

A vibrant, fantastical landscape with mountains, waterfalls, and a large Buddha statue. The scene is set against a dramatic sky with orange and purple hues. In the foreground, there are traditional Chinese-style buildings and a large Buddha statue. The overall atmosphere is mystical and majestic.

# HEAVY INDUSTRIES



# What is an Industry?

Industry in short refers to, the place where a large scale production of the products that we use in our day-to-day lives, takes place, generally the quantity of products being generated is in tens of thousands or more...

Examples of industries are:

- a) Textile Industry
- b) Automobiles Industry
- c) Communication Industry
- d) Heavy Industry



# What is the 'Heavy Industry'?

- Heavy industry refers to an industry that produces large industrial products, which requires large and heavy machinery and facilities and involves complex production processes.
- As opposed to the light industry - which is less capital intensive and sells products to consumers - heavy industry sells its products to large purchasers such as businesses, industries, and governments. It is also usually more cyclical in both investment and employment.



# Examples of Heavy Industry

Aerospace

Shipbuilding

Mining

Machine tool building

Locomotive manufacturing

Oil and gas

Steel production

Chemical production

Construction of large buildings and  
infrastructure



# Benefits of Heavy Industry

- Heavy industry provides employment to millions of people around the world. Due to the massive scale of production, individual facilities may employ tens of thousands of people. Companies within the industry require a diverse range of skills and occupations to make their businesses work. Engineers, scientists, management personnel, low-skill laborers, and many others are employed in heavy industry.
- Heavy industry is also responsible for many important innovations. The production of satellites, the exploration of space, the ease of global travel, and the introduction of renewable energy methods such as wind farms are all due to the work of heavy industry. Furthermore, it produces many of the machinery and tools needed in other sectors of the economy.



# Downsides of Heavy Industry


- Due to the nature of its products and production processes, heavy industry exerts a significant environmental impact. It accounts for about 22% of global greenhouse gas emissions and features other problems such as chemical leakage, oil spills, and expansive water usage. The building of massive facilities required in heavy industry can also result in the displacement of various animal species and even people.



# Heavy Industry in the World Economy

- Heavy industry is a key part of many Asian countries' economies due to government economic policy. Several metallurgic industries are located in East Asia, including steel and aluminum, due to the wide variety of mineral resources in the region. China and Japan are the two top steel producers globally, while Japan and South Korea are known for their aerospace and defense manufacturing.
- Heavy industry also requires significant capital investment, resulting in barriers to entry that are often quite high. Therefore, market power within most heavy industries is concentrated in the hands of a small number of dominant firms.



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- In North America, heavy industry is also very important. In the past, Canadian aerospace giant Bombardier received billions of dollars in subsidies from the Canadian government in an effort to help the company develop its C-Series aircraft. Boeing, one of the world's largest aerospace manufacturers and defense contractors, also obtained millions in non-repayable federal grants and billions in federal loans and loan guarantees from the U.S. government between 2000 and 2014.



# The Future of Heavy Industry

- As more and more countries strive towards achieving net-zero greenhouse gas emissions, heavy industry will become the target of increasingly stringent environmental regulations. It will raise the already significant costs associated with the industry and may result in job losses in certain sectors.
- Nonetheless, demand for energy, construction, mining, and other heavy industry will continue to grow as the global population grows through the 21st century. The transition to a cleaner future involves constructing environmentally-friendly buildings, the introduction of renewable energy plants, including solar farms and wind turbines, and the implementation of technological innovations in heavy industry's production processes. Heavy industry will play an increasingly important role in the global economy, and new opportunities will arise.



# Heavy Industry in India

- Heavy Engineering and Machine Tools Sector consists of Capital Goods Industry. Prominent sub-sectors of Capital Goods Industry are Machine Tools, Textile Machinery, Construction and Earthmoving, Construction and Mining Machinery and other heavy industrial machinery such as Cement Machinery, Rubber Machinery, Metallurgical Machinery, Chemical and Fertilizer Machinery, Printing Machinery, Dairy Machinery, Material Handling Equipment, Oil Field Equipment, Paper Machinery etc.
- These industries are de-licensed and foreign direct investment (FDI) up to 100 percent under automatic route as well as technology collaboration is allowed freely. Import of old and new machineries is allowed freely.



- The maximum basic customs duty rate is generally 7.5%. India has entered many FTAs , in which the duty rates are even lower. Lower duty rates are also available under the Project Imports facility.
- Exports are promoted by allowing duty free imports of raw materials, consumables , components and sub-assemblies through various schemes of DGFT.
- The Department has reconstituted Development Councils for Machine Tools Industry, Earthmoving, Construction and Mining Machines and Textile Machinery Industry. These Development Councils are the platform where machinery/equipment manufacturers, users of machineries and policy maker from Government Departments discuss the various issues and take decisions for the sustainable growth of these industries.
- The Department's Scheme for Enhancement in the Competitiveness of the Capital Goods Sector has encouraged technology upgradation, skill development and augmentation of modern manufacturing capacities in an effort to enhance the competitiveness of the industry.



# Machine Tools Industry

- The Machine Tool industry is considered as the mother industry as it supplies machinery for the entire manufacturing sector.
- The manufacturers of machine tools are mostly SMEs, few of them are mid-sized manufacturers which have an annual turnover varying between Rs. 300-500 crore.
- The types of machine tools currently manufactured are general/special purpose machines, standard Computer Numerical Control (CNC) machines, gear cutting, grinding, medium size machines, electrical discharge machining (EDM), presses, press brakes, pipe bending, rolling, bending machines, etc.



# Major Heavy Industries of India

a) Heavy Engineering Corporation (HEC)



b) Bokaro Steel Plant (SAIL)





# a) Heavy Engineering Corporation

Overview

Vision and Mission of HEC

Machine Tools

Fields of Specialization



# Overview

- Heavy Engineering Corporation Ltd., is one of the leading suppliers of capital equipment in India for steel, mining, railways, power, defense, space research, nuclear and strategic sectors. It also executes turn-key projects from concept-to-commissioning. Set-up in the year 1958, HEC has acquired expertise in its field through its more than half a century's experience.
- With the seamless integration of its facilities, HEC is one of the largest integrated engineering complex. Sprawling in an area of around 2100,000 sq.mt, HEC has facilities starting from steel melting, casting, forging, fabrication, machining, assembly and testing. It has its own in-house research and product development wing to deliver products suiting customers' specifications.



- HEC is headquartered at Ranchi, the capital city of Jharkhand, in eastern part of India, and also has its manufacturing facilities located here. A well-suited location nearing to customer sites and proximity to the ports for import items, is an added advantage for its cost-effectiveness.
- Founded primarily to facilitate manufacture of steel plant equipment indigenously, HEC has made immense contribution in setting-up, expansion and modernization of steel plants in India. In due course, HEC had diversified to different sectors and made commendable contributions towards manufacture and supply of import-substitute products. Bestowed with the onus of making the country self-reliant for heavy engineering equipment and services, HEC continues to contribute in the nation-building endeavor.



# Vision and Mission of HEC

- To be a market leader in Heavy Engineering industry in India providing quality products and services to the Steel, Mining, Railways and other Strategic Sectors.
- To achieve growth of 20% in Turnover after completion of modernization / upgradation of Plant/Facilities.

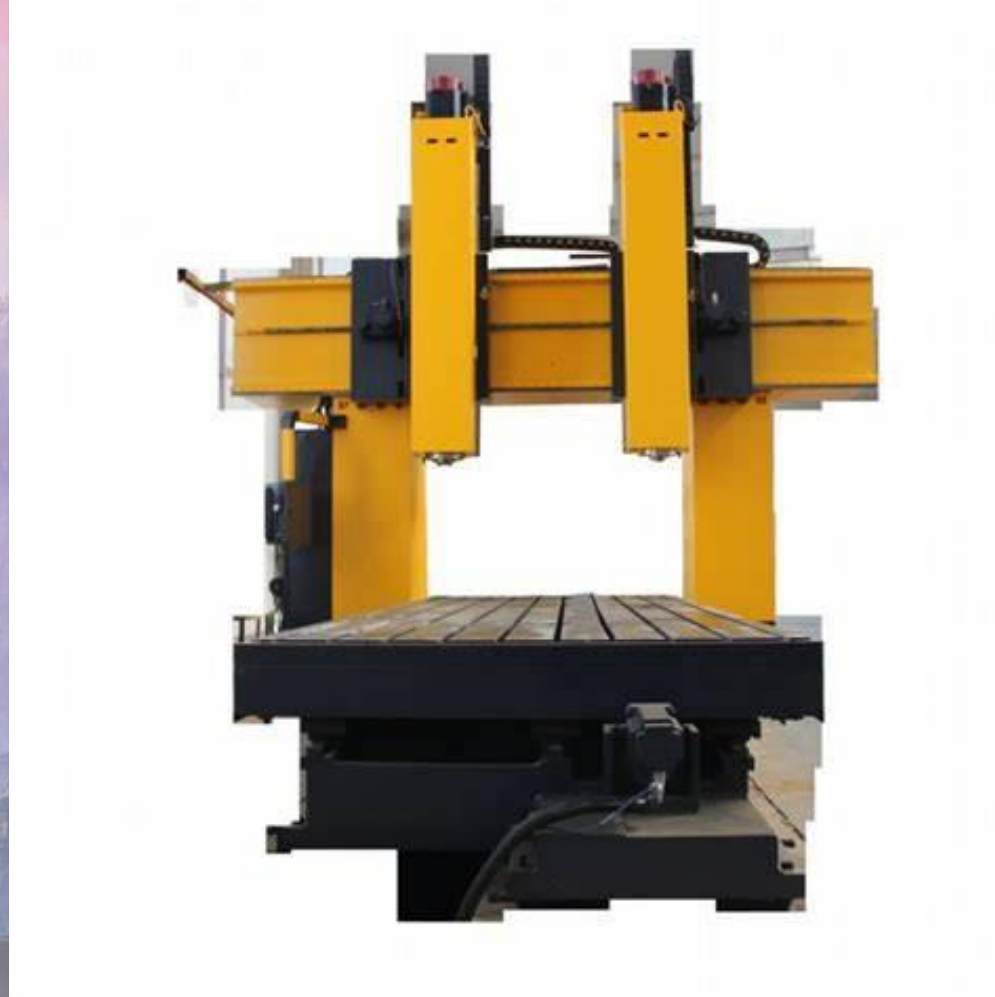


# Machine Tools

- Vertical Turning & Milling Machine
- Lathe
- Roll Grinding Machine
- Deep Hole Boring Machine
- Horizontal Boring Machine
- Radial Drilling Machine
- Planning Machine
- Plano Milling Machine
- Special Purpose Railway Machine Tools

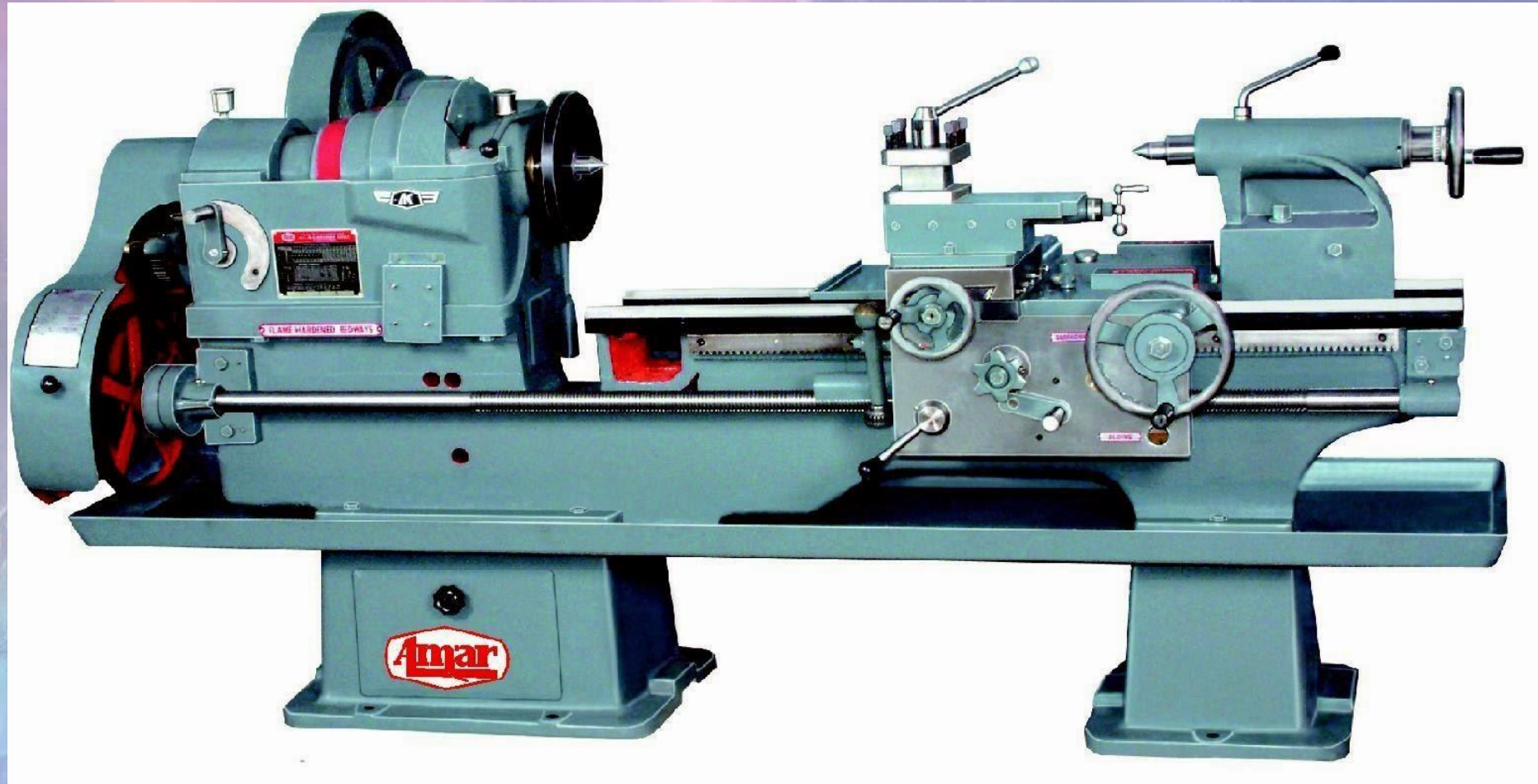


# Vertical Turning & Milling Machine





# Lathe



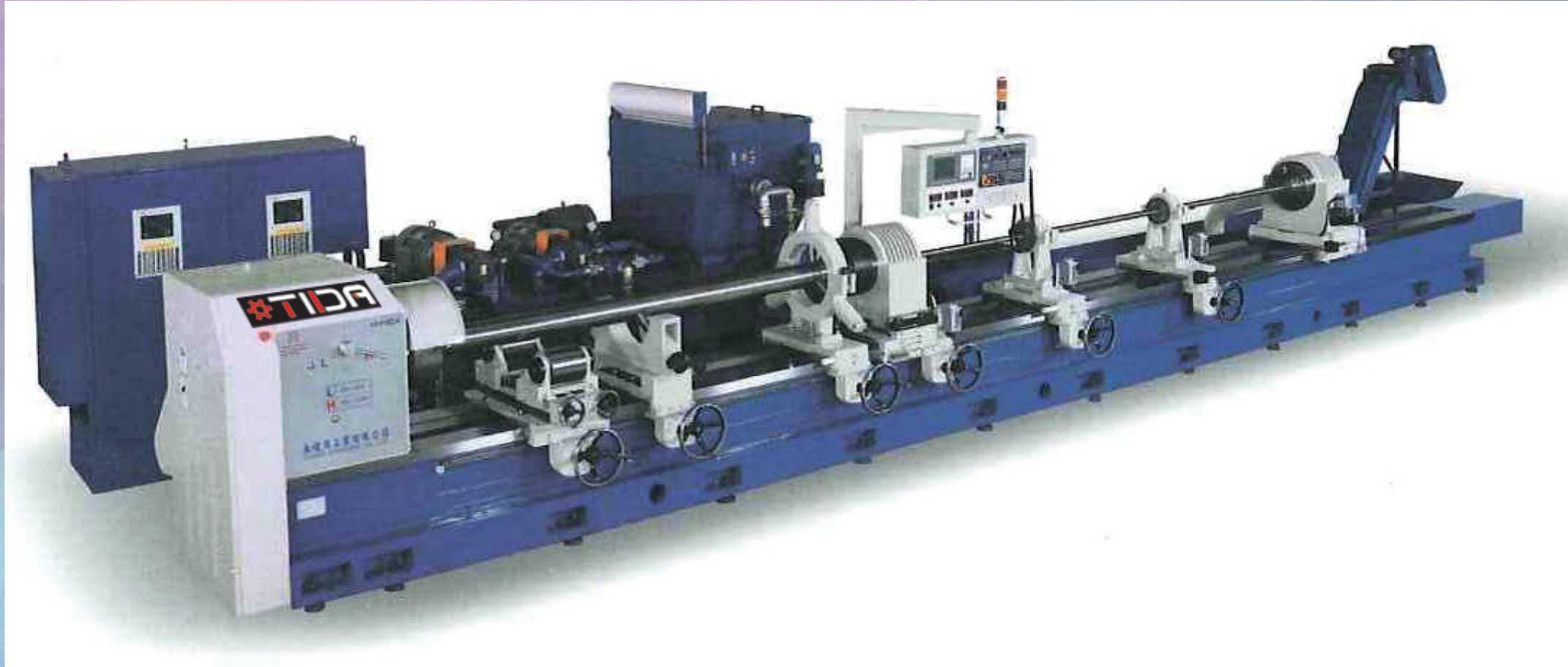


# Roll Grinding Machine





# Deep Hole Boring Machine





# Horizontal Boring Machine





# Radial Drilling Machine





# Planning Machine





# Plano Milling Machine





# Special Purpose Railway Machine Tools



Surface Wheel Lathe



# Fields of Specialization

- Material Handling Plant
- Coal Handling Plants
- Coal Washeries
- Feasibility studies & Site selection
- Basic Engineering with Process Flow Sheets, Energy and Material Balance
- Detail Specification of Plant and Process Equipment
- Manufacturing, Erection, Testing & Commissioning of Plant & Equipment



## b) Bokaro Steel Plant

- History
- People - The Moving Force
- Directions
- Steel Authority of India Ltd. (SAIL)
- Products Produced



# History

- Bokaro Steel Plant - the fourth integrated plant in the Public Sector - started taking shape in 1965 in collaboration with the Soviet Union. It was originally incorporated as a limited company on 29th January 1964, and was later merged with SAIL, first as a subsidiary and then as a unit, through the Public Sector Iron & Steel Companies (Restructuring & Miscellaneous Provisions) Act 1978. The construction work started on 6th April 1968.
- Bokaro is designed to produce flat products like Hot Rolled Coils, Hot Rolled Plates, Hot Rolled Sheets, Cold Rolled Coils, Cold Rolled Sheets, Tin Mill Black Plates (TMBP) and Galvanized Plain and Corrugated (GP/GC) Sheets. Bokaro Steel has provided a strong raw material base for a variety of modern engineering industries including automobile, pipe and tube, LPG cylinder, barrel and drum producing industries.



- The Plant is hailed as the country's first Swadeshi Steel Plant, built with maximum indigenous content in terms of equipment, material and know-how. Its first Blast Furnace started on 2nd October 1972 and the first phase of 1.7 MT Ingot steel was completed on 26th February 1978 with the commissioning of the third Blast Furnace. All units of 4 MT stage have already been commissioned and the modernization taken subsequently has further upgraded this to 4.65 MT of liquid steel.



# People – The Moving Force

- Bokaro Steel values its people as the fulcrum of all organizational activities.
- The saga of Bokaro Steel is the story of Bokaroans erecting a gigantic plant in the wilderness of Chotanagpur, reaching milestones one after another, staving off stiff challenges in the liberalized era, modernizing its facilities and innovating their way to the top of the heap.



# Directions

- Bokaro Steel is working towards becoming a one-stop-shop for world-class flat steel in India.
- The modernization plans are aimed at increasing the liquid steel production capacity, coupled with fresh rolling and coating facilities.
- The new facilities will be capable of producing the most premium grades required by the most discerning customer segments.



# Steel Authority of India Ltd. (SAIL)

- SAIL, a Central Public Sector Enterprises (CPSE) is India's largest steel producer with around 17.43 MT of Hot Metal and 16.15 MT of Crude Steel production. With Annual Turnover of more than Rs. 61000 crores in 2019-20, SAIL is one of the 'Maharatna CPSE' of country and has been the pivot of the domestic steel industry has continuously moved with the times to carve a niche for itself among the leading steel producers of the World.
- SAIL Plants together produce the widest spectrum of steel products in the country, covering both flat and long product segments, providing cost-effective and superior quality of products and services.
- SAIL has completed a massive expansion plan and increased its crude steel production capacity to 21 million tonnes (MT) enabling its steel plants to produce 100% steel through the basic oxygen furnace-continuous casting route and an expanded product mix with a larger proportion of value-added items. A long term strategic plan has been worked out to steer the company towards a target of 50 MT of hot metal production by 2031, thereby meeting the strategic objectives of maintaining leadership position in Indian steel sector and a position amongst the top steel companies globally and makes its steel available at customers' doorsteps through one of the most extensive warehouse, distributor and dealer networks.



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# Products Produced

## BOKARO STEEL PLANT – PRODUCT BASKET

Shop	Products	Thickness range (mm)	Width range (mm)	Length (metre)
HSM	HR Coils	1.6 -16	900-1850	
HRCF	HR Plates	5-10	1800	2.5-12
	HR Sheets	1.6-4	1500	1.5-4.5
CRM I &II	CR Coils/ Sheets	0.63-2.5	700-1850	
	CR Coils/ Sheets	0.63-1.6	650-1250	
	CR Coils/ Sheets, TMBP	0.22-0.8	650-1040	
	GP Coils & Sheets GC Sheets	0.3-1.6	650-1250	
CRM-III	CR Coil	0.25-2.0	876-1560	
	GP Coil-III	0.4-1.6	900-1220	



# Link of Industrial Advancement to Sustainable Development Goals

- The industrial advancement that is taking place around the globe is related to the Sustainable Development Goals [SDG's] in it's ninth context which is, Industry, Innovation and Infrastructure.





# HEC land boost for Ranchi Smart City project

- Ranchi is among the 100 cities under India's Smart City mission.
- Ranchi Smart City Corporation Limited (a special purpose vehicle formed to execute this project) is all set to build a new city across over 656 acres in the HEC region of Dhurwa-Jagannathpur with modern commercial, residential and office establishments.
- The proposed land use includes institutional (136.37 acres), residential (79.8- acres), commercial (68.6 acres), public (57.57 acres), mixed-use (71.90 acres) and open spaces and circulation, including green and open areas, roads (243.19 acres). A big bulk comprises green, open spaces and roads to give the area an airy, contemporary feel.
- Build educational institutions including residential schools and colleges with modern amenities, internal roads, skill centres, Jharkhand Urban and Planning Management Institute, health management and research institute, law college, fashion and hotel management cradles.
- There will be modern drainage and sewerage, rainwater harvesting, power and water supply for the residential colonies with smart features.
- Pan-city development, on its part, comprises model roads and integrated traffic and transport system integrating all upcoming and present solutions related to transport and traffic under one umbrella through ICT (information-communication-technology).



# SAIL

SAIL is committed to continuously promote Sustainable Development encompassing environmental, societal and economic aspects related to its business activities.

## GUIDING PRINCIPLES

- Affirm its commitment to contributing towards a clean and sustainable environment and continually enhancing its environment related performance as an integral part of its business philosophy and values.
- Strive to integrate its business values in an ethical and transparent manner to demonstrate its commitment to sustainable development and to meet the interests of its stakeholders.
- Create a positive footprint within the society to make a meaningful difference in the lives of people by continually aligning its initiatives to the goals for sustainable development.
- Regularly interact with stakeholders to assess and achieve sustainability goals associated with its business activities through, constructive dialogue.
- Maintain commitment to business and people for quality, health and safety in every aspect.
- **Bokaro: Bokaro Steel Plant (BSL) has won the prestigious Greentech Environment Excellence award, 2020 in the “recycling and waste management” category for 98.12% utilization of its solid waste that is generated from its steel making process.**
- Steel major Bokaro Steel Plant (BSL) is earning more than Rs 550 crore revenue annually by selling its solid wastes. Apart from earning this huge amount, the company is also saving around Rs 250-280 crore yearly by recycling or reusing these wastes again in the production process.
  - These are the new avenues where BSL’s generated solid waste is utilised:
  - “Steel Slag – Flyash” based bricks
  - Use of weathered LD slag of 20-65 mm size as rail track ballast
  - Steam ageing facility of BOF slag for its use as cement concrete
  - Use of LD slag as soil conditioner for acidic soil of Jharkhand
  - Use of air-cooled blast furnace slag in road making



# Path to work in Industries

- Industrial Engineering as a career
- Eligibility for Pursuing Industrial Engineering Courses
- Eligibility for Industrial Engineering Degree Course
- Scope in Industrial Engineering
- Colleges that offer a course in Industrial Engineering



# Industrial Engineering as a career

- Industrial engineering professionals work in every engineering industry, be it mechanical, electrical, electronics or computers.
- There are enormous job opportunities for industrial engineering professionals as they are required in almost every organization engaged in production or manufacturing.
- The industrial engineering skill are very much required in increasing the overall efficiency of production by minimizing the operating cost, planned use of manpower and other resources.
- The future prospect of industrial engineering is also very bright considering the increase in demand from production units which would lead to rise in such professionals.



# What is an Industrial Engineer?

- Industrial engineers design, create, test and assess various ways of managing industrial production processes. Their main goal is to discover new ways of making these processes more efficient and they do that by implementing systems that integrate all production components of a product or a service, like workers, machinery, raw materials, energy and information. Some of the most common industrial engineer tasks are:
- Analyzing various components of manufacturing processes, like schedules, flows and specifications, with the purpose of understanding all methods and activities involved
- Creating management control systems for improving cost analysis and financial planning efficiency
- Reducing costs and production issues by implementing quality control procedures
- Discovering new ways to improve the efficiency of manufacturing processes and service delivery
- Designing and implementing control systems ensuring that all products meet certain quality standards
- Advising clients regarding product specifications



# Eligibility for Pursuing Industrial Engineering Courses

- Candidates interested in pursuing industrial engineering course need to fulfill certain eligibility criteria.
- The eligibility criteria varies for the level of courses and will be different for industrial engineering degree, industrial engineering certifications and industrial engineering diploma.



# Eligibility for Industrial Engineering Degree Course

- Candidates seeking admission in graduate courses need to have passed class 12 with Physics, Chemistry and Mathematics as compulsory subjects.
- Candidates interested in masters course need to have passed engineering graduate course with relevant branch.
- The requirement of percentage of marks in the course varies from institute to institute.
- Candidates should qualify the entrance exam of the institution through which the institute offer admission.



# Eligibility Criteria For Undergraduate Courses (B. Tech or B.Sc. in Industrial Engineering)

- Candidate must be a PCM student, i.e. a Physics, Chemistry, Mathematics student in class 12.
- A student must have passed 10+2 exam with PCM as their major subject and with a minimum of 50 percent marks in PCM.
- In case, a student has done a diploma course in Industrial Engineering after 10th, may get admission directly to the second year in B.Tech. However, not all universities have lateral entry, so this happens only if the university you are enrolling for provides lateral entry or not.



# Eligibility Criteria For Post-graduate courses (M. Tech or M.Sc. in Industrial Engineering)

- Candidates must have scored at least 50 percent marks in their bachelor's degree or an equivalent degree in order to become eligible.



# Eligibility Criteria For Doctoral courses (PhD in Industrial Engineering)

- Candidates must have scored 70% marks in their master's degree in Industrial Engineering or 60% marks in any other related master's course.



# Industrial Engineering Entrance Exams

- In order to get enrolled in a public university, you can go for these entrance exams:
  - JEE Mains
  - JEE Advanced
  - Gratitude Aptitude Test in Engineering (GATE)
  - UGC National Eligibility Test
  - State Level Exams
- In order to get enrolled in a private university, you can go for these exams:
  - BITSAT
  - SRMJEE
  - VITEEE



# JEE Mains

- By qualifying this examination, the candidate can get enrolled in IITs, NITs and various other government universities throughout the country.



# JEE Advanced

- This exam is also held throughout the entire nation; however, to give this exam, you'll have to qualify JEE Main. Once you qualify JEE Main, you'll be eligible to give JEE Advanced. If you qualify this exam, then you'll have the chance to get enrolled in one of the top IITs in India.



# Graduate Aptitude Test in Engineering (GATE)

- This exam is for the students who have completed their bachelor's degree and is thinking of pursuing his/her master's degree in Industrial Engineering. This exam is also held across the nation, and if you qualify GATE, then there is a high chance that you can get enrolled into various universities for a master's degree in Industrial Engineering.



# UGC National Eligibility Test (NET)

- This exam is for students who are thinking of pursuing a PhD in Industrial Engineering. Not only that, but this exam also determines the eligibility for the post of Assistant Professor and Junior Researcher in Indian universities and colleges.



# State Level Exams

- Note that apart from these exams, almost all state government institutes organize a particular entrance exam that you can give in order to get enrolled into one of these public institutions. However, you can get enrolled into IITs and NITs only by qualifying JEE Main and JEE Advanced, if you are a 12th passed student and GATE if you are a Bachelor degree holder or pursuing student.



# BITSAT

- It is the entrance exam held by Birla Institute of Technology and Science every year. You can opt-in for this exam if you want to get into BITS, which is one of the well-known private institutes that provides Industrial Engineering degree.



# SRMJEE

- SRMJEE is the entrance exam held by SRMIST every year. This institute is another institute which is well-known for its Industrial Engineering course.



# VITEEE

- VITEEE is the entrance exam held by Vellore Institute of Technology. This institute is also well-known for its Industrial Engineering course.



# Some of the Skill Courses offered at Secondary Level & Senior Secondary Level in CBSE:

- Engineering Science 622
- Mech. Engineering 626
- Auto Engg II 627
- Electrical Machine 787
- Electrical Appliance 788
- Automotive 404
- Electrical Technology 819
- Electronic Technology 820



# Soft Skills developed in School life:

- Soft skills include, but are not limited to, how a person is in a professional space, how they interact with others, solve crisis situations etc. Soft skills are developed in the students in school life through interactive learning experiences, games, and activities.

Some of the commonly preferred soft skills in an individual:

- Communication
- Work ethic
- Leadership
- Humility
- Accountability
- Problem-solving
- Adaptability
- Negotiating





# Why teach Soft Skills to Students?

1. The present world including workplace and educational institutions runs on interpersonal skills.
2. Soft skills complement the hard skills, set the students apart in their own way and increase the chances of getting hired.
3. These help in cultivating work-life balance and how to manage stressful situations in a better way.
4. Helps in adapting to the constantly changing workspace and strategies and grow with the organization.
5. Helps in improving listening skills leading to mindfulness, empathy and a better grasp of the situation and people.



# Ways for teaching soft skills to students:

- Group project & Teamwork (Group projects usually include interpersonal communication, discussions, problem-solving, goal setting).
- Through Experimental Learning Techniques (Using project-based learning techniques will help the students combine their hard skills and soft skills).
- Through Crisis Management
- Active Listening
- Teach Critical Thinking With Innovations and Experiments
- Boost the Students' Confidence With Mock interviews
- Note Taking and Self-Reflections
- Peer Review and the 3 P's – Polite, Positive and Professional

Developing soft skills should be part of every student's individual learning process. As an educator, it's important to create opportunities for the students to innovate, communicate, build self-reliance and more with the help of these soft skills.



# Course Subjects

- If you are pursuing a B. Tech in Industrial Engineering, then it is a four years course consisting of 8 semesters. Each semester will hold the target to improve various skills that you need in this field. Some of the subjects you are most likely to be taught semester- wise are:
  - Semester 1
  - Semester 2
  - Semester 3
  - Semester 4
  - Semester 5
  - Semester 6
  - Semester 7
  - Semester 8



# Semester 1

- Mathematics
- Chemistry
- English
- Electronics
- Mechanics
- Engineering Graphics
- Electrical Engineering
- Manufacturing Process





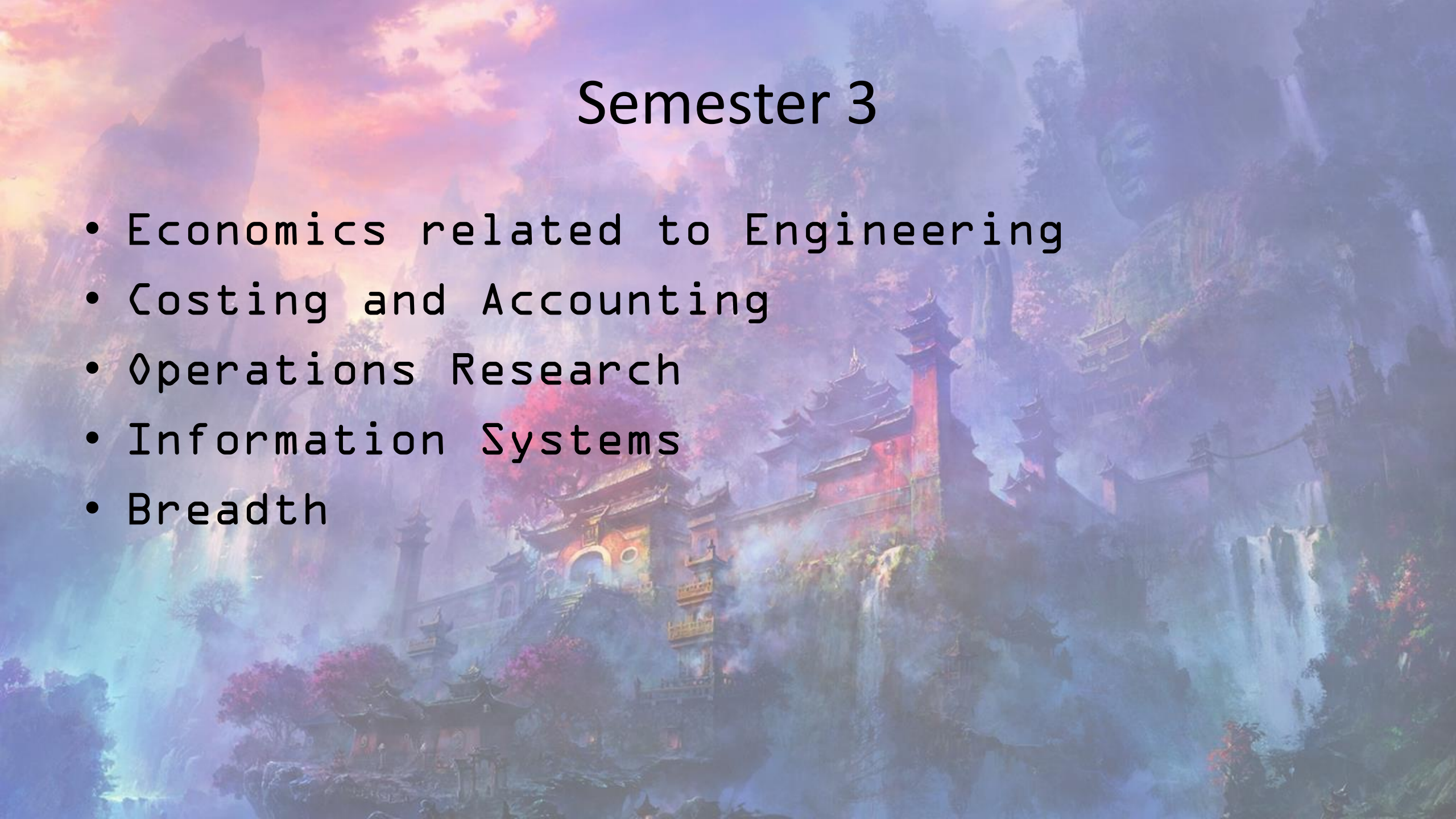
# Semester 2

- Physics
- Mathematics
- Data Structure
- Basic Programming
- Mechanical Engineering
- Graphics
- Manufacturing Process Advanced



# Semester 3

- Economics related to Engineering
- Costing and Accounting
- Operations Research
- Information Systems
- Breadth





# Semester 4



- Productions Economics
- Work System Design
- Operations Research Advanced
- Breadth



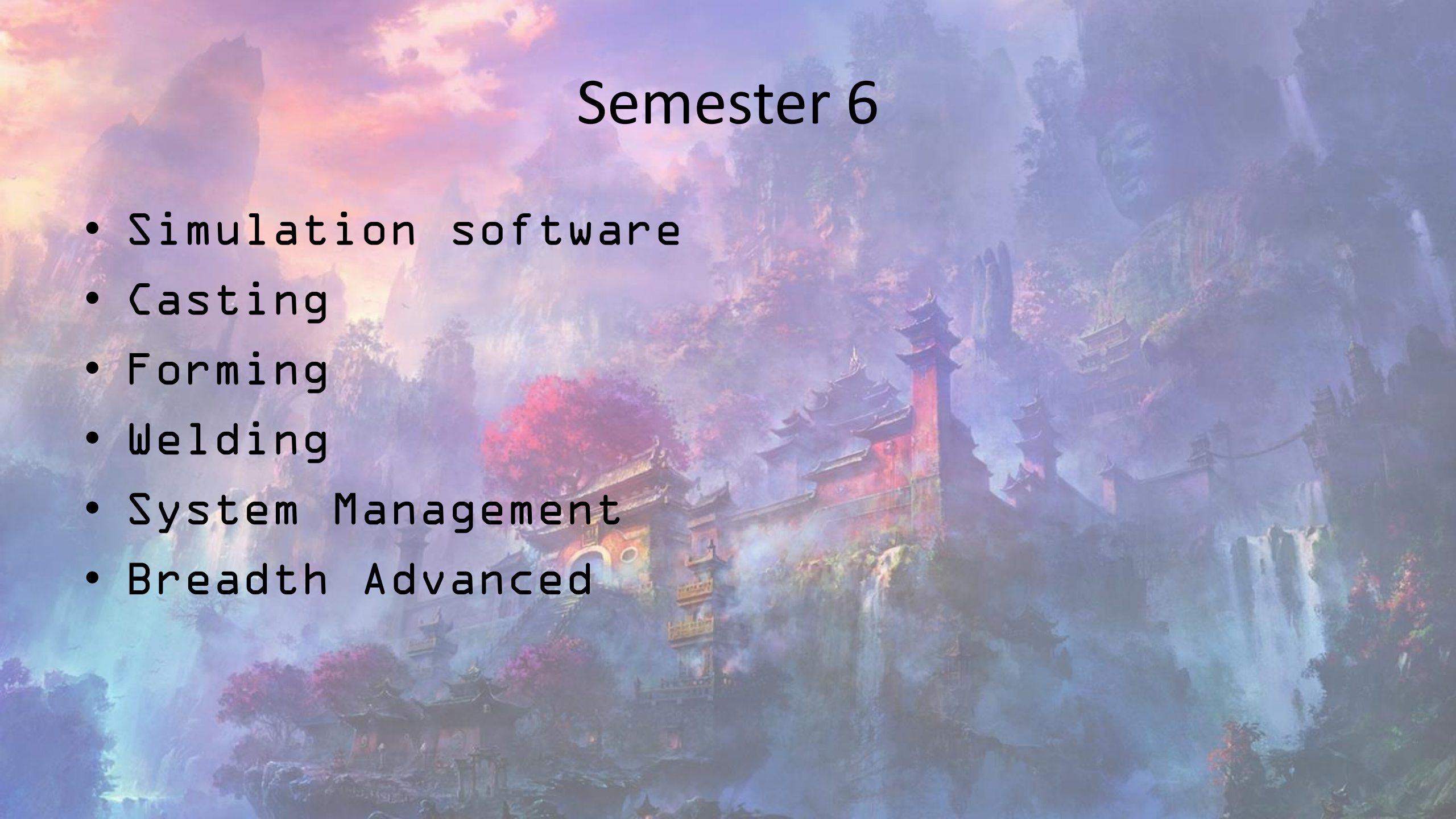
# Semester 5

- Machine Learning
- Tools and Machining
- Breadth Advanced
- Quality Design
- Quality Control
- Facility Layout and Design



# Semester 6

- Simulation software
- Casting
- Forming
- Welding
- System Management
- Breadth Advanced





# Semester 7

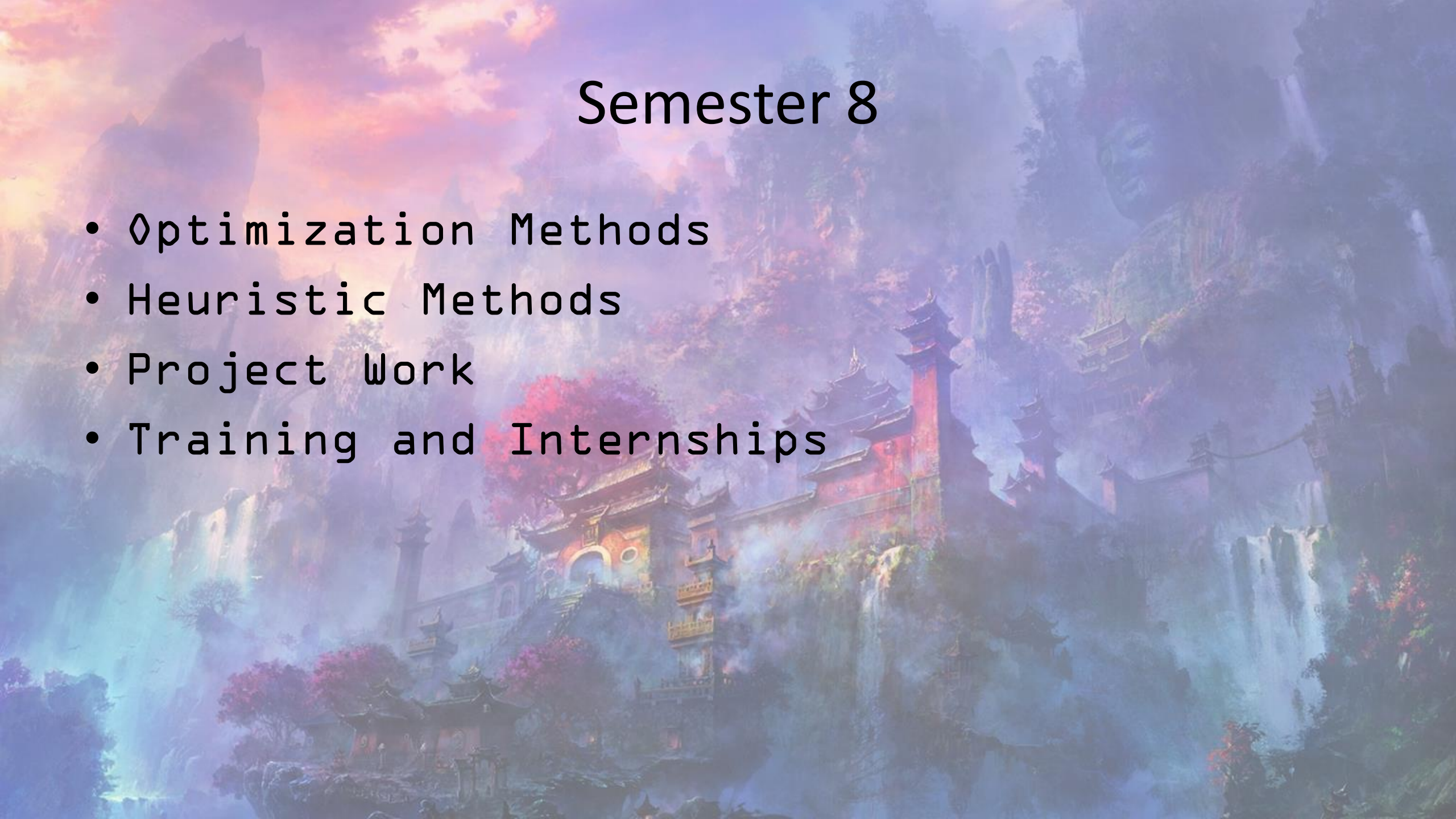
- Product Development
- Training and Internships Project Work





# Semester 8

- Optimization Methods
- Heuristic Methods
- Project Work
- Training and Internships

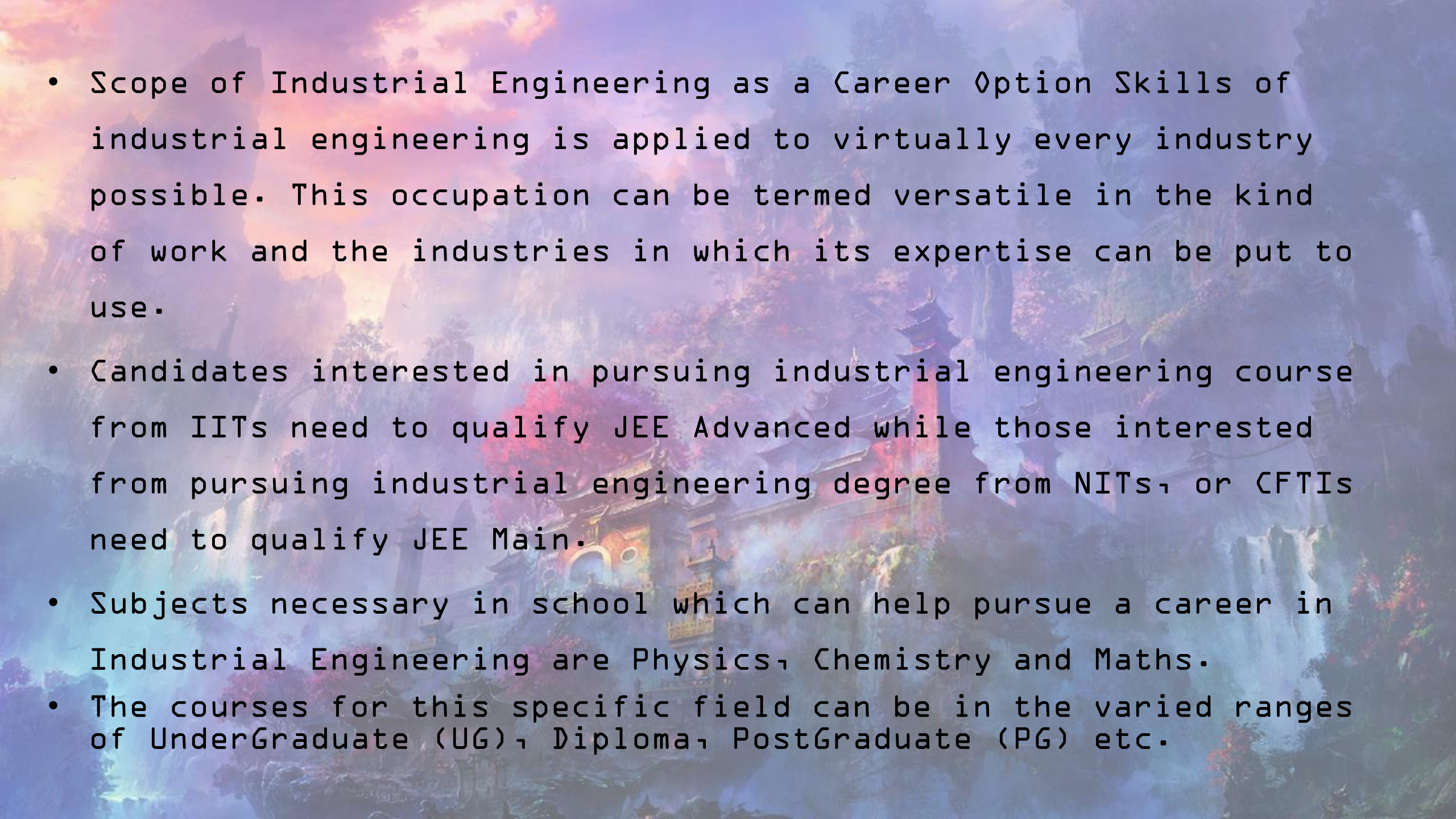




# Scope in Industrial Engineering

- Industrial engineers may work with supply chain and also overlook production factors, safety and budgetary concerns. An industrial engineer can pursue different careers which include the following:
- Safety Engineer
- Industrial Engineer
- Industrial Production Manager
- Industrial Maintenance Engineering
- Industrial Management Engineer
- Industrial Systems Engineer



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- Scope of Industrial Engineering as a Career Option Skills of industrial engineering is applied to virtually every industry possible. This occupation can be termed versatile in the kind of work and the industries in which its expertise can be put to use.
  - Candidates interested in pursuing industrial engineering course from IITs need to qualify JEE Advanced while those interested from pursuing industrial engineering degree from NITs, or CFTIs need to qualify JEE Main.
  - Subjects necessary in school which can help pursue a career in Industrial Engineering are Physics, Chemistry and Maths.
  - The courses for this specific field can be in the varied ranges of UnderGraduate (UG), Diploma, PostGraduate (PG) etc.



# Colleges that offer a course in Industrial Engineering

Name of College	Course
IIT Kharagpur	B.Tech in Industrial Engineering
College of Engineering, Trivandrum	B.E. Industrial Engineering
Ramaiah Institute of Technology, Bangalore	B.E. Industrial Engineering
College of Engineering, Guindy	B.E. Industrial Engineering
Pandit Deendayal Petroleum University, Gandhinagar	B.Tech Industrial Engineering
JSS Academy of Technical Education, Bangalore	B.Tech Industrial Engineering
Visvesvaraya Technological University, Belagavi	B.Tech in Industrial Engineering and Management
Bangalore Institute of Technology, Bangalore	B.Tech in Industrial Engineering and Management
Ramaiah Institute of Technology, Bangalore	B.Tech in Industrial Engineering and Management
Dayananda Sagar College of Engineering, Bangalore	B.E. in Industrial Engineering and Management
PSG College of Technology, Coimbatore	M.E. Industrial Engineering
IIT Delhi	M.Tech Industrial Engineering
College of Engineering, Trivandrum	M.Tech Industrial Engineering
IIT Bombay	M.E. Industrial Engineering and Operations Research
IIT Kharagpur	M.Tech Industrial Engineering and Management
NIT Trichy	M.Tech Industrial Engineering and Management



# Global Colleges that offer Industrial Engineering

#1	Georgia Institute of Technology, Atlanta, GA
#2	University of Michigan—Ann Arbor, Ann Arbor, MI
#3	University of California—Berkeley, Berkeley, CA
#4	Northwestern University (McCormick), Evanston, IL
#5	Stanford University, Stanford, CA
#6	Massachusetts Institute of Technology, Cambridge, MA
#7	Virginia Tech, Blacksburg, VA
#8	Cornell University, Ithaca, NY
#9	Purdue University—West Lafayette, West Lafayette, IN
#10	Pennsylvania State University—University Park, University Park, PA



# Industrial Engineering Syllabus

## Industrial Engineering Syllabus

Core Industrial Engineering Subjects	Elective Industrial Engineering Subjects
Kinematics and Dynamics of Machines	Computer Aided Mechanical Design
Industrial Engineering and Operations Research	Vibrations Engineering Design
Casting and Welding	Robotics Engineering
Metal Forming and Machining	Total Quality Management
Metrology and Quality Assurance	Project Management
Machine Element Design	Flexible Manufacturing Systems
Operations Planning and Controls	Materials Management
Machine-tools and CNC Manufacturing	CNC Machines and Programming
Computers in Manufacturing Enterprises	Microprocessor Applications in Manufacturing
Introduction to Production and Industrial Engineering	Micro- and Nano-Manufacturing
Mechanical Engineering Drawing	Design for Manufacturing and Assembly
Design Innovation and Manufacturing	Geometric Modelling for Manufacturing
Process Engineering and Tool Design Project	Injection Moulding and Mould Design
Control Theory and Applications	Design and Manufacturing of Composites
Investment Planning	Low Cost Automation
Value Engineering	Advances in Metal Forming



# What are Industrial Engineer Skills?

- Industrial engineer skills are a unique set of abilities that allow industrial engineers to successfully perform their roles.
- Given the complexity of the role, a successful industrial engineer requires a mix of soft and hard skills.
- Besides industry-specific knowledge, they need the skills to be able to design specific systems and processes, implement them and assess their impact.



# Necessary Industrial Skills



1. Problem Solving
2. Communication
3. Project Planning
4. Quality Management
5. Critical Thinking
6. Management



# Problem Solving

- Given an industrial engineer's main role of making systems and processes more efficient, having a natural problem-solving ability is one of the most important skills for the job.
- This ability means that successful industrial engineers are able to detect various issues, analyze their nature and causes, design ways to resolve them and implement these ways.
- This process requires a distinct set of sub-skills, such as critical thinking and the ability to focus.



# Communication

- As most industrial processes involve multiple workers and departments, industrial engineers need excellent written and verbal communication skills to successfully coordinate and implement their plans and procedures.
- Successfully performing the role requires the ability to maintain communication with multiple departments at a time and persuade employees and management that the methods you want to implement can improve industrial efficiency.
- Successful relationship management with everyone involved in the development and production processes typically results in higher productivity.



# Project Planning

- Project-planning skills are essential to industrial engineers, as they need to coordinate personnel and machinery in a way that ensures that projects are completed on time and within standards.
- Each project requires an optimum amount of workers and technology, with industrial engineers needing to determine that amount without taking up too much or too little of the company's resources.
- This implies scheduling workers based on their expertise and availability and creating strict schedules for machinery use.



# Quality Management

- Given that the main task of industrial engineers is making processes more efficient, they first need to be able to identify the areas that can be improved.
- This requires them to manage quality-control operations and continuously look for elements of the development and manufacturing processes that are not up to standard.
- As part of the quality control process, they must also manage relationships with suppliers and make sure all raw components are up to certain quality standards.



# Critical Thinking

- Industrial engineers often need to use logic and reasoning to identify the advantages and downsides of each proposed solution.
- Critical thinking skills also help them resolve complex problems and implement ways to fix or mitigate them in a way that uses an optimum amount of company resources.
- Given the limited time and resources at their disposal, they must also think critically when prioritizing one action over another.



# Management

- The job of an industrial engineer involves managing personnel and resources. They need to identify the best employees for each task, motivate them to maintain high professional standards and direct their work. As for resource management, they need to make sure that all equipment, facilities and raw materials are available and used appropriately.



# Industrial Engineer Certifications that up your ante

1. Six Sigma Black Belt Certification
2. Project Management Professional (PMP)
3. Certified Manufacturing Engineer (CMfgE)
4. Certified Quality Engineer (CQE)



# Six Sigma Black Belt Certification

- Earning this certification shows that you're able to lead teams, understanding relationship dynamics, distinct roles and specific responsibilities.
- The certification pre-requirements are at least two years of education and training after high school and at least two years of relevant work experience.
- The exam consists of 150 questions and takes a maximum of four hours and renewal is needed every three years.



# Project Management Professional (PMP)

- Earning the Project Management Professional certification shows potential and current employers that you're exceptionally competent at project management.
- It has certain educational and experience requirements, like a four-year degree, at least 36 months of project leading experience and 35 hours of project management training.
- The certification exam assesses the candidate's ability to demonstrate their knowledge of project management in various stages of a project, such as initiation, planning, execution, monitoring, control and closing.



# Certified Manufacturing Engineer (CMfgE)

- This certification is appropriate if you want to improve your credentials as an industrial engineer specialized in manufacturing processes. Pursuing it requires at least eight years of manufacturing-related combined experience and education, with at least four of these years being direct work experience. The Certified Manufacturing Engineer exam takes a maximum of four hours and is open-book. Candidates receive approximately 180 multiple-choice questions from pre-recommended reading materials. Candidates with a score of at least 60% are considered successful.



# Certified Quality Engineer (CQE)

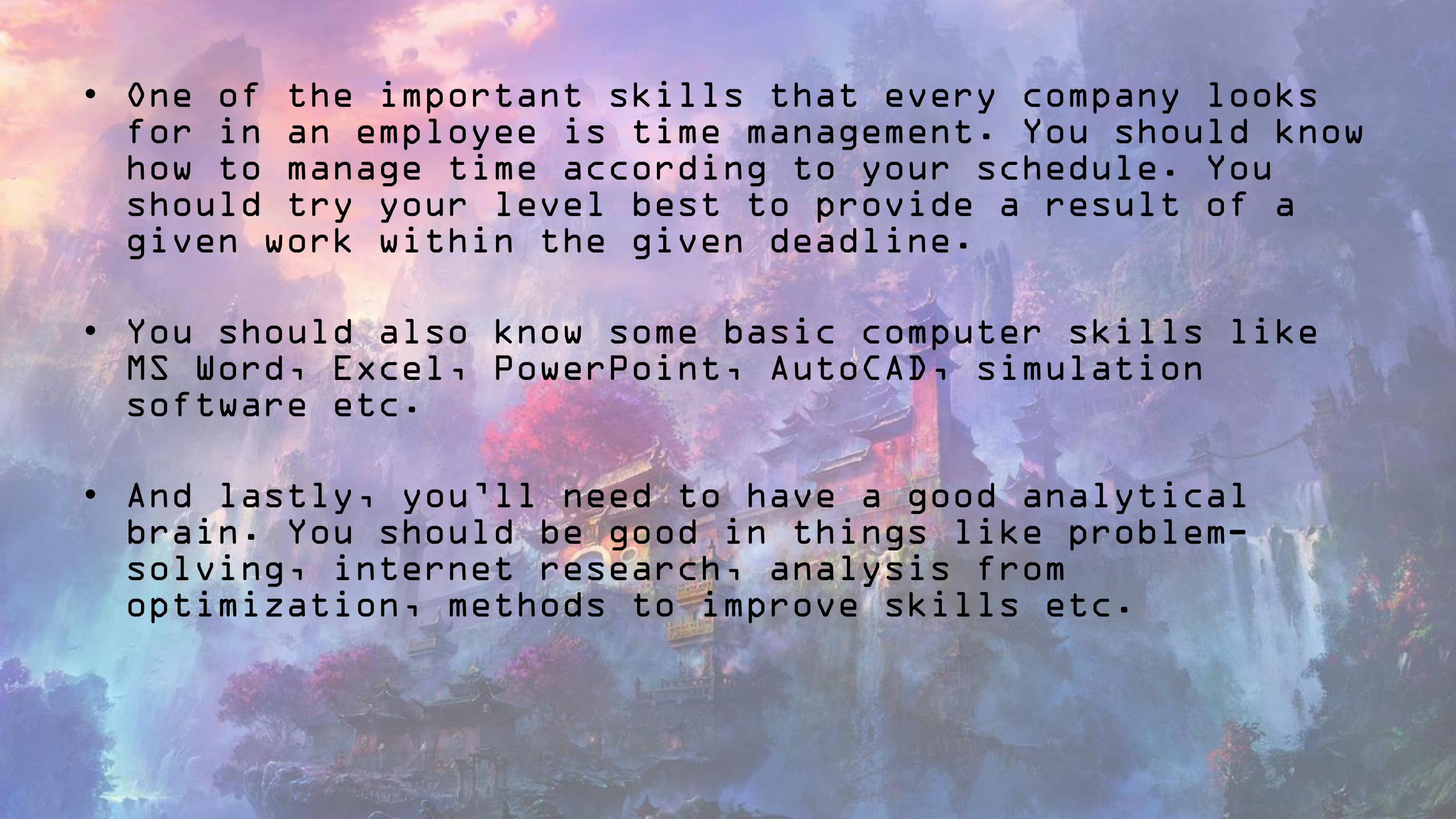
- This certification shows that you understand the main principles of quality control for both products and services. Candidates require at least two years of work experience and the exam consists of 175 multiple-choice questions, out of which 160 are scored. The certification requires renewal every three years.



# Required Skillset for Industrial Engineering

- Skills required to work in Industrial Engineering sector are:
- You should have basic knowledge about ISE, which means Identity Service Engine. You should know how to apply ISE to various fields like production control, process analysis, statistical report, product handling etc.
- You should have a strong knowledge of some basic Engineering concepts like material strength, thermodynamics, machine learning, applied physics etc.
- You should have good communication skill. This will help you work efficiently as an individual and also as a team. You should have the ability to describe an idea to others in a team without any errors.



- 
- The background of the slide is a colorful, stylized illustration of a traditional Chinese landscape. It features a temple complex with multiple pavilions and a large pagoda, situated on a rocky outcrop. A waterfall cascades down the right side of the scene. The sky is filled with soft, colorful clouds in shades of purple, blue, and orange, suggesting a sunrise or sunset. The overall aesthetic is reminiscent of traditional Chinese ink wash painting but with a more vibrant, digital color palette.
- One of the important skills that every company looks for in an employee is time management. You should know how to manage time according to your schedule. You should try your level best to provide a result of a given work within the given deadline.
  - You should also know some basic computer skills like MS Word, Excel, PowerPoint, AutoCAD, simulation software etc.
  - And lastly, you'll need to have a good analytical brain. You should be good in things like problem-solving, internet research, analysis from optimization, methods to improve skills etc.



# Soft Skills

- Soft skills are must have traits for any employee in any work sector, be it in the Industrial sector, the Public sector, the Private sector etc.
- Some soft skills that can be useful to any employee in the Industrial Sector are:
  - a) Problem-Solving Skills
  - b) Emotional Intelligence
  - c) Leadership Skills
  - d) Strong Work Ethic
  - e) Teamwork
  - f) Communication Skills
  - g) Adaptability





# Job Profiles Offered After Completing Industrial Engineering Course

<b>Job Profile</b>	<b>Job Description</b>
Quality Control Manager	The work of a quality control manager is to check that the quality of the products manufactured by a company is good and it meets the requirements so that it can be distributed in the market for the consumers.
Project Manager	The work of a project manager is to lead a team of people and execute a project given to them in the most efficient way possible.
Management Consultant	The work of a management consultant is to solve business problems, improve business performance and maximise growth.
Manufacturing Engineer	The work of a manufacturing engineer is to design, develop and operate the production of various materials for the industry.
Logistics Manager	The work of a logistics manager is to plan, coordinate and monitor logistics operations such as transportations, analysing supply chain etc.
Operations Manager	The work of an operation manager is to analyse and carry out various operations that might lead to the betterment of the company. These operations might vary from recruiting people to organising training and business meetings.
Business Process Engineer	The work of a business process engineer is to study the current business process of a company and come up with new ways and techniques to improve the business growth in a company via more productivity, efficiency etc.
Human Resource Manager	The work of a human resource manager is to manage people, hire people in a strategic way that leads to business gain and more efficiency of the company
Scheduling and Planning Manager	The work of a scheduling and planning manager is to schedule work for different people in a team and plan their course of action to make a product.
Business System Analyst	The work of a business system analyst is to provide technological guidelines, which refers to the type of computer technologies required in a company to work efficiently.
Health and Safety Manager	The work of a health and safety manager is to monitor health and safety in a workplace and overcome any risks and hazards that might occur.
Plant Supervisor	The work of a plant supervisor is to coordinate and monitor all the work that is going on in a factory plant.



<b>Job Profile</b>	<b>Average Annual Income</b>
Quality Control Manager	Rs. 3 - 5.7 Lakhs
Project Manager	Rs. 10 - 30 Lakhs
Management Consultant	Rs. 11 - 20 Lakhs
Manufacturing Engineer	Rs. 4 - 16 Lakhs
Logistics Manager	Rs. 4.8 - 18.5 Lakhs
Operations Manager	Rs. 10 - 16 Lakhs
Business Process Engineer	Rs. 4 - 8 Lakhs
Human Resource Manager	Rs. 12 - 19 Lakhs
Scheduling and Planning Manager	Rs. 10 - 18 Lakhs
Business System Analyst	Rs. 8 - 16 Lakhs
Health and Safety Manager	Rs. 6 - 10 Lakhs
Plant Supervisor	Rs. 4 - 12 Lakh

## Average Salary In Industrial Engineering Field

Average salary of  
an Industrial  
Engineer is  
roughly  
Rs.29,200.



# Creative Segment

- 2 job profiles that I think will come into existence in the near future are:
- Machinery Expert
- Internal Analyst



# Machinery Expert

- I believe that this job profile will refer to the person who is in-charge of the robots or the AI System that will carry out the functioning's of the industry and help in production.
- This person will solely be responsible for the management of the mechanical help in the industry.



# Internal Analyst

- This person would probably be in-charge of keeping the records of the robots that are currently helping in the processes of the industry.
- This person would keep an account of all the activities done by the automatons and their maintenance record etc.



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