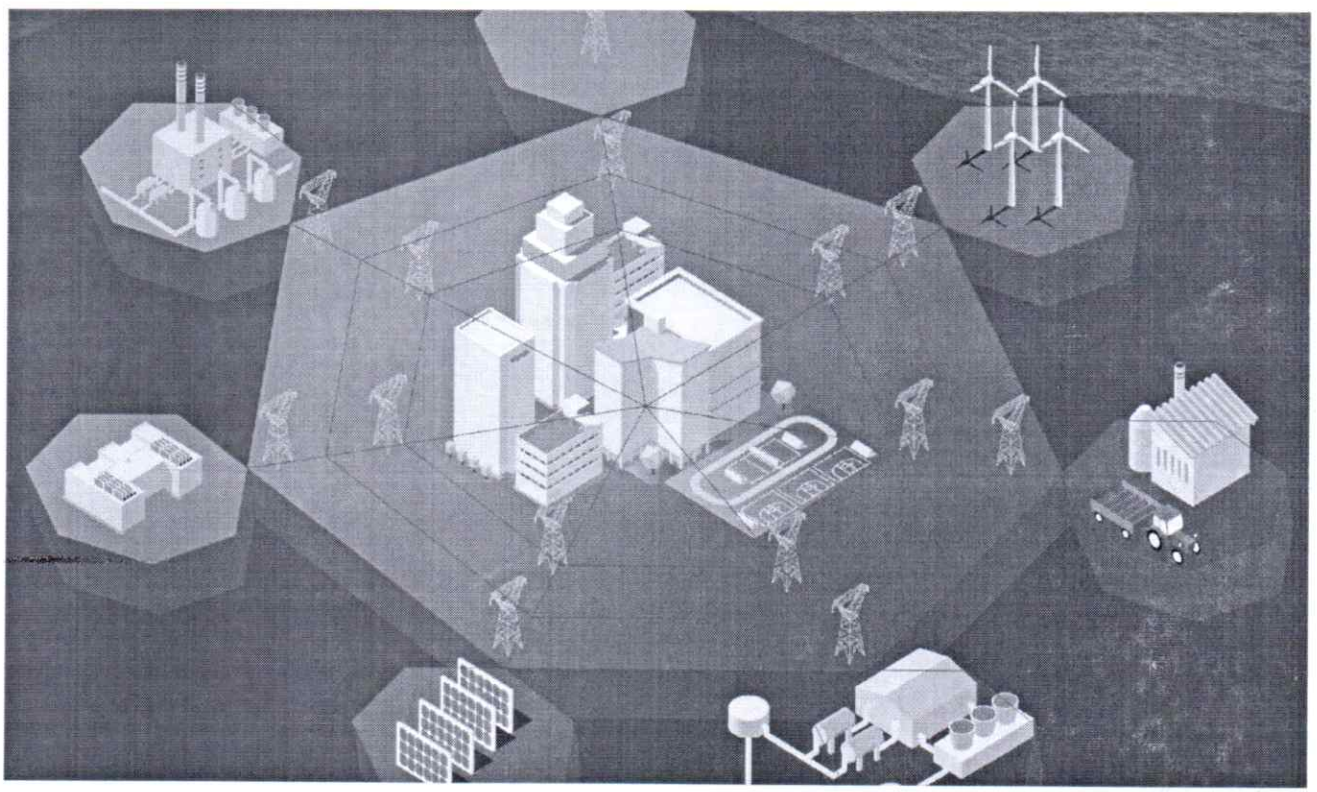
# RAMA UNIVERSITY, KANPUR, UTTAR PRADESH, INDIA

# DEPARTMENT OF ELECTRICAL AND ELECTRONIC ENGINEERIONG



## STRATEGY PLAN 2019-2024

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## 1. Strategic Development Process

The Chairman, Secretary and the members of the Governing Body have felt the need of preparing a strategic development plan for the institution in a formal written document format. The mandate was given to the Principal to develop strategic plan 2020-2025 for the institution. Departments play a pivotal for the institution. The implementation plan for the departments also reflected all details such as budget, resources needed as well as leader responsible with time lines. HODs form the core team for implementing departmental goals under the guidance of Deans/ Principal.

Electrical & electronics engineering, the branch of engineering concerned with the practical applications & research of electricity in all its forms, including the field of electronics. With this strategic plan, EEE Department lays out its direction for the next five years of research and education.

The present strategic Plan principally based on:

- The NAAC guidelines for ensuring quality aspects in the higher education
- Vision and Mission of the EEE Department
- Feedback from stakeholders
- Societal expectations from the Faculty
- SWOC Analysis done by IQAC
- EEE Department is a promising for an institution which aspires to break into the league of top 500 institutions in the world in the next 5 years

**Ranked by National Institutional Ranking Framework**

**Ranked in BRICS QS Ranking**

**Ranked in ASIA QS Rankings**

**Ranked in THES World Rankings**



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## 2. Vision of the Department

To be a leading global technology university that provides a transformative education to create leaders and innovators, and generates new knowledge for society and industry.

## 3. Mission of the Department

- To create an ambience in which new ideas, research and scholarship flourish, and from which the leaders and innovators of tomorrow emerge.
- To address problems faced by the nation and the world through the talent we nurture and the research we do.
- To provide an education that transforms students through rigorous coursework and by providing an understanding of the needs of society and industry.
- To collaborate with other academic and research institutes around the world to strengthen the education and research ecosystem.

## 4. Goals of the Department

RAMA University, Kanpur as a modern research university, performs a diverse set of activities, which include:

- Educating high quality manpower with the required skills and knowledge at both undergraduate and postgraduate levels.
- Generating new knowledge through fundamental research.
- Being a repository of knowledge and of experts.
- Being a source of new ideas and independent opinions through scholarship.
- Being a source of innovation leading to solution of local problems, development of new products, processes, and formation of new businesses, leading to wealth and employment generation.

In addition to the broad range of activities that the Institute carries out in pursuit of its mission, the following goals have been identified to be given special emphasis in the strategic plan:

1. Enhance engagement with society and industry
2. Broaden educational areas
3. Improve internal support systems
4. Enhance student experience



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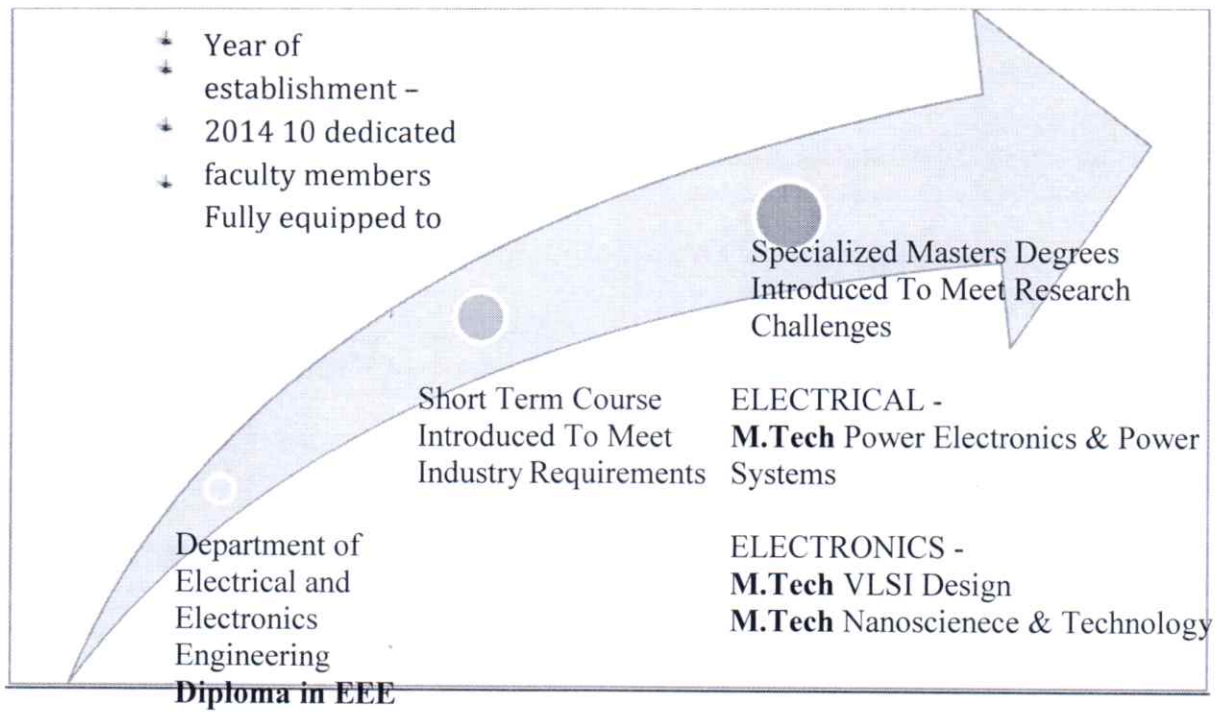
5. Broaden funding base
6. Enhance diversity

**STRATEGIC PLAN: 2020 - 2025**




## 5. FACTORS CONSIDERED FOR FORMULATING THE STRATEGIC FIVE YEAR PLAN

### 5.1 Opportunities in India in Electrical domain-

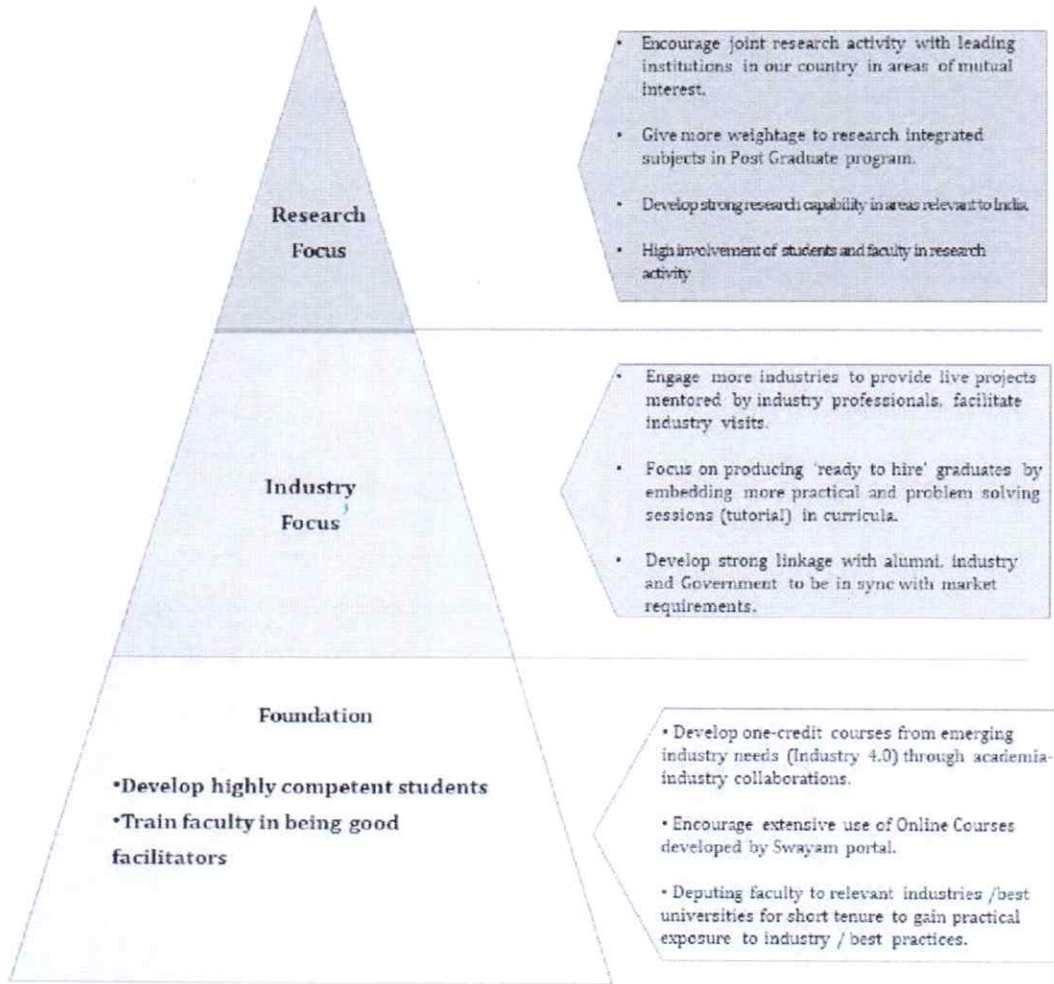
- **Electrical** Engineers are much in demand in **India**. In the recent years, from house to companies every where there is a necessity of electricity to function, offering numerous opportunities to **electrical** engineers. These engineers can work in atomic power plants, hydro power plants or thermal power plants.

### 5.2 Opportunities in India in Electronics Domain -

- Government of India has envisioned a policy to substitute the import of electronic products by 2025. Between 2020 and 2025, automotive electronics and industrial electronics are estimated to be high growth segments.
- Government infrastructure projects such as smart cities,

modernization of railways and increasing automation in industries as well as investments by Electronic manufacturing companies, especially in the mobile phone segment, to serve the Indian domestic market are giving impetus to growth of the Indian electronics segment.

## 5.3 Overall Strategy for Inclusive Growth in the Department–




**Specific Targets –**

- Collaboration with IIT Kanpur for research, patents, product development and curriculum development.
- To Collaborate with industry and introduce 2 to 5One-Credit courses / advanced high impact electives in Curriculum of each programme per year and also offer advanced One Year Diploma Certificate programs for engineers.
- Engaging with the Alumni network for mentoring students and improving their placement prospects; with the average salary level of students to increase by 25% over a period of 2 years.
- To increase the number of faculty members involved in patents, publications and research funding in department from 50% to 75%
- Establish infrastructure to cater to intellectual and manpower needs of the



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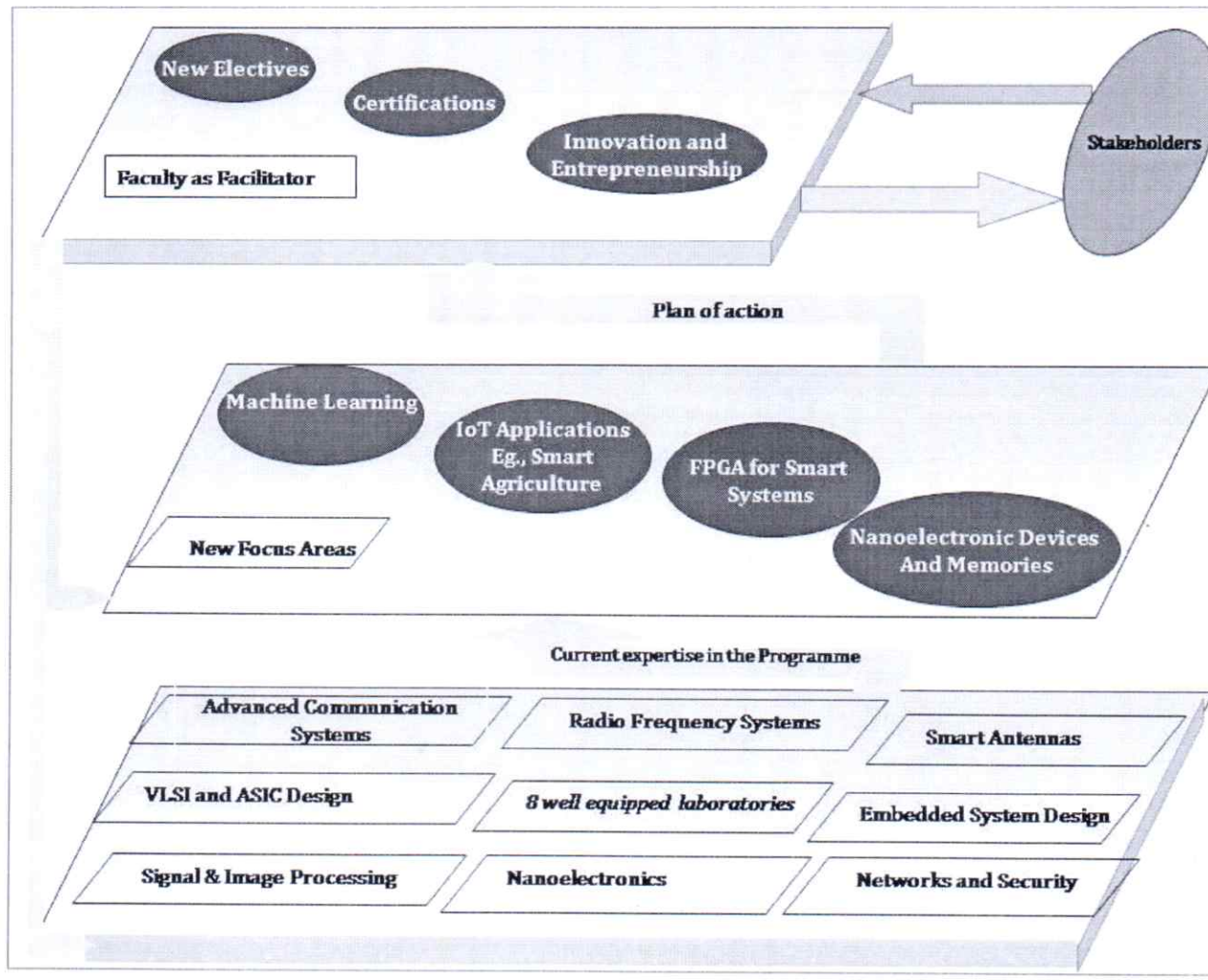
country through corporate funding and schemes announced by Government under Smart City, Digital India and Make in India initiatives through Ministry of Electronics and Information Technology, Ministry of Power, DRDO, DST and ISRO.

# 6. Academic Programme

## 6.1 Diploma Programme in EEE

**Strategy -**




**Specific Targets -**

- To discuss with stakeholders (Industry, Alumni, Government) and design curriculum and pedagogy to improve functional skills and soft skills of students as per emerging global and national megatrends.

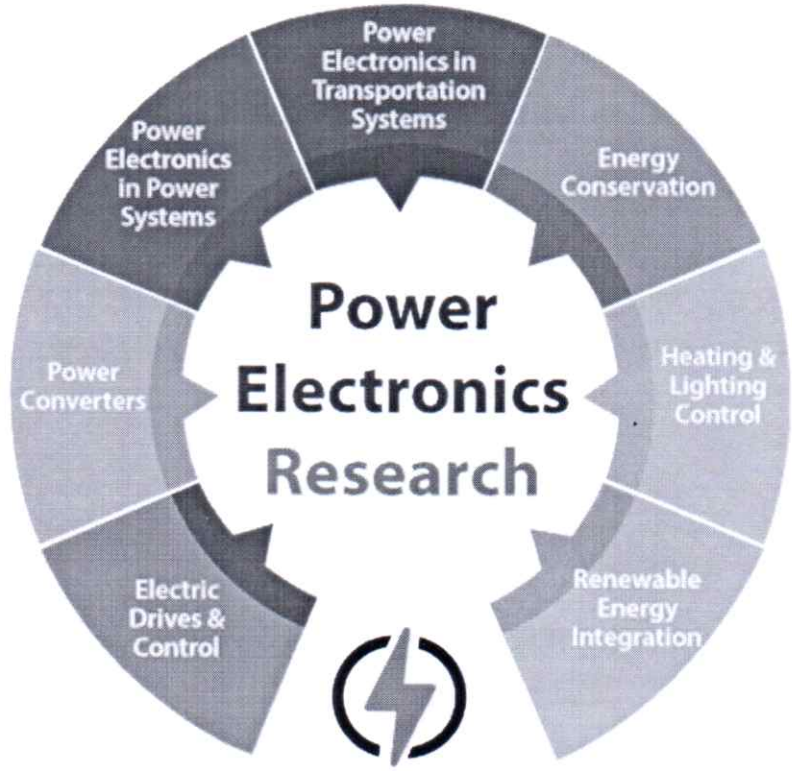
- To increase the number of students who take up online certification courses that are recognized by the industry.
- To increase the number of industry driven student projects from 75% to 100%.
- To encourage student participation in Innovation Contests and encourage idea-to-product pre-incubation involving students and faculty.
- Every faculty member to be engaged with any one industry at any given point of time.

### 6.2 M.Tech Programme in Power Electronic & Power Systems

The Power Electronics and Power Systems of the Electrical & Electronics Engineering Department at RAMA University Kanpur conduct research in several areas. Master's and doctoral students are actively involved in this activity. Research areas include:

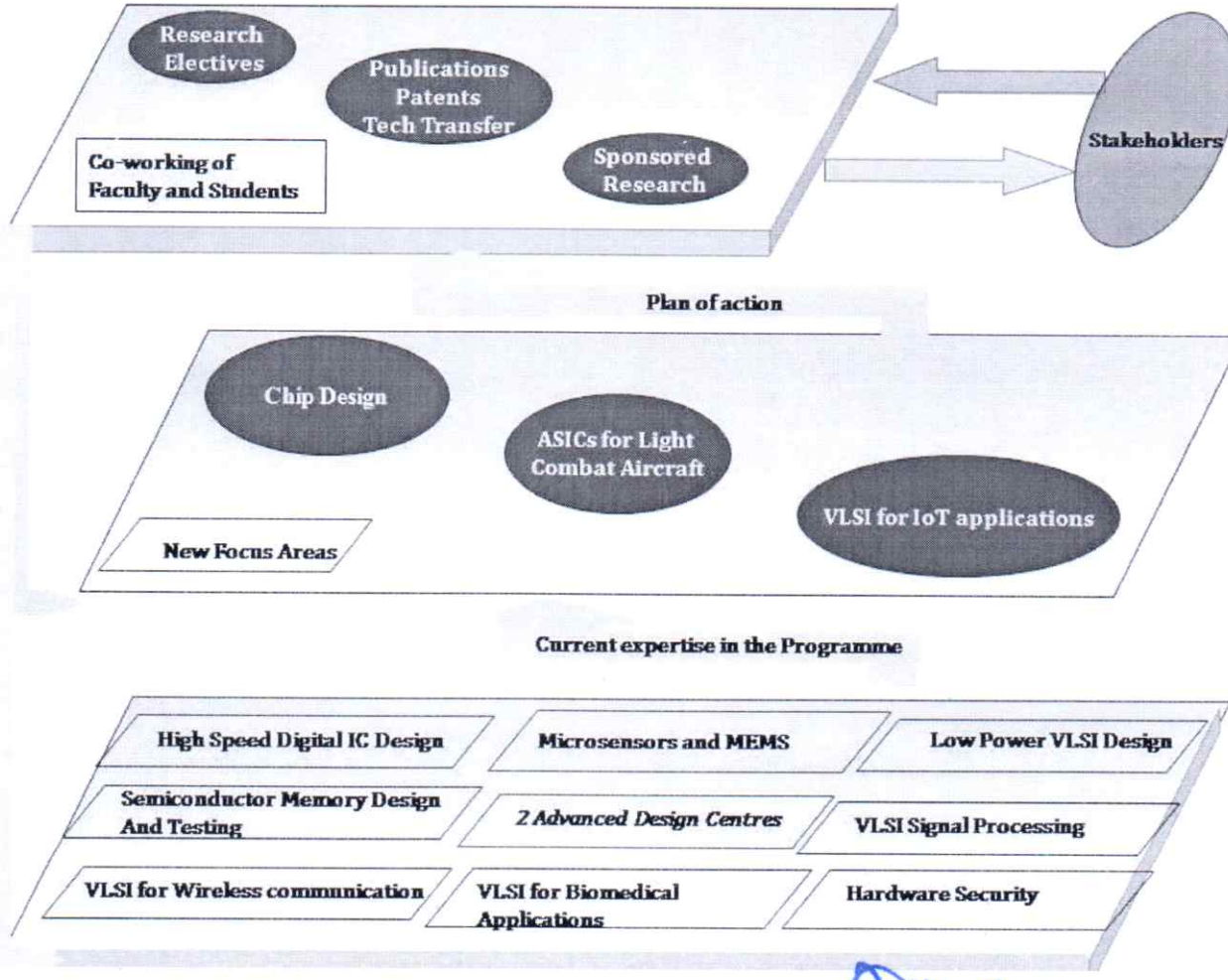
- Power system dynamics, computation, protection and planning
- Flexible ac transmission and HVDC systems
- Power system deregulation
- Distributed generation and microgrids
- Coupled field computations, transformer design, analysis and diagnostics
- Electric power quality and static compensation
- Non-conventional energy interfaces
- Electric machine design, analysis and control
- Power electronic and power system transient simulation

An important aspect of the group's programme is the integration of power electronics with the study of power systems. This has caused the group to be involved in several areas that are important to the development of the country's electric power infrastructure. Apart from undergraduate and postgraduate teaching, the group has been highly active in providing technical expertise to local industry through consultancy and continuing education programmes. The group faculty members and students regularly contribute papers and articles to international technical journals.
The Group hosts In power an electronic discussion forum for power systems professionals and academics in India. In addition, the Group faculty members are active participants in the National Mission on Power Electronics Technology (NAMPET), an initiative of the Department of Information Technology of the Indian government.




**6.3 M.Tech Programme in VLSI Design**

**Strategy –**

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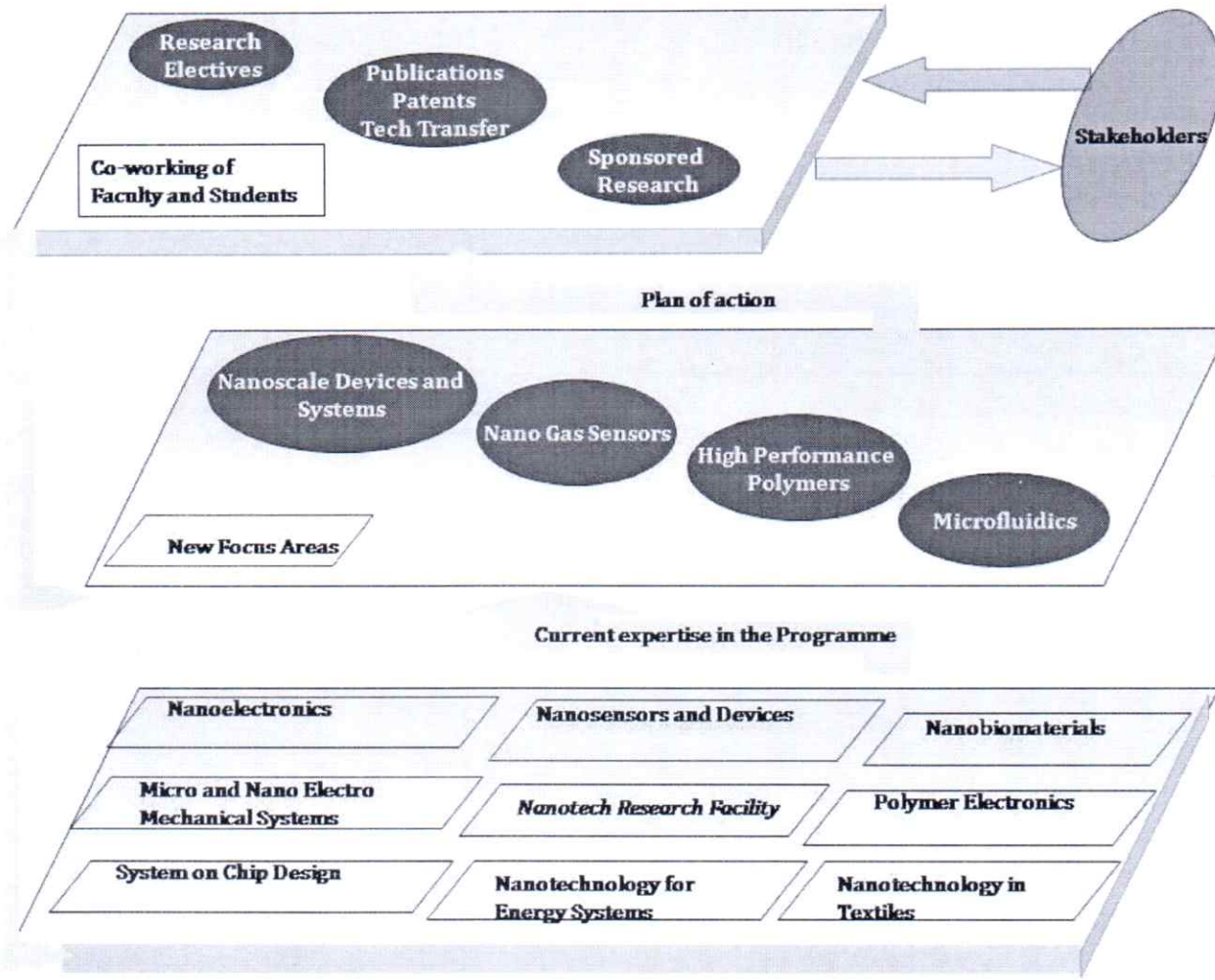
**Specific Targets –**

- To leverage the facilities available under the Special Manpower Development Programme for Chip to System Design, by Department of Electronics and Information Technology, GoI and assign student projects focused on societal applications and industrial electronics.
- To develop at least 2 new elective courses by collaborating with industries including Intel, Xilinx, AMD and others based on EDA tools such as Xilinx, Cadence, Synopsys and Mentor Graphics available in department.
- To collaborate with Semiconductor Research Work Laboratory, Department of Space, GoI and IISc, Bangalore for joint research and publication.
- To establish a Defense Incubation Centre.
- To bring the number of industry sponsored projects research / live projects of students to 100%.
- To publish large fraction of papers in top journals where the peers in top 100 institutions publish their papers.
- To achieve a Ph.D graduation rate of 0.25% per year per faculty member.

## 6.4 M.Tech Programme in Nanoscience & Technology

**Strategy -**




**Specific Targets –**

- To leverage the facilities in the Nanotechnology Research and Development facility at PSG Tech for development of products that are of societal value.
- To develop new elective courses based on each faculty research areas namely Polymer Nanocomposites, Biomedical Nanotechnology, Sensors and Biosensing in Nanotechnology.
- Focus on product development in Healthcare domain and Nanosensors.
- Establish a Centre of Excellence in Wearable Medical Devices.
- To bring the number of industry sponsored projects research / live projects to 100%.
- To publish large fraction of papers in top journals where the peers in top 100

institutions publish their papers.

- To increase the funding through sponsored research from DST Nano Mission, DST and others in areas of Sensors, Nanobiomaterials, MEMS, Nanocomposites and Nanoelectronics, from 1 -2 crores to 5 crores.
- To achieve a Ph.D graduation rate of 0.25% per year per faculty member.



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## 7. STRATEGY PLAN – Brief Report

### 7.1 Curricular Aspects

**New Initiatives:**

- Academic Matters –
  To identify **'Professors of Practice'** – experts from the industry with suitable academic qualification and industry experience to teach 25% of all the skill based elective courses in the Diploma, UG as well as PG curriculum.

- Administrative matters –
  To broadly have **two groups of students** in each class where the first group would consist of more potential students and second group will consist of students who require close monitoring and attention over their academic progress; and to **appoint two tutors for each class** where the tutors would take up a mentor/facilitator role and guide their respective students in the true spirit for which the class division has been made. **This would also improve the attendance and pass percentage.**

- **Curriculum Structure and Revision of Regulation**
  New electives and one credit courses for **DIPLOMA** are planned to prepare the students for Industry 4.0.
- The new electives planned for **PG** are designed to be offered in the respective CoE / Programme Specific Laboratory to improve the students' familiarity and utilization of equipment/software in the CoE. This would lead to better project work / research outcomes.
- We strongly recommend **flexible / suitable credit system** so that students have opportunity to improve their skillets for upcoming new jobs in the industry (Figure 1). It is suggested to create a common pool of subjects required for Industry 4.0 and permit students to choose 20% of their courses from this common basket.

### 7.2 Teaching – Learning & Evaluation

- **Faculty training and Development Initiatives**

We plan to make Faculty Development and Training Programs mandatory and create a systematic approach for the same. A **Hub and Spoke Model** is planned to be adopted where potential Knowledge Hubs are identified. Faculty members whose

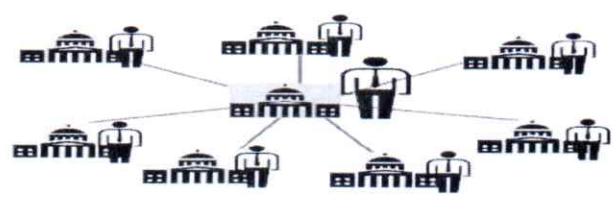

Figure 2: Hub and Spoke Model

HUB FACULTY

research and training requirements match with each Hub are assigned to respective Hub and they would participate in the faculty development and exchange activities happening in the hub. Few Hubs identified include IIT Kanpur, Govt. Polytechnic Kanpur, Power Grid, Semi-conductor Laboratory in Chandigarh, IIIT- Allahabad, etc.

### 7.3 Research, Innovations and Extension

Specific and realizable targets are planned for each research component as follows:

- To increase the number of faculty members involved in patents, publications and research funding in department from 50% to 75% and also improve the research ambiance through providing RA & TA.
- To publish large fraction of papers in top journals where the peers in top 100 institutions publish their papers.
- To achieve a Ph.D graduation rate of 0.25% per year per faculty member.
- To Collaborate with industry and introduce 2 to 5 One-Credit courses / advanced high impact electives in Curriculum of each programme per year and also offer advanced One Year Diploma Certificate programs for engineers.
- To increase the number of students who take up online certification courses that are recognized by the industry.
- Engaging with the Alumni network for mentoring students and improving their placement prospects; with the average salary level of students to increase by 25% over a period of 2 years.

  It is planned to bring in sponsored research from Government as well as Industry by utilizing the following opportunities:
  - Telecommunication and Telecommunication Infrastructure is the backbone of 'Digital India', as well as Industry 4.0
  - Government of India has envisioned a policy to substitute the import of power grid & electronic products by 2025. Between 2020 and 2025, automotive electronics and industrial electronics are estimated to be high growth segments.
  - Government infrastructure projects such as smart cities, modernization of railways and increasing automation in industries as well as investments by Power & Electronic manufacturing companies, to serve the Indian domestic market are giving impetus to growth of the Indian electronics segment.

| | | | |
|---|---|---|---|
| 2020-21 onwards | **Research Projects** | Minimum one research project mandatory for department at Assistant Professor level and above | This project may also be sent for seed money grant to R&D Cell and may also |

| | | | |
|---|---|---|---|
| | | | involve students to combine with diploma & PG students projects |
| 2020-21 onwards | **Diploma Students Research Projects** | each Faculty member to mandatorily design one project involving 4-5 Diploma & PG students | |
| 2020-21 onwards | **Books** | minimum two book mandatory for department in one session with a reputed publisher | |
| 2020-21 onwards | **Book Chapters** | minimum one chapters mandatory for each Faculty member in one session with a reputed publisher only | |
| 2020-21 onwards | **Research/ Review Articles** | minimum one papers mandatory for each Faculty member in one session with a SCOPUS/UGC indexed journal only | |
| 2020-21 onwards | **Patent** | minimum one patent mandatory for each Faculty member in one session | |
| 2021-22 | **Consultancy** | | |

**Linkages with Universities & Industry:**

| | | |
|---|---|---|
| 2021-22 | MoU with reputed University & Institution | will need a lot of exercise and fine-tuning the modalities |
| 2023-24 | MoU with Foreign University | Look for Asia-Pacific, North America, Russia Explore students exchange possibilities<br>Relax attendance norms for students taking up exchange program<br>Use methods other than written exam for internal evaluation. Work out the modalities |



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| | | |
|---|---|---|
| | | with CoE and Academic Council |
| 2022-23 | MoU with an industry | Explore possibilities of training Diploma & PG students in the industry for full semester relax attendance norms for students taking up such training<br>Use methods other than written exam for internal evaluation. Work out the modalities with CoE and Academic Council<br>University may even pay some amount as stipend through the industry to make students take it up Placements will see marked boost up |

## 7.4 Infrastructure and Learning Resources

- **Planned Infrastructure facilities in the department –**

1. **Centre of Excellence in Power Processing** in collaboration with KESCO Kanpur and Power Grid New Delhi., funded by AICTE, UPCST, DRDO and TEQIP III. The following are the primary objectives:
   - Training for DIPLOMA students (part of curriculum).
   - Training for PG students using advanced digital signal processors.
   - Training for Faculty (Internal & External) on research activities through workshops, training programs and FDP's.
   - Establishing a Design and Testing Consultancy Centre for Industry projects.
   - Providing a research platform for the faculty and research scholars from various departments.

   The following activities are also planned as part of the Centre's outcomes:
   - UPCST Funded Project Titled 'Advanced Power Transmission & Monitoring system'
   - DRDO Funded project titled 'VLSI Design & Nanotechnology'
   - Executive Development program for Industry Professionals

2. **VLSI Design Centre** sponsored by Ministry of Electronics and Information Technology (MEITy), RAMA Management, INTEL, Enixs and TEQIP. The broad objectives of the centre include:
    - To develop ASIC catered to societal applications similar to ASIC used in Light Combat Aircraft.
    - To develop projects catering to industry and societal requirements.
    - To develop new electives and assign student projects leading to chip development.

### 3. Computerization of administration in department

The following computerization is planned in the department:

- Development of **Infrastructure Database** to ensure the utilization of infrastructure in teaching as well as research laboratories. The up gradation plan will be based on the database.
- **Faculty and Student Database for internal record maintenance and reference**. This would be highly useful for activities like Accreditation, Harbinger/Tech day report preparation, etc

**Creation of infrastructure**

| | |
|---|---|
| 2020-21 | ICT to be augmented Labs to be created for Diploma |
| 2022-23 | Labs and Classrooms to be created and equipped and increase in intake of Diploma & PG |
| 2022-23 | Fully equipped, well furnished, hi-class Seminar Hall for Diploma to be created |
| 2022-23 | Language Lab |
| 2022-23 | Each faculty to have fully functional work station |

## 7.5 Student Support and Progression

India is poised to be the major supplier of manpower to the rest of the world by 2030. Hence we plan to identify the megatrends that drive innovation and technology at a global level through our Alumni who are spread out in several parts of the world. The Department plans to identify alumni and give them title of '**Career Coach**' and arrange for regular interactive sessions with students as well as faculty on new subjects and skills requirements; also on existing job requirements in market.

- The EEE Association would be conducting GATE coaching classes with our GATE qualified department faculty as resource persons.
- It is decided that **PCD** in I year, **Innovation Lab** in Third year and Project Work would be innovation driven and max. Need to be based on real life challenges.
- The skills based courses in curriculum would be identified and at least **one CO in the subject be related to Innovation**. The pedagogy used to impart this outcome can be of experiential learning model.
- The innovation pipeline would identify student ideas at early stage through appropriate means (eg. competition), validated, supported and mentored to develop PoC followed by prototype validation. Encourage **Student Start-ups.**

| | | |
|---|---|---|
| 2020-21 onwards | Conduct short term course, circuit simulation & expert lecture | enroll internal & external students on paid basis for some courses |
| | Review of result analysis & taking necessary action | For more improvement of students results |
| 2021-22 onwards | Start long term course online or offline | enroll students from other colleges too on paid basis |
| 2022-23 | Establishment of Innovation Lab | For Project Work, student start-up & innovation |
| 2023-24 | Start B.Tech in Electrical Engineering Program | Academic enhancement of students |
| 2024-25 | Conduct GATE coaching classes with our GATE qualified faculty for 4th Year B.Tech Students | enroll students from other colleges too on paid basis |

**Placements**

| | | |
|---|---|---|
| 2021-22 onwards | Identify alumni & setup **'Career Coach'** for regular interactive sessions with students | For 3rd year diploma students |
| 2022-23 onwards | Indentify new skills requirements on existing job in market. | For 2nd & 3rd year students |

| | | |
|---|---|---|
| 2023-2024 | Placement quality (level of companies & salary packages) should put us in top 10 institutes of UP at least | For 3rd year diploma students |
| 2024-25 | Placement quality (level of companies & salary packages) should put us in top 10 institutes of India at least | For 3rd year diploma students |

## 7.6 Institutional Values and Best Practices

**Best Practices**

- Conduct of Project Exhibition in department
- Every faculty member associated with Industry and Interaction sustained through on-site reviews
- Toppers in Examinations are honored through EEE Association
- Recognition of teachers in Research
- Good research ambiance through excellent infrastructure
- Encouragement of senior as well as young alumni to visit their alma mater and involve in department activities.

SWOT Analysis Strengths:

- Faculty
- Best students in the region are admitted to the programmes
- High Quality Research and maximum number of research guides and PhDs ongoing/completed
- Infrastructure

**Weakness:**

- Consultancy and Testing

**Opportunities:**

- Several Govt. initiatives have Telecommunication infrastructure as the backbone which is an opportunity to work with Government as a stakeholder in research.
- Industry 4.0 requires Smart Factories which depend on Machine to Machine Communication thus improving placement prospects for EEE students.

**Threats:**

- Declining student motivation to take up challenging tasks in academia.

- To sustain the quality of admissions to post graduate programmes.

## 7.7 Focused Work

### a. Design and Implementation of GSM Based Intelligent Fuel Meter & Fuel Theft Detection Using PIC Microcontroller

- Fuel level indication in digital form" gives the quantity of the fuel in the fuel tank in the form of numeric digits more accurately.
- Mileage of the vehicles can also be determined.
- During fuel theft a text message is delivered on mobile to the owner of the bike.

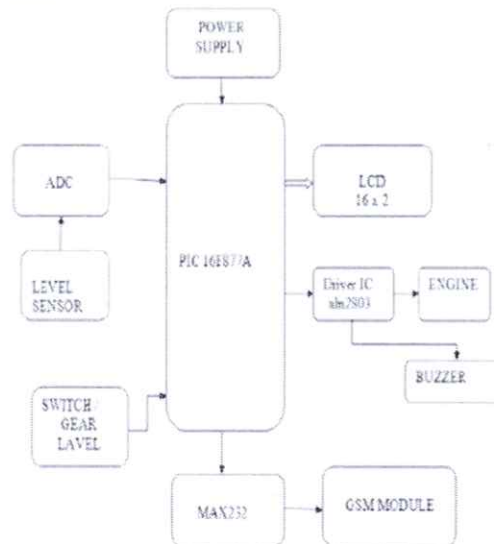



Figure 2: Block diagram of system.

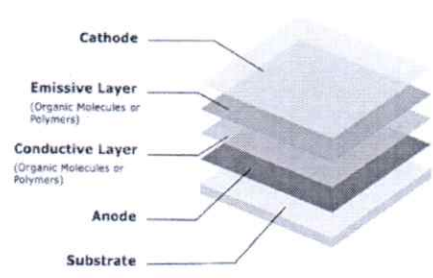
### b. High Density Automatic Fogging Machine

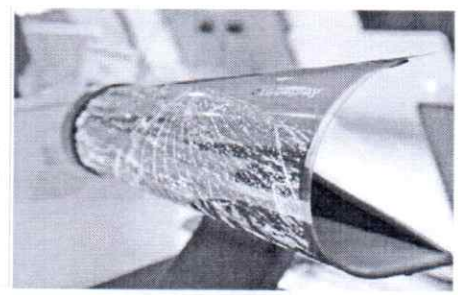
- A fog machine, fog generator, or smoke machine is a device that emits a dense vapor that appears similar to fog or smoke. This artificial fog is most commonly used in professional entertainment applications, but smaller, more affordable fog machines are becoming common for personal use. Fog machines can also be found in use in a variety of industrial, training, and some military applications. Typically, fog is created by vaporizing proprietary water and glycol-based or glycerin-based fluids or through the atomization of mineral oil. This fluid (often referred to colloquially as *fog juice*) vaporizes or atomizes inside the fog machine. Upon exiting the fog machine and mixing with cooler outside air the vapor condenses, resulting in a thick visible fog.

c. **Mechanical to Electrical Vehicle Conversion Project Collaboration with Mechanical Engg. Deptt.**

d. **Organic Light Emitting Diode(OLED)**

- Organic LEDs are light emitting diodes (LEDs) that use polymers or small organic molecules as their optically active element.
- Organic LEDs can be fabricated on flexible substrates, unlike their rigid inorganic counterparts.
- Over the last few years, organic light-emitting diodes (OLEDs) have found promising applications in flat-panel displays, replacing cathode ray tubes (CRTs) or LED displays. Solid-state OLEDs make it easier to fabricate flexible displays.

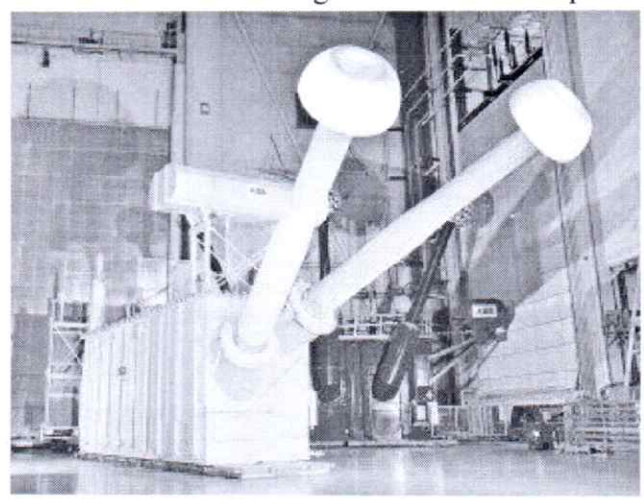


e. **UHVDC Technology**

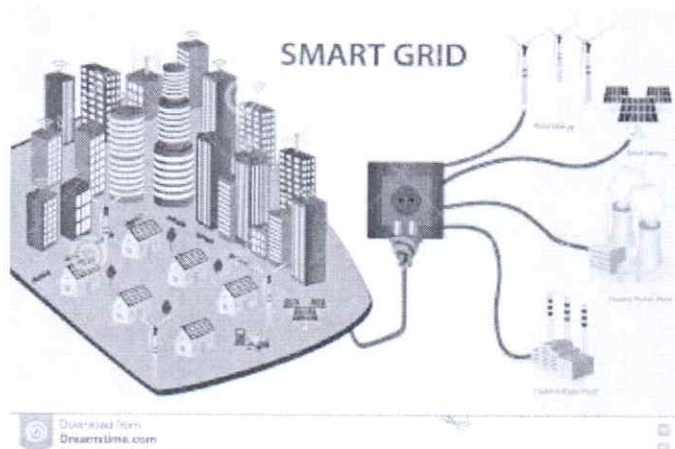
- By using high voltage DC for transmission for longer distance (>500km) the transmission losses can be considerably reduced. The transmission efficiency is nearly 98–99%.

- But the designing of switchgears and circuit breaker is difficult for this. So research is being carried out in this part.



f. **Smart grid & micro grid**

- Smart Grids can collect much more data than the manual energy meter reading system. This permits the use of data analysis techniques and the preparation of highly realistic consumption forecasts.
- The load demand & supply can be predetermined; this eliminates the grid failure which occurred 2 times in northern grid of India in 2012.




g. **Renewable energy &Clean energy**

- Considering the coal reserves and other fossil fuels the renewable energy is being promoted. But harnessed the energy from these is not sufficient. Research is being done on *increasing the efficiency of solar cells.*
- It is also given importance to manufacture at lower cost.

h. **VLSI Design**

- The **trend** in design and manufacturing of very large scale integrated circuit shows an ongoing move towards smaller devices on increasing wafer dimensions. CMOS has become the prevailing technology due to its high speed and packing density coupled with low power consumption.


i. **The Energy Management and Optimized Operation of Electric Vehicles Based on Microgrid**

- The regional energy management and optimized operating strategies of electric vehicles (EVs) and battery swapping station (BSS) are proposed in this paper based on smart microgrid according to the effects of the utility grid caused by uncoordinated charging of EVs and BSS. A price-incentive model is utilized to generate the management strategy to coordinate the charging of EVs and BSS to minimize the total cost of EVs and maximize the profit of BSS in grid-connected mode. In islanded mode, based on the power balance between renewable electric sources and loads,

the fuzzy control method is applied to produce the service price of EV according to its state of charge. Combined with the interruptible-load scheduling, the energy management and dispatch of EVs and BSS are optimized to minimize the operational cost and maximize the benefit of islanded microgrid. The main optimization problems are formulated as a cost minimizing problem and a profit maximizing one, which are implemented in A Modeling Language for Mathematical Programming. The effectiveness of the proposed strategies for the optimized operation of EVs and BSS is validated by case studies.