



# Electrical Engineering

A Concise Introduction  
Mohammad Hadi  
Summer 2022

# I know EE!



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What's EE?



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EE or others?



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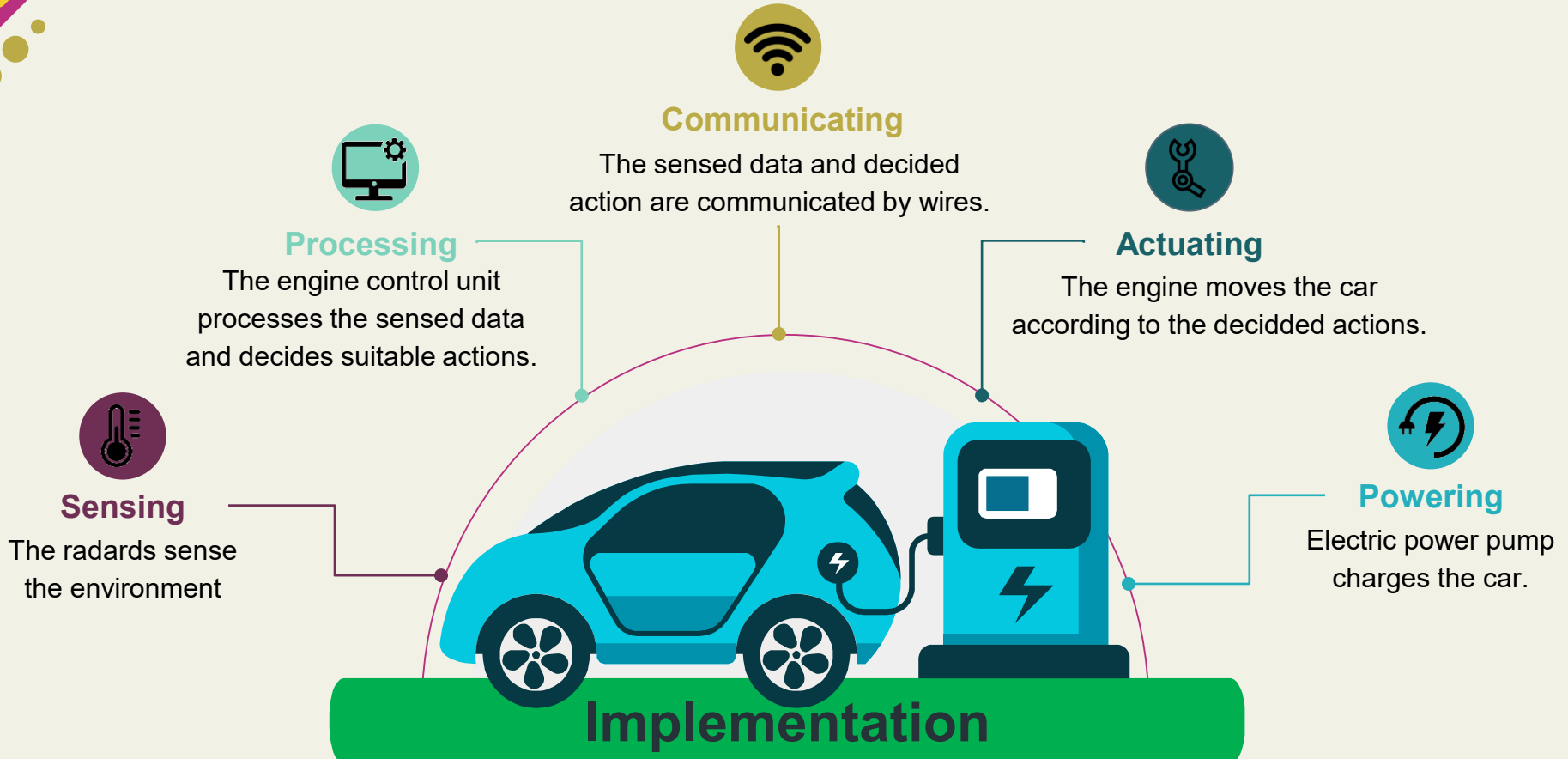


**01**

# **Introduction**

What's EE?

# Electric Car



# EE Fields

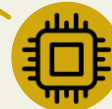
Communication  
Networks & Systems



Microwave &  
Photonics



Control & Dynamic  
Systems



Digital Systems



Electrical Energy  
Systems



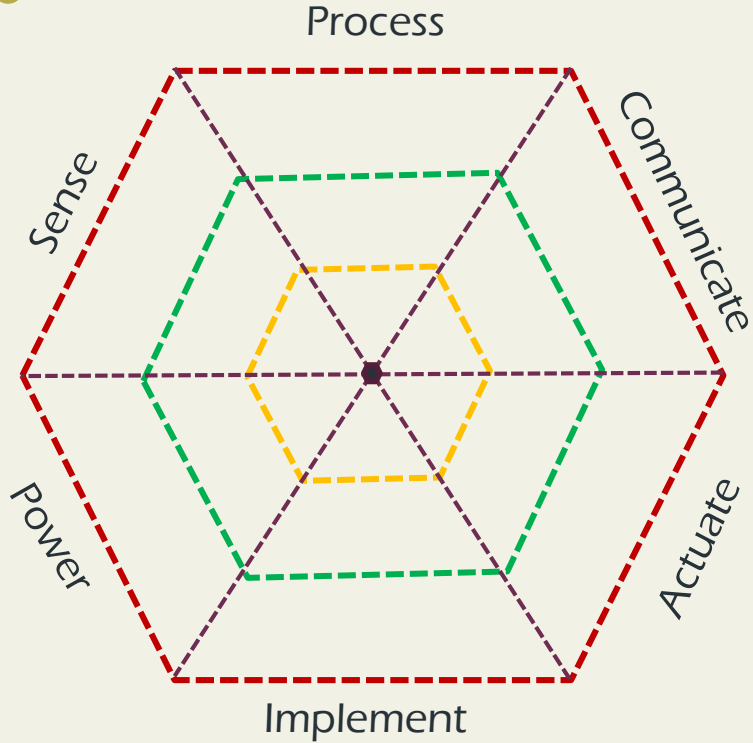
Electronics



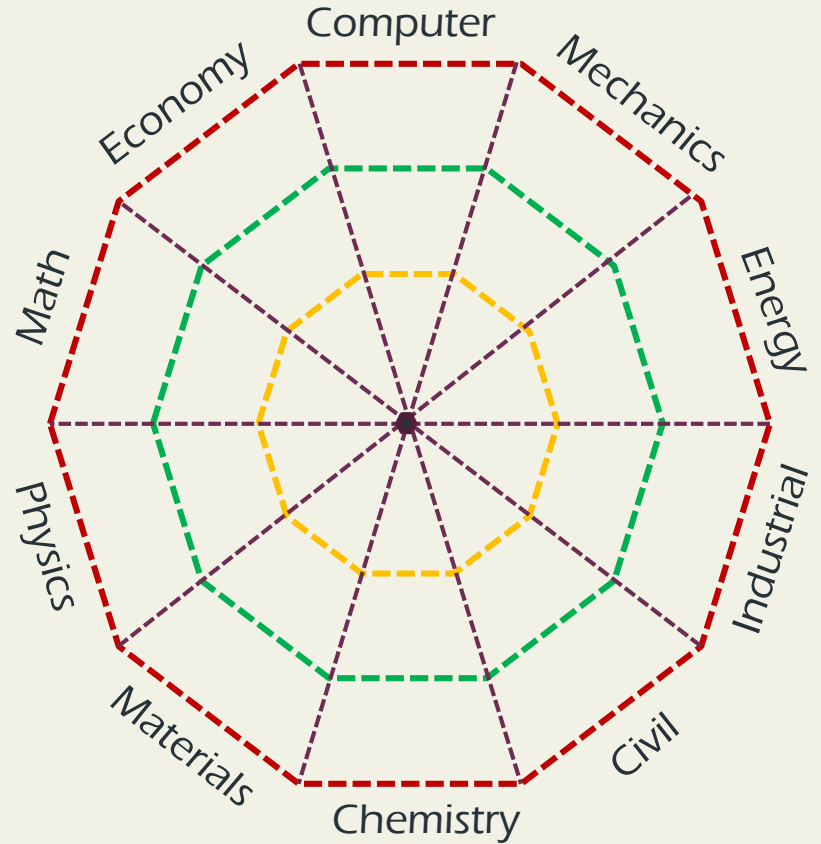
Bioelectrics



# EE How to's



# EE Friendships



# Electrical Energy Systems



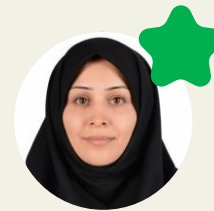
A. Abbaspoor



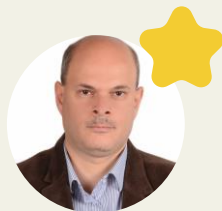
M. Vakilian



H. Hosseini



Z. Nasiri



S. Kaboli



M. Parniani



A. Safdarian



H. Mokhtari



M. Fotuhi



H. Oraei



E. Hajipour



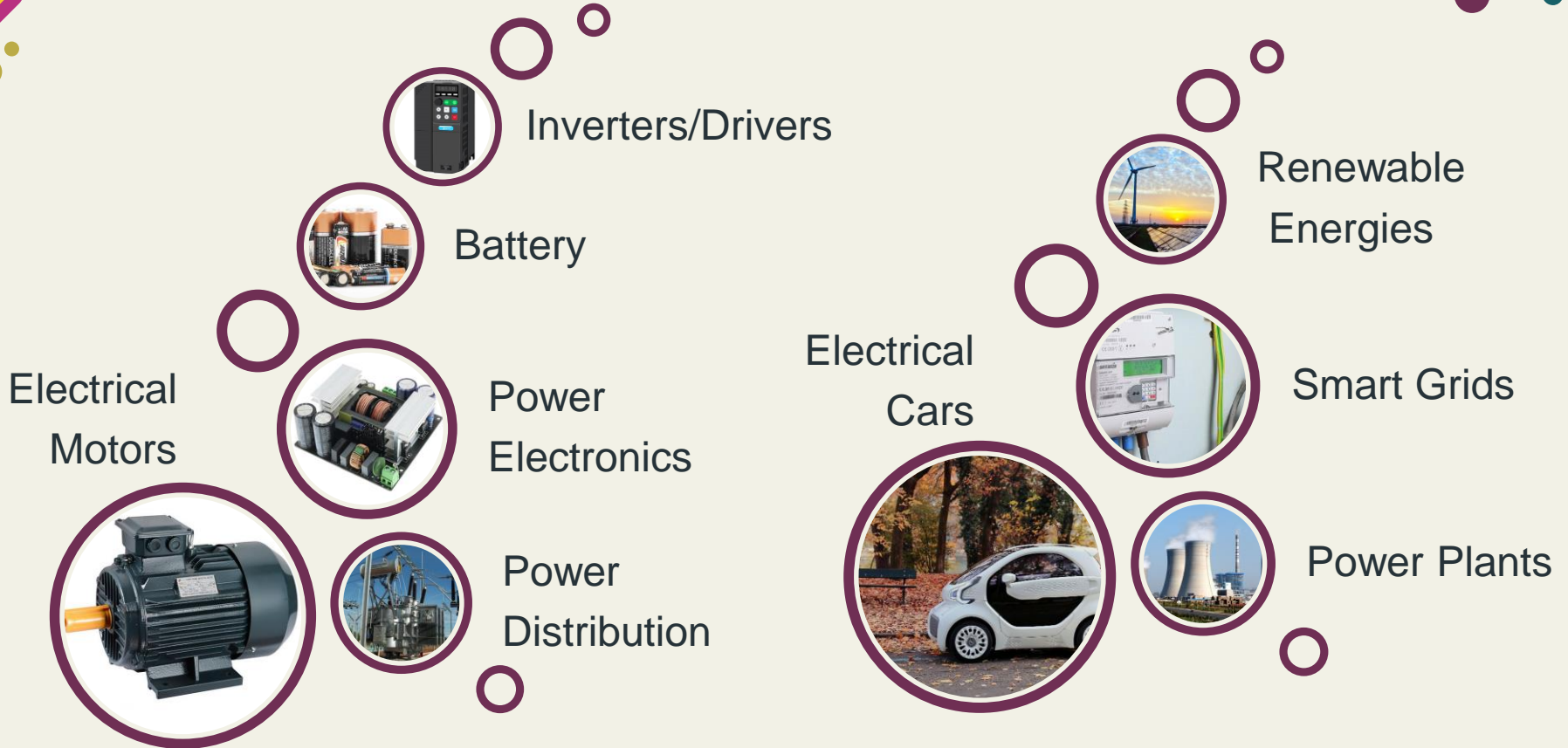
F. Tahami



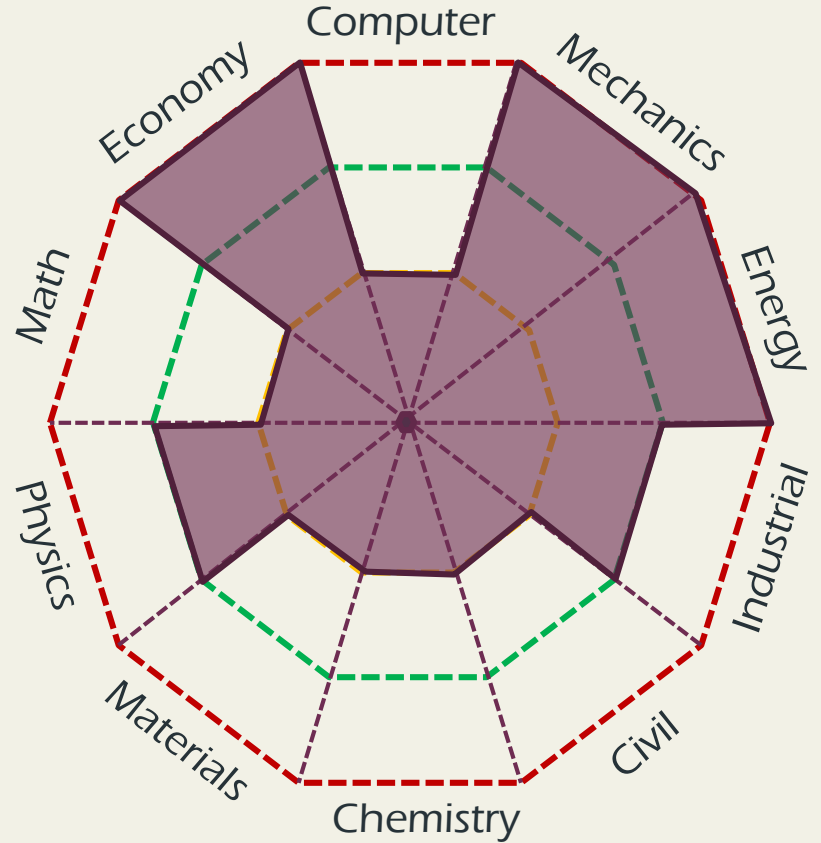
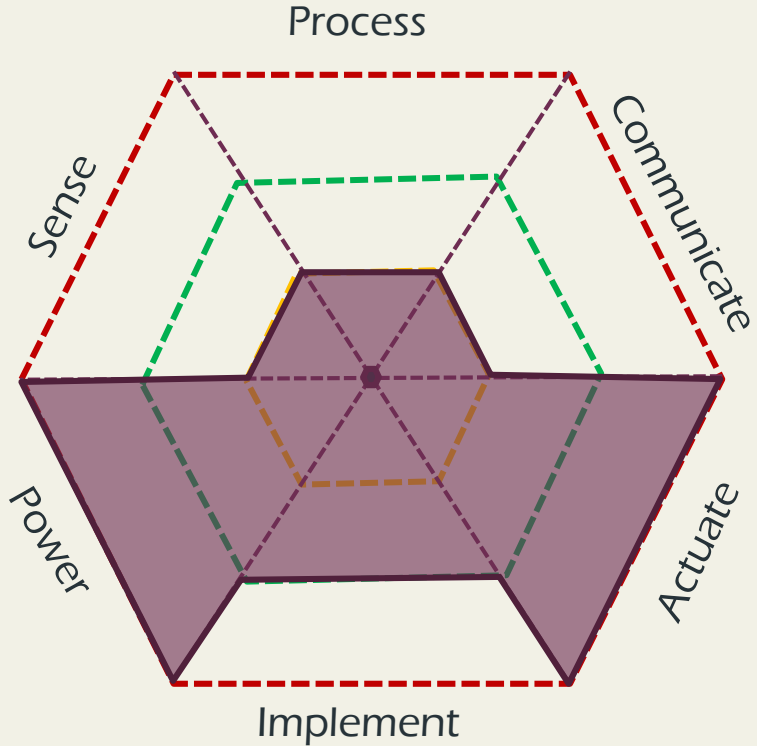
M. Zolghadri



# Electrical Energy Systems



# Electrical Energy Systems



# Electronics



M. Atarodi



M. Fakharzadeh



M. Fardmanesh



R. Sarvari



Z. Kavehvash



B. Rashidian



F. Akbar



A. Fotowat



A. Medi



M. Sharifkhani

# Electronics



Superconductivity



Photonic ICs



Wearable  
Electronics



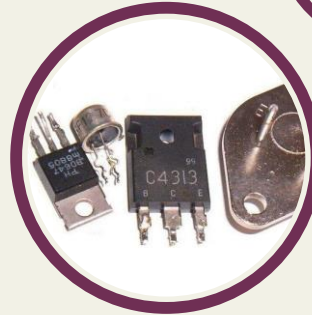
Analog  
Circuits



RF Circuits



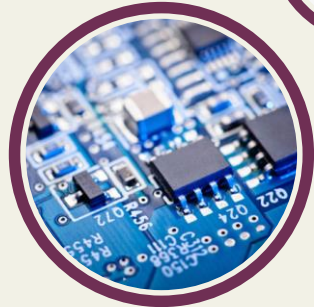
IC Fabrication



Solid State  
Components

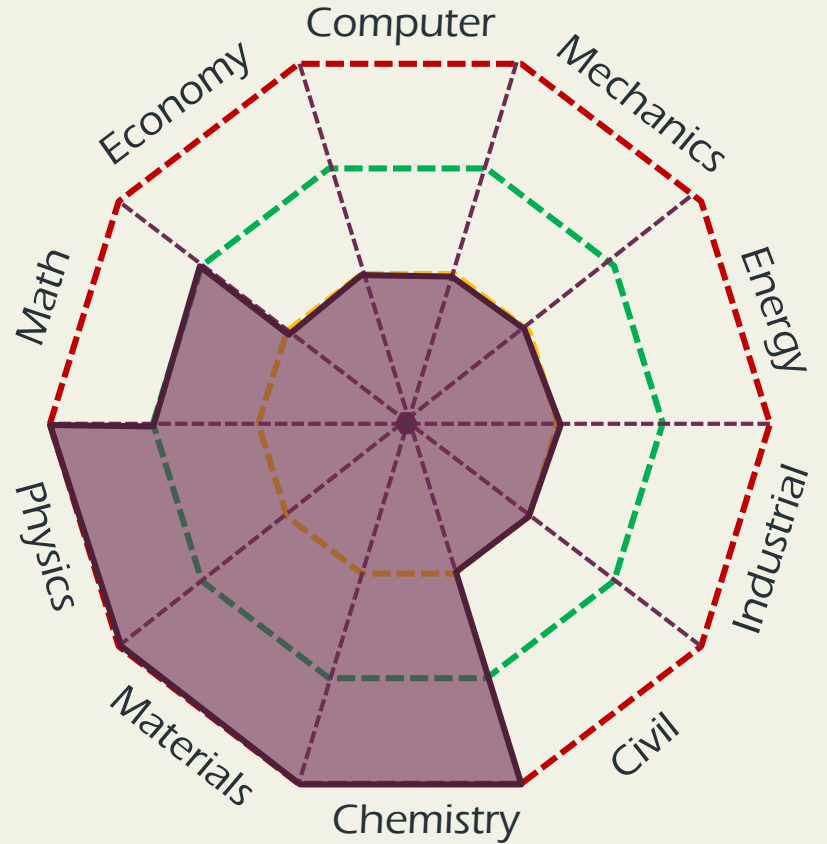
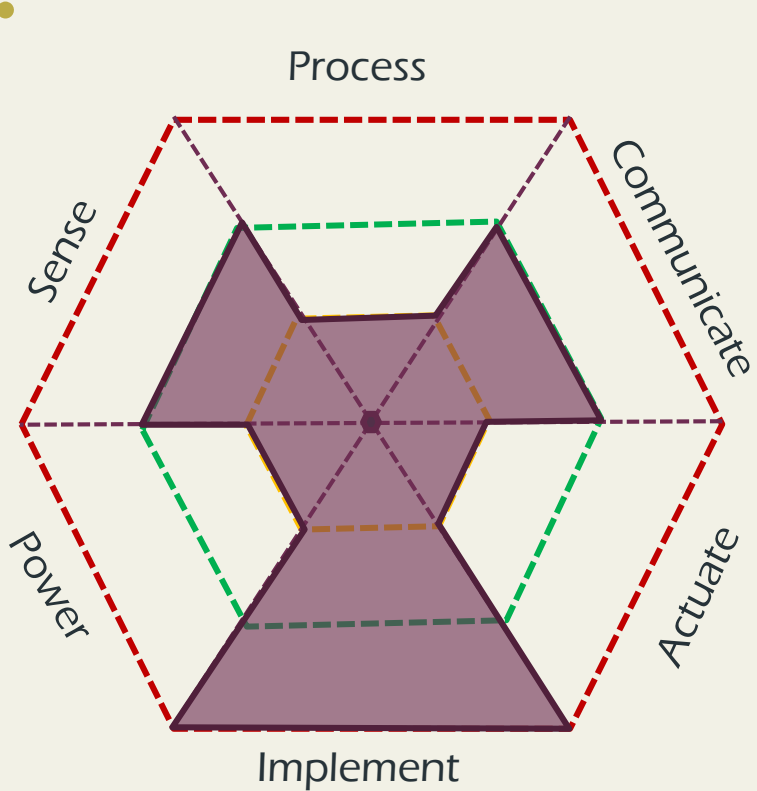


THz Circuits



Chip & PCB  
Design

# Electronics



# Bioelectrics



M. Fardmanesh



M. Shamsollahi



E. Fatemizadeh



S. Hajipour



H. Mohammadzadeh



A. Ghazizadeh



M. Jahed



B. Vosooghi

# Bioelectrics



Electroencephalogram



Artificial Organs



Medical Signal Processing



Medical Instrument



Medical Imaging



Patient Monitor



Genomics

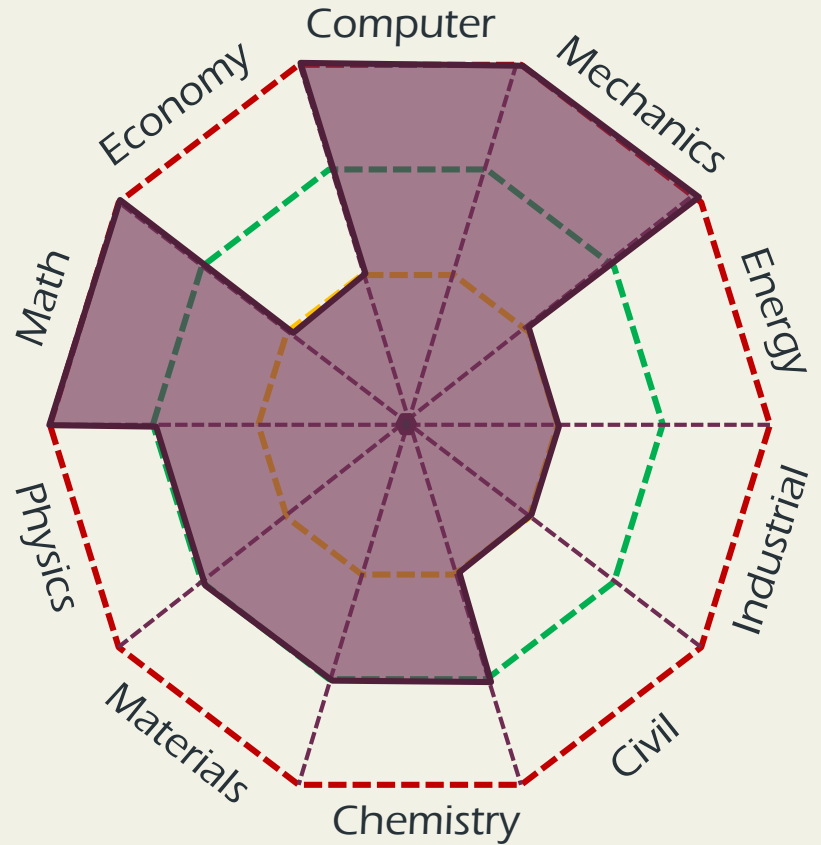
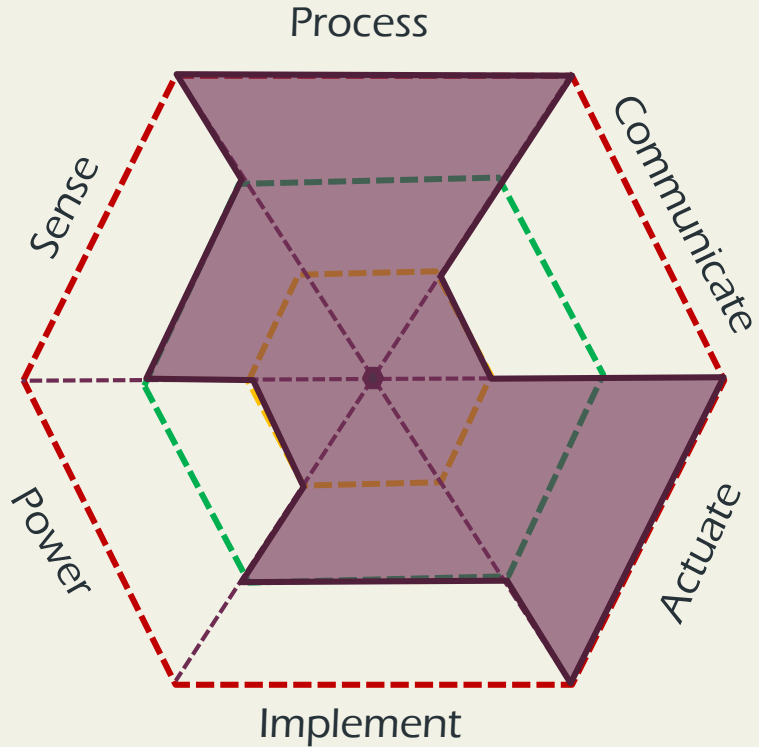


Neuroscience



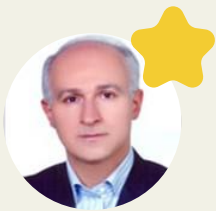
Endoscopy

# Bioelectrics





# Digital Systems



S. Bagheri



M. Babaeizadeh



M. Pakravan



H. Mohammadzadeh



A. Farhadi



K. Hajsadeghi



M. Hashemi



M. Jahed



M. Namvar



S. Saleh



M. Shabani



H. Shahmansoori



M. Sharifkhani

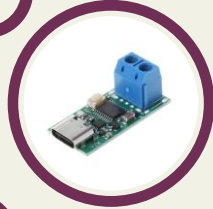
# Digital Systems



Algorithm  
Development



Neural Networks



Interface  
Circuits



Microcontrollers  
DSP



CPU  
GPU



FPGA  
ASIC



Logical Circuits



Machine  
Learning

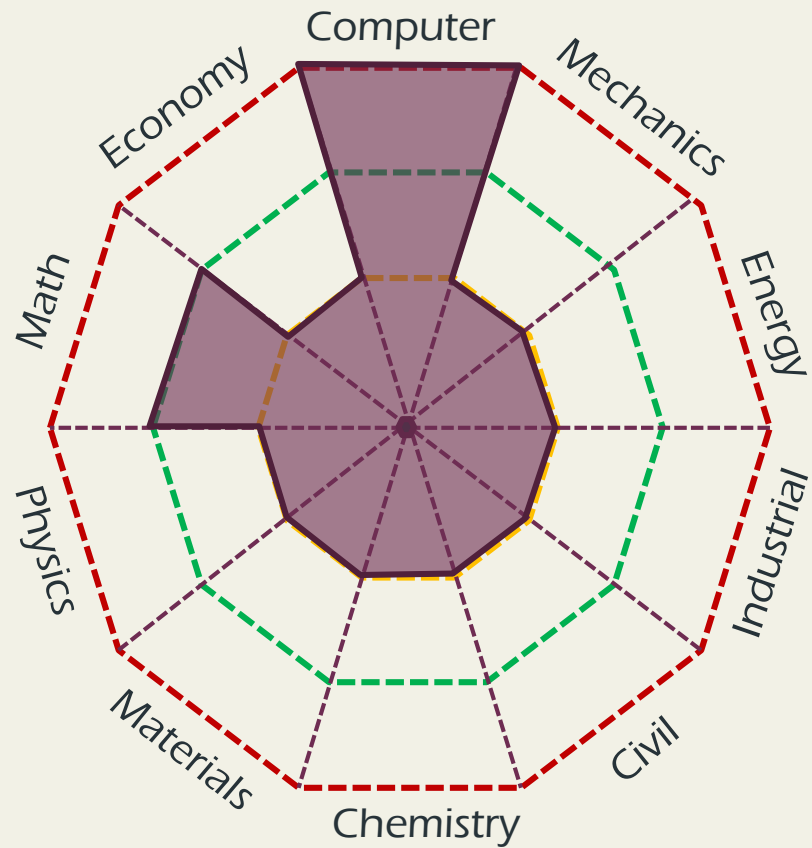
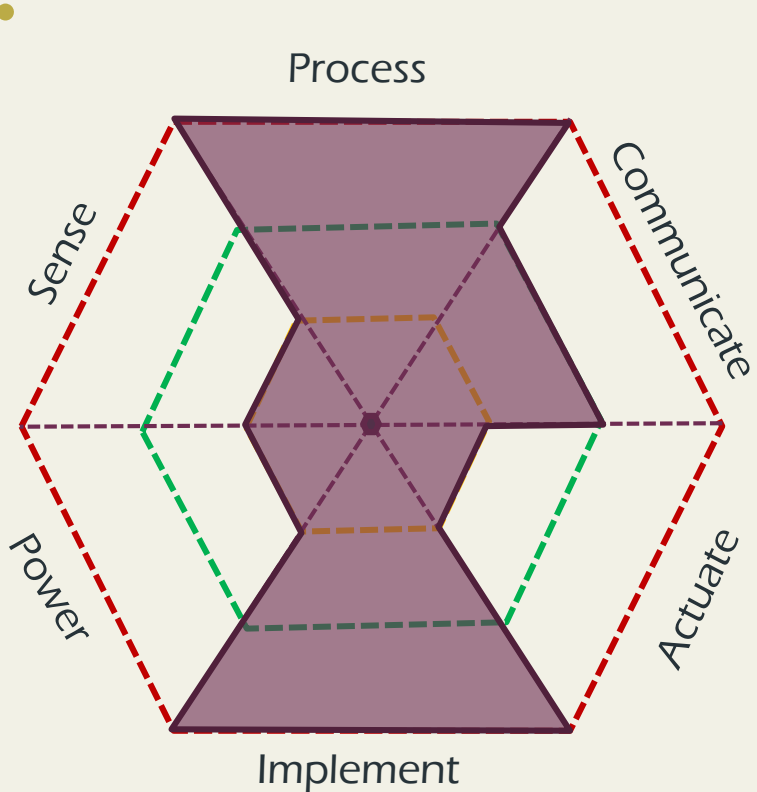


Embedded  
Systems



Edge, Fog, Cloud &  
Distributed Computing

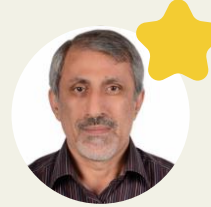
# Digital Systems



# Control & Dynamic Systems



A. Rezaeizadeh



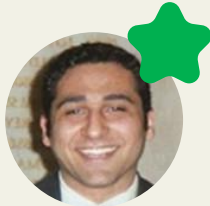
M. Haeri



M. Tavazoei



M. Babazadeh



A. Nobakhti



N. Sadati

# Control & Dynamic Systems



Environmental  
Sensors



3D Printing



Traffic Control



Smart Agriculture



UAVs



Automation

Spacecraft



Robotics

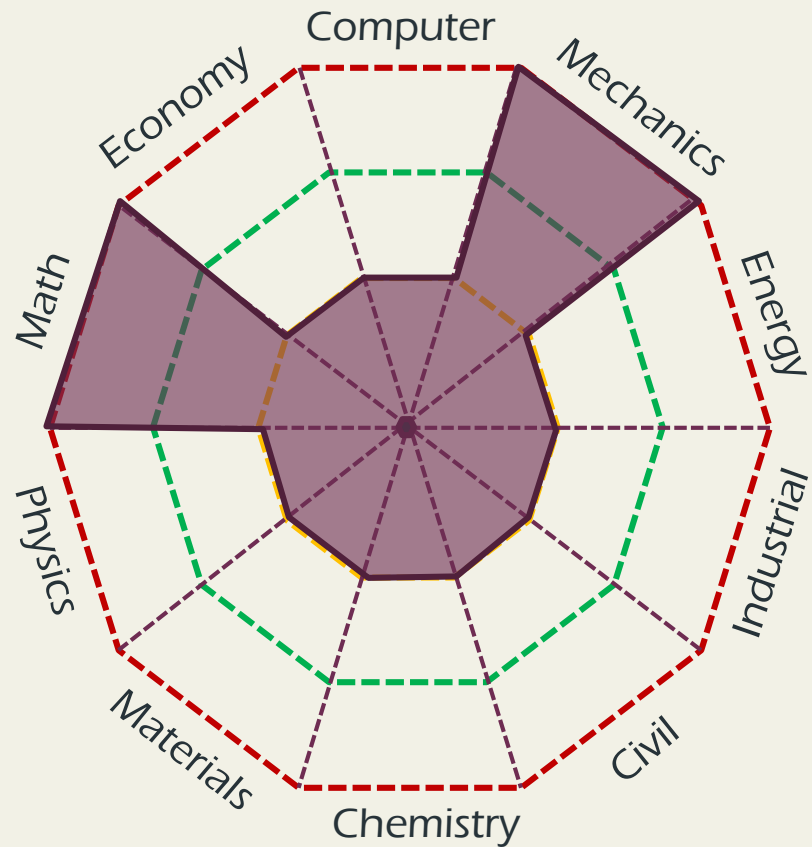
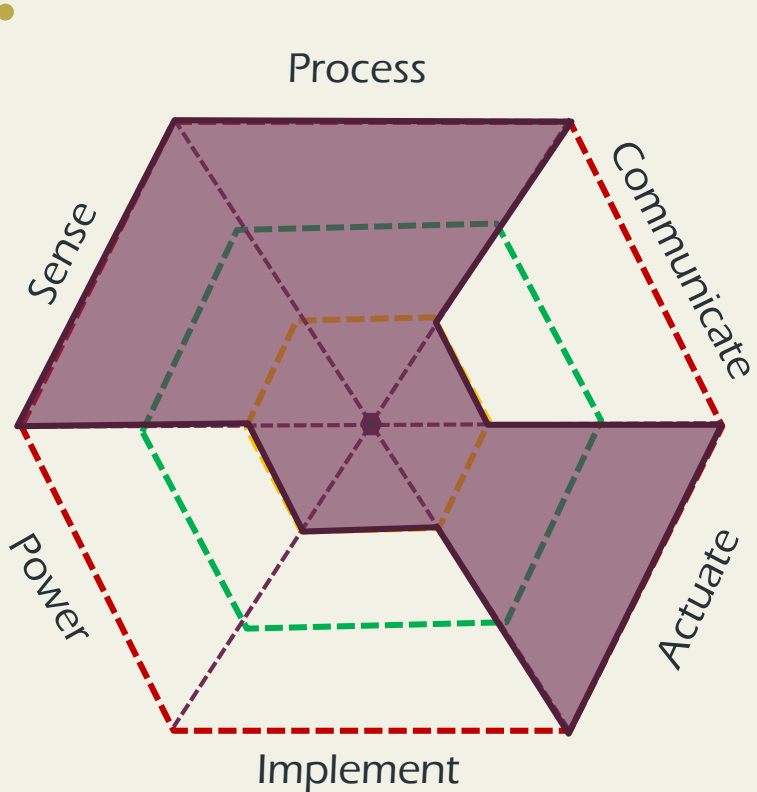


Navigation  
Systems



Mechatronics

# Control & Dynamic Systems



# Microwave & Photonics



M. Ahmadi



M. Akbari



A. Banaei



B. Rejaei



A. Khavasi



A. Shishegar



F. Farzaneh

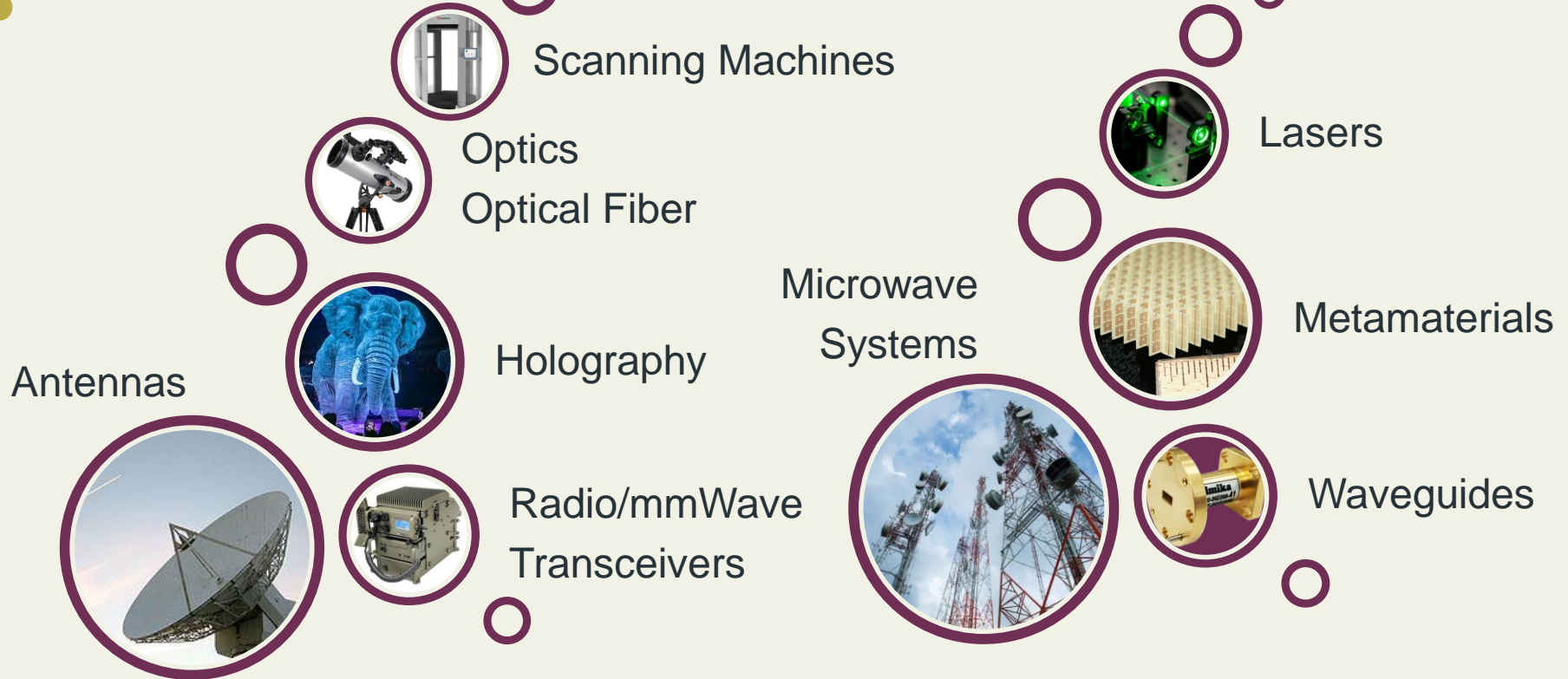


M. Memarian



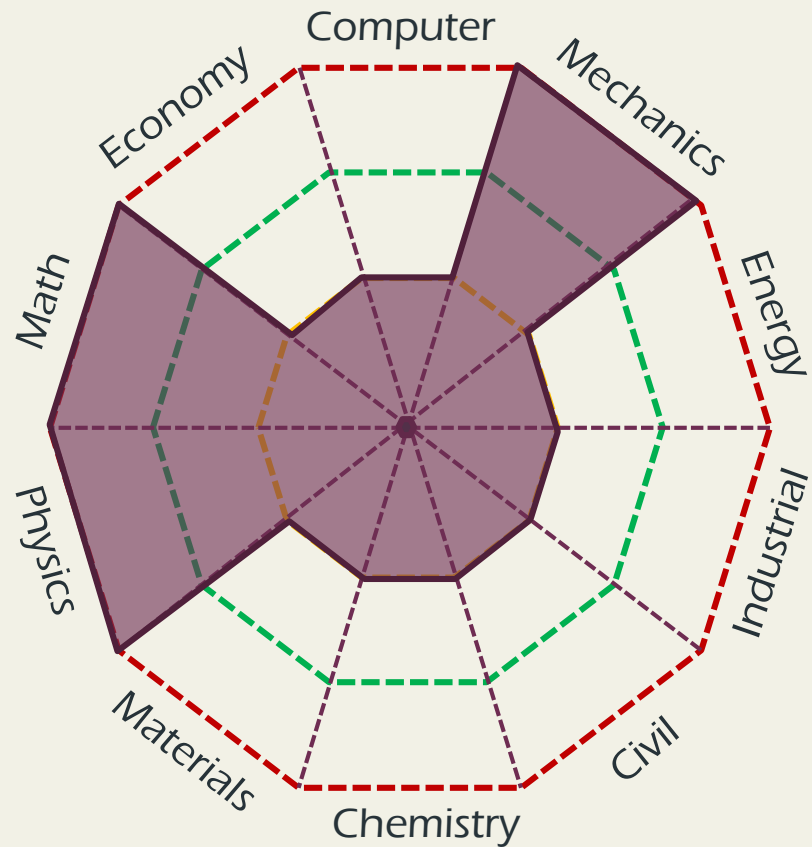
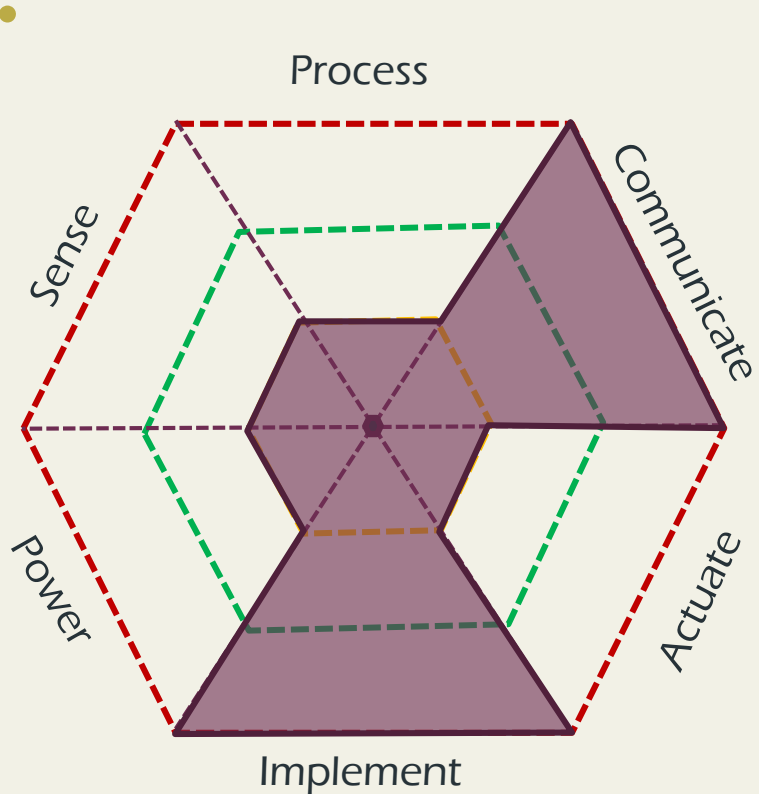
K. Mehrany

# Microwave & Photonics

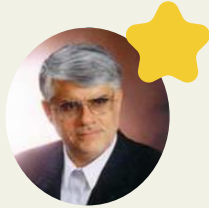




# Microwave & Photonics



# Communication Networks & Systems



M. Aref



M. Bastani



F. Behnia



M. Naebi



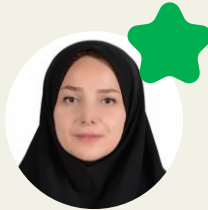
A. Amini



F. Ashtiani



M. Babaeizadeh



M. Mirmohseni



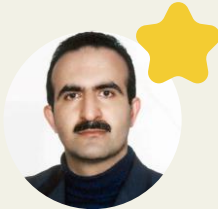
M. Pakravan



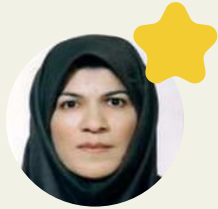
H. Behroozi



M. Karbasi



B. Khalaj



M. Nasiri



J. Salehi

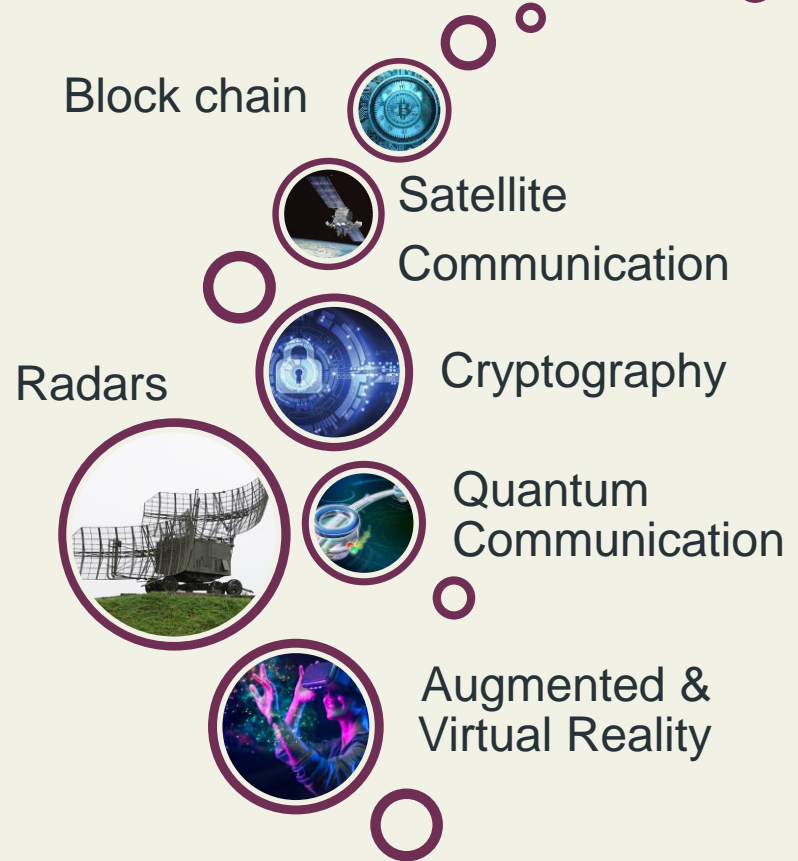
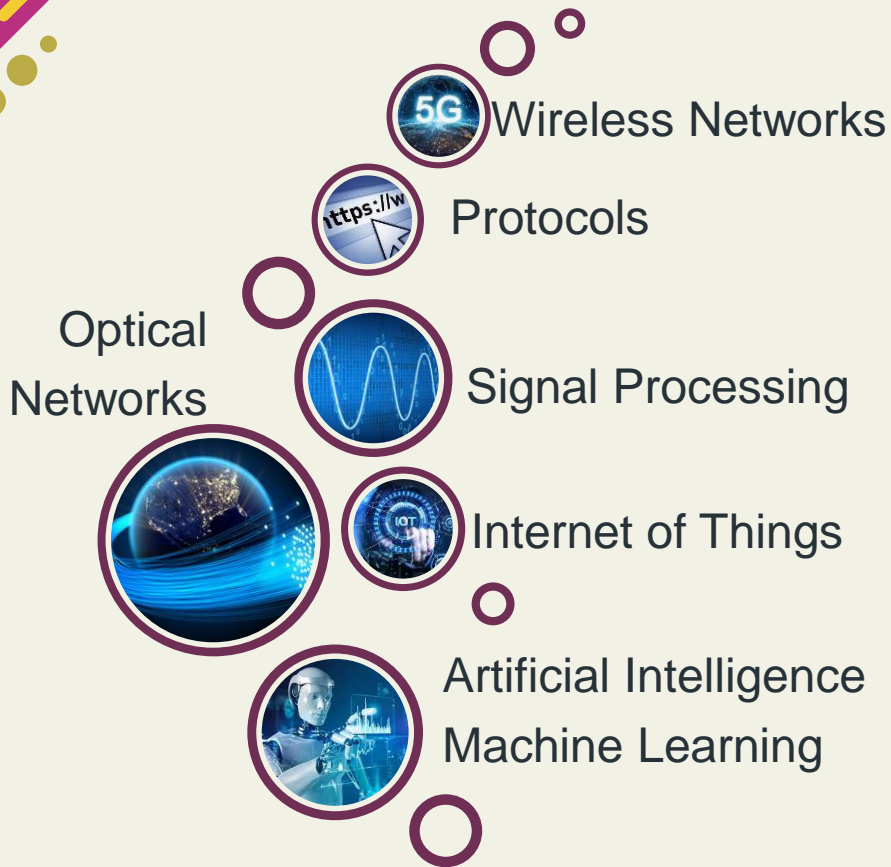


M. Yassaee

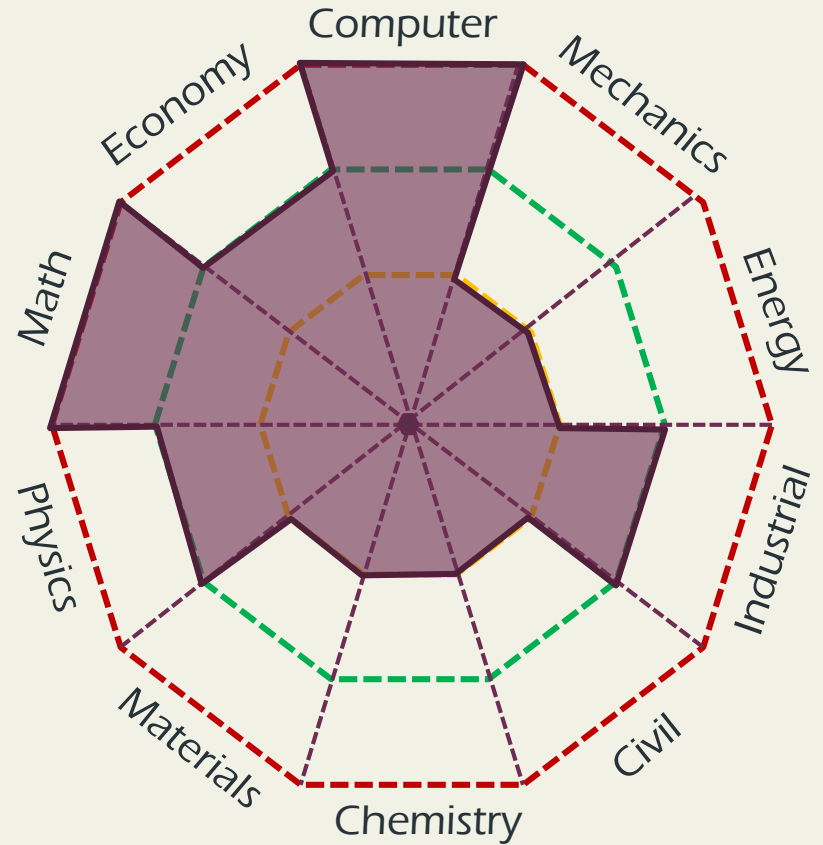
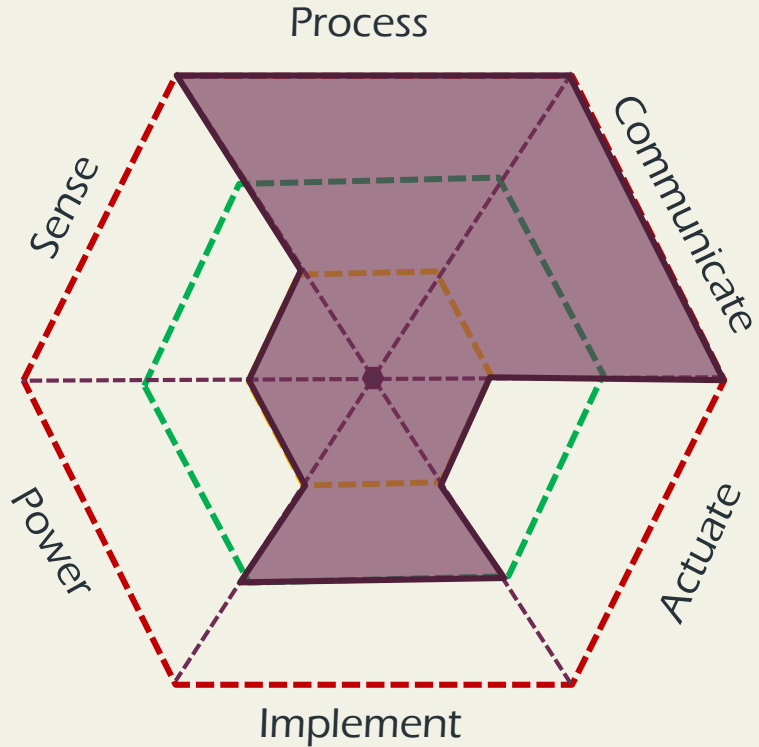


M. Hadi

# Communication Networks & Systems



# Communication Networks & Systems





**02**

# **Comparison**

EE or others?

# EE Versus Others

## Technology trends and underlying technologies

### Industry-agnostic trends



**1** Next-level process automation...

Industrial IoT<sup>1</sup>  
Robots/cobots<sup>2</sup>/RPA<sup>3</sup>



... and process virtualization

Digital twins  
3-D/4-D printing



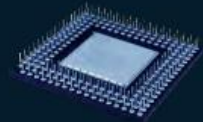
**2** Future of connectivity

5G and IoT connectivity



**3** Distributed infrastructure

Cloud and edge computing



**4** Next-generation computing

Quantum computing  
Neuromorphic chips (ASICs<sup>4</sup>)



**5** Applied AI

Computer vision, natural-language processing, and speech technology



**6** Future of programming

Software 2.0



**7** Trust architecture

Zero-trust security  
Blockchain

### Industry-specific trends



**8** Bio Revolution

Biomolecules/"-omics"/ biosystems  
Biomachines/biocomputing/augmentation



**9** Next-generation materials

Nanomaterials, graphene and 2-D materials, molybdenum disulfide nanoparticles



**10** Future of clean technologies

Nuclear fusion  
Smart distribution/metering  
Battery/battery storage  
Carbon-neutral energy generation

# EE Versus Others



Artificial intelligence



Augmented reality



Blockchain



Drones

The Essential  
**Eight**



Internet of things



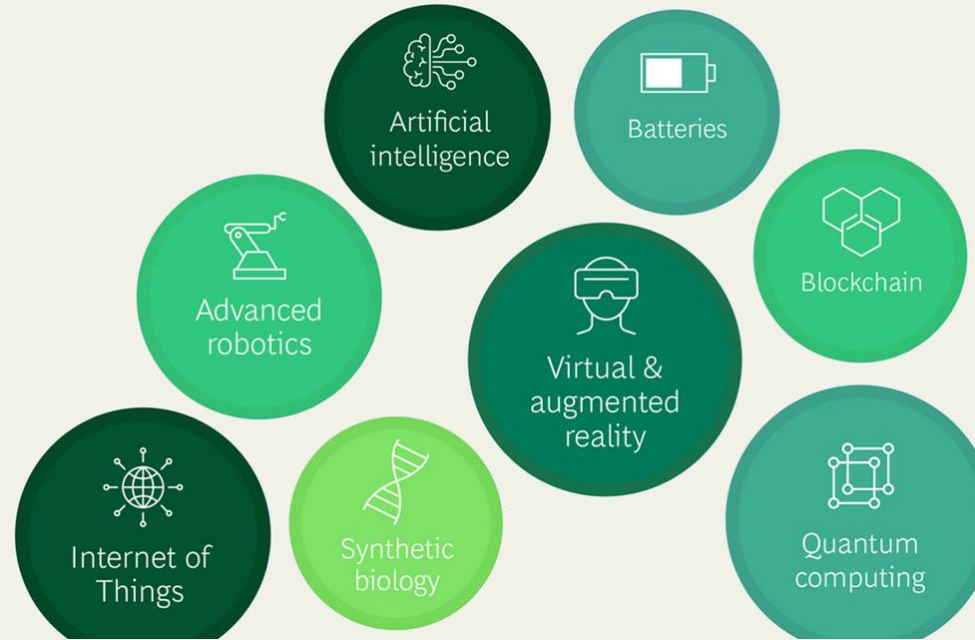
Robotics



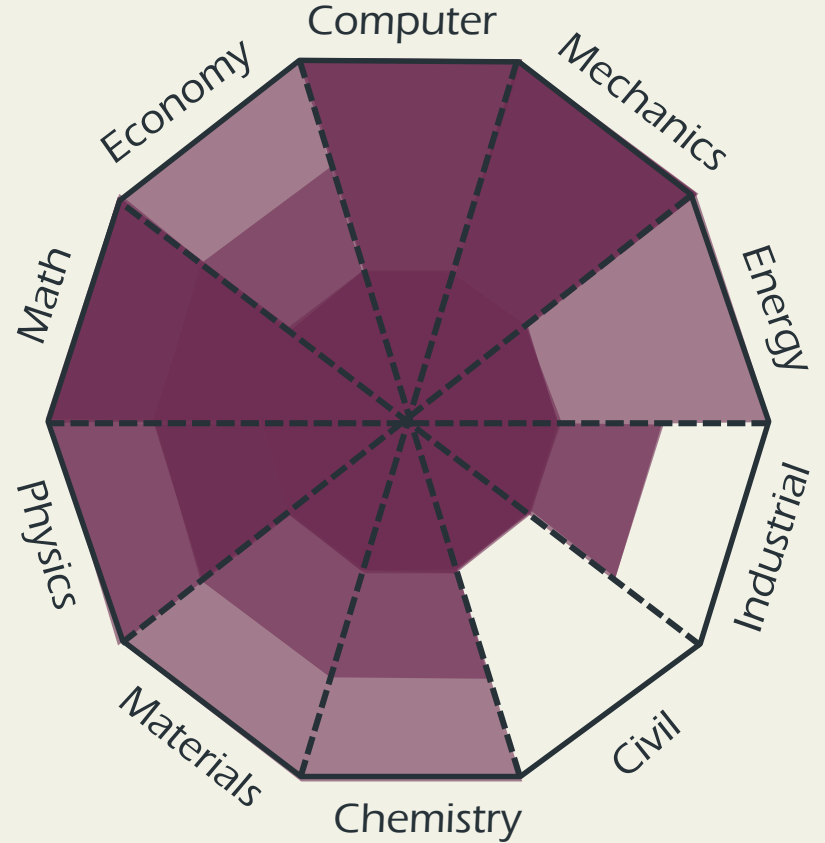
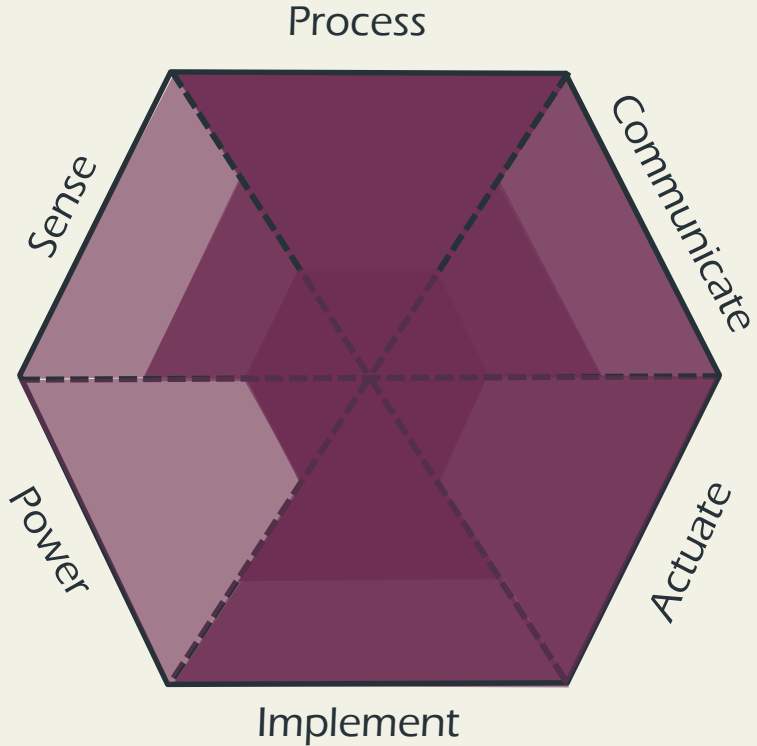
Virtual reality



3-D printing



# EE Coverage & Correlation







**EE or  
Computer?**

# EE or Computer?

Comprehensive  
View



Particular  
View



Infrastructure  
Oriented



Application  
Oriented



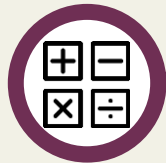
Specific  
Audience



Generic  
Audience



Mathematical  
Analysis



Algorithmic  
Analysis





**EE or  
Mechanics?**

# EE or Mechanics?

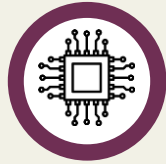
**Abstract  
Concepts**



**Growing  
Field**



**Invisible  
Results**



**Fine  
Design**



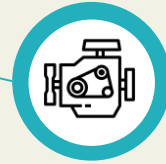
**Sensible  
Concepts**



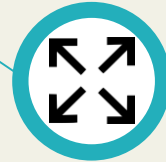
**Mature  
Field**

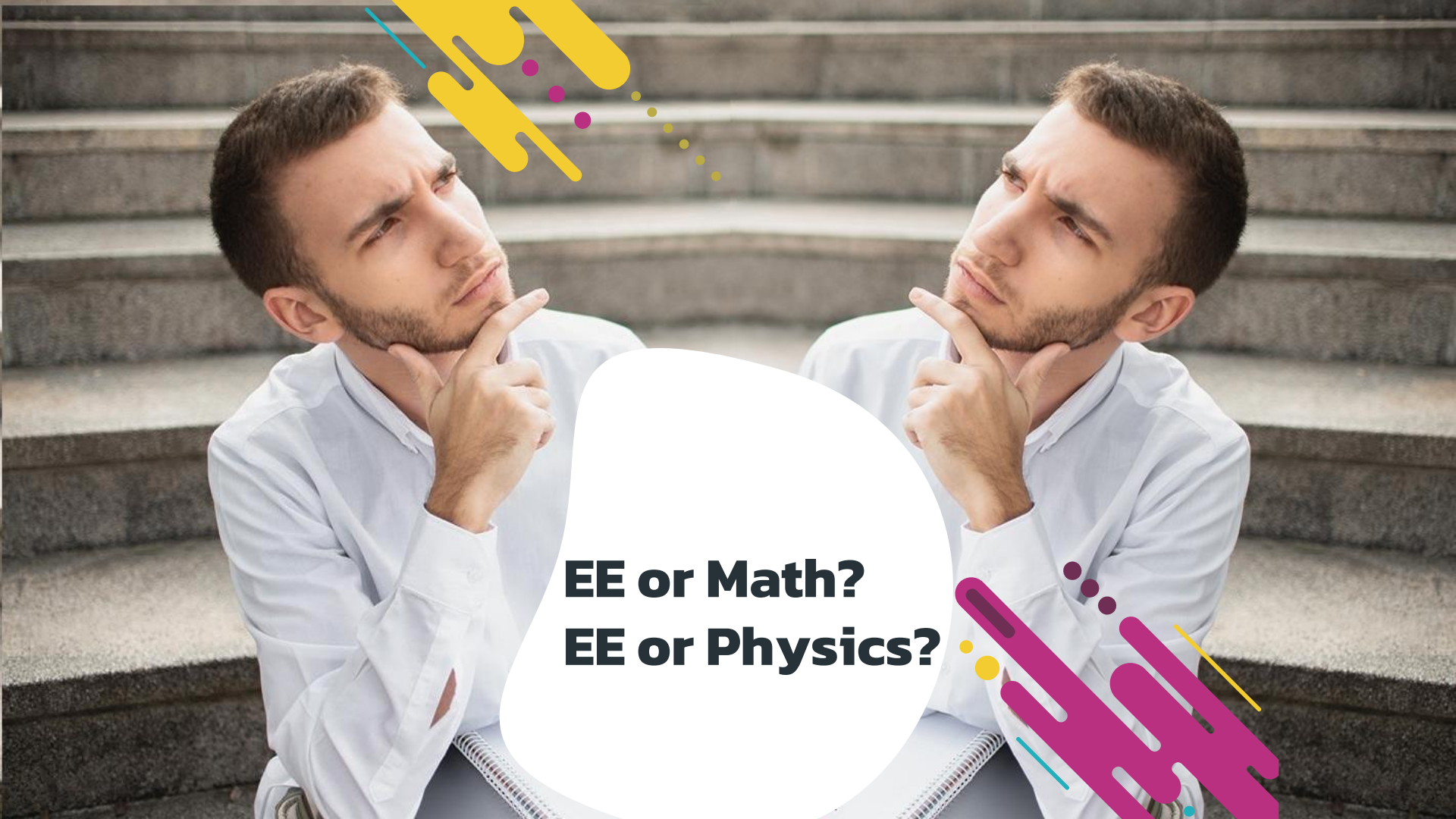


**Visible  
Results**



**Bulk  
Design**





**EE or Math?**  
**EE or Physics?**

# EE or Math/Physics?

Functional  
View



Applied  
Concepts



Design



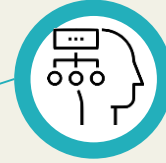
Relaxed  
Analysis



Fundamental  
View



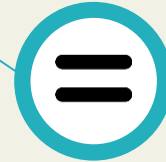
Theoretic  
Concepts



Knowledge



Firm  
Analysis





**03**

# **Preparation**

Successful EE?

**I'm a Sharif EE  
Student!  
I should study 24 h a  
day!**





**I'm a Sharif EE  
Student!  
I study 24 min a  
day!**

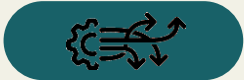


# EE Properties

Variety



Flexibility



Practicality



Rapid Evolution



Attractive Jobs



Multi-disciplinary

# Successful EE



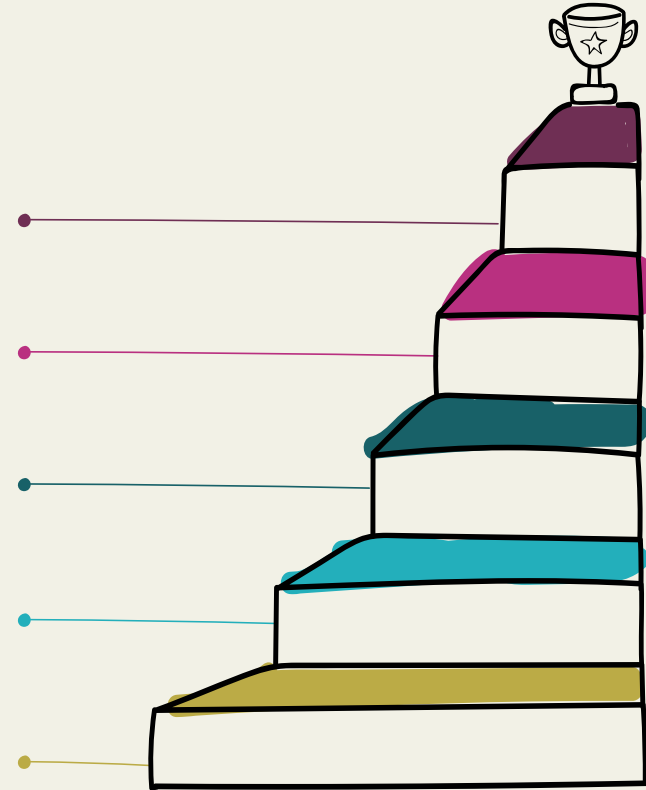
**Purposeful Study**

**Engineering Approach**

**Team-working & Collaboration**

**Curiosity & Being Up-to-date**

**Hard-working & Multi-dimensionality**



# EE Roadmap





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