available in various articles, books, and extracts of books. Case studies.
Mandatory readings:
Morris, Peter, and Therivel, Riki (2009) Methods of Environmental Impact Assessment (The Natural and Built Environment Series). 3rd or later edition. New York: Routledge. (This book is a methodology book about how to assess EIA).
Collection of papers and extracts of books will be uploaded at Studienet.viauc.dk
Additional readings:
Glasson, John, Therivel, Riki, and Chadwick, Andrew (2011) Introduction To Environmental Impact Assessment (Natural and Built Environment Series). 4th Edition or later. New York: Routledge. (This book covers the international and especially EU legislation within EIA)

Water, Brian (2013) Introduction to Environmental Management. New York: Routledge. (This bog covers environmental circumstances and impacts from human activity in general).

Prerequisites:

SEN SE1, SPJ SE1

Assessment:

For full-degree students:
Approval on basis of several of the following criteria:
• Given assignments/reports, which must be handed in on time and approved with a satisfactory result,
• Tests, which must not have a crucial importance for the approval,
• Course work/cases, which must be handed in on time and approved,
• Study activity (attendance registration).

It must be possible to pass the course from multiple combinations of the criteria. None of the criteria must be weighted so high that they alone can decide whether the student passes the course. 80% of the overall criteria must be fulfilled. Specification of each course valuation criteria will be clear from course material on study net.

For exchange students:
Grading on basis of several of the criteria mentioned above.

SPJ SE2 Semester project 2 - EIA Screening
Keywords: EIA Screening, legislation in Denmark and the EU, GIS systems, data and data processing, data analysis.

Credits: 10 ECTS

Learning goals:

Knowledge:
The students must obtain an understanding of EIA Screening, the legislation and the use of geographical information systems, data processing and data analysis.
The students must obtain an understanding of EIA Screenings, the use of geographical data and geographical information systems and furthermore, they must be skilled in the execution of projects within this area.

Skills:
To show understanding of the entire project complexity
• To use the gained theoretical knowledge in practical activities
• To analyse and use data
• To set up, describe and interpret the collected data, including the development of individual competencies
• To describe and complete a report, including presentation material
• To present the project material

The course includes IT as a pedagogical method. The purpose is to support the students' learning processes and their understanding of the engineering opportunities, which is part of e.g. the use of modelling, simulation etc.

Competences:
After the semester project, the student will be able to apply knowledge and skills to:
• Interpret and use relevant data e.g. geological, climatic and hydrological and maps for Denmark using GIS tools for planning and conducting of an EIA screening.
• Conduct an EIA screening
• Be able to participate in the daily work of planning and operating within the contracting, consulting or public corporation in terms of knowledge of the juridical and legal framework for the company when conducting an EIA Screening.

Topics:
The content is described in details in the project courses; SEN S2 and DGI S1. The project includes the preparation of an EIA screening for a construction project using geographical information systems and data processing and data analysis.

Resources:
Literature is not yet determined.

Prerequisites:
The students must participate in the applicable courses and the requirements of the project work must be met.
SPJ SE1;#3757

Assessment:
Oral examination with an external or internal examiner.
Evaluation of the project will be based on presentation and conversation about the project work at an oral exam with an internal or external examiner.
Project description must be duly handed in and approved in order to register for exam in the semester project.
The project courses are included in the semester project with different weighting.

DRAFT – Course descriptions 3. semester

Appendix 4

Title	SCIENCE 3
Code	SCI S3
Language	English
Provider	Supply Engineering
Responsible	Loren Ramsay
ECTS Point	5
Prerequisites	SPJ S2, SCI S2
Main purpose	To provide students with a foundation for further work with inorganic and organic chemical issues in the fields of water, waste water and district heating.
Keywords	Chemical bonding theory, chemical thermodynamics, equilibrium, kinetics, solutions, carbonate system, oxidation/reduction, instrumental analysis.
Topics	• Chemicals and bonds (inorganic and organic substances, orbitals, covalent bonds , ionic bonds , hydrogen bonds, van der Waals forces) • Chemical thermodynamics (enthalpy, entropy , Gibbs free energy, Arrhenius equation, PHREEQC database) • Equilibrium (law of mass action, Le Chatelier's principle, equilibrium constants, equilibrium constants/free energy relationship) • Kinetics (reaction order, reaction mechanisms , activation energy, temperature dependence, catalysts) • Aqueous solutions (units, ionic strength, activity, Debye Hückel equation, common ion effect, aqueous complexes, speciation, impact of temperature and pressure, geochemical modeling with PHREEQC) • Phase change (dissolution of gases, dissolving of solids, degree of saturation, evaporation of volatile substances from water, sorpti -on of dissolved substances to solids) • Carbonate system (buffer effect, acid constants, CO_2 exchange, Bjerrum diagrams) • Oxidation/Reduction (oxidation numbers, reduction potential, Pourbaix diagrams) • Instrumental Analysis (UV/VIS , IC, AAS , ICP, GC , MS)
Knowledge	The student will gain knowledge about chemical substances and their reactions. In addition, knowledge about aqueous solutions, including acid/base and redox conditions. Finally the students will obtain insight into the various chemical analyses of water samples.
Skills	After completion of the course the student will be able to: • distinguish between bonding types and their occurrence • identify and use tabulated values for thermodynamics parameters • prepare equilibrium equations from a reaction equations • Identify reaction order and calculate activities • Prepare input files, perform calculations and understand the results using the geochemical model PHREEQC • calculate equilibrium concentrations for phase changes from water to air and from water to solid phase • understand the carbonate system in water and calculate the concentrations of various components • calculate oxidation numbers and prepare Pourbaix diagrams • understand measurement principles of various water analysis methods and when each is applicable.
Teaching methods and study activity	137.5 hours of work for the student, 4-6 lessons per week for 12 weeks with a total of 60 lessons. Lectures are followed by individual exercises / group exercises / journals /mini-project.
Evaluation	Written exam with an external censor

Examination	Before participation in this exam, it is a condition that the semester project is passed.
Grading criteria	Grading based on the Danish 7 point scale
Resources	Literature is not yet determined
Additional information	Compulsory course, 3. semester.

Title	**CONSTRUCTION MANAGEMENT AND ECONOMY**
Code	CMA S2
Language	English
Provider	Supply Engineering
Responsible	Gorm Rytter
ECTS Point	5
Prerequisites	SPJ S2, CMA S1
Main purpose	The aim is to give students a solid understanding of construction projects within the supply area - for planning, execution and economy.
Keywords	Structural design and management, statical systems, project and design methodology, basic principles of precast concrete drawings, risk management, earthworks and economy, soil classification, mass calculation, soft ground work, soil quality criteria, , accounts analysis, cash budgeting, the A – L –method, human resources
Topics	• Basic Principles of Structural Design and Management: Statical systems (commerce and office buildings), "good practice" in construction, design process, introduction to precast concrete projects, project and design methodology, basic principles of precast concrete drawings (BIPS a113), choice of distribution models, design Management, risk Management. • Civil Engineering Management, Earthworks and Economy: Soil classifications, mass calculations, dispositions of machinery, calculations and quotations, soft ground work, budgeting, soil quality criteria, accounts analysis, key ratios of the financial statement, cost analysis, cash budgeting, investment calculations according to different methods, calculation forms, the successive principle, calculation basis, offer allocation, the A – L –method, human Resources, time indicators.
Knowledge	After participation in the course the student will have knowledge of: • Basic principles of structural design and management • Soil calculations and mass calculations, which can be used to determine the engineering effort at the project, to manage production planning, to calculate quotations for construction projects, including the ability to choose construction methods, personnel and machinery. • Calculations on different levels. • Settlement negotiation tools. • Participating in the daily work within the contracting, consulting or public corporation, including having an understanding of the economic operation of the company.
Skills	After completion of the course the student must be able to: • Design and process the construction of concrete projects taking into account project and design methodology and basic principles of precast concrete drawings • Do mass calculations and to have knowledge about mass curves • Choose and dimension soil machinery • Plan soft ground work in relation to road works • Present a realistic time schedule • Calculate a quotation in accordance to Indicating Times and/or V&S price tables • Be able to carry out accounts analyses

	• Be able to perform investment analyses for technical equipment • Possess knowledge of budgeting and liquidity analyses • Be able to draw up calculations for building and construction projects • Calculate a quotation in accordance to Indicating Times and/or V&S
Teaching methods and study activity	137.5 hours of work for the student, 4-6 lessons per week for 12 weeks with a total of 60 lessons. Activities during the course are lectures, theory, fieldwork, exercises and self-study.
Evaluation	For full-degree students: • Approval on basis of several of the following criteria: • Given assignments/reports, which must be handed in on time and approved with a satisfactory result, • Tests, which must not have a crucial importance for the approval, • Course work/cases, which must be handed in on time and approved, • Study activity (attendance registration). It must be possible to pass the course from multiple combinations of the criteria. None of the criteria must be weighted so high that they alone can decide whether the student passes the course. 80% of the overall criteria must be fulfilled. Specification of each course valuation criteria will be clear from course material on study net. For exchange students: • Grading on basis of several of the criteria mentioned above.
Examination	Approved / not approved
Grading criteria	For full-degree students: Approved / not approved . For exchange students: Grading based on the Danish 7-point scale.
Resources	• Civil Engineering Management 1, Mechanical equipment and methods of execution (Pdf-file at Studienet.viauc.dk) • Civil Engineering Management 2, Construction management (Pdf-file at Studienet.viauc.dk) • Civil Engineering Management 3, Economy in contracting companies (Pdf-file at Studienet.viauc.dk) • Notes for economy in construction management. Notes from the teacher
Additional information	Compulsory course, 3. semester.

Title	**ENGINEERING GEOLOGY AN GEOTECHNIQUES**
Code	GEO S2
Language	English
Provider	Supply Engineering
Responsible	Randi Warncke Nissen
ECTS Point	5
Prerequisites	SPJ S2, GEO S1
Main purpose	The aim of the course is to give students a basic understanding of soil mechanics and challenges associated with construction works in soil.
Keywords	Danish soil types, groundwater, uplift problems, groundwater lowering, open cast work, stresses, uplift and slope stability.
Topics	Danish soil types, geological and geotechnical data, classification of soils, stresses in soil, hydraulics and hydrogeology, Geotechnical challenges in open excavations.

Knowledge	The student gain knowledge about the aspects of Danish soil. The student also receive knowledge about the basic physical theories and methods used when describing geotechnical problems as well as enable the student to outline and design the best possible solution for a give construction based on a practical interpretation of soil and groundwater conditions. Further slope stability is examined.
Skills	After completing this course the student must be able to • Identify and describe typical Danish soil types • Identify geological settings and which soil types can be expected based on relevant maps and drilling data • Determine the different classification parameters • Determine total, neutral and effective stresses • Define potential, gradient and permeability as well as analyzing the groundwater conditions • Determine the critical gradient, erosion and uplift problems • Determine the geotechnical category • Be knowledgeable of the bearing capacity of footings and piles • Calculate slope stability according to extreme method and shredding method • Determine groundwater lowering methods • Determine Soil pressure • Determine settlement
Teaching methods and study activity	137,5 hours of work for the student, 4-6 lessons per week for 12 weeks with a total of 60 lessons. Activities during the course are lectures, theory, fieldwork, exercises and self-study. The course is part of the semester project (SPJ 3) on the 3rd semester.
Evaluation	For full-degree students: • Approval on basis of several of the following criteria: • Given assignments/reports, which must be handed in on time and approved with a satisfactory result, • Tests, which must not have a crucial importance for the approval, • Course work/cases, which must be handed in on time and approved, • Study activity (attendance registration). It must be possible to pass the course from multiple combinations of the criteria. None of the criteria must be weighted so high that they alone can decide whether the student passes the course. 80% of the overall criteria must be fulfilled. Specification of each course valuation criteria will be clear from course material on study net. For exchange students: • Grading on basis of several of the criteria mentioned above.
Examination	Approved / not approved
Grading criteria	For full-degree students: Approved / not approved. For exchange students: Grading based on the Danish 7-point scale.
Resources	Literature is not yet to be determined.
Semester	Compulsory course 3rd. semester.

Title	HYDRAULIC 1
Code	HYD S1
Language	English
Provider	Supply Engineering
Responsible	Jan Henrik Sørensen
ECTS Point	5
Prerequisites	SPJ S2, SCI S1, SCI S2
Main purpose	The purpose of this course is to provide the student with a basic knowledge of hydraulics.
Keywords	Bernoulli's Equation, energy Equation, pressure loss, Colebrook & Whites formula, Bretting's Formulas
Topics	Main topics are: • flow in closed pipes • flow in open channels • outlet through an orifice
Knowledge	The purpose of the course is to give the student the necessary insight and understanding to be able to: • carry out calculations of pressure loss in closed pipe systems • carry out calculations of water levels in open channels • understand how calculations of emptying of storage tanks are carried out
Skills	After the completion of the course, the student must be able to: • calculate pipe losses • calculate single losses • Draw hydraulic profiles with water levels • Calculate natural and critical depth in open channels • Understand the meaning of different types of flow • Calculate the time spent to empty a storage tank
Teaching methods and study activity	137.5 hours of work for the student, 6 lessons per week for 12 weeks. Activities during the course are lectures, theory, fieldwork, exercises and self-study. The result of the field measurements is to be presented in a report.
Evaluation	For full-degree students: Approval on basis of several of the following criteria: - Given assignments/reports, which must be handed in on time and approved with a satisfactory result, - Tests, which must not have a crucial importance for the approval, - Course work/cases, which must be handed in on time and approved, - Study activity (attendance registration). It must be possible to pass the course from multiple combinations of the criteria. None of the criteria must be weighted so high that they alone can decide whether the student passes the course. 80% of the overall criteria must be fulfilled. Specification of each course valuation criteria will be clear from course material on study net. For exchange students: Grading on basis of several of the criteria mentioned above.
Examination	Approved / not approved
Grading criteria	For full-degree students: Approved / not approved. For exchange students: Grading based on the Danish 7-point scale.
Resources	Notes issued by the teacher. Literature not yet determined.
Additional information	Compulsory course, 3. semester.

Title	SEMESTER PROJECT 3 – Land Development
Code	SPJ S3
Language	English
Provider	Supply Engineering
Responsible	Gorm Rytter
ECTS Point	10
Prerequisites	The students must participate in the applicable courses and the requirements of the project work must be met.
Main purpose	The purpose of the course is to ensure the student obtains an understanding of planning and project design of infrastructural facilities as well as obtains a routine in the completion of projects in this sector.
Keywords	Land development in urban areas, planning and project designing, infrastructural facilities, problem statement, project description, collection and procession of data, design
Topics	The content is further described under the courses included in the project: GEO S2, CMA S2 and HYD S1. Theme courses are included. With basis in a proposal for a development project, an analysis of the material is carried out in preparation for compilation of solution options. The analysis could be: • Assessment of methodical terms for the project • Possible suggestions and alternatives for the project design • Quantitative and qualitative aspects of the proposed solution • Assessment and choice of method for project presentation to client
Knowledge	Through working on a project including infrastructural planning of a new development area located in connection with an existing urban community, the student must develop skills in planning, problem statement, project description, collection and processing of data as well as the design of this type of facility. In connection with the project work, obligatory as well as free theme courses supporting the project work are conducted. Through completion of the project's theme part, and road building field, supporting the analytical skills of the student.
Skills	• To show understanding of the entire project complexity • Skills in applying learned knowledge to the solving of practical infrastructural project work. • The ability to convert the results of lab work into practical project oriented application. • The ability to plan and complete practical project works. • Skills in communication of the project results to the client. • To use the gained theoretical knowledge in practical activities • To analyse and use data • To set up, describe and interpret the collected data, including the development of individual competencies • To describe and complete a report, including presentation material • To present the project material The course includes IT as a pedagogical method. The purpose is to support the students' learning processes and their understanding of the engineering opportunities, which is part of e.g. the use of modeling, simulation etc. Analyses of the team on basis of a Belbin test. Group formation and analyses of the strength and weaknesses of the group. You must put out a contract for the group. At the end of the project period, the group must reflect on the cooperation in the group, on basis of the teams Belbin profile.
Teaching methods and study activity	The project period is 15 weeks, incorporated into the schedule for the first 12 weeks and then full time project work during the last 3 weeks. The

	working hours for each student are approx. 275 hours. The following courses are part of the semester project: GEO S2, CMA S2 and HYD S1.
Evaluation	Evaluation of the project will be based on presentation and conversation about the project work at an oral exam with an internal examiner. Project description must be duly handed in and approved in order to register for exam in the semester project. The project courses are included in the semester project with different weighting.
Examination	Oral examination with an external or internal examiner.
Grading criteria	Grading based on the Danish 7-point scale
Resources	Literature is not yet determined.
Additional information	Semester project on the 3. semester

Title	SCIENCE 4
Code	SCI S4
Language	English
Provider	Supply Engineering
Responsible	Torben Brøchner
ECTS Point	5
Prerequisites	SPJ S3, SCI S3
Main purpose	The aim of the course is for the students to be able to manipulate data set with matrix based methods and to perform analysis with appropriate statistical methods.
Keywords	MATLAB®, Introduction to matrix manipulations, introduction to the statistics toolbox, import of data, descriptive statistics, data presentation, data comparison, correlation, linear regression analysis
Topics	This module encompasses a mix of technical computation and applied statistics. • Introduction to matrix manipulations using MATLAB® • Introduction to MATLAB® Statistics toolbox • Transfer of data sets from Excel to MATLAB® • Descriptive statistics and graphical data presentation • Analytic statics as comparisons of estimates using binominal and continuous scales • Correlation and linear regressions analysis • Statistics in validity and reliability
Knowledge	The student will gain knowledge of statistics and processing of statistical data. In addition, the student will attain knowledge about the use of MATLAB® as a tool for mathematical calculations and statistical analyzes.
Skills	After completion of the course the student will be able to: • perform and explain descriptive statistics analysis in Excel and MATLAB • perform and explain basic statistics analysis in Excel and MATLAB • perform and explain adjusted data analysis in Excel and MATLAB • discuss and evaluate the appropriateness of using different statistical methods in analyzing data • perform and explain reliability and validity analysis in MATLAB • perform and explain basic data-analysis and present these by graphics in figures and tables
Teaching methods and study activity	137.5 hours of work for the student, 4-6 lessons per week for 12 weeks with a total of 60 lessons. Lectures are followed by individual exercises / group exercises / journals /mini-project.
Evaluation	Written exam with an external censor
Examination	Before participation in this exam, it is a condition that the semester project is passed.
Grading criteria	Grading based on the Danish 7 point scale
Resources	Literature is not yet determined
Additional information	Compulsory course, 4. semester.

Title	HYDRAULIC 2
Code	HYD S2
Language	English
Provider	Supply Engineering
Responsible	Jan Henrik Sørensen
ECTS Point	5
Prerequisites	SPJ S3, HYD S1

Main purpose	The purpose of this course is to provide the student with basic knowledge of gravitational flow in open pipes and pressurized flow in closed pipe systems respectively. The course also provides knowledge on how pipe systems are registered and utilized in GIS
Keywords	Gravity flow, pressure flow, flow and temperature, rainwater- , wastewater- and combined pipe systems, water supply systems, district heating pipe systems, longitudinal profiles, registration of pipe systems in GIS
Topics	Main topics are: • Design of gravitational pipes for rainwater and wastewater • Design of pressure systems for water supply • Design of pressure systems for district heating pipes • Creation of drawings (plans and profiles) for all pipe systems • Danish and European legislation
Knowledge	The purpose of the course is to give the student the necessary insight and understanding to be able to design basic systems of sewers, water supply and district heating in residential areas.
Skills	After the completion of the course, the student must be able to: • Carry out design and calculations of rain water and wastewater pipe systems including back water calculations • Carry out design and calculations of water supply pipe systems • Carry out design and calculations of district heating pipe systems • Make final drawings for all pipe systems • Make longitudinal profiles for all systems • Calculate pressure levels • Make general cross sections in a typical road showing correct location of all pipe systems
Teaching methods and study activity	137.5 hours of work for the student, 6 lessons per week for 12 weeks. Activities during the course are lectures, theory, fieldwork, exercises and self-study. The result of the field measurements is to be presented in a report.
Evaluation	For full-degree students: Approval on basis of several of the following criteria: - Given assignments/reports, which must be handed in on time and approved with a satisfactory result, - Tests, which must not have a crucial importance for the approval, - Course work/cases, which must be handed in on time and approved, - Study activity (attendance registration). It must be possible to pass the course from multiple combinations of the criteria. None of the criteria must be weighted so high that they alone can decide whether the student passes the course. 80% of the overall criteria must be fulfilled. Specification of each course valuation criteria will be clear from course material on study net. For exchange students: Grading on basis of several of the criteria mentioned above.
Examination	Approved / not approved
Grading criteria	For full-degree students: Approved / not approved. For exchange students: Grading based on the Danish 7-point scale.
Resources	Literature is not yet determined
Additional information	Compulsory course, 4. semester.

Title	MATERIAL SCIENCE AND PRODUCTS
Code	MSP S1
Language	English
Provider	Supply Engineering
Responsible	Gitte Norman Munch-Petersen
ECTS Point	5
Prerequisites	SPJ S3, SCI S3
Main purpose	To provide the student with a basic knowledge of materials and products used in the supply industry
Keywords	Porosity, density, strength, stiffness/rigidity, thermal expansion, steel, plastic, concrete, corrosion, degradation, laboratory exercises
Topics	• Porosity and Density • Structure of atoms and crystalline solids • Strength and stiffness • Moisture mechanic and Diffusion • Degradation mechanisms • Durability • Thermal expansion • Properties of steel stainless steel, concrete and plastic • Pipe materials for water, waste and district • Release of substances from pipes • Corrosion, wear and abrasion in pipes • Pipe materials, dimensions and product types • Statics of pipes and reservoirs • Laboratory exercises
Knowledge	After the completion of the course, the student must have acquired knowledge about: • Density, strength and rigidity • Structures of atoms and crystalline solids • Moisture mechanic and diffusion • Steel, stainless steel, concrete and plastic; its manufacturing, structure and physical properties. • thermal expansion and static of pipes • The release of substances from pipes, and its influence on the drinking water • Moistures mechanic and the interrelation between moisture and durability • Corrosion, wear and abrasion in pipes.
Skills	After completion of the course the student must be able to • Distinguish between and decide on specific materials for different project types • Calculate thermal expansions for different pipe types • Calculate the possible durability for different materials • Be able to perform laboratory experiments and associated reports.
Teaching methods and study activity	137.50 hours of work for the student, 6 lessons per week for 12 weeks. Activities during the course are lectures, theory, fieldwork, exercises and self-study.
Evaluation	For full-degree students: • Approval on basis of several of the following criteria: • Given assignments/reports, which must be handed in on time and approved with a satisfactory result, • Tests, which must not have a crucial importance for the approval, • Course work/cases, which must be handed in on time and approved, • Study activity (attendance registration). It must be possible to pass the course from multiple combinations of the

	criteria. None of the criteria must be weighted so high that they alone can decide whether the student passes the course. 80% of the overall criteria must be fulfilled. Specification of each course valuation criteria will be clear from course material on study net. For exchange students: Grading on basis of several of the criteria mentioned above
Examination	Approved / not approved
Grading criteria	For full-degree students: Approved / not approved. For exchange students: Grading based on the Danish 7-point scale.
Resources	• William D. Callister, Jr.: Material science and engineering, an introduction, seventh edition.
Additional information	Compulsory course, 4. semester.

Title	**SUPPLY ENGINEERING 3**
Code	SEN S3
Language	English
Provider	Supply Engineering
Responsible	Linne Lauesen
ECTS Point	5
Prerequisites	SPJ S3, SEN S2
Main purpose	To provide students with knowledge of the juridical terms and conditions, sectorial legislation, and terms and bidding processes for procurement in supply engineering.
Keywords	National and international framework for supply engineering, sectorial legislation, benchmarking, planning, procurement, tender evaluation, AB92
Topics	• Legislation, juridical terms and conditions for utility management • Sectorial legislation; water, wastewater, district heating • National benchmarking and external monitoring • Sectorial planning • Service and environmental objectives • Security of supply • Internal monitoring • Tender law and Utilities Directive • Terms and bidding processes for procurement • Requirement specifications and documents • Award criteria and tender evaluation • Guidelines, Codes, and Standards, hereunder the Danish AB92
Knowledge	The student will obtain knowledge of the main juridical conditions and terms and have an overview of the national and international legislation and regulation in Denmark, the EU, and internationally. Furthermore the student will obtain a basic knowledge of procurement and tender evaluation.
Skills	At the completion of the course, the student must: • Possess knowledge of different juridical and legal frameworks within water, wastewater, and district heating utilities. • Possess knowledge and a basic overview of the different sectorial laws, codes, standards, and guidelines • Be able to structure and carry out the planning of utility management • Be able to carry out data collection and relevant analyses • Be able to perform planning analyses and communication strategies for stakeholder management

	• Possess knowledge of Corporate Social Responsibility and Sustainable management • Be able to perform a tendering using different legislation and processes for national, regional (e.g. the EU), or international tenders The course will thus enhance the student's ability to participate in the daily work of planning and operating within the contracting, consulting or public corporation in terms of knowledge of the juridical and legal framework and procurement.
Teaching methods and study activity	137.5 hours of work for the student, 4-6 lessons per week for 12 weeks with a total of 60 lessons. Activities during the course are lectures, theory, fieldwork, exercises and self-study. The course is part of the semester project (SPJ S4) on the 4 rd. semester.
Evaluation	For full-degree students: Approval on basis of several of the following criteria: • Given assignments/reports, which must be handed in on time and approved with a satisfactory result, • Tests, which must not have a crucial importance for the approval, • Course work/cases, which must be handed in on time and approved, • Study activity (attendance registration). It must be possible to pass the course from multiple combinations of the criteria. None of the criteria must be weighted so high that they alone can decide whether the student passes the course. 80% of the overall criteria must be fulfilled. Specification of each course valuation criteria will be clear from course material on study net. For exchange students: Grading on basis of several of the criteria mentioned above.
Examination	Approved / not approved
Grading criteria	For full-degree students: Approved / not approved. For exchange students: Grading based on the Danish 7-point scale.
Resources	Digital available written lessons with related questions. Assignments based on given cases and information available in various articles, books, and extracts of books. Case studies. The final assignment will be made in small groups. <u>Mandatory readings</u>: Bell, Stuart, and McGillivray, Donald (2013) *Environmental Law*. 8th Edition or later. Oxford: Oxford University Press. Weishaar, Stephen (2013) *Cartels, Competition and Public Procurement: Law and Economic Approaches to Big Bidding (New Horizons in Competition Law and Economics Series)*. Cheltenham, UK: Edward Elgar Publishing Limited. (Or similar cross-international book. This book covers procurement in the EU, China and Japan. Other nations will be covered in the collection of papers and extracts of books.) Collection of papers and extracts of books will be uploaded at Studienet.viauc.dk
Additional information	Compulsory course, 4 rd. semester.

Title	SEMESTER PROJECT 4 – Analysis of a supply district area
Code	SPJ S4
Language	English
Provider	Supply Engineering
Responsible	Henrik Bjørn
ECTS Point	10
Prerequisites	The students must participate in the applicable courses and the requirements of the project work must be met.
Main purpose	The purpose of the course is for the student to be able to perform an analysis of a supply district area and on the basis of knowledge about the framework and sectorial legislation to make informed forecasts for the area.
Keywords	Supply district areas, legislation and municipality planning, consumer patterns, supply potential, forecasting
Topics	The content is further described under the courses included in the project: SEN S3, MSP S1 and HYD S2. • Supply sector framework conditions and sector legislation and contracting and procurement for utilities • Materials and products may be used in connection with construction of utility lines • Supply pipe networks
Knowledge	The project is based on an analysis of a supply district area The area is analyzed in terms of utility, consumer patterns, local plans and supply potential and forecasting of changing supply needs and suggestions for correcting and expansion of the pipeline network. Academically it is based on the overall well-known and well-defined methods and with a close relationship to the way land development is carried out today in practice. The training will be based on the latest knowledge and application of current theory and principles.
Skills	• To show understanding of the entire project complexity • Skills in applying learned knowledge to the solving of practical project work. • The ability to plan and complete practical project works. • Skills in communication of the project results to the client. • To use the gained theoretical knowledge in practical activities • To analyse and use data • To set up, describe and interpret the collected data, including the development of individual competencies • To describe and complete a report, including presentation material • To present the project material The course includes IT as a pedagogical method. The purpose is to support the students' learning processes and their understanding of the engineering opportunities, which is part of e.g. the use of modeling, simulation etc. Analyses of the team on basis of a Belbin test. Group formation and analyses of the strength and weaknesses of the group. You must put out a contract for the group. At the end of the project period, the group must reflect on the cooperation in the group, on basis of the teams Belbin profile.
Teaching methods and study activity	The project period is 15 weeks, incorporated into the schedule for the first 12 weeks and then full time project work during the last 3 weeks. The working hours for each student are approx. 275 hours. The following courses are part of the semester project: SEN S3, MSP S1 and HYD 2.
Evaluation	Evaluation of the project will be based on presentation and conversation about the project work at an oral exam with an internal examiner. Project description must be duly handed in and approved in order to register

	for exam in the semester project. The project courses are included in the semester project with different weighting.
Examination	Oral examination with an external or internal examiner.
Grading criteria	Grading based on the Danish 7-point scale
Resources	Literature is not yet determined.
Additional information	Semester project on the 4. semester

Course descriptions Workshops practice (subject to change)

Appendix 6

Title	WORKSHOP 1
Code	PWS S1
Language	English
Provider	Supply Engineering
Responsible	Henrik Bjørn
Prerequisites	
Main purpose	To give students an understanding of the supply business.
Keywords	Company visits
Topics	Company visits: • Water Supply Company and Water Plant • Sewage treatment Plant • District Heating Plant • Construction Company • Municipality
Knowledge	To give students an understanding of the Supply business area and knowledge of the different players on the market.
Skills	After the course, participants will have gained insight into the Supply Business Area and the different types of Supply.
Teaching methods and study activity	52 hours of work for the student. Activities during the course are lectures, theory, fieldwork, exercises and self-study.
Evaluation	The course is evaluated on the basis of participation in the listed topics and reporting of individual activities. Required 90% participation to pass.
Additional information	Practical Workshop on 1. semester

Title	WORKSHOP 2
Code	PWS S2
Language	English
Provider	Supply Engineering
Responsible	Niels Leo Christensen
Prerequisites	
Main purpose	The purpose of the course is to give the student insight into the basic methods and theory used for simple land surveying and setting out. The course must enable the student to plan and execute simple land surveying and setting out projects.
Keywords	Planning, quality control, levelling, marketing, GPS
Topics	The following topics will be presented in the course: • Geometrical levelling • Check and adjust of Total Station and levelling instrument • Setting out and measuring by the aid of Total Station • Setting out levels by rotary laser • Measuring and setting out with GPS • Control measurements • Reference systems
Knowledge	After completion of the course the student must have obtained an insight into the basic methods and theory used for simple land surveying and setting out. The course must enable the student to plan and execute simple land surveying and setting out projects.

Skills	After completion of the course, the student must: • Be able to plan and perform simple surveying assignments by use of a complete station, levelling instruments and GPS. • Be able to perform quality control and measuring in general. • Be able to make geometric and trigonometric levelling, to calculate contours and complete quality assessments of the contours. • Be able to calculate and market simple constructions and single points. • Be able to calculate the market data for road construction. • To assess complete stations and levelling tools for regulative errors. • To use surveying IT programmes for calculation of surveying observations in order to prepare a schedule. • Have obtained understanding of the basic principles within GPS and must be able to measure and market on this basis.
Teaching methods and study activity	52 hours of work for the student. Activities during the course are lectures, theory, fieldwork, exercises and self-study.
Evaluation	The course is evaluated on the basis of participation in the listed topics and reporting of individual activities. Required 90% participation to pass.
Additional information	Practical Workshop on 1. semester

Title	**WORKSHOP 3**
Code	PWS S3
Language	English
Provider	Supply Engineering
Responsible	Gorm Rytter
Prerequisites	
Main purpose	The main purpose is to provide the students with an understanding of welding and the different materials and welding methods.
Keywords	Welding and plumbing
Topics	WELDING: • Environment: § 26 (only partly about welding and grinding) • Introduction to different welding methods, CO2, Electrode, Tig. and A-measuring • Assignment: Welding of a Kubus stick etc. (group work). PLUMBING INSTALLATIONS: • Information of different materials, which are used in installations • The screwing together and the sealing of fittings with hemp and jointing compound, including the use of special machinery for press fittings Through workshop activities, the students mount heating and water on workstations in accordance to dimensioned drawings. EVALUATION: • The advantages and the disadvantages of the different assemblies and materials

	EXCURSIONS: • Manufactor and distributor of pipes and fittings
Knowledge	Through theoretical and practical workshops: • To provide the students with an understanding of welding and the different welding methods. • To acquire knowledge of different assembly methods, fittings and technical installations within heating and water.
Skills	After the completion of the course, the student must: • Be able to know the difference between the welding methods, weaknesses and strengths and have knowledge of the working environment. • Be able to have knowledge about the technical installations within heating and water.
Teaching methods and study activity	52 hours of work for the student. Activities during the course are lectures, theory, fieldwork, exercises and self-study.
Evaluation	The course is evaluated on the basis of participation in the listed topics and reporting of individual activities. Required 90% participation to pass.
Additional information	Practical Workshop on 2. semester

Title	**WORKSHOP 4**
Code	PWS S4
Language	English
Provider	Supply Engineering
Responsible	Loren Ramsay
Prerequisites	
Main purpose	The main purpose of this course is to provide the students with knowledge about investigation methods and risk assessments at contaminated sites, as well as relevant activities for remediation of contaminated sites.
Keywords	Soil contamination, laboratory activities and fieldwork
Topics	Soil types and aquifers - overview. Different contaminants and how they behave in the soil/groundwater environment. Strategies and methods for investigation of contaminated sites. Sampling of soil, groundwater and soil gas. Legislation about contaminated soil. Quality criteria for soil, groundwater and gas. Risk assessments. Remediation techniques. Re-use of contaminated soil. Waste disposals. Landfill gas.
Knowledge	Through participation in the course the student will gain knowledge of • Characteristic of main contaminants and their ability to spread in soil and groundwater • Investigation methods including sampling of soil, groundwater and soil gas- know main legislation and use of quality criteria for soil, groundwater and gas • Laboratory methods and interpretation of results
Skills	After following this workshop the students should: • Be able to outline strategies for investigation of a case of contamination and carry out investigations on a site • Be able to carry out risk assessments of contaminated sites based on given data.

	• Be able to suggest relevant remediation technique for a given, contaminated site.
Teaching methods and study activity	52 hours of work for the student. Activities during the course are lectures, theory, fieldwork, exercises and self-study.
Evaluation	The course is evaluated on the basis of participation in the listed topics and reporting of individual activities. Required 90% participation to pass.
Additional information	Practical Workshop on 2. semester

Title	**WORKSHOP 5**
Code	PWS S5
Language	English
Provider	Supply Engineering
Responsible	Gorm Rytter
Prerequisites	
Main purpose	At the site visit to a major construction project, to provide students with a practical sense of the scale of such a great work and insight into the practical details.
Keywords	Construction site visit, visit at a land development site
Topics	Construction site visit and visit at a land development site
Knowledge	At a site visit to a major construction project and land development project, to provide students with a practical sense of the scale of such a great work and insight into the practical details.
Skills	After the course, students must have a background understanding of the work in connection with a major construction project and land development in open country that supports the semester project.
Teaching methods and study activity	52 hours of work for the student. Activities during the course are lectures, theory, fieldwork, exercises and self-study.
Evaluation	The course is evaluated on the basis of participation in the listed topics and reporting of individual activities. Required 90% participation to pass.
Additional information	Practical Workshop on 3. semester

Appendix 7

Title	WATER SUPPLY 1
Code	WSU S1
Language	English
Provider	Supply Engineering
Responsible	Henrik Bjørn
ECTS Point	10
Prerequisites	SPJ S4
Main purpose	To give the student a detailed knowledge of water supply, with a focus on the processes related to extraction of ground and surface water, the subsequent treatment of this water at the waterworks, storage and distribution of the water to the consumers.
Keywords	Water supply systems, ground water and surface water sources, resource protection, sustainable water resource management, hydrology and hydrogeology, water chemistry, drinking water treatment processes, pump technology, energy optimisation.
Topics	• The hydrological cycle • Basic water resource mapping • Basic hydrogeology and well testing • Basic water chemistry • Well construction, water intake and drilling techniques • Well field design and management • Raw water management and resource protection • Pumping technology • Technical design and dimensioning of water treatment plants • Filtration, treatment methods and process chemistry • Drinking water quality • Mechanical and hydraulic engineering in the waterworks • Properties and characteristics of materials • Drinking water storage tanks • Design and dimensioning of pumping plants • Basic knowledge of pipe networks • Energy efficiency • Hygiene and drinking water safety • Risk assessment • Benchmarking and optimization • Systems and process control data management, SCADA • Sustainable management • Economy, operations, investments and rates • Operation and maintenance plans • Customer relations • Legislation
Knowledge	The student should have detailed knowledge of water supply systems from water source to pumping plant and basic knowledge of pipe networks. The student should be able to evaluate an existing water supply system in terms of well field capacity, state of technical installations, process chemistry, energy efficiency and supply security. The student must be able to give recommendations based on the analysis.
Skills	After completion of the course the student must be able to: • analyse the capacity, chemical quality and vulnerability of a well-field and its technical installations • select the most appropriate drilling method • design well-houses and select well-pumps according to the well capacity, water demand and energy consumption • select an appropriate water treatment process based on water chemistry and economy • dimension filters, water tanks/towers and pumping plants in relation to water quality, supply security and economy for installation and operation • give suggestions to construction, dimension and structure of supply network

	• estimate the need for pressure boost or reduction in network • make a risk assessment for technical stability, water quality and capacity of well-field and water works in relation to existing and future water demand • select relevant control points • make a basic description for a systems control system • select relevant data acquisition points • sketch a plan for operation and maintenance for an existing water supply system • identify the relevant legislation for the different elements of a water supply system
Teaching methods and study activity	300 hours of work for the student, 8-12 lessons per week for 12 weeks with a total of 120 lessons. Activities during the course are lectures, theory, field work at waterworks, exercises and self-study. The result of the field work is to be presented in a report.
Evaluation	For full-degree students: • Approval on basis of several of the following criteria: • Given assignments/reports, which must be handed in on time and approved with a satisfactory result, • Tests, which must not have a crucial importance for the approval, • Course work/cases, which must be handed in on time and approved, • Study activity (attendance registration). It must be possible to pass the course from multiple combinations of the criteria. None of the criteria must be weighted so high that they alone can decide whether the student passes the course. 80% of the overall criteria must be fulfilled. Specification of each course valuation criteria will be clear from course material on study net. For exchange students: Grading on basis of several of the criteria mentioned above.
Examination	Approved / not approved
Grading criteria	For full-degree students: Approved / not approved. For exchange students: Grading based on the Danish 7-point scale.
Resources	http://vandforsyning.nyttf.dk/uk/chapters.cfm
Additional information	Compulsory course on the 6. Semester on the Water Supply specialization

Title	**WATER SUPPLY 2**
Code	WSU S2
Language	English
Provider	Supply Engineering
Responsible	Jan Henrik Sørensen
ECTS Point	5
Prerequisites	SPJ S4, WSU S1
Main purpose	To give students a detailed knowledge of distribution of drinking water in piping systems.
Keywords	Network structure, pressurized pipe networks, network modeling, pumps, computerized network modeling tools, Integration with GIS
Topics	• Water consumption • Demand patterns • Pressure demands and pump systems • Distribution and pipe networks • Calculations of pressure relations • Management and control of water supply systems • Danish and European legislation and administration of water supply

Knowledge	The purpose of the course is to give the student the necessary insight and understanding of the detailed design of a complex water supply system with all its components.
Skills	After completion of the course, the student must be able to: • Establish design criteria's such as demand and demand patterns for a new residential area • Dimension/design a minor water supply system by hand • Design and analyze a large water supply system by use of modeling software • Construct relevant drawings • Be familiar with standard materials for e.g. pipes and valves and when they are used • Be familiar with Danish and European legislation
Teaching methods and study activity	137.5 hours of work for the student, 6 lessons per week for 12 weeks. Activities during the course are lectures, theory, fieldwork, exercises and self-study. The result of the field measurements is to be presented in a report.
Evaluation	For full-degree students: • Approval on basis of several of the following criteria: • Given assignments/reports, which must be handed in on time and approved with a satisfactory result, • Tests, which must not have a crucial importance for the approval, • Course work/cases, which must be handed in on time and approved, • Study activity (attendance registration). It must be possible to pass the course from multiple combinations of the criteria. None of the criteria must be weighted so high that they alone can decide whether the student passes the course. 80% of the overall criteria must be fulfilled. Specification of each course valuation criteria will be clear from course material on study net. For exchange students: Grading on basis of several of the criteria mentioned above.
Examination	Approved / not approved
Grading criteria	For full-degree students: Approved / not approved. For exchange students: Grading based on the Danish 7-point scale.
Resources	Literature is not yet determined.
Additional information	Compulsory course, 7. Semester on the Water Supply specialization

Title	**WASTE WATER SUPPLY 1**
Code	WWS S1
Language	English
Provider	Supply Engineering
Responsible	Jan Henrik Sørensen
ECTS Point	5
Prerequisites	SPJ S4
Main purpose	The purpose of this course is to provide the student with detailed knowledge of design/dimensioning of sewerage pipe systems.
Keywords	Rain, rainwater pipes, wastewater pipes, combined pipes, basins, CSOs (Combined Sewer Overflows), hydraulic analysis, back water, flooding, pollution, Mike Urban

Topics	• Definition of the inlet to the pipe system (rainwater and wastewater) • Design of basins • Design of CSOs • Use of Mike Urban including LTS • Creation of pipe systems in a new residential area, by use of Mike Urban • Analyses of an existing pipe system by use of Mike Urban • Danish and European legislation
Knowledge	The purpose of the course is to give the student the necessary insight and understanding to be able to design a complex sewer system with basins and CSOs. Furthermore the students must be able to evaluate an existing system and estimate the return period of flooding and calculate the amount of pollution spilled by the sewers to the recipients (eg. rivers and fjords)
Skills	After the completion of the course, the student must be able to: • Design basins for storage of rain and/or wastewater • Design CSOs • Create CDS-rains with different return periods to be used in Mike Urban • Design new and analyze existing pipe systems with Mike Urban • Solve problems with flooded basements and/or flooded roads • Calculate the pollution out of an urban sewer system (actual rain event, monthly and yearly) • Make final plan drawings an longitudinal profiles
Teaching methods and study activity	137.5 hours of work for the student, 6 lessons per week for 12 weeks. Activities during the course are lectures, theory, fieldwork, exercises and self-study.
Evaluation	For full-degree students: • Approval on basis of several of the following criteria: • Given assignments/reports, which must be handed in on time and approved with a satisfactory result, • Tests, which must not have a crucial importance for the approval, • Course work/cases, which must be handed in on time and approved, • Study activity (attendance registration). It must be possible to pass the course from multiple combinations of the criteria. None of the criteria must be weighted so high that they alone can decide whether the student passes the course. 80% of the overall criteria must be fulfilled. Specification of each course valuation criteria will be clear from course material on study net. For exchange students:
Examination	Approved / not approved
Grading criteria	For full-degree students: Approved / not approved. For exchange students: Grading based on the Danish 7-point scale.
Resources	Literature is not yet determined
Additional information	Compulsory course, 6. Semester on the Waste Water Supply specialization.

Title	**WASTE WATER SUPPLY 2**
Code	WWS S2
Language	English
Provider	Supply Engineering
Responsible	Ernst Skytte Hjorth
ECTS Point	10
Prerequisites	SPJ S4, WWS S1

Main purpose	The purpose of this course is to provide the student with knowledge of both the organization needed to run a municipal waste water supply system as well as a detailed knowledge of how to dimension and design a domestic wastewater treatment plant which complies with the strict demands of the Danish laws.
Keywords	
Topics	• Calculation of contamination characteristics • EU as well as Danish legislation • Calculation of expected purification rate on BOD, nitrogen and phosphor • Typical analysis and their importance to running an optimal biological process • Excess sludge before and after sludge dewatering • Flow- and block-diagrams for water as well as sludge within the wastewater treatment plant • Dimensioning and designing of storage tank and overflow system, inlet pumping station, pumps, screening systems, aerated sand traps, activated sludge process tank with nitrification, de-nitrification, biological phosphor removal and sludge stabilization, aeration system based on small bubble diffusors, primary and secondary settlement tank • Main topics regarding hydraulic requirements • Types of valves and their applications • Level control devices and their applications • Sensors for measuring oxygen, pH, ammonia and nitrate • Flow and dry matter measurements as well as sampling devices • Advanced control systems (SCADA) • Key parameters concerning security of supply • Key parameters concerning cost calculations • Interaction between consumer habits, pipeline system and wastewater treatment plant • Economic consequences by optimizing the running of the plant • Benchmarking' • welfare facilities needed to fulfill the Danish law
Knowledge	After completion of the course the student must have a detailed knowledge of: • The construction of a waste water supply organization including needed staff, price and tariff system. • The organization needed to run a municipal wastewater plant – including pipeline system, pumping stations, wastewater treatment plants, . • Design of all main elements of an advanced biological plant treating domestic wastewater and certain types of industrial wastewater including civil works, machinery, sensors and measuring equipment. • The optimal design according to the requirements. • The facilities needed to fulfill health and safety regulations. • The design and dimension at a low technology water treatment plant for small communities.
kills	After completion of the course the student must be able to: • Calculate contamination characteristics and purification rate on BOD, nitrogen and phosphor • Create flow- and block-diagrams for water as well as sludge within the wastewater treatment plant • Give suggestions to the dimension and design of storage tank, overflow systems, pumping stations, pumps, aerated sand traps, activated sludge process tanks, aeration systems and primary and secondary settlement tank. • make a basic description for a systems control system • sketch a plan for operation and maintenance for an existing waste water supply system

	• identify the relevant legislation for the different elements of a waste water supply system
Teaching methods and study activity	275 hours of work for the student, 8-12 lessons per week for 12 weeks with a total of 120 lessons. Activities during the course are lectures, theory, field work at waste water plants, exercises and self-study. The result of the field work is to be presented in a report.
Evaluation	For full-degree students: • Approval on basis of several of the following criteria: • Given assignments/reports, which must be handed in on time and approved with a satisfactory result, • Tests, which must not have a crucial importance for the approval, • Course work/cases, which must be handed in on time and approved, • Study activity (attendance registration). It must be possible to pass the course from multiple combinations of the criteria. None of the criteria must be weighted so high that they alone can decide whether the student passes the course. 80% of the overall criteria must be fulfilled. Specification of each course valuation criteria will be clear from course material on study net. For exchange students: Grading on basis of several of the criteria mentioned above.
Examination	Approved / not approved
Grading criteria	For full-degree students: Approved / not approved. For exchange students: Grading based on the Danish 7-point scale.
Resources	Literature is not yet determined.
Additional information	Compulsory course on the 7. Semester on the Waste Water supply specialization

Title	**District Heating Supply 1**
Code	DHS S1
Language	English
Provider	Supply Engineering
Responsible	Per Kristensen
ECTS Point	10
Prerequisites	SPJ S4
Main purpose	To provide the student with a fundamental knowledge of the district heating technologies, different types of district heating plants and the relationships between district heat and other energy forms and sustainable energy.
Keywords	District heating supply and district heating plants, energy sources, sustainable energy, smart grid, strategic energy planning, machine and process technology, electricity markets, extended thermodynamics, combustion technology, data and data management, work environment, water treatment, energy optimization, pumps and pump technology
Topics	• District heating supply • Different district heating plants; decentralized and centralized plants, combined heat and power plants (CHP), heat plants without electricity production • Structural settings • Heat pump opportunities • Energy sources; fossil fuels, waste, biomass, wind power, solar energy, surplus energy from industrial processes, seawater, groundwater etc. • Smart grid; grid structures and perspectives, solar power in smart grid structures, grid integration of wind power plants.

	• Energy storage, seasonal thermal energy storage (pit storage, ATES, BTES etc.) • Electricity markets, sales and purchase of electricity • Transmission pipelines • Strategic energy planning • Basic machine and process technology • Combustion technology • Extended thermodynamics (pumps and pressure drop, plants and machinery, steam power plant, theory of cooling and heat pumps, humid air, combustion technology)
Knowledge	The student should understand the fundamentals of district heating supply, the different plant types and differences in energy sources. Furthermore the student should have knowledge of the complex structures on an emerging energy market, of prices, supply and demand and smart grid systems. Furthermore the student most have an understanding of the operation of the district heating plant and therefore have a basic knowledge of machine and process technology as well as pumps and pump technology. The basis for understanding the technical elements of this course is a basic knowledge of thermodynamics obtained in the initial part of the course.

Title	**District Heating Supply 2**
Code	DHS S2
Language	English
Provider	Supply Engineering
Responsible	Per Kristensen
ECTS Point	5
Prerequisites	1.-4. semester
Main purpose	To provide the student with a fundamental knowledge of the distribution networks in the district heating sector and the connected customer installations.
Keywords	Distribution network, optimization of distribution systems, customer installations, pumps and pump control, temperature optimization, dimensioning of pipes, pipe system modeling, tension and expansion
Topics	• Distribution network and transmission pipelines • Economic optimization of distribution systems • Determination of heat and power demand • Customer installations • Monitoring • Special conditions in municipality planning and relevant regulations • Renovation of pipes and energy savings in the distribution network and in the customer installations. • Pumps and pump control • Optimization and selection of pumps • Temperature optimization • Pressure and differential pressure control of plant • Dimensioning and design of pipes and pumps • Pipe system modeling • Establishment of supply pressure and temperature at connection points • Calculation of pressure loss • Tension and expansion
Knowledge	The student will obtain a basic knowledge of the distribution system, the network and the transmission pipelines. In addition, they will get a thorough introduction to the economic conditions associated with optimization and renovation of the distribution system.

	The students will also obtain a basic knowledge of dimensioning and design of pipe systems and pumps, modeling and establishing pressure and temperature at connection points and calculation of pressure loss.
Skills	After completion of the course, the student must: • Be able to calculate economic consequences of optimization and renovation • Be able to calculate the existing and future demand for heat and plan and dimension pipelines and pumps at an overall level • Understand and be able to take into account local and national plans and regulations • Be able to on an overall level to setup models for the distribute systems and determine temperature and pressure at connection points and calculate pressure loss
Teaching methods and study activity	137.5 hours of work for the student, 4-6 lessons per week for 12 weeks with a total of 60 lessons. Activities during the course are lectures, theory, fieldwork, exercises and self-study.
Evaluation	For full-degree students: • Approval on basis of several of the following criteria: • Given assignments/reports, which must be handed in on time and approved with a satisfactory result, • Tests, which must not have a crucial importance for the approval, • Course work/cases, which must be handed in on time and approved, • Study activity (attendance registration). It must be possible to pass the course from multiple combinations of the criteria. None of the criteria must be weighted so high that they alone can decide whether the student passes the course. 80% of the overall criteria must be fulfilled. Specification of each course valuation criteria will be clear from course material on study net. For exchange students: Grading on basis of several of the criteria mentioned above.
Examination	Approved / not approved
Grading criteria	For full-degree students: Approved / not approved. For exchange students: Grading based on the Danish 7-point scale.
Resources	Literature is yet to be determined.
Additional information	Compulsory course, 7. semester on the District Heating Supply Specialization

Title	**INTERDISCIPLINARY PROJECT**
Code	IDP S1
Language	English
Provider	Supply Engineering
Responsible	Lotte Thøgersen
ECTS Point	10
Prerequisites	SPJ S4, WPL S1
Main purpose	The purpose is to document the student's ability to apply engineering theories and methods within a certain limited subject area.
Keywords	Interdisciplinary project
Topics	• Project description of the subject matter of the project, which is to be selected by the student • Carrying out the project including follow up on the time schedule and completion of the planned activities

	• Documentation of time used according to the project record • Application of computational technology relevant to the project • Documentation and promotion of the project result in a report • Planning of the oral presentation of the project
Knowledge	The purpose is to document the student's ability to apply engineering theories and methods within a certain limited subject area.
Skills	After the completion of the project work, the student must be able to: • Carry out a project description after given rules. • Apply engineering theories and methods within chosen subjects and independently be able to plan and carry out experiments or practical measurements as appropriate. • Acquire new knowledge critically within relevant engineering fields. • Consider a project from a social perspective and explain legislation and work environmental consequences relevant to the project. • Apply approved quality assurance principles. • Make financial estimates relevant for the project. • Communicate with clarity orally and in writing and be able to state references and relevant sources correctly. • Cooperate with people with different educational, language and cultural background. • Extract the essence of a project, partly by an oral presentation, partly by writing an abstract covering the key points of a project.
Teaching methods and study activity	The project covers 10 ECTS credits equal to 275 hours of work for the student. The activities of the course are project work within the disciplines included in the project. Classes are not offered, but project supervision is provided according to the current rules.
Evaluation	The basis for the assessment is a written report, which is to be presented and discussed at an oral examination attended by an external examiner. • If the mark awarded is 00 or -3, the basis of the assessment will be explained in writing by the project supervisor and the external examiner in unison.
Examination	Oral examination with an external examiner.
Grading criteria	Grading based on the Danish 7-point scale.
Resources	Not yet determined.
Additional information	Compulsory for 6. Semester

Title	BACHELOR PROJECT
Code	PRO S1
Language	English
Provider	Supply Engineering
Responsible	Lotte Thøgersen
ECTS Point	20
Prerequisites	IDP S1
Main purpose	The purpose is to document the student's ability to apply engineering theories and methods within a certain limited subject area.
Keywords	Interdisciplinary project
Topics	• Project description of the subject matter of the project, which is to be selected by the student • Carrying out the project including follow up on the time schedule and completion of the planned activities • Documentation of time used according to the project record • Application of computational technology relevant to the project • Documentation and promotion of the project result in a report • Planning of the oral presentation of the project

Knowledge	The purpose is to document the student's ability to apply engineering theories and methods within a certain limited subject area.
Skills	After the completion of the project work, the student must be able to: • Carry out a project description after given rules. • Apply engineering theories and methods within chosen subjects and independently be able to plan and carry out experiments or practical measurements as appropriate. • Acquire new knowledge critically within relevant engineering fields. • Consider a project from a social perspective and explain legislation and work environmental consequences relevant to the project. • Apply approved quality assurance principles. • Make financial estimates relevant for the project. • Communicate with clarity orally and in writing and be able to state references and relevant sources correctly. • Cooperate with people with different educational, language and cultural background. • Extract the essence of a project, partly by an oral presentation, partly by writing an abstract covering the key points of a project.
Teaching methods and study activity	The project covers 20 ECTS credits equal to 550 hours of work for the student. The activities of the course are project work within the disciplines included in the project. Classes are not offered, but project supervision is provided according to the current rules.
Evaluation	The basis for the assessment is a written report, which is to be presented and discussed at an oral examination attended by an external examiner. • If the mark awarded is 00 or -3, the basis of the assessment will be explained in writing by the project supervisor and the external examiner in unison.
Examination	Oral examination with an external examiner.
Grading criteria	Grading based on the Danish 7-point scale.
Resources	Not yet determined.
Additional information	Compulsory for 6. Semester

Title	**CLIMATE ADAPTION AND FLOOD ANALYSIS**
Code	CAF S1
Language	English
Provider	Supply Engineering
Responsible	Jan Henrik Sørensen
ECTS Point	5
Prerequisites	SPJ S4, WWS S1
Main purpose	The purpose of this course is to provide the students with a basic knowledge of climate change adaptation and flood analysis. How to implement sustainable solutions to handle an increase of rain in urban areas
Keywords	Climate change, rain water, green roofs, infiltration basins, open channels, flooding, Mike Urban, Mike 21 and Mike Flood
Topics	• Precipitation • Sea water level • Methods to handle rain water locally • Reuse of rainwater. • Analyze flooding in new and existing residential areas • Danish and European legislation
Knowledge	The purpose of the course is to give the student the necessary insight and understanding to be able to analyze the risk of flooding due to climate changes. The students have to design sustainable solutions to remove (or reduce) the risk of flooding.

Skills	After the completion of the course, the student must be able to:
	• Analyze rain series and sea water levels and propose factors for climate change
	• Create relevant rain series to be used in Mike software
	• Carry out flooding analyzes with Mike Flood
	• Bring up ideas on how to remove or reduce flooding in residential areas
	  o Open channels
	  o Infiltration basins
	  o Swales and Wadis
	  o Rain gardens
	  o Basins
	  o Green roofs
	• Combine sustainable solutions with a more traditional way of dealing with rainwater run off
	• Make a final plan for implementation of sustainable solutions to remove flooding in a specific residential area

Teaching methods and study activity	137.5 hours of work for the student, 6 lessons per week for 12 weeks. Activities during the course are lectures, theory, fieldwork, exercises and self-study. The result of the field measurements is to be presented in a report.
Evaluation	For full-degree students: • Approval on basis of several of the following criteria: • Given assignments/reports, which must be handed in on time and approved with a satisfactory result, • Tests, which must not have a crucial importance for the approval, • Course work/cases, which must be handed in on time and approved, • Study activity (attendance registration). It must be possible to pass the course from multiple combinations of the criteria. None of the criteria must be weighted so high that they alone can decide whether the student passes the course. 80% of the overall criteria must be fulfilled. Specification of each course valuation criteria will be clear from course material on study net. For exchange students: Grading on basis of several of the criteria mentioned above.
Examination	Approved / not approved
Grading criteria	For full-degree students: Approved / not approved. For exchange students: Grading based on the Danish 7-point scale.
Resources	Literature is not yet determined
Additional information	Elective course, 6.-7. Semester on the Waste Water Supply specialization

Title	**ENERGY AND ENERGY PRODUCTION AT THE WASTE WATER PLANT**
Code	EPW S1
Language	English
Provider	Supply Engineering
Responsible	Elaheh Roshani
ECTS Point	5
Prerequisites	SPJ S4
Main purpose	To provide students with an understanding of the energy situation and energy production at the wastewater treatment plant.
Keywords	Energy content in sludge, biogas production from sludge, sludge incineration, pre-treatment methods

Topics	• Basic knowledge of energy content in sludge (raw sludge, chemical sludge and biological sludge) • Methods for utilization of energy content in sludge (biogas production, sludge incineration) and assessment of these methods • The pre-treatment methods for optimization biogas production and assessment of these
Knowledge	The student should be able to assess energy content in sludge for biogas production and have knowledge of the optimization opportunities of this process.
Skills	After completion of the course, the student must: • Have acquired knowledge of the energy content of different types of sludge and their importance for the further process • Be able to analyze the process in biogas production and • which parameters should be monitored • Have knowledge of which methods that can be used to increase utilization of energy content in sludge for the further processing and assessment of their strengths and weaknesses
Teaching methods and study activity	137.5 hours of work for the student, 4-6 lessons per week for 12 weeks with a total of 60 lessons. Activities during the course are lectures, theory, fieldwork, exercises and self-study.
Evaluation	For full-degree students: • Approval on basis of several of the following criteria: • Given assignments/reports, which must be handed in on time and approved with a satisfactory result, • Tests, which must not have a crucial importance for the approval, • Course work/cases, which must be handed in on time and approved, • Study activity (attendance registration). It must be possible to pass the course from multiple combinations of the criteria. None of the criteria must be weighted so high that they alone can decide whether the student passes the course. 80% of the overall criteria must be fulfilled. Specification of each course valuation criteria will be clear from course material on study net. For exchange students: • Grading on basis of several of the criteria mentioned above.
Examination	Approved / not approved
Grading criteria	For full-degree students: Approved / not approved . For exchange students: Grading based on the Danish 7-point scale.
Resources	Literature is not yet determined.
Additional information	Elective course, 6.-7. Semester on the Waste Water Supply specialization

Title	**GROUNDWATER CHEMISTRY**
Code	GCH S1
Language	English
Provider	Supply Engineering
Responsible	Loren Ramsay
ECTS Point	5
Prerequisites	SPJ S4
Main purpose	The purpose of this course is to provide the students with an understanding of the chemical composition of groundwater and the physical, chemical and biological processes that cause compositional changes.

Keywords	Chemical composition of groundwater, geology and its influence on the chemistry, toxicology, drinking water criteria, data management, acid/base, redox theory, water analyses
Topics	• Groundwater composition • Overview of geology & hydrogeology • Toxicology & drinking water criteria • Data management & presentation • Equilibrium calculations • Acid/base theory • Redox theory • Groundwater processes • Interpretation of water analyses • Natural and xenobiotic contaminants
Knowledge	After completion of the course the students must have an understanding of the chemical composition of groundwater and the physical, chemical and biological processes that cause compositional changes.
Skills	After the completion of the course, the student must: • Be familiar with the natural composition of groundwater in various types of aquifers. • Be able to calculate water hardness, ion balance, ion strength, activity coefficients, Eh/pH-diagrams, saturation index, degree of ion exchange, degree of weathering. • Know the names and chemical formulas of the most important minerals in sediments. • Be able to use the software Microsoft Access for creating simple queries into the Jupiter database. • Be able to present chemical data using the graphical methods frequency plot, scatter plot, ion plot, radial diagram, Piper plot. • Recognize the theory behind acid/base reactions and redox reactions. • Understand the groundwater processes mineral dissolution, ion exchange, pyrite oxidation, sulphate reduction. • Be able to interpret a water analysis, identify groundwater redox types, and assess aquifer vulnerability. • Be familiar with properties of the groundwater contaminants chlorinated solvents, aromatics, pesticides, nitrate, and arsenic.
Teaching methods and study activity	137.5 hours of work for the student, 4-6 lessons per week for 12 weeks with a total of 60 lessons. Activities during the course are lectures, theory, fieldwork, exercises and self-study.
Evaluation	For full-degree students: • Approval on basis of several of the following criteria: • Given assignments/reports, which must be handed in on time and approved with a satisfactory result, • Tests, which must not have a crucial importance for the approval, • Course work/cases, which must be handed in on time and approved, • Study activity (attendance registration). It must be possible to pass the course from multiple combinations of the criteria. None of the criteria must be weighted so high that they alone can decide whether the student passes the course. 80% of the overall criteria must be fulfilled. Specification of each course valuation criteria will be clear from course material on study net. For exchange students: • Grading on basis of several of the criteria mentioned above.

Examination	Approved / not approved
Grading criteria	For full-degree students: Approved / not approved . For exchange students: Grading based on the Danish 7-point scale.
Resources	Selected chapters from The Chemistry of Groundwater Systems. Ram-say, L. In addition: Selected chapters from Water Supply, 2nd edition. Editor, Inga Sørensen
Additional information	Elective course, 6.-7. Semester on the Water Supply specialization

Title	**GROUNDWATER FLOW AND WELL TESTING**
Code	GFT S1
Language	English
Provider	Supply Engineering
Responsible	Søren Erbs Poulsen
ECTS Point	5
Prerequisites	SPJ S4
Main purpose	The course aims to provide students with the knowledge and skills that is acquired in order to plan, execute and interpret pumping tests.
Keywords	Steady and non-steady flow in porous media, well test analysis, conceptual groundwater models, drilling and completion of groundwater wells, design of well sites, evaluation of contamination, risk of aquifers.
Topics	Fundamental concepts, steady state and non-steady state flow in porous media, well test analysis (theory and practice), conceptual groundwater models, drilling and completion of groundwater wells. Design of well sites, estimation of long-term drawdown and evaluation of contamination risks of aquifers.
Knowledge	The student should be able to evaluate hydro geological conditions with a view to withdrawal of groundwater from aquifers. Furthermore the students should be able to plan and carry out well tests and interpret well test data, and the student should be able to design well sites, estimate the long-term drawdown and evaluate the contamination risk of the aquifer.
Skills	After the completion of the course, the student must: • Be able to evaluate the withdrawal from aquifers and the vulnerability of aquifers to contamination. • Be able to analyse and calculate flow and pressure variations for simple groundwater models. • Be able to plan and carry out well tests. • Be able to interpret well test data. • Have acquired knowledge on computer interpretation of well test data. • Have acquired knowledge on drilling techniques and completion of Water wells. • Be able to design well sites and evaluate the long-term drawdown of aquifers.
Teaching methods and study activity	137.5 hours of work for the student, 4-6 lessons per week for 12 weeks with a total of 60 lessons. Activities during the course are lectures, theory, fieldwork, exercises and self-study.
Evaluation	For full-degree students: • Approval on basis of several of the following criteria: • Given assignments/reports, which must be handed in on time and approved with a satisfactory result, • Tests, which must not have a crucial importance for the approval, • Course work/cases, which must be handed in on time and approved, • Study activity (attendance registration).

	It must be possible to pass the course from multiple combinations of the criteria. None of the criteria must be weighted so high that they alone can decide whether the student passes the course. 80% of the overall criteria must be fulfilled. Specification of each course valuation criteria will be clear from course material on study net. For exchange students: • Grading on basis of several of the criteria mentioned above.
Examination	Approved / not approved
Grading criteria	For full-degree students: Approved / not approved . For exchange students: Grading based on the Danish 7-point scale.
Resources	• Bai, W. (1992): Well Test Analysis of Aquifers. Geotechnical Laboratory, The Engineering College of Horsens, Denmark, 46 p • Bai, W. (1992): Well Test Analysis of Aquifers, Examples. Geotechnical Laboratory, The Engineering College of Horsens, Denmark, 20 p • Bai, W. (1996): Well Test Analysis of Aquifers, Example Problems. Geotechnical Laboratory, The Engineering College of Horsens, Denmark, 86 p. • Bai, W. (1996): Fluid Flow in Porous Media. Geotechnical Laboratory, The Engineering College of Horsens, Denmark, 20 p • Krusemann, G. P. & de Ridder, N. A. (1994): Analysis and Evaluation of Pumping test Data. ILRI, The Netherlands, 337p • Driscoll, F. D. (1989): Groundwater and Wells. Johnson Filtration Systems Inc., St. Paul, Minnesota, 1089 p When relevant, result from national and international research and development projects will be used.
Additional information	Elective course, 6.-7. Semester on the Water Supply specialization

Title	**GEOPHYSICAL METHODS**
Code	GME S1
Language	English
Provider	Supply Engineering
Responsible	Randi Warncke Nissen
ECTS Point	5
Prerequisites	SPJ S4
Main purpose	To gain knowledge about the various geophysical methods and their application
Keywords	Planning, geophysical planning, well logs, geophysical investigations
Topics	• Basic concepts • Surface-geophysical methods • Geophysical well logging • Choice of method and strategy • Data recording, data processing • Interpretation by hand • Examples of application
Knowledge	The student should be able to plan, execute, interpret and assess geophysical investigations in relation to resources (groundwater, natural resources), delimitation of aquifers and assessment of their vulnerability.

Skills	After the completion of the course, the student must: • Have acquired knowledge on the geophysical properties of soil and rock and their importance for the choice of geophysical methods and strategy. • Be able to plan and carry out geophysical investigations. • Be able to interpret geophysical data physically and mathematically and be able to set up a geological model. • Be able to interpret geophysical well logs (gamma ray, resistibility, conductivity) and fit them into the physical and geological model. • Have acquired knowledge on other geophysical methods and their principles and applications. • Have acquired basic knowledge on instrument handling, calibration and control. • Have acquired knowledge on computer interpretation of geophysical data.
Teaching methods and study activity	137.5 hours of work for the student, 4-6 lessons per week for 12 weeks with a total of 60 lessons. Activities during the course are lectures, theory, fieldwork, exercises and self-study. The result of the field measurements is to be presented in a report.
Evaluation	For full-degree students: • Approval on basis of several of the following criteria: • Given assignments/reports, which must be handed in on time and approved with a satisfactory result, • Tests, which must not have a crucial importance for the approval, • Course work/cases, which must be handed in on time and approved, • Study activity (attendance registration). It must be possible to pass the course from multiple combinations of the criteria. None of the criteria must be weighted so high that they alone can decide whether the student passes the course. 80% of the overall criteria must be fulfilled. Specification of each course valuation criteria will be clear from course material on study net. For exchange students: Grading on basis of several of the criteria mentioned above.
Examination	Approved / not approved
Grading criteria	For full-degree students: Approved / not approved. For exchange students: Grading based on the Danish 7-point scale.
Resources	• Bai, W (1989): Den geoelektriske metode, Laboratoriet for Geoteknik, The Engineering College of Horsens, 112 p • Bai, W (1990): Geofysisk borehulsmåling, logging. Laboratoriet for Geoteknik, The Engineering College of Horsens, 126 p • English translation of the above-mentioned textbooks will be available for foreign students. Information will be given at the start of the course • Supplementary literature: • Information will be given during the course
Additional information	Elective course, 6.-7. Semester on the Water Supply specialization

Title	GROUNDWATER MODELING
Code	GMO S1
Language	English
Provider	Supply Engineering
Responsible	Søren Erbs Poulsen
ECTS Point	5
Prerequisites	SPJ S4
Main purpose	Develop groundwater modelling skills and an understanding of sub-surface flow regimes, the way in which conceptual models of a groundwater system can be built, and how appropriate modelling software can be used to test and refine that understanding;
Keywords	Hydrogeology, groundwater flow processes, numerical methods for groundwater modelling, conceptual model development, introduction to groundwater modelling software, model calibration, practical examples
Topics	• Groundwater flow & hydrogeology • Aquifers and aquitards • Darcy's law • The groundwater flow equation: steady-state and transient flow • Hydrogeological parameters • Conceptual modelling, hydrogeological modelling • Boundary conditions: specified head, flow and transfer • Numerical modelling: finite element method • Model input: initial- and boundary conditions, hydrogeological stresses • Model calibration and validation: well site model • Model prediction: determination of capture zones • Introduction to FEFLOW
Knowledge	The purpose of the course is to provide participants with a theoretical and practical understanding of numerical modelling of groundwater flow in porous media. The course teaches participants to construct and calibrate simple groundwater models from field data in engineering applications. Participants will acquire the skills necessary to perform quality control of the model design and the calibration.
Skills	After the completion of the course, the student must be able to: • Describe the hydrogeological properties of porous rock and soil. • Explain the fundamental principles of groundwater flow. • Explain the fundamental principles of numerical modelling. • Define the field data necessary for constructing groundwater models in engineering applications. • Construct groundwater models from field data in the modelling software FEFLOW. • Calibrate groundwater models to field data. • Make predictions with groundwater models
Teaching methods and study activity	137.5 hours of work for the student, 4-6 lessons per week for 12 weeks with a total of 60 lessons. Activities during the course are lectures, theory, fieldwork, exercises and self-study.
Evaluation	For full-degree students: • Approval on basis of several of the following criteria: • Given assignments/reports, which must be handed in on time and approved with a satisfactory result, • Tests, which must not have a crucial importance for the approval, • Course work/cases, which must be handed in on time and approved, • Study activity (attendance registration). It must be possible to pass the course from multiple combinations of the criteria. None of the criteria must be weighted so high that they alone can decide whether the student passes the course. 80% of the overall criteria must be fulfilled. Specification of each course valuation criteria will be clear

	from course material on study net. For exchange students: • Grading on basis of several of the criteria mentioned above.
Examination	Approved / not approved
Grading criteria	For full-degree students: Approved / not approved . For exchange students: Grading based on the Danish 7-point scale.
Resources	Teaching material is not yet determined. Written exercises will be available for download.
Additional information	Elective course, 6.-7. Semester on the Water Supply specialization

Title	**Groundwater Mapping and Protection**
Code	GMP S1
Language	English
Provider	Supply Engineering
Responsible	Jette Sørensen
ECTS Point	5
Prerequisites	SPJ S4
Main purpose	Course description is being prepared
Keywords	Groundwater mapping, groundwater protection, legislation, administration, planning, abstraction permits, Water plans, Groundwater monitoring
Topics	•
Knowledge	
Skills	•
Teaching methods and study activity	137.5 hours of work for the student, 4-6 lessons per week for 12 weeks with a total of 60 lessons. Activities during the course are lectures, theory, fieldwork, exercises and self-study.
Evaluation	For full-degree students: • Approval on basis of several of the following criteria: • Given assignments/reports, which must be handed in on time and approved with a satisfactory result, • Tests, which must not have a crucial importance for the approval, • Course work/cases, which must be handed in on time and approved, • Study activity (attendance registration). It must be possible to pass the course from multiple combinations of the criteria. None of the criteria must be weighted so high that they alone can decide whether the student passes the course. 80% of the overall criteria must be fulfilled. Specification of each course valuation criteria will be clear from course material on study net. For exchange students: Grading on basis of several of the criteria mentioned above.
Examination	Approved / not approved
Grading criteria	For full-degree students: Approved / not approved. For exchange students: Grading based on the Danish 7-point scale.
Resources	Literature is not yet determined.
Additional information	Elective course, 6/7. semester on the Water Supply Specialization

Title	GEOPHYSICAL METHODS
Code	GPM S1
Language	English
Provider	Supply Engineering
Responsible	Randi Warncke Nissen
ECTS Point	5
Prerequisites	SPJ S4
Main purpose	To gain knowledge about the various geophysical methods and their application
Keywords	Planning, geophysical planning, well logs, geophysical investigations
Topics	• Basic concepts • Surface-geophysical methods • Geophysical well logging • Choice of method and strategy • Data recording, data processing • Interpretation by hand • Examples of application
Knowledge	The student should be able to plan, execute, interpret and assess geophysical investigations in relation to resources (groundwater, natural resources), delimitation of aquifers and assessment of their vulnerability.
Skills	After the completion of the course, the student must: • Have acquired knowledge on the geophysical properties of soil and rock and their importance for the choice of geophysical methods and strategy. • Be able to plan and carry out geophysical investigations. • Be able to interpret geophysical data physically and mathematically and be able to set up a geological model. • Be able to interpret geophysical well logs (gamma ray, resistibility, conductivity) and fit them into the physical and geological model. • Have acquired knowledge on other geophysical methods and their principles and applications. • Have acquired basic knowledge on instrument handling, calibration and control. • Have acquired knowledge on computer interpretation of geophysical data.
Teaching methods and study activity	137.5 hours of work for the student, 6 lessons per week for 12 weeks. Activities during the course are lectures, theory, fieldwork, exercises and self-study. The result of the field measurements is to be presented in a report.
Evaluation	For full-degree students: Approval on basis of several of the following criteria: - Given assignments/reports, which must be handed in on time and approved with a satisfactory result, - Tests, which must not have a crucial importance for the approval, - Course work/cases, which must be handed in on time and approved, - Study activity (attendance registration). It must be possible to pass the course from multiple combinations of the criteria. None of the criteria must be weighted so high that they alone can decide whether the student passes the course. 80% of the overall criteria must be fulfilled. Specification of each course valuation criteria will be clear from course material on study net. For exchange students: Grading on basis of several of the criteria mentioned above.

Examination	Approved / not approved
Grading criteria	For full-degree students: Approved / not approved. For exchange students: Grading based on the Danish 7-point scale.
Resources	• Bai, W (1989): Den geoelektriske metode, Laboratoriet for Geoteknik, The Engineering College of Horsens, 112 p • Bai, W (1990): Geofysisk borehulsmåling, logging. Laboratoriet for Geoteknik, The Engineering College of Horsens, 126 p • English translation of the above-mentioned textbooks will be available for foreign students. Information will be given at the start of the course Supplementary literature: Information will be given during the course
Semester	Elective course, 6.-7. semester

Title	**GEOTHERMAL MODELING**
Code	GTM S1
Language	English
Provider	Supply Engineering
Responsible	Søren Erbs Poulsen
ECTS Point	5
Prerequisites	SPJ S4
Main purpose	The purpose of the course is to provide participants with a theoretical and practical understanding of analytical and numerical modelling of heat transport in porous media.
Keywords	Thermal properties, heat conduction, heat advection, mechanical heat dispersion, steady state flow, transient flow, numerical modeling, finite difference and element methods, calibration
Topics	• Thermal properties of porous media • Mixing laws for bulk thermal properties of porous media • Heat conduction (Fourier's law) • Heat advection and groundwater flow • Mechanical heat dispersion • Analytical models of steady-state and transient heat flow • Fundamentals of numerical modelling • The Finite Difference Method • The Finite Element Method • Model building and field data • Quality assessment of geothermal models • Model calibration
Knowledge	Participants will gain basic proficiencies in analytical and numerical modelling of heat transport in porous media. The course teaches participants to construct and calibrate geothermal models from field data in engineering applications. Participants will acquire the skills necessary to perform quality control of the model design and the calibration.
Skills	After the completion of the course, the student must be able to: • Describe the thermal properties of porous rock and soil. • Apply the mixing laws used to calculate bulk thermal properties of porous rock and soil. • Explain the physics of heat transport in porous media. • Explain the fundamental principles of groundwater flow. • Derive analytical models of steady-state and transient one-dimensional heat flow. • Explain the underlying principles of numerical modelling. • Explain the fundamental principles of The Finite Difference Method (FDM).

	• Explain the fundamental principles of The Finite Element Method (FDM). • Define the field data necessary for constructing geothermal models in engineering applications. • Construct geothermal models from field data in the modelling soft-ware FEFLOW. • Document the quality of geothermal models by discretization studies. • Calibrate geothermal models to field data in engineering applications.
Teaching methods and study activity	137.5 hours of work for the student, 4-6 lessons per week for 12 weeks with a total of 60 lessons. Activities during the course are lectures, theory, fieldwork, exercises and self-study.
Evaluation	For full-degree students: • Approval on basis of several of the following criteria: • Given assignments/reports, which must be handed in on time and approved with a satisfactory result, • Tests, which must not have a crucial importance for the approval, • Course work/cases, which must be handed in on time and approved, • Study activity (attendance registration). It must be possible to pass the course from multiple combinations of the criteria. None of the criteria must be weighted so high that they alone can decide whether the student passes the course. 80% of the overall criteria must be fulfilled. Specification of each course valuation criteria will be clear from course material on study net. For exchange students: • Grading on basis of several of the criteria mentioned above.
Examination	Approved / not approved
Grading criteria	For full-degree students: Approved / not approved . For exchange students: Grading based on the Danish 7-point scale.
Resources	Teaching material is not yet determined. Written exercises will be available for download.
Additional information	Elective course, 6.-7. Semester on the District Heating Supply specialization

Title	**HEAT PUMP TECHNOLOGY AND COOLING TECHNIQUES**
Code	HPC S1
Language	English
Provider	Supply Engineering
Responsible	Claus Nørgaard Poulsen
ECTS Point	5
Prerequisites	SPJ S4
Main purpose	The students will gain knowledge about physical design, function and performance calculations of large scale heat pump and refrigeration/ cooling plants with special focus on heat recovery, energy saving and financial and environmental impacts.
Keywords	Refrigeration cycle, legislation, heat pumps, heat pump types, cooling, heat recovery, district heating and cooling, smart grid
Topics	• The refrigeration cycle • Working principle and main components • Refrigerants and legislation • Heat pumps in the public energy supply systems • Heat pump types and applications • Refrigeration and cooling applications • Heat recovery and application examples

	• District heating and cooling • System integration and smart grid balancing • Opportunities and limitations
Knowledge	The student will obtain a detailed knowledge of the working principles of heat pumps and cooling systems and thorough understanding of the effectiveness and economic factors associated with the installation of heat pumps and the use of conventional cooling techniques.
Skills	The student will be able to analyse heating and cooling needs for a given situation and to dimension respectively, heat pumps and refrigeration systems.
Teaching methods and study activity	137.5 hours of work for the student, 4-6 lessons per week for 12 weeks with a total of 60 lessons. Activities during the course are lectures, theory, fieldwork, exercises and self-study.
Evaluation	For full-degree students: • Approval on basis of several of the following criteria: • Given assignments/reports, which must be handed in on time and approved with a satisfactory result, • Tests, which must not have a crucial importance for the approval, • Course work/cases, which must be handed in on time and approved, • Study activity (attendance registration). It must be possible to pass the course from multiple combinations of the criteria. None of the criteria must be weighted so high that they alone can decide whether the student passes the course. 80% of the overall criteria must be fulfilled. Specification of each course valuation criteria will be clear from course material on study net. For exchange students: • Grading on basis of several of the criteria mentioned above.
Examination	Approved / not approved
Grading criteria	For full-degree students: Approved / not approved . For exchange students: Grading based on the Danish 7-point scale.
Resources	Literature is not yet determined.
Additional information	Elective course, 6.-7. Semester on the District Heating Supply specialization.

Title	**MICROBIOLOGY AND ENVIRONMENTAL TOXICOLOGY**
Code	MBT S1
Language	English
Provider	Supply Engineering
Responsible	Loren Ramsay
ECTS Point	5
Prerequisites	SPJ S4
Main purpose	To provide students with a foundation for further work with microbiology in connection with drinking water and waste water treatment processes, groundwater, pathogenic water quality, bioenergy production, and contaminant biodegradation as well as further work with exposure, end points and toxicological studies of chemical substances.
Keywords	Microbial growth, biotransformation, engineered microbial processes, pathogenicity, instrumental analysis, exposure, dose/response, end-points.
Topics	• classification of microorganisms • microbial metabolism and growth, including the effect of nutrients and additional environmental factors

	• growth and biotransformation kinetics • natural processes in soil & groundwater, after growth • engineered processes in sand filters, waste water treatment, biogas production, contaminant biodegradation • pathogenicity: infectious diseases, virulence, toxins, immunosuppression • disinfection methods: UV, oxidation, thermal, survival of pathogens • instrumental analysis: traditional plating methods, PCR, rapid enzymatic methods, on-line methods • human exposure pathways to toxic chemicals • toxicological end points: acute, chronic, carcinogenic, mutagenic, endocrine, reproductive, immune system • dose/response relationship: linear, Langmuir, sigmoidal, NOAEL, LD_{50} • experimental studies: in-vitro, animal testing, epidemiology
Knowledge	The student will gain knowledge about microorganisms in water in connection with engineered processes, natural processes and pathogenicity. In addition, students will gain knowledge about exposure, dose and response to toxic chemical substances.
Skills	After completion of the course the student will be able to: • distinguish between different bacteria by their energy source and carbon source • discuss how environmental factors influence microorganisms • Measure and calculate biotransformation rates and energetics • Describe the function of microorganisms in engineered processes • select appropriate analytical methods for quantifying and identifying microorganisms • describe critical exposure pathways to toxic chemicals • understand the relationship between dose and response in connection with toxic chemicals • understand toxicological studies
Teaching methods and study activity	137.5 hours of work for the student, 4-6 lessons per week for 12 weeks with a total of 60 lessons. Lectures are followed by individual exercises / group exercises / journals /mini-project.
Evaluation	For full-degree students: • Approval on basis of several of the following criteria: • Given assignments/reports, which must be handed in on time and approved with a satisfactory result, • Tests, which must not have a crucial importance for the approval, • Course work/cases, which must be handed in on time and approved, • Study activity (attendance registration). It must be possible to pass the course from multiple combinations of the criteria. None of the criteria must be weighted so high that they alone can decide whether the student passes the course. 80% of the overall criteria must be fulfilled. Specification of each course valuation criteria will be clear from course material on study net. For exchange students: • Grading on basis of several of the criteria mentioned above.
Examination	Approved / not approved
Grading criteria	For full-degree students: Approved / not approved. For exchange students: Grading based on the Danish 7-point scale.
Resources	Literature is not yet determined
Additional information	Elective course, 6.-7. Semester on the Water Supply and Waste Water Supply specialization

Title	ORGANISATION THEORY AND GOVERNANCE
Code	OTG S1
Language	English
Provider	Supply Engineering
Responsible	Linne Lauesen
ECTS Point	5
Prerequisites	SPJ S4
Main purpose	The main objective of this course is to provide the student with a basic sociological knowledge about organisational structure, purpose, functioning, and governance.
Keywords	Organisational sociology, governance in organisations, project organisations and management, organisational culture, learning organisations
Topics	• Basic sociological knowledge about organizational structure, purpose, functioning, and governance. • Examination of specific organizational issues such as power, conflicts, organizational change, and every day and project related operations by looking into governance, decision-making theory, group dynamics, and leadership. • Case studies of different types of organizations including project organizations and identification and analysis of how various types of activities are organized in the private and public sector.
Knowledge	The student should learn to analyze organizations, its structures, purpose, functions, governance, and cultures based on relevant theories. The student should be able to identify different organizational models, types, formations, and cultures and relate it to the engineering field. The student should be able to combine the theories in organizational sociology with decision-making in organizations relevant to the engineering field.
Skills	• The student must after completion of the course be able to: • Account for, at a basic level, how organisations are viewed and analysed from a perspective based on relevant theories of organisational sociology. • Account for the organisational structure, purpose, functions, governance, and cultures of organisations, hereunder project organisations, when analysed through different perspectives in organisational sociology. • Describe, explain, compare, and assess organisational circumstances and identify models of how organisational handle their everyday and project operations. • Account for and discuss the implications of different models of organisation for actual organisational practices. • Apply the theories covered in the curriculum to empirical cases and use them to formulate and justify relevant research questions.
Teaching methods and study activity	137.5 hours of work for the student, 4-6 lessons per week for 12 weeks with a total of 60 lessons. Activities during the course are lectures, theory, fieldwork, exercises and self-study.
Evaluation	For full-degree students: • Approval on basis of several of the following criteria: • Given assignments/reports, which must be handed in on time and approved with a satisfactory result, • Tests, which must not have a crucial importance for the approval, • Course work/cases, which must be handed in on time and approved, • Study activity (attendance registration). It must be possible to pass the course from multiple combinations of the criteria. None of the criteria must be weighted so high that they alone can decide whether the student passes the course. 80% of the overall criteria must be fulfilled. Specification of each course valuation criteria will be clear from course material on study net.

	For exchange students: • Grading on basis of several of the criteria mentioned above.
Examination	Approved / not approved
Grading criteria	For full-degree students: Approved / not approved . For exchange students: Grading based on the Danish 7-point scale.
Resources	• Digital available written lessons with related questions. Assignments based on given cases and information available in various articles, books, and extracts of books. Case studies. Mandatory readings: • Adler, Paul S. (2009) The Oxford Handbook of Sociology and Organizational Studies. Classical Foundations. Oxford: Oxford University Press • Collection of papers uploaded at Studienet.viauc.dk Additional, non-mandatory readings: • Handel, Michael J. (2003) The Sociology of Organizations. Classics, Contemporary, and Critical Readings. Thousand Oaks, London, New Delhi: SAGE • Hatch, Mary Jo (2006) Organization Theory: Modern, Symbolic, and Postmodern Perspectives. Oxford: Oxford University Press. • Jacobsen, Dag Ingvar and Jan Thorsvik (2002) Hvordan organisationer fungerer: Indføring i organisation og ledelse. København: Hans Reitzels Forlag • Pugh, Derek S. (2008) Organization Theory. Selected Classical Readings. 5th Edition. London: Penguin Books • Scott, Richard (2002) Organizations: Rational, Natural, and Open Systems. 5th Edition. Upper Saddle River, New Jersey: Prentice Hall.
Additional information	Elective course, 6.-7. Semester on the Water-, Waste Water-, and District Heating Supply specializations

Title	**PROJECT MANAGEMENT**
Code	PMA S1
Language	English
Provider	Supply Engineering
Responsible	Linne Lauesen
ECTS Point	5
Prerequisites	SPJ S4
Main purpose	The main objective of this course is to provide the student with basic knowledge and instruments to navigate a project successfully to completion as well in the private as in the public sector.
Keywords	Project management, project group organization, leadership in project groups, meeting management, cooperation and conflict management, Communication, SWOT analyses, Stakeholder analysis, personal development
Topics	• Cooperative forms, Partnering, and Public-Private Partnering • Project Group Organisation • Leadership in Project Groups and Decision-Making • Meeting Management • Team Development and Group Dynamics • Motivation and Engagement in the Project Group/Organisation • Cooperation and Conflict Management • Communication, internal and external • Strategic Development • SWOT and advanced RISK analyses in projects

	• Stakeholder analysis • Advanced Project economy • Personal Development • Tools and Instruments in Project Management
Knowledge	The student should learn to describe and analyse management of projects, its structures, purpose, functions, governance, and cultures and suggest which methods, instruments, and behaviours are best for solving different problems based on relevant theories. The student should be able to identify different project management instruments, issues, planning activities, control systems, and operations and relate it to the engineering field. The student should be able to combine the theories in project management with decision-making theory relevant to the engineering field.
Skills	After completion of the course the student must able to: • Account for, at a basic level, what project management requires from a perspective based on relevant theories. • Account for the project structure, purpose, functions, governance, and cultures of project organisations, when analysed through different perspectives in project management. • Describe, explain, compare, and assess project circumstances and identify models of how project managers can handle their everyday and project operations. • Account for and discuss the implications of different instruments, tools, and models for project management in everyday practices. • Apply the theories covered in the curriculum to empirical cases and use them to formulate and justify relevant research questions.
Teaching methods and study activity	137.5 hours of work for the student, 4-6 lessons per week for 12 weeks with a total of 60 lessons. Activities during the course are lectures, theory, fieldwork, exercises and self-study.
Evaluation	For full-degree students: • Approval on basis of several of the following criteria: • Given assignments/reports, which must be handed in on time and approved with a satisfactory result, • Tests, which must not have a crucial importance for the approval, • Course work/cases, which must be handed in on time and approved, • Study activity (attendance registration). It must be possible to pass the course from multiple combinations of the criteria. None of the criteria must be weighted so high that they alone can decide whether the student passes the course. 80% of the overall criteria must be fulfilled. Specification of each course valuation criteria will be clear from course material on study net. For exchange students: • Grading on basis of several of the criteria mentioned above.
Examination	Approved / not approved
Grading criteria	For full-degree students: Approved / not approved . For exchange students: Grading based on the Danish 7-point scale.
Resources	Digital available written lessons with related questions. Assignments based on given cases and information available in various articles, books, and extracts of books. Case studies. Mandatory readings: Project Management Institute (2013) A Guide to the Project Management Body of Knowledge (PMBOK Guide), 5th Edition. Newton Square, Pennsylvania: Project Management Institute Inc.

	Collection of papers uploaded at Studienet.viauc.dk
Additional information	Elective course, 6.-7. Semester on the Water Supply, Waste Water Supply and District Heating specialization

Title	**PLANNING AND EXECUTION OF ROAD CONSTRUCTION WORKS IN URBAN AREAS**
Code	RCW S1
Language	English
Provider	Supply Engineering
Responsible	Regner Bæk Hessellund
ECTS Point	5
Prerequisites	SPJ S4
Main purpose	The purpose of the course is to provide the students with knowledge and tools to solve problems concerning the planning and execution of different construction and infrastructural works in urban areas.
Keywords	Authorities, pipe owners, relocation of traffic, planning of road construction processes.
Topics	• Planning of administrative and construction processes in road refurbishment in urban areas • Process of planning and execution regarding topics as the public, authorities, owners of pipes and wires, traffic companies, police etc. • Design execution setup for different work situations on different road types regarding traffic signs and road marking • Planning will be carried out with considerations to traffic, traffic safety and necessary negotiations with interested parties such as the nearby public, authorities, pipe owners etc. • Introduction to ITM – Intelligent traffic management, variable signs etc.
Knowledge	After completion of the course the student will have gained knowledge of: • process of planning and execution regarding topics as the public, authorities, owners of pipes and lines, traffic companies, police etc • Design and execution setup for different work situations on different road types regarding traffic signs and road marking. • Traffic safety and the work environment for road workers •
Skills	After the completion of the course, the student must be able to: • Plan construction works in urban areas • Identify the relevant authorities, pipe owners, public and other stake holders and learn how to communicate with them • Plan the necessary adjustments and relocations of existing traffic during construction works • Design the temporary setup of traffic signs and road marking throughout the execution period • Realize problems concerning traffic safety and the work environment for road workers, and be able to suggest useful proposals and solutions to avoid accidents • Obtain knowledge about ITM – Intelligent traffic management - variable signs etc.

Title	REHABILITATION OF SEWAGE SYSTEMS
Code	RSS S1
Language	English
Provider	Supply Engineering
Responsible	Jan H. Sørensen
ECTS Point	5
Prerequisites	SPJ S4
Main purpose	The purpose of the course is to provide the student with the necessary knowledge and skills to be able to create a plan for sewer rehabilitations of a major urban area.
Keywords	MOUSE programme, TV inspection, sewer rehabilitation, hydraulic modelling, hydraulic profiles, DAS programme, Access databases, operation, maintenance
Topics	• Advanced computerized hydraulic modelling of urban sewer systems by use of the MOUSE programme including: Rain, historic and synthetic, Surface run off, Pipe flow, combined sewer overflows, Hydraulic profiles. • Computerized analysis of the conditions of urban sewer systems by use of the DAS programme. • Investigations including: TV inspections of sewer systems, Access databases. • Creation of a plan for sewer rehabilitations of a major urban area including: Calculations, Operation and maintenance, Renewal of sewer systems
Knowledge	The student must be able to create a plan for sewer rehabilitation of an urban area.
Skills	After the completion of the course, the student must be able to: • Use relevant computer tools for hydraulic modelling • Interpret a TV inspection of a sewer system • Make a plan for sewer rehabilitation based on hydraulic calculation
Teaching methods and study activity	137.5 hours of work for the student, 4-6 lessons per week for 12 weeks with a total of 60 lessons. Activities during the course are lectures, theory, fieldwork, exercises and self-study. The main part of the students' work is the creation of a plan for sewer rehabilitation of a major urban area
Evaluation	For full-degree students: • Approval on basis of several of the following criteria: • Given assignments/reports, which must be handed in on time and approved with a satisfactory result, • Tests, which must not have a crucial importance for the approval, • Course work/cases, which must be handed in on time and approved, • Study activity (attendance registration). It must be possible to pass the course from multiple combinations of the criteria. None of the criteria must be weighted so high that they alone can decide whether the student passes the course. 80% of the overall criteria must be fulfilled. Specification of each course valuation criteria will be clear from course material on study net. For exchange students: • Grading on basis of several of the criteria mentioned above.
Examination	Approved / not approved
Grading criteria	For full-degree students: Approved / not approved . For exchange students: Grading based on the Danish 7-point scale.
Resources	Manuals for the MOUSE programme Notes given by the teacher
Additional information	Elective course, 6.-7. Semester on the Waste Water Supply specialization.

Title	SMART GRID SYSTEMS
Code	SMG S1
Language	English
Provider	Supply Engineering
Responsible	Per Kristensen
ECTS Point	5
Prerequisites	SPJ S4
Main purpose	To provide the student with a fundamental knowledge of smart grid and smart grid solutions.
Keywords	Smart grid, renewable energy, energy transmission, infrastructure security
Topics	The topic of this course is electricity production from various forms of renewable energy, and the course provides a survey of the function, system design and operation, technical and tariff changes ahead, the integration between district heating plants, combined heat and power plants, heat-transmission pipelines and the vision of the smart grid concept and short and long time energy storage. The course will deal with smart grid components including demand response, virtual power plants, dynamic pricing, grid enhancement funding, demand analysis, promotion of renewable energy sources, seasonal energy storage, governmental regulation, network standards, network integration, supply reliability and economy. Furthermore the technical, economic and environmental issues of energy transmission are discussed as well as infrastructure security. The lectures will involve useful examples of best implementation practices of smart grid solutions.
Knowledge	• The student should understand the fundamentals of the smart grid concept the different energy sources in relation to economy, efficiency and infrastructure.. • Furthermore the student should have an extended knowledge of the complex structures on an emerging energy market, of prices, supply and demand. • The student will gain an understanding of best practices to enhance energy conservation, control and plan electric generation, and transmit electricity from lowest cost and environmentally acceptable heat and electric generation sources. • Furthermore the student will gain an understanding of vulnerabilities in the smart grid systems
Skills	After completion of the course, the student must: • Be able to explain the structural settings regarding smart grid systems and be able to calculate different setups and smart grid solutions. • Have a balanced understanding of why and how the smart grid will be operated, both from the utility perspective as well as the customer perspective. • Be able to calculate and plan different seasonal heat storage solutions with the purpose of enhancing the efficiency of smart grid systems.
Teaching methods and study activity	137.5 hours of work for the student, 4-6 lessons per week for 12 weeks. Activities during the course are lectures, theory, fieldwork, exercises and self-study. The result of the field measurements is to be presented in a report.
Evaluation	For full-degree students: Approval on basis of several of the following criteria: - Given assignments/reports, which must be handed in on time and approved with a satisfactory result, - Tests, which must not have a crucial importance for the approval, - Course work/cases, which must be handed in on time and approved, - Study activity (attendance registration). It must be possible to pass the course from multiple combinations of the

	criteria. None of the criteria must be weighted so high that they alone can decide whether the student passes the course. 80% of the overall criteria must be fulfilled. Specification of each course valuation criteria will be clear from course material on study net. For exchange students: Grading on basis of several of the criteria mentioned above.
Examination	Approved / not approved
Grading criteria	For full-degree students: Approved / not approved. For exchange students: Grading based on the Danish 7-point scale.
Resources	Literature is not yet determined.
Additional information	Elective course, 6.-7.semester on the District Heating Supply Specialization

Title	SEWAGE SLUDGE AND SLUDGE TREATMENT
Code	SST S1
Language	English
Provider	Supply Engineering
Responsible	Elaheh Roshani
ECTS Point	5
Prerequisites	SPJ S4
Main purpose	To provide students with an enhanced understanding of sludge and sludge treatment on the waste water plant
Keywords	Sewage sludge, sludge stabilization, sludge dewatering, final disposal
Topics	• Basic knowledge of sludge (sludge production, sludge types and characterization) • Sludge stabilization methods • Sludge dewatering methods (advantages and disadvantages) Sludge disposal
Knowledge	The student should be able to plan, execute and assess at the typical wastewater treatment plant in relation to sludge treatment methods and assessment of their vulnerability
Skills	After completion of the course, the student must: • Have acquired knowledge of the different types of sludge at the typical wastewater treatment plan and their importance for the further process • Be able to analyze different stabilization methods and characterization of the most optimal and environmental friendly method • Be able to analyze different dewatering methods and explain the advantages and disadvantages of these methods • Have knowledge of the sludge disposal concepts and the including legal framework
Teaching methods and study activity	137.5 hours of work for the student, 6 lessons per week for 12 weeks. Activities during the course are lectures, theory, fieldwork, exercises and self-study.
Evaluation	For full-degree students: • Approval on basis of several of the following criteria: • Given assignments/reports, which must be handed in on time and approved with a satisfactory result, • Tests, which must not have a crucial importance for the approval, • Course work/cases, which must be handed in on time and approved, • Study activity (attendance registration). It must be possible to pass the course from multiple combinations of the

	criteria. None of the criteria must be weighted so high that they alone can decide whether the student passes the course. 80% of the overall criteria must be fulfilled. Specification of each course valuation criteria will be clear from course material on study net. For exchange students: • Grading on basis of several of the criteria mentioned above.
Examination	Approved / not approved
Grading criteria	For full-degree students: Approved / not approved . For exchange students: Grading based on the Danish 7-point scale.
Resources	Literature is not yet determined
Additional information	Elective course, 6.-7. Semester on the Waste Water Supply specialization

Title	**STRATEGIC ENERGY PLANNING**
Code	STE S1
Language	English
Provider	Supply Engineering
Responsible	Per Kristensen
ECTS Point	5
Prerequisites	SPJ S4
Main purpose	To provide the student with a fundamental knowledge of strategic energy planning and enable them to carry out strategic energy plans
Keywords	Strategic energy planning, cost effectiveness, transition to sustainable energy, interaction between energy systems, transmission pipelines, Multi-strand production technologies, environmental issues, modeling.
Topics	This course will address the topic of strategic energy planning with regards to the various sources of sustainable energy and technological developments in the field as well as political and economic issues. • Energy resource planning • Interconnection of district heating plants and conversion from individual heating to district heating • Converting to renewable energy technologies in areas which are not supplied with district heating • Components of strategic energy planning • Cost effective energy decisions • Short and long term actions to improve and sustain the energy efficiency of the facility • Transition to sustainable energy sources and new suppliers • Expansion, or reduction in production and occupancy • Interaction between energy systems, technology, markets and economy • Transmission pipelines • Structural issues • Multi-strand production technologies • Best practices, regulations and standards • Environmental issues • Models used for prediction of energy, environmental and economic development
Knowledge	The student gain knowledge about Interaction between energy policy, economics and environmental issues and the single components of a strategic energy plan. The student also receives knowledge about the basic theories and methods used and the national and international framework.
Skills	The student will be able to • See the district heating systems and the individual heating technologies

	in a larger context with many different production technologies and the interconnection of district heating and conversion from individual heating to district heating. • To develop an overall energy resource plan to ensure that necessary energy resources are available • To make the most cost effective energy decisions • To address and define procurement strategy, and provide contingencies for outages, expansion, or reduction in production and occupancy. • To address environmental consequences of using different energy resources and technologies and to calculate CO2 emissions
Teaching methods and study activity	137.5 hours of work for the student, 4-6 lessons per week for 12 weeks. Activities during the course are lectures, theory, fieldwork, exercises and self-study. The result of the field measurements is to be presented in a report.
Evaluation	For full-degree students: Approval on basis of several of the following criteria: - Given assignments/reports, which must be handed in on time and approved with a satisfactory result, - Tests, which must not have a crucial importance for the approval, - Course work/cases, which must be handed in on time and approved, - Study activity (attendance registration). It must be possible to pass the course from multiple combinations of the criteria. None of the criteria must be weighted so high that they alone can decide whether the student passes the course. 80% of the overall criteria must be fulfilled. Specification of each course valuation criteria will be clear from course material on study net. For exchange students: Grading on basis of several of the criteria mentioned above.
Examination	Approved / not approved
Grading criteria	For full-degree students: Approved / not approved. For exchange students: Grading based on the Danish 7-point scale.
Resources	Literature is not yet determined.
Additional information	Elective course, 6.-7.semester on the District Heating Supply Specialization

Title	**SUSTAINABLE ENERGY**
Code	SUE S1
Language	English
Provider	Supply Engineering
Responsible	Claus Nørgaard Poulsen
ECTS Point	5
Prerequisites	SPJ S4
Main purpose	The course aims to provide students with knowledge of the most common forms of renewable energy and to make the student able to identify the optimum energy solution for a given situation.
Keywords	Energy savings, shallow geothermal energy, heat pumps, thermal solar heating systems, combustion of biomass, feasibility study of energy investments
Topics	• Energy savings • Shallow geothermal energy • Heat pumps • Thermal solar heating systems

	• Combustion of biomass • District heating • Photo voltaic
Knowledge	The students will gain knowledge about physical design, function and performance calculations of sustainable energy plants with special focus on energy saving and environmental conditions.
Skills	After completion of this course the students must: • Know the physical design, structure and operation of plants for sustainable energy production. • Be able to make principal calculations of performance of renewable energy plants. • Know the principles of dimensioning renewable energy plants as regards consumption. • Calculate and plan energy savings. • Know the principles of designing a shallow geothermal energy plant. • Know how to evaluate energy investments
Teaching methods and study activity	137.5 hours of work for the student, 4-6 lessons per week for 12 weeks with a total of 60 lessons. Activities include; theory, problem solving, compulsory written tasks and excursion to a district heating plant heat pump system and an industrial waste heat recovery system.
Evaluation	For full-degree students: • Approval on basis of several of the following criteria: • Given assignments/reports, which must be handed in on time and approved with a satisfactory result, • Tests, which must not have a crucial importance for the approval, • Course work/cases, which must be handed in on time and approved, • Study activity (attendance registration). It must be possible to pass the course from multiple combinations of the criteria. None of the criteria must be weighted so high that they alone can decide whether the student passes the course. 80% of the overall criteria must be fulfilled. Specification of each course valuation criteria will be clear from course material on study net. For exchange students: • Grading on basis of several of the criteria mentioned above.
Examination	Approved / not approved
Grading criteria	For full-degree students: Approved / not approved . For exchange students: Grading based on the Danish 7-point scale.
Resources	Literature is not yet determined
Additional information	Elective course, 6.-7. Semester on the District Heating Supply specialization

Title	TRENCHLESS TECHNOLOGIES AND NO-DIG
Code	TTN S1
Language	English
Provider	Supply Engineering
Responsible	Linne Lauesen
ECTS Point	5
Prerequisites	SPJ S4
Main purpose	To introduce the student to the methods of trenchless technologies including their production methods, planning of a No Dig project, the juridical legislation, installation and operation of trenchless technologies and the pipe systems established.
Keywords	Trenchless Technologies (TT), No Dig, project Management in No Dig/TT, Planning and Operation of No Dig/TT installations, Environmental and Climate Emission perspectives.
Topics	• Basic overview of the processes of producing, planning, tendering, project management, installation, soil mechanics, and operation of the trenchless technologies and No Dig • TV inspection, Pipe Flushing, and Leak Detection • Cured In Place Pipe (CIPP) • Slip Lining, Panel Lining, and Closed Fit Lining • Pipe Bursting and Cracking • Horizontal Directional Drilling (HDD) • Horizontal Auger Boring • Thermo foamed piping • Manhole Renewal • Pipe Ramming • Micro tunnelling • Pilot Tube Installations and micro tunnelling • Pipe Jacking and other Large Tunnelling Methods • General soil mechanics in the above No Dig technologies
Knowledge	After completion of the course the student will have learned the basic premises and adaption methods of trenchless technologies including their production methods, how to plan a No Dig project, how to make different tenders related to No Dig and juridical legislation, project management, installation and operation of trenchless technologies and the pipe systems established.
Skills	After completion of the course the student must be able to: • Account for, at a basic level, how different trenchless technologies are produced, planned, and managed in different settings and soil contexts • Account for the environmental, social, and economic variables and impacts that trenchless technologies have in comparison with traditional trenching methods (excavation) • Describe, explain, compare, and assess different trenchless technologies as methods in different circumstantial settings • Account for and discuss the implications of different trenchless technologies upon strategic planning of urban infrastructure • Apply the trenchless technologies covered in the curriculum to empirical cases and use them to formulate and justify relevant research questions.
Teaching methods and study activity	137.5 hours of work for the student, 4-6 lessons per week for 12 weeks with a total of 60 lessons. Activities during the course are lectures, theory, fieldwork, exercises and self-study. As part of the course there will be visits to sites of trenchless technology installations. Besides the students will in small groups participate in a two-day fieldwork following a project of No Dig installation in the field in cooperation with a construction engineering company.
Evaluation	For full-degree students: • Approval on basis of several of the following criteria:

	• Given assignments/reports, which must be handed in on time and approved with a satisfactory result, • Tests, which must not have a crucial importance for the approval, • Course work/cases, which must be handed in on time and approved, • Study activity (attendance registration). It must be possible to pass the course from multiple combinations of the criteria. None of the criteria must be weighted so high that they alone can decide whether the student passes the course. 80% of the overall criteria must be fulfilled. Specification of each course valuation criteria will be clear from course material on study net. For exchange students: • Grading on basis of several of the criteria mentioned above.
Examination	Approved / not approved
Grading criteria	For full-degree students: Approved / not approved . For exchange students: Grading based on the Danish 7-point scale.
Resources	Not yet determined.
Additional information	Elective course, 6.-7. Semester on the Water Supply, Waste Water Supply and District Heating Supply specialization

Assessment Criteria for Supply Engineering Programme

A grade of **12** is given to a student who completely fulfills the objectives of the course by:	A grade of **7** is given to a student who:	A grade of **02** is given to a student who:
Demonstrating a **comprehensive and holistic** insight of the theory, methods and solutions, their assumptions together with having an **overview** of the connection between relevant subjects.	Can demonstrate a **solid** insight into the theory, methods and solutions, their assumptions together with having **a fair overview** of the connection between relevant subjects.	Can demonstrate a **limited** insight into the theory, methods and solutions, their assumptions together with having **a minor (albeit lacking) overview** of the connection between relevant subjects
Applying theory, methods and solutions in ways that are **relevant** in relation to the learning goals as well as topical engineering problems.	**Can apply a significant majority** of the theory, methods and solutions in ways that are **relevant** in relation to the learning goals as well as topical engineering problems.	Can **use the majority** of these theories, methods and solutions in ways that are **at least to some extent relevant** to the learning goals as well as topical engineering problems..
Being able to make **relevant** engineering judgments on topical engineering-related issues and theoretical and methodological assumptions through the use of **appropriate** language and concepts.	Can make generally **relevant** engineering judgments on topical engineering-related issues and theoretical and methodological assumptions through the use of **generally appropriate** language and concepts.	Can make **relevant, albeit inadequate** engineering judgments on topical engineering-related issues and theoretical and methodological assumptions through the use of **partially appropriate** language and concepts.
Demonstrating a **good** sense of perspective and rationalization of the **relevance** of related disciplines and problems.	Can demonstrate **some** sense of perspective and rationalization of the relevance of related disciplines and problems.	Demonstrate an **inadequate sense** of perspective and rationalization of the **relevance** of related disciplines and problems.