



# **The Concept of Railway Design and Construction Research Institute**

Presented By Mr. Salman  
Noor Siddiqui

Pakistan Railways Suffered Loss 35 Billion Pak Rupees per Year, where many Countries Railway is profitable Organization.

In 2019 Net Sale of Pakistan Railways were 54.59 Billion Rupees and Expenditures were approx. 90 Billion Rupees, So Net Loss was 35 Billion Rupees.

Rivals are not just for hyper-nationalist face-offs, honorable nations also try to learn development keys from those ahead of them. Mere political and jingoistic rhetoric is not enough for prosperity and success.

### **Indian Railway:**

**Indian Railways (IR)** is India's national railway system operated by the Ministry of Railways. It is run by the government as a public good and manages the fourth largest railway network in the world by size, with a route length of 95,981-kilometre (59,640 mi) as of March 2019. About 61.62% of the routes are electrified with 25 kV 50 Hz AC electric traction while 33% of them are double or multi-tracked.

In the fiscal year ending 2019, IR carried 8.32 billion passengers and transported 1.29 billion tonnes of freight. In the fiscal year 2018–19, IR received revenue of 1.914 trillion Indian Rupees (US\$27 billion), consisting of 1.175 trillion Rupees (US\$16 billion) in freight revenue and 501.25 billion Rupees (US\$7.0 billion) in passenger revenue, with an operating ratio of 96.0 percent. Net Profit of Indian Railways in 2018 – 2019 was 377.4 Billion Indian Rupees or (615 Million US\$)

Indian Railway (IR) runs more than 20,000 passenger trains daily, on both long-distance and suburban routes, from 7,321 stations across India.

As of March 2019, Indian Railways' rolling stock consisted of 289,185 freight wagons, 55,258 passenger coaches and 12,108 Diesel and Electric locomotives

The government has committed to electrify its entire rail network by 2023, and become a "net-zero railway" by 2030.<sup>[10]</sup> So far Indian Railways has electrified 39,866 RKMs which accounts for about 63% of total Route Kilometers on Indian Railways. Presently about 57% of passenger traffic and about 65% of freight traffic is being carried on electric traction. It is planned to electrify all BG routes of IR by 2024.

### **Comparison between Pakistan Railways Vs Indian Railways**

Pakistan Railways Revenues were in 2018 – 2019 only 340.5 Million US\$ where Indian Railways were 27 Billion US\$, that means Indian Railway Revenues are **80 TIMES** more than Pakistan Railways.

Population wise India is 6.5 time Larger than Pakistan, if we Consider this Population Difference than Pakistan Railway Revenues should be 4.5 – 5 Billion Rupees that means as per our Population size as Compare to India our Railway Revenues are 14 – 15 time lower.

India has 12,108 Locomotives where Pakistan has only 293 Locomotives.

Pakistan Railways carrying 70 Million Passengers annually where Indian Railways Carrying 8.32 Billion Passengers Annually, that means Indian Railways Carrying 118 times more Passengers than Pakistan Railways. if we Consider this Population Difference of India than Pakistan Railway Should Carry 1.1 – 1.2 Billion Passengers that means as per our Population size as Compare to India our Railway Carrying 16 – 17 time less Passengers.

### **German Railway:**

Germany's "Deutsche Bahn" had Earned Revenues of 54.14 Billion US\$ in 2019, making it the World's Largest Railway Operator by Revenue.

### **French Railways:**

French State – owned Railway Company "The SNCF" had Earned Revenues of 43.12 Billion US\$ in 2019. It's Revenues Increased by 4.2% in 2019 due to Strong Growth in its Passengers & Freight Transport Volumes.

### **Russian Railways:**

Russian State – owned Railway Company "The JSC Russian Railways" had Earned Revenues of 42.04 Billion US\$ in 2019. It's Revenues Increased by 5.6% in 2019 due to Strong Growth of a 9.5% of its Freight & Infrastructure Operations.

### **The East Japan Railway Company:**

The East Japan Railway Company (JR East) has Bagged Revenues of 28.96 Billion US\$ in 2019, posting a growth of 2.4%.

### **BNSF Texas USA:**

The Texas based BNSF Railways has posted Revenues of 22.39 Billion US\$ in 2019.

### **THE Nebraska – based Union Pacific Corporation USA:**

THE Nebraska – based Union Pacific Corporation of United States had Earned Revenues of 22.24 Billion US\$ in 2019.

### **The West Japan Railway Company (JR – WEST)**

The West Japan Railway Company had Earned Revenues of 15.62 Billion US\$ in 2019.

### **The Florida – Based Messrs CSX Corporation USA**

The Florida – Based Messrs CSX Corporation had Recorded Revenues of 12.56 Billion US\$ in 2019.

## **Pakistan Railways:**

If it is said that in the past Pakistan Railways has been the most neglected department of Government of Pakistan then it would not be wrong. At the time of Partition, double tracks at the main line were only present on Karachi-Lodhran and Lahore-Raiwind sections. After 56 years, doubling of track from Lodhran to Khanewal via Multan commenced in 2003, which was opened for traffic on 2007.

Pakistan Railways is a public body, which neglected its commercial perspective resulting in lasting damage. Railways all over the world is considered as the cheapest mode of transportation. But in Pakistan, it is made difficult due to expensive fares, lack of punctuality and uneasy journeys. Theft of rail tracks, engines and particular parts have been commonplace for decades. According to BBC reports, Senate's standing committee on Railways of Senate, has investigated many a time over missing belongings of railways and every time they disclose that the missing stuff was sold at very cheap rates in scrap markets.

Pakistan Railways is the national, state-owned railway company of Pakistan. Founded in 1861 and headquartered in Lahore, it owns 7,791 kilometers (4,841 miles) of track across Pakistan from Torkham to Karachi and operates freight and passenger service.

After Independent from 1947 as a Nation we could not able to increase our Railway Track very well.

In 1954, a branch line was extended from the Karachi-Peshawar Railway Line to Mardan and Charsada. Two years later, the Jacobabad-Kashmore metre-gauge line was converted to 1,676 mm (5 ft 6 in) broad gauge. The Kot Adu-Kashmore section of the Kotri-Attock Railway Line was built from

1969 to 1973, providing an alternate route from Karachi to northern Pakistan. In 1974, Pakistan Western Railways was renamed Pakistan Railways. In February 2006, the 126-kilometre (78 mi) Hyderabad–Khokhrapar Branch Line was converted to 1,676 mm (5 ft 6 in). All narrow-gauge tracks in the country were converted to 1,676 mm (5 ft 6 in) or dismantled during 2000s. On 8 January 2016, the Lodhran–Raiwind Branch Line double-rail project was completed.

## **Units and Divisions**

Pakistan Railways has three functional units: operations, manufacturing and welfare and special initiatives. The operations unit is divided into three main departments. The Infrastructure Department oversees civil engineering, signaling, telecommunications, design and the directorate of property. The Mechanical Engineering Department oversees mechanical engineering, purchasing, stores and electrical engineering, and the Traffic Department oversees passenger facilities, operations, marketing and the directorate of information technology. Several

smaller departments, including personnel, railway police, planning, legal affairs, public relations and the Pakistan Railways Academy, are also part of the operations unit. The railway has eight territorial operating divisions:

Karachi- Lahore

Multan – Peshawar

Quetta – Rawalpindi

Sukkur – Gwadar

Gawadar Division is not yet operational. In addition to these 8 divisions, one division is non-operating division which is Mughulpura Division, Lahore. This division is, primarily, engaged with maintenance of rolling stock.

## **Rolling Stock**

Pakistan Railways has 190 working diesel-electric locomotives. The average life of the fleet is 25 years, and they are serviced at the Pakistan Locomotive Factory.

In January 2016, the railway ordered 800 hopper wagons from Jinan Railway Vehicles Equipment. The first 205 wagons will be built in China, and the remaining 595 wagons will be assembled at the Moghalpura Railway Workshops in Pakistan. The wagons will carry coal to power stations in Karachi and Qadirabad.

## **Manufacturing:**

The Pakistan Locomotive Factory was built in Risalpur in 1993 at a cost of Rs228.4 million (US\$1.6 million). The factory's capacity is 150 coaches per year on a single-shift basis.

The Moghalpura Railway Workshops, on the Lahore–Wagah Branch Line at Moghalpura Junction railway station (MGPR) in Lahore, are one of several rolling-stock repair sites. The workshop complex emerged at its present site in 1904 to manufacture, repair and overhaul passenger coaches and freight wagons for the North Western State Railway. After Pakistan's independence in 1947, it was the only state-of-the-art workshop for Pakistan Railways.

The railway owns five concrete sleeper factories in Sukkur, Khanewal, Kohat, Shahinabad and Kotri. The first factory was established in Sukkur in 1967, and the other four factories were opened between 1979 and 1981.

# Pakistan Railways Net Work

## Lines:

The Pakistan Railways network is divided into main lines and branch lines. The Karachi-Peshawar line is the main north-south line, and the Rohri-Chaman line is the main east-west line.

## Main Lines:

- ❖ Main Line 1 (ML-1) Karachi–Peshawar Line
- ❖ Main Line 2 (ML-2) Kotri–Attock Line
- ❖ Main Line 3 (ML-3) Rohri–Chaman Line
- ❖ Main Line 4 (ML-4) Quetta–Taftan Line
- ❖ Main Line 5 (ML-5) Taxila–Khunjerab Line
- ❖

## Main Line 1 (ML-1) Karachi–Peshawar Line:

Karachi–Peshawar Railway Line (کراچی-پشاور مرکزی راہ آهن خط) (also referred to as Main Line 1 or ML-1) is one of four main railway lines in Pakistan, operated and maintained by Pakistan Railways. The line begins from Karachi City station or Kiamari station and ends at Peshawar Cantonment Station. The total length of this railway line is 1,687 kilometers (1,048 mi). There are 184 railway stations from Kiamari to Peshawar Cantonment on this line.<sup>[4]</sup> The line serves as the main passenger and freight line of the country. 75% of the country's cargo and passenger traffic uses the line. The line is currently undergoing a six-year (US\$9.5 billion) upgrade and renovation as part of the China Pakistan Economic Corridor, with average rail speeds expected be doubled to 160 kilometers per hour upon completion.

## **Main Line 2 (ML-2) Kotri–Attock Line**

Kotri–Attock Railway Line (کوٹری–اٹک مرکزی ریلوے خط) (also referred to as Main Line 2 or ML-2) is one of four main railway lines in Pakistan, operated and maintained by Pakistan Railways. The line begins from Kotri Junction and ends at Attock City Junction. The total length of this railway line is 1,519 kilometers (944 mi). There are 73 railway stations from Kotri Junction to Attock City Junction on this line.

## **Main Line 3 (ML-3) Rohri–Chaman Line**

Rohri–Chaman Railway Line (روہڑی–چمن مرکزی راہ آہن خط) (also referred to as Main Line 3 or ML-3) is one of four main railway lines in Pakistan, operated and maintained by Pakistan Railways. The line begins from Rohri Junction station and ends at Chaman station. The total length of this railway line is 523 kilometers (325 mi). There are 35 railway stations from Rohri Junction to Chaman on this line and is famous for passing through the historic Bolan Pass. This line incorporates part of the historic Sind–Pishin State Railway.

## **Main Line 4 (ML-4) Quetta–Taftan Line**

Quetta–Taftan Railway Line (کوئٹہ–تفتان مرکزی راہ آہن خط) (also referred to as Main Line 4 or ML-4) is one of four main railway lines in Pakistan, operated and maintained by Pakistan Railways. The line begins from Quetta station and ends at Koh-e-Taftan station. The total length of this railway line is 523 kilometers (325 mi). There are 23 railway stations from Quetta to Koh-e-Taftan. The line then crosses into Iran and extends to Zahedan.

## **Main Line 5 (ML-5) Taxila–Khunjerab Line**

Taxila–Khunjerab Railway Line (ٹیکسلا - خنجراب مرکزی راہ آہن خط), also known as Khunjerab Railway or Karakoram Railway, is one of several proposed railway lines in Pakistan, to be operated and maintained by Pakistan Railways. The current active line begins from Taxila Junction station and ends at Havelian station. A proposed extension will see new track laid from Havelian station to the Pakistan-China border at the Khunjerab Pass where it will link up with China's Kashgar–Hotan railway.

## **Tracks of Pakistan Railways**

Pakistan Railways owns 11,881 kilometres (7,383 mi) of track. 80% of the tracks are around 80 to 90 years old. All are 1,676 mm (5 ft 6 in) (broad gauge), except for some industrial lines. The broad-gauge track axle load limit is 22.86 tonnes, except for the Rohri-Chaman Line (limit 17.78 tonnes) and Quetta-Taftan Line (limit 17.27 tonnes). The maximum speed on most lines is 120 kilometres per hour (75 mph), but upgraded sections of the Karachi-Peshawar Line allow speeds up to 130 kilometres per hour (81 mph). Work is in progress to upgrade all main lines to 160 kilometres per hour (99 mph).

## **Freight Services of Pakistan Railways**

Pakistan Railways was the predominant mode of freight transportation from coastal ports to the interior. **At their peak, between 1955 and 1960, PR handled 73 percent of the country's freight traffic (compared to less than four percent in 2019).** The Freight Business Unit operates over 200 freight stations, including the Port of Karachi and Bin Qasim Port, and

several dry ports in Pakistan's four provinces. With 12,000 employees, the unit generates revenue from the movement of agricultural, industrial and imported products such as petroleum oil and lubricants, wheat, coal, fertilizer, rock phosphate, cement and sugar from the ports to the interior.

On February 22, 2020 the first cargo train bound for Afghanistan left Karachi, Pakistan with a load of containers. Pakistan Railways Chairman Habib-ur-Rehman Gilani inaugurated the train which departed from the Pakistan International Container Terminal in Karachi with 35 containers on board for the country's southwest Chaman city bordering Afghanistan. From there, the goods will be shifted across the border via road.

## **New Proposed Lines in Pakistan**

New rail lines have been proposed by Pakistan Railways to connect Gwadar Port to Rest of Pakistan and Central Asia, including:

- ❖ Karachi–Gwadar Railway Line (Makran Railway)
- ❖ Gwadar–Mastung Branch Line
- ❖ Basima–Jacobabad Branch Line
- ❖ Bostan–Zhob–Dera Ismail Khan Branch Line
- ❖ Islamabad–Muzaffarabad Branch Line

# HOW PAKISTAN CAN BECOME A REGIONAL RAILWAY HUB

## **IRAN – PAKISTAN – TURKEY – South & South East Europe**

Iran - Pakistan Railways is connected to the Islamic Republic of Iran Railways at Zahedan, where a break-of-gauge exists between the 1,676 mm (5 ft 6 in) Quetta-Taftan Railway Line and the 1,435 mm (4 ft 8 ½ in) Kerman-Zahedan line. The link was completed on 18 May 2007.

If Pakistan Railway will be worked Seriously than between Pakistan – Iran – Turkey Cargo Train can be Run.

The completion of the Pakistan-Iran link has made it possible, in principle, to run trains between Pakistan and Turkey via Iran. A container train trial service was begun by Prime Minister Yousuf Raza Gilani between Islamabad and Istanbul on 14 August 2009. The first train carried 20 containers with a capacity of about 750 t (738 long tons; 827 short tons), and was scheduled to travel 6,500 km (4,000 mi) from Islamabad through Tehran to Istanbul. An Istanbul-Tehran-Islamabad passenger rail service has also been proposed. In 2009, Minister for Railways Ghulam Ahmad Bilour expressed the hope that after the container-train trial a passenger train would be introduced.

**There are also hopes that the route would link Europe and Central Asia and carry passengers and Freight Trains.**

## **Pakistan – Afghanistan – Turkmenistan Line I**

Presently there is no rail link to Afghanistan, but Pakistan Railways has proposed to help build an Afghan rail network in three phases. Phase one would stretch from the Chaman to Spin Boldak as an extension of the Rohri–Chaman Line. Phase two would extend the line from Spin Boldak to Kandahar. Phase three would run from Kandahar to Herat and Khushka, Turkmenistan, linking the 1,676 mm (5 ft 6 in) with the Central Asian 1,520 mm (4 ft 11 <sup>27</sup>/<sub>32</sub> in). It is unknown where the break-of-gauge station would be.

## **Pakistan – Afghanistan – Turkmenistan Line II Euro – Asia Railway Connectivity**

Gwadar – Chaghi (Pakistan) - Nimruz – Farah – Herat (Afghanistan) – Mari Region (Turkmenistan)

This Railway Line will be the Game Changer for the Euro Asia Region. This Proposed Railway Line will be the Key Connectivity between Middle East, South Asia, Central Asia and East Europe.

### **Euro Asia Railway Connectivity:**

This Proposed Railway Line will also leverage the Turkmenistan-Afghanistan-Tajikistan (TAT) rail line from 2013, Afghanistan-Turkmenistan-Azerbaijan-Georgia-Turkey transportation corridor in 2014, Iran-Turkmenistan-Kazakhstan railroad and TRACECA (Transport Corridor Europe-Caucasus-Asia) comprising the EU and 14 Eastern European, South Caucasus and Central Asian states.

## **North–South Transport Corridor**

For enhanced connectivity, this Proposed Railway Line will also synchronize with the International North–South Transport Corridor encompassing ship, rail including Trans-Caspian railway,

and road route for moving freight between Pakistan, Russia, Europe, Middle East and Central Asia. The route primarily involves moving freight from Middle East to Pakistan, Afghanistan, Turkmenistan, Russia and Europe via ship, rail and road.

Turkmenistan Already Built a huge port on Caspian Sea at Turkemenbashi City for Connectivity of Euro Asia.

With the Help of this Railway Line we'll kick out India from the North West Corridor & from Chabahar (Iran).

### **Pakistan – Afghanistan – Uzbekistan**

Another Line would extend the Karachi-Peshawar Line to Kabul - Mazar Sharif via Jalalabad. From Mazar Sharif (Afghanistan) to Tirmiz (Uzbekistan) Railway line already Exist.

This Pakistan – Afghanistan – Uzbekistan Railway Line will be a Game Changer for the Regional Connectivity. Uzbekistan, Tajikistan, Kyrgyzstan and South & East Kazakhstan will have Access to Arabian Sea and it'll be the Shortest Route to Int'l Seas for aforesaid 4 Central Asian Countries. They can Export Raw Cotton, Textile, Petro Chemicals, Petroleum Products, Grain, Agriculture Products and Chemicals through this Route, and will also Imports Machinery, Automobiles & their Parts, Food Products, Pharmaceuticals etc.

Pakistan Railways will Earn Billions of US\$ from Freight Service at the same Time our Ports will also Earning Healthy Revenues.

## **Pakistan – China Railway Line**

There is no present rail link with China. On 28 February 2007, contracts were awarded for feasibility studies on the Taxila–Khunjerab Line, extending it from Havelian via the Khunjerab Pass to the Chinese railhead at Kashgar, a distance of about 750 kilometres (470 mi).

In 2007, consultants were engaged to investigate the construction of a railway through the Khunjerab Pass in Gilgit-Baltistan to connect China Railway with Pakistan Railways. A feasibility study started in November 2009 for a line connecting Havelian and Kashgar. 750 km (466 mi) of the line would extend through Pakistan, while the remaining 350 km (217 mi) in China. In June 2014, China commissioned a "preliminary research study" to build an international rail link to Pakistan. In 2016 this 682 km proposed railway link was reported to be part of the China–Pakistan Economic Corridor, and was to commence construction during the second phase of CPEC. China's involvement in several rail projects in Pakistan is motivated primarily by commercial considerations, but it also sees distinct advantages for its improved transportation and access to Central Asia and the Persian Gulf states.

The stations on this line are as follows:

### **Active Line**

- **Taxila Cantonment Junction**
- Usman Khattar
- Mohra Shah Wali
- Hattar
- Kot Najib Ullah

- Haripur Hazara
- Serai Saleh
- Baldher
- Havelian

### **Proposed Line**

- Abbottabad
- Mansehra
- Besham
- Dasu
- Chilas
- Gilgit
- Hunza
- Sost
- Khunjerab Junction

In My above mentioned Deep Analysis we found the Potential of Pakistan Railway Connectivity with China, Afghanistan, Turkmenistan, Uzbekistan, Kazakhstan, Tajikistan, Kyrgyzstan, Iran, Turkey, Georgia, Azerbaijan, Russia, Scandinavian Countries and South and South East Europe.

Meanwhile Huge Potential of Passengers & Freight Services in Domestic Market of Pakistan.

As I mentioned that other Countries like India, Russia, Japan, Germany and France etc. are Earning Billions of US\$ every Year.

As a Nation we have Great and Ideal Strategic Geographic Location and we have Tremendous Potential to become a Regional Hub of Railway Freight as well as Sea Freight but Unfortunately this Gigantic Potential not Utilized Yet.

It's a time to Grab this Enormous Opportunity and to Avail this Opportunity we need strong Foundation of Pakistan Railway for this as a Nation we need Railway Design & Research Institute.

Please find below the Concept of Railway Design & Research Institute.

The Concept of this Institute will Complete phase wise with in 12 – 15 Years.

In First Phase we'll Adopt the Railway Technology of 1960's from ML1, where Proposed Railway Institute will provide Qualified Human Recourses.

Start to Build Karachi – Gwadar, Gwadar Mastung, Basima – Jacobabad, Bostan – Zhob – Dera Ismail Khan and Islamabad Muzaffarabad Railway Line by our own Pakistan Railway Technology.

In Second Phase we'll be Focused to Grab the railway Technologies of 1990 – 2000.

In Second Phase we Must be able to Manufacture Railway Track / Line from Pakistan to Central Asia by our own Technology with Signaling System, Construction of Railway Stations, Railway Bridges & tunnels with Pakistani Technology.

In Second Phase we must start Electrification of our National Railway Tracks and Domestic Production of Electric / Diesel Locomotives.

In Third Phase our Target will be to Adopt the 21<sup>st</sup> Century Railway Technology where high Speed Bullet Trains, Electrified Railway Tracks For High Speed Trains and for Railway Subways for Karachi, Lahore, Islamabad.

## **The Concept of Railway Design and Construction Research Institute**

The Institute will have an educational and methodological center "Organizational and technological modeling and construction management".

The Institute will have a training laboratory for technology, mechanization and automation of railway construction.

The work of the graduating Departments is multidimensional and will have many parameters – directions, each of which is extremely important for the main object – ensuring high quality of the educational process and training of highly qualified railway engineers - builders.

Railway Design and Construction Research Institutes Motto will be in Phase I:



Global experience of "Design and construction of Railways" shows that the staff of the Department copes with all the main areas of work providing a high level of teaching disciplines, developing methodological documentation and conducting educational work among students in Railway institutes.

# INSTITUTE OF ELECTRONIC & INFORMATION ENGINEERING

## FACULTIES:

- Communication Engineering
- Automation
- Rail Traffic Signaling & Control
- Electronic Science & Technology

## Communication Engineering

- I. DURATION OF COURSE:  
Standard: Four Years on a full time basis
  
- II. DEGREE:  
Bachelor of Engineering
  
- III. PROGRAM OBJECTIVES:

The Program aim to creating exceedingly specialized Professionals in Design, Development and Management in field of Communications and Information, who with a solid Foundation of Theoretical and Professional Knowledge and Noble Sense of Innovation, are Qualified to meet the requirements of Social & Economic Development for Information Professionals.

A part from the Students Mastery of the Theoretical and Practical Skills of Communication Engineering the Great Focus will be placed upon the Training of the Students capabilities in Application, Design and Development in the Field of Commutation System and Communication Network.

# Automation Engineering

- I. DURATION OF COURSE:  
Standard: Four Years on a full time basis
  
- II. DEGREE:  
Bachelor of Engineering
  
- III. PROGRAM OBJECTIVES:

Systematically dominant in basic theories, knowledge, Skills and abilities in Automatic Control, Intelligent Traffic, Automatic Measurement Technology, Intelligent Control and Computer Applications, and should be familiar with the development Trend and Application Prospect of the Discipline.

Fluent in English Language so will be able to Professional Literature Smoothly.

Students will be Stringently trained in Scientific Approach & Thinking, Scientific Experiments in Labs so will be able to analyze, Evaluate, Investigate and Resolve the Scientific & Engineering Problems.

The Focus will be to prepare Students who'll be able to participate in Engineering Design, Engineering Implementation, Scientific Research, Technology Development and Technology Management related to Automatic Control, Intelligent Traffic, Automatic Measurement Technology, Computer Application Technology and Information Processing.

## **Automation and Telemechanics in railway transport**

1. Design, construction and service support of microprocessor control systems based on microcomputers and programmable controllers: EC-MPC, MPC-MPC, UEP MPC, DC-MPC and CAS DU;
2. Development and implementation of the railway automation device diagnostics system (STD-MPC);
3. Development of technology for maintenance of railway automation and telemechanics systems and devices;
4. Examination and testing of railway automation and telemechanics systems for compliance with the requirements;
5. Development of a software package for calculating tonal rail chains;
6. Information service for subscribers of telecommunications networks;

# **Rail Traffic Signaling & Control System**

- I. DURATION OF COURSE:  
Standard: Four Years on a full time basis
  
- II. DEGREE:  
Bachelor of Engineering
  
- III. PROGRAM OBJECTIVES:

The basic focus of program will be to produce extraordinarily Specialists of Rail Traffic Signaling and Control with concrete Foundation of Theoretical and Proficient Knowledge & Skills and Methodologies in Rail Traffic Signaling Engineering and Improvement with Familiarity with Development trend and Application Prospect of the Discipline.

Students will be strictly skilled in Scientific Methodology & Thinking, Scientific Experiments in Labs so will be able to analyze, Evaluate, Investigate and Resolve the Scientific & Engineering Problems.

The Emphasis will be to prepare Students who'll be able to contribute in Engineering Design, Engineering Implementation, Scientific Research, Technology Development and Technology Management in the field of Rail Traffic & Railway Singling Engineering.

## **Electronic Science and Technology:**

- I. DURATION OF COURSE:  
Standard: Four Years on a full time basis
  
- II. DEGREE:  
Bachelor of Engineering
  
- III. PROGRAM OBJECTIVES:

The Program aim to encourage highly Specialized Professionals in Design, Development and Management in the Field of Electronic Science and Technology and other interdisciplinary fields with a solid foundation of knowledge with great scene of Innovation, are qualified to meet Various Job requirements.

Priority will be given to the development of Students personalities and characters so as to ensure balanced and all around development of their scruples, intelligence and Innovative Character.

Students will be stringently skilled in theoretical knowledge of Mathematics, Physics, Signal and Information Processing, Microelectronics, technology, and Integrated Circuit Design.

With the help of Prodigious Motivation Students will be prepare upon the Training, Polish their Capabilities & Potential to Comportment Scientific Research to get them Well - prepare for their Future Development in Research and Solution Provider in the Fields of Electronics, Information Communication and other related areas.

Special Emphasis will be on Microelectronics and Solid State Electronics, meanwhile focuses the Student Proficiencies for Semi - Conductor Devices and IC Designs.

Simultaneously Concentration will be provided on Circuits & Systems is to furnish Students with both a best Familiarity in Circuits & Systems and Signal & Image Processing and Competencies of Designing Information Processing Systems and of Developing Digital Signal Processing (DSP) & Electronic Design Automation (EDA) Technologies and Embedded Systems.

Electromagnetic Field and Microwave Technology Contemplates on Developing Specialists Capable of Designing and Testing Electronic & Communications Systems by Applying the Knowledge of Electromagnetic Fields and Magnetic Waves, Microwave and Antenna Technology and Electromagnetic Compatibility.

## CURRICULUM SYSTEM



PROGRAM FOR SCIENCE ENGINEERING UNDER GRADUATES 167 CREDITS (MINIMUM) IN TOTAL. 109 COMPULSORY CREDITS AND 58 OPTIONAL CREDITS



1. Basic Courses of Natural Sciences: 35 Credits in Total. 30 Compulsory Credits & 5 Optional Credits
2. Specialized Courses: 87 Credits in Total. 67 Compulsory Credits & 20 Optional Credits



Basic Courses of Humanities and Social Sciences 45 Credits. 18 Compulsory Credits and 27 Optional Credits

# Institute of Mechanical, Electronic and Control Engineering

## **FACULTIES:**

- **Mechanical Engineering**
- **Vehicle Engineering**
- **Measurement, Control Technology and Instrumentation**
- **Energy and Power Engineering**
- **Industrial Engineering**
- **Mechatronics Engineering**

## **Mechanical Engineering**

- I. DURATION OF COURSE:  
Standard: Four Years on a full time basis
- II. DEGREE:  
Bachelor of Engineering
- III. PROGRAM OBJECTIVES:

The Objective is to Intensification Engineering Talents who can meet the Emergent Demands of Contemporary Manufacturing Industry, Students will be Connoisseurs Fundamentals such as Mathematics, Physics and Computer.

They have Specialized Knowledge and Skills, Practice, as well as Potential in Mechanical Design, Manufacturing and Automation. Students will be Focused and Engage in Engineering Design, Mechanical Manufacturing, Technological Development, Scientific Research, Production and Management in Mechanical Engineering fields.

The program will combines a broad-based education in the engineering sciences with a strong grounding in quantitative, problem-solving, design, and communications skills. By implementing the approach of learning by doing, it will gives students the broad knowledge and skills set. All strive to help students develop independence, teamwork, innovation, as well as the capability for continuing professional growth in mechanical engineering fields.

The objective will be to foster engineering talents who can meet the emerging demand generated from development of modern manufacturing industries. Students will build a solid base in mathematics, English, physics and computer. They have specialized knowledge and skills, professional practice ability, as well as sustainable potential and quality in mechanical design, manufacturing and automation. They are expected to engage in engineering design, mechanical manufacturing, technological development, scientific research, production and management in mechanical engineering fields.

### **Main Courses:**

- ✓ Computer Aided 3D design
- ✓ Mechanical Innovative Design
- ✓ Finite Element Method and Its Application
- ✓ CAD/CAM
- ✓ Advanced Manufacturing Technologies
- ✓ Mechatronics
- ✓ Robotic Technologies
- ✓ Mold Design

## CURRICULUM SYSTEM



PROGRAM FOR SCIENCE ENGINEERING UNDER GRADUATES 173 CREDITS (MINIMUM) IN TOTAL. 116 COMPULSORY CREDITS AND 57 OPTIONAL CREDITS



1. Basic Courses of Natural Sciences: 32 Credits in Total.  
2. Specialized Courses: 86 Credits in Total. 66 Compulsory Credits & 20 Optional Credits



Basic Courses of Humanities and Social Sciences 45 Credits. 18 Compulsory Credits and 27 Optional Credits  
Free Elective Courses: 10

# Vehicle Engineering

- I. DURATION OF COURSE:  
Standard: Four Years on a full time basis
  
- II. DEGREE:  
Bachelor of Engineering
  
- III. PROGRAM OBJECTIVES:

Vehicle Engineering will in the list of "Training Plan of Excellent Engineers". Focusing on the need of the future economic and social development for excellent engineers in the vehicle field, closely tracking the leading edge theory of rail transit, centering on the key technology of rail vehicle engineering, relying on what are and will related to rail transit, such as NUTECH key discipline, NUTECH key laboratory, NUTECH experimental teaching demonstration center, training base outside, this major will aimed to train talented people with the back ground of rail transit, mastering the rail transit system theory and special knowledge and key technology in the rail vehicle engineering field.

The undergraduates will be highlighted the practice in the enterprises with at least 40 weeks, which is aimed to strengthen the ability of applying multi-course knowledge, solving practical problems, communication, teamwork, putting the knowledge into results and creative. Outstanding students will participate in the undergraduate-master unified, industry-academia jointed training in "3+1+2" model, in which "3" means the study in NUTECH at the first three years of undergraduate; "1" means practice in the enterprises and finishing the graduation design at the fourth year after you get the entrance for Professional Master with no

examination; “2” means two year of postgraduate, applying industry-academia jointed training with two tutors, one in NUTECH and the other in enterprise.

To Train the Students as Outstanding and Proficient in the Field of Rail Vehicle with the help of Incomparable Training, Substantial Knowledge of Basic Theory, Systematic Professional Skills.

Refine their Competencies & Potential to Demeanor Scientific Research to get them State of the Art Specialists for their Future Development in Research and Solution Provider in the Fields of Rail Vehicle Engineering with Practical Ability and Team Sprit, Potential to becoming Field Leader and International Competitiveness. .

### **Main Courses:**

- EMU Design
- Vehicle System Dynamics
- EMU Power Electronics Technology
- EMU Equipments
- EMU Transmission and Control
- EMU Traction and Braking
- EMU Manufacturing Process and Equipments

# Measurement Control Technology and Instrumentation Engineering

- I. DURATION OF COURSE:  
Standard: Four Years on a full time basis
- II. DEGREE:  
Bachelor of Engineering
- III. PROGRAM OBJECTIVES:

Measurement and Control Technology and Instrumentation will takes information acquisition, transmission, processing and control technologies as the main line and integrate optical, mechanical, electrical and control technologies. It strengthens the knowledge of detection and control based on mastering basic mechanical engineering knowledge. The major will be a wide adaptability in optical, mechanical and electrical comprehensive engineering fields.

The major will Produce the senior specialized personnel who will adapt to the modern scientific and technical development and economic construction and has a strong foundation of natural science and good humanities and social sciences foundation with the knowledge structure of optical, mechanical, electrical and control. The innovative spirit and practical ability will also trained. The students can engage in information acquisition and processing, industrial automatic detection and process control, and mechatronics instrumentation and test equipment design, manufacture and management.

To Produce the Specialized Mavens who can adopt the Modern Scientific and Technical Development and will put the Foundation of Measurement Control & Instrumentation Industry in Pakistan with the Knowledge Structure of Optical, Mechanical, Electrical and Control.

Students will be expert in Information Acquisition and Processing, Industrial Automatic Detection & Process Control, Design, Manufacture and Management of Mechatronics Instrumentation and test equipment.

### **Main courses:**

- ❖ The Theory and Application of Sensor
- ❖ Computer Control Technology
- ❖ Error Theory and Data Processing
- ❖ Signal Analysis of Electro-Mechanical Systems
- ❖ Auto-Detection Technology
- ❖ Electronic Measurement Technology
- ❖ Optical Information Technology
- ❖ Modern Sensor Technology
- ❖ Electrical Control System
- ❖ Process Control System
- ❖ Hydraulic and Pneumatic Technology
- ❖ PLC Control System
- ❖ Principles of Intelligent Instrumentation
- ❖ Circuit CAD and Simulation
- ❖ Measurement and Control Circuit
- ❖ Field Bus Control Network
- ❖ Virtual Instrument Technology

# Energy and Power Engineering

- I. DURATION OF COURSE:  
Standard: Four Years on a full time basis
  
- II. DEGREE:  
Bachelor of Engineering
  
- III. PROGRAM OBJECTIVES:

The specialty orientation will to develop professional education according to the major's discipline characteristics of Thermal Energy and Power Engineering, make the major reach domestic leading level. Produce Highly Specialized Engineers with solid professional knowledge and expertise of a proficient direction, also can further study to become a special research talent in the field of thermal energy and power engineering, and will engage in engineering design, product development and technical management work in other fields related to Thermal Energy and Power Engineering. Main courses include Specialty Basic Courses and Specialty courses such as Basic Engineering Drawing (A), Theoretical Mechanics, Material Mechanics, Mechanical Principles, Mechanical Design, Engineering Thermodynamics, Fluid Mechanics, Heat Transfer, Automatic Control Principle, Test Technology of Thermal Energy and Power, Combustion Engineering, Principles of Internal Combustion Engine, Theory of Automobile, Principle of Steam Boiler, Theory of Steam Turbine, etc. The specialty teaching features will be: all the main courses and some specialty courses adopt research-oriented teaching mode, some main courses adopt bilingual teaching.

Combined with the characteristics of this major and on the broad basis of Thermal Energy and Power Engineering, students will be experts according to two professional directions, "Locomotives and engine direction" and "Thermal power engineering direction". "Locomotives and engine direction" will be mainly produce senior specialized technical abilities who have deep attainments in the field of Locomotives and engine. "Thermal power engineering direction" mainly Prepare senior specialized technical Capabilities who will have deep attainments in the field of thermal power engineering, especially in the field of thermal power plants.

This major will be Providing mainly Preparation senior specialized technical abilities who will have solid theoretical foundation, strong practical, adaptive and creative ability, and with high moral and culture quality in the field of thermal energy and power engineering, especially in "Locomotives and engine direction" and "Thermal power engineering direction", in order to meet Industry's demand in the field of thermal energy and power engineering, especially in research, design, teaching, engineering technology, business management aspects in "Locomotives and engine direction" and "Thermal power engineering direction". Graduated students should be equipped with broad knowledge of science technology, humanities and social science, broad theoretical basis of thermal, mechanics, electricity, machinery, automatic control and system engineering, professional knowledge and practical ability in the field of thermal energy and power engineering, knowledge of computer application and automatic control technology aspects. Graduated students will engage in design, teaching, development, manufacturing, planning, management and marketing works in thermal energy and power engineering field. Graduated students can also continue to pursue advanced studies in this major or related majors, study for a master degree and doctor degree.

The Objective will be to produce Particular Technical Abilities who have solid Theoretical Foundation, Resilient practical, Adaptive and Ingenious Ability in the Field of Thermal Energy and Power Engineering, Especially in Locomotives and Engine Direction and Thermal Energy Engineering Direction.

The major aim to meet the International Standards in the Field of Thermal Energy and Power Engineering Especially in Research, Design, Teaching, Engineering Technology.

Graduates Students will be Equipped with Comprehensive of Science Technology, Humanities and Social Sciences, Extensive Theoretical basis of Thermal, Mechanics, Electricity, Machinery, Automatic Control and System Engineering, Specialized Skills and Practical Capability in the Field of Thermal Energy and Power Engineering, Knowledge of Computer Application and Automatic Control Technology aspects.

Graduate Students will participated in Design, Teaching, Development, Manufacturing, Planning and Management Works in Thermal Energy and Power Engineering Sector.

# Industrial Engineering

- I. DURATION OF COURSE:  
Standard: Four Years on a full time basis
  
- II. DEGREE:  
Bachelor of Engineering
  
- III. PROGRAM OBJECTIVES:

The Industrial Engineering (IE) program will be based on "The Innovative Education Experiment Program for International Entrepreneurial Engineering and Management Capabilities". The education strategy of this program will "Learning by doing', Industry-education cooperation, Internationalization", and "project-based learning" will adopted as a key teaching model for this program. The career environment for engineers will be introduced into the engineering education environment. Students in this program will gain innovative engineering proficiencies, entrepreneurial and management capabilities, self-learning and teaching capabilities, capabilities for coordinating and developing within environments, integrating competences, etc.

The program will be to substitute engineering talents with both process management techniques and managerial capabilities, as well as global vision and competitiveness. Graduates will expected to become future leaders or experts of process management in the industry with lifelong learning ability and leadership, involving in improving efficiency of production and service systems, optimizing recourse utilization, improving workingconditions, and promoting economic and social progress.

The objective is to meet the emerging demand generated from our economic development for engineering talents with both engineering techniques and managerial skills, to exploit advantage of interdisciplinary integration. The major will be aimed at fostering industrial engineers to meet the international talent standards who master professional knowledge and skills of industrial engineering with the sustainable potential and quality (Systematic and critical thinking, Learning ability, Analyzing and problem solving, Professional ethics, Teamwork, Communication, Multicultural perspective, Sense of social responsibility) as well as certain engineering practice ability.

Due to Rapid World Economic Growth there are enormous demand for Engineers with both Engineering Techniques and Managerial Skills in International Industry.

In order to fulfill this trend the Program will aims to encourage Industrial Engineers of Int'l Standards.

Graduates will have the Engineering Practice Capability Simultaneously they will be the Dominant Professional Knowledge and Skills of Industrial Engineering with Good Potential Important qualities such as Systematical and Critical thinking, Learning, Analyzing and Problem Solving Capabilities, Team Sprits, Communication Skills, Multicultural Perspective and Scene of Social Responsibility.

## **Main Courses:**

- Operations Research
- Applied Statistics
- Advanced Manufacturing Systems
- Logistics System Planning
- Ergonomics
- Mechatronics
- Production Planning and Control
- Engineering Economics
- Product Design and Development
- Quality Management
- System Engineering
- Supply Chain Management
- Data Structure
- Management Information System

# **Mechatronics Engineering**

- I. DURATION OF COURSE:  
Standard: Four Years on a full time basis
  
- II. DEGREE:  
Bachelor of Engineering
  
- III. PROGRAM OBJECTIVES:

Mechatronics will be a unique program. The Program will of four years full-time duration with two academic semesters each year. The training mode is flexible.

Mechatronics and robotics (Mechatronics and robotics Profile "Mechatronic and robotic systems")

1. Modeling of complex transport systems; optimization of transport flows;
2. The application of artificial intelligence in transportation and logistics systems;
3. Computer-aided design of mechatronic systems and processes: methods and stages of design, examples of practical application;

## **Main Courses:**

- ✓ Engineering Drawing
- ✓ Mechanics
- ✓ Mechanics of Material
- ✓ Fluid Mechanics
- ✓ Heat Transfer
- ✓ Thermodynamics
- ✓ Mechanical Design
- ✓ Measurement Technology
- ✓ Material Science and Engineering
- ✓ Kinematics and Dynamics of Machinery
- ✓ Automatic Control
- ✓ Dynamic Systems and Control
- ✓ Manufacturing Technology

# Institute of Civil Engineering

## **FACULTIES:**

- **Civil Engineering**
- **Railway Bridge & Tunnel Construction**
- **Construction Structures & Building and Structures**
- **Transport Construction in Extreme Weather**
- **Transport Tunnels & Subway Construction**
- **Environmental Engineering**
- **Engineering Mechanics**

## **Civil Engineering**

- I. DURATION OF COURSE:  
Standard: Four Years on a full time basis
- II. DEGREE:  
Bachelor of Engineering
- III. PROGRAM OBJECTIVES:

Students will be Solid Fundamental Knowledge of Modern Civil Engineering and will be Proficient in Planning, Design, Construction, Management and Work of Research and Development in the Field of Civil Engineering.

They will have the Ability to further Study Innovation, Organization and Coordination with the Team Sprit and International Outlook and will able to Lead Technological Development in the Field of Civil Engineering.

# **Railway Bridge & Tunnel Construction**

- I. DURATION OF COURSE:  
Standard: Four Years on a full time basis
  
- II. DEGREE:  
Bachelor of Engineering
  
- III. PROGRAM OBJECTIVES:

The main scientific directions of the Department will be the development of the theory of strength and plasticity of concrete and reinforced concrete for the design of reinforced concrete bridge structures; theoretical study, experimental research and introduction of new bridge structures; evaluation and methods of improving fatigue life of railway bridges; development of methods of defect-free manufacturing of reinforced concrete superstructures; development of new concepts of monitoring of road and rail bridges.

The Department will operate as "Research center for the study of bridges and transport structures", the development of new structural forms of bridge structures, project expertise and scientific support of large transport construction projects.

The Department will focus a number of major scientific problems, on the basis of the research: New methods for calculating bridge structures Methods for calculating, evaluating and predicting the durability of reinforced concrete superstructures, taking into account the impact of the external environment. Technical instructions for calculations and resource

estimation of metal bridge spans. Guidelines for monitoring the condition of bridge structures in use. A new concept of the stress-strain state of elements of metal superstructures made of plastic steels etc.

1. Design of a reinforced concrete girder superstructure for railway loading, reinforced with polymer composite reinforcement;
2. Increasing the reliability of artificial structures on Railways during new construction and maintenance, taking into account cost optimization based on the use of polymer composite materials;
3. Investigation of deformations of structures by geodesic methods;

# **Construction Structures & Building and Structures**

## **I. DURATION OF COURSE:**

Standard: Four Years on a full time basis

## **II. DEGREE:**

Bachelor of Engineering

## **III. PROGRAM OBJECTIVES:**

1. Design solutions and calculation methods for industrial and civil buildings;
2. Improvement of monolithic structures of multi-storey frame buildings;
3. Survey and development of technical solutions for strengthening damaged structures of construction objects;

The educational complex will include two specialized parts equipped with modern projection equipment and mock-UPS of structures; a computer class; a design and research office with an extensive scientific and methodological library.

# **Environmental Engineering**

- I. DURATION OF COURSE:  
Standard: Four Years on a full time basis
  
- II. DEGREE:  
Bachelor of Engineering
  
- III. PROGRAM OBJECTIVES:

Environmental Engineering will be Focused to Environmental Higher Education and Research in wide range of Fields. The Faculty will be committed to Developing Students Skills with Solid Theoretical and Systematic Knowledge and capability for Environmental Problem Solving.

Students Training will be with Comprehensive Expertise in Natural Sciences and other disciplinary Professions.

## **Engineering environmental protection in transport**

1. increasing safety and improving methods of engineering and environmental surveys of linear capital construction projects;
2. Biochemical complex-accumulative phytofilter for deep cleaning of surface runoff from the territory of railway transport enterprises;
3. Investigation of the concentration of chrysotile-asbestos fibers in atmospheric air, during wear of brake products;
4. Electromagnetic safety of the electrified railway transport.

# Engineering Mechanics

- I. DURATION OF COURSE:  
Standard: Four Years on a full time basis
- II. DEGREE:  
Bachelor of Engineering
- III. PROGRAM OBJECTIVES:

The Program will undertake the Responsibility of Educating Students in terms of Academic Mission the Students of Engineering Mechanics will be supposed to be equipped with Practical Skills & Creativity.

To be precise they will be Proficient Theoretic Mathematics background, Understand the real Situation of Engineering, Learn to Solve the Problems in Engineering with Mathematical Methods, Acquire Scientific Basis for Engineering Technology and Engineering Design & Practice and will be able to solve real problems with the aforesaid Knowledge and Skills.

After Intensive Study in this Program the Graduates will be supposed to become Qualified Researches, Scientists and Key Engineers who are Capable of working in every Engineering Field are related with Mechanics such as Civil Engineering, Mechanics, Aerospace and Space Aviation, Transportation Engineering & Energy Engineering.

# Institute of Traffic and Transportation

## **FACULTIES:**

- **Traffic & Transportation**
- **Logistic Engineering**
- **Traffic Engineering**
- **E - Commerce**

## **Traffic and Transportation**

- I. DURATION OF COURSE:  
Standard: Four Years on a full time basis
- II. DEGREE:  
Bachelor of Engineering
- III. PROGRAM OBJECTIVES:

Students will be trained as capable Graduates with International Competitiveness and Potential in Leading the Railway Transportation Science, Technology and Management.

The Objective of Course will be Legal Complacencies, with expertise in Traffic & Transportation & Railway Transportation Features.

The Students will expected to meet the Demand of Railway Transportation, get generous foundation broadened Vision, colossal Development Potential, high Innovative Awareness, outstanding Engineering Quality and Excellent Comprehensive Qualities.

Students will be the Leading Experts in Theory of Traffic & Transportation, Specified Skills and key Technology in the Field of Railway Transportation Demand Investigation, Network Plan & Design Transportation Resources Assignment, Operation Management and Control.

# Logistic Engineering

- I. DURATION OF COURSE:  
Standard: Four Years on a full time basis
- II. DEGREE:  
Bachelor of Engineering
- III. PROGRAM OBJECTIVES:

In Context of CPEC Challenges the need of Development in the Railway transportation / & transportation and Logistic Industries as per Requirement of International Standards.

There'll be Need to Produce Superlative Engineering Human Resources who will be Connoisseurs not only in Solid Theory Foundations, Strong Prospect of Innovation, Outstanding Engineering Potentials, Brilliant & Widespread Vision but also can Tremendous and Specified Skills and key Technologies of Logistic Demand, Survey and Analysis, System Planning & Design, Recourses Allocation & Construction, Operation and Project Management, Understand the Development Global Trends of the Industry and have the Prominent Potentiality and International Competitiveness in the Fields of Logistic Science, Technology and Administration.

**Technology of transport processes** ("Technology of transport processes". Profile of "Transportation logistics")

1. Corporate quality management systems for transport and logistics services in railway transport

2. Methodological tools for assessing the stability and effectiveness of the development of the macro-regional transport and logistics system using mathematical modeling;

Operation of transport and technological machines and complexes

# Traffic Engineering

- I. DURATION OF COURSE:  
Standard: Four Years on a full time basis
  
- II. DEGREE:  
Bachelor of Engineering
  
- III. PROGRAM OBJECTIVES:

The Disinterested of the Program will be to produce Discipline, Law – Abiding, with Integrated Railway Transportation System Background and Urban Transportation Characteristics, Substantial Foundation, Vide Vision, Strong Character of Innovation, Superb Engineering Triumph.

These Future Engineers will also Anticipated to have a Comprehensive Cultural & Scientific Quality, Railway Transportation & Traffic System Analysis, Planning, Design, Construction and Management of Intelligent Railway Transportation & Traffic System Control and Operational management as well as Railway Traffic Safety Management Expertise and Ability to Participate in Field of System Analysis, Planning, Design, Construction, Operations, Administration and Excellent in Railway Traffic Engineering & Management as a Foundation to Lead the Industry Development in Pakistan.

**Information systems and technologies** (Information systems and technologies Profile " System administration of information and communication systems)

1. The system of traffic safety of trains; the information transmission system, optimization of technological communication;
2. increase of noise immunity of railway transport information transmission channels;

# Institute & Research Center of Electrical Engineering

## **FACULTIES:**

- **Electrical Engineering & Automation**
- **Electric Power System**
- **Electric Drive & Control Engineering**
- **Power Electronics & Electric Traction**
- **Traction Power Supply**

## **Electric Engineering & Automation**

- I. DURATION OF COURSE:  
Standard: Four Years on a full time basis
  
- II. DEGREE:  
Bachelor of Engineering
  
- III. PROGRAM OBJECTIVES:

This Program will be Designed to Produce High – Caliber & Multidisciplinary Engineers will be Equipped with a Comprehensive Knowledge of Basic Sciences, Humanities & Social Sciences.

These Graduates will be Connoisseurs & Proficient in Fundamentals of Electrical Engineering, well Abreast in the Cutting Edge Technologies and will be well Trained in Engineering Practices with Basic Concept of Engineering Design, System Analysis, Information Processing, Experiment Analysis, Research & Development & Management in Electric Engineering related Fields of System

Operation, Test & Control Electric Power Electronics & Computer Applications.

# Electric Power System Research Center

- ❖ Areas of cooperation: protection and control of the smart grid; protection and control of rail transit power supply system
- ❖ Mode of cooperation: project will grants; students will be jointly trained and accomplish the research practice at any European or Russian Site.

## Smart Grid Related Research

### **(1) Integrated network of digital substation protection and control**

The smart-grid structure is more complicated nowadays, and the operational mode is more flexible, the disadvantage of device independence and information limits is becoming obvious, which may lead to increase the possibility of intertripping. So it's necessary to utilize redundant information to strengthen the ability of real-time monitoring, estimate and control, it is also very important to use integrated information to enhance the system observability in normal condition and accuracy of protection. This project will be a National Railway Science Foundation project. Based on digital substation, and computer and communications technology, this project will be research of the substation equipment integrated protection, through information redundancy and information sharing, coordination and cooperation of protection functions of between different devices, it optimized the related control strategies to improve synthesis and integration capabilities of substation equipment protection performance. Based on the structure and protection configuration of real

substation, accurate simulation model will be build using the Real Time Digital Simulator (RTDS). At the same time, the integrated protection hardware platform will be constructed which includes transducers, merging units, GOOSE switches, protection device and intelligent units. According to the IEC61850-9-2 communication protocol, transducers collected analog signals and data will be sent to merging units and switches through optical-fiber Ethernet to achieve sharing. Protection equipments finish the calculation by using the redundant information and the final action will be done. In order to promote the combination property and integrated property of substation, the integrated protection will be provides platform of communication and data sharing. Meanwhile, taking full advantages of the large sum of information is helpful to research new algorithms and control schemes of multiple apparatuses.

## **(2) Protection system electromagnetic transient (PSCAD/EMTDC) model of UHV DC transmission ( $\pm 800\text{kV}$ )**

For the construction of Ultra-High Voltage (UHV) power grid, based on the PSCAD/EMTDC, this project will be to construct PSCAD / EMTDC equivalent model used in  $\pm 800\text{kV}$  UHV DC transmission system to simulate equivalently current DC protection system and carry out characteristics research. Construct equivalent model of  $\pm 800\text{kV}$  UHV DC transmission primary system in PSCAD / EMTDC platform, to achieve signal acquisition and transmission of control signals of the primary system in the PSCAD / EMTDC platform; Construct PSCAD / EMTDC interface with DC system protection function for engineering, will be use external function library to multiplex the DC system protection code for engineering in order to achieve equivalent protection simulation; construct time equivalent mechanism between the PSCAD / EMTDC offline simulation system and DC protection system for engineering to achieve equivalent simulation of real-time systems; conduct typical

failure experiments to simulate equivalently in real-time  $\pm 800\text{kV}$  UHV DC transmission protection function, will do the research of protection features and action situations, inspect and determine the protection configurations and will check rating parameters in engineering, suggest improvement and optimization plans, and provide technical support for engineering debug and operation.

### **(3) Power quality on-line monitoring and management system**

Power quality on-line monitoring and management system Multi-function on-line monitoring and management system for power quality mainly will be consists of the power monitoring center, Ethernet and the monitoring units in substations which is a hierarchical, distributed system. The monitoring units get the fundamental power parameters and the power quality indicators in substations and send them to the power monitoring center via Ethernet. The monitoring center analyze and process the data from monitoring units, and will be generating report forms and curves to have a complete knowledge of the power quality of power system so that it will provide the basis for improving power quality.

### **(4) Complex multi-branch distribution network online fault location research**

The project will belongs to one of the smart grid international communication series projects carried out in collaboration with the Russian / Chinese Company R & D center. It will Addressing the complex multi-branch distribution network, with unbalanced three-phase load, mixed deposit and load volatility characteristics of overhead lines and underground cables, this project propose a recursive type segmented flow calculation method, it is just needs

the information of the first segment of the distribution network feeder before and during the fault to quickly and accurately online search for the fault location. The method has high accuracy and strong robustness, especially for complex distribution network online fault location, and establish a solid theoretical foundation for the self-healing control of the smart grid.

With its unique modular structure, rapid reactive power response, characteristics of sub-phase equilibrium and control ability and harmonic elimination capacity, cascade STATCOM has been widely applied in the fields of group of wind power connected to the grid, electrified railway harmonic control, active and reactive power and voltage control of AC and DC hybrid system, etc. And it is one of the most active hot spots of FACTS research area since the beginning of the 21st century. This project will be carried out in-depth research from main circuit structure, the modulation strategy, system-level control strategy, the soft Phase-Locked Loop(PLL) technology, startup mode, and other aspects; built a detailed model of STATCOM under the PSCAD environment, and proposed a direct current decoupling control and nonlinear control strategy, It will be specific harmonic elimination modulation strategy, improved soft PLL technology, three DC capacitor voltage balance control strategies, and self-motivation and additional charging circuit startup mode, etc. It has passed verification through simulation.

## **2、 Interactive technology research of electric vehicles connected to grid (V2G)**

Smart Grid will be emphasizes safe, reliable, cost-effective, clean, environment protective, friendly interactive. Electric vehicles can be a distributed mobile energy storage unit in the grid. Interactive technology of electric vehicles to grid (V2G) will be

refers to the two-way communication between electric vehicles and the grid to realize the energy conversion between electric vehicles and the grid under the control of it. It will be involves in research of large-scale interactive influence of V2G to the power grid.

### **3. Research related with Condition monitoring of electrical equipment status**

#### **(1) Circuit Breaker on-line monitoring system**

Circuit Breaker on-line monitoring system will realized the data collection, storage, processing and display and statistics for recorded waves of 10 kV AC circuit breaker and 750V DC circuit breaker. It will be composed of the communication program, data processing program, and the user interface program. It will monitor the mechanical vibration signals of the circuit breaker switching process, breaker switching coil current, breaker switching main loop current, control power supply voltage, power supply voltage of the energy storage motor, and the circuit breaker auxiliary contact state, thus to distinguish the breaker critical states of its remaining electricity life, breaker switching coil current continuous time, breaker switching coil current, breaker switching time, mechanical parts of the movement of the breaker, energy storage motor action situation, etc.

#### **(2) Power transformer condition maintenance system based on sonic information**

This project will be monitor the sound of power transformers in running time, and use audio characteristic to identify the operating conditions of power transformers through the relationship study of audio features corresponding to different conditions of the power

transformer, and to find out individual and common characteristics corresponding to these states; and will use these characteristics to do qualitative or quantitative assessment of the overall state of the power transformer to form condition examination based maintenance decisions or recommendations. Distinguished results will be used as a separate indicator of the power transformer operating status, and can also be used as a part of various power transformer state maintenance methods; with other exam results, the audio exam results will realize the condition maintenance of the transformer.

#### **4. Research related with traction power supply system**

##### **A) . Effect of the high-speed electrified railway to power grid stability characteristics**

For studying the interaction of the Power Grid and the high-speed passenger / Freight dedicated line, using the methods of traction substation on-site measurement, modeling and simulation of transient stability calculations, relay protection calibration and other methods, the project will do a comprehensive and systematic study from the static and transient aspects of the influence of the high-speed electrified railway to power grid stability characteristics. According to the measured data, it calculated the electrified railway harmonics and negative sequence distribution in the grid, verified relay protection settings, greatly reduced the reliability of relay malfunction, will be improved stable operation level of the power system. This project as a whole will be in the international advanced level; it will in the international leading level in traction substation transient stable modeling aspect. Overall it achieved fruitful research results.

## **(B) High-speed railway traction power supply system RAMS assessment theory and its application**

The project will be belongs to the Pakistan Railway Science Foundation project. The subjects of the project include reliability, availability, maintainability and safety assessment of the high-speed rail 27.5kV traction power supply system and 10kV power supply system; from the external power system, the project will be many aspects of research including reliability assessment of high-speed rail power supply, the voltage level of traction substation connected to the power system, reliability assessment of the traction substation, reliability assessment of the catenary, multi-objective optimization of catenary periodic preventive maintenance strategy, the safety assessment for considering the traction power supply system in the extreme weather conditions, such as gale, ice covered and lightning; establish a RAMS theoretical assessment system of high-speed railway power supply system, and applied research results to the reality of Pakistan's first passenger line of Karachi to Lahore intercity.

## **(C) Fault location device based on traveling wave for the high-speed railway traction system**

This project combines the characteristics of the electric railway traction system fault, chose type A distance measurement method as the main method, and the type B and C distance measurement methods as supplementary ranging methods. In the algorithm, it will be selected third-order B-spline wavelet as the basic wavelet, according to wavelet transform singularity detection theory to locate the singular points, and put forward the concrete steps of using the traveling wave to measure catenary fault distance.

The core portion of the device hardware mainly will be adopted DSP control board and ARM control panel, based on high-speed sampling, and the GPS synchronized clock to achieve the precise positioning of the traveling wave. The research results will be used in high-speed rail (especially passenger dedicated line) to measure catenary fault distance; it greatly improved the accuracy of fault location, shortened the distance measuring time, and it is essential to the exclusion of the catenary fault; the results have social and promotional value.

#### **(D) Contact net (catenary) safety state real- time monitoring and testing technology**

Contact net safety real- time monitoring system will be use the technology as hidden trouble testing which puts contact line break line as the core ,whose monitoring contain height of Clump fell , the weight of contact wire tension, position of ratchet wheel , pulley deflection of Pulley and so on.; and it will be uses the platinum resistance sensor temperature measuring technology to monitor catenary temperature ; at the same time it will be uses methods such as Mining feature information extraction, classification and identification. Finally it will be realizes the contact network security monitoring and intelligent assessment and early warning system. The system will be uses high-accuracy sensor to realize real-time data acquisition, and at the same time uses respective data acquisition and processing module to analyze the data statistically , and also uses GPRS module to upload data to the upper machine. Through the management of Multiple terminals, collected data analysis and processing, we will be able to judge whether the contact line that in a anchor within the scope of the period is safe.

# Electric Drive & Control Engineering Research Center

Department of Electric Drive & Control Engineering will be mainly responsible for the professional teaching and research tasks of power electronics and electric drive, detection technology and automatic equipment.

The Faculty for doctoral students and graduate students will be in two disciplines of electrical engineering, and control science and engineering.

Department of Electric Drive & Control Engineering, the department will be carries out teaching and research work in the secondary disciplines of Power Electronics and Electric Drive, Detection Technology and Automation, Electrotechnics Theory and New Technology, Transport Apparatus Operation engineering.

It will be accumulated a number of scientific research and trained a number of Pakistani's who will be required high-tech talented professionals in rail transit traction drive equipment, train communication networks, sensor networks and network control, energy saving devices, computer monitoring and control systems, etc.

## **PART I Teaching and student training work**

### 1) Teaching work

Electric control department will undertaking 5 undergraduate main courses

- ❖ Automatic control theory,
- ❖ Circuits,
- ❖ Analog electronics,
- ❖ Digital electronics,
- ❖ Power electronics technology;

This Department undertaking the undergraduate teaching and academic research work in electric traction control technology, modern control theory, signal and systems, computer networks, fieldbus, sensor technology, electrical measuring technology, embedded systems, power electronics application technology, computer simulation, electrical control and PLC, electric drive automatic control system, AC motor variable frequency control, etc.

Electric control department will also undertakes postgraduate courses, including degree courses of power electronic circuits and systems, data communication and control networks, modern control theory, etc.

Academic researchers in electric control department not only will be responsible for substantial teaching tasks, but also will actively carry out research work about teaching.

## **PART II Main research Objectives**

### **I) Rail transit traction drive and energy-feedback power supply equipment System**

The Rail Transit Equipment Research Center of Electric Drive & Control Engineering will carried out close and effective Production & Research Cooperation in metro traction, low-floor light rail vehicle traction, energy feedback traction power supply for urban transit, linear induction motor (LIM) rail transit and the safety of high-speed railway, etc. The Research Center will grasp key technologies including electric traction system modeling for rail transit, 4-Quadrant converter control, traction electric machine converter control, high-frequency auxiliary power, optimized adhesion utilization, fault detect and diagnosis, network monitoring, damage assessment & life prediction, security prediction and control, dynamic maintenance.

#### **1) Traction and auxiliary converter system of low-floor light rail vehicles**

The key plan of Research will be development of 100%low-floor light rail vehicle.

It will provides electric traction and auxiliary converter system for the first 100% low-floor light rail vehicle of our beloved country with completely self-research. It will be uses advanced technologies such as vector control and digital high frequency control with the characteristics of compact structure, modularization, lightweight, low noise hommization etc.

## **2) Subway A type traction and auxiliary converter**

The subway traction converter will be based on 'the National development of the system of urban rail traffic energy-feedback traction power supply and traction drives', which will be the completely independent and will be applied into the system of subway traction drives to drive and control the motors. It will be the characteristics of modularization, lightweight, low noise and so on, which will totally take the Revolution in Pakistan Railways.

## **3) Energy-feedback Traction Power Supply System**

Energy-feedback traction power supply system will be based on the latest scientific and technologically Advance 'the development of the system of urban rail traffic energy-feedback traction power supply and traction drives', which gathers the characteristics of energy- feedback, traction power supply, high power supply quality and the compensation of power factor and harmonics. It will be the high performance-price ratio.

## **4) Traction Converter for Linear Electric Motors System**

Traction Converter for linear electric motors is the newest scientific and technological achievement, in the Global Railway Engineering.

Project: 'Development of the key technology and equipment for the new type linear electric motors transporting system'.

It will be used for applying AC power that linear electric motors need. It will adopts a vector control method compensated the end effect and realize high-performance traction control of linear electric motors.

## **II) Train control Communications Network**

Traction Control and Network Research of Electric control department, in Train Communication Network (TCN, ARCNET, etc.), rail transport fault detection and diagnostic systems, automatic testing, will develop a number of products with independent intellectual property rights and technology platforms, formed our own professional characteristics, conducted in-depth theoretical studies and will be published a series of academic research papers in real-time train communication network and reliability, the comprehensive monitoring of rail vehicles, high-speed train condition monitoring and fault diagnosis fields.

### **1) Web-based vehicle fault diagnosis system**

By technical means, the main objective of the system will be to accomplish the fault monitoring and diagnosis of key components of locomotives to detect and determine the fault position, record the failure process, through the cab display screen and other methods send an alarm and prompt troubleshooting methods or will make recommendations about how to take emergency measures to the driver and conductors. The system will be remarkable economic and social benefits.

### **2) Sensor networks, electric drive system network control**

Traffic Information and Networked Control (TINC) Research Center of Electric control department, mainly will undertakes research and development work in sensor networks, electric drive system network control, condition monitoring, field bus, and other aspects. Research center cooperated with the research and development of

road traffic information collected by sensor networks, network control and status monitoring system of the electric drive system, distributed sewage flow monitoring system.

# Power Electronics & Electric Traction Research Center

Power electronics and electric traction Research will be mainly betrothed in the research and teaching work in the power electronics and electric traction areas, and will play an important role in the applications of rail traffic electric traction, green energy conversion, and special power supply.

Research Center will be Focused on following Fields of Electric Traction:

- Rail traffic electric traction
- HXD2 heavy loaded electric locomotive auxiliary inverter system
- Inverter modules
- Chopper module
- Charger module
- Over-voltage suppressor module
- The application of linear traction motor in rail transit
- Linear motor belt line
- High temperature superconducting linear motor prototype
- The application of linear motor in rail transit
- Development and testing of high power ac drive locomotive traction control unit
- High power ac drive locomotive traction control unit
- Super capacitor energy storage system will be used in rail transit
- Super capacitor energy storage system experimental platform on-board
- Super capacitor energy storage system experimental platform in ground
- Super capacitor energy storage system used in rail transit

- Electric locomotive ac drive control system
- Ac drive control system platform
- Drive system of permanent magnet synchronous motor
- Permanent magnet synchronous motor drive system
- Green energy conversions
- Monocrystalline silicon/polysilicon reduction furnace and DC power system
- Monocrystalline silicon reduction furnace
- Growth process of Monocrystalline silicon
- DC power supply cabinet
- Key technology research of High power PV inverter test platform and Photovoltaic inverter
- High power PV inverter test platform
- Power conditioning unit
- Test system
- Power Conditioning Unit in spacecraft application

# Traction Power Supply

Traction power supply Research Center, mainly will be affianced in the research and teaching work in the electric railway traction power supply areas.

The Research Center will Conducts Research in the directions of the simulation and testing of the high-speed railway integrated grounding system, electric railway power quality testing and assessment, high-order harmonic resonance of the catenary and its suppression, long-distance railway power cable supply, etc.

Research Center will be Focused on following Fields of Traction Power Supply:

- ❖ "Research of the key technologies for power supply of electric railways
- ❖ "Research of passenger dedicated line long distance cable power supply technology"
- ❖ "High-speed railway power supply and power quality research and application
- ❖ "Technology and device of electrified railway catenary high harmonic resonance and its suppression

The Traction Power Supply Research Center will actively carries out the theory research and technology development in the fields of simulation and optimization of the traction power supply systems, electrical coupling mechanism and electrical matching key technologies of the train and catenary, high-speed railway catenary on-line monitoring technology, and strives for National electrified railway development to make a greater contribution.

The Research Center will be focused in the field of new energy, Traction Power Supply and will be open up new research directions in the areas of optimization design of electric vehicle charging stations, charging load scheduling management, etc.

Traction substation and catenary dynamic simulation test device

Developed train traction calculation and traction power supply simulation software's

The Research Center will assisting the school Training Department, the Research Center will undertaken the training task for the power supply operation and maintenance staffs of the Ministry of Railways.

# CENTER OF ELECTRICAL LABORATORIES

WITH the Aforesaid Concept of Electrical Engineering Research Center, to satisfy the main type development and demand of the electrical engineering academics, to gratify the teaching requirement of electrical foundation practice teaching, and utilize electrical facilities, instruments, and meters, the Electrical Engineering Laboratories will be constructed, the center of electrical laboratories with high level, multi-function and high performance.

The Following Labs will be required for Center of Electrical Laboratories:

- ❖ Electrical drive lab
- ❖ Motor lab,
- ❖ Electrical power lab,
- ❖ Automatic control lab,
- ❖ Electronic measuring lab
- ❖ Electronics technology lab
- ❖ Electrical machinery lab
- ❖ Power system emulation lab
- ❖ Technical innovation area

## **The comprehensive experiment center**

The construction of the Center of Electrical Laboratories will be constructed in phases and steps and will be achieved unified modular, network-based, systematic, multi-level teaching system.

In order to satisfy the requirements of electrical engineering development, and to complete the practice teaching based on the State of the Art programs, the center will aiming to develop into a system in academic and professional direction. To make students understand the interconnection between the fundamental subjects and the professional subjects, the system includes main course experiment, curricular design, comprehensive design, graduation design and internship. The center will adopts open teaching and management, with compulsory and elective courses of electrical experiments for all the students of the Research Center to choose.

## **The unified center management system**

The center of electrical laboratories will be established a unified management system, organize a professional experimental technical team and will appoint full-time persons in charge of the organizational management, implementation of the system, scheduling and coordination of all kinds of experiments to further improve the quality of professional practice teaching. Meanwhile, the Research Center will set up a laboratory management information system, implementing a unified informationized management of laboratory, experimental equipment, curriculum arrangement, staff arrangement, courses and student achievement. Students will choose the experiment combinations

based on their own level, the development direction and personal interest.

## **Characteristics**

Features of the Center of Electrical Laboratories will be below:

1. Optimized allocation, modularization and serialization of resources;
2. Diverse forms: simulation, teaching system, industrial environment;
3. Openness: all experimental series will open to students;
4. Innovation: sophisticated equipment especially for innovation;
4. Multi layers: classroom teaching, basic skill training and comprehensive training of engineering ability, innovative practice;
5. Individualization: The project provides conditions for individualization;
6. Wide coverage of subjects;
7. A variety of experiments;
8. Wide orientation.

# **INSTITUTE OF RAILWAY ROLLING STOCK**

**Railway rolling stock Institute will produce Specialists in  
Following Fields:**

**Railway rolling stock. Specialization "Freight cars"**

**Railway rolling stock. Specialization " High-Speed land transport"**

**Railway rolling stock. The specialization of "electric transport of Railways"**

**Cargo Commercial Work**

## **Railway rolling stock. Specialization "Freight cars"**

1. Railway Rolling stock: research and design of components and parts of rolling stock; improvement of maintenance and repair;
2. Study of the thermal state of the axle box Assembly with roller and conical bearings and substantiation of new principles of thermal diagnostics of the axle box;
3. Analysis of technical equipment of car repair enterprises and development of technologies for car repair;
4. Research of dynamic loading of perspective domestic rolling stock by mathematical modeling methods;
5. Assessment of vibronagruzennosti bodies of gondola cars when unloading caked and frozen cargo with the use of vibrotechnics;
6. Manage service maintenance and repair of rolling stock;

## **Railway rolling stock High-speed ground transport;**

### **Electric railway transport**

1. Development of the technological process for scheduled maintenance and current repair of traction vehicles (electric locomotives, diesel locomotives, electric trains);
2. Increasing the resource of wheel pairs and implementation of coupling interaction of wheels and rails when braking traction rolling stock;
3. Development of 24 kV DC electric traction system for high-speed railway;
4. Improving the operational reliability of traction motors;

Railway operation (Railway operation. Specialization of "bulk transport."), (Railway operation. Specialization " Cargo and commercial work"),

1. application of mathematical methods to improve the transportation process in transport;
2. Improving the safety and reliability of transport facilities in case of technological failures;
3. Simulation of the operation of main and industrial railway stations, railway and industrial transport hubs in solving problems related to the justification of investment decisions for the development of transport infrastructure;

## **Railway operation**

### **Cargo and commercial work**

1. Improving container and package transport by rail;
2. Research of interaction of cargo and rolling stock in the process of transportation on railway transport in various conditions (on a straight section, in curves, on the slope of ascent and descent, at junctions, etc.);
3. Optimization of the public service system in suburban transport in a combined way;
4. Legal regulation of relations between owners and users of access roads and carriers of public railway transport;

# Path and track management Institute

## **Main Objectives of the Institute**

1. Improvement of structures and methods of strengthening the roadbed, creation of methods for forecasting its reliability, calculations for strength and stability;
2. Development of advanced technologies of track management and creation of means of mechanization of track works;
3. Calculations of the rail track and justification of the main parameters of the design of switches;
4. Development of methods of feasibility studies in the track economy.

## **Scientific schools of the Institute**

1. Problems of the upper structure of the path
2. Problems of organization, planning and management of track facilities
3. Problems of railway trackbed

## **Research Objectives of the Institute**

- ❖ Theoretical foundations of centrifugal modeling of the roadbed.
- ❖ Assessment of the reliability of the operated roadbed.
- ❖ New ways to stabilize and strengthen the roadbed, including embankments with armasrulebeli designs and gabion structures, embankments on weak foundations and permafrost soils and strengthening the main site with geosynthetic materials.
- ❖ Theory of stability and reliability of the joint-free path.
- ❖ Investigation of the hijacking path and suggestions for securing from hijacking.
- ❖ Construction of the glue-bolt joint.
- ❖ Construction of the permanent way on manmade structures, including ballast less design
- ❖ Development of the ARS bond design.
- ❖ Ways to calculate the straightening of the path and the mechanization of straightening.
- ❖ Technical and economic research in the track economy.

- ❖ Information technologies in track management and in the design of Railways and highways;
- ❖ Geoinformation technologies in the design, construction and operation of linear objects;
- ❖ Investigation of the work of elements of the upper structure of the path;
- ❖ Survey of industrial railway tracks and optimization of the transport complex of enterprises;
- ❖ Railway transport as part of General urban passenger transport;
- ❖ Survey of railway tracks and industrial enterprises;
- ❖ Survey and design of Railways taking into account the impact of the environment;

# School of Geodesy, Geoinformatics and Navigation

## Main Courses

- Jurisprudence;
- Computer science;
- The General course of the Railways;
- Fundamentals of railway construction;
- Computer graphics;
- Forming geo-information space;
- Inventory of buildings and structures;
- Engineering arrangement of territories;
- Fundamentals of urban planning and planning of localities;
- Land management;
- Fundamentals of real estate cadastre;
- Typology of real estate objects;
- Legal support of land management and cadastre;
- State registration, accounting and evaluation of land;
- Registration of real estate transactions;
- Economics of enterprise;
- Geodesic works when maintaining the cadastre;
- Photogrammetry and remote sensing;
- Legal support of real estate activities;
- Development of territories;
- Investment designing.

The educational process will build using modern teaching methods, such as: conducting lectures with demonstrations of modern equipment, laboratory classes with the possibility of individual work with the instrument fleet of the Department, practical classes using specialized software, mandatory training practices.

**Teachers of the Department will conduct classes in the following specialties:"**

Land Management and cadastre", " real estate management Expertise ". In addition to engineering geodesy courses will be in the first year, the Department will conducts a special course in engineering geodesy and Metrology. In the educational process, in addition to traditional courses, promising elements of geo-information technologies will be used, based on the use of modern measuring equipment, digital representation and storage of terrain models, automated construction of maps, plans and projects of structures.

# Institute of Computer, I.T & Software Engineering

## **FACULTIES:**

- **Computer Science & Technology**
- **Information Security**
- **Software Engineering**
- **CAD SYSTEM**

## **Computer Science & Technology**

- I. DURATION OF COURSE:  
Standard: Four Years on a full time basis
  
- II. DEGREE:  
Bachelor of Engineering
  
- III. PROGRAM OBJECTIVES:

The Specialty of Course will be to Produce High Ethical, with Good Communication Skills, Expression & Writing Skills and Learning Ability.

Simultaneously Students will be Prodigious Knowledge of Mathematics, Electronics, Computer & Communication. Meanwhile they'll be Expert in Basic Theory and Application Technology of the Internet things.

These Graduates will be Proficient with Practical approach of Innovation & Strong Team Work. Graduates will work in many areas including research on the level of both the Internet of Things System and Applications, System Development, Technology Application, System Integration I.T. Management.

## **Information Security**

- I. DURATION OF COURSE:  
Standard: Four Years on a full time basis
  
- II. DEGREE:  
Bachelor of Engineering
  
- III. PROGRAM OBJECTIVES:

The Specialty of this Course will be to Develop Experts with Good Communication Skills, Expression & Writing Skills and Learning Ability.

Simultaneously Students will have Strong Knowledge of Mathematics and Electronics. Meanwhile they will Superlative Skills in Key Information Security Technology, Managements Methods & Standards, Laws and Regulations of Information Security.

Students will have Strong Practical Capability & Consciousness of Ground Issues of Information Security, Sagacity of Innovation and Sprit of Teamwork.

After Graduation Students may become Leading Specified Professionals with Potential to Develop Social Adaptability who will able to work in many fields including Research & Development Information Security Production, Design and Analysis of Information System Security, Information Security Infrastructure, Operation & Maintenance, Information Security Production, Integration, Information Security Technology Consultation and Assessment Services, Teaching, Management and Law Enforcement.

Information security & Techno sphere security (Information security Profile " Organization and technology of information security (in transport)"

1. Models and methods of information security management;
2. the Concept and structure of the information and educational environment in the areas of training "Information systems and technologies" and " Information security»;
3. Development and improvement of cryptographic algorithms for information protection

# Software Engineering

- I. DURATION OF COURSE:  
Standard: Four Years on a full time basis
- II. DEGREE:  
Bachelor of Engineering
- III. PROGRAM OBJECTIVES:

The Course will be Engrossed to Produce Elite Engineers with High Level Excellence, International Exposures, Acquaintances & View Point of Latest Software Developments, Resilient Engineering Ability and Inventive Consciousness.

The Students will have high Realization & Comprehension of The Ground Realities related to Railway Transport & Infrastructure issues, Professional Morality, Unfathomable Knowledge of Computer Software & Software Engineering.

They will advance and Superficial Capability of Software Designing, Programming & Project Management, with a strong Vision & Proactive Capacity, Cooperative Approach and Cross Cultural Communiqué Capability and They will able to Lead the Development of Railway Transportation Software Industry and Computer Software Industry in general.

# CAD System

## **1. high-Quality traditional engineering education combined with intensive study of information technology in special disciplines:**

- ✓ "Operating systems",
- ✓ "Databases",
- ✓ "Computer information protection"
- ✓ "Computer graphics",
- ✓ "Intelligent systems",
- ✓ "Computer networks",
- ✓ "Geometric modeling" and others.

## **2. Study and application of various software products in the educational process:**

- ❖ Visual C++ (object-oriented programming)
- ❖ VBA (built-in programming language for Windows applications)
- ❖ Word, Excel, Access (main Windows applications)
- ❖ AutoCAD, Visual Lisp (computer graphics)
- ❖ SCADA (system for calculating and designing structures)
- ❖ KATRAN (calculation of load-bearing structures)
- ❖ Variant (solving design selection and optimization problems)
- ❖ T-flex and other 3D graphics packages
- ❖ Visual Prolog (the creation of expert systems)
- ❖ Other New Programs of CAD

# Institute of Architecture Engineering



## **FACULTIES:**

- **Architecture**
- **Architecture and Civil Engineering**
- **Urban & Rural Planning**
- **Industrial Design Engineering**
- **Design**

## **Architecture**

- I. DURATION OF COURSE:  
Standard: Four Years on a full time basis
  
- II. DEGREE:  
Bachelor of Engineering
  
- III. PROGRAM OBJECTIVES:

## **ARCHITECTURE**

Researches the buildings and the built environment which human beings inhabit, architecture is a Comprehensive Discipline which aims to Recapitulate the knowledge gained from the process of building activities, study the rules and methods of this, and create proper form and spatial environment which could meet human beings' needs and aesthetic standards. As a combination of science and art, engineering and humanities, the major of Architecture contains characters of both fields. This professional field includes majors of Architectural Design, Architectural History, Architectural Technology, Urban Design, Interior Design and Architectural Preservation, which composites the domain of human's environment altogether with areas of urban and rural planning and landscape architecture.

### **Research areas**

Architectural Design and Theory, Urban Design and Theory, Architecture History and Theory, Architecture Technology Science.

## **Training characteristics and objective**

To train the students to Dominant architecture theory and basic knowledge system as well as design skills, obtain higher creative way of thinking and academic ability, acknowledge fundamental history and current situation of the discipline, obtain independent ability to carry out architectural design and research, become interdisciplinary architectural design talent with potential abilities for higher level of research and design.

## **Employment Areas**

Participating architectural design and research in various kinds of architectural design institutions, urban planning and design institutions; devoting on working areas such as management, education, development, consulting in construction policy and management departments, real estate development company, construction departments, supervisor departments. Graduates could also choose to carry on Ph.D study as other choices.

## **Major Modules**

Architectural Design and Theory, Architectural Design and Theory, Architecture Theory, Architecture Critics, Discrepancy of the Sub-Continent & Pakistan and Western Architectural Culture, Urban Design, Architectural Heritage Conservation, Sustainable Architecture Design and Theory, etc.

# Architecture and Civil Engineering

- I. DURATION OF COURSE:  
Standard: Four Years on a full time basis
- II. DEGREE:  
Bachelor of Engineering
- III. PROGRAM OBJECTIVES:

## Major Description

Stared as a Fundamental Construction Engineering area, the major of Architecture and Civil Engineering will be Emphases on Researching and Generating human beings living Environment, as well as Constructing and Improving Various Construction Facilities. Its area relates to regional and urban planning, industrial and civic architecture design, as well as all kinds of civic facilities and survey, design, construction and maintenance of the built environment. This major includes Regional Planning, Urban Planning, Urban Design and Architecture Design.

## Research areas

Architectural Design and Theory, Urban Design and Theory, Architecture Technology Sciences.

## Training characteristics and objective

This major Accepts training program will be with a combinations of classes learning and professional practices and double-supervisor-system. One's 1st supervisor should be taken by teaching

members with graduates-supervision quality from the School of Architecture and Design. One's 2nd supervisor should be taken by off campus professional experts with rich architectural design experience. Therefore, students will be trained to dominant solid fundamental theory as well as broad professional knowledge, higher level of design practice ability, actual on-site problem-solving ability. They will be are capable of professional tasks, managements works. Graduates will be trained to be professional talents with excellent professional quality.

### **Employment Areas**

Participating architectural design and research in various kinds of architectural design institutions, urban planning and design institutions; devoting on working areas such as management, education, development, consulting in construction policy and management departments, real estate development company, construction departments, supervisor departments.

### **Major Modules**

Architectural Theory and Practices, Urban Design Theory and Practices, Landscape Planning Design Theory and Practices, Construction and Engineering Theory and Practice, Sustainable Architecture Theory and Design, Transportation & Railway Transportation Architecture Design, Architecture Codes, Urban Conjunctions Design Practices, Urban Landscape Design, Preservation and Regenerations of Historic Architecture, Large-scale Public Architecture Design.

# Urban & Rural Planning

- I. DURATION OF COURSE:  
Standard: Four Years on a full time basis
  
- II. DEGREE:  
Bachelor of Engineering
  
- III. PROGRAM OBJECTIVES:

## Major Description

The discipline of rural and urban planning concentrates on the urban land employment and substantial urban space planning. The discipline is also cross-related with social sciences on policies, planning theories, and construction administration of urban and rural planning. Its research object covers the whole environment of urban and rural areas.

## Research areas

Urban planning and design theory, Urban design, Planning and design of civil dwellings, Reform and Regeneration of Cities, Urban landscape design.

## **Training characteristics and objective**

Based on this course discipline and resources of the school and faculties, the course is aimed to culture talented students with international visions and creative minds on neo-generation on city design-planning and administration. The course is taught with newest textbooks though the world. The target students can also get their furtherance by means of international exchange programs and cooperation with practice institutes.

## **Employment Areas**

Design Institutes, Investment Agency, Government Department, Public Institutes and etc.

## **Major Modules**

Urban planning and design, Urban morphology, Theory and Method on Urban Regeneration, Civil Dwelling Planning and Civil Architecture Design, Reservation and Reformation of Ancient City, Landscape Design.

# **Industrial Design Engineering**

- I. DURATION OF COURSE:  
Standard: Four Years on a full time basis
  
- II. DEGREE:  
Bachelor of Engineering
  
- III. PROGRAM OBJECTIVES:

## **Major Description**

Industrial Design Engineering is a professional discipline under the categories of Art. It is an art and science, production and life, design art and design disciplines engaged in theoretical research. This professional field includes majors of environmental design, visual communication, digital media art, and industrial design.

## **Research areas**

Environmental Design, Visual Communication Design, Digital Media Art, Industrial Design.

## **Training characteristics and objective**

To train the students to master design theory and basic knowledge system as well as design skills, obtain higher creative way of thinking and academic ability, acknowledge fundamental history and current situation of the discipline, obtain independent ability to carry out architectural design and research, become interdisciplinary design talent with potential abilities for higher level of research, design and Social practice.

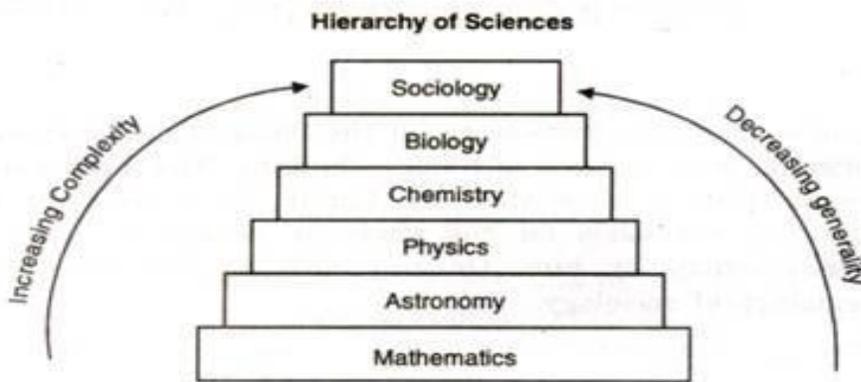
## **Employment Areas**

In graphic design, advertising, branding information industry, printing industry, all kinds of interior design and landscape design, public art and design, exhibition design, interactive media design, digital video production, animation, design and production, game design and other design fields of enterprises, education and research institutions engaged in the design, research, teaching, construction, management, supervision and other work. Graduates could also choose to carry on Ph.D study as other choices.

## **Major Modules**

Design History of Art Theory, Design Thinking and Methodology, Chromatics, Print Media Design Research, Design Studies of Indoor and Outdoor Environment, Public Art Research, Industrial Design Theory and Methods, Environmental Awareness and Expression, Contemporary Design and Aesthetic Image of Thinking, Visual Arts and Design Research, Design of Modern Western Art, and other courses.

# Institute of Fundamental Sciences



## **FACULTIES:**

- **Department of Mathematics**
- **Department of Physics**
- **Department of Chemistry**
- **Research Center of Optoelectronic Technology**
- **Academy of Fundamental & Interdisciplinary**
- **College of Life Sciences & Bio Engineering**

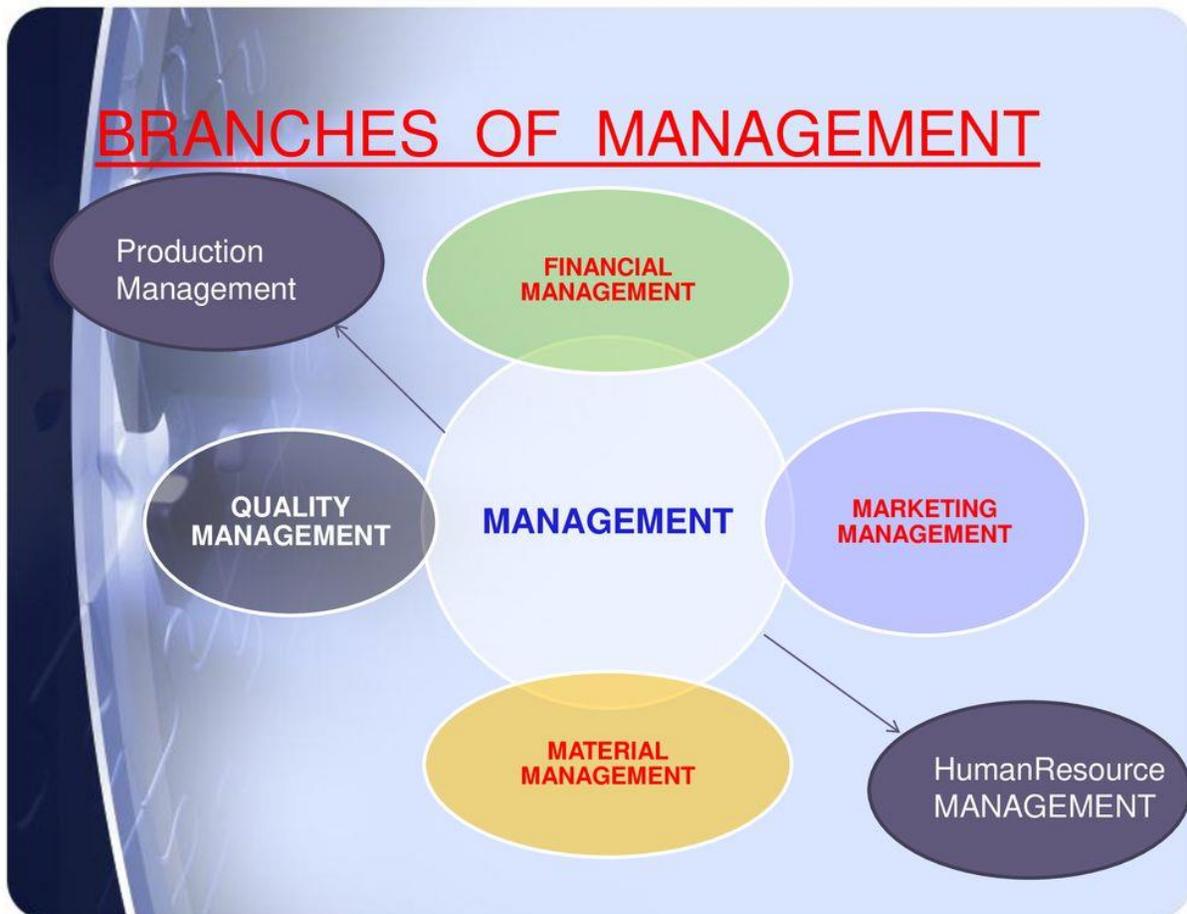
## **Research Center of Optoelectronic Technology**

The College of Optoelectronic Technology will be researched on following Fields:

- ❖ Inorganic and Organic Electroluminescent Materials & Devices
- ❖ Low Dimensional Semiconductor Physics
- ❖ Rare Earth Materials

- ❖ Optical & Electrical Properties of Materials Characterization and its Application in Display & Memory Devices and their Operation Mechanisms.

# Institute of Railway Management Sciences



## **FACULTIES:**

- **Department of Economics**
- **MBA in Management & Marketing**
- **MBA in H.R.**
- **MBA in Int'l Logistics & Railway Logistics**
- **MBA in Railway Trade & Business**
- **MBA in Railway Transport & Tourist Services**
- **Department of Sociology**

## **Faculty of Economy**

Accounting, analysis and audit in railway transport;

Economics of railway transport enterprises and organizations

1. Ensuring the balance of production and economic parameters of the Pakistan Railways holding as a factor for improving the efficiency of the transport business;
2. Economic regulation of business units in the conditions of the Pakistan Railways holding;
3. Development of an automated software package for determining labor costs using microelement time standards;
4. Market relations in railway transport and industry; development and evaluation of economic parameters of railway operation;
5. Management models development of the transport network in the framework of spatial Economics;

# Faculty of Marketing & Management

Management of service activities in transport;

Management of transport organizations;

Organization management

1. Management and marketing of transport complexes;

2. Improving railway transport management;

3. Methodological tools for assessing the stability and effectiveness of the development of the macro-regional transport and logistics system using mathematical modeling;

# **Faculty of Human Resources**

## **Personnel management in transport**

1. Management and Human Resources;
2. Development of an effective social system of human resource management in the conditions of innovative development of enterprises and improvement of social management technologies;
3. Training of specialists of personnel services of the Sverdlovsk railway;

# **MBA in Railway Trade & Business**

## **Trade business**

### **Commerce on transport**

1. Practice-oriented approach to the formation of professional competencies of specialists in the network system of the educational process;
2. A method for quantitative assessment of competencies of specialists of transport enterprises;
3. Corporate quality management systems for transport and logistics services in railway transport
4. Methodological tools for assessing the stability and effectiveness of the development of the macro-regional transport and logistics system using mathematical modeling;

## **Department of Sociology**

### **Sociology**

1. Sociological analysis of the principles, methods and social results of management innovations; the problem of management effectiveness;
2. Methods of collecting, analyzing and evaluating social information in the human resource management system of the transport complex;
3. Sociology of work;
4. Development and improvement of social technologies and programs in the human resource management system in the context of innovative development of transport complex enterprises;.

# **MBA in Railway Transport & Tourist Services**

## **Transport services**

1. Optimization of the system of public service in suburban transport in a combined way;
2. Formation of a new scientific and practical paradigm "Management of green transport chains" in the context of sustainable development of the world community;

## **Transport tourism**

1. Problems of formation and prospects of development of railway tourism;
2. Technology of complex actualization of the cultural and historical heritage of the cities of Pakistan;
3. Improving the economic and financial activities of travel agencies; business planning in tourism;

THANKS

TEN END