KLE Technological University

Creating Value
Leveraging Knowledge

Basic Electronics

18EECF101

(4-0-0)

Course Outcomes

By the end of the course student should be able to

1. Discuss the current trends in electronics industry.
2. Describe the characteristics of semiconductor devices and their applications in rectifiers, switches, regulators, gates.
3. Apply the Boolean algebra concepts to design and simplify various logical expressions to develop basic digital applications.
4. Realize circuits to perform arithmetic operations on signals such as addition, subtraction, integration using operational amplifiers.
5. Discuss the basic principles of communication systems and their related applications as super heterodyne receiver.
6. Discuss the concepts of linear power supply, UPS and measurement of electrical signal/ parameters using CRO.

KLE Technological University
Creating Value
Leveraging Knowledge

Assessment

- ISA1
- ISA2
- Assignments

IT systems and hardware	UPS, inverters, weighing scales, power supplies Desktops, notebooks, tablets, monitors, servers, storage flash memory cards, USB drives and printers/MFDs
Telecom products and equipment Mobile devices	Fixed-line and mobile telecommunications equipment, modems, routers, switches, IP PBX, BTS (GSM, CDMA), WiMax (BTS,CPE), PON/GPON ONT/OLT, DWDM Mobile handsets
Other electronics	Aerospace, Strategic electronics including defense, medical electronics, smart cards

2. Electronic components

- Electronic components segment includes
  - –active components such as transistor, diode and CRT
  - –passive components such as resistors and capacitors
  - –electro-mechanical components such as PCBs, power devices, switches, relays, connectors, cable and associate components such as magnets

Key trends

1. Convergence of technologies 2. Surface mount technology (SMT): **3.Growing focus on miniaturization**

With the convergence of technologies, a single device such as a smartphone, is now using diverse technologies to offer multiple services such as communication, gaming, computing and location services. This trend is likely to move across other devices as well generating demand for more sophisticated and integrated high-tech electronic components.

2. Surface mount technology (SMT):

The concept of surface mount technology involves construction of electronic circuits in which surface mount components are mounted directly on the PCB. The technology, which is being used across modern devices such as tablets, smartphones, laptops etc, offers significant advantages such as automation, high speed assembly, miniaturization and better mechanical and electrical performance.

3.Growing focus on miniaturization

- With the advent of surface mount technology and nanotechnology, miniaturization is gaining increasing focus as it results in cost reduction and better aesthetics and quality in the final product. This trend is resulting in discrete components being replaced by integrated components. Since Indian electronic component industry mostly manufactures discrete components, there is a need to move fast to catch up with this trend

Growth drivers

1. Increasing maturity of the semiconductor industry
2. Availability of talent pool
3. Cost competitiveness
4. Stringent IP protection measures

3. Semiconductor design

a trend which is being seen in India, is driving the growth of the semiconductor design industry in the country.

-Intel, Samsung Electronics, Taiwan Semiconductor manufacturing company

-Broadcom operation, Qualcomm…….

4. Electronic manufacturing services

Involves

- Designing--->testing-->manufacturing, and maintenance of electronic components and assemblies for original equipment manufacturers (OEMs).

KLE Technological University
Creating Value
Leveraging Knowledge

Schemes for Electronics Manufacturing

1. Production Linked Incentive Scheme (PLI) for Large Scale Electronics Manufacturing
2. Production Linked Incentive Scheme (PLI) for IT Hardware
3. Scheme for Promotion of Manufacturing of Electronic Components and Semiconductors (SPECS)
4. Modified Electronics Manufacturing Clusters Scheme (EMC 2.0)

Case studies

- Automobiles
- Defense
- Telecom
- Health
- Agriculture
- Consumer Applications

Scope for Electronics in automobile industry

With the growth of on-board electronics in the automobile sector, from two-wheelers to tractors and heavy commercial vehicles, semi-conductor industry experts believe that in the immediate future, electronics will be the differentiator.

Electronics in automobiles

Automotive electronics or automotive embedded systems are distributed systems and according to different domains in the automotive field they can be classified into:

- Engine Electronics
- Transmission Electronics
- Active Safety
- Driver assistance
- Passenger Comfort

Engine Electronics

- Fuel injection rate
- Emission control, Nox control
- Regeneration of oxidation catalytic converter
- Turbocharger control
- Cooling system control
- Throttle control
- In a Gasoline engine
- Lambda control
- OBD On Board diagnosis
- Cooling system control
- Ignition system control
- Lubrication system control (only few has electronic control)
- Fuel injection rate control
- Throttle control

Driver assistance

- Lane assistance system
- Speed assistance system
- Blind spot detection
- Park assistance System
- Adaptive Cruise Control System

Passenger Comfort

- Automatic Climate control
- Electronic seat adjustment with memory
- Automatic wipers
- Automatic Headlamps – adjusts beam automatically

Etc……

Four key tasks for auto electronics suppliers

1. Focus on the end user

The development of new features is still being driven more by [illegible] than by customers' needs. Those who can correctly interpret the customers' needs will be able to design products that set them apart from their competitors. They will also be able to better gauge the future order volumes for special features.

2. Achieve differentiation through Mechatronics

To date, a clear trend towards purely electronic components has not been observed. That is because many electronic functions can be usefully combined with mechanical components. By integrating these two types of components to form a complete system, automotive suppliers can set themselves apart from their competitors.

Contd..

3. Pay close attention to the development of standards and automotive architectures

No supplier can escape the trend towards standardization and new architectures. At the moment, however, it is impossible to tell what standards will be established, at what time and in what way Quick decisions can be expected only in those areas in which new end user benefits can be created. For automotive suppliers, it will be very important to achieve an advantageous positioning within the changing world of automotive architectures, at an early stage of development.

4. Keep costs under control

Automotive suppliers from emerging markets are quickly catching up to established suppliers. In the coming years, electronics suppliers from Asia will intensify the cost pressure on the industry even more. Therefore, Western manufacturers will have to master the full range of cost reduction instruments.

Can you all name top 10 autonomous vehicles company for the year 2021??

Contd…

- Due to excess production capacities around the world and the rising competition from developing countries, cost pressures are bound to increase in the automotive supplier industry.

BMW new Series

Electronics in Defense

Different Applications are,

1. **UAV: Unmanned Aeria Vehicles (UAVs):** Lethal and non-lethal force multipliers in warfare, cost-effective alternatives to manned aircraft in specialized civilian roles. They find application in weather research, communications, disaster management, pollution monitoring, and law enforcement.

–

2. LAKSHYA – DRDO:

i. Pilotless Target Aircraft (PTA) (named as “Lakshya”) is a reusable aerial target system

ii. Operated from ground to provide aerial target for training of gun and Missile crew and Air Defense pilots

3. **RADAR**: It is an object-detection system which uses electromagnetic waves—specifically radio waves—to determine the range, altitude, direction, or speed of both moving and fixed objects.

RADAR can:

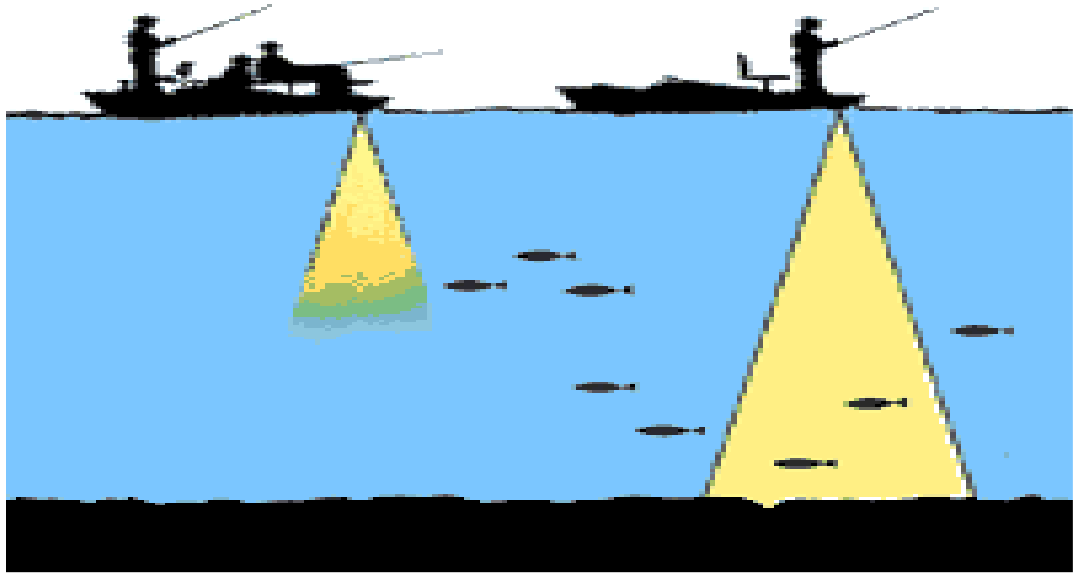
- Detect the presence of an object at a distance
- Detect the speed of an object

Can you all name few Unmanned Aerial Vehicles Used by Indian Armed Forces??

- **SONAR: SOund Navigation And Ranging**

> Sonar is a modern technology which helps us to track submarines, fish, ship wrecks, map the seabed and for other navigational purposes.

> The four main factors that affect the performance of a sonar system are a high power transmitter, an efficient transducer, a sensitive receiver and an acoustic communication system.



- **Industries relating to this field:**

I. Hindustan Aeronautics Limited (HAL)
II. DRDO
III. Bharat Electronics Limited (BEL)
IV. Bharat Earth Movers Limited (BEML)
V. Mazagon Dock Limited (MDL)
VI. Garden Reach Shipbuilders & Engineers Limited (GRSE)
VII. Goa Sihipyard Limited (GSL)
VIII. Bharat Dynamics Limited (BDL)
IX. Mishra Dhatu Nigam Limited (MIDHANI)

Electronics in Telecom

- Transmission of information over significant distances to communicate…
- Visual signals such as smoke signals, semaphore telegraphs, signal flags, and optical heliographs, or audio messages via coded drumbeats, lung-blown horns, or sent by loud whistles…

Contd…

- Telegraphs, telephones, and tele printers, the use of radio and microwave communications, as well as fiber optics and their associated electronics, plus the use of the orbiting satellites and the internet…

The Digital Revolution

1. The Digital Revolution (also known as the Third Industrial Revolution) is the shift from mechanical and analogue electronic technology to digital electronics which began in the latter half of the 20th century, with the adoption and proliferation of digital computers and digital record-keeping, that continues to the present day

Information Age

Evolution

Conversion of below analog technologies to digital. (The decade indicated is the period when digital became dominant form.)

- Analog computer to digital computer (1950s)
- Telex to fax (1980s)
- Phonograph cylinder, gramophone record and compact cassette to compact disc (1980s and 1990s, although sales of vinyl records have increased again in the 2010s among antique collectors)
- VHS to DVD (2000s)
- Analog photography (photographic plate and photographic film) to digital photography (2000s)
- Analog cinematography (film stock) to digital cinematography (2010s)
- Analog television to digital television (2010s)
- Analog radio to digital radio (2020s (expected))
- Analog mobile phone (1G) to digital mobile phone (2G) (1990s)
- Analog watch and clock to digital watch and clock (not yet predictable)
- Analog thermometer to digital thermometer (2010s)
- Offset printing to digital printing (2020s (expected))

Evolution

Decline or disappearance of below analog technologies:

- Mail (parcel to continue, others to be discontinued) (2020s (expected))[*citation needed*]
- Telegram (2010s)
- Typewriter (2010s)

Disappearance of other technologies also attributed to digital revolution. (Analog–digital classification doesn't apply to these.)

- CRT (2010s)
- Plasma display (2010s)
- CCFL backlit LCDs (2010s)

Improvements in digital technologies.

- Desktop computer to laptop to tablet computer
- DVD to Blu-ray Disc to 4K Blu-ray Disc
- 2G to 3G to 4G to 5G
- Mobile phone to smartphone (2010s)
- Digital watch to smartwatch
- Analog weighing scale to digital weighing scale

Which countries in the world use ultra fast network?
Highest G-network??

Electronics in Medical science

- The core health care science and research in medical sciences will have ever-increasing interface with technology areas.

- The future will not only be dominated by advances in life sciences but will witness the merging of entire technologies and medicine

Contd…

- To meet these challenges, a new breed of medical professionals is required which will be conversant with the medical profession as well as the engineering profession, and who will be able to fuse together the medical sciences with the high-end technologies.

Example

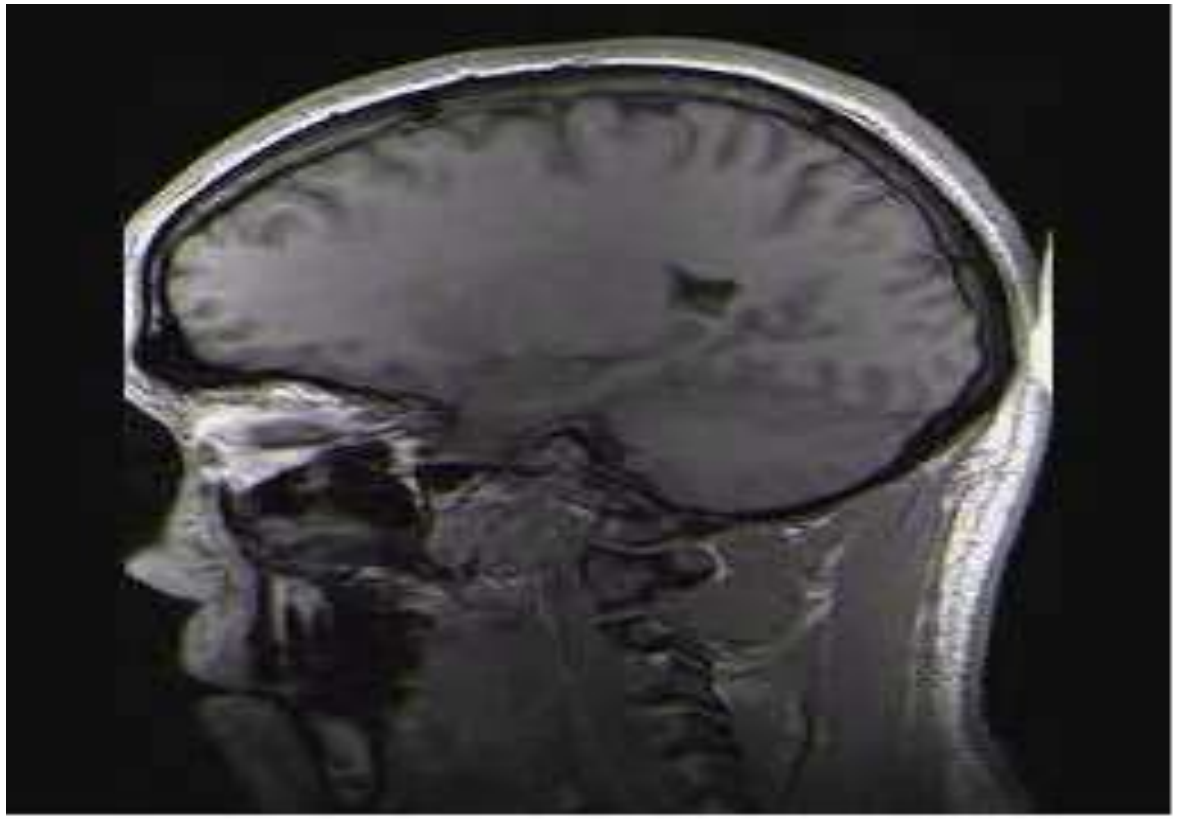
An MRI scan of a human head, an example of a biomedical engineering application of electrical engineering to diagnostic imaging.

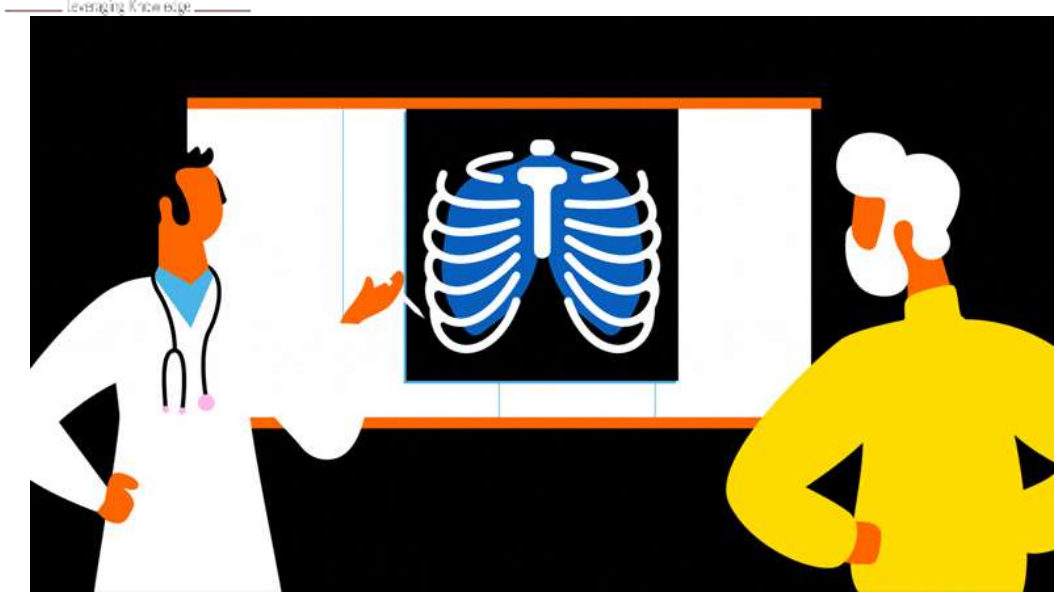
Imaging technologies are often essential to medical diagnosis, and are typically the most complex equipment found in a hospital including:

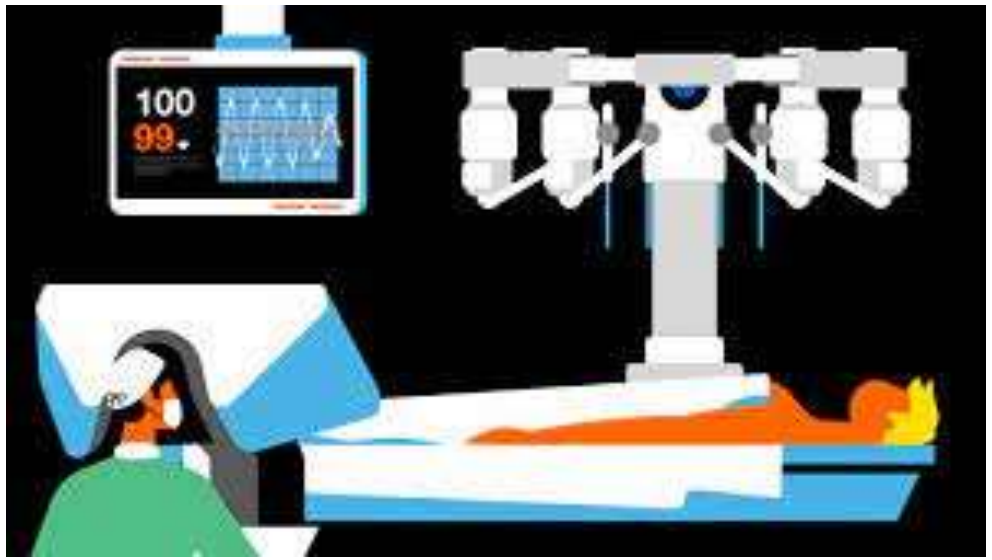
- Magnetic resonance imaging (MRI)
- Nuclear medicine
- Projection radiography such as X-rays and CT scans
- Ultrasound
- Optical microscopy

X-Ray

MRI scan of human head






100
99.


HOSPITAL

Technology adopted during this COVID-19 Pandemic

https://www.drdo.gov.in/covid-19-assistance

Sub disciplines within biomedical engineering

- Biomedical Electronics
- Biomechatronics
- Bioinstrumentation
- Biomaterials
- Biomechanics
- Bionics
- Cellular, Tissue, and Genetic Engineering
- Clinical Engineering
- Medical Imaging
- Orthopaedic Bioengineering
- Rehabilitation engineering
- Systems Physiology
- Bionanotechnology
- Neural Engineering

Consumer Electronics

- Intended for everyday use, most often in entertainment, communications and office productivity.
- Radio broadcasting in the early 20th century brought the first major consumer product, the broadcast receiver…
- Later products include PC's, telephones, MP3 palyers, audio equipment, TV's, calculators,, GPS automative electronics, digi cameras and players and recorders using video media such as DVD's, VCR's or camcorders

Policies

REGULATORY ENVIRONMENT

1) Implementation of ITA-I under WTO

The aim of the treaty is to lower all taxes and tariffs on information technology products by signatories to zero

The ITA covers a large number of high technology products, including computers, telecommunication equipment, semiconductors, semiconductor manufacturing and testing equipment, software, scientific instruments, as well as most of the parts and accessories of these products.

The ITA requires each participant to eliminate and bind customs duties at zero for all products specified in the Agreement.


INFORMATION TECHNOLOGY AGREEMENT (ITA-2)
BRINGING DOWN THE COST OF TECHNOLOGY
Covering $1.3 trillion in annual trade
BETWEEN
52
WTO MEMBERS
ACROSS
201
TECHNOLOGY PRODUCTS
COVERING
90%
OF GLOBAL TRADE
TARIFFS OF UP TO
35%
ELIMINATED
AUSTRALIAN AVERAGE ANNUAL IMPORTS
$19.0 billion
AUSTRALIAN AVERAGE ANNUAL EXPORTS
$3.6 billion
ITA-2 will eliminate global tariffs on products central to our daily lives:
HEADPHONES
VIDEO GAME CONSOLES
GPS DEVICES
VIDEO CAMERAS
PACEMAKERS
ULTRASOUND MACHINES
MULTI-COMPONENT SEMICONDUCTORS
MRI MACHINES

2) Foreign Investment Policy

FDI In Electronic Systems Sectors

The fast-growing electronics market in India is backed by rapid urbanization and increased incomes.

Digitization has led to increased demand for high-end technology devices, escalating the consumption of electronic devices

Technology transitions such as the rollout of 4G/ LTE networks and IoT are driving accelerated adoption of electronics products

Initiatives such as ‘Digital India’ and ‘Smart City’ projects have raised the demand for IoT in the market

FDI in electronics in India will result in better technology, increase cash flow and other resources that will help discover this potential to the fullest.

3) Foreign Trade Policy

4) SEZ Scheme

KLE Technological University
Creating Value
Leveraging Knowledge

INDUSTRY SCENARIO

- **Digital media**
  Digital wallets, Wi-Fi connectivity: IoT, routers, Machine to Machine devices
- **Smart cities**
  Goal to build 100 smart cities by 2020
- **Government cloud initiative**
  "Meghraj" – cloud adoption for e-governance services
- **National Knowledge Network (NKN)**
  The government aims to connect educational institutes and labs
- **Ultra mega solar project**
  Solar power driven pump sets & water pumping stations

2) Foreign Investment Policy

RECENT INVESTMENTS

- **Jan 2019:** TEGNA Electronics in partnership with Chinese handset maker Oppo and other companies is setting up a Greenfield Electronics Manufacturing Cluster in Uttar Pradesh to manufacture electronics and support accessories.
- **Dec 2018:** IESA and Government of Karnataka launch India's First Semiconductor Fabless Accelerator Lab.
- **Mar 2018:** Tata Communications will invest $97.5 mn in developing IoT business.
- **Mar 2018:** Kyocera CTC Precision Tools Private Limited (KCPT) will invest $37.51 mn – $40.0 mn to increase production by 3 times within next 3 years.
- **Mar 2018:** Micromax will invest $30.0 mn to further diversify into consumer electronics segment.

3) Foreign Trade Policy

What is India’s Foreign Trade Policy?

The foreign trade policy is essentially a set of guidelines for the import and export of goods and services.

These are established by the Directorate General of Foreign Trade (DGFT), the governing body for the promotion and facilitation of exports and imports under the Ministry of Commerce and Industry.

Its primary objective is to facilitate trade by reducing transaction cost and time, thereby making Indian exports more globally competitive

3) Foreign Trade Policy

It aims to:

•Accelerate economic activity and make the most of global market opportunities

•Encourage sustained economic growth by providing access to raw materials, components, intermediates (goods used as inputs for the production of other goods), consumables and capital goods required for production

•Strengthen Indian agriculture, industry and services

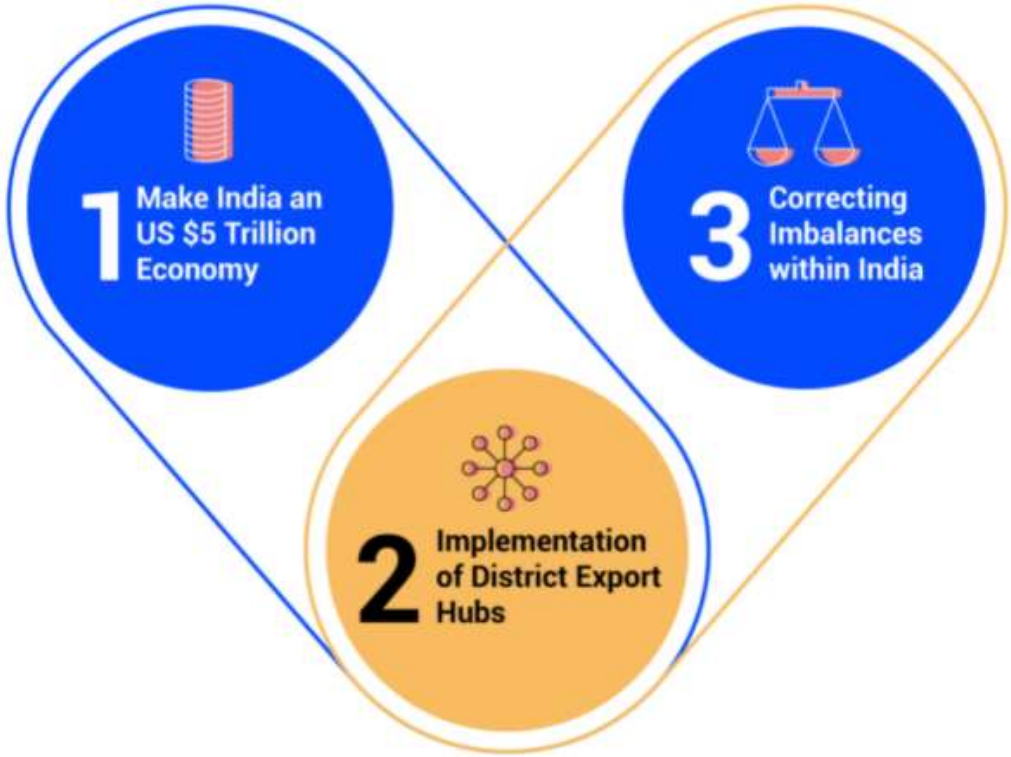
•Generate employment

•Encourage stakeholders to strive for international standards of quality

•Provide quality consumer products at reasonable prices

3) Foreign Trade Policy

What are the expectations from FTP 2021-2026?



Covid-19 was catastrophic for international trade. Indian exports fell by a record 60% and imports by 59% in April 2020.

4) SEZ Scheme

What is Special Economic Zone?

The Special Economic Zone (SEZ) policy in India first came into inception on April 1, 2000.

The prime objective was to enhance foreign investment and provide an internationally competitive and hassle free environment for exports.

Standards

1) Technical Standard- IEEE Standards

2) RS-232 Standard

3) Bluetooth

4) Wireless LAN

Opportunities and Scope

Private Sector

- The private sector is that part of the economy, sometimes referred to as the citizen sector, which is run by private individuals or groups, usually as a means of enterprise for profit, and is not controlled by the state.

Various Fields

- Telecommunication
- Software Engineering/IT
- Power sector
- Hardware Manufacturing
- Home Appliance and VLSI design, etc

Benefits of working in a private sector

- Excellent remuneration packages
- Salary increases based on performance
- Excellent medical schemes
- Better promotion opportunities
- More networking opportunities
- Challenging offers

Different sectors…….

B.Tech graduates can look for jobs in government sector

- Civil services
- Defense services
- Indian Railways
- Indian Air Force
- Indian Navy
- BSNL
- Doordarshan (Prasarbharthi), etc
- ISRO
- BEL
- DRDO
- Apart from these jobs, it is also possible for the candidates to take up teaching or research in any engineering colleges in the country. DRDO also take in Electronics engineers to various research positions

- Indian Engineering Service (IES),
- Indian Telephone Industries, BSNL/ MTNL,
- Semiconductor, Chip Design-Industries (Motorola , IBM, HP, STM, Philips, IT etc),
- Indian Oil Corporation Ltd. (HPCL / BPCL / IPCL),
- Oil and Natural Gas Corporation Limited (ONGC),
- Civil Aviation Department;
- Steel Authority of Indian Limited (SAIL),
- Power Sector (NTPC / NHPC Ltd.),
- Bharat Electronics Limited,
- Indian Railways,
- Indus tan Aeronautics Limited (ISRO),

- Software Industries (ALL MNC’S)

Exams…

- 1.IES
  2.IAS
  3.UES
  4.CDS
  5.EKT
  6.NAVY
  7.ARMY
  8.UPSC
  9.CIVIL SERVICE

Contd…

- The IES i.e. Indian Engineering Services is one of the most royal jobs in India.
- There are two papers in the examination
  1. General Science or General Ability Test (Common Paper)
  2. Elective Engineering paper (Any one of CIVIL, MECHANICAL, ELECTRICAL, ELECTRONICS).

  For details visit
  http://www.ies.edu/
  http://www.iesacademy.com/

Science and Technology in India

- More than one-third of the top 1,000 global R&D spenders have centers in India. Around 50 per cent of the global 500 companies present have more than 10 per cent of the global headcount in India

- About 28 per cent companies with headquarters in Japan, the EU and APAC have a R&D centers in India

- There is a potential to create 200,000 R&D jobs by Global 500 companies in the next five years.

Companies Incubated by CTIE so far are 34

Success Stories

Sl. No.	Organizations Incubated	Technology Vertical	Current Status
1	**Sankalp Semiconductors**	Semiconductor/VLSI Design	**over 450 employees** RED-Herring listing -Top 100 Companies in the world -**2012** *
2	**Navya Biologicals pvt. Ltd**	Bio-technology, R&D	**35 employees.** 'Most Innovative Company' award by DBT, Govt. of India

** most promising private ventures from around the world.*

KLE Tech Enabling “ Make in India...

EDM
(Electrical discharge machining)

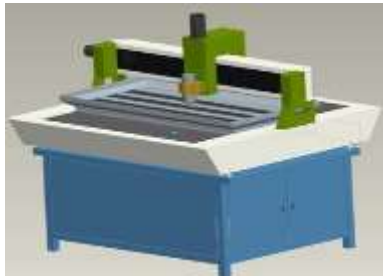
Roland-monofab

CNC Machines

Maker’s Space

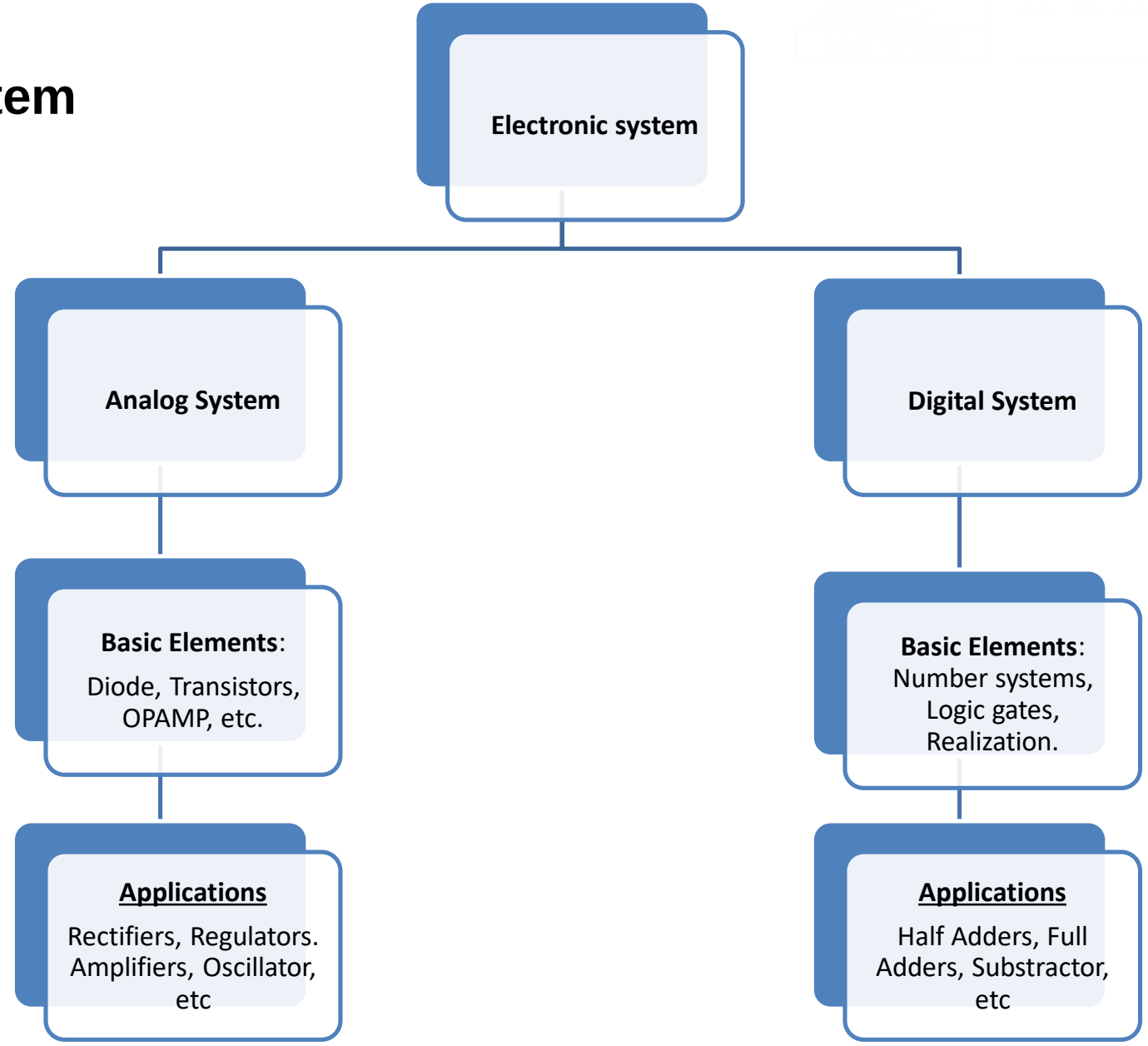
3D –Object Printers

PCB Etching



CNC Engraver -Router

Electronic System Components



References:

[1]https://www.maiervidorno.com/industry-expertise/electronics-electricals/#:~:text=Market%20Stats,-As%20a%20matter&text=India%20is%20expected%20to%20become%20a%20%24%2028.3%20billion%20consumer%20electronics,17%25%20in%202014%2D2020.&text=India's%20electronics%20imports%20touched%20a%20record%20%24%2055.6%20billion%20in%20FY19.

[2] https://www.electronicsb2b.com/headlines/indias-electronics-industry-one-of-the-fastest-growing-in-the-world/

[3] https://www.meity.gov.in/writereaddata/files/Notification_NPE2019_dated25.02.2019.pdf

[4] https://iesaonline.org/information-hub/government-engagements

[5] https://www.investindia.gov.in/schemes-for-electronics-manufacturing

[6]https://www.google.com/search?q=robotic+surgery+gif&tbm=isch&source=iu&ictx=1&fir=wHuO0XNy2YrlUM%252Cm929KqB8TYPKCM%252C_&vet=1&usg=AI4_-kTwNPAckjoJppq04QETVlUyH5r9eA&sa=X&ved=2ahUKEwiu_trcxr7wAhVPwTgGHX5uCagQ9QF6BAgMEAE&biw=1360&bih=657#imgrc=wHuO0XNy2YrlUM

KLE Technological University
Creating Value
Leveraging Knowledge

THANK YOU