Uddannelses- og Forskningsministeriet

Prækvalifikation af videregående uddannelser - Bachelor i teknisk videnskab, computer engineering

Udskrevet 12. marts 2026

Bachelor - Bachelor i teknisk videnskab, computer engineering - Danmarks Tekniske Universitet

Institutionsnavn: Danmarks Tekniske Universitet
Indsendt: 14/09-2022 14:22
Ansøgningsrunde: 2022-2
Status på ansøgning: Godkendt
Afgørelsesbilag
Download den samlede ansøgning
Læs hele ansøgningen

Ansøgningstype
Ny uddannelse

Udbudssted
DTU Lyngby Campus

Informationer på kontaktperson for ansøgningen (navn, email og telefonnummer)
Christa Trandum, chefkonsulent, mail:chtra@adm.dtu.dk, mobil: 23652206

Er institutionen institutionsakkrediteret?
Ja

Er der tidligere søgt om godkendelse af uddannelsen eller udbuddet?
Nej

Uddannelsestype
Bachelor

Uddannelsens fagbetegnelse på dansk
Bachelor i teknisk videnskab, computer engineering

Uddannelsens fagbetegnelse på engelsk
Bachelor of Science in Engineering, Computer Engineering

Angiv den officielle danske titel, som institutionen forventer at bruge til den nye uddannelse
Bachelor i teknisk videnskab, computer engineering

Angiv den officielle engelske titel, som institutionen forventer at bruge til den nye uddannelse

Bachelor of Science in Engineering, Computer Engineering

Hvilket hovedområde hører uddannelsen under?

Teknisk videnskab

Hvilke adgangskrav gælder til uddannelsen?

For at blive optaget på DTU skal man have bestået en studentereksamen, højere forberedelseseksamen, højere handelseksamen, højere teknisk eksamen, adgangskursus til ingeniøruddannelserne eller GIF-eksamen. Den adgangsgivende eksamen skal som minimum indeholde følgende fag, for at ansøgeren kan blive optaget på bacheloruddannelsen i computer engineering:

- Engelsk på B-niveau
  Matematik på A-niveau
- Fysik på B-niveau (eller Geovidenskab A-niveau)
- Kemi på C-niveau (eller Bioteknologi A)

Ansøgere, der søger ind på baggrund af en udenlandsk studentereksamen eller lignende, skal endvidere dokumentere Dansk på A-niveau.

Er det et internationalt samarbejde, herunder Erasmus, fællesuddannelse el. lign.?

Nej

Hvis ja, hvilket samarbejde?

Hvilket sprog udbydes uddannelsen på?

Dansk

Er uddannelsen primært baseret på e-læring?

Nej, undervisningen foregår slet ikke eller i mindre grad på nettet.

ECTS-omfang

180

Beskrivelse af uddannelsens formål og erhvervssigte. Beskrivelsen må maks. fylde 1200 anslag

Fagområdet Computer Engineering, herunder design af komplekse digitale chips, er i dag endnu mere relevant end nogensinde.

Ifølge Dansk Industri [DI analyse, marts 2022] blev der i 2021 omsat for 324 mia kr. i tech-branchen (heraf 189 mia kr. i eksport), hvilket er en vækst på 11% i forhold til 2020. I et 10-årigt perspektiv er omsætningen steget med 54% (fra 210 mia kr i 2011). Hele branchen beskæftiger 52.000 personer med en elektronik uddannelse [DI Digital beskæftigelsesanalyse, april 2021]. Antallet af dimittender over en 10 årig periode er nogenlunde konstant, men efterspørgslen er kraftigt stigende.

Computer Engineering er i 2020 indgående behandlet i en stor rapport, som de internationale fagorganisationer IEEE og ACM har udgivet: ”Computing Curricula 2020, Paradigms for Global Computing Education”. På DTU er fagområdet primært forankret på DTU Compute, men DTU Electro bidrager også med relevante kurser.

Kandidaterne skal have en god baggrund inden for både hardware og software, og for at nå den fornødne faglige dybde, skal disse kompetencer opbygges allerede fra første studieår. Den mulighed findes ikke i dag med de eksisterende bacheloruddannelser på DTU.

Uddannelses struktur og konstituerende faglige elementer

Uddannelsen i Computer Engineering er en teknisk-videnskabelig bacheloruddannelse med fokus på konstruktion af digitale computersystemer. Uddannelsen tilbyder tre specialiseringer: i) Chipdesign, ii) Embedded systemer; iii) Computersystemer.

I de første tre semestre deltager de studerende i obligatoriske kurser, der giver en dybdegående baggrund i matematik, fysik og kemi, samt kurser, der introducerer elektronik, programmering og computerarkitektur. På fjerde semester introducerer kurserne den studerende til uddannelsens tre specialiseringsområder.

På femte og sjette semester deltager den studerende i kurser specialiseret inden for et af disse områder. I løbet af sjette semester afsluttes uddannelsen med et bachelorprojekt. Mange studerende vil lave deres bachelorprojekt i samarbejde med en virksomhed.

Flere kurser er dedikeret til design-build projekter. Det er gruppebaserede projekter, hvor studerende løser konkrete problemer fra det virkelige liv ved at gennemgå de problemløsningsfaser, der typisk bruges af ingeniører. Et forslag til en detaljeret studieplan findes i bilag 2.

Kompetenceprofil “Retningsspecifikke mål for læringsudbytte”:

• Kan analysere og designe software- og hardwarestrukturen i computersystemer og forklare samspillet mellem hardware og software.

• Kan designe og implementere større digitale kredsløb (f.eks. hardwareacceleratorer og ved hjælp af relevante værktøjer og udviklingsmetoder, kan realisere disse i FPGA-teknologi og chipteknologi.

• Kan forklare og anvende de fysiske principper for analoge og digitale kredsløb (strøm, spænding, ladning, energiforbrug, MOS transistor, RC switch modeller, Thévenin og Norton ækvivalenter, superpositions princip, simple forstærker kredsløb mv.)

• Kan anvende de grundlæggende principper for chipteknologier til at analysere, hvordan typiske digitale komponenter realiseres og ræsonnere omkring deres hastighed, energiforbrug og areal.

• Kan designe og implementere komplette softwaresystemer ved at anvende teoretiske og praktiske principper for operativsystemer, programmeringssprog og oversættere.

• Kan forklare og analysere grundlæggende emner inden for mindst to af de fagområder, hvor skræddersyede indlejrede systemer typisk anvendes (digital signalbehandling, digitale styresystemer, kunstig intelligens, kommunikationssystemer og protokoller).

Begrundet forslag til takstindplacering af uddannelsen

Uddannelsen skal placeres under takst 3, da uddannelsen i lighed med DTU's øvrige bacheloruddannelser er baseret på et
stærkt teknisk-naturvidenskabeligt fundament og sikrer den færdige kandidat en solid polyteknisk helhedskompetence, der ud over en identitetsskabende faglighed omfatter at kunne overskue en kompleks, teknisk problemstilling og at kunne tænke en teknisk faglighed ind i erhvervs- og samfundsmæssige sammenhænge. Uddannelsen forudsætter i lighed med andre tekniske og naturvidenskabelige uddannelser adgang til laboratoriefaciliteter.

Forslag til censorkorps

Civilingeniøruddannelsernes Censorkorps, Elektronik, IT og Energi

Dokumentation af efterspørgsel på uddannelsesprofil - Upload PDF-fil på max 30 sider. Der kan kun uploades én fil

Følgebrev og Appendix.pdf

Kort redegørelse for det nationale og regionale behov for den nye uddannelse. Besvarelsen må maks. fylde 1800 anslag

European Chip Act har til formål at styrke Europas modstandsdygtighed og konkurrenceevne inden for halvlederteknologier og -applikationer. Danmark, og især Sjælland, har et stærkt fodfæste af virksomheder, der arbejder direkte i chipdesignindustrien, samt virksomheder, der udvikler produkter, der er afhængige af halvlederindustrien (se bilag afsnit 4). Der er gennemført en omfattende dialog med disse interessenter i form af møder (se bilag afsnit 3) og en spørgeskemabaseret undersøgelse (se bilag afsnit 5) for at skitsere deres præcise behov i branchen.

Alle virksomheder har bekræftet, at der er et udækket behov for kandidater og en konkret kamp, ■■når man forsøger at rekruttere kandidater, der besidder de færdigheder og kompetencer, der er omfattet af denne nye uddannelse. Ikke at kunne ansætte kandidater medfører ofte, at stillingen flyttes til udlandet eller besættes fra udlandet. Chipproducenterne har allerede i dag svært ved at imødekomme markedets krav og det øgede behov for halvledere vil øge asymmetrien mellem behov og efterspørgsel. Den halvlederbaserede industri i Danmark er i øjeblikket på en voksende tendens, og virksomhederne har bemærket, at i takt med, at Europa forsøger at blive selvstændig på halvlederdomænet, forventes efterspørgslen efter kandidater med passende færdigheder at stige.

Uddybende bemærkninger

Intet at bemærke

Underbygget skøn over det nationale og regionale behov for dimittender. Besvarelsen må maks. fylde 1200 anslag

De ønskede kompetencer og færdigheder for en kommende computer ingeniør er formulerede i en dialog med et udvalg af potentielle aftagere. Virksomheder har evalueret og valideret en detaljeret liste over programmets emner og kompetencer (se bilag afsnit 1 og 2) samt en foreløbig plan for kurser.

Undersøgelsens resultat fastslår, at kompetencerne dækker industriens behov, og den foreslåede kombination af kurser, der dækker design af chips, software og computerarkitektur, er korrekt afbalanceret og dækker viden, kandidater fra eksisterende programmer savner.

Et flertal af de adspurgte virksomheder har udtrykt interesse og et ønske om at bidrage mere direkte til de formative aktiviteter. Sådanne bidrag omfatter gæsteforelæsninger, samarbejder om afsluttende projekter og deltagelse i real-life cases, der skal bruges i undervisningen. Den nye uddannelse fanger dette samarbejde i form af fire Design and build-kurser, hvor de studerende anvender deres færdigheder og kompetencer til at løse problemer stillet af de deltagende virksomheder.

Hvilke aftagere har været inddraget i behovsundersøgelsen? Besvarelsen må maks. fylde 1200 anslag

For at afdække behovet blandt potentielle aftagere af kommende computer ingeniører gennemførtes en undersøgelse med deltagelse af et bredt udsnit af relevante virksomheder. Resultatet fremhæver en stærk efterspørgsel fra IKT industrien (informations- og kommunikationsteknologi) efter kandidater med dyb faglig færdigheds- og kompetenceprofil som foreslået. DTU's Aftagerpanel bemærker fx "at dette er den bedste nyhed i mange år".

Stikprøven omfatter virksomheder inden for den mere teknisk prægede ende af computer teknologi; En overvægt af virksomheder, der er direkte involveret i design og produktion af halvlederchips samt virksomheder, der anvender chips og avancerede computersystemer i indlejrede systemer og IoT-enheder, eksempelvis som høreapparater, lydbehandlingsenheder og industrielt udstyr.

For at nå en repræsentativ beskrivelse af markedets behov omfatter undersøgelsen mellemstore og større danske virksomheder samt danske filialer af store multinationale virksomheder.

Hvordan er det konkret sikret, at den nye uddannelse matcher det påviste behov? Besvarelsen må maks. fylde 1200 anslag

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Beskriv ligheder og forskelle til beslægtede uddannelser, herunder beskæftigelse og eventuel dimensionering. Besvarelsen må maks. fylde 1200 anslag

Både AU og AAU har bacheloruddannelser i computerteknologi. På AAU er fokus på at forstå processoren, hvordan er arkitekturen opbygget, hvordan programmeres den, og hvordan den kan indgå i et distribueret system. Derudover har de fokus på anvendelser så som high performance, realtid og sikkerhed. På AU er fokus bredere med bl.a et kursus som giver en forståelse af den grundlæggende teknologi og kurser orienteret mod software systemer.

I disse uddannelser er der ikke fokus på konstruktion af nye computerarkitekturer til specifikke anvendelser, så som signal- og billedbehandling og machine learning algoritmer).

Den foreslåede bacheloruddannelse Computer Engineering på DTU vil som den eneste indeholde digital chip design og forståelse af chip fabrikations processerne. Den vil have et stærkt element af embedded hardware- og softwareudvikling, hvor de studerende udvikler nye distribuerede computersystemer fra bunden. Endelig vil uddannelsen have et fokus på realtime og lowpower performance.

Uddannelsen bygger på en forskning- og undervisningstradition der går tilbage til 60’erne hvor DASK, den første computer i Danmark, blev udviklet.

Uddybende bemærkninger

Intet at bemærke

Beskriv rekrutteringsgrundlaget for ansøgte, herunder eventuelle konsekvenser for eksisterende beslægtede udbud. Besvarelsen må maks. fylde 1200 anslag

Bacheloruddannelsen i Computer Engineering henvender sig til dansktalende uddannelsessøgende, der har en gymnasial ungdomsuddannelse med dansk og matematik på A-niveau og fysik og engelsk på B-niveau samt kemi på C-niveau.

På DTU er de tættest beslægtede uddannelser BSc i software teknologi og BSc i Elektroteknologi. Begge oplever stor søgning og kræver en vis adgangskvotient. Selv om den nye uddannelse måtte tiltrække nogle studerende fra disse beslægtede uddannelser, vurderes det at den samlede ansøgermasse er så stor, at det ikke vil have nævneværdig betydning for optaget på de eksisterende uddannelser.

Uddannelsens profil, herunder dens unikke fokus på chipdesign som et af de tre specialiseringsområder, betyder samtidig at der kan forventes ansøgere fra hele landet. På nationalt niveau er det Aarhus Universitets bacheloruddannelse i Computerteknologi som ligget tættest på den her foreslåede uddannelse, men uden samme specialiserede fokus på konstruktion af nye computerarkitekturer til fx signal- og billedbehandling og machine learning algoritmer.

Beskriv kort mulighederne for videreuddannelse

Afhængig af valg af specialisering, vil denne uddannelse give adgang til følgende kandidatuddannelser på DTU eller tilsvarende på andre danske eller udenlandske universiteter:

- Computer Science and Engineering (DTU) RETSKRAV

- Mathematical Modelling and Computation (DTU)

- Electrical Engineering (DTU, AU)

- Human-Centered Artificial Intelligence (DTU)

- Autonomous Systems (DTU)

- Communication Technologies and System Design (DTU)

- Computerteknologi (AU)

- Computer Engineering (AAU)

- Electronic systems (AAU)

- Robotteknologi (SDU)

- Mechatronics (SDU)

Forventet optag på de første 3 år af uddannelsen. Besvarelsen må maks. fylde 200 anslag

30, 60, 60.

Første år udbydes 30 pladser, men med mulighed for at øget antallet af pladser, hvis behovet er tilstede. Derefter udviddes til 60 pladser som for DTU's øvrige bacheloruddannelser.

Hvis relevant: forventede praktikaftaler. Besvarelsen må maks. fylde 1200 anslag

Ikke relevant

Øvrige bemærkninger til ansøgningen

Intet at bemærke

Hermed erklæres, at ansøgning om prækvalifikation er godkendt af institutionens rektor

Ja

Status på ansøgningen

Godkendt

Ansøgningsrunde

2022-2

Afgørelsesbilag - Upload PDF-fil

Afgørelsesbrev A9 DTU - bachelor i computer engineering.pdf

Samlet godkendelsesbrev - Upload PDF-fil

Uddannelses- og Forskningsministeriet
Bredgade 38
DK-1269 København K

Ansøgning om prækvalifikation af ny uddannelse

15. september 2022
chtra

På vegne af Danmarks Tekniske Universitet (DTU) fremsendes hermed ansøgning om oprettelse af en ny bacheloruddannelse, *bacheloruddannelsen i teknisk videnskab, Computerteknologi,* på engelsk *Bachelor of Science in Engineering, Computer Engineering*.

Ansøgningen er udarbejdet i henhold til vejledning om prækvalifikation af nye uddannelser og er baseret på en omfattende aftagerdialog (jf. ansøgningens afdækning af kriterium 1 og tilhørende bilagsmateriale). Herunder er både DTU's Aftagerpanel, Advisory Board på DTU Compute samt en række private virksomheder og offentlige institutioner inddraget.

Uddannelsen adresserer et aktuelt behov på arbejdsmarkedet, som afspejler den teknologiske og samfundsmæssige udvikling, som ikke allerede imødekommes af eksisterende uddannelser (jf. ansøgningens afdækning af kriterium 2). Således understøtter ansøgningen DTU's mission om at udvikle og nyttiggøre naturvidenskab og teknisk videnskab til gavn for samfundet.

Ansøgningen består af en udfyldelse af ministeriets elektroniske ansøgningsskema samt bilagsmateriale. Såfremt der er behov for yderligere oplysninger, vil vi naturligvis tilvejebringe dem så hurtigt som muligt.

Venlig hilsen

Anders O. Bjarklev
Rektor, DTU

Danmarks Tekniske Universitet
Ledelse og Administration

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Appendix - BSc in Computer Engineering

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1 Topics and competencies

This section presents a summary of the topics and competencies of the BSc in Computer Engineering. For each topic, a list of base competencies is reported. These have been extracted from the reports *Computer Engineering Curricula 2016 - Guidelines for Undergraduate Degree Programs in Computer* and *Computing Curricula 2020 - Paradigms for Global Computing Education* developed by the *Association for Computing Machinery (ACM)* and *the IEEE Computer Society*.

Circuits and Electronics

- Electric circuit and devices
- Fundamental of analog electronics
- VLSI design basics

Computing Algorithms

- Algorithmic analysis, algorithmic complexity, and computability theory
- Algorithm design for classic application specific algorithms

Computer Architecture and Organization

- Processor organization and (instruction set) architecture
- Distributed system/multicore/parallel architectures
- Computer performance

Digital Design

- Number systems and data encoding
- Boolean algebra and basic logic circuits
- Combinational circuits and sequential circuits
- Finite state machine with datapath

Embedded Systems

- Software design for embedded systems
- Computing platforms for embedded systems (microcontrollers)
- Input/output, serial communication, sensors, and actuators
- Networked embedded systems

Computer Networks

- Network architecture and communication protocols
- Network applications
- Wireless systems and networks

Preparation for Professional Practice

- Ethical and legal responsibilities
- Interdisciplinary team approaches

Information Security

- Data security and integrity
- Computer system and network security

Software Design

- Programming fundamentals and data structures
- Imperative programming (low level programming)
- Object-oriented design and programming

- Data engineering

Systems and Project Engineering
- Project management principles
- System specifications and requirements analysis
- System integration, testing and validation
- Software and hardware design for AI
- System design and development methodologies

Systems Resource Management
- Operating system principles
- Classic, mobile, embedded, and real-time operating systems
- System performance evaluation

Signal Processing
- Signal processing theory and applications
- Control system theory and applications

Base Scientific Topics
- Mathematics
- Discrete mathematics
- Statistics
- Physics, chemistry, and biology

2 Study plan

The following table shows an overview of the study plan courses for the 6 semesters of the BSc in Computer Engineering. For each course, the ECTS credits are reported in square brackets.

1st semester	**2nd semester**	**3rd semester**	**4th semester**	**5th semester**	**6th semester**
Mathematics 1/2 [10]	Mathematics 2/2 [10]	Interdisciplinary biology [5]	Discrete mathematics [5]	Depending on specialization: - Introduction to chip design [5] - Parallel-systems [5] - Control theory [5]	BSc final project [15]
Physics 1/2 [5]	Chemistry/biology [5]	Physics 2/2 [5]	Operating systems [5]	Depending on specialization: - Design for hardware testing [5] -Distributed embedded systems [5] -Networks [5]	Elective courses [10]
Electric circuits [5]	Introduction to programming [5]	Algorithms and data [5]	Software engineering [5]	Elective courses [15]	
Digital electronics [5]	Digital systems [5]	Computer architecture and engineering [5]	Embedded systems and microcontrollers [5]		
		Elective course [5]	Elective course [5]		
3-week January	**3-week June**	**3-week January**	**3-week June**	**3-week January**	**3-week June**
Theory of science in engineering [5]	Design and build project: FSMD-design on FPGA [5]	Design and build project: RISC-V processor on FPGA [5]	Design and build project: Project with company involvement (e.g., build an hearing aid) [5]	Elective course [5]	Elective course [5]

The following presents a complete list of courses divided into specialization areas. For each course, the ECTS credits are reported in square brackets.

Background courses

- Mathematics [10] + [10]
- Physics [5] + [5]
- Chemistry/biology [5]
- Statistics [5]
- Interdisciplinary biology [5]
- Discrete mathematics [5]
- Theory of science in engineering [5]

Hardware courses

- Electric circuits [5]
- Digital electronics [5]
- Computes systems [5]
- Computer architecture and engineering [5]
- Digital systems [5]
- Introduction to chip design [5]
- Design for hardware testing [5]
- Microcontrollers [5]

Software courses

- Introduction to programming [5]
- Algorithms and data [5]
- Operating systems [5]
- Software engineering [5]
- Real time systems [5]
- Compilers [5]
- Parallel programming [5]

System courses

- Embedded systems and microcontrollers [5]
- Parallel systems [5]
- Distributed embedded systems [5]
- Non-conventional computing [5]

Application courses

- Signal processing in discrete time [5]
- Control theory [5]
- Networks [5]

Design and build project courses

- Design and build project: Discrete components electronic circuits [5]
- Design and build project: FSMD design on FPGA [5]
- Design and build project: RISC-V processor on FPGA [5]
- Design and build project: Project with company involvement [5]

3 Log of activities

The following list reports relevant meetings where the need for the BSc in Computer Engineering was discussed.

- **April 24, 2019:** Meeting with DI Digital (Elektronikudvalg) at DTU to discuss the future of digital electronics education (including DTU Compute and DTU Electro)

- **March 27, 2020**: Industry meeting on chip design education (including DTU Compute, DTU Photonics, and DTU Electro)
    - Planning of a DTU Chip Day, but later canceled due to COVID-19

- **June 22, 2020**: Workshop on *Digital Design Education at DTU*

- **October 30, 2020:** Workshop on digital verification with industry

    - 10 presentations by students and researchers
    - Participation of chip companies
    - Online

- **November 30, December 1, 2021:** Digital Tech Summit
    - Two sessions on chip design and production in Denmark, DTU and industry

- **April 19, 2022:** DTU Chip Day
    - 20 companies
    - 160+ participants
    - https://github.com/os-chip-design/ChipDay
    - https://www.dtu.dk/english/news/all-news/nyhed?id=07dcbdbb-b948-425a-8568-7331bb271414

- **April 22, 2022:** Computer engineering education, Meeting with the Deans at DTU
    - Lars D. Christoffersen, Bachelor Dean of DTU
    - Phillip John Binning, Dean of DTU
    - Martin Schoeberl, Prof. at DTU Compute
    - Jens Sparsø, Prof. at DTU Compute
    - Jan Madsen, Prof. and Deputy Director of DTU Compute

- **May 17, 2022:** Chip design education, Meeting with Rektor at DTU
    - Peter Stuhr Lassen and Ketil Julsgaard, representing 20 chip design companies
    - Anders O. Bjarklev, Rector of DTU, Lars D. Christoffersen, Bachelor Dean of DTU
    - Jorg Hubner, Director of DTU Nanolab
    - Lars Ulrik, Director of DTU Electro
    - Jan Madsen, Deputy Director of DTU Compute

4 Companies in the Copenhagen region

This section presents a list of the companies in the Copenhagen region that work in the field of Computer Engineering and to which the applicants have direct contacts.

- Asyngn
- Cadence Design Systems
- CheetahAI
- Comcores
- Danfoss
- Demant
- GN Audio/Hearing
- Grundfos Holding
- IC Works
- Indesmatech
- Infineon Technologies Denmark
- Intel
- Knowles
- Microchip
- NVIDIA
- Napatech
- Novo Nordisk
- Polaric Semiconductor
- Presto
- Presto Engineering
- Silicom Denmark
- Skycore Semiconductors
- Synopsys
- SyoSil
- Teledyne Reson
- Trifork
- VELUX
- WSAudiology
- Zeuxion

5 Company survey

This section contains the responses to the survey we conducted to support the need for this new education. We surveyed a sample of companies located in Zealand representing possible employers for the candidates produced by the new education. Overall, the responses highlighted the demand for more graduates with expertise in the chip design industry.

The survey outcome shows that there is an unmet need for candidates and a concrete struggle when attempting to recruit candidates possessing the skills and competencies covered by this new education. The survey also reveals that the competencies are aligned with the needs of the industry and the proposed combination of courses covering chip design, software, and computer architecture is properly balanced and covers knowledge that is usually missing by current candidates.

In the following, we report the text of the email sent to the companies asking to participate in the survey, the questionnaire template, and the responses we got from the surveys.

5.1 Email sent to companies

Dear <recipient>,

To better serve the needs of the ICT and electronics industry, DTU is planning a new bachelor of science program in Computer Engineering which is supposed to start in the autumn of 2023.

The next step is to obtain approval from the Ministry of Higher Education and Science.

For this application, we need your input and support, and we invite you and your company to help us in shaping a relevant contemporary curriculum, as well as qualifying the current and future needs of your company in particular, and its business domain at large.

We would like you to answer (preferably by August 15) the 7 questions in the attached questionnaire (answers can be in Danish or English). Your answers will help us to document the need for such candidates now and in the future, and to collect inputs to the structure and contents of the programme (we have included a table of topics to be covered).

According to an analysis conducted by DI (Marts 2022), the turnover of this industry has, during the last 10 years, increased by 54% from 210 billion kr. in 2011 to 324 billion kr. in 2021. In the same period, the production of relevant candidates has been steady, while the demand has grown dramatically, partly because a wide range of other industries relies on the development and deployment of embedded computer systems.

DTU wants to complement the existing bachelor programmes in Electrical Engineering (focusing on analog and power electronics), Cyber-Technology (focusing on digital communication technology), and Software Technology (focusing on software development), with a program focusing on digital hardware design, embedded software, and computer systems, covering the theoretical foundation as well as practical skills to design and build complex contemporary computer systems. The proposed programme is structured according to the IEEE/ACM "Computing Curricula 2020, Paradigms for Global Computing Education". The new Computer Engineering bachelor of science programme will make a smooth transition for undergraduate students into the master of science programme in Computer Science and Engineering, where they

can go deeper into advanced topics of Computer Engineering.

Best regards,
<sender>

5.2 Questionnaire template

This is the questionnaire template we sent to the companies.

Company: Contact person: Email: Date:
NOTE:
1. What candidates within the area of Computer Engineering are you hiring today (what are the skills, profile, competencies)?
2. Is there an unmet need for which this BSc education will help?
3. What would you expect to be the impact of this BSc education on your company (future hiring plan for your company). From your perspective, how is the general need for this type of candidate (market, future of sector/business, is there a need for more or less candidates)?
4. Are there competences which should be included, strengthened, or reduced? (see the table of topics to be covered)
5. How can we improve (favor, support) diversity?
6. How can you contribute to the development of the BSc education? (cases and problem exercises, guest lectures, hackathons, internships, etc.)
7. Any other comments or suggestions

5.3 Responses from the companies

5.3.1 Cadence Design Systems

Company: Cadence Design Systems Contact person: Anton Klotz Email: aklotz@cadence.com Date: 20.07.2022
NOTE: Cadence doesn't have an office in Denmark, but we hire graduates all across Europe and we are interested that our customers have sufficient amount of engineers, who will use our solutions for chip design
1. What candidates within the area of Computer Engineering are you hiring today (what are the skills, profile, competencies)? We have several required profiles which can be roughly split into two groups: R&D and Application Engineer. R&D must understand coding with mostly C++, algorithms for Big Data, also ML algorithms. They should have some understanding of design of microelectronics. The application engineers must have deep understanding of various steps microelectronics design, EDA tools, scripting languages.
2. Is there an unmet need for which this BSc education will help? As have already been stated in the email, there is huge demand for graduates with understanding of VLSI basics and coders who have understanding of computer hardware. I like the Systems and Project Engineering part of the curriculum, this is knowledge that is often missed.
3. What would you expect to be the impact of this BSc education on your company (future hiring plan for your company). From your perspective, how is the general need for this type of candidate (market, future of sector/business, is there a need for more or less candidates)? As VLSI design doesn't play a big role in the curriculum, I would expect that the graduates would fit into the R&D role, rather than Application Engineer role. In the recent years there is a clear plan to increase the number of R&D positions in Europe, also current R&D engineers will retire in the next 5-10 years, therefore Cadence would be interested in the graduates from this course, to hire them as R&D engineers. For companies, which are doing design of embedded systems, this bachelor is a good fit, they can become designers of such systems, however on a higher level, than IC design
4. Are there competences which should be included, strengthened, or reduced? (see the table of topics to be covered) I would include a basic lectures on economy, if the students become manager at some point, they will benefit of this knowledge. I would prefer a stronger emphasis on VLSI design, but this would probably overload the curriculum. I also would include a lecture on web-technologies, it is very useful to have some understanding on these technologies

5. How can we improve (favor, support) diversity? I foresee very little diversity in this Bsc. In context of female participation, however from my experience lot of students with migration background are keen to become engineers. In the “Preparation for Professional Practice” part, a lecture on leading/working in a multicultural team could be included
6. How can you contribute to the development of the BSc education? (cases and problem exercises, guest lectures, hackathons, internships, etc.) For the VLSI design part, Cadence is contributing licenses and training material. We could provide online guest lectures and international internships
7. Any other comments or suggestions This Bsc. reminds me very much on my own studies at the University of Mannheim, where I’ve studied technical computer sciences 1998-2003. In my current job I lack deep knowledge of analog and RF design, especially front-end, but for all other aspects I feel well prepared. This Bsc. includes also topics which are mandatory for new generation of students like AI, security. Also I find the inclusion of biology and chemistry a good approach, as it broadens the scope and shows where computational systems can be applied.

5.3.2 Demant A/S

Company: Demant A/S Contact person: Anders Hebsgaard Email: aheb@demant.com Date: 18-08-2022
NOTE:
1. What candidates within the area of Computer Engineering are you hiring today (what are the skills, profile, competencies)? Digital IC design and verification. processor design, HW-SW Codesign, Embedded SW engineers C, C++, python, and bash programming Signal processing Bluetooth and RF communication DevOps Compiler theory and DSL

2. Is there an unmet need for which this BSc education will help?

Many engineering students have a focus on algorithmic and theoretical solutions. On the software side we hope for more candidates with a focus on the craft of software development.
Engineers with knowledge of Verification and UVM (Universal Verification Methods).
Design methodology with stronger focus on verification, more focus on the complete V-model.
Spec writing, requirements management from functional spec to verification spec, the complete engineering loop.
There is a need for computer engineering spanning the HW, embedded SW, and HW/SW co-design and architecture.

3. What would you expect to be the impact of this BSc education on your company (future hiring plan for your company). From your perspective, how is the general need for this type of candidate (market, future of sector/business, is there a need for more or less candidates)?

We need more younger engineers, at least a couple of good ones every year. We have been lacking young people for more than 10 yeas now and have to hire from outside of Denmark for many years now. When hiring from outside of Denmark there is a bigger risk of uneven education level.

We currently have challenges filling all positions. We sometimes search outside Denmark, or even outside Europe for candidates. We see our need increasing in the future. One of our preferred ways of finding new colleagues is through some sort of university project where we have tried out the collaboration.

Over the last 10 years the number of employees in Demant A/S with a computer engineering or computer science background has grown by approximately 300%. The growth is expected to continue based on an expected growth rate for the marked driven by baby -boomers, ageing population, and hearing loss related to other health factors such as dementia.

4. Are there competences which should be included, strengthened, or reduced? (see the table of topics to be covered)

Even for embedded software, there is a large requirement regarding continuous integration and software best practices. This is an area which is often lacking in the skillset of new graduates.
-Version control, branching, collaboration on code, code review
-Build systems
-Unit testing and designing code for testability

Network and communication protocols should include Bluetooth/Bluetooth Low Energy

The VLSI should be more than basic to support chip engineer development. This can easily be achieved by combining it with one of the other topic areas like “Computer Architecture”

5. How can we improve (favor, support) diversity?

The main challenge today is the lack of candidates due to the lack of visibility of the options in this field. The visibility is missing at the age where career directions are chosen.

This can be addressed by promoting computer engineering opportunities and role models starting at least in high school (gynmasiet) and preferably even 7th – 9th grade.
Visibility of business areas that hire computer engineers such as health care could also attract a more diverse group of students.

- The program has to be given in English for attracting foreign students.
- Hire female lecturer more often.
- Have more female teachers in early courses.
- Having invited talks from women, either from other universities or industry.
- More advertisement in high school. Summer school program in Electrical engineering for school kids.
- Maybe network with organization like Hypatia to create special scholarship program for female students in certain subject, like IC design.

6. How can you contribute to the development of the BSc education? (cases and problem exercises, guest lectures, hackathons, internships, etc.?

We can contribute with most of these. We are already collecting and engaged in project and internship ideas, and doing yearly case study competitions (Oticon explorers). We could probably expand this.
Guest lecture from me and my colleagues, maybe a good talk with the lecturer about how the competence area of both HW and SW verification is built up and into the curriculum, and help design a few lecture/education program with DTU.
Finally we can and do offer student jobs with relevant content.

7. Any other comments or suggestions

Circuits and electronics:
Suggest to Include FPGAs as this is has an industry wide relevance

Preparation For Professional Practice:
Less relevant, I would suggest adding another topic that provides some more hard skills

Systems an Project Engineering:
"Software and Hardware design for AI" – this seems a bit too specific and a bit out of context

Signal Processing:
General Signal analysis and basic understanding of such concepts as transfer functions, Laplace transforms etc will likely be needed to understand this topic

Base Scientific Topics:
Only discrete mathematics has real relevance, and should be taught first semester

Suggested (advanced) topics:
Lab experience
Compiler construction and formal languages
Advanced data structures and algorithm theory
Co-design and simulation

Semiconductor Verification (UVM, verification IP, formal verification etc.)

5.3.3 DI Digital

Company: DI Digital Contact person: Morten Kristiansen Email: mokr@di.dk Date: 4. August 2022
NOTE:
1. What candidates within the area of Computer Engineering are you hiring today (what are the skills, profile, competencies)? N/A
2. Is there an unmet need for which this BSc education will help? Especially within the field of IoT we see high growth and thus demand from IoT-companies for the right candidates. This new education will in our opinion help in closing this concrete competence gap. This is however also true when we look at the broader picture where ICT-companies are struggling with recruiting the right candidates. Therefore we believe this education will be an important contribution to the Danish ICT industry in general and for IoT-companies specifically.
3. What would you expect to be the impact of this BSc education on your company (future hiring plan for your company). From your perspective, how is the general need for this type of candidate (market, future of sector/business, is there a need for more or less candidates)? N/A
4. Are there competences which should be included, strengthened, or reduced? (see the table of topics to be covered)
5. How can we improve (favor, support) diversity?
6. How can you contribute to the development of the BSc education? (cases and problem exercises, guest lectures, hackathons, internships, etc.)
7. Any other comments or suggestions

5.3.4 Grundfos Holding A/S

Company: Grundfos Holding A/S Contact person: Thorkild Kvisgaard Email: tkvisgaard@grundfos.com Date: 2022-09-07
NOTE:
1. What candidates within the area of Computer Engineering are you hiring today (what are the skills, profile, competencies)? We are hiring candidates within almost all the topics mentioned in the Curriculum topics, but topics like “Combinational circuits and sequential circuits”, “Finite state machine with data path” and “VLSI design basics” are minor areas. We also see an increasing need for knowledge within Data Security in combination with (Machine) safety.
2. Is there an unmet need for which this BSc education will help? “Software and hardware design for AI” and “Data Security and integrity”
3. What would you expect to be the impact of this BSc education on your company (future hiring plan for your company). From your perspective, how is the general need for this type of candidate (market, future of sector/business, is there a need for more or less candidates)? Hard to be specific on hiring plans – but Digital Offerings is expected to a significant part of our future business – so this new bachelor supports this well.
4. Are there competences which should be included, strengthened, or reduced? (see the table of topics to be covered). See above.
5. How can we improve (favor, support) diversity? Don’t now – today there is not that many female bachelors
6. How can you contribute to the development of the BSc education? (cases and problem exercises, guest lectures, hackathons, internships, etc.). We happily supports internships, bachelors projects etc.

7. Any other comments or suggestions

5.3.5 Indesmatech ApS

Company: Indesmatech ApS Contact person: Rune Domsten Email: rdo@indesmatech.com Date: august 4th
NOTE:
1. What candidates within the area of Computer Engineering are you hiring today (what are the skills, profile, competencies)? The biggest challenges is to find Candidates with skills both covering the fundamental hardware design and embedded SW (including advanced algo implementation) Missing the full stack makes it very difficult to make optimal implementations either on existing FPGA/DSP/GPU/CPU architecture or even more difficult to design a new system with a dedicated and optimized architecture towards performance, latency, throughput and/or power. Remember that compters and both in edge and cloud is major power consumers.
2. Is there an unmet need for which this BSc education will help? The proposed combination of courses covering both hardware understanding, software and computing architecture looks like a very good mix for the missing profiles. The demand on the skills will be high – it will need to very bright students that can work on the fullstack. But it is a real need.
3. What would you expect to be the impact of this BSc education on your company (future hiring plan for your company). From your perspective, how is the general need for this type of candidate (market, future of sector/business, is there a need for more or less candidates)? Generally most candidates covers to little of the technology stack. In many cases it means that it is the older engineers that can design these advanced systems or debug a complicated structure. Most of the good engineers is now in the 50s and 60s.This is a very critical industrial challenge that can be addressed with the proposed profile for the new education
4. Are there competences which should be included, strengthened, or reduced? (see the table of topics to be covered) Real-time system design both on OS and HW system level – with multicore architectures. Are the traditional real-time OS old fashion and not meeting the possibilities of new hardware architectures. From algorithmen to efficient implementation in CPU's/DSP/GPU/GPGA(logic) understanding the processingplatfoms impact on performance, power and much more

5. How can we improve (favor, support) diversity? This always a challenge. One profil is energi/environmental friendly computing. Second is working on an umbrella project with a greater goal the just technology. – What makes life better, more equaly and – Helping blind and def people to experience and navigate in the real world – human sensor expansion. – (Human) robots the can do the boring and routine oriented work.
6. How can you contribute to the development of the BSc education? (cases and problem exercises, guest lectures, hackathons, internships, etc.) - Internships we are happy to have intern's – could work with chip or wireless design - Guest lecturer – design challenges and projects - Propose start-up projects – with DTU entrepreneurship – and coach
7. Any other comments or suggestions The technology is often relevant for many DTU start-ups but today they don't have skills to build the actual projects where advanced computers systems is needed.

5.3.6 Microchip

Company: Microchip Contact person: Thomas Aakjer Email: thomas.aakjer@microchip.com Date: 220826
NOTE:
1. What candidates within the area of Computer Engineering are you hiring today (what are the skills, profile, competencies)? Candidates for ASIC design (VHDL designers)
2. Is there an unmet need for which this BSc education will help? I belive a more ASIC/VLSI focused Bachelor line will benefit the chip design industry in Denmark. It is a timely addition considering the macro-political changes and focus on Semiconductor fabrication (and design) in EU.

3. What would you expect to be the impact of this BSc education on your company (future hiring plan for your company). From your perspective, how is the general need for this type of candidate (market, future of sector/business, is there a need for more or less candidates)? Right now, I belive there are clearly too few candidates available for the semiconductor industry in Denmark. Not being able to find the right candidates partly results in the job positions moving abroad, hiring from abroad.
4. Are there competences which should be included, strengthened, or reduced? (see the table of topics to be covered). Going through the list, I think this is a good guess on the topics to come around for the semiconductor design industry.
5. How can we improve (favor, support) diversity?
6. How can you contribute to the development of the BSc education? (cases and problem exercises, guest lectures, hackathons, internships, etc.). We can support with individual courses, BSc projects, potentially guest lectures.
7. Any other comments or suggestions

5.3.7 Napatech

Company: Napatech Contact person: Anders Tranberg-Hansen Email: ath@napatech.com Date: 04-09-22
NOTE:
1. What candidates within the area of Computer Engineering are you hiring today (what are the skills, profile, competencies)? - Digital design and verification profiles - Capable of doing requirement breakdown, design, documentation, architecture, implementation and/or verification. - Knowledge of digital simulators and synthesis and implementation tools for FPGAs will be a big plus.

2. Is there an unmet need for which this BSc education will help?

In general, the average seniority is high and we are lacking access to newly graduates as the number of students specializing within digital hardware and/or verification seems to have dropped significantly within the past decade. Currently, the area is developing in a more international direction.

3. What would you expect to be the impact of this BSc education on your company (future hiring plan for your company). From your perspective, how is the general need for this type of candidate (market, future of sector/business, is there a need for more or less candidates)?

In the future, we expect to see an increasing demand for profiles within digital hardware design and verification. Napatech is centered around reconfigurable computing and it is crucial that we have access to specialist within digital hardware design and verification to ensure our continued growth journey. The increase in additional specialist within this domain will increase the need for specialist in associated domains such as software and hardware (PCB) development. A strong education at DTU will make it easier for our company to grow and ensure an even tighter relationship with DTU e.g. as student project collaborations are expected to increase.

4. Are there competences which should be included, strengthened, or reduced? (see the table of topics to be covered)

You could consider to include a topic of verification of complex digital designs, as we spend a lot of time on this topic both in the ASIC and FPGA industry.

5. How can we improve (favor, support) diversity? The current subject list looks diverse in terms of interaction between the subjects.

Diversity can be supported by communicating clearly about the openness and benefits available within the domain. We are searching for individuals who are open minded, capable of taking responsibility for their own task and offer a high degree of flexibility in the way the individual's daily work is planned. Furthermore, it is a very international domain both employee wise but also the whole business is primarily focused on North America, EMEA and APAC. We truly believe that diversity helps bring out the best solutions and currently, we are international, however, we must admit that we have a very unified staff in relation to gender and would welcome initiatives to improve diversity to bring out the best solutions and foster even better ideas.

6. How can you contribute to the development of the BSc education? (cases and problem exercises, guest lectures, hackathons, internships, etc.)

At Napatech, we will be able to support the education primarily with student projects and internships. Depending on the course, we could provide guest lectures which gives insight into Napatech use-cases and the business we operate in, including the digital hardware design and verification skills we employ in our daily work.

7. Any other comments or suggestions

5.3.8 Novo Nordisk A/S, Devices & Delivery Solutions

Company: Novo Nordisk A/S, Devices & Delivery Solutions Contact person: DYKH Email: dykh@novonordisk.com Date: 2022-08-08
NOTE:
1. What candidates within the area of Computer Engineering are you hiring today (what are the skills, profile, competencies)? We are actively looking for candidates with following skill-sets: Embedded systems, circuits and electronics, systems engineering.
2. Is there an unmet need for which this BSc education will help? Yes. There is an unmet need in the market for educations with focus on systems engineering / systems thinking.
3. What would you expect to be the impact of this BSc education on your company (future hiring plan for your company). From your perspective, how is the general need for this type of candidate (market, future of sector/business, is there a need for more or less candidates)? Seen from ours perspective, complexity from design and connectivity will keep on increasing and requiring systems skills.
4. Are there competences which should be included, strengthened, or reduced? (see the table of topics to be covered) We believe that the current subject list is very relevant. We also believe that the following topics should be strengthened to meet the current market needs: Systems engineering, information security. It will be helpful for students to get a basic understanding of AI/ML principles.
5. How can we improve (favor, support) diversity? The current subject list looks diverse in terms of interaction between the subjects.

6. How can you contribute to the development of the BSc education? (cases and problem exercises, guest lectures, hackathons, internships, etc.) We can contribute by providing guest lectures and opportunities for students to work for Novo Nordisk as student helpers / interns.
7. Any other comments or suggestions - No

5.3.9 Synopsys Inc

Company: Synopsys Inc Contact person: Alec Vogt Email: alec.vogt@synopsys.com Date: 17th August, 2022
NOTE:
1. What candidates within the area of Computer Engineering are you hiring today (what are the skills, profile, competencies)? Synopsys is hiring candidates from a variety of science and technology degrees which include Electronic Engineering, Computer Science and Computer Engineering degrees. Our main focus is on graduates and post-graduates who have some industry experience (1-2 years for junior positions, 3-10 years for senior positions). Essential skills include knowledge of digital and/or analog design and verification of ASIC and FPGA circuits. It is also advantageous to have competence in some or all of the following: computer architectures, AI, semiconductor processes. Increasingly, Synopsys is hiring graduates into its IP R&D teams which are implementing complex interface IP required for processor-based ASICs. Knowledge of digital verification techniques and processor systems are also essential skills in this area.
2. Is there an unmet need for which this BSc education will help? There is a shortage of skills in the semiconductor industry throughout Europe, especially in the domains of ASIC and FPGA design and verification techniques. Graduates joining Synopsys today learn to program at university but have seldom worked with design or implementation tools. They have to be taught these skills from scratch.
3. What would you expect to be the impact of this BSc education on your company (future hiring plan for your company). From your perspective, how is the general need for this type of candidate (market, future of sector/business, is there a need for more or less candidates)?

As indicated previously, there is a need for more candidates from suitable degree courses. In general, computer architectures and processor design are core competencies in Europe that require this type of candidate. Furthermore, ASIC and FPGA design is essential to several industries that have semiconductors at their heart.

The impact of this BSc education would be reduced lead times to find suitable candidates, which can often take months, and reduced lead times to make these new hires operational. As Europe tries to become independent in this domain, the demand for graduates with suitable skills is only going to increase.

4. Are there competences which should be included, strengthened, or reduced? (see the table of topics to be covered).

The competencies outlined cover the topics expected for this type of course. Nevertheless, Synopsys would recommend the inclusion of modules focused on the implementation and verification of ASICs and FPGAs. It would not be unreasonable, for example, to expect students completing this course to have experience of taking digital designs through verification and implementation onto an FPGA.

Though not essential for an undergraduate course, it would be valuable to complement the theoretical modules on computer and processors with seminars or short lectures on the requirements and special considerations for the design of soft and hard processor cores (IP) in modern SoCs.

5. How can we improve (favor, support) diversity?

This question is not entirely clear.

6. How can you contribute to the development of the BSc education? (cases and problem exercises, guest lectures, hackathons, internships, etc.).

Synopsys in Europe is expanding its support for university programs and actively looking to engage in initiatives that strengthen the semiconductor ecosystem, such as skills development and support for research and innovation.

Synopsys could contribute with:

- Internships programs agreed with DTU
- Proactive campaigns to identify promising graduates for the inclusion in Synopsys hiring programs
- On-going support in the form of guest lectures; selected contributions to course modules (as required); and selected labs/practical exercises.
- Sharing of existing Synopsys course material developed to deliver university courses that include a strong practical/real world component based on Synopsys tools.
- Access to teaching licences for agreed course modules (digital, analog, FPGA synthesis, etc.). The Synopsys university program collaborates closely with Europractice to deliver its software products to universities for both research and teaching.

All contributions to this course would be part of a separate agreement between DTU and Synopsys.
7. Any other comments or suggestions

5.3.10 SyoSil ApS

Company: SyoSil ApS Contact person: Peter Jensen, Mananging Director Email: peter@syosil.com Date: 16-08-2022
NOTE:
1. What candidates within the area of Computer Engineering are you hiring today (what are the skills, profile, competencies)? Below a list of the current major engineering groups that SyoSil employs and hires, with their background mapped to the “Curriculum topics for new BSc. In Computer Engineering at DTU”: ASIC/FPGA design engineers: - Circuits and Electronics - Digital Design - Computer Architecture and Organization - Signal Processing ASIC/FPGA verification engineers: - Digital Design - Software Design - Systems and Project Engineering - Systems Resource Management - Computing Algorithms Embedded SW/FW engineers & SW specialists - Embedded Systems - Software Design - Computing Algorithms
2. Is there an unmet need for which this BSc education will help? Definitely yes. Good ASIC/FPGA *verification* engineers’ mixed skillset of abstract SW techniques and digital electronics knowledge is hard to find, especially from DTU. The proposed BSc education would address exactly our needs in this field.

3. What would you expect to be the impact of this BSc education on your company (future hiring plan for your company). From your perspective, how is the general need for this type of candidate (market, future of sector/business, is there a need for more or less candidates)?

SyoSil today employs 40 engineers, almost all holding a background in the area which the new BSc education would address. Alone in 2022, our staff has grown by 25%, and we expect this to continue in 2023.

Of the 10 new engineers added to SyoSil in 2022, unfortunately nobody was educated at DTU, which would have been our first choice. Instead, we hire people from other EU/nonEU states, initially giving them proper internal training. Due to the lack of the number of DTU computer engineering BSc/MSc's expected to graduate in the coming years, we project that 80-90% of our new hires will have an engineering background from other universities than DTU.

For SyoSil as a project based consulting organization with focus on FPGA/ASIC engineering, it is imperative for our company in the future to be able to hire BSc/MSc's with a first class background in computer science.

We would like to emphasize that the primary factor currently limiting SyoSil's growth is the availability of suitable engineers in the above listed categories.

We find the proposed new BSc education to be *extremely important* for not only SyoSil, but the whole ASIC/FPGA/electronics industry in Denmark in general:

- Today engineering freshmen students interested in computer engineering are forced to choose between SW technologies and classical EE engineering. Only a minority of these today find their way towards the computer engineering MSc, which are exactly the kind of people the industry is searching for.
- With a comprehensive and well marketed computer engineering BSc education at DTU, we believe the "supply chain" for the MSc. CS may be capable of producing at least 25-50% of the engineers that SyoSil – and the industry – is looking for.
- SyoSil prefers to hire engineers from DTU due to their high academic level, affiliation with Denmark, and ultimately the probability of them staying in Denmark.

4. Are there competences which should be included, strengthened, or reduced? (see the table of topics to be covered)

For advanced ASIC design & verification, following topics should be strengthened even further:

- hardware modelling, abstract models
- digital verification using constrained random/coverage driven methodologies
- digital verification using formal property checking (model checking)
- SystemVerilog for design, SystemVerilog/UVM for verification (VHDL doesn't suffice)
- big data management
- hardware/software co-design
- project oriented courses in chip-design, co-taught and co-developed with the industry. Currently a "special course" exists here, we hope this will continue to be offered and hopefully extended e.g. with extra lab/summer courses. SyoSil is willing to be a part of driving such courses.

5. How can we improve (favor, support) diversity?

Today the industry presents itself as rather diverse in terms of people's nationality, culture and origin. Of the 40 SyoSil staff engineers, approximately half are native Danes, rest have relocated to Denmark from across the globe.

Biggest diversity issue in the field of computer engineering in Denmark continues to be a gender issue. SyoSil is very much in favor of encouraging females to study computer sciences, ultimately leading to a more balanced gender distribution that we find to give a better environment in our company.

We don't find favoring any particular groups (e.g. females) to be the right instrument. Instead we believe in telling the story about e.g. successful females in our industry by

- Offering DTU projects to Danish high-schools with special focus for females
- Letting the female technical leads from the industry stand up in media and to present at guest lectures and the DTU Chip Day
- Marketing that engineering jobs in the Danish industry offers a very attractive work/life balance, especially taking the financial aspects into view

SyoSil of course would like to participate in such initiatives.

6. How can you contribute to the development of the BSc education? (cases and problem exercises, guest lectures, hackathons, internships, etc.)

SyoSil already participates in

- Giving guest lectures
- Partly teaching curriculum at some courses
- Speaker and exhibitor at the DTU Chip Day in 2022
- Internships with students (BSc, MSc)

We are more than willing to extend the collaboration with DTU staff and DTU in general.

7. Any other comments or suggestions

SyoSil sees this BSc. Initiative as extremely valuable for our business and the Danish electronics/SW industry in general. To secure a vital and very valuable industry sector for the future benefit of the society, we very much hope the Ministry of Higher Education and Science is prepared to support this initiative.

5.3.11 Teledyne Reson A/S

Company: Teledyne Reson A/S
Contact person: Morten Rytter
Email: morten.rytter@teledyne.com
Date: 10th August 2022

NOTE:
1. What candidates within the area of Computer Engineering are you hiring today (what are the skills, profile, competencies)? We hire analog, digital, signal processing, embedded software, application software, UI Software etc. More or less all DTU electrical and software profiles. We hire both in-experienced and very experienced engineers
2. Is there an unmet need for which this BSc education will help? The skillset of freshly educated engineers could be better suited. Eg there are very few courses on validation and testing but once engineers have some years of experience, they have received this.
3. What would you expect to be the impact of this BSc education on your company (future hiring plan for your company). From your perspective, how is the general need for this type of candidate (market, future of sector/business, is there a need for more or less candidates)? The proposed content of the candidate education would be an excellent fit for many of our positions
4. Are there competences which should be included, strengthened, or reduced? (see the table of topics to be covered) See above. Test and verification is typically 50% of the work to develop a new product but close to 0% of the courses in DTU
5. How can we improve (favor, support) diversity? We do not need diversity as such. We need clever and skilled engineers no matter their gender or orientation.
6. How can you contribute to the development of the BSc education? (cases and problem exercises, guest lectures, hackathons, internships, etc.) We can offer guest lectures, internships and perhaps cases
7. Any other comments or suggestions

5.3.12 Trifork A/S

Company: Trifork A/S Contact person: Morten Wagner Email: mow@trifork.com Date: 12/08 2022
NOTE:
1. What candidates within the area of Computer Engineering are you hiring today (what are the skills, profile, competencies)? Data scientists, backend and frontend developers, architects, UX
2. Is there an unmet need for which this BSc education will help? Definately. Many of Trifork's business units (60 of them) needs developers.
3. What would you expect to be the impact of this BSc education on your company (future hiring plan for your company). From your perspective, how is the general need for this type of candidate (market, future of sector/business, is there a need for more or less candidates)? As most of our hires are on the backend/frontend sides of IT development, anything that can create more IT professionals would be good for our business.
4. Are there competences which should be included, strengthened, or reduced? (see the table of topics to be covered) It is important – i feel – to know about the internal workings, (embedded programming, signal processing, etc) of computers. Mostly, though, Trifork hires developers and architects that are working on higher levels of programming. But it is important to know about, anyways. Maybe a little less signal processing could make way for a bit on introduction to IT architecture and more on security and test?
5. How can we improve (favor, support) diversity? Good question…
6. How can you contribute to the development of the BSc education? (cases and problem exercises, guest lectures, hackathons, internships, etc.) All of the above ;)

7. Any other comments or suggestions

5.3.13 WSAudiology

Company: WSAudiology Contact person: Ketil Julsgaard Email: ketil.julsgaard@wsa.com Date: 22/7/2022
NOTE:
1. What candidates within the area of Computer Engineering are you hiring today (what are the skills, profile, competencies)? Digital ASIC/chip design and verification engineers. Key skills are RTL coding, digital circuits, processor and computer architecture, digital signal processing
2. Is there an unmet need for which this BSc education will help? Yes. We have a hard time to find qualified design engineers. This BSc should hopefully help increasing the pool of students going in this direction and then possibly continue to a masters degree specializing further into chip design. The overall profile for this BSc also seems to match very well with the overall competences that we are looking for.
3. What would you expect to be the impact of this BSc education on your company (future hiring plan for your company). From your perspective, how is the general need for this type of candidate (market, future of sector/business, is there a need for more or less candidates)? See above (#3).
4. Are there competences which should be included, strengthened, or reduced? (see the table of topics to be covered) In general a good general list of topics. “VLSI design basics” will hopefully include also some RTL coding – alternatively as minimum as an elective.
5. How can we improve (favor, support) diversity?
6. How can you contribute to the development of the BSc education? (cases and problem exercises, guest lectures, hackathons, internships, etc.)

We will be happy to help with both lectures, real life problem exercises, internships and bachelor projects.
7. Any other comments or suggestions Overall a good and promising structure for a new BSc. Matches quite well the needs we see.

Ministeren

Rektor Anders Overgaard Bjarklev

Kære Anders Overgaard Bjarklev

17. januar 2023

Uddannelses- og Forskningsministeriet
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22/42640-5

På baggrund af gennemført prækvalifikation af Danmarks Tekniske Universitets ansøgning om godkendelse af ny uddannelse er der truffet følgende afgørelse:

Foreløbig godkendelse af ny bacheloruddannelse i Computer Engineering

Afgørelsen er truffet i medfør af § 20, stk. 1, nr. 1, i bekendtgørelse om akkreditering af videregående uddannelsesinstitutioner og godkendelse af videregående uddannelser (nr. 1558 af 2. juli 2021 med senere ændring).

Afgørelsen om at godkende et nyt uddannelsesudbud i Lyngby er betinget af, at DTU snarest muligt indmelder en revideret tilpasningsprofil, der honorerer ambitionerne om en gradvis tilpasning af tilgangen i de store byer frem mod 2030, jf. den politiske aftale om *Flere og bedre uddannelsesmuligheder i hele Danmark*.

Det er en forudsætning for godkendelsen, at uddannelsen og dennes studieordning skal opfylde uddannelsesreglerne, herunder bekendtgørelse nr. 2285 af 1. december 2021 om universitetsuddannelser tilrettelagt på heltid (uddannelsesbekendtgørelsen).

Da Danmarks Tekniske Universitet er positivt institutionsakkrediteret, gives godkendelsen til umiddelbar oprettelse af uddannelsen.

Ansøgningen er blevet vurderet af Det rådgivende udvalg for vurdering af udbud af videregående uddannelser (RUVU). Vurderingen er vedlagt som bilag.

Vedlagt i bilag er desuden uddannelsens grundoplysninger. Ved spørgsmål til afgørelsen eller de vedlagte grundoplysninger kan Uddannelses- og Forskningsstyrelsen kontaktes på pkf@ufm.dk

Med venlig hilsen

Christina Egelund

Bilag: Bilag 1 – RUVU's vurdering af ansøgningen
Bilag 2 – Følgebrev fra Uddannelses- og Forskningsstyrelsen med uddannelsens grundoplysninger

Uddannelses- og Forskningsministeriet

Bilag 1 – RUVU's vurdering af ansøgningen

Nr. A9 – Ny uddannelse – prækvalifikation (Efterår 2022)			**Status på ansøgningen:** Godkendt	
Ansøger og udbudssted:	Danmarks Tekniske Universitet (Lyngby)			
Uddannelsestype:	Bacheloruddannelse			
Uddannelsens navn (fagbetegnelse):	Bachelor (BSc) i teknisk videnskab (Computer Engineering)			
Den uddannedes titler på hhv. da/eng:	- Bachelor i teknisk videnskab (Computer Engineering) - Bachelor of Science in Engineering (Computer Engineering)			
Hovedområde:	Teknisk videnskab		**Genansøgning:** (ja/nej)	Nej
Sprog:	Dansk	**Antal ECTS:**	180 ECTS	
Link til ansøgning på pkf.ufm.dk:	http://pkf.ufm.dk/flows/b01924ab75899bf4a6015764780acb95			
RUVU's vurdering på møde d. 24. oktober 2022	RUVU vurderer, at ansøgningen opfylder kriterierne som fastsat i bilag 4 i bekendtgørelse om akkreditering af videregående uddannelsesinstitutioner og godkendelse af videregående uddannelser (nr. 1558 af 2. juli 2021 med senere ændring). RUVU lægger til grund for sin vurdering, at DTU ved inddragelse af relevante aftagere har godtgjort behovet for kompetencer og viden inden for særligt chip design og vurderer, at der er et aftagergrundlag for uddannelsens dimittender. RUVU vurderer på den baggrund, at der er grundlag for oprettelse af uddannelsen, og at den ikke vil forringe vilkårene for øvrige udbud.			

Bilag 2 – Uddannelses- og Forskningsstyrelsen grundoplysninger

Bacheloruddannelsen i Computer Engineering

Hovedområde:
Uddannelsen hører under det teknisk-videnskabelige hovedområde.

Titel:
Efter reglerne i uddannelsesbekendtgørelsens § 17, stk. 3, fastlægges uddannelsens titel til:

- **Dansk:** Bachelor (BSc) i teknisk videnskab (Computer Engineering)
- **Engelsk:** Bachelor of Science (BSc) in Engineering (Computer Engineering)

Uddannelses- og Forskningsministeriet

Udbudssted:
Lyngby.

Sprog:
Ministeriet har noteret sig, at uddannelsen udbydes på dansk.

Normeret studietid:
Efter reglerne i uddannelsesbekendtgørelsens § 16 fastlægges uddannelsens normering til 180 ECTS-point.

Takstindplacering:
Uddannelsen indplaceres til: Takst 3
Aktivitetsgruppekode: 7930

Koder Danmarks Statistik:
UDD: 5614
AUDD: 5614

Censorkorps:
Ministeriet har noteret sig, at uddannelsen tilknyttes censorkorpset for civilingeniøruddannelserne – Elektronik, IT og Energi.

Adgangskrav:
Efter det oplyste kræves jf. § 4 i bekendtgørelse nr. 35 af 13. januar 2022 om adgang til universitetsuddannelser tilrettelagt på heltid (adgangsbekendtgørelsen) en gymnasial studentereksamen med:

- Dansk A
- Engelsk B
- Matematik A
- Fysik B eller Geovidenskab A
- Kemi C eller Bioteknologi A.

Dertil har ministeriet noteret sig, at bacheloruddannelsen er adgangsgivende til:

- Computer Science and Engineering (retskrav) (DTU).

Afhængig af valg af specialisering, vil uddannelsen endvidere give adgang til følgende kandidatuddannelser:

- Mathematical Modelling and Computation (DTU)
- Electrical Engineering (DTU, AU)
- Human-Centered Artificial Intelligence (DTU)
- Autonomous Systems (DTU)
- Communication Technologies and System Design (DTU)
- Computerteknologi (AU)
- Computer Engineering (AAU)
- Electronic systems (AAU)
- Robotteknologi (SDU)
- Mechatronics (SDU).

Uddannelses- og Forskningsministeriet