The Institution of Engineers (India)

MUZAFFARPUR LOCAL CENTRE

M.I.T., MUZAFFARPUR-842 003

2021

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52nd ANNUAL GENERAL MEETING

SOUVENIR

WEBINAR

ON

"Role of industrial Revolution for Engineers"

30th October 2021

THE INSTITUTION OF ENGINEERS (INDIA)
MUZAFFARPUR LOCAL CENTRE
(FOUNDED 1969)

MUZAFFARPUR INSTITUTE OF TECHNOLOGY
MUZAFFARPUR – 842003 (BIHAR)

Dr. Anjani Kumar Mishra, FIE
Chairman

Er. Narendra Kumar Jha, MIE
Honorary Secretary

The Institution of Engineers (India)
Muzaffarpur Local Centre
M.I.T., Muzaffarpur-842003 (BIHAR)
2021

ROLL OF HONOUR

YEAR	CHAIRMAN	HON. SECRETARY	JOINT HON. SEC.
1969-70	Er. K.P. Agrawal	Prof. I.C. Nayak	
1970-70	Er. R.P. Agrawal	Er. K.R. Rajagopal	
1971-72	Er. S. Prasad	Er. K.R. Rajagopal	
1972-73	Er. S. Prasad	Er. K.R. Rjagopal	
1973-74	Er. K.R. Rajagopal	Er. R.P. Jayaswal	
1974-75	Er. M.A. Samad	Er. R.P. Jayaswal	
1975-76	Er. M.A. Samad	Er. R.P. Jayaswal	
1976-77	Dr.B.P Sinha	Er. J.S Prasad	Er. J.S. Prasad
1977-78	Dr. B.P.Sinha	Er. K. Prasad	Dr. K. Prasad
1978-79	Er. R.K. Sinha	Dr. K. Prasad	
1979-80	Prof. R.P. Sinha	Er. B.B. Prasad	
1980-81	Prof. R.P. Sinha	Er. B.B. Prasad	
		Er. J.S. Prasad	
1981-82	Prof. R.P.Sinha	Er. I.S. Prasad	
1982-83	Er. G.M. Sahai	Er. I.S. Prasad	
1983-84	Prof. R.K. Garg	Er. B.P. Sahani'Arun'	Er. M. Qutuba
1984-85	Er. Y.P. Sharma	Er. B.P. Sahani'Arun'	
1985-86	Er. Y.P Sharma	Er. B.P. Sahani'Arun'	
1986-87	Dr. U.N. Sharan	Er. B.P. Sahani'Arun'	
1987-88	Dr. U.N. Sharan	Dr. H.P. Sinha	
	Dr. M.K. P. Mishra	Dr. H.P. Sinha	
1988-89	Dr.B.B. Prasad	Prof. S.N.P. Srivastava	
1989-90	Dr. B.B. Prasad	Prof. S.N.P. Srivastava	
1990-91	Prof. B.P. Sahani'Arun'	Prof. S.N.P. Srivastava	Prof. A.K. Nathani
1991-92	prof. B.P. Sahani'Arun'	Dr.H.P. Sinha	
1992-93	Er. S.K.P. Verma	Dr. H.P. Sinha	
1993-94	Er. S.K.P Verma	Dr. R.C Das 'Vikal'	
1994-95	Dr. U.C. Verma	Dr. R.C. Das 'Vikal'	
1995-96	Dr. U.C. Verma	Dr. R.C. Das 'Vikal'	
1996-97	Dr. U.C. Verma	Dr. R.C. Das 'Vikal'	
1997-98	Dr. R.C. Das 'Vikal'	Dr. B.K. Prasad	
1998-99	Dr. R.C. Das 'Vikal'	Dr. B.K. Prasad	
	Er. U. R. Sinha	Dr. B. K. Prasad	
1999-2K	Prof. Bhola Sahu	Dr. B. K. Prasad	
2K-2K1	Prof. Bhola Sahu	Dr. B.K. Prasad	
2K1-2K2	Dr. B.K. Prasad	Dr. Achintya	
2K2-2K3	Dr. B.K. Prasad	Dr. Achintya	
2K3-2K4	Dr. R. Pandey	Prof. Suresh Kumar	
2K4-2K6	Er. V.N. Sahu	Dr. A. K. Rai	
2K6-2K8	Dr. Achintya	Prof. C.B. Rai	
2K8-2K10	Dr. Suresh Kumar	Dr. Sunil Kumar	
2k10-2K12	Dr. A. K. Rai	Er. S.K Tiwary	
2K12-2K14	Prof. C.B.Rai	Er. Jayant Ajat Shatru	
2K14-2K16	Dr. Sunil Kumar	Er. A.P Singh	
2K16-2K18	Er. S.K. Mishra	Dr. Rajeev Ranjan Kumar	
2K18-2K20	Dr. Anjani Kumar Mishra	Er. Narendra Kumar	
2K20-2K21	Dr. Anjani Kumar Mishra	Er. Narendra Kumar	

Dear Corporate Members/Faculty Members/Engineering professionals and students

The 52nd Annual General Body Meeting of The Institution of Engineers (India), Muzaffarpur Local Centre is going to be held on the 30 October 2021. A Webinar will also be organised on the occasion on the topic **“Role of industrial Revolution for Engineers"**

Corporate Members, Faculty Members and all Engineering professionals are invited to participate in The Celebration and also requested to contribute paper for the webinar by 25 October 2021. Your Paper will be printed in the E-Souvenir to be published on the occasion. In order to maintain the schedule, it has been decided that individual paper should not contain more than **1000 (One thousand)** words. The paper to be presented in the Souvenir Should be sent to the Office on e -mail no. **muzaffarpurlc@ieindia.org**

I requested you on behalf the Executive Committee kindly to attend the webinar.

<u>Webinar Session</u>

BUSINESS MEETING OF CORPORATE MEMBERS	-	3.00 PM to 3.30 PM
WEBINAR	-	3.30 PM to 4.30 PM

Yours faithfully

Honorary Secretary

<u>AGENDA OF MEETING ON 30.10.2021</u>

1. Welcome Address by the Chairman
2. Presentation of Annual Financial Report for 2020-21
3. Discussion on The Annual Report
4. Webinar session
5. Chairman’s Address
6. Vote of thanks by the Hon. Secretary

WELCOME ADDRESS BY DR. ANJANI KUMAR MISHRA

THE INSTITUTION OF ENGINEERS (INDIA), MUZAFFARPUR LOCAL CENTRE

Respected President, Chief Guest, Dignitaries, Corporate Members and Engineers.

It is a matter of great pleasure for me to welcome the chief guest dignitaries and engineers at the 52nd Annual General Meeting of the Institution of Engineers (India), Muzaffarpur Local Centre, on this pious occasion afternoon.

On this auspicious day webinar on the topic **“Role of industrial Revolution for Engineers"** Has also been arranged. Such webinar are arranged each year in M.I.T., Muzaffarpur for interaction between fellow engineers. Such discussions have become more relevant in order to reshape Bihar. We hope such discussions are very useful for individuals as well as the whole society.

I have pleasure to call upon all the honorable members to take active interest in the working of the Centre, suggest improvements and encourage us by enrolling themselves as fresh members. This is also the need of the hour to strengthen the engineering fraternity.
With these words, I again extend big welcome to you all to make programme a success.

CHAIRMAN

THE INSTITUTION OF ENGINEERS (INDIA)
MUZAFFARPUR LOCAL CENTRE
M.I.T., MUZAFFARPUR-842003
Proceeding of 51st Annual General Meeting

Proceeding of Online 51st Annual General Meeting of The Institution of Engineers (I) Muzaffarpur Local Centre of, held on 18.04.2021

The Online 51st Annual General Meeting of The Institution of Engineers (India), Muzaffarpur Local Centre, M.I.T., Muzaffarpur was held on 18.04.2021 in two Session.

In the First session Business meeting of the corporate members was held with the welcome address by the Chairman Dr. Anjani Kumar Mishra, Principal, Govt. Polytechnic, Gopalganj. Thereafter Er. Narendra Kumar Jha, Honorary Secretary of the Local Centre read the proceeding of the 50th Annual General Meeting and also presented the 51st Annual General Report based on the activities and facilities that was all through available during the period. He also presented the Income and Expenditure with Balance Sheet for the Financial year 2019-20 duly Audited by the Charted Accountants followed by the Auditors Reports before the house, which was passed by the house after brief discussion.

Then the matter of appointment of Auditors for the financial year 2020-21 was also discussed in the house with fixation their remuneration.

The house authorized the Executive Committee of the Local Centre to appoint Auditors and fix their remuneration in their next meeting.

Thereafter webinar session started on the topic **"Preserve human heritage in 21st Century"** , Er. Anjani Kumar Srivastava, FIE, of the Local Centre was elected president unanimously for the session. Dr. Shivesh Kumar, Assst. Professor, L.N. College Bhagwanpur, Vaishali was the Chief Guest. The session was started with the lecture of the Chief Guest on the topic in which he told that protection of the human heritage is most essential. There are so many Human Heritages are present in Muzaffarpur and its nearby areas. Its protection is most important. In the world history the name of Muzaffarpur and Vaishali is shown for the heritage. World's first democracy was situated in vaishali. Not only this more other things also available here.

Then Er. Anjani Kumar Srivastava his presidential speech said that April 18 is celebrated on World Heritage Day every year. Preserving our heritage in India is critical for cultural and economic strength of this nation. India has a rich heritage that incorporation a storehouse of archeological fortunes and mind blowing moments. The cultural history in heritage movement's origination form a memorable past of old civilization. The Tajmahal, Agra fort and fathehpur sikri in Agra, The Konark Sun Temple, Khajuraho Temple etc are a portion of the monuments. In UNESCO world Heritage list of India is at 5th Place. He discussed the matter very nicely and it's different.

Er. Rajiv Ranjan Kumar, Er. Nilmani Srivastva, Er. Krishna Kanhai, Er. Prabhat Ranajan Bhardwaj, Er. Rahul Kumar alongwith many members were present in the programme.

The Programme was anchored by Er. Lok Ranjan and ended with vots of thanks by Er. Narendra Kumar Jha, Honorary Secretary, of the Local Centre.

Honorary Secretary

THE INSTITUTION OF ENGINEERS (INDIA)
MUZAFFARPUR LOCAL CENTRE
M.I.T., MUZAFFARPUR-842003

THE 52nd ANNUAL REPORT

I feel pleasure to present the 52nd Annual report of the Muzaffarpur Local Centre of the Institution of Engineers (India) before the august body of the corporate members on the 30 October 2021.

In order to popularize the functioning of this local Centre, "Use of artificial intelligence for flood Control" 13th December 2020, 10th January 2021 "Role of Yoga in stress Management for professionals" 28th February 2021 "Microsoft machine learning tool" World Telecommunication day 17.05.2021, World Environment 05.06.2021 day, Royal Charter Day 09.09.2021 and Engineer's day 15th September 2021 were celebrated respectively. A number of eminent engineers and distinguished faculty members of M.I.T., Muzaffarpur were present. Student took active part in webinar held during these occasions.

Committee Meeting

During the period 30.11.2020 to this date Ninth online committee meeting were held on , 25.12.2020,30.01.2021,14.03.2021,09.05.2021,17.06.2021,31.07.2021,30.08.2021,26.09.2021.

Financial status

The duly audited statement of accounts for the period from April 2020 to March 2021 is appended with the report for the kind perusal of the members

Library facility

The local Centre library is frequently utilized by ST/T members attached to this local Centre. There is good collection of textbooks and reference books. Returnable sum of Rs.50/- is realized from each members interested in using library facilities. The books are issued for a period of 15 days. The corporate members are also entitled to avail the library facility without any Security deposit.

Membership

The strength of membership of the local Centre is as follows:-

	2019-2020	**2020-2021**	**Growth**
FIE	55	90	35
MIE	195	282	87
AMIE	789	1427	638

We are trying to increase student's activities in the Institution by arranging more debates, educational discussions, installation of students chapter is also on cards. We solicit the cooperation of Honorable Principal, M.I.T., Muzaffarpur and faculty members of M.I.T., Muzaffarpur in our programme.

The local Centre committee expresses sincere gratitude to all members of M.I.T., family in general and Principal M.I.T in particular for extending all possible facilities to the local Centre. It is very much hoped that the local Centre committee would continue to enjoy enhanced cooperation from all concerned.

With these words, I again extend big welcome to you all to make programme a success.

Thanks.

Er. Narendra Kumar Jha
Honorary Secretary

Singh & Thakur
Chartered Accountants

We have examined the attached Balance Sheet of **THE INSTITUTE OF ENGINEERS (INDIA) MUZAFFARPUR LOCAL CENTRE** from 01/04/2020 to 31/03/2021 & the related Income & Expenditure Account on the said date.

These financial statements are the responsibility of the THE INSTITUTE OF ENGINEERS (INDIA) MUZAFFARPUR LOCAL CENTRE management. Our responsibility is to express an opinion on these financial statements based on our audit. We conducted our audit in accordance with generally accepted auditing standards in India. These standards require that we plan and perform the audit to obtain reasonable assurance whether the financial statements are prepared, in all material respects, in accordance with an identified financial reporting framework and are free of material misstatements. An audit includes, examining the evidence supporting the amounts and disclosures in the financial statements. An audit also includes assessing the accounting principles used and significant estimates made by management, as well as evaluating the overall financial statements. We believe that our audit provides a reasonable basis for our opinion.

On the basis of the information and explanation given to us, we are of the opinion that:

(a) Balance Sheet gives a true and fair view of the state of affairs of **THE INSTITUTE OF ENGINEERS (INDIA) MUZAFFARPUR LOCAL CENTRE**, as at 01/04/2020 To 31/03/2021; and

(b) Income & Expenditure Account gives a true and fair view of the results of operation of **THE INSTITUTE OF ENGINEERS (INDIA) MUZAFFARPUR LOCAL CENTRE** for the year ended on the date stated above.

For **SINGH & THAKUR**
Chartered Accountants
FRN. 024623N

SINGH & THAKUR CHARTERED ACCOUNTANTS FRN-024623N

(CHANDAN THAKUR)
Proprietor
M. No. 523869
UDIN- 21523869AAAAGS5633

Place: Muzaffarpur
Date: 30.06.2021

H.O. : Speaker Road | Nayatola | Muzaffarpur (Bihar) - 842001
B.O. : Hotel Umang | Kiran Chowk | Sitamarhi (Bihar) - 843301

THE INSTITUTION OF ENGINEERS (INDIA)
Muzaffarpur Local Centre
Balance Sheet as at 31st March 2021

ANNEXURE-1 (Page1 of 7)

31st March 2020 Rs.	LIABILITIES	Schedules	31st March 2021 Rs.	31st March 2020 Rs.	ASSETS	Schedules	31st March 2021 Rs.
	Reserve & Surplus	7	-		Fixed Assets	1	1,80,212.36
					Investments : Long Term		
	Capital Reserve	8	4,621,277.25	-	Fixed Deposits with Banks	2	2,500,000.00
					Current Assets		
					Stock	3	-
	Earmarked Funds	9	-		Sundry Receivables	4	
					Cash & Bank Balances and short term Fixed Deposits with Banks	5	1,951,364.89
-	Current Liabilities & Provisions	10	10,300.00	-	Other Advances	6	-
					Interest Outstanding and accrued on Investments	2	-
-	TOTAL		4,631,577.25	-	TOTAL		4,631,577.25

Notes to Accounts 11

This is the Balance Sheet referred to in our report of even date.
For SINGH & THAKUR
CHARTERED ACCOUNTANTS
Firm Registration No. 024623N

Date : 30/06/2021

Place: Muzaffarpur

05/07/21
Name and Siganture
Honorary Secretary

Honorary Secretary
The Institution of Engrs.(I)
Muzaffarpur Local Centre
M.I.T. Muzaffarpur

Name and Signature
Chairman

Chairman
THE INSTITUTION OF ENGRS. (INDIA)
MUZAFFARPUR LOCAL CENTRE

(CHANDAN THAKUR)
PROPRIETOR
Membership No. 523869

SINGH & THAKUR
CA
FRN: 024623N
CHARTERED ACCOUNTANTS

THE INSTITUTION OF ENGINEERS (INDIA)
Income and Expenditure Account for the year ended 31st March 2021
Muzaffarpur Local Centre

ANNEXURE-1 (Page 2 of 7)

2019-2020		INCOME	RATIO		2020-2021		TOTAL
Research & Development	Education		R&D	EDU	Research & Development	Education	
Rs.	Rs.				Rs.	Rs.	Rs.
333,539	83,385	**Grant received from Head Quarter:**					
		For Manpower Grant	80	20	360,821	90,205	451,026
		For Sr/Jr Most Salaries					
		For Leave encashment					
		For Bonus/ Exgratia					
		For Staff Welfare Expenses					
		For Technical activities					
		For Seminars and Symposia					
		For National convention					
		For International Conference					
		For Council Meeting Grant					
		For Engineering Congress Grant					
0		For Election Grant					
		For Technical publications					
		For Jubilee celebration					
		For opening New centre					
		For Best Centre award					
		For procurement of hardware for election					
		For Examinations Expenses					
		For Convocation Grant					
	300	For Technician/students chapter					
197,158	49,289	For Annual Recurring Grant	80	20	209,635	52,409.00	262,044
		For Special Repairs Grant					
		For Land and Building Grant					
		For Non conventional energy Grant					
4,800	1,200	For Incentives	80	20	4,800	1,200.00	6,000
		For Special Grant					
		For reimbursement of TA/DA					
		For Miscellaneous Grant					
535,497	134,174	**Sub-Total (A)**			575,256	143,814.00	719,070
		Income Generated by Centre:					
		Receipts for National Convention of Division					
		Receipts from Seminars and Symposia					
		Receipts for Technical Activities					
		Sponsorship fees					
100		Donations & Development Charge	100	0	-	-	-
		Receipts for Continuing education					
		Receipts for Technicians' Chapter					
		Refresher Course Lecture					
		Advertisement					
		Interest from Investments & Bank Fixed Deposit					
49,634	12,409	Interest from Savings Bank Accounts	80	20	38,515	9,629	48,144
		Hall/Space rent					
		Rent received from guest house accomodations					
		Sale of Scrap					
		Miscellaneous Receipts					
		Liabilities no longer required written back					
		Sale of publication					
		Sale of Institution Ties and Badges					
49,734	12,409	**Sub-Total (B)**			38,515	9,629	48,144
585,231	146,583	**: GRAND TOTAL (A+B) :**			613,771	153,443	767,214

This is the Income and Expenditure Account referred to in our report of even date.

For SINGH & THAKUR
CHARTERED ACCOUNTANTS
Firm Registration No. 024623N

(CA. CHANDAN THAKUR)
Proprietor
Membership No. 523869
Date : 30/06/2021
Place: Muzaffarpur

SINGH & THAKUR CHARTERED ACCOUNTANTS FRN: 024623N

05/07/21
Name and Siganture
Honorary Secretary
Honorary Secretary
The Institution of Engrs. (I)
Muzaffarpur Local Centre
M.I.T. Muzaffarpur

Name and Signature
Chairman
5/7/
Chairman
THE INSTITUTION OF ENGRS. (INDIA)
MUZAFFARPUR LOCAL CENTRE

THE INSTITUTION OF ENGINEERS (INDIA)

Income and Expenditure Account for the year ended 31st March 2021

Muzaffarpur Local Centre

ANNEXURE-1 (Page 3 of 7)

2019 - 2020			RATIO		2020 - 2021		
Research & Development	Education	EXPENDITURE	R& D	EDU	Research & Development	Education	TOTAL
Rs.	Rs.		21%	79%	Rs.	Rs.	Rs.
		Salaries and Allowances, etc. to Permanent staff					
34,446	129,581	Salaries and Allowances, etc. to Temporary staff	22	78	39,422	139,767	179,189
		Staff welfare expenses					
		Direct Expenses for conducting Examination					
		Technical Publication					
-	-	Expenses for National Convention of Division					
-	-	Expenses for Seminars and Symposia					
48,190		Exp. Technical Activities (Engineers Day)	100	0	-		-
		Refresher Course Lecture					
		Expenses for Technicians' Chapter Activities					
		Expenses for Continuing education					
		Prize Awarded					
		Convocation Expenses					
		Expenses for Lectures					
16,689		Annual General Meeting Expenses	100	0	59,724		59,724
73,203	-	General Meeting Expenses	100	0	-		-
		Indian Engineering Congress Expenses					
		Council Meeting Expenses					
14,318		Committee Meeting Expenses	100	0	-		-
9,356	2,339	Data Procesing Exp. (Computer Exp.)	80	20	2,607	652	3,259
13,922	3,481	Printing and Stationery	80	20	504	126	630
2,072	518	Postage expenses	80	20	1,907	477	2,384
18,160	4,540	Office Eqiptment (Printer & R.O)	80	20	-	-	-
		Electricity Charges					
		Advertisement Expenses					
		Election Expenses					
260	65	Bank Charges	80	20	-	-	-
		Charges General					
17,293	4,323	Internet Expenses	80	20	951	238	1,189
		Rent, Rates and Taxes					
		Refreshment Expenses					
3,776	944	Statutory Audit Fees	80	20	5,192	1,298	6,490
		Other Auditors' Fees					
		Internal Audit Fees					
27,263	6,817	Misc. Expenses	80	20	7,633	1,908	9,541
-	-	Repairs and Maintenance on Buildings					
		Repairs and Maintenance on Others					
		Books and Periodicals					
		Travelling and Conveyance					
		TA/DA to Committee Members					
		Bad Debts written off					
		Fixed assets written off					
278,948	152,608	**Sub-Total (C)**			117,940	144,466	262,406
-	-	Excess of Income/exp. over Exp./income [Surplus/(Deficit)] [(A+B) - C = D]					
		: GRAND TOTAL (C + D) :					

This is the Income and Expenditure Account referred to in our report of even date.

For SINGH & THAKUR
CHARTERED ACCOUNTANTS
Firm Registration No. 024623N

(CA. CHANDAN THAKUR)
Proprietor
Membership No. 523869
Date : 30/06/2021
Place: Muzaffarpur

SINGH & THAKUR CHARTERED ACCOUNTANTS CA FRN: 024623N

Name and Signature
Honorary Secretary
Honorary Secretary
The Institution of Engrs.(I)
Muzaffarpur Local Centre
M.I.T. Muzaffarpur

Name and Signature
Chairman
Chairman
THE INSTITUTION OF ENGRS. (INDIA)
MUZAFFARPUR LOCAL CENTRE

Role of Industrial Revolution for Engineers

Dr. Anjani Kumar Mishra, FIE
Chairman, IEI,
Muzaffarpur Local Centre, Bihar

Er. Akash Kumar,
Lecturer (Civil Engineering),
Govt. Polytechnic Vaishali, Bihar

Abstract

Industrial Revolution is a term that describes present technological age. It is the fourth industrial era since the inception of the initial industrial revolution of the 18th century which began in Britain and spread to other parts of the world. It can be defined as gradual shift from agrarian economy to economy based on modern machines and manufacturing process involving technology. First revolution used water and steam power to mechanize production. Second Revolution used electric power for mass production. Third revolution used electronics and information technology to automate production. Now this fourth revolution is digital revolution which is the fusion of physical, digital and biological spheres of technology. It will bring smart technology and it is warmly welcomed by Prime Minster of India, who gave an institutional shape to it. It is an initiative of the World Economic Forum and, India becomes the fourth country to have such a center after US, Japan, and China. Engineers, scientists, Technocrats, Innovators played crucial roles in each of the revolution. Moreover Covid-19 pandemic gave an acceleration to the automation of things and introduction of artificial intelligence in different wings of industrial process.

Keywords: Revolution, Industry 4.0, Economy, Engineers 4.0.

Main Thrust

Engineers are working towards manufacturing automation and information exchange throughout manufacturing. Since population of India is very large, so data of consumers available are also very large and in order to compile such big data statistics move from computer automation to cyber physical machines and encompassing internet of things, big data analytics, cloud computing, Cognitive computing, machine learning, smart manufacturing robots, 3D Technology is necessary. It is our job as Engineers to take this initial innovation to our manufacturing, brought about by Industry 4.0 technology and shift it upward to the required range.

Impact of Industry 4.0

- Improvement in services and business model.
- Continuous productivity with real time feedback.
- Better resource utilization and sustainable development.
- It security, machine safety and better working conditions.

The best example of industrial revolution brought by latest technocrats would be processed artificial intelligence which has broken the distinction between the Man, The Machine and Intelligence. Impact of the revolution will be highly significant on India’s development and role of Engineers will be highly significant towards implementation of this revolution.

The most important question is “Where do Engineers Fit in?” in this revolution.

The short answer is everywhere. From creating machine components to perfecting signals and systems for Industry 4.0, engineers are the most valued workforce that has aided the build-up to the latest Industrial Revolution for years.
According to An Overview of Industry 4.0: Definition, Components and Government Initiatives, there's three main components where engineers play a substantial role including:

Horizontal integration: Here corporations cooperate and also compete with each other to drive efficient production systems. While firms could compete to get the biggest contracts, the value of their research and new developments should be shared within the engineering field.

Vertical integration: Basically, engineers should drive a highly flexible production line where hierarchal subsystems within that line are achieved.

Engineering integration: Here the previous two components are in place and there is a complete system that is recognized everywhere.

Challenges for India and Indian Engineers in this revolution process:

- Slow implementation of government policies.
- Lack of resources for Indian Engineers.
- Lack of strong internet connection in major part of India.
- Lack of training of existing workforce.
- Implementation of new education policy.
- Making the institution equipped with latest world class facility needed for industrial innovation.

From Industry 4.0 to Engineer 4.0

As Industry is going through revolution process, Engineers needs also to revolutionize itself. We must investigate, adapt and optimize ourselves. Engineering specialist in materials, biochemical, nanotechnology and robotics will become critically important to the industry in coming days as per report of world economic forum. This will have a tremendous impact on jobs and as per report over 7.1 million jobs could be lost through redundancy and automation. But on the other hand 2.1 million new jobs will be created, mostly in specialized areas such as computer and Mathematical or Architecture and Engineering and there will be demand for professionals in every field. So it's not only the industry is changing but also the nature of work is changing as new technology enables to work from anywhere and anytime. So Engineers needs also to up skill themselves and institution needs to train their workforce for the upcoming challenges. In developing country like India were economy is growing very fast this revolution will have a great impact on GDP if we train our young workforce in the right direction at appropriate time. Government will also have to make a rapid and fundamental change in their education system to prepare for the new labour market. If the government fails to do so it will have to cope with ever – growing unemployment and inequality and businesses with a shrinking consumer base. Upcoming Engineers have to be equipped with the requirements of tremendously changing manufacturing process. NEW EDUCATION POLICY should be formulated in such a way that role of Engineers and industrial revolution can fulfill each other requirements and demands. In order to be at the top of our game as engineers, as innovators, we must become early adopters, or risk being left behind in the future of making things.

Conclusion:

Engineers trained with latest technology can play a major role in alleviating poverty. Advanced and low-cost health care system can be established through the implementation of artificial Intelligence driven diagnostics, personalized treatment, early warning of potential pandemics, and imaging diagnostics, among others. Growing farmer's income by providing them with the latest technologies, improvement in crop yield through real-time advisory, advanced detection of pest attacks, and prediction of crop prices to inform sowing practices. All this will strengthen infrastructure and improve connectivity to the very last village of India. Advantage of Artificial intelligence can be used to empower and enable specially-abled people. Such innovations will improve ease of living and ease of doing business using smart technologies. Drone policy launched in India will play an important role in surveillance, security, traffic and mapping.

References:

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Role of Industrial Revolution for Engineers

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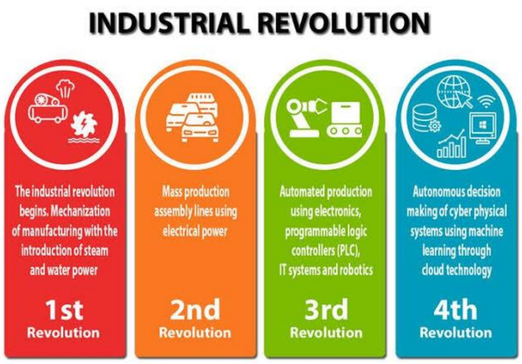
"No other revolution has made such a great impact as the Industrial Revolution has ever made--- Jawaharlal Nehru

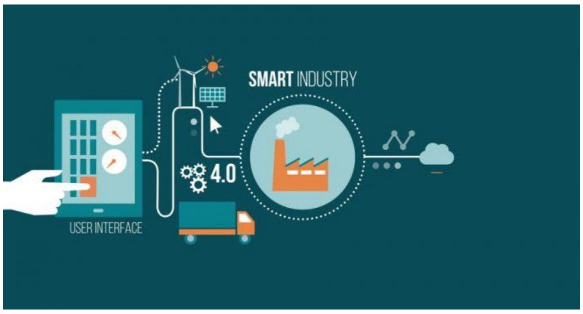
INTRODUCTION

We stand on the bank of a technological revolution that will fundamentally alter the way we live, work, and relate to one another. The role of the engineer is presently redefined by the rapid and very much disruptive emergence of the **Fourth Industrial Revolution.** The economy is on the verge of fourth industrial revolution. Driven by the internet, real and virtual world continue to converge towards an Internet of Things.



The **First** Industrial Revolution used water and steam power to mechanize production. The **Second** used electric power to create mass production. The **Third** used electronics and information technology to automate production. Now a **Fourth Industrial Revolution** also known as **Industry 4.0** is building on the Third , the digital Revolution that has been occurring since the middle of the last century. It is characterized by a fusion of technologies that is blurring the lines between the physical, digital and biological spheres. It is ushering in a new economic era, exposing new source of value and growth. New opportunities, businesses and markets can be created as a result of this new economy.

Thanks to intelligent systems and robotics, much of the work that is essentially 3D (dirty, dangerous, and difficult) can be taken over from humans, leaving them to pursue other creative activities to expand the industry. Fundamentally, the role of the engineer remains the same, which is to provide technological solutions to issues and problems faced in the society. On top of mastering essential knowledge and skills in their chosen disciplines, they should be creative and critical thinkers. They must also be able to evolve and change to fit with the needs and demands of industry trends.



In the future, it would no longer just be about solving problems for components; instead, the focus will be on intersectionality, by way of overviewing and connecting systems. Engineering will be about connecting machines and assembly lines together through cloud technology. Engineers need to master the essential knowledge, ensuring that their skills remain current. Being literate in computing and coding, in particular, improves future career prospects drastically. Mastering the key enabling technologies is becoming an essential skill today for future engineers, who will be able to apply them and create solutions for complex problems in their disciplines. It is becoming as important as mathematics, design and communication skills.

Challenges and opportunities

Like the revolutions that preceded it, the Fourth Industrial Revolution has the potential to raise global income levels and improve the quality of life for populations around the world. To date, those who have gained the most from it have been consumers able to afford and access the digital world; technology has made possible new products and services that increase the efficiency and pleasure of our personal lives. Ordering a cab, booking a flight, buying a product, making a payment, listening to music, watching a film, or playing a game--- any of these can now be done remotely.

In the future, technological innovation will also lead to a supply side miracle, with long term gains in efficiency and productivity. Transportation and communication costs will drop, logistics and global supply chains will become more effective, and the cost of trade will diminish, all of which will open new markets and drive economic growth.

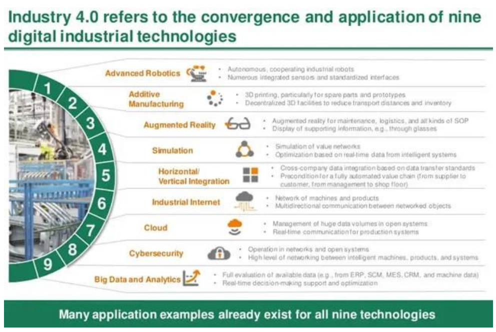
At the same time , the revolution could yield greater inequality, particularly in its potential to disrupt labour markets. As automation substitutes for labour across the entire economy, the net displacement of workers by machines might exacerbate the gap between returns to capital and returns to labour. On the other hand, it is also possible that the displacement of workers by technology will, in aggregate, result in a net increase in safe and rewarding jobs. It can not be saidat this point which scenario is likely to emerge, and history suggests that the outcome is likely to be some combination of the two.

Benefits of Industry 4.0

- **Enhanced productivity through optimization and automation**
- **Real- time data for a real-time supply chain in a real-time economy**
- **Higher business continuity through advanced maintenance and monitoring possibilities**
- **Better quality products: real-time monitoring, IoT-enabled quality improvement and robots**
- **Better working conditions and sustainability**
- **Personalization and customization for the new consumer**
- **Improved agility**
- **The development of innovative capabilities and new revenue models**

Industry 4.0 is basically a transition that is currently taking place. Most engineers expect the fourth industrial revolution to involve more optimization than invention. It will definitely have an effect on engineering.

Engineering graduates can get involved in the nine pillars within Industry 4.0



1. **Big data**
2. **Augmented reality**
3. **Simulation**
4. **Internet of Things (IOT)**
5. **System integration**
6. **Additive manufacturing(3 D printing)**
7. **Autonomous system**
8. **Cloud computing**
9. **Cybersecurity**

Internet of Things

- Analytics and Data: through the use of IoT, engineers will be able to capture, analyse and store data on every part of production. All the way from design to production they will be able to understand the entire process with ease.
- Engineering Simulations: this model relies solely on VR (Virtual Reality) which helps create realistic holograms or images. These holograms and

images eventually fasten product design, reduce time spend on marketing and also reduce iterations.

- Additive Manufacturing: 4D and 3D printing which were previously unimaginable can now be created in even new materials. These allow experts to design products that were previously difficult to create using traditional methods.

IoT data can be used to effectively optimize the manufacturing process. This can be done through engineering process. Automation and robotics which are key aspects of the industry 4.0 will be in most of manufacturing equipment in the form of manufacturing features. With a new generation of 3D printing, for example, people are now able to manufacture a turbine blade or a complex structure like a single turbine engine. With big data, Optimisation, and decentralised facilities, manufacturing can be open, on demand, low cost, short cycle, high yield, among others. Technology will definitely make a great impact on the manufacturing industry.

CONCLUSION

The Industrial Revolution was another one of those extraordinary jumps forward in the story of civilization. The Fourth Industrial Revolution is creating a demand for new skills and new competencies. More than 30 percent of the global population now uses social media platforms to connect, learn and share information. On the whole, there are four main effects that the Fourth Industrial Revolution has on business-on customer expectations, on product enhancement, on collaborative innovation, and on organisational forms. Having knowledge of important theories and practical cues by heart is not enough for a engineer to excel at workplace. It is also important for students to get involved in activities, to develop and sharpen their soft skills. Engineers should think outside – the –box, and develop solutions to solve real time development problems.

Ultimately, it’s about cultivating their ability to work not only in international environments but also in a multiracial, multicultural settings society. They need to manage projects, people and relations, as well as navigate crises and be sensitive to the needs of other people. How do you deal with people from different cultures who have different needs and habits? These are some questions which need to be addressed in an inclusive and engaging way. Engineers must have aspirations to contribute to society and not be afraid to take up leadership roles to drive the change for a better world.

“Every industrial revolution brings along a learning revolution”— Alexander De Croo

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About the Author

Anjani Kumar Srivastava has graduated with distinction in Mechanical Engineering from MIT, Muzaffarpur in year 1979. He was Teacher Fellow at BIT Sindri before joining Hindustan Aeronautics Ltd. as GET in year 1980. He has superannuated as DGM (HAL) Lucknow in year 2017. He is Fellow of the Institution of Engineers (India) and life member of Aeronautical Society of India. His papers have been published on many occasions in seminar, conferences etc.

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Role of industrial Revolution for Engineers

Er. Lok Ranjan
Er. Krishna Kanhai

The Industrial Revolution (1750–1850) brought some of the biggest and fastest changes in human history. It began in Great Britain. Then, it spread to other European countries and the United States. Many new machines were first introduced during this period. People's everyday lives were greatly transformed. Below are some of the key changes.

Agriculture

Eighteenth-century Britain saw a major increase in agricultural productivity. Farms grew more crops than ever before. New inventions were partly responsible. The seed drill is one important example. Farmers also learned better farming methods. New kinds of crops were developed as well. The result of all this was far bigger harvests. In turn, that led to a quickly growing **population.**

Farming became much more large-scale during these years. Land long open to all became private property. Small peasant farmers began struggling. Many were forced to move to the cities. Often, they became factory workers.

Energy

By the 1500s, England had lost many of its forests. This led to a shortage of wood for fuel. Coal then became a new fuel. By the late 1600s, England had largely switched to coal. The coal-fired steam engine was soon developed. It became the key technology of the Industrial **Revolution.**

In preindustrial Europe, water power was widely used as a source of energy. By the late 1700s, however, steam engines had been perfected. Steam power soon replaced water power. It became the key power supply.

The steam engine powered factory work. It also freed manufacturers from the need to build their factories near water. Large new factories were built in cities. They turned many cities into industrial centers.

Metallurgy

Many valuable metals can be found in rock. Rock containing metal is called ore. Metallurgy involves extracting, or removing, that metal. The metal is separated out through heating and melting, or smelting. Metal heated to the melting point is called molten. Metallurgy also involves the shaping of metal.

Wood was long used to power the smelting process. That changed during the Industrial Revolution. Metallurgists switched to coal. The new fuel turned out to be highly useful. It allowed for much greater iron production. Iron is one of the strongest materials.

There were other advances as well. One was a new way of stirring molten iron. It made it possible to produce larger amounts of wrought iron. Wrought iron is very malleable, or moldable. It is useful for making machinery.

Textiles

Textiles were key to Britain's economic growth between 1750 and 1850. Cotton was the most important of these fabrics. Cotton production had long been a small-scale business. People wove and spun cloth in their homes. Most of these workers lived in small villages. During the years of the Industrial Revolution, that changed. Cotton production turned into a large, factory-based business. Machines took over much of the work. More cloth than ever before was produced.

Several new inventions greatly increased productivity in the textile industry. They included the spinning jenny, the spinning mule, the cotton gin, and the power loom. Steam power was also very important. It sped up the production of textiles. It was used to run power looms and other machines.

Chemicals

The chemical industry also developed very quickly during these years. It arose partly to meet the demand for better bleaches. These were used to whiten cloth. Soon, many other valuable chemicals were being developed.

Transportation

Huge increases in the production of goods had many ripple effects. One was a need for better transportation systems. Producers needed faster ways to get their goods to market. Because of this, better roads were built. New canals were dug. Soon, it became far easier to move goods and people around the world.

The first steamboats appeared in the early 1800s. Steam-engine trains appeared soon after. Railways quickly spread across Europe and North America. They helped industrial societies grow even further.

Spinning and weaving

The creation of the following ingenious machines made possible the mass production of high-quality cotton and woolen thread and yarn and helped transform Great Britain into the world's leading manufacturer of textiles in the second half of the 18th century.

The spinning jenny. About 1764 James Hargreaves, a poor uneducated spinner and weaver living in Lancashire, England, conceived a new kind of spinning machine that would draw thread from eight spindles simultaneously instead of just one, as in the traditional spinning wheel. The idea reportedly occurred to him after his daughter Jenny accidentally knocked over the family's spinning wheel; the spindle continued to turn even as the machine lay on the floor, suggesting to Hargreaves that a single wheel could turn several spindles at once. He obtained a patent for the spinning jenny in 1770.

The water frame. So called because it was powered by a waterwheel, the water frame, patented in 1769 by Richard Arkwright, was the first fully automatic and continuously operating spinning machine. It produced stronger and greater quantities of thread than the spinning jenny did. Because of its size and power source, the water frame could not be housed in the homes of spinners, as earlier machines had been. Instead, it required a location in a large building near a fast-running stream. Arkwright and his partners built several such factories in the mountainous areas of Britain. Spinners, including child laborers, thereafter worked in ever-larger factories rather than in their homes.

The spinning mule. About 1779 Samuel Crompton invented the spinning mule, which he designed by combining features of the spinning jenny and the water frame. His machine was capable of producing fine as well as coarse yarn and made it possible for a single operator to work more than 1,000 spindles simultaneously. Unfortunately, Crompton, being poor, lacked the money to patent his idea. He was cheated out of his invention by a group of manufacturers who paid him much less than they had promised for the design. The spinning mule was eventually used in hundreds of factories throughout the British textile industry

The steam engine

Through its application in manufacturing and as a power source in ships and railway locomotives, the steam engine increased the productive capacity of factories and led to the great expansion of national and international transportation networks in the 19th century.

Watt's steam engine. In Britain in the 17th century, primitive steam engines were used to pump water out of mines. In 1765 Scottish inventor James Watt, building on earlier improvements, increased the efficiency of steam pumping engines by adding a separate condenser, and in 1781 he designed a machine to rotate a shaft rather than generate the up-and-down motion of a pump. With further improvements in the 1780s, Watt's engine became a primary power source in paper mills, flour mills, cotton mills, iron mills, distilleries, canals, and waterworks, making Watt a wealthy man.

The steam locomotive. British engineer Richard Trevithick is generally recognized as the inventor of the steam railway locomotive (1803), an application of the steam engine that Watt himself had once dismissed as impractical. Trevithick also adapted his engine to propel a barge by turning paddle wheels and to operate a dredger. Trevithick's engine, which generated greater power than Watt's by operating at higher pressures, soon became common in industrial applications in Britain, displacing Watt's less-efficient design. The first steam-powered locomotive to carry paying passengers was the Active (later renamed the Locomotion), designed by English engineer George Stephenson, which made its maiden run in 1825. For a new passenger railroad line between Liverpool and Manchester, completed in 1830, Stephenson and his son designed the Rocket, which achieved a speed of 36 miles (58 km) per hour.

Steamboats and steamships. Steamboats and other steamships were pioneered in France, Britain, and the United States in the late 18th and early 19th centuries. The first commercially successful paddle steamer, the North River Steamboat, designed by American engineer Robert Fulton, traveled up the Hudson River from New York City to Albany, New York, in 1807 at a speed of about 5 miles (8 km) per hour. Eventually, ever larger steamboats delivered cargo as well as passengers over hundreds of miles of inland waterways of the eastern and central United States, especially the Mississippi River. The first transoceanic voyage to employ steam power was completed in 1819 by the Savannah, an American sailing ship with an auxiliary steam-powered paddle. It sailed from Savannah, Georgia, to Liverpool in a little more than 27 days, though its paddle operated for only 85 hours of the voyage. By the second half of the 19th century, ever larger and faster steamships were regularly carrying passengers, cargo, and mail across the North Atlantic, a service dubbed "the Atlantic Ferry."

Harnessing electricity

In the early 19th century, scientists in Europe and the United States explored the relationship between electricity and magnetism, and their research soon led to practical applications of electromagnetic phenomena.

Electric generators and electric motors. In the 1820s and '30s British scientist Michael Faraday demonstrated experimentally that passing an electric current through a coil of wire between two poles of a magnet would cause the coil to turn, while turning a coil of wire between two poles of a magnet would generate an electric current in the coil (electromagnetic induction). The first phenomenon eventually became the basis of the electric motor, which converts electrical energy into mechanical energy, while the second eventually became the basis of the electric generator, or dynamo, which converts mechanical energy into electrical energy. Although both motors and generators underwent substantial improvements in the mid-19th century, their practical employment on a large scale depended on the later invention of other machines—namely, electrically powered trains and electric lighting.

Electric railways and tramways. The first electric railway, intended for use in urban mass transit, was demonstrated by German engineer Werner von Siemens in Berlin in 1879. By the early 20th century, electric railways were operating within and between several major cities in

Europe and the United States. The first electrified section of London's subway system, called the London Underground, began operation in 1890.

The incandescent lamp.In 1878–79 Joseph Wilson Swan in England and later Thomas Alva Edison in the United States independently invented a practical electric incandescent lamp, which produces continuous light by heating a filament with an electric current in a vacuum (or near vacuum). Both inventors applied for patents, and their legal wrangling ended only after they agreed to form a joint company in 1883. Edison has since been given most of the credit for the invention, because he also devised the power lines and other equipment necessary for a practical lighting system. During the next 50 years, electric incandescent lamps gradually replaced gas and kerosene lamps as the major form of artificial light in urban areas, though gas-lit street lamps persisted in Britain until the mid-20th century.

The telegraph and the telephone

Two inventions of the 19th century, the electric telegraph and the electric telephone, made reliable instantaneous communication over great distances possible for the first time. Their effects on commerce, diplomacy, military operations, journalism, and myriad aspects of everyday life were nearly immediate and proved to be long-lasting.

The telegraph. The first practical electric telegraph systems were created almost simultaneously in Britain and the United States in 1837. In the device developed by British inventors William Fothergill Cooke and Charles Wheatstone, needles on a mounting plate at a receiver pointed to specific letters or numbers when electric current passed through attached wires. American artist and inventor Samuel F.B. Morse created his own electric telegraph and, more famously, a universal code, since known as Morse Code, that could be used in any system of telegraphy. The code, consisting of a set of symbolic dots, dashes, and spaces, was soon adopted (in modified form to accommodate diacritics) throughout the world. A demonstration telegraph line between Washington, D.C., and Baltimore, Maryland, was completed in 1844. The first message sent on it was, "What hath God wrought!" Telegraph cables were first laid across the English Channel in 1851 and across the Atlantic Ocean in 1858. In the United States the spread of telegraphic communication through the growth of private telegraph companies such as Western Union aided the maintenance of law and order in the Western territories and the control of traffic on the railroads. What's more, it enabled the transmission of national and international news through wire services such as the Associated Press. In 1896 Italian physicist and inventor Guglielmo Marconi perfected a system of wireless telegraphy (radiotelegraphy) that had important military applications in the 20th century.

The telephone. In 1876 Scottish-born American scientist Alexander Graham Bell successfully demonstrated the telephone, which transmitted sound, including that of the human voice, by means of an electric current. Bell's device consisted of two sets of metallic reeds (membranes) and electromagnetic coils. Sound waves produced near one membrane caused it to vibrate at certain frequencies, which induced corresponding currents in the electromagnetic coil connected to it, and those currents then flowed to the other coil, which in turn caused the other membrane to vibrate at the same frequencies, reproducing the original sound waves. The first "telephone call" (successful electric transmission of intelligible human speech) took place between two rooms of Bell's Boston laboratory on March 10, 1876, when Bell summoned his assistant, Thomas Watson, with the famous words that Bell transcribed in his notes as "Mr. Watson—Come here—I want to see you." Initially the telephone was a curiosity or a toy for the rich, but by the mid-20th century it had become a common household instrument, billions of which were in use throughout the world.

The internal-combustion engine and the automobile

Among the most-consequential inventions of the late Industrial Revolution were the internal-combustion engine and, along with it, the gasoline-powered automobile. The automobile, which replaced the horse and carriage in Europe and the United States, offered greater freedom of travel for ordinary people, facilitated commercial links between urban and rural areas, influenced urban planning and the growth of large cities, and contributed to severe air-pollution problems in urban areas.

The internal-combustion engine. The internal-combustion engine generates work through the combustion inside the engine of a compressed mixture of oxidizer (air) and fuel, the hot gaseous products of combustion pushing against moving surfaces of the engine, such as a piston or a rotor. The first commercially successful internal-combustion engine, which used a mixture of coal gas and air, was constructed about 1859 by Belgian inventor Étienne Lenoir. Initially expensive to run and inefficient, it was significantly modified in 1878 by German engineer Nikolaus Otto, who introduced the four-stroke cycle of induction-compression-firing-exhaust. Because of their greater efficiency, durability, and ease of use, gas-powered engines based on Otto's design soon replaced steam engines in small industrial applications. The first gasoline-powered internal-combustion engine, also based on Otto's four-stroke design, was invented by German engineer Gottlieb Daimler in 1885. Soon afterward, in the early 1890s, another German engineer, Rudolf Diesel, constructed an internal-combustion engine (the diesel engine) that used heavy oil instead of gasoline and was more efficient than the Otto engine. It was widely used to power locomotives, heavy machinery, and submarines.
The automobile. Because of its efficiency and light weight, the gasoline-powered engine was ideal for light vehicular locomotion. The first motorcycle and motorcar powered by an internal-combustion engine were constructed by Daimler and Karl Benz, respectively, in 1885. By the 1890s a nascent industry in continental Europe and the United States was producing increasingly sophisticated automobiles for mostly wealthy customers. Less than 20 years later American industrialist Henry Ford perfected assembly-line methods of manufacturing to produce millions of automobiles (especially the Model T) and light trucks annually. The great economies of scale he achieved made automobile ownership affordable for Americans of average income, a major development in the history of transportation.

Role of Industrial Revolution for Engineers

Er. Prabhat Ranjan Bhardwaj

Industrial Revolution, in modern history, the process of change from an agrarian and handicraft economy to one dominated by industry and machine manufacturing. These technological changes introduced novel ways of working and living and fundamentally transformed society. This process began in Britain in the 18th century and from there spread to other parts of the world. Although used earlier by French writers, the term Industrial Revolution was first popularized by the English economic historian Arnold Toynbee (1852–83) to describe Britain's economic development from 1760 to 1840. Since Toynbee's time the term has been more broadly applied as a process of economic transformation than as a period of time in a particular setting. This explains why some areas, such as China and India, did not begin their first industrial revolutions until the 20th century, while others, such as the United States and western Europe, began undergoing "second" industrial revolutions by the late 19th century

A brief treatment of the Industrial Revolution follows. For full treatment of the Industrial Revolution as it occurred in Europe, see Europe, history of: The Industrial Revolution.

Characteristics of the Industrial Revolution

The main features involved in the Industrial Revolution were technological, socioeconomic, and cultural. The technological changes included the following: (1) the use of new basic materials, chiefly iron and steel, (2) the use of new energy sources, including both fuels and motive power, such as coal, the steam engine, electricity, petroleum, and the internal-combustion engine, (3) the invention of new machines, such as the spinning jenny and the power loom that permitted increased production with a smaller expenditure of human energy, (4) a new organization of work known as the factory system, which entailed increased division of labour and specialization of function, (5) important developments in transportation and communication, including the steam locomotive, steamship, automobile, airplane, telegraph, and radio, and (6) the increasing application of science to industry. These technological changes made possible a tremendously increased use of natural resources and the mass production of manufactured goods.

There were also many new developments in nonindustrial spheres, including the following: (1) agricultural improvements that made possible the provision of food for a larger nonagricultural population, (2) economic changes that resulted in a wider distribution of wealth, the decline of land as a source of wealth in the face of rising industrial production, and increased international trade, (3) political changes reflecting the shift in economic power, as well as newstate policies corresponding to the needs of an industrialized society, (4) sweeping social changes, including the growth of cities, the development of working-class movements, and the emergence of new patterns of authority, and (5) cultural transformations of a broad order. Workers acquired new and distinctive skills, and their relation to their tasks shifted; instead of being craftsmen working with hand tools, they became machine operators, subject to factory discipline. Finally, there was a psychological change: confidence in the ability to use resources and to master nature was heightened

The first Industrial Revolution

In the period 1760 to 1830 the Industrial Revolution was largely confined to Britain. Aware of their head start, the British forbade the export of machinery, skilled workers, and manufacturing techniques. The British monopoly could not last forever, especially since some Britons saw profitable industrial opportunities abroad, while continental European businessmen sought to lure British

know-how to their countries. Two Englishmen, William and John Cockerill, brought the Industrial Revolution to Belgium by developing machine shops at Liège (c. 1807), and Belgium became the first country in continental Europe to be transformed economically. Like its British progenitor, the Belgian Industrial Revolution centred in iron, coal, and textiles.

France was more slowly and less thoroughly industrialized than either Britain or Belgium. While Britain was establishing its industrial leadership, France was immersed in its Revolution, and the uncertain political situation discouraged large investments in industrial innovations. By 1848 France had become an industrial power, but, despite great growth under the Second Empire, it remained behind Britain.

Other European countries lagged far behind. Their bourgeoisie lacked the wealth, power, and opportunities of their British, French, and Belgian counterparts. Political conditions in the other nations also hindered industrial expansion. Germany, for example, despite vast resources of coal and iron, did not begin its industrial expansion until after national unity was achieved in 1870. Once begun, Germany's industrial production grew so rapidly that byte turn of the century that nation was outproducing Britain in steel and had become the world leader in the chemical industries. The rise of U.S. industrial power in the 19th and 20th centuries also far outstripped European efforts. And Japan too joined the Industrial Revolution with striking success.

The eastern European countries were behind early in the 20th century. It was not until the five-year plans that the Soviet Union became a major industrial power, telescoping into a few decades the industrialization that had taken a century and a half in Britain. The mid-20th century witnessed the spread of the Industrial Revolution into hitherto nonindustrialized areas such as China and India.

The technological and economic aspects of the Industrial Revolution brought about significant sociocultural changes. In its initial stages it seemed to deepen labourers' poverty and misery. Their employment and subsistence became dependent on costly means of production that few people could afford to own. Job security was lacking: workers were frequently displaced by technological improvements and a large labour pool. Lack of worker protections and regulations meant long work hoursfor miserable wages, living in unsanitary tenements, and exploitation and abuse in the workplace. But even as problems arose, so too did new ideas that aimed to address them. These ideas pushed innovations and regulations that provided people with more material conveniences while also enabling them to produce more, travel faster, and communicate more rapidly.

The second Industrial Revolution

Despite considerable overlapping with the "old," there was mounting evidence for a "new" Industrial Revolution in the late 19th and 20th centuries. In terms of basic materials, modern industry began to exploit many natural and synthetic resources not hitherto utilized: lighter metals, rare earths, new alloys, and synthetic products such as plastics, as well as new energy sources. Combined with these were developments in machines, tools, and computers that gave rise to the automatic factory. Although some segments of industry were almost completely mechanized in the early to mid-19th century, automatic operation, as distinct from the assembly line, first achieved major significance in the second half of the 20th century. Ownership of the means of production also underwent changes. The oligarchical ownership of the means of production that characterized the Industrial Revolution in the early to mid-19th century gave way to a wider distribution of ownership through purchase of common stocks by individuals and by institutions such as insurance companies. In the first half of the 20th century, many countries of Europe socialized basic sectors of their economies. There was also during that period a change in political theories: instead of the laissez-faire ideas that dominated the economic and social thought of the classical Industrial Revolution, governments generally moved into the social and economic realm to meet the needs of their more complex industrial societies. That trend was reversed in the United States and the United Kingdom beginning in the 1980s.

"Role of industrial Revolution for Engineers"

Er. Rahul Kumar

REVOLUTION: - The Industrial Revolution occupied the eighteenth and nineteenth centuries. It was a time of sweeping technological changes, most of them developed by engineers. A primary aspect of the Industrial Revolution is that machine power replaced human and animal power. For example, steam engines were developed to pump water from mines, replacing human or animal powered pumps.

It pulled production out of the inefficient processes when products were mostly made within people's homes, and into a modern age. The revolution paved the way for the efficiency and volume of the production lines we have today. In this blog, we shall look at how the industrial revolution became possible through great feats of engineering.

The Industrial Revolution was the transition to new manufacturing processes in Britain, continental Europe and the United States. transition included going from hand production methods to machines, new chemical manufacturing and iron production processes, the increasing use of steam power and water power, the development of machine tools and the rise of the mechanized factory system.

The Industrial Revolution also led to an unprecedented rise in the rate of population growth.

REQUIREMENT:-

Six factors facilitated industrialization:

- High levels of agricultural productivity to provide excess manpower and food;
- A pool of managerial and entrepreneurial skills;
- Available ports, rivers, canals and roads to cheaply move raw materials and outputs;
- Natural resources such as coal, iron and waterfalls; political stability and a legal system that supported business; and
- Financial capital available to invest. Once industrialization began in Great Britain, new factors can be added:
- The eagerness of British entrepreneurs to export industrial expertise and the willingness to import the process.

Characteristics of the Industrial Revolution

The main features involved in the Industrial Revolution were technological, socioeconomic, and cultural. The technological changes included the following:

(1) The use of new basic materials, chiefly iron and steel,

(2) the use of new energy sources, including both fuels and motive power, such as coal, the steam engine, electricity, petroleum, and the internal-combustion engine,

(3) The invention of new machines, such as the spinning jenny and the power loom that permitted increased production with a smaller expenditure of human energy,

(4) A new organization of work known as the factory system, which entailed increased division of labor and specialization of function,

(5) important developments in transportation and communication, including the steam locomotive, steamship, automobile, airplane, telegraph, and radio, and

(6) The increasing application of science to industry. These technological changes made possible a tremendously increased use of natural resources and the mass production of manufactured goods.

Advantages and Disadvantages of the Industrial Revolution

Advantages

- Advancements in production
- Growth in innovations and inventions
- Workers earned higher wages
- Improvements in transportation networks

Disadvantages

- Deplorable working conditions and child labor
- Unsanitary living conditions and pollution
- Food shortages

CAUSES

The Industrial Revolution began in Britain in the 1760s, largely with new developments in the textile industry.

Before that time making cloth was a slow process. After wool was gathered it had to be spun into yarn and then woven into fabric by hand. A machine called a spinning jenny, first conceived by James Hargreaves in 1764, made it easier to spin yarn. In 1793 Eli Whitney invented the cotton gin, which helped clean cotton after it was picked. These and other devices permitted increased production with a smaller expenditure of human energy.

Whitney also came up with the idea of interchangeable parts. Before a worker would spend a great deal of time making a single product by hand. Whitney discovered that a machine could make many copies of the individual parts of a product at once. The parts could then be assembled by any worker. This meant that many goods could be produced quickly.

Other changes that helped bring about the Industrial Revolution included the use of steam, and later of other kinds of power, in place of the muscles of human beings and of animals.

EFFECTS

The Industrial Revolution brought about sweeping changes in economic and social organization.

These changes included a wider distribution of wealth and increased international trade.

Managerial hierarchies also developed to oversee the division of labor.

By the late 1700s many people could no longer earn their living in the countryside. Increasingly, people moved from farms and villages into bigger towns and cities to find work in factories.

Cities grew larger, but they were often dirty, crowded, and unhealthy.

Machines greatly increased production. This meant that products were cheaper to make and also cheaper to buy. Many factory owners became rich.

Although the machines made work easier in some ways, factory work created many problems for the laborers. Factory employees did not earn much, and the work was often dangerous. Many worked 14 to 16 hours per day six days per week. Men, women, and even small children worked in factories.

So, The Industrial Revolution transformed economies that had been based on agriculture and handicrafts into economies based on large-scale industry, mechanized manufacturing, and the factory system. New machines, new power sources, and new ways of organizing work made existing industries more productive and efficient.

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MUZAFFARPUR LOCAL CENTRE

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2018-2021

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