GHULAM ISHAQ KHAN INSTITUTE
OF ENGINEERING SCIENCES AND TECHNOLOGY

30 YEARS OF EXCELLENCE

UNDERGRADUATE PROSPECTUS 2024

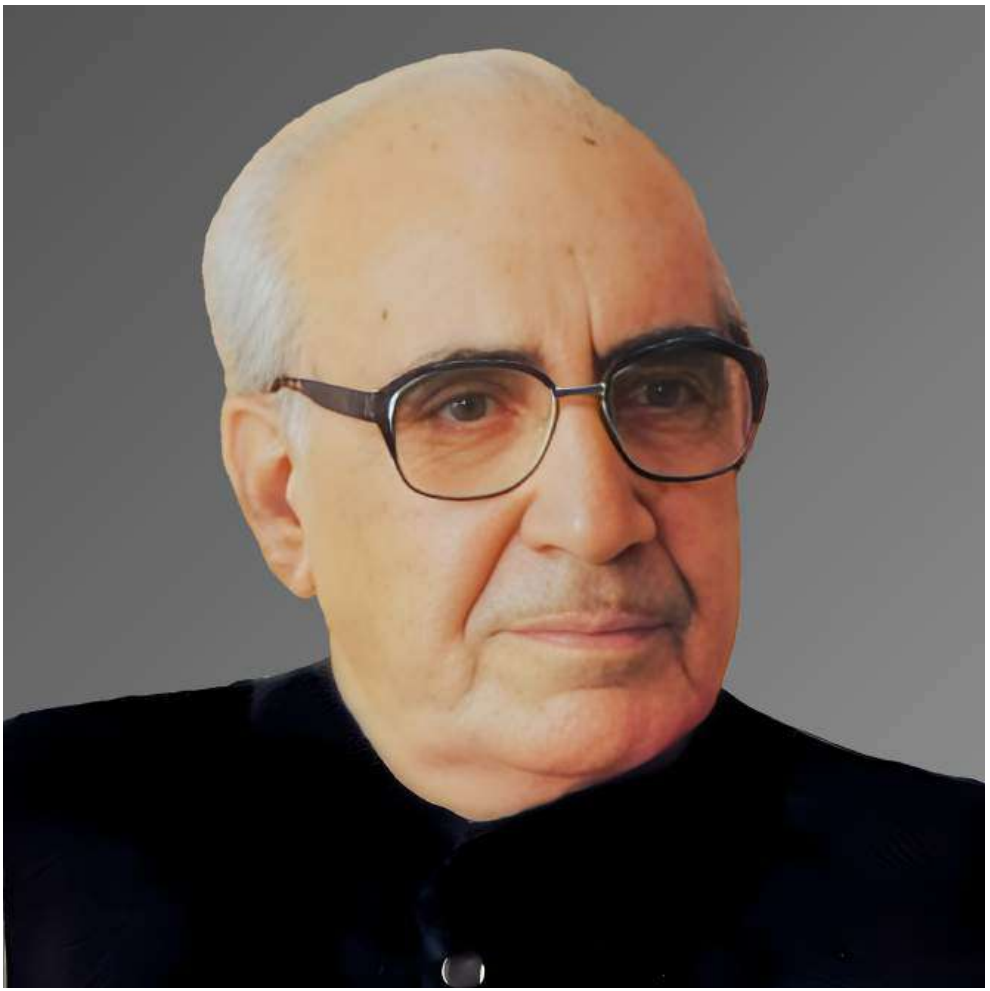
VISION

The GIK Institute seeks to play an inspiring role in imparting high-quality education and research in the fields of engineering, sciences, emerging technologies, and other disciplines.

MISSION

The Institute is to provide excellent teaching and research environment to produce graduates who distinguish themselves by their professional competence, research, entrepreneurship, humanistic outlook, ethical rectitude, pragmatic approach to problem solving, managerial skills and ability to respond to the challenge of socio economic development to serve as the vanguard of techno-industrial transformation of the society.

The Founder



The GIK Institute is as dear to me as a child to his parents. It gives me pleasure to see that the sapling we planted in 1993 is now a flowering tree providing its cool shade to seekers of knowledge.

Ghulam Ishaq Khan

From the Chancellor

The Ghulam Ishaq Khan (GIK) Institute of Engineering Sciences and Technology has been delivering top-tier education in engineering. Computing, technology, and management programs. I commend the dedication of the faculty, staff, students, and alumni, whose collective efforts have brought the Institute national and international acclaim.

Let us reaffirm our dedication to excellence. With its commitment to innovation and adaptation, the GIK Institute is poised to catalyze socio-economic transformation. Its alumni, equipped with the nurtured knowledge and skill, will contribute to the advancement of Pakistan and beyond.

Institutions like GIKI, with a legacy of three decades of excellence, serve as pillars of progress and innovation. They must act as a catalyst for transformative change, nurturing visionary leaders within the techno-industrial sphere. I hope that GIK Institute will continue its pursuit of excellence, empowering its students and alumni to become agents of positive change and fostering a prosperous future for Pakistan.

I am delighted that the institute produces high-quality, competent, and skilled professionals endowed with optimal management, administrative, and technical skills to serve the country.

Asif Ali Zardari
President of Islamic Republic of Pakistan

From the President

As the President of SOPREST, I am delighted to convey this message to the prospective students and their families.

The Ghulam Ishaq Khan Institute of Engineering Sciences and Technology (GIKI) was founded in 1993 by the late Ghulam Ishaq Khan, former President of Pakistan. In the ensuing three decades the University has grown into a center of excellence in teaching and research in engineering, science, and technology. Today the Institute boasts an alumni body of over 7000, in more than seventy countries, many of whom have excelled in and made lasting contributions to their chosen fields of endeavor.

Despite the challenges faced by our country, I believe that Pakistan has enormous potential, and our young people are a critical part of unlocking that potential. We need to invest in their education and provide them with the tools and knowledge necessary to compete globally. Given the opportunity, Pakistanis can compete with - and beat - the best in the world. GIKI's selective admission process, which emphasizes merit and potential, ensures that the brightest young Pakistani women and men are given the opportunity to learn from our highly qualified faculty and develop the skills and knowledge necessary to drive growth and development in Pakistan.

It goes without saying that the future talent of a country shapes how governments and private organizations/ firms are best governed. They derive value from their human capital. In the current economic turmoil, the responsibilities of educational institutions and talented students have assumed significant importance. I would certainly be wishing all the best and expect GIK to empower its talent to become knowledge workers. GIK should provide an enabling environment to students to learn and help organize the activities in a novel way for providing ultimate support to the country.

Change is the only constant in life, and as we move further into the 21st century, we are witnessing huge advancements in technology, particularly in the areas of artificial intelligence (Al) and automation. These technologies have the potential to transform industries and society in ways we cannot even imagine. GIKI is determined to be at the forefront of these developments, with plans for setting up a Center of Excellence in proposed campus at Islamabad. This comes alongside further additions to our computer sciences programs. In today's digital world where information and knowledge are fast becoming the basis of human economic and social progress, I am glad to see that GIKI is determined to build up its lead as Pakistan's pre-eminent center of excellence in these areas.

The strength of the GIKI "brand" allows it to collaborate with highly ranked universities and corporations around the world through student and faculty exchange programs. As entrepreneurs upend the established corporate world order, our business and management program, with a focus on entrepreneurship and enterprise

development, aims to supplement the sound technical expertise of our students with the tools that they need to succeed in the business world.

GIKI's location - a beautiful campus nestled amongst picturesque hills in Topi, Khyber Pakhtunkhwa, a ninety-minute drive from Islamabad is another competitive advantage. The serene surroundings provide an ideal learning environment. The clean air and natural beauty of the area also promote health and well-being, which is vital for students to perform their best academically. Our student body is incredibly close-knit, with most of our students residing on campus. This also means that our faculty - many of whom are leading figures in their academic fields are always accessible to students on a 24/7 basis.

The Institute's infrastructure facilities such as state-of-the-art smart classrooms, modern laboratories, sports facilities, and residential hostels offer a fully supportive environment for study, research, creative and co-curricular activities.

I want to thank our able Rector and the other members of our distinguished faculty for their leadership. We are fortunate to have a body of experienced and dedicated supervisors, teachers, and support staff, who are important assets to the Institution. All faculty members recognize their key role as teachers and mentors to our young students, who can rely upon them for their guidance and support.

I am confident that the Ghulam Ishaq Khan Institute of Engineering Sciences and Technology is an excellent academic experience for those who choose to pursue their education with us. Our focus on excellence, innovation, and creativity will help our students succeed in whatever career path they choose.

On behalf of SOPREST, I invite all prospective students and their families to consider GIKI as a pathway to a successful and meaningful career.

Engr. Salim Saifullah Khan
President SOPREST

From the Rector

It is my great pleasure to welcome you to the GIK Institute, an icon of quality education recognized nationally and internationally. Over the past three decades, GIK Institute has earned acclaim from prestigious organizations such as Times Higher Education, QS World University Rankings, and UI GreenMetric.

Our fully residential campus fosters a close-knit community where students and faculty live within walking distance of state-of-the-art classrooms and laboratories, enhancing the learning experience and promoting collaboration. The Institute hosts students from diverse backgrounds across the country. We offer undergraduate, master's, and doctoral programs in fields such as Electrical Engineering, Computer Science and Engineering, Mechanical Engineering, Material Science & Chemical Engineering, Civil Engineering, and Management Sciences. Our alumni network, with over 7,000 members in 70 countries, includes many who hold influential positions in Fortune 500 companies.

To meet the demands of the digital era, we have introduced new programs in Software Engineering, Artificial Intelligence, Data Science, and Cyber Security. Our curriculum, featuring courses on Generative Artificial Intelligence, Machine Learning, and Innovation, equips students with cutting-edge knowledge and skills. We are enhancing our first-year common courses to include modules on freelancing and skill development. These modules will provide our students with the necessary tools and knowledge to undertake remote work and freelance opportunities, enabling them to contribute to the economy from the outset of their academic journey.

This year, we are also introducing Chemical Engineering with a specialization in Oil and Gas, in collaboration with OGDCL. Our mission is to achieve excellence in education, engineering, technology, and innovation through the combined efforts of our faculty, students, and staff. We strive to provide a unique learning experience that fosters critical thinking, research skills, practical abilities, and professional competence, preparing our students for leadership roles.

As a sustainability-focused institute, our faculty are engaged in groundbreaking research in areas such as Sustainable Development, Green Hydrogen, Clean Energy, Robotics, Chip Design Verification, AR/VR in Education, Nanotechnology, Electric Vehicles, 5G/6G Networks, Machine Learning, Blockchain, Quantum Computing, and Functional Reverse Engineering. Their work advances knowledge and addresses critical societal challenges, solidifying our reputation as a center of research excellence.

We cultivate future industry leaders through our startup incubator and an Outcome-Based Education curriculum, featuring innovation and makers labs. This approach empowers students to develop competencies in product development, software, devices, and project management, leading to national and international recognition, including from the Washington Accord.

GIK Institute offers extensive financial assistance, including scholarships and aid, and partners with organizations for additional scholarships. The GIK Alumni Association also supports current students through fundraising, scholarships, internships, and mentorship.

We are grateful to all our partners, friends, and well-wishers, especially the Founding Fathers, Board Members, Rectors, Pro Rectors, Deans, Directors, faculty, staff, and alumni for their immense contributions to the Institute's success.

Thank you for being part of the community, and we look forward to welcoming you to the Institute.

Prof. Dr. Fazal Ahmad Khalid, SI
Rector

Content

CAMPUS LIFE

Genisis

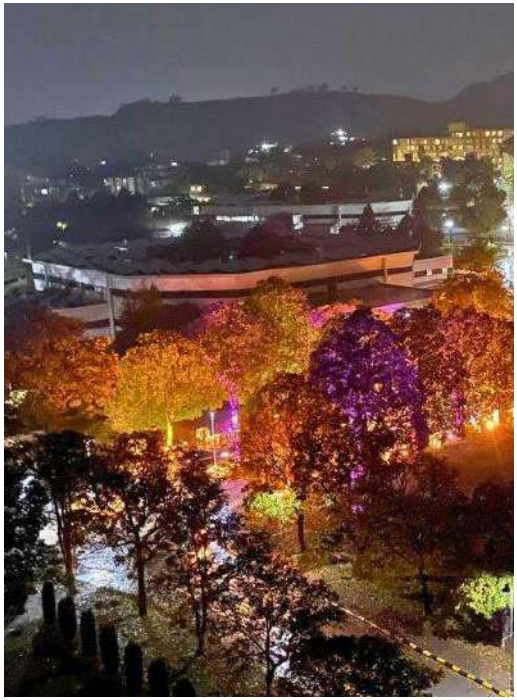
The Genesis of the Institute goes back to the early 50's when the late Mr. Ghulam Ishaq Khan, during his close association with the Water and Power Development Authority and the Pakistan Industrial Development Corporation, became acutely aware of Pakistan's dependence on foreign expertise and imported technology. His frequent interaction with foreign and local experts led to the idea of establishing a center of excellence in engineering sciences and production technology whose standards of education would be comparable to those of its counterparts in advanced countries. The transformation of this idea into a practical proposition took place in December 1985 when the Benevolent Community Care and Infaq Foundation donated Rs. 50 million for setting up an institute, and the Khyber Pakhtunkhwa Government donated 218 acres of land for its campus.

A milestone in the evolution of the Institute was the registration, in June 1988, of its parent body, namely the Society for the Promotion of Engineering Sciences and Technology in Pakistan (SOPREST). Mr. Ghulam Ishaq Khan, the then President of the Islamic Republic of Pakistan, was elected President of the Society for life and Mr. H. U. Beg appointed its honorary Executive Director. The task of conceiving and formulating the basic form and features of the Institute was entrusted to a group of eminent scientists and engineers. Civil works at the campus site were started in early 1990. An interim office of the Institute was set up in August 1992 where experienced professionals worked on the educational aims and philosophy of the Institute, its curricula, and requisite equipment for its laboratories and workshops. The Ordinance for the establishment of the Institute was promulgated by the NWFP Government in March 1993 while the GIK Act was passed by the provincial Assembly in 1994. The first batch of students entered its portals in October 1993. It is the first not-for-profit, non-governmental institute of its kind in the country and is dedicated to bringing our engineering education at par with that of advanced countries.

A rare picture with an autograph by the Late Ghulam Ishaq Khan founder of GIK Institute

Aims & Objectives

The aim of the Institute is to pursue excellence in education and research by developing appropriate curricula and teaching practices, acquiring talented faculty /students and providing an environment conducive to teaching and learning. Its graduates are expected to possess high professional competence combined with the humanistic and moral values envisaged in its Profile of the Graduates. The educational philosophy of the Institute lays emphasis on training of the mind rather than stuffing it with an inert body off acts; on expanding the scientific imagination of the students rather than making them tread well-worn and outmoded grooves of thought. Guided by such convictions, the Institute imparts Education to its students by confronting them with real-life problems and inculcating in them a problem-solving approach.They are encouraged to explore and solve problems,to break new grounds and to cultivate leadership qualities.



Pakistan is on the threshold of a major breakthrough in the techno-industrial fields and needs professionals with ability and vision to lead the way. The Institute aims at producing such professionals with a strong base of engineering education and research. It strives to produce graduates who can upgrade existing technological activities in the country and in whom professional excellence is inseparable from a commitment to national ideals.

Board of Governors

The Board of Governors sits at the apex of the statutory pyramid of the Institute and its composition is the same as that of the General Council of the Society for the Promotion of Engineering Sciences and Technology. It has overall control of the Institute, the powers to create new components of the Institute such as a school, faculty, or any other teaching or research unit, and to change the constitution of its Executive Committee and Governing Council.

PRESIDENT SOPREST
Engr. Salim Saifullah Khan

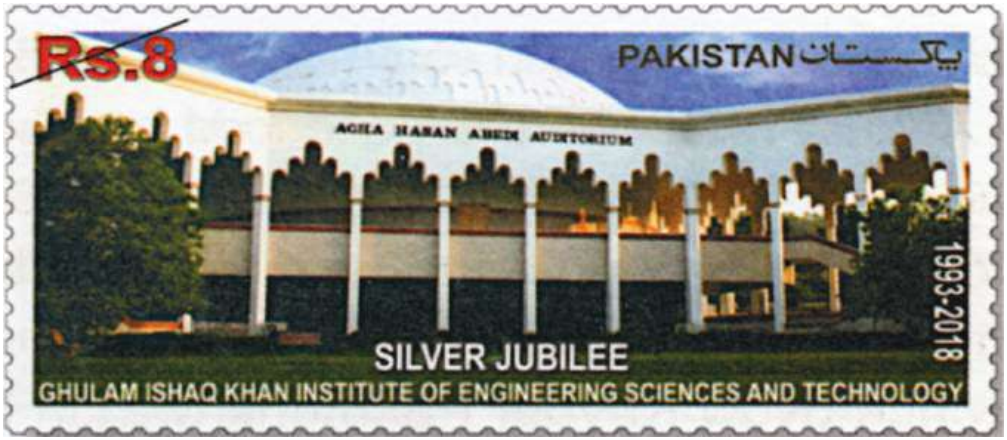
Executive Director
Mr. Shakil Durrani

Members
Mr. M. Adil Khattak
Kh. Zaheer Ahmad
Mr. Osman Saifullah Khan
Dr. Samia Altaf
Mr. Shah Faisal Afridi
Dr. Mohammad Zubair Khan
Mr. Tariq Iqbal Khan
Mr. Iftikhar H. Sherazi
Ms. Nargis Ali Akbar Ghaloo
Ms. Khadija Jamal Shahban
Ms. Asmat Gul Khattak

Ex-Officio Members
Chairman, Higher Education Commission (HEC)
Chairman, Water and Power Development Authority (WAPDA)
Executive Director, SOPREST
Secretary, Finance Division, Govt. of Pakistan
Chief Secretary, Khyber Pakhtunkhwa
Secretary Science Technology and Information Technology (SRU), Khyber Pakhtunkhwa

Acting Secretary SOPREST and BOG
Mr. Irfan Ahmad

COMMEMORATIVE POSTAGE STAMP



SILVER JUBILEE
GHULAM ISHAQ KHAN INSTITUTE OF ENGINEERING SCIENCES AND TECHNOLOGY
(1993-2018)

Environment

Spread over a vast area of about 421 acres, the Ghulam Ishaq Khan Institute is located in the midst of the unspoilt and nature-rich countryside of the Khyber Pakhtunkhwa Province of Pakistan. Lying at the foot of the beautiful lake of Tarbela Dam, one of the largest earth filled dams of the world, it is set against the picturesque backdrop of rolling hills, and vast grassy fields with the mighty Indus meandering across a lush green belt.

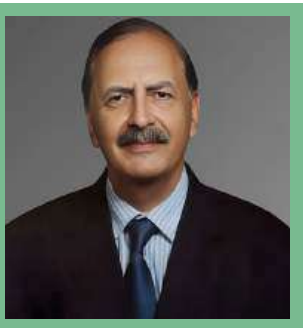
Bordering on its campus is the traditional village of Topi, the birthplace of Sahibzada Abdul Qayyum Khan, who was the pioneer of modern education in the province. Close by is the ancient village of Hund where Alexander the Great crossed the Indus. The surrounding area, once known as the land of Gandhara, is dotted profusely with archaeological sites of great cultural significance. These include the well-known sites of the ancient seats of learning, the Taxila University of the Gandhara period, and the Buddhist Monastery at Takht Bhai, to these seats of learning flocked students and scholars from all over South Asia, Central Asia, and China. It is in this region that we find the sayings of Ashoka carved on rocks at Shabaz Garhi; the Naighe Gatte megaliths (stone columns) on the Swabi-Mardan road; and numerous stupas and chambers which fire the imagination of the visitors to the area with the mysteries and glories of its past. The excavated sites around Taxila, at Takht Bhai, Dir andin Swat Valley transport them back to the civilization that flourished here almost 2500 years back. Exquisite relics of that era are the treasured possessions of the museums at Lahore, Peshawar, Karachi, Dir, Swat, and Taxila.

In addition to its great historical character, the location of the Institute offers many advantages. The Gilgit Baltistan Valley which attracts expeditions from all over the world is easily accessible from here. Perhaps the most important advantage is the invaluable opportunities it offers for establishing interaction between industry and the university and close proximity to high-quality industrial minerals. Some of the most important national industries are located quite close to the Institute. These include the Telephone Industries of Pakistan, Heavy Mechanical Complex, Heavy Electrical Complex, Heavy Industries, Pakistan Ordnance Factories, Wah Cement Industries, Kamra Aeronautical Complex, Heavy Rebuild Factory, and Pakistan Locomotive Factory. Their proximity offers invaluable opportunities for practical training of the students.

Location of the Institute

Though away from the congestion, noise, and pollution of big cities, the Institute has easy access to Islamabad and Peshawar. Both cities are connected with the rest of the country through frequent air, train, and bus services. Islamabad, the capital of Pakistan, has an international airport which provides ready access to the outside world. The Institute is located just by the river Indus, adjacent to Tarbela Dam, and near the border with Punjab. Driving time from Islamabad is just over an hour mostly along the Islamabad - Peshawar Motorway.

Sardar Aminullah Khan
Pro-Rector (Admin & Finance)



The office of the Pro-Rector Admin & Finance is administering the vast GIK Institute Campus. It includes the faculties, hostels, civic amenities, residences, and many other structures and services. This challenge is met by the Administration and Finance Wing with the help and support of various departments including Finance, Facilitation, IT, Works, GIK Medical Center, Security & Protocol, Procurement and Marketing.

Each Faculty of the Institute is housed in a building of its own which has a graceful exterior and an elegant interior with all comforts and conveniences for its users, Each academic block has its teaching and research laboratories, workshops, a computer center, and offices for the faculty and staff, a well-furnished conference hall, a discussion room, three classrooms, a lecture hall, and a library for the faculty. The number of laboratories in the Institute has now risen to 74. The laboratories are equipped with the most advanced and up-to-date equipment where high-quality research is possible.
The Administration block of the Institute includes the Offices of the Rector, Pro-Rectors, and Dean (Student Affairs), Director (A&E), Director (Admin), Director (Finance), Director (Procurement), and Other allied Offices.

New Academic Block: A marvelous new addition to GIK Campus is the New Academic Block. Constructed with the gracious assistance of the Khyber Pakhtunkhwa Government. It is spread over 155,000 SFT area and has state-of-the-art classrooms, large Lecture Halls, Conference Rooms, and cafeteria and is fully air-conditioned with about one MW standby generator. It was handed over to GIK in 2019 at a ceremony presided by the Prime Minister of Pakistan, Chief Minister, Khyber Pakhtunkhwa, Speaker National Assembly, and other dignitaries. The Building hosts, the Faculty of Chemical Engineering, Department of Civil Engineering, Faculty of Computer Sciences and Engineering, and Director of Information Technology and Student Wellness Center.

Business Incubator: Extending its services as a is a five-room fully furnished and air-conditioned catalyst to the regional and national economic accommodation. This accommodation is available development the Institute has recently set up a to parents and guardians on first-come-first-serve business incubator. It provides the managerial basis on reasonable charges for short visits. Efforts training, business guidance, office space, and are made to make their stay as comfortable as logistic support to start-ups.

Facilities

Students Accommodation: The accommodation Facilities for students are entirely on-campus. There are eleven (II) hostels for boys and two for girl facilities students. The rooms in the hostels are equipped with modem furniture and attached bathroom. The Institute provides shared accommodation to all freshmen and sophomore students. Single rooms are usually allotted to junior and senior students on merit basis. Phase II ofthe new Girls Hostel is under construction, which will shortly be shining the hills standing out in silhouette offering accommodation to about 355 female students tests.

Health & Medical Facilities: The Institute has its own hospital in the campus that provides medical facilities to its employees, their families, and students on 24/7 basis. The patients are provided free medical care which includes the ambulance service, medicines, lab investigations and other tests. The Medical Centre comprises of 13 bed hospital supported by an operation theater, pharmacy, x-rays and clinical laboratory with computerized equipment for a wide range o f hematology, bio-chemistry and endocrinology tests.

Civic Amenities: The campus is becoming a self-contained university town with adequate health, security, welfare, and Other civic amenities. There are three beautiful mosques on the campus, one of which is in the staff residential area, the Other near the hostels and the third one, next to the Guest House.

Parents Lodge: In view of the difficulties faced by the visiting parents/guardians for overnight stays, a parents Lodge has been set up near the students' hostels. It is a five-room fully furnished and air-conditioned accommodation. This accommodation is available to parents and guardians on a first-come-first-serve basis on reasonable charges for short visits. Efforts are made to make their stay as comfortable as possible.

Cafeteria: The Institute's cafeteria has been named as GIKafe. It offers regular meals and snacks at modest prices. It caters for both the faculty and the students. Students who normally have their regular meals in their hostel mess use this facility as an alternative. Official and private parties and numerous student functions are also held in the cafeteria.

Shopping Area: The following utility services are available at the Shopping Centre located within the premises of the Institute: General Stores, Restaurants, Barbeque Corner, Coffee Corners, Stationery Shop, Fruit and Vegetable Shop, Dry Cleaning and Laundry Services, Barber Shop, Dairy Shop, Juice Bar.

Service Centre: The Centre provides photocopying, services to the staff and students on payment.

Sports Facilities: Sports Complex is located in close proximity to the students hostels. It spreads over an area of 7324 Sq. Yds. with a covered area of 31 Sq. Ft. It consists of a completely covered swimming pool of international standard with comprehensive facilities, three stand and Squash Courts and a Gymnasium. The Gymnasium consists of a main hall and an exercise room. The main hall houses the facilities to play Basketball, Volleyball and Badminton. In the exercise room. modern equipments for various physical exercises have been installed. Common facilities such as lockers, showers, storage, checkrooms, administrative offices, and refreshment rooms have been provided. A separate ladies gym is also operative in the sports complex.

Facilities

Grounds are available for outdoor sports like tennis, basketball, volleyball, football and cricket, etc. There are hiking and jogging tracks in the hills behind the main buildings of the Campus.

Transport Facilities: The transport section of the Institute has 20 vehicles in its pool comprising cars, vans, trucks, and air-conditioned coaches. The Institute provides pick-and-drop services to students and staff from Rawalpindi, Islamabad, and Peshawar on weekends, mid and end of semester breaks, industrial tours and picnics. Day and night emergencies are attended to by the ambulance service and duty vehicles. In emergency, students and employees are Transported to Rawalpindi, Islamabad or Peshawar by Institute vehicles.

Faculty and Staff Residences: The Institute is fully residential. The entire faculty and staff of the Institute are accommodated in independent houses and flats on the campus.

Faculty Club: Faculty Club has been constructed on the top of a hill and presents a picturesque view been installed. Common facilities such as lockers, of Tarbela Dam and its environs. Its building has showers, storage, checkroom,administrative conditioned, and is fully furnished. The accommodation comprises four bedrooms, a 4000 high quality peer-reviewed journals, spacious sitting hall and a dining room where over databases is available at GIK Institute through HEC 100 persons can be entertained.

Library Introduction and Information Services: Initially the library was housed in the Faculty of Metallurgy and Material Engineering. Later, the construction of the main library building was started and was completed in 1996. It is a stately three-story building, set against the background of the brooding and austere hills of Tarbela Dam. Its interior design, decor, and furniture create an atmosphere of an intellectual sanctuary wherein the students and faculty can concentrate on their studies. Its collection comprises of books, eBooks,

Journals, e-Journals and Audio-visual materials rising to reasonable counts, All the users are facility to use the library 15 hours daily, and the time is extended during examination to late night. The library has a facility of resource sharing through inter library loan with other prestigious institutions apart from this reprographic facility is available for students in the library.

HEC Digital Library: HEC National Digital Library (DL) is a program to provide online access to researchers within public and private universities in Pakistan and non-profit research and development organizations to international scholarly literature, peer-reviewed journals, databases, and articles across a wide range of disciplines. Online access to more than 4000 high quality peer-reviewed journals, and databases is available at GIK Institute through HEC.

Basic resources:
ASTM Compass
Springer Link
INFORMS
OVID
Taylor & Francis Journals
Wiley-Blackwell Journals

Premium resources:
IEEE Explore (Partial access)
Emerald Insight

E-Library of GIK Institute: Thee-library of GIK Institute has a rich collection of e-books. These e-books are related to all disciplines of GIK Institute. Apart from this, it consists of soft copies of article/paper, FYP Reports, MS & PhD theses. which are accessible within the campus through IP. Wireless network is available in the library and open for all users. Students' society meeting/Discussion room available in library on request. Turnitin services: Turnitin software for plagiarism detection service is also available to facilitate the students to improve their writingskills.

ACADEMIC

Prof. Dr. Syed Mohammad Hasan Zaidi
Pro-Rector (Academic)

Prof. Dr. Syed Mohammad Hasan Zaidi, is the chief academic officer overseeing academic and research pursuits of the University, ensuring the growth and prosperity of its students, faculty and allied academic staff. He is supported by following Dean/ HoDs and Directors:

i. Dean Faculty of Materials and Chemical Engineering (FMCE), Dr. Fahd Nawaz Khan Dean
ii. Dean Faculty of Engineering Sciences (FES), Dr. Naveed R. Butt
iii. Dean Faculty of Electrical Engineering (FEE), Dr. Arbab Abdur Rahim
iv. Dean Faculty of Mechanical Engineering (FME), Dr. Taqi Ahmad Cheema
v. Dean Faculty of Computer Science and Engineering (FCSE), Dr. Qadeer ul Hassan
vi. Dean School of Management Science (SMgS), Dr. Sami Farooq
vii. Dean Student Affairs (DSA), Dr. Muhammad Imran Khan
viii. Head of Department of Chemical Engineering (DChE), Dr. Javaid Rabbani Khan
ix. Head of Department Civil Engineering (DCvE), Dr. M. Ashraf Tanoli
x. Head of Department Computer Science and Artificial Intelligence Program, Dr. Zahid Halim
xi. Head of Department Software Engineering and Cyber Security Program, Dr. Ghulam Abbas
xii. Head of Department Computer Engineering and Data Science, Dr. Masroor Hussain
xiii. Director Admissions and Examinations(A&E), Mr. Muhammad Faheem Akhtar
xiv. Director Admissions, Muhammad Waqas Malik
xv. Director Quality Enhancement Cell (QEC), Mr. Muhammad Wisal Khalil
xvi. Director Incubation, Mr. Muhammad Amin Qureshi
xvii. Director ORIC, Mr. Amar Ali Khan

Following Programs are being offered:

Programs	BS	MS	PhD
Artificial Intelligence	✓		
Computer Engineering	✓	✓	✓
Computer Science	✓	✓	✓
Cyber Security	✓		
Chemical Engineering	✓	✓	✓
Civil Engineering	✓	✓	✓
Software Engineering	✓		
Engineering Management		✓	
Electronic Engineering		✓	✓
Data Science	✓		
Electrical Engineering	✓	✓	✓
Engineering Sciences	✓	✓*	✓*
Management Sciences	✓		
Material Engineering	✓	✓**	✓
Mechanical Engineering	✓	✓	✓

*Engineering Sciences offers MS and PhD in Applied Mathematics, Applied Physics and Engineering.
**Material Engineering offers MS in Nanotechnology and Materials Engineering.

International Advisory Board

The founding fathers of the Institute were conscious of the fact that in spite of all the idealism one may have, new institutions tend to regress towards the existing models, and fail thereby to live up to the ideals which inspired their creation. They, therefore, took care to build monitoring devices to keep up Institute's standards of education and research. One such device is the International Advisory Board consisting of scientists, engineers, and academicians of international standing. The Board sets up international standards for the Institute in terms of the quality of education and research, caliber of the faculty, revision and review of the curricula, and adequacy of the laboratory and library facilities. It also reviews the developmental programs of the Institute and provides guidelines for its growth in future. The present Advisory Board comprises the following:

Prof Dr. Shuichi Miyazaki
Institute of Materials Science, University of Tsukuba
Tsukuba, Japan.
Prof. Dr. Di Su
The University of Tokyo, Tokyo, Japan
Dr. Zahid Ayub
President Isotherm, Inc., Texas 76001, USA
Dr. Kamran Iqbal
Department of Systems Engineering
University of Arkansas at Little Rock , 2801 S. USA
Dr. Muhammad Suhail Zubairy
Department of Physics, Texas A&M University College Station, TX 77843-4242, USA
Prof. Dr. Samee Khan
Department of Electrical & Computer Engineering Mississippi State University, USA
Prof. Dr. Joseph D. Smith
Wayne and Gayle Laufer Endowed Energy Chair Missouri University of Science and Technology, USA
Dr. Bilal Malik
Clinical Imaging Senior Scientist, Personalized Healthcare, Genentech, DNA Way, South San Francisco, CA 94080, USA
Prof. Dr. Kaifeng Yang
Florida State University Tallahassee Florida 32306-2250, USA.
Prof. Dr. Hanif Chaudhary
University of South Carolina, Columbia SC, USA
Dr. Costas Constantinou
School of Electronic Electrical and Computer Engineering
University of Birmingham, Edgbaston. Birmingham, UK
Dr. Talha J. Pirzada
Department of Materials, University of Oxford, UK
Dr. Julfikar Haider
Department of Engineering, Manchester Metropolitan University, UK
Prof. Dr. Andrea Bondavalli
Dipartimento di Matematica e Informatica, viale Morgagni, 65 50134 - Firenze, Italy
Dr. Jianfu Zhang
Department of Mechanical Engineering, Tsinghua University, 100084, Beijing, China
Prof. Dr. Yan Bing
Tianjin University of Technology and Education TUTE, China
Prof. Dr. Shahbaz Khan
Director, UNESCO, Beijing, China
Prof. Dr. Kai Sang Lock
Singapore Institute of Technology, Singapore
Prof. Dr. Manuel Andres Rodrigo Rodrigo
Faculty of Chemical Sciences and Technologies, University of Castilla-La Mancha, Chemical Engineering Department, Spain
Dr. Nikoletta Athanassopoulou
Institute for Manufacturing, University Of Cambridge, UK
Dr. Arsalan Ghani
Institute for Manufacturing, University Of Cambridge, UK
Prof. Dr. Jawwad Darr
Dept of Chemistry, Faculty of Maths & Physical Sciences
University College London, UK
Prof. Dr. Ali Kashif Bashir
Computer Networks and Cybersecurity, Department of Computing and Mathematics, Manchester Metropolitan University, UK
Prof. Dr. Ashfaq Khokhar
Dean, Department of Electrical and Computer Engineering, Iowa State University, USA
Prof, Dr. Muhammad Shafique
Department of Computer Engineering, NYU Abu Dhabi
Dr. John Gowdy
Rittenhouse Teaching Professor of Humanities and Social Sciences, Department of Economics, Rensselaer Polytechnic Institute, New York, USA
Prof. Dr. Marco Vanni
Department of Applied Science and Technology, Politecntico di Torino, Corso Duca degli Abruzzi 24- 1029 Torino (Italy)
Prof. Dr. Chansik Park
School of Architecture and Building Science, Chung-Ang University, Seoul, South Korea
Dr. William H. Sanders
Dean of Engineering, Carnegie Mellon University, Pennsylvania, USA
Mr. Ashar Aziz
1. Chairman, Sky electric INC, USA
2. Board Chairman and Co-Founder at Bedrock Systems based in San Mateo, California.

Mr. Masood Faizullah
Chief Executive, Dimal Asia Pacific, Singapore
Dr. Yarjan Abdul Samad
Khalifa University, UAE.
Dr. Wardah Inam
Co-Founder and CEO, Overjet, USA.

Muhammad Faheem Akhtar
Director Admissions & Examinations

Muhammad Waqas Malik
Director Admissions

Iftikhar Ali	Deputy Director Examinations	Zil-e-Huma	Assistant Director
Waheed-ur-Rehman	Examination Officer	Riaz Ahmed	Admission Officer
Muhammad Israr	Office Assistant	Muhammad Kamran	Office Assistant
Gul-e-Saba	Office Assistant	Osama Zahid	MTO Admissions
Sadia Saleem	Office Assistant		

Admissions

The Institute is open to all persons who are academically qualified for admission to the courses of study offered by the Institute and no such person shall be denied the privileges of the Institute on the grounds only of sex, religion, color, creed, race, class or domicile.

The admission to the Institute is strictly on the basis of merit determined by its own admission test and earlier academic achievements. There are no special quotas, reserved seats or admission by donations nor any arbitrary age limit for the applicants, but preference will be given to fresh graduates.

Admission to the Bachelor Programs of the Institute is decided on the basis of candidate's earlier educational achievements and his/her score in the admission test. Since medium of instruction of the Institute is English, students are also assessed for their English language skills. A sample of such questions is available on Institute website. The test is held online and the timings and general instructions for the test are given on the downloadable Admit Cards. The results of the admission test are communicated to all candidates online. A former student of the Institute whose enrolment was cancelled due to unsatisfactory academic performance is also allowed to appear in the admission test. If selected, he/she will be enrolled in the first semester as a freshman. Any student who is currently on the roll of the Institute and wants to change the faculty is allowed to re-appear in the admission test. If selected, he/she may not be given any credits for the courses passed earlier.

Applications: The admission processing fee is Rs. 3,000 with an additional Rs. 1,500 in case of appearing in both the Pre-Engineering/Computing & Management Sciences entrance test. The payment can be made through Habib Bank Limited (HBL) A/C No. 00427991707703 for local applicants or equivalent amount in US Dollar for oversees applicants to Habib Bank Limited (HBL) A/C No. 00427991707703. Those applying for Financial Assistant must pay Rs.1000/- extra with processing fee.

Advance Standing: A person who has been enrolled for a relevant Bachelors degree program in engineering / Computing / Management degree at an institution with accreditation of PEC / NCEAC respectively, if applying from within Pakistan and is recognized by HEC if applying from outside Pakistan and has earned 15 or more transferable credits hours with a minimum CGPA of 2.5 on the scale of 4.0, may apply to this Institute for admission with advanced standing. However, the student at the GIK Institute, to qualify for a bachelor degree, must earn a minimum of 70 credits including 6 credit hours of senior year design project. An applicant for transfer from a local or foreign Institution is required to have passed the Institute's admission test by securing equal/more marks than the minimum merit of the BS Program in which he/she seeks admission. However, acceptance of request for transfer will depend on availability of seat, and the quality of academic work already completed by the applicant. For supplementary Candidates, who have completed one of the above qualifications and are awaiting results, may apply for provisional admission. Confirmation of admission will, however, be subject to submission of results by the date specified in the offer letter and fulfillment of the above criteria.

HOW TO APPLY

Only Online Applications will be accepted. Complete instructions are available on the link http://admissions.giki.edu.pk. The application procedure is as below:

1. Register yourself as Candidate for Admission on above link
2. Fill in and submit online admission form. Those interested in Financial Assistance (FA) and Scholarship, must fill FA and Scholarship registration
   form online.
3. Arrange to pay in any branch of HBL as per amount printed on bank challan.
4. Upload Payment details on admission portal
5. Download Admit Card.
6. Appear in online admission test.
7. Check your result and proceed as per online instructions.

Basic Eligibility for BS Engineering Programs

Candidates for admission must meet one of the following criteria:

1. HSSC (Pre-Engineering i.e., Mathematics, Physics and Chemistry) with 60% or above marks each in Mathematics, Physics & Overall.
2. HSSC (ICS i.e. Mathematics, Physics and Computer Studies/Science/IT) with 60% or above marks each in Mathematics, Physics & Overall.
3. HSSC (Pre-Medical) with Additional Mathematics and 60% or above marks each in Mathematics, Physics & Overall.
4. A-Level in three subjects Mathematics, Physics and Chemistry with D or above grade each in Mathematics & Physics and O-Levels in eight subjects (English, Mathematics, Physics, Chemistry, Biology/Computer Science, Urdu, Islamic Studies & Pakistan Studies) for local applicants and in five subjects (English, Mathematics, Physics, Chemistry, Biology/Computer Science/IT) for those applying from abroad.
5. A-Level in three subjects Mathematics, Physics and Computer Studies/IT with D or above grade each in Mathematics & Physics and O-Levels in eight subjects (English, Mathematics, Physics, Chemistry, Biology/Computer Science, Urdu, Islamic Studies & Pakistan Studies) for local applicants and in five subjects (English, Mathematics, Physics, Chemistry, Biology/Computer Science/IT) for those applying from abroad.
6. American or Canadian High School Diploma or International Baccalaureate Diploma with Mathematics (with Calculus), Physics and Chemistry with 60% or above marks, as per IBCC equivalence formula, each in Mathematics, Physics & Overall.
7. Three years Diploma of Associate Engineering (DAE) in relevant technology from a Pakistani Board of Technical Education with at least 60% marks each in Mathematics, Physics & Overall.

Note:

1. Applicant with Mathematics, Physics and Chemistry/Computer Studies background can apply for all engineering programs.
2. IBCC equivalence is required for all foreign qualification including A-Levels/O-Levels

Basic Eligibility Criteria for Artificial Intelligence, Computer Science, Data Science, Cyber Security, and Software Engineering:

Candidates for admission must meet one of the following criteria:

1. HSSC with Mathematics, Physics, and any other subject as third elective with 60% or above marks each in Mathematics, Physics & Overall.
2. A-Levels in three subjects Mathematics, Physics and any other third subject, with Dor above grade each in Mathematics & Physics and O-Levels in eight subjects (English, Mathematics, Physics, Chemistry, Biology/Computer Science, Urdu, Islamic Studies & Pakistan Studies) for local applicants and in five subjects (English, Mathematics, Physics, Chemistry, Biology/Computer Science) for those applying from abroad.

Basic Eligibility for BS Management Sciences Program

Basic Eligibility Criteria: Candidates for Admission must one of the following criteria:

1. HSSC (Pre-Engg), HSSC (General Science), HSSC (ICS), HSSC (Pre-Medical), HSSC (Humanities) with at least 60% marks.
2. A-Levels in three subjects with D's or above grades in two principal subjects and O-Levels in eight subjects for local applicants and in five subjects for those applying from abroad with overall 60% or above equivalence as per IBCC formula.
3. American or Canadian High School Diploma or International Baccalaureate Diploma with overall 60% or above marks, as per IBCC equivalence formula.

Candidates are advised to carefully read above eligibility criteria before applying for admission. The admission will be cancelled if eligibility criteria is not met. The candidates are responsible for fulfilling eligibility and must immediately contact admission office if rendered ineligible upon declaration of result. The admission of ineligible candidate, upon request, can be deferred for a maximum of one year or the tuition fee will be refunded. It is mandatory for all applicants with O-levels and A-levels background to submit equivalence certificates from IBCC.

Comparative Assessment Criteria (Merit List)

Score in Admission Test	85%
SSC/O-levels (for Those with A-levels and O-levels background)/ Equivalent	15%
Last completed qualification for High School diploma, 1B diploma or B.Sc. or DAE	15%

The Institute is a not-for-profit organization and provides quality education. The Semester Fee (Tuition fee & Accommodation Charges), non refundable, except in case an applicant is rendered ineligible upon declaration of results where refund is made, is as under for the 4 years for local residents and wards of expatriate Pakistanis.

S. No.	Academic Year	Engineering & Computer Sciences Rs.)	Management Sciences (Rs.)
1.	2024-25	427,500	375,000
2.	2025-26	447,500	390,000
3.	2026-27	467,500	405,000
4.	2027-28	492,500	425,000

The annual tuition fee for foreign students is US$ 3,000/- 5% of semester tuition fee will be collected as administrative charges against each semester. No administrative charges will be charged if student pays entire fee for two semesters in lump sum. Semester fee cannot be paid in installment. The tuition fee is payable before commencement of the semester. A non refundable admission fee of Rs. 65,000/-for Pakistani or US $ 680/- for foreign applicants is also required to be deposited at the time of admission. Rs. 40,000 will be charged as security, refundable at the time of leaving the Institute subject to the clearance from relevant departments. The final year students are charged convocation fee of Rs. 17,500/-. An advance of Rs. 15,000 is to be deposited by each student as mess security.

Refund Policy:

If a freshly inducted student finds it necessary to withdraw his/her admission, he/she must inform GIK Institute in writing. The following refund policy will apply to the Semester Fee:

In case an applicant is rendered ineligible upon declaration of results, 100% tuition fee refunded if applied within 10 days of declaration of result along with proof of ineligibility.

Timel **ines**	**Fee Refund (%age)**
Before Joining GIK Institute	100%
Upto first seven days of commencement of classes	100 % after deduction of 10 % of semester fee as administrative charges
From 8th till 15th day of commencement of classes	50%
From 16th day of commence ment of classes	No refund

Free Electricity Unit:

The Institute shall provide free electricity to each student in the hostels as under:

Summer: 100 units per month
Winter: 70 units per month

In addition to above, Free units allowed for common areas per hostel will be as under:

Summer: 3943 units per month
Winter: 534 units per month

Any excess consumption of electricity in the hostels will be charged from the students residing in respective hostels.

Academic Calendar:

An academic year comprises two regular semesters of sixteen weeks each, and an eight-week summer school. The timings of two semesters and summer school are as follows:

Fall: August to December Spring: January to May
Summer: June to July

The last week of a semester is reserved for the final examinations. There is normally a mid semester break in a semester.

Duration of Bachelor Studies:

Students have to complete their entire degree requirements within the following time-limits:

Normal Duration: 4 years
Maximum Duration: 6 years

Financial Assistance:

The Institute provides financial assistance to the needy and deserving students covering full or partial tuition fee in the form of interest free loan. Each year about 40-50 students get benefit of financial assistance. Students desirous of getting financial assistance may submit financial assistance form available at the Admission Portal GIK along with the admission form (Please add Rs. 1,000 added as financial assistance processing fee in addition to Rs. 3,000 admission procession fee). Applicants will be informed about award of financial assistance along with admission offer.

Scholarships:

Different government organizations, private companies and donors award scholarship to GIK students. The GIKI Alumni Association provides scholarships to deserving students of 2nd, 3rd and 4th years.
Following full or partial scholarships and financial assistance are likely to be available for those to be admitted in the academic year 2024-2025:

	Name	Qualification/Conditions/Criteria	
Scholarships	GIK Merit Scholarship	Top 20 Merit Scholarships	20
	GIK Alumni Association Scholarship	Needy students (2nd year onwards)	55
	Chief Minister Khyber Pakhtunkhwa Scholarship	KP domiciled with annual income less than Rs.600,000	20
	DWP Foundation	KP domiciled with annual income less than Rs. 840,000	15
	Punjab Educational Endowment Fund (PEEF) Scholarship	Punjab domiciled with annual family income less than Rs. 720,000/-	10
	Khyber Pakhtunkhwa Education Foundation Scholarship	KP domiciled with annual family income less than Rs. 120,000/-	2
	Balochistan Scholarship	Balochistan domiciled	4
	Sindh Scholarship	Sindh domiciled with annual family income less than Rs. 1,200,000/-	5
	Chief Minister Educational Endowment Fund Scholarship (CMEEF)	KP domiciled with annual income less than Rs.1200,000 Faculty of Engineering Sciences with specialization in photononics	4
	Descon Endowment Fund	Eligibel for Financial Assistance of GIK, rural area	1
	Fast scholarship	Electrical Engineering student with GPA 3.0 (Zakat eligible)	1
	HBL Platinum Scholarship	Need-Cum-Merit Basis	1
	ICI Scholarship	Top Female	1
	Lucky Cement Scholarship	Pakistani National, preference will be given to KP domicile holder	1
	Bestway Educational Foundation scholarship	Merit-cum-Need basis	1
Financial Assistance (Loan)	Financial Assistance by GIK Institute	Need cum merit basis	40
	GIK Financial Assistance for Top Female	Top 10 Female	10
	Ihsan Trust loan	need basis	20
	Habbah Trust loan	need basis	4

For further details:

Please Contact Admission Office GIK Institute at Telephone:+92-938-281026, Ext: 2301, 2342, 2349, 2518, 2354, 2595.

Examinations

Examinations Office

The Examinations Office works under the supervision of Director Admissions Examinations. This office is responsible for preparing class and examination schedules, holding of semester's examinations, maintenance and compilation of results issuance of semester result reports, transcripts, certificates and degrees.

Registration Schedule: Students have to register for their courses during the period specified for the purpose before the commencement of a semester. The office of the Examinations, before the start of every semester, will notify the registration deadline. Requests for late registration for valid reasons can be entertained by the approval of Pro Rector (Academic) till the end of the third week of a semester. However, such students are required to pay Rs. 1000 per day late registration fee.

Registration in the Summer: An eight week summer session is organized each year for those students who fail to qualify in a course or they want to improve courses with D or a D+grade. The courses offered in the summer are decided by the respective Dean's office keeping in view the number of students interested in taking a particular course. Students have to pay separately for registering in a summer course. Students cannot register in a higher level course during summer and the maximum limit for registration is 8 Credit Hours.

Double Degree Program: Graduates of the Institute desirous of obtaining a degree in a discipline other than the previously earned degree can apply afresh for a separate Double Degree Program. They would be required to spend additional two to four semesters in the Institute to complete the requirements of a double degree. The students have to do a separate project for a Double Degree. The acceptance in the Degree program and details of the requirements are worked out by the respective Dean's office and communicated to the office of the Controller of Examinations.

Attendance Rule: Although the students are expected to attend all the lectures and laboratories work pertaining to their courses of study but are required to attend at least 80% of the total Lectures/Lab work for each course to qualify for appearance in the final examination.

Change in Courses: Once registered for a semester, students may add or drop courses only with the approval of their Deans and in conformity with the prescribed procedures and time-limits. & Courses dropped during

this period are not shown on the semester result report or transcript.

Withdrawal from Courses: Students may withdraw from one or more courses with the approval of their Dean between the 4th and 10th week of a semester. In such cases, a W grade appears on their transcripts. Any withdrawal after the 10th week entails award of an F grade in the course.

Incomplete (I) Grade: An I grade is given to students in a course if the outstanding requirement, in such cases, is to be met during the first two weeks of the next semester and the students themselves are responsible to make arrangement for the purpose with their instructors. Failing this, the I grade is converted to F grade. They cannot re-register for a course in which they have the I grade. The grade point average of a student for a semester is calculated excluding the I grade and it is re-calculated when a regular grade has been awarded in the course.

Repeating Courses: Courses in which students secure F grade, and which are a requirement for the degree have to be repeated in entirely. They may opt for a substitute course only if there is an alternative in the curriculum. Students can repeat courses for which they obtained F, C-, D+ or D grade, on the condition that they repeat the courses within 3 semesters after the semesters in which they obtained these grades. In case of repeated courses, all grades achieved by students appear in their transcripts. However, only the latest grade in chronological order will be counted for the Cumulative Grade Point Average, even if it is lower than the earlier one.

Interruption of Studies: If a student interrupts his study programs for a period longer than one semester then, upon his return, all the credits previously earned by him at the Institute are evaluated by the Dean to determine their relevance to the changes made in the curriculum, if any. He may be required to modify his degree plan to ensure conformity to the latest version of the curriculum.

Academic Advisors

All Students are assigned to academic advisors. The advisors develop plans of study for them, monitor their records, and guide them on all academic matters.

Credit Hour System: The credit hours assigned to a theory or a laboratory course are determined by the contact hours allocated to it per week throughout a semester. For a theory course one credit hour is equivalent to one contact hour of lecture per week, and for a laboratory course, three contact hours of practical work per week constitute one credit hour.

Semester Credit Hours Load: Students can normally register in accordance with his / her degree program, 15-18 credit hours in a semester. No exception to this upper limit is allowed to freshmen. However, in later years this limit may be relaxed for students with good academic standing, with the approval of the Dean. Under all cases the maximum limit remains 21 credit hours.

Degree Requirements: For a Bachelor degree a student must earn a minimum of 132 to 136 credits, depending upon his / her faculty. At the time of graduation, the Cumulative Grade Point Average (CGPA) should not be below 2.00.

Medium of Instruction: The medium of instruction and examinations of the Institute is English. All the courses are taught throughout in English.

Curriculum Components: The major academic components of the Bachelors degree programs are described below:

Foundational Courses in Engineering Education: Courses in physics, chemistry, mathematics and introductory engineering are common for students of all faculties before they move on the major courses of their own faculty. The aim of these courses is to provide through grounding in the basic principles and analytical skills essential for studies in specialized areas of all faculties before they move on the major courses of their own faculty.

Management Sciences and Humanities Courses: Common courses in English language, social sciences and engineering management are required for all students. They are meant to inculcate in them an awareness of our history and culture, to help them cultivate aesthetic

and moral dimensions of their personalities and to equip them with communicational and managerial skills.

Faculty Courses: Students are required to take a number of core and elective courses of their own faculty which are listed in the academic programs of each faculty.
Inter-faculty Courses: Students are required to select some courses offered by faculties other than their own. Such courses aim at providing broader bases to their studies, and widening their awareness of allied fields, which impinge on their areas of specialization.

Technical Electives: Students are also required to take a number of advanced technical courses. To fulfill this requirement, they may choose additional courses in their own field of specialization, select a second area of specialization, or select advanced courses from some different fields. Each faculty offers a number of advanced courses in different fields.

Senior Year Design Project: In the final year, students have to undertake a project, which is assigned 6 credits hours. They must work under direct supervision of their project advisor for the completion of the project. Students are encouraged to undertake projects, which are of interest to industry or to government departments. They are expected to complete their projects and present their reports by the end of the eighth semester before the final examination.

Summer Internship: Every student has to participate in a practical training program of four to eight weeks during the summer of junior year and submit a formal written report about it.

Course Codes: The courses are identified by the course numbers, which consist of two letters and three digits. The first two letters represent the major field; the first digit indicates the level of course; the next digit the broad area of the course; and the last, the sequence number of the course offered in the same area at the same level (year).

AI Artificial Intelligence
CE Computer Engineering
CH Chemical Engineering
CS Computer Science
CV Civil Engineering
Cy Cyber Security
DS Data Science
EE Electrical Engineering
ES Engineering Sciences

HM Humanities & Social Sciences
ME Mechanical Engineering
MM Materials Science and Engineering
MS Management Sciences
MT Mathematics
PH Physics
SE Software Engineering

Student Evaluation: Students are evaluated by mid-semester test, home assignments, quizzes, case studies, course project, laboratory reports, oral tests and the end-of-semester examination. The weight allocated to them depends upon the nature of the course. Usually, the end-of-semester examination carries 50% weightage of a course.

Grading System: Depending upon academic performance, students are awarded grades A, A-, B+, B, B-, C+, C, C-, D+, D, F, I, E and Wfor each course. These grades indicate the following levels of performance:
A. Excellent
B. Good
C. Adequate
D. Minimum acceptable
F. Failure, implying that the student must repeat the course to receive any credit
I. Incomplete
E. Exemption
W. Withdrawn

Each grade is assigned Grade Points per Credit with no credit transfer if two consecutive (GPC). The following table indicates the gradation probations are experienced in first two semesters. from excellent to failure:

Grade	GPC	Grade	GPC
A	4.00	C	2.00
A-	3.67	C-	1.67
B+	3.33	D+	1.33
B	3.00	D	1.00
B-	2.67	F	0.00
C+	2.33		

I, E and W grades are not counted in calculation of GPA.

The academic standing of a student is referred as grade point average (GPA) which is the ration of the total number of grade points earned to the total number of credits attempted. The maximum possible GPA is 4.00 The minimum semester GPA to remain is satisfactory academic standing is 2.00. Students are placed on academic probation at the end of any semester in which their semester GPA falls below 2.00. A student on probation is allowed to register only 10-13 credit hours. A student whose semester GPA remains below 2.00 is given a warning for his/her poor performance. If his/her SGPA remains below 2.00 for two consecutive semesters (excluding summer school) his/her name is removed from the roll of the Institute. Freshmen, upon request, may start a fresh with no credit transfer if two consecutive probations are experienced in first two semesters.

FACULTY OF COMPUTER SCIENCE AND ENGINEERING

INTRODUCTION

At the Faculty of Computer Science and Engineering (FCSE), we go beyond merely conferring degrees—we equip you to thrive in the ever-evolving landscape of technology and innovation. Our mission is to deliver quality education that transcends traditional boundaries, empowering you with the knowledge and skills necessary to excel in today's dynamic work environment. Guided by a distinguished faculty comprising experts with terminal degrees from prestigious institutions across the globe—including the USA, Europe, South Korea, Malaysia, and Pakistan—we offer a transformative learning experience. Our cutting-edge facilities, including the recently upgraded High-Performance Computing Lab equipped with computers boasting state-of-the-art GPUs, underscore our commitment to providing students with the latest equipment for research and development. Backed by robust theoretical foundations and exceptional laboratory resources, we offer hands-on training and practical exposure, instilling in you the confidence and expertise needed to navigate and succeed in the competitive world of computer science and engineering. Thanks to our comprehensive, rigorous, and skill-focused education, many FCSE alumni have secured positions in prestigious Fortune 500 companies such as Apple, Amazon, Google, and Meta. Additionally, others have pursued advanced studies at renowned global universities including Oxford, ETH Zurich, Cambridge, Harvard, and MIT, etc. Hence, it is with great pride that we assert that a degree in computing programs from FCSE at GIK Institute not only holds exceptional value within Pakistan but also serves as a gateway to a prosperous and fulfilling future in the industry and higher education at renowned international universities.

FCSE offers bachelors programs in Artificial Intelligence (AI), Computer Engineering (CE), Computer Science (CS), Cyber Security (CyS), Data Science (DS), and Software Engineering (SE). The BS Computer Engineering (CE) program is accredited by Pakistan Engineering Council (PEC) while the other five undergraduate programs are accredited by National Computing Education Accreditation Council (NCEAC).

Faculty of Computer Science and Engineering

ACADEMIC MANAGEMENT

- Prof. Dr. Qadeer ul Hassan, Dean FCSE, PhD (Boston University, Boston, USA)
- Prof. Dr. Zahid Halim, HOD (AI & CS), PhD (NUCES, Islamabad, Pakistan)
- Prof. Dr. Masroor Hussain, HOD (CE & DS), PhD (GIK Institute, Topi, Pakistan)
- Prof. Dr. Ghulam Abbas, HOD (CyS & SE), PhD (University of Liverpool, Liverpool, UK)

BACHELORS DEGREE PROGRAM IN ARTIFICIAL INTELLIGENCE (AI)

Faculty

- Dr. Raja Hashim Ali, PhD (Kungliga Tekniska Högskolan, Stockholm, Sweden) (on leave)
- Dr. Taj Muhammad Khan, PhD (University of Grenoble, Grenoble, France) (on leave)
- Dr. Sarah Iqbal, PhD (Universiti Malaya, Kuala Lumpur, Malaysia)
- Dr. Musadaq Mansoor, PhD (NUCES, Peshawar, Pakistan)
- Qasim Riaz, MS (NUST, Islamabad, Pakistan)
- Beenish Arooj, MS (CUI, Islamabad, Pakistan)
- Muhammad Talha Ashfaq, MS (CUI, Islamabad, Pakistan)

Lab Engineers and Graduate Assistants

- Sania Akhtar (GA-4), MS (CUI, Islamabad, Pakistan)
- Engr. Amna Arooj, BS Computer Engineering (Islamia University, Bahawalpur, Pakistan)
- Ms. Memoona Saleem, BS Software Engineering (CUI, Attock, Pakistan)
- Mr. Asim Shah, BS Information Technology (University of Agriculture, Peshawar, Pakistan)

BACHELORS DEGREE PROGRAM IN COMPUTER ENGINEERING (CE)

Faculty

- Prof. Dr. Qadeer ul Hassan, Dean FCSE, PhD (Boston University, Boston, USA)
- Dr. Ahmar Rashid, PhD (Jeju National University, Jeju, South Korea)
- Dr. Shahabuddin Ansari, PhD (GIK Institute, Topi, Pakistan)
- Dr. Muhammad Hanif, PhD (Australian National University, Canberra, Australia)
- Dr. Waqar Ahmad, PhD (Sabanci University, Istanbul, Turkey)
- Dr. Adnan Shah, PhD (Australian National University, Canberra, Australia)
- Badre Munir, MS (GIK Institute, Topi, Pakistan)
- Salman Saeed, MS (Moscow Institute of Physics and Technology, Moscow, Russian Federation) (on leave)

Lab Engineers and Graduate Assistants

- Muhammad Abu Bakar, BS Electrical (Computer) Engineering (CUI, Wah, Pakistan)
- Irfanullah, BS Computer Systems Engineering (UET, Peshawar, Pakistan)
- Muhammad Shakaib Khan, BS Electrical (Telecommunication) Engineering (CUI, Islamabad, Pakistan)
- Zaheer Ahmed, BS Electrical (Computer) Engineering (CUI, Islamabad, Pakistan)

BACHELORS DEGREE PROGRAM IN COMPUTER SCIENCE (CS)

Faculty

- Prof. Dr. Zahid Halim, PhD (NUCES, Islamabad, Pakistan)
- Dr. Salman Ahmed, PhD (University of Alberta, Edmonton, Canada)
- Dr. Khurram Jadoon Khan, PhD (Hanyang University, Seoul, South Korea)
- Dr. Qamar Abbas, PhD (NUST, Islamabad, Pakistan)
- Dr. Ali Imran Sandhu, PhD (KAUST, Thuwal, KSA)
- Ahsan Shah, MS (GIK Institute, Topi, Pakistan)
- Sajid Ali, MS (NUCES, Islamabad, Pakistan)

On Leave

- Prof. Dr. Syed Fawad Hussain, PhD (to University of Birmingham)

Lab Engineers and Graduate Assistants

- Usama Arshad (GA-4), MS Computer Science (CUI, Islamabad, Pakistan)
- Amna Riaz, BS Information Technology (University of Agriculture, Faisalabad, Pakistan)
- Marwa Bibi, BS Computer Science (CUI, Attock, Pakistan)
- Eisha Ter Razzia Mir, BS Software Engineering (Fatima Jinnah Women University, Rawalpindi, Pakistan)
- Hifza Omer, BS Software Engineering (CUI, Attock, Pakistan)

BACHELORS DEGREE PROGRAM IN CYBER SECURITY (CyS)

Faculty list

- Dr. Rashad Maqbool Jillani, PhD (Florida Atlantic University, Boca Raton, USA)
- Dr. Muhammad Zain Siddiqi, PhD (Tsinghua University, Beijing, China)
- Abdullah Bin Zarshaid, MS (CUI, Abbottabad, Pakistan)

BACHELORS DEGREE PROGRAM IN DATA SCIENCE (DS)

Faculty list

- Prof. Dr. Masroor Hussain, PhD (GIK Institute, Topi, Pakistan)
- Dr. Farhan Khan, PhD (Bilkent Univeristy, Bilkent, Turkey)
- Dr. Fahad Bin Muslim, PhD (Politecnico di Torino, Torino, Italy)
- Abinta Mehmood Mir, MS (UET Taxila, Taxila, Pakistan)
- Nazia Shehzadi, MS (CUI, Islamabad, Pakistan)

Lab Engineers and Graduate Assistants

- Faheem-ur-Rehman, MS Electrical Engineering (NUST, Islamabad, Pakistan)
- Sabahat Gul, BS Computer Engineering (UET Taxila, Taxila, Pakistan)
- Shehla Gul, BS Computer Engineering (UET Taxila, Taxila, Pakistan)
- Ujala Akmal, BS Software Engineering (CUI, Attock, Pakistan)

BACHELORS DEGREE PROGRAM IN SOFTWARE ENGINEERING (SE)

Faculty

- Prof. Dr. Ghulam Abbas, PhD (University of Liverpool, Liverpool, UK)
- Laraib Afzal, MS (CUI, Abbottabad, Pakistan)
- Said Nabi, MS (CUI, Islamabad, Pakistan)

Lab Engineers and Graduate Assistants

- Junaid Ahmad, BS Computer Software Engineering (CUI, Attock, Pakistan)

Personal Secretary to Dean

- Farhad Gul, MSc Mathematics (Univ. of Peshawar) and MCS (Virtual University)

EDUCATIONAL PHILOSOPHY FOR COMPUTING PROGRAMS

The Faculty of Computer Science and Engineering adheres to the principles of outcome-based education (OBE) in its teaching approach. In OBE, the educational system is structured around specific goals (outcomes), with the aim that each student attains these objectives by the end of their educational journey. At GIK Institute, we establish and evaluate these outcomes at various stages: by the conclusion of a course (Course Learning Outcomes or CLOs), by the completion of the four-year degree program (Program Learning Outcomes or PLOs), or within 3-5 years after a student's graduation (Program Educational Objectives or PEOs). There isn't a fixed teaching or assessment style within OBE; instead, various methods such as classes, projects, presentations, labs, and assessments are employed to assist students in achieving the predetermined outcomes. The faculty's role varies, encompassing that of instructor, trainer, facilitator, and/or mentor, depending on the targeted outcomes. Assessment of outcomes is conducted by evaluating marks obtained in assessments for CLOs, achieving the ten Seoul Accord PLO (SA-PLOs) or twelve Washington Accord PLOs (WA-PLOs) throughout the four-year degree program, and gathering feedback through alumni/employer surveys for PEOs. The PEOs and PLOs for each undergraduate degree program, offered by FCSE, are given below, while the CLOs can be seen in the course outlines given at the start of every course offered.

PROGRAM EDUCATIONAL OBJECTIVES (PEOs)

Program educational objectives (PEOs) are statements that describe the expected accomplishments of graduates within 3-5 years after completing their university education. Overall, program educational objectives play a vital role in ensuring the relevance, quality, and effectiveness of university education by providing a roadmap for curriculum development, assessment, and continuous improvement. Each BS program has their own program educational objectives, approved from the relevant academic body of the institute. The PEOs for each individual BS program offered by FCSE are mentioned below.

PEOs for BS Artificial Intelligence (AI) Program

1. Graduates utilizing their skills and knowledge to solve complex problems in real-world settings.
2. Graduates practicing in the area of Artificial Intelligence in a socially and ethically responsible way.
3. Graduates demonstrating lifelong learning skills in Artificial Intelligence and allied disciplines.

PEOs for BS Computer Engineering (CE) Program

1. Graduates responsibly practicing in a variety of computer engineering and allied disciplines.
2. Graduates utilizing their skills and knowledge to solve complex engineering problems in real-world settings.
3. Graduates demonstrating sustained learning and adapting to evolving fields through continued professional development and self-study.

PEOs for BS Computer Science (CS) Program

1. Practice professional careers while maintaining environmental, ethical and social values.
2. Apply and effectively communicate knowledge both individually and in a team through state-of-the-art tools and technologies.
3. Stay current with technological innovations through trainings, higher education, and lifelong learning.

PEOs for BS Cyber Security (CyS) Program

1. Graduates utilizing their skills and knowledge to solve complex problems in real-world settings.
2. Graduates practicing in the area of Cyber Security in a socially and ethically responsible way.
3. Graduates demonstrating lifelong learning skills in Cyber Security and allied disciplines.

PEOs for BS Data Science (DS) Program

1. Graduates utilizing their skills and knowledge to solve complex problems in real-world settings.
2. Graduates practicing in the area of Data Science in a socially and ethically responsible way.
3. Graduates demonstrating lifelong learning skills in Data Science and allied disciplines.

PEOs for BS Software Engineering (SE) Program

1. Graduates utilize their diverse technical skills and in-depth software engineering & development knowledge to build complex software systems in real-world settings.
2. Graduates act responsibly and ethically in their profession and as informed citizens, and possibly make a socio-economic impact.
3. Graduates demonstrate lifelong learning skills in

Software Engineering and allied disciplines.

4. Communicate effectively, demonstrate leadership, and work collaboratively in diverse teams/ organizations.

PROGRAM LEARNING OUTCOMES (PLOs)

Program Learning Outcomes (PLOs) represent the specific knowledge, skills, and competencies that students are expected to demonstrate upon completion of a particular computing degree program. These outcomes serve as measurable statements of what students should know and be able to do by the end of their studies, reflecting the core objectives and educational priorities of the program. PLOs guide curriculum development, assessment practices, and instructional strategies, ensuring that the learning experiences provided align with the desired educational outcomes. By articulating clear and attainable learning objectives, PLOs facilitate effective teaching and learning processes, promote accountability, and enable stakeholders to assess the success of the program in preparing students for future academic and professional endeavors. At FCSE, the BS Computer Engineering (BS CE) program, accredited by PEC, follows the twelve graduate attributes listed under Washington Accord as the program learning outcomes (termed as WA-PLOs) while the other degree programs (AI, CS, CyS, DS, and SE), accredited by NCEAC, observe the ten graduate attributes listed under Seoul Accord as the program learning outcomes (termed as SA-PLOs).

Seoul Accord Program Learning Outcomes (SA-PLOs)

	SA-PLO	Description
SA-PLO1	Academic education	Completion of an accredited program of study designed to prepare graduates as computing professionals.
SA-PLO2	Knowledge for solving computing problems	Apply knowledge of computing fundamentals, knowledge of a computing specialization, and mathematics, science, and domain knowledge appropriate for the computing specialization to the abstraction and conceptualization of computing models from defined problems and requirements.
SA-PLO3	Problem analysis	Identify, formulate, research literature, and solve complex computing problems reaching substantiated conclusions using fundamental principles of mathematics, computing sciences, and relevant domain disciplines.
SA-PLO4	Design/ development of solutions	Design and evaluate solutions for complex computing problems, and design and evaluate systems, components, or processes that meet specified needs with appropriate consideration for public health and safety, cultural, societal, and environmental considerations.
SA-PLO5	Modern tool usage	Create, select, adapt and apply appropriate techniques, resources, and modern computing tools to complex computing activities, with an understanding of the limitations.
SA-PLO6	Individual and teamwork	Function effectively as an individual and as a member or leader in diverse teams and in multi-disciplinary settings.
SA-PLO7	Communication	Communicate effectively with the computing community and with society at large about complex computing activities by being able to comprehend and write effective reports, design documentation, make effective presentations, and give and understand clear instructions.
SA-PLO8	Computing professionalism and society	Understand and assess societal, health, safety, legal, and cultural issues within local and global contexts, and the consequential responsibilities relevant to professional computing practice.
SA-PLO9	Ethics	Understand and commit to professional ethics, responsibilities, and norms of professional computing practice.
SA-PLO10	Life-long learning	Recognize the need, and have the ability, to engage in independent learning for continual development as a computing professional.

Upon completion of BS AI / BS CS / BS CyS / BS DS / BS SE degree, all the students should have attained the aforementioned ten SOs.

Washington Accord Program Learning Outcomes (WA-PLOs)

	WA-PLO	Description
WA-PLO1	Engineering knowledge	Ability to apply knowledge of mathematics, science, engineering fundamentals and an engineering specialization to the solution of complex engineering problems.
WA-PLO2	Problem analysis	Ability to identify, formulate, research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences and engineering sciences.
WA-PLO3	Design/ development of solutions	Ability to design solutions for complex engineering problems and design systems, components or processes that meet specified needs with appropriate consideration for public health and safety, cultural, societal, and environmental considerations.
WA-PLO4	Investigation	Ability to investigate complex engineering problems in a methodical way including literature survey, design and conduct of experiments, analysis and interpretation of experimental data, and synthesis of information to derive valid conclusions.
WA-PLO5	Modern tool usage	Ability to create, select and apply appropriate techniques, resources, and modern engineering and IT tools, including prediction and modeling, to complex engineering activities, with an understanding of the limitations.
WA-PLO6	The engineer and society	Ability to apply reasoning informed by contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to professional engineering practice and solution to complex engineering problems.
WA-PLO7	Environment and sustainability	Ability to understand the impact of professional engineering solutions in societal and environmental contexts and demonstrate knowledge of and need for sustainable development.
WA-PLO8	Ethics	Ability to apply ethical principles and commit to professional ethics and responsibilities and norms of engineering practice.
WA-PLO9	Individual and team work	Ability to work effectively, as an individual or in a team, on multifaceted and/or multidisciplinary settings.
WA-PLO10	Communication	Ability to communicate effectively, orally as well as in writing, on complex engineering activities with the engineering community and with society at large, such as being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.
WA-PLO11	Project management	Ability to demonstrate management skills and apply engineering principles to one's own work, as a member and/or leader in a team, to manage projects in a multidisciplinary environment.
WA-PLO12	Lifelong learning	Ability to recognize importance of, and pursue lifelong learning in the broader context of innovation and technological developments.

Upon completion of BS CE degree, all students should have attained the aforementioned twelve PLOs.

KNOWLEDGE PROFILES (WKs) FOR BS (COMPUTER ENGINEERING)

As a signatory of Washington Accord and accredited by PEC, the engineering curriculum, divided into various specialized knowledge profiles (WKs), is the most important tool for grooming our students. The BS Computer Engineering curriculum is based on the following knowledge profiles (WKs) in order to instill different dimensions of thinking – mathematical, computational, design, and creative – among students in the Cognitive, Psychomotor, and Affective domains.

	Knowledge Profiles	Description
WK1	Natural Sciences	A systematic theory-based understanding of natural sciences applicable to the discipline.
WK2	Mathematics and Computing	The concept-based mathematical thinking, numerical analysis, statistics and formal aspects of computer and information science to support analysis and modelling applicable to the discipline.
WK3	Engineering Fundamentals	A systematic, theory-based formulation of engineering fundamentals required in an engineering discipline.
WK4	Engineering Specialization	The knowledge of Engineering specialization that provides theoretical frameworks and bodies of knowledge for the accepted practice areas that are at the forefront in a discipline.
WK5	Engineering Design	The Design Thinking Knowledge that supports engineering design in a practice area of an engineering discipline.
WK6	Engineering Practice	The Knowledge of engineering practices (technology) in different practice areas of an engineering discipline.
WK7	Engineering in Society	A systematic, comprehension-based knowledge of the role of engineers in a society and the professional issues related to practicing engineering profession in a discipline: ethics and the professional responsibility of an engineer to public safety including the impact of an engineering activity i.e. economic, social, cultural, environmental and sustainability.
WK8	Research Literature	Engagement with selected knowledge in the research literature of the discipline.

UNDERGRADUATE DEGREE PROGRAMS OFFERED BY FCSE
BACHELORS DEGREE PROGRAM IN ARTIFICIAL INTELLIGENCE (AI)

Introduction

The undergraduate Artificial Intelligence (BS AI) degree program aims to give in-depth knowledge required to transform data (including Big Data) into intelligent decisions. Upon completion of the coursework students will be able to select data driven technologies to mimic or enhance human capabilities. With the recent boom in Artificial Intelligence, the program equips students with both theoretical understanding and practical expertise in artificial intelligence, machine learning, and deep learning, preparing them to tackle real-world challenges, particularly in areas such as computer vision and natural language processing.

Thrust Areas

- Artificial Intelligence and Robotics
- Machine Learning and Deep Learning
- Natural Language Processing
- Computer Vision

Degree Plan

	Course Code	Course Titles	Credit Hrs	Lec. Hrs	Lab. Hrs	Pre-req
1st Semester	CS101, CS101L	Computing & Artificial Intelligence	3	2	3	-
	HM101	Communication Skills	3	1	6	-
	IF101L	Innovation & Makers Lab I	1	0	3	-
	MT101	Calculus I	3	3	0	-
	PH101, PH101L	Applied Physics	4	3	3	-
	MM101, MM141L	Materials & Nanotechnology	3	2	3	-
	Total		**17**	**11**	**18**	

	Course Code	Course Titles	Credit Hrs	Lec. Hrs	Lab. Hrs	Pre-req
2nd Semester	CS112, CS112L	Object-oriented Programming & Design	4	3	3	CS101
	ES111	Probability & Statistics	3	3	0	MT101
	HM102	Critical Thinking & Expository Writing	3	2	3	-
	IF102L	Innovation & Makers Lab II	1	0	3	IF101L
	CH161	Occupational Health & Safety	1	1	0	-
	CH101	Applied Chemistry & Environment	2	2	0	-
	MT102	Differential Equations & Linear Algebra I	3	3	0	MT101
	Total		**17**	**14**	**9**	

3rd Semester

Course Code	Course Titles	Credit Hrs	Lec. Hrs	Lab. Hrs	Pre-req
CE221, CE221L	Digital Logic Design	4	3	3	-
CS202	Information & Communication Technologies	2	2	0	-
CS221, CS221L	Data Structures & Algorithms	4	3	3	CS112
CS231	Discrete Mathematics	3	3	0	-
ES205	Advanced Linear Algebra	3	3	0	MT102
AI201L	Programming for AI Lab	1	0	3	-
Total		**17**	**14**	**9**	

4th Semester

Course Code	Course Titles	Credit Hrs	Lec. Hrs	Lab. Hrs	Pre-req
AI202	Concepts in AI	3	3	0	CS231
AI221, AI221L	Machine Learning	4	3	3	AI201L
CE222, CE222L	Computer Organization & Assembly Language	4	3	3	CE221
HM211	Islamic Studies	2	2	0	-
CS232, CS232L	Database Management Systems	4	3	3	CS112
Total		**17**	**14**	**9**	

5th Semester

Course Code	Course Titles	Credit Hrs	Lec. Hrs	Lab. Hrs	Pre-req
AI311	Knowledge Representation & Problem Solving	2	2	0	AI202
AI331, AI331L	Deep Neural Networks	4	3	3	AI221
CS311, CS311L	Operating Systems	4	3	3	CE222
CS325	Software Engineering	3	3	0	CS112
CS391	Entrepreneurship & Technology Commercialization	2	2	0	-
Total		**15**	**13**	**6**	

6th Semester

Course Code	Course Titles	Credit Hrs	Lec. Hrs	Lab. Hrs	Pre-req
AI341, AI341L	Computer Vision	4	3	3	AI331
AI351, AI351L	Natural Language Processing	4	3	3	AI331
CE313	Computer Communications & Networks	3	3	0	CS231
CS392	Software Project Management	2	2	0	CS325
CX3xx	Area Elective I	3	3	0	**
	Ideology and Constitution of Pakistan	2	2	0	-
Total		**18**	**16**	**6**	

7th Semester	Course Code	Course Titles	Credit Hrs	Lec. Hrs	Lab. Hrs	Pre-req
	AI4xx	Technical Elective	3	3	0	**
	CS478	Design & Analysis of Algorithms	3	3	0	CS231
	CS481	Senior Design Project (Part-I)	3	0	9	-
	CS493	Scientific Communication	3	3	0	CS325
	CX4xx	Area Elective II	3	3	0	**
	Total		**15**	**12**	**9**	

8th Semester	Course Code	Course Titles	Credit Hrs	Lec. Hrs	Lab. Hrs	Pre-req
	CS417	Parallel Processing & Distributed Computing	3	3	0	CS311
	CS465	Data & Network Security	3	3	0	CE313
	CS482	Senior Design Project (Part II)	3	0	9	-
	CS494	Professional Issues in IT	2	2	0	CS202
		Civics and Community Engagement	1	1	0	-
	CX4xx	Area Elective III	3	3	0	**
	Total		**15**	**12**	**9**	

** means that the pre-requisites may vary depending on the electives.

BACHELORS DEGREE PROGRAM IN COMPUTER ENGINEERING (CE)

Introduction

The undergraduate Computer Engineering (BS CE) program focuses on knowledge of Mathematics and basic sciences, necessary for the analysis and design of computer software, hardware, and systems through an understanding of the principles and applications of computer engineering principles. Chip designing holds promising future prospects in terms of industry demand, technological advancements, and research opportunities. Pursuing higher education in this field can provide specialized knowledge, research opportunities, and collaborations with industry, opening doors to exciting career paths and potential entrepreneurship in chip design.

Thrust Areas

- Network Communications
- Signal and Image Processing
- Cloud Computing
- Embedded Systems and IC Design

Degree Plan

	Course Code	Course Titles	Credit Hrs	Lec. Hrs	Lab. Hrs	Pre-req
1st Semester	CH101	Applied Chemistry & Environment	2	2	0	-
	CS101, CS101L	Computing & Artificial Intelligence	3	2	3	-
	HM101	Communication Skills	3	1	6	-
	IF101L	Innovation & Makers Lab I	1	0	3	-
	MT101	Calculus I	3	3	0	-
	PH101, PH101L	Applied Physics	4	3	3	-
	CH161	Occupational Health & Safety	1	1	0	-
	Total		**17**	**12**	**15**	

	Course Code	Course Titles	Credit Hrs	Lec. Hrs	Lab. Hrs	Pre-req
2nd Semester	CS112, CS112L	Object-oriented Programming & Design	4	3	3	CS101
	ES111	Probability & Statistics	3	3	0	MT101
	HM102	Critical Thinking & Expository Writing	3	2	3	-
	IF102L	Innovation & Makers Lab II	1	0	3	IF101L
	MM101, MM141L	Materials & Nanotechnology	3	2	3	-
	MT102	Differential Equations & Linear Algebra I	3	3	0	MT101
	Total		**17**	**13**	**12**	

Faculty of Computer Science and Engineering

3rd Semester	Course Code	Course Titles	Credit Hrs	Lec. Hrs	Lab. Hrs	Pre-req
	CE211, CE211L	Circuit Analysis	4	3	3	-
	CE221, CE221L	Digital Logic Design	4	3	3	-
	CS202	Information and Communication Technologies	2	2	0	-
	CS221, CS221L	Data Structures and Algorithms	4	3	3	CS112
	CS231	Discrete Mathematics	3	3	0	-
	Total		**17**	**14**	**9**	

4th Semester	Course Code	Course Titles	Credit Hrs	Lec. Hrs	Lab. Hrs	Pre-req
	CE222, CE222L	Computer Organization and Assembly Language	4	3	3	CE221
	CE231, CE231L	Electronics – I	4	3	3	CE211
	CS232, CS232L	Database Management Systems	4	3	3	CS112
	ES205	Advanced Linear Algebra	3	3	0	MT102
	HM211	Islamic Studies	2	2	0	-
	Total		**17**	**14**	**9**	

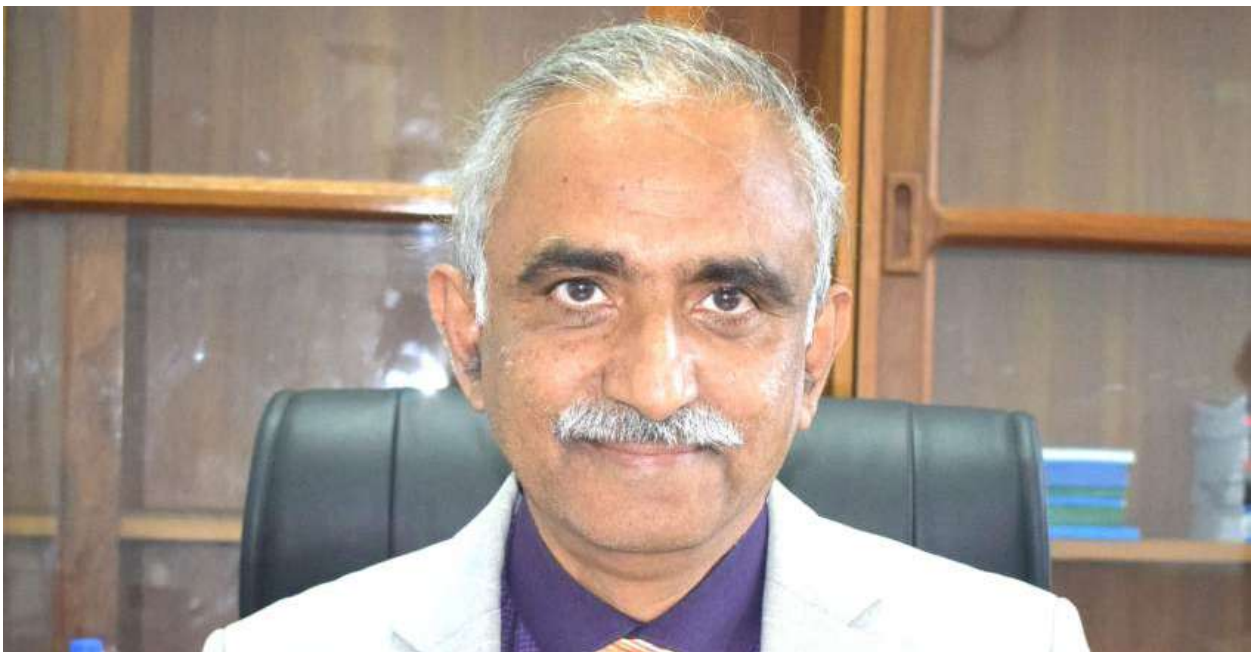
5th Semester	Course Code	Course Titles	Credit Hrs	Lec. Hrs	Lab. Hrs	Pre-req
	CE324, CE324L	Microprocessor Interfacing	4	3	3	CE222
	CE341, CE341L	Signals & Systems	4	3	3	MT102
	CS311, CS311L	Operating Systems	4	3	3	CE222
	CS325	Software Engineering	3	3	0	CS112
	CS391	Entrepreneurship & Technology Commercialization	2	2	0	-
	Total		**17**	**14**	**9**	

6th Semester	Course Code	Course Titles	Credit Hrs	Lec. Hrs	Lab. Hrs	Pre-req
	CE313	Computer Communications & Networks	3	3	0	CS231
	CE342	Computational Methods and Techniques	3	3	0	MT102
	CE361, CE361L	Digital Signal Processing	4	3	3	CE341
	CS361	Computer Architecture	3	3	0	CE222
	CS392	Software Project Management	2	2	0	-
		Ideology and Constitution of Pakistan	2	2	0	-
	Total		**17**	**16**	**3**	

7th Semester	Course Code	Course Titles	Credit Hrs	Lec. Hrs	Lab. Hrs	Pre-req
	CE408	Cloud Computing	3	3	0	CE313
	CE436, CE436L	Digital System Design	4	3	3	CE324
	CS478	Design & Analysis of Algorithms	3	3	0	CS231
	CS481	Senior Design Project (Part-I)	3	0	9	-
	CX4xx	Area Elective I	3	3	0	**
	Total		**16**	**12**	**12**	

8th Semester	Course Code	Course Titles	Credit Hrs	Lec. Hrs	Lab. Hrs	Pre-req
	CE4xx	Technical Elective	3	3	0	**
	CS465	Data and Network Security	3	3	0	CE313
	CS482	Senior Design Project (Part II)	3	0	9	
	CS494	Professional Issues in IT	2	2	0	-
		Civics and Community Engagement	1	1	0	-
	CX4xx	Area Elective II	3	3	0	**
	Total		**15**	**12**	**9**	

** means that the pre-requisites may vary depending on the electives.



BACHELORS DEGREE PROGRAM IN COMPUTER SCIENCE (CS)

Introduction

The undergraduate Computer Science (BS CS) program offers a comprehensive understanding of the field by introducing concepts, theories, and techniques, with an emphasis on core areas such as compilers, software engineering and development, and computer systems development. In BS CS program, we offer the students a broad perspective to specialization fields like Artificial Intelligence, Data Science and Cyber Security. This program encourages students to develop and utilize abstract models as well as empowers them to apply cutting-edge technologies in real-world scenarios, encouraging a holistic and hands-on approach to learning.

Thrust Areas

- Algorithms and Computational Theory
- High Performance Computing
- Computer Architecture
- Database Management

Degree Plan

	Course Code	Course Titles	Credit Hrs	Lec. Hrs	Lab. Hrs	Pre-req
1st Semester	CS101, CS101L	Computing & Artificial Intelligence	3	2	3	-
	HM101	Communication Skills	3	1	6	-
	IF101L	Innovation & Makers Lab I	1	0	3	-
	MT101	Calculus I	3	3	0	-
	PH101, PH101L	Applied Physics	4	3	3	-
	MM101, MM141L	Materials & Nanotechnology	3	2	3	-
	Total		**17**	**11**	**18**	

	Course Code	Course Titles	Credit Hrs	Lec. Hrs	Lab. Hrs	Pre-req
2nd Semester	CS112, CS112L	Object-oriented Programming & Design	4	3	3	CS101
	ES111	Probability & Statistics	3	3	0	MT101
	HM102	Critical Thinking & Expository Writing	3	2	3	-
	IF102L	Innovation & Makers Lab II	1	0	3	IF101L
	CH161	Occupational Health & Safety	1	1	0	-
	CH101	Applied Chemistry & Environment	2	2	0	-
	MT102	Differential Equations & Linear Algebra I	3	3	0	MT101
	Total		**17**	**14**	**9**	

3rd Semester	Course Code	Course Titles	Credit Hrs	Lec. Hrs	Lab. Hrs	Pre-req
	CE221, CE221L	Digital Logic Design	4	3	3	-
	CS202	Information & Communication Technologies	2	2	0	-
	CS221, CS221L	Data Structures & Algorithms	4	3	3	CS112
	CS231	Discrete Mathematics	3	3	0	-
	ES205	Advanced Linear Algebra	3	3	0	MT102
	Total		**16**	**14**	**6**	

4th Semester	Course Code	Course Titles	Credit Hrs	Lec. Hrs	Lab. Hrs	Pre-req
	CE222, CE222L	Computer Organization & Assembly Language	4	3	3	CE221
	CS224	Formal Languages and Automata Theory	3	3	0	CS221
	CS232, CS232L	Database Management Systems	4	3	3	CS112
	CS272	Human Computer Interface and Computer Graphics	3	3	0	CS231
	HM211	Islamic Studies	2	2	0	-
	SE202L	Development Operations Lab	1	0	3	-
	Total		**17**	**14**	**9**	

5th Semester	Course Code	Course Titles	Credit Hrs	Lec. Hrs	Lab. Hrs	Pre-req
	CS311, CS311L	Operating Systems	4	3	3	CE222
	CS325	Software Engineering	3	3	0	CS112
	CS342	Advanced Database Management Systems	4	3	3	CS232
	CS351, CS351L	Artificial Intelligence	4	3	3	CS231
	CS391	Entrepreneurship & Technology Commercialization	2	2	0	-
	Total		**17**	**14**	**9**	

Faculty of Computer Science and Engineering

6th Semester	Course Code	Course Titles	Credit Hrs	Lec. Hrs	Lab. Hrs	Pre-req
	CE313	Computer Communications & Networks	3	3	0	CS231
	CS324	Computer Architecture	3	3	0	CE222
	CS334, CS334L	Compiler Construction	4	3	3	CS224
	CS392	Software Project Management	2	2	0	CS325
	CX3xx	Area Elective I	3	3	0	**
		Ideology and Constitution of Pakistan	2	2	0	-
	Total		**17**	**16**	**3**	

7th Semester	Course Code	Course Titles	Credit Hrs	Lec. Hrs	Lab. Hrs	Pre-req
	CS478	Design & Analysis of Algorithms	3	3	0	CS231
	CS481	Senior Design Project (Part-I)	3	0	9	-
	CS493	Scientific Communication	3	3	0	CS325
	CS4xx	Technical Elective	3	3	0	**
	CX4xx	Area Elective II	3	3	0	**
	Total		**15**	**12**	**9**	

8th Semester	Course Code	Course Titles	Credit Hrs	Lec. Hrs	Lab. Hrs	Pre-req
	CS417	Parallel Processing & Distributed Computing	3	3	0	CS311
	CS465	Data & Network Security	3	3	0	CE313
	CS482	Senior Design Project (Part II)	3	0	9	–
	CS494	Professional Issues in IT	2	2	0	CS202
		Civics and Community Engagement	1	1	0	-
	CX4xx	Area Elective III	3	3	0	**
	Total		**15**	**12**	**9**	

** means that the pre-requisites may vary depending on the electives.

BACHELORS DEGREE PROGRAM IN CYBER SECURITY (CyS)

Introduction

The undergraduate Cyber Security (BS CyS) program at GIK Institute is a dynamic and comprehensive discipline designed to prepare students for the challenges of securing digital assets in today's interconnected world. Our program's vision is to foster a generation of cybersecurity professionals who are not only technically proficient but also ethical and innovative in their approach. By focusing on knowledge areas such as Secure Software and Development, Cryptography and Cryptanalysis, and Secure Communication and Networking, the program ensures that graduates possess a well-rounded skill set to address the complex cybersecurity challenges of today and tomorrow.

Thrust Areas

- Network Communications and Distributed Systems
- Cyber Security
- Penetration Testing
- Cryptography

Degree Plan

	Course Code	Course Titles	Credit Hrs	Lec. Hrs	Lab. Hrs	Pre-req
1st Semester	CS101, CS101L	Computing & Artificial Intelligence	3	2	3	-
	HM101	Communication Skills	3	1	6	-
	IF101L	Innovation & Makers Lab I	1	0	3	-
	MT101	Calculus I	3	3	0	-
	PH101, PH101L	Applied Physics	4	3	3	-
	MM101, MM141L	Materials & Nanotechnology	3	2	3	-
	Total		**17**	**11**	**18**	

	Course Code	Course Titles	Credit Hrs	Lec. Hrs	Lab. Hrs	Pre-req
2nd Semester	CS112, CS112L	Object-oriented Programming & Design	4	3	3	CS101
	ES111	Probability & Statistics	3	3	0	MT101
	HM102	Critical Thinking & Expository Writing	3	2	3	-
	IF102L	Innovation & Makers Lab II	1	0	3	IF101L
	CH161	Occupational Health & Safety	1	1	0	-
	CH101	Applied Chemistry & Environment	2	2	0	-
	MT102	Differential Equations & Linear Algebra I	3	3	0	MT101
	Total		**17**	**14**	**9**	

Faculty of Computer Science and Engineering

3rd Semester	Course Code	Course Titles	Credit Hrs	Lec. Hrs	Lab. Hrs	Pre-req
	CE221, CE221L	Digital Logic Design	4	3	3	-
	CS202	Information & Communication Technologies	2	2	0	-
	CS221, CS221L	Data Structures & Algorithms	4	3	3	CS112
	CS231	Discrete Mathematics	3	3	0	-
	ES205	Advanced Linear Algebra	3	3	0	MT102
	Total		**16**	**14**	**6**	

4th Semester	Course Code	Course Titles	Credit Hrs	Lec. Hrs	Lab. Hrs	Pre-req
	CE222, CE222L	Computer Organization & Assembly Language	4	3	3	CE221
	CS232, CS232L	Database Management Systems	4	3	3	CS112
	CY201	Cyber Security Principles & Concepts	3	3	0	CS231
	CY211	Information Security	3	3	0	ES111
	HM211	Islamic Studies	2	2	0	-
	Total		**16**	**14**	**6**	

5th Semester	Course Code	Course Titles	Credit Hrs	Lec. Hrs	Lab. Hrs	Pre-req
	CS311, CS311L	Operating Systems	4	3	3	CE222
	CS325	Software Engineering	3	3	0	CS112
	CS342	Advanced Database Management Systems	4	3	3	CS232
	CS351, CS351L	Artificial Intelligence	4	3	3	CS231
	CS391	Entrepreneurship & Technology Commercialization	2	2	0	-
	Total		**17**	**14**	**9**	

6th Semester	Course Code	Course Titles	Credit Hrs	Lec. Hrs	Lab. Hrs	Pre-req
	CE313	Computer Communications & Networks	3	3	0	CS231
	CE342	Computational Methods and Techniques	3	3	0	MT102
	CE361, CE361L	Digital Signal Processing	4	3	3	CE341
	CS361	Computer Architecture	3	3	0	CE222
	CS392	Software Project Management	2	2	0	-
	HM112	Ideology and Constitution of Pakistan	2	2	0	-
	Total		**18**	**16**	**6**	

7th Semester	Course Code	Course Titles	Credit Hrs	Lec. Hrs	Lab. Hrs	Pre-req
	CS478	Design & Analysis of Algorithms	3	3	0	CS231
	CS481	Senior Design Project (Part-I)	3	0	9	-
	CS493	Scientific Communication	3	3	0	CS325
	CS4xx	Technical Elective	3	3	0	**
	CX4xx	Area Elective I	3	3	0	**
	CY412	Cryptography	3	3	0	ES205
	Total		**18**	**15**	**9**	

8th Semester	Course Code	Course Titles	Credit Hrs	Lec. Hrs	Lab. Hrs	Pre-req
	CS417	Parallel Processing & Distributed Computing	3	3	0	CS311
	CS465	Data & Network Security	3	3	0	CE313
	CS482	Senior Design Project (Part II)	3	0	9	–
	CS494	Professional Issues in IT	2	2	0	CS202
	HM323	Civics and Community Engagement	1	1	0	-
	CX4xx	Area Elective II	3	3	0	**
	Total		**15**	**12**	**9**	

**** means that the pre-requisites may vary depending on the electives.**

BACHELORS DEGREE PROGRAM IN DATA SCIENCE (DS)

Introduction

The undergraduate Data Science (BS DS) program equips students with vital skills for data-intensive industries. Through analytics, visualization, and warehousing, students learn to uncover patterns and make predictions, meeting the demand for skilled professionals. Practical applications like predictive analytics prepare graduates to tackle real-world challenges and drive innovation. This program offers a competitive edge in a rapidly evolving field where expertise is highly sought after.

Thrust Areas

- Data Science & Data Mining
- Data Warehousing
- Data Engineering
- Big Data Analytics

Degree Plan

	Course Code	Course Titles	Credit Hrs	Lec. Hrs	Lab. Hrs	Pre-req
1st Semester	CS101, CS101L	Computing & Artificial Intelligence	3	2	3	-
	HM101	Communication Skills	3	1	6	-
	IF101L	Innovation & Makers Lab I	1	0	3	-
	MT101	Calculus I	3	3	0	-
	PH101, PH101L	Applied Physics	4	3	3	-
	MM101, MM141L	Materials & Nanotechnology	3	2	3	-
	Total		**17**	**11**	**18**	

	Course Code	Course Titles	Credit Hrs	Lec. Hrs	Lab. Hrs	Pre-req
2nd Semester	CS112, CS112L	Object-oriented Programming & Design	4	3	3	CS101
	ES111	Probability & Statistics	3	3	0	MT101
	HM102	Critical Thinking & Expository Writing	3	2	3	-
	IF102L	Innovation & Makers Lab II	1	0	3	IF101L
	CH161	Occupational Health & Safety	1	1	0	-
	CH101	Applied Chemistry & Environment	2	2	0	-
	MT102	Differential Equations & Linear Algebra I	3	3	0	MT101
	Total		**17**	**14**	**9**	

3rd Semester	Course Code	Course Titles	Credit Hrs	Lec. Hrs	Lab. Hrs	Pre-req
	CE221, CE221L	Digital Logic Design	4	3	3	-
	CS202	Information & Communication Technologies	2	2	0	-
	CS221, CS221L	Data Structures & Algorithms	4	3	3	CS112
	CS231	Discrete Mathematics	3	3	0	-
	ES205	Advanced Linear Algebra	3	3	0	MT102
	Total		**16**	**14**	**6**	

4th Semester	Course Code	Course Titles	Credit Hrs	Lec. Hrs	Lab. Hrs	Pre-req
	CE222, CE222L	Computer Organization & Assembly Language	4	3	3	CE221
	CS232, CS232L	Database Management Systems	4	3	3	CS112
	DS211	Theory of Data Science	3	3	0	ES111
	DS221	Inferential Statistics & Applied Probability	3	3	0	ES111
	HM211	Islamic Studies	2	2	0	-
	SE202L	Development Operations Lab	1	0	3	CS112
	Total		**17**	**14**	**9**	

5th Semester	Course Code	Course Titles	Credit Hrs	Lec. Hrs	Lab. Hrs	Pre-req
	CS311, CS311L	Operating Systems	4	3	3	CE222
	CS325	Software Engineering	3	3	0	CS112
	CS351, CS351L	Artificial Intelligence	4	3	3	CS231
	CS391	Entrepreneurship & Technology Commercialization	2	2	0	-
	DS341	Data Mining	3	3	0	DS211
	Total		**16**	**14**	**6**	

6th Semester	Course Code	Course Titles	Credit Hrs	Lec. Hrs	Lab. Hrs	Pre-req
	CE313	Computer Communications & Networks	3	3	0	CS231
	CS392	Software Project Management	2	2	0	CS325
	DS331, DS331L	Data Warehousing & Businss Intelligence	4	3	3	DS211
	DS351, DS351L	Data Visualization	3	2	3	DS341
	DS361, DS361L	Big Data Analytics	4	3	3	DS321
		Ideology and Constitution of Pakistan	2	2	0	-
	Total		**18**	**15**	**9**	

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	Course Code	Course Titles	Credit Hrs	Lec. Hrs	Lab. Hrs	Pre-req
7th Semester	CS478	Design & Analysis of Algorithms	3	3	0	CS231
	CS481	Senior Design Project (Part-I)	3	0	9	-
	CS493	Scientific Communication	3	3	0	CS325
	CS4xx	Technical Elective	3	3	0	**
	CX4xx	Area Elective I	3	3	0	**
	DS471	Data Engineering	2	2	0	DS331
	Total		**17**	**14**	**9**	

	Course Code	Course Titles	Credit Hrs	Lec. Hrs	Lab. Hrs	Pre-req
8th Semester	CS417	Parallel Processing & Distributed Computing	3	3	0	CS311
	CS465	Data & Network Security	3	3	0	CE313
	CS482	Senior Design Project (Part II)	3	0	9	-
	CS494	Professional Issues in IT	2	2	0	CS202
		Civics and Community Engagement	1	1	0	-
	CX4xx	Area Elective II	3	3	0	**
	Total		**15**	**12**	**9**	

**** means that the pre-requisites may vary depending on the electives.**

BACHELORS DEGREE PROGRAM IN SOFTWARE ENGINEERING (SE)

Introduction

The undergraduate Software Engineering (SE) program aims to equip students for careers in software development by teaching industry-standard design and implementation practices. The curriculum covers software requirements engineering, UI/UX design, software design and architecture, web engineering, and project management. The program provides students with a strong theoretical and practical foundation in software development, which plays a crucial role in Pakistan's economy.

Thrust Areas

- Software Architecture and Design Patterns
- Artificial Intelligence and Machine Learning
- DevOps and Continuous Delivery
- Human-Computer Interaction (HCI) and User Experience (UX)

Degree Plan

	Course Code	Course Titles	Credit Hrs	Lec. Hrs	Lab. Hrs	Pre-req
1st Semester	CS101, CS101L	Computing & Artificial Intelligence	3	2	3	-
	HM101	Communication Skills	3	1	6	-
	IF101L	Innovation & Makers Lab I	1	0	3	-
	MT101	Calculus I	3	3	0	-
	PH101, PH101L	Applied Physics	4	3	3	-
	MM101, MM141L	Materials & Nanotechnology	3	2	3	-
	Total		**17**	**11**	**18**	

	Course Code	Course Titles	Credit Hrs	Lec. Hrs	Lab. Hrs	Pre-req
2nd Semester	CS112, CS112L	Object-oriented Programming & Design	4	3	3	CS101
	ES111	Probability & Statistics	3	3	0	MT101
	HM102	Critical Thinking & Expository Writing	3	2	3	-
	IF102L	Innovation & Makers Lab II	1	0	3	IF101L
	CH161	Occupational Health & Safety	1	1	0	-
	CH101	Applied Chemistry & Environment	2	2	0	-
	MT102	Differential Equations & Linear Algebra I	3	3	0	MT101
	Total		**17**	**14**	**9**	

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3rd Semester	Course Code	Course Titles	Credit Hrs	Lec. Hrs	Lab. Hrs	Pre-req
	CE221, CE221L	Digital Logic Design	4	3	3	-
	CS221, CS221L	Data Structures & Algorithms	4	3	3	CS112
	CS231	Discrete Mathematics	3	3	0	-
	ES205	Advanced Linear Algebra	3	3	0	MT102
	SE201	Software Engineering	3	3	0	CS112
	Total		**17**	**15**	**6**	

4th Semester	Course Code	Course Titles	Credit Hrs	Lec. Hrs	Lab. Hrs	Pre-req
	CE222, CE222L	Computer Organization & Assembly Language	4	3	3	CE221
	CS202	Information & Communication Technologies	2	2	0	-
	CS232, CS232L	Database Management Systems	4	3	3	CS112
	HM211	Islamic Studies	2	2	0	-
	SE202L	Development Operations Lab	1	0	3	CS112
	SE211	Software Requirement Engineering	3	3	0	SE201
	Total		**16**	**13**	**9**	

5th Semester	Course Code	Course Titles	Credit Hrs	Lec. Hrs	Lab. Hrs	Pre-req
	CS311, CS311L	Operating Systems	4	3	3	CE222
	CS351, CS351L	Artificial Intelligence	4	3	3	CS231
	CS372	Human Computer Interaction & UI Graphics	3	3	0	SE201
	CS391	Entrepreneurship & Technology Commercialization	2	2	0	-
	SE322, SE322L	Software Design & Architecture	4	3	3	SE211
	Total		**17**	**14**	**9**	

6th Semester	Course Code	Course Titles	Credit Hrs	Lec. Hrs	Lab. Hrs	Pre-req
	CE313	Computer Communications & Networks	3	3	0	CS231
	SE351, SE351L	Web Engineering & Mobile App Development	4	3	3	SE201
	SE323, SE323L	Software Construction & Development	4	3	3	SE322
	SE331	Software Quality Assurance	3	3	0	SE201
	CS392	Software Project Management	2	2	0	SE201
		Ideology and Constitution of Pakistan	2	2	0	-
	Total		**18**	**16**	**6**	

7th Semester	Course Code	Course Titles	Credit Hrs	Lec. Hrs	Lab. Hrs	Pre-req
	CS478	Design & Analysis of Algorithms	3	3	0	CS231
	CS481	Senior Design Project (Part-I)	3	0	9	-
	CS493	Scientific Communication	3	3	0	CS325
	CS4xx	Technical Elective	3	3	0	**
	CX4xx	Area Elective I	3	3	0	**
	Total		**15**	**12**	**9**	

8th Semester	Course Code	Course Titles	Credit Hrs	Lec. Hrs	Lab. Hrs	Pre-req
	CS417	Parallel Processing & Distributed Computing	3	3	0	CS311
	CS465	Data & Network Security	3	3	0	CE313
	CS482	Senior Design Project (Part II)	3	0	9	–
	CS494	Professional Issues in IT	2	2	0	CS202
		Civics and Community Engagement	1	1	0	-
	CX4xx	Area Elective II	3	3	0	**
	Total		**15**	**12**	**9**	

**** means that the pre-requisites may vary depending on the electives.**

CAREER OPPORTUNITES FOR BS GRADUATES FROM FCSE

Due to recent advancements in computing technologies, particularly in specialized areas such as artificial intelligence, chip design, high-performance computing, cybersecurity, data science, and software development, graduates from the BS programs offered by FCSE are highly sought after in research, academia, and industry. The digital landscape offers a plethora of job opportunities, some of which are among the highest paid positions, leading graduates from other engineering and management fields to pivot their career paths towards computing. In addition to the national and international interest and popularity of Computer Science and Artificial Intelligence, this trend is also supported by the significant interest exhibited by students during the entrance exams at GIK Institute, where the six degree programs offered by FCSE consistently rank among the top selections across the university.

Our alumni possess a diverse skill set that prepares them for promising career opportunities in both academia and industry. In academic pursuits, these graduates have the option to further their studies by pursuing master's and doctoral degrees in computing or management fields. This path often leads to research and teaching roles in esteemed universities and research institutions worldwide. Their extensive knowledge of fundamental computer science principles coupled with specialized expertise in their chosen domains enable them to make significant contributions to academic research and innovation. In recent years, a notable number of FCSE graduates have pursued advanced education at prestigious institutions ranked within the top 10 globally in computing and management, including institutions like Yale, MIT, Cambridge, and Oxford, among others.

With access to a variety of industrial elective courses, including internet of things, data science, blockchain, and cybersecurity, graduates are well-prepared to tackle complex real-world challenges and foster innovation in areas such as autonomous systems, personalized healthcare, and smart cities, among others. Their adeptness at applying state-of-the-art computing techniques across diverse domains positions them as valuable assets for roles like AI engineers, data scientists, research scientists, software developers, consultants, and project managers. This abundance of career paths provides ample opportunities for professional growth and meaningful impact in the rapidly evolving specialized and allied computing fields. Notably, recent FCSE graduates have secured positions at Fortune 500 companies, including Google, Meta, Amazon, and Twitter, highlighting the recognition and demand for their skills and expertise in the industry.

LABORATORIES AT FCSE

Each computing program offered by FCSE is backed by well-equipped laboratories featuring cutting-edge computer systems running a diverse array of applications and specialized software tailored to support the curriculum. Furthermore, the department boasts fully equipped instructional and research facilities, including the Artificial Intelligence Laboratory, which boasts 55 iMac machines powered by the latest M1 (21, 2) processors, the Data Analytics Laboratory furnished with 55 12th generation Core-i7 networked All-in-One Ultra PCs, the Software Engineering Laboratory equipped with 53 12th generation Core-i7 processors, and the Intelligent Computing and Research (ICAR) Laboratory outfitted with 15 state-of-the-art Intel Xeon W-2275 processor with Nvidia RTX - A2000 GPU machines. These resources are available for both undergraduate and graduate students, as well as faculty members, to facilitate research activities and the delivery of specialized courses, particularly for the practical lab components. Notably, all computers within FCSE are outfitted with a minimum of 500 GB of SSD storage and 16 GB of RAM. Additionally, FCSE features

two hardware laboratories stocked with Atlas 200 kits, Arduino development kits, and other hardware essentials to support hardware-oriented labs, semester projects, and senior year design projects.

COURSE WORK REQUIREMENTS

Course requirements for obtaining a BS degree offered by FCSE are given below. The department will choose which electives are to be offered depending on the availability and willingness of course instructor. The list of electives is for illustrative purposes and more courses can be added to this list at the time of course offerings.

Every undergraduate student is required to participate in a summer training program and submit a formal written report during the summer of Junior Year. Moreover, every undergraduate student will undertake a 15-hour community service activity as a degree requirement using the summers or fall semester of their Sophomore Year.

For obtaining Bachelor of Science degree in Computing programs, the students must complete the mentioned number of credit hours with a CGPA of 2.0 or above.

Program Name	General Education Requirements (CH)	Core Requirements (CH)	Program Specialization Requirements (CH)	Technical Electives (CH)	Area Electives (CH)	Total Credit Hours
BS Artificial Intelligence	49	51	19	3	9	131 CH
BS Computer Engineering	46	45	33	3	6	133 CH
BS Computer Science	49	52	18	3	9	131 CH
BS Cyber Security	49	52	24	3	6	134 CH
BS Data Science	49	52	23	3	6	133 CH
BS Software Engineering	49	52	22	3	6	132 CH

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(a) General Education Requirements (44-47 Credit Hours)

Main Category	Subcategory	Course Title	Course Code	Credit Hours	BS AI	BS CE	BS CS	BS CyS	BS DS	BS SE
General Education Requirements	Basic Engineering	Applied Chemistry & Environment	CH101	2	✓	✓	✓	✓	✓	✓
		Occupational Health & Safety	CH161	1	✓	✓	✓	✓	✓	✓
		Innovation & Makers Lab I	IF101L	1	✓	✓	✓	✓	✓	✓
		Innovation & Makers Lab II	IF102L	1	✓	✓	✓	✓	✓	✓
		Materials & Nanotechnology	MM101, MM101L	2+1	✓	✓	✓	✓	✓	✓
		Applied Physics	PH101, PH101L	3+1	✓	✓	✓	✓	✓	✓
	Computing	Computing & Artificial Intelligence	CS101, CS101L	2+1	✓	✓	✓	✓	✓	✓
		Information & Communication Technologies	CS202	2	✓	✓	✓	✓	✓	✓
	English Language	Scientific Communication	CS493	3	✓		✓	✓	✓	✓
		Communication Skills	HM101	3	✓	✓	✓	✓	✓	✓
		Critical Thinking & Expository Writing	HM102	3	✓	✓	✓	✓	✓	✓
	Humanities	Islamic Studies	HM211	3	✓	✓	✓	✓	✓	✓
		Ideology and Constitution of Pakistan	HM3XX	2	✓	✓	✓	✓	✓	✓
		Civics and Community Engagement	HM4XX	1	✓	✓	✓	✓	✓	✓
	Management	Entrepreneurship & Technology Commercialization	CS391	2	✓	✓	✓	✓	✓	✓
		Software Project Management	CS392	2	✓	✓	✓	✓	✓	✓
		Professional Issues in IT	CS494	2	✓	✓	✓	✓	✓	✓
	Mathematics	Probability & Statistics	ES111	3	✓	✓	✓	✓	✓	✓
		Advanced Linear Algebra	ES205	3	✓	✓	✓	✓	✓	✓
		Calculus I	MT101	3	✓	✓	✓	✓	✓	✓
		Differential Equations & Linear Algebra I	MT102	3	✓	✓	✓	✓	✓	✓
Total Credit Hours				**49**	**49**	**46**	**49**	**49**	**49**	**49**

(b) Core Requirements (45-52 Credit Hours)

Course Title	Course Code	Credit Hours	BS AI	BS CE	BS CS	BS CyS	BS DS	BS SE
Concepts in Artificial Intelligence	AI202	3	✓					
Digital Logic Design + Lab	CE221, CE221L	3+1	✓	✓	✓	✓	✓	✓
Computer Organization & Assembly Language + Lab	CE222, CE222L	3+1	✓	✓	✓	✓	✓	✓
Computer Communications and Networks	CE313	3	✓	✓	✓	✓	✓	✓
Object-Oriented Programming and Design + Lab	CS112, CS112L	3+1	✓	✓	✓	✓	✓	✓
Data Structure & Algorithms + Lab	CS221, CS221L	3+1	✓	✓	✓	✓	✓	✓
Discrete Mathematics	CS231	3	✓	✓	✓	✓	✓	✓
Database Management Systems + Lab	CS232, CS232L	3+1	✓	✓	✓	✓	✓	✓
Operating Systems + Lab	CS311, CS311L	3+1	✓	✓	✓	✓	✓	✓
Software Engineering	CS325/SE201	3	✓	✓	✓	✓	✓	✓
Artificial Intelligence + Lab	CS351, CS351L	3+1			✓	✓	✓	✓
Parallel Processing & Distributed Computing	CS417	3	✓		✓	✓	✓	✓
Data & Networks Security	CS465	3	✓	✓	✓	✓	✓	✓
Design & Analysis of Algorithms	CS478	3	✓	✓	✓	✓	✓	✓
Senior Design Project (Part-I)	CS481	0+3	✓	✓	✓	✓	✓	✓
Senior Design Project (Part-II)	CS482	0+3	✓	✓	✓	✓	✓	✓
Total Credit Hours		**55**	**51**	**45**	**52**	**52**	**52**	**52**

(c) Program Specialization Requirements (18-33 Credit Hours)

Course Title	Course Code	Credit Hours	BS AI	BS CE	BS CS	BS CyS	BS DS	BS SE
Programming for Artificial Intelligence Lab	AI201L	0+1	✓					
Machine Learning + Lab	AI221, AI221L	3+1	✓					
Knowledge Representation & Problem Solving	AI311	2	✓					
Deep Neural Networks + Lab	AI331, AI331L	3+1	✓					
Computer Vision	AI341, AI341L	3+1	✓					
Natural Language Processing	AI351, AI351L	3+1	✓					
Circuit Analysis + Lab	CE211, CE211L	3+1		✓				

Electronics-I + Lab	CE231, CE231L	3+1		✓				
Microprocessor Interfacing + Lab	CE324, CE324L	3+1		✓				
Signals and Systems + Lab	CE341, CE341L	3+1		✓				
Computational Methods & Techniques	CE342	3		✓				
Digital Signal Processing + Lab	CE361, CE361L	3+1		✓				
Cloud Computing	CE408	3		✓				
Digital System Design + Lab	CE436, CE436L	3+1		✓				
Formal Languages & Automata Theory	CS224	3			✓			
Human Computer Interaction & Computer Graphics	CS272/CS372	3			✓			✓
Compiler Construction + Lab	CS334, CS334L	**3+1**			✓			
Advance Database Management Systems + Lab	CS342, CS342L	3+1			✓			
Computer Architecture	CS361	3		✓	✓			
Cyber Security Principles & Concepts	CY201	3				✓		
Information Security	CY211	3				✓		
Secure Software Design & Engineering + Lab	CY321, CY321L	3+1				✓		
Information Assurance	CY331	3				✓		
Digital Forensics + Lab	CY341, CY341L	3+1				✓		
Unix System Administration	CY351, CY351L	3+1				✓		
Cryptography	CY412	3				✓		
Theory of Data Science	DS211	3					✓	
Inferential Statistics & Applied Probability	DS221	3					✓	
Data ware Housing & Business Intelligence + Lab	DS331, DS331L	3+1					✓	
Data Mining	DS341	3					✓	
Data Visualization + Lab	DS351, DS351L	2+1					✓	
Big Data Analytics + Lab	DS361, DS361L	3+1					✓	
Data Engineering	DS471	2					✓	
Development Operations Lab	SE202L	**0+1**			✓		✓	✓
Software Requirements Engineering	SE211	3						✓
Software Design and Architecture + Lab	SE322, SE322L	3+1						✓
Software Construction and Development + Lab	SE323, SE323L	3+1						✓

Software Quality Assurance	SE331	3						✓
Web Engineering and Mobile App Development+ Lab	SE351, SE351L	3+1						✓
Total Credit Hours			**19**	**33**	**18**	**24**	**23**	**22**

(d) List of Technical Electives (03 Credit Hours)

Course Title	Course Code	Credit Hours	BS AI	BS CE	BS CS	BS CyS	BS DS	BS SE
Deep Reinforcement Learning & Control	AI432	3	✓					
Medical Image Processing	AI442	3	✓					
Visual Perception for Self-Driving Cars	AI443	3	✓					
Soft Computing	AI461	3	✓					
Nature Inspired Computing	AI462	3	✓					
Computational Neuroscience	AI463	3	✓					
Edge AI	AI464	3	✓					
Reinforcement Learning	AI465	3	✓					
Fuzzy Logic Based Learning	AI466	3	✓				✓	
Cloud Computing	CE408	3					✓	
Robotic Vision	CE453	3		✓				
Wireless and Mobile Networks	CE463	3		✓				
ASIC Design	CE465	3		✓				
Multimedia Systems	CE471	3		✓				
Real Time Embedded Systems	CE475	3		✓				
Systems Programming	CS413	3			✓			
Development Operations	CS416	**3**						✓
Full Stack Web Development	CS417	3						✓
Object-Oriented Analysis & Design	CS423	3			✓			
Design of Programming Language	CS425	3			✓			
Real-Time Programming	CS426	3			✓			
Structure & Interpretation of Computer Programs	CS427	3			✓			
Software Engineering II	CS432	3			✓			
Design Patterns	CS434	3			✓			

Software Testing & Quality Assurance	CS435	3			✓			
Advance Database Management Systems	CS442	3					✓	
Informational retrieval	CS444	3					✓	
Web Mining and Social Media Analysis	CS447	3					✓	
Artificial Neural Networks	CS453	3			✓			
Distributed Systems	CS465	3			✓			
Block chain	CS478	3					✓	✓
Simulation and Modeling	CS479	3					✓	✓
Vulnerability Assessment	CY451	3				✓		
Penetration Testing	CY461	**3**				✓		
Malware Analysis	CY471	3				✓		
Cryptanalysis	CY472	3				✓		
Embedded System Security	CY473	3				✓		
Wireless and Mobile Security	CY474	3				✓		
Formal Methods in Software Engineering	SE412	3						✓
Software Re-Engineering	SE424	3						✓
Software Design & Architecture	SE432	3			✓			
Count of Technical Elective Courses			**9**	**6**	**11**	**6**	**7**	**7**

(e) List of Area Electives (06-09 Credit Hours)

Course Title	Course Code	Credit Hours	BS AI	BS CE	BS CS	BS CyS	BS DS	BS SE
Edge AI	AI464	3	✓	✓				
General Purpose Computing with GPU	CE323/CE427	3	✓	✓	✓		✓	✓
ASIC Design	CE465	3		✓				
Communication Theory	CE4xx	3		✓				
System Programming	CS313/CS413	2+1		✓		✓	✓	✓
Mobile Computing	CS314/CS414	2+1	✓	✓	✓	✓	✓	✓
Web Engineering	CS315/CS415	2+1	✓	✓		✓	✓	✓
Development Operations	CS316/CS416	2+1	✓	✓		✓	✓	
Full Stack Web Development	CS318/CS418	2+1	✓	✓		✓	✓	

Object-oriented Analysis and Design	CS323/CS423	2+1	✓	✓		✓	✓	✓
Structure and Interpretation of Computer Programs	CS326/CS426	3	✓	✓		✓	✓	✓
Software Design and Architecture	CS333/CS433	3					✓	
Design Patterns	CS334/CS434	3	✓				✓	
Software Testing and Quality Assurance	CS335/CS435	3					✓	
Advanced Database Management Systems	CS342/CS442	3	✓	✓		✓	✓	✓
Data Science	CS343/CS443	3	✓	✓	✓	✓	✓	✓
Information Retrieval	CS344/CS444	**3**	✓	✓	✓	✓	✓	✓
Management Info Systems & Decision Support Systems	CS345/CS445	3			✓		✓	
Data Warehousing & Data Mining	CS346/CS446	2+1	✓	✓	✓	✓	✓	✓
Web Mining & Social Media Analysis	CS347/CS447	2+1	✓	✓	✓	✓	✓	✓
Geographic Information Systems	CS348/CS448	3	✓	✓	✓	✓	✓	✓
Soft Computing	CS352/CS452	2+1	✓	✓	✓	✓	✓	✓
Deep Learning	CS354/CS454	2+1		✓	✓	✓	✓	✓
Natural Language Processing with Deep Learning	CS355/CS455	2+1		✓	✓	✓	✓	✓
Computer Architecture	CS361/CS461	3	✓	✓		✓	✓	✓
Internet of Things	CS364/CS464	2+1	✓	✓	✓	✓	✓	✓
Network Security & Cyber Ethics	CS366/CS466	3			✓		✓	
Data Security and Encryption	CS367/CS467	3			✓			
Digital Image Processing	CS373/CS473	2+1	✓	✓	✓	✓	✓	✓
Computer Graphics	CS374/CS474	3	✓	✓		✓	✓	✓
Cyber Security	CS375/CS475	2+1	✓	✓	✓		✓	✓
Bio-inspired Computing	CS376/CS476	2+1	✓	✓	✓		✓	✓
Bioinformatics	CS377/CS477	2+1	✓	✓	✓	✓	✓	✓
Block Chain	CS378/CS478	**2+1**	✓	✓	✓	✓		
Scientific Communication	CS393/CS493	3		✓				
Operation Research	CS395/CS495	3	✓	✓	✓	✓	✓	✓
Total Offered Electives			**25**	**30**	**20**	**23**	**31**	**23**

COURSE DESCRIPTION

CORE COMPUTING COURSES

CE221 Digital Logic Design (3 3 4): Basic concepts and tools used to design digital hardware consisting of both combinational and sequential logic circuits, Boolean algebra, logic gates, combinational logic design, sequential logic design, memory, programmable logic devices (PLDs), hardware description language (HDL) and their use to design the basic digital hardware.
Prerequisite(s): None
Core for: *All Computing programs*

CE222 Computer Organization & Assembly Language (3 3 4): Microprocessor bus structure: addressing, data and control, memory organization and structure (segmented and linear models), registers and flags, data movement, arithmetic and logic, program control, subroutines, stack and its operation, peripheral control interrupts, interfacing with high level languages. Assembly language, addressing modes, introduction to the assembler and debugger, manipulate and translate machine and assembly code, actions inside the processing chip, operations performed by an instruction set, write documented programs, using an assembler of choice.
Prerequisite(s): CE221
Core for: *All Computing programs*

CE313 Computer Communications & Networks (3 3 4): Introduction to data communications, network topologies, LAN and WAN, OSI model of computer communications, communications media, data link layer, network layer, transport layer, TCP/IP protocols, switching and routing, and networking technologies.
Prerequisite(s): CS231
Core for: *All Computing programs*

CS101 Computing and Artificial Intelligence (2 3 3): Computers and their fundamentals, algorithms, flowcharts, pseudocode, components of algorithms, comments, assignment operators, simple and nested control structures, switch statements, repetition via loops, lists and arrays, passing arrays to functions, searching in arrays, pointers, function pointers, references, library functions, and Standard Template Library (STL).
Prerequisite(s): None
Core for: *All faculties*

CS112 Object-Oriented Programming (3 3 4): User-defined data types, structures, unions and enumerations, ADTs and C++ classes, constructor, destructors, static/constant data members and functions, copy constructor, inheritance, virtual functions and polymorphism, operator overloading, function and class templates, exception handling, I/O streams and file handling, standard template library.
Prerequisite(s): CS101
Core for: *All faculties*

CS202 Information and Communication Technologies (2 0 2): A bird-eye view of computer science, basics of computer organization and hardware, operating systems, networking and the Internet, algorithm development, software engineering, databases, use of computers in various domains, and recent and future trends in IT.
Prerequisite(s): None
Core for: *All Computing programs*

CS221 Data Structures & Algorithms (3 3 4): Introduction to data structures and algorithms, arrays, stacks, infix, postfix and prefix notations, recursion, backtracking, binary search, queues, linked lists, trees, graphs and operations, algorithm performance, complexity issues, sorting algorithms, searching algorithms, hashing, dynamic memory management.
Prerequisite(s): CS112
Core for: *All Computing programs*

CS231 Discrete Mathematics (3 0 3): Formal logic, quantifiers and predicates, tautologies, rules of inferences, proof techniques, mathematical induction, recurrence relations, set theory, counting, permutations and combinations, relations and functions, Boolean algebra, introduction to graph theory and tree algorithms.
Prerequisite(s): None
Core for: *All Computing programs*

CS232 Database Management Systems (3 3 4): Introduction to databases, basic concepts and architecture, relational model, SQL, data manipulation, data definition language, methodology-driven conceptual, logical, physical database design, data modeling, entity-relationship diagrams, functional dependencies, normalization, relational database design, relational algebra, record storage and primary file organization, query processing and optimizations, transaction processing, and concurrency control.
Prerequisite(s): CS112
Core for: *All Computing Programs*

CS311 Operating Systems (3 3 4): History and goals, evolution of multi-user systems, process and CPU management, multithreading, kernel and user modes, protection, problems of cooperative processes, synchronization, deadlocks, memory management and virtual memory, relocation, fragmentation, paging and segmentation, secondary storage, security and protection, file systems, I/O systems, distributed operating systems, scheduling and dispatch, and concurrency.
Prerequisite(s): CS221
Core for: *All Computing programs*

CS325/SE201 Software Engineering (3 0 3): Nature of software, Professional software development, Software engineering practices, Software process structure and models (context, interaction, structural, and behavioral), Agile software development, Requirements engineering process, model driven engineering, Architectural design and implementation, UML diagrams, Design patterns, Testing, Quality assurance, Software evolution, Project management and planning, configuration management, and Software process improvement.
Prerequisite(s): CS112
Core for: *All Computing programs*

CS351/AI202 Artificial Intelligence / Trends and Techniques in AI (3 3 4): Introduction to Artificial Intelligence and its applications, Reasoning and knowledge representation, Problem solving by searching (informed, uninformed, local, adversarial search techniques), Optimization algorithms (hill climbing, genetic algorithms, simulated annealing), Probabilistic algorithms (Markov chains, HMMs), Machine learning (Supervised and unsupervised learning techniques), Deep learning, and Fuzzy logic and inference.
Prerequisite(s): CS221
Core for: *All Computing Programs*

CS378 Design & Analysis of Algorithms (3 0 3): Introduction, Comparison sorting, Integer sorting and selection, Lower bounds, Divide and conquer, Master theorem, Dynamic programming, Graph representation, Traversal, Ordering, Shortest paths, Greedy algorithms, Minimum spanning trees, String algorithms, Amortized analysis, Computational geometry, NP-completeness, and Approximation.
Prerequisite(s): CS221
Core for: *All Computing Programs*

CS464 Data and Network Security (3 0 3): Introduction, cryptology and simple cryptosystems, conventional encryption techniques, stream and block ciphers, DES, more on block ciphers, advanced encryption standard, confidentiality and message authentication: hash functions, number theory and algorithm complexity,

DUA SIPRA (BS DS)

GIKI is not only a premier institute of engineering and technology, but it is also a hidden gem in the heart of nature. The serene and peaceful environment provides the perfect backdrop for learning and growth. I had the privilege of attending GIKI and it was one of the most challenging and rewarding experiences of my life. As a student at GIKI, I was constantly inspired by the beauty of my surroundings. The campus's natural setting made studying and working on projects an enjoyable experience. I can say that the combination of world-class education and a stunning natural setting makes GIKI truly one-of-a-kind. The curriculum is rigorous and provides a solid foundation in engineering and technology, and the hands-on projects and research opportunities allow students to apply what they have learned in real-world situations.

What sets it apart is its emphasis on experiential learning and its commitment to sustainability. During my time here, I had the opportunity to work on real-world projects that directly impacted local communities, and I was able to apply the knowledge I gained in the classroom to meaningful work. During my tenure at GIKI, I underwent a profound transformation and forged friendships that will last a lifetime. I am deeply grateful for the exceptional education, valuable experiences, and meaningful relationships that I acquired at this esteemed institution. Overall, GIKI is not just an institute, it is a life-changing journey full of enriching experiences.

public key encryption, RSA and discrete logarithms, elliptic curves, digital signatures, key management schemes, identification schemes, dial-up security, e-mail security, PGP, S-MIME, kerberos and directory authentication, emerging Internet security standards, SET, SSL and IPsec, VPNs, firewalls, viruses, & miscellaneous topics.
Prerequisite(s): CS311
Core for: *All Computing Programs*

CS481 & CS482 Senior Design Project - I & II (6 Credits) (0 18 6): The aim of the course is to fine tune the general computing skills of the students in a specific area and exercise their communication skills. It will allow students to choose a specific area of study of interest to them and to choose a method of working which is suited to their area of study. Therefore, some may adopt a research-oriented approach while others may concentrate on building specific systems to solve known problems.
Prerequisite(s): None
Core for: *All Computing Programs*

CORE MANAGEMENT COURSES

CS391 Entrepreneurship & Technology Commercialization (3 0 3): Understanding the entrepreneurship process, concepts, practices and tools of the entrepreneurial world, readings, cases studies and projects covering unique environment of the entrepreneurs and new ventures, tools necessary to think creatively, to plan out whether ideas are marketable to investors, launching own business, or supporting an employer in launching and growing an entrepreneurial venture, the focus shall be on items particularly important for technology ventures.
Prerequisite(s): None
Core for: All Computing Programs

CS392 Professional Issues in IT (3 0 3): The laws and how they are created, professional bodies in IT, the computing profession and the nature, structure and management of commercial IT organizations, financing of start-up companies, financial accounting, management accounting and the evaluation of investment proposals, human resources issues and management, discrimination and anti-discrimination legislation, social networking, spotting fake news, gender and racial issues, ethics, software contracts and liability, copyrights, piracy, intellectual property rights, freedom of information, data protection, cyber laws, peer-to-peer torrents and legislation that affects use/misuse of computers.
Prerequisite(s): None
Core for: All Computing Programs

CS493 Scientific Communication (3 0 3): Understanding the scientific writing process and its importance, impact, structure and organization, clarity and coherence, grammar and style, literature review, data presentation, citations, referencing, ethics, plagiarism, revision, editing, authorship roles and positions,

scientific presentations and its importance, structure and organization, slide design, delivery techniques, audience engagement, time management, handling questions, importance of practice, and feedback.
Prerequisite(s): HM102, CS325
Core for: AI, CS, Cy Sec, DS and SE

CS494 Software Project Management (3 0 3): This course highlights the importance and role of software product management. It also provides an overview of the specialization, as well as its goals, structure, and expectations. The course explains the value of process, requirements, planning, and monitoring in producing better software.
Prerequisite(s): SE201/CS325
Core for: All Computing Programs

DOMAIN SPECIFIC CORE COURSES

ARTIFICIAL INTELLIGENCE

AI201L Programming for AI Lab (0 3 1): IDE for the language (e.g., Jupyter Notebook or IPython), variables, expressions, operands and operators, loops, control structures, debugging, error messages, functions, strings, lists, object-oriented constructs and basic graphics in the language, writing production quality clean code in the programming language using version control (git and subversion), pertinent libraries necessary for interpreting, analyzing and plotting numerical data (e.g., NumPy, MatPlotLib, Anaconda and Pandas for Python) and examples of each library using simple use cases and small case studies.
Prerequisite(s): CS112
Core for: AI

AI311 Knowledge Representation and Problem Solving (2 0 2): Propositional Logic, First-order Logic, Horn Clauses, Description Logic, Reasoning using Description Logic, Forward and Backward Chaining in Inference Engines, Semantic Networks, Ontologies and Ontology Languages, Logical Agents, Planning, Rule-based Knowledge Representation, Reasoning Under Uncertainty, Bayesian Networks Representation, Inference in Bayesian Networks, Fuzzy Logic, Inference using Fuzzy Rules, Markov Models, Commonsense Reasoning, Explainable AI.
Prerequisite(s): CS231

AZAM AFRIDI (BS AI)

Being part of the first Bachelor in AI cohort at our university has been nothing short of a rollercoaster ride. The program's innovative curriculum, combined with a strong focus on hands-on learning, has provided me with a deep understanding of AI principles and applications. The supportive faculty and collaborative environment have fostered a sense of community and innovation, making my time here truly unforgettable.

Core for: AI

AI321 Machine Learning (3 3 4): Introduction, Data preprocessing, Feature selection, Dimensionality reduction (principal component analysis), Data splitting (training, validation, testing), Classification vs. Regression, Evaluation metrics, Supervised learning (decision trees, Naive Bayes, artificial neural networks, support vector machines, overfitting, underfitting, noisy data, and pruning), Ensemble learning (stacking, bagging, and boosting with random forests), Regression (linear, logistic), Unsupervised learning (hierarchical clustering, k-means partitional clustering, k-Nearest-neighbor algorithm), Semi-supervised learning with EM using labeled and unlabeled data, Reinforcement learning.
Prerequisite(s): AI202
Core for: AI

AI331 Deep Neural Networks (3 3 4): Introduction to artificial and biological neurons, learning from data, artificial neural networks and non-linear activation functions, error back propagation and restricted boltzman machine algorithms, deep vs. shallow learning, data augmentation, theory of generalization, convolutional neural networks, recurrent neural networks, generative adversarial networks, deep unsupervised and reinforcement learning, parallel computing for AI (GPU computing, CuDNN, etc.), and application areas of deep

learning – speech recognition, images, vision, etc.
Prerequisite(s): AI321
Core for: AI

AI441 Computer Vision (3 0 3): Foundation of image formation, measurement, and analysis, geometric relationships between 2D images and the 3D world, object and scene recognition and categorization from images, fundamentals of image formation, camera imaging geometry, image filtering, feature detection and matching, stereo vision, motion estimation and tracking, deep learning architectures for computer vision, AlexNet, GoogleNet, VGGNet, ResNet, Xception, ResNext-50, YOLO and others, and semantic segmentation, pose estimation, image classification and scene understanding.
Prerequisite(s): AI331
Core for: AI

AI451 Natural Language Processing (3 0 3): Deterministic and stochastic grammars, parsing algorithms, CFGs, representing meaning/semantics, semantic roles, temporal representations, corpus-based methods, N-grams and HMMs, smoothing and backoff, POS tagging and morphology, information retrieval, vector space model, precision and recall, information extraction, language translation, text classification, categorization, transformers, convolutional neural networks (CNN) or recurrent neural networks (RNN), rules for language analysis, word embedding, sentiment analysis, understand relations between words, semantics, and context through their association with related words, vector representations using look-up tables, weights based on probabilistic intent and bag of words model.
Prerequisite(s): AI331
Core for: AI

COMPUTER ENGINEERING

CE211 Circuit Analysis (3 3 4): Fundamentals of circuit analysis, Voltage, Current, Sources, Ohm's law, Develop methods and procedures (nodal/mesh analysis, network theorems) to resolve complex electric circuits, Solutions for resistive circuits followed by complex elements, e.g., capacitors, inductors and operational amplifiers, Circuits with DC sources, and Circuits with sinusoidal sources.
Prerequisite(s): None
Core for: CE

CE231 Electronics I (3 3 4): Introduction to basic electronics, semiconductor diode, diode applications, bipolar junction transistor, transistor configurations, DC biasing, field-effect transistor, BJT and FET small signal equivalent circuit models, design of BJT and FET amplifiers, and differential amplifiers.
Prerequisite(s): CE211
Core for: CE

CE324 Microprocessor Interfacing (3 3 4): Introduction to 16-bit microprocessor, software model, addressing modes, instruction set, assembly language programming, hardware moel, read/write cycles, exception/interrupt processing, interfacing to ACIA, PIA, PI/T, DMA, A/D, D/A converters, introduction to micro-controllers and embedded systems.
Prerequisite(s): CE222
Core for: CE

CE341 Signals and Systems (3 3 4): Introduction to signals, basic continuous and discrete time signals, introduction to systems, discrete time linear time invariant (DT-LTI) systems, continuous time linear time invariant (CT-LTI) systems, properties of CT-LTI systems, Laplace transform and CT-LTI systems, inverse Laplace transform, z-transform and DT-LTI systems, Fourier series representation of CT/DT periodic signals, the Fourier transform, selected applications of Fourier series and transforms including sampling, filtering, communication, and control system.
Prerequisite(s): MT102
Core for: CE

CE342/CE442 Computational Methods and Techniques (3 0 3): Introduction, floating-point arithmetic, types of errors & error propagation, solving equations (Bisection, Newton-Raphson, & Secant methods and fixed-point iteration), interpolation & curve fitting (Polynomial interpolation, Least squares approximation, and cubic splines), numerical differentiation & integration (finite difference approximation, Newton-Cotes formulas, Gaussian quadrature), solution of linear systems (Gaussian elimination, LU decomposition, matrix

factorization (Cholesky, QR)), Eigenvalue problems (power iteration method, QR algorithm, singular value decomposition (SVD)), numerical solution of Ordinary Differential Equations (Euler's, Runge-Kutta, & Multistep methods), and boundary value problems for ODEs (Shooting, finite difference, & spectral methods).
Prerequisite(s): MT102
Core for: CE, CS

CE361 Digital Signal Processing (3 3 4): Discrete-time signals, sampling theory, interpolation and decimation, discrete-time Fourier transform, z-transform, discrete Fourier transform, fast Fourier transform, digital filter design techniques, parallel IIR and FIR filters, finite word length effects, introduction to discrete stochastic processes.
Prerequisite(s): CE341
Core for: CE

CE408 Cloud and Distributed Computing (3 0 3): Overview and introduction, characteristics of cloud computing, virtualization techniques, cloud infrastructure, cloud security, cloud service models, cloud cost management, cloud migration strategies, cloud native development, serverless computing, big data and analytics in the cloud, high availability and disaster recovery, edge computing and IoT, blockchain and distributed ledger technologies, cloud security and privacy, future directions, challenges, and emerging trends.
Prerequisite(s): CE313
Core for: CE

CE436 Digital Systems Design (3 0 3): Arithmetic circuits, computer design fundamentals, HDL Behavioral, Sequential coding, and ModelSim – design using flip-flop and latches, state machines, state reduction, timing issues, design of adders and subtractors, carry lookahead adders, serial adders, array multipliers, critical paths, Booth and Radix-4 encoded signed multipliers, further VHDL modeling, parameterization; FPGA Implementations – LFSR, BRM, Function Generators, Design Examples, Faults and Testability – BIST and SCAN techniques, Design for test – JTAG, Advanced HDL – Memories and Register Files, Design Examples
Prerequisite(s): CE324
Core for: CE

CS224 Formal Languages and Automata Theory (3 0 3): Introduction and overview, deterministic finite automata (DFA), non-deterministic finite automata (NFA), minimization of DFA, equivalence between DFA and NFA, regular languages, regular expressions and finite state machines, pushdown automata, context free grammar (CFG), Turing machines, context sensitive languages and linear-bounded automata, Church-Turing thesis, Hierarchy theorems, quantum automata and languages, and applications of formal languages and finite state machines.
Prerequisite(s): CS231
Core for: CS

CS324 Computer Architecture (3 0 3): Fundamentals, processor design, pipelining, memory hierarchy Input/Output systems, instruction level parallelism, multiprocessor systems, vector and SIMD architectures, advanced processor features, energy-efficient architectures, power-aware scheduling, energy-efficient processor design principles, RISC vs. CISC architectures, computer architecture for emerging technologies, Quantum computing fundamentals, Neuromorphic computing concepts, FPGA (Field-Programmable Gate Array) architectures and applications, and overview of hardware accelerators (GPUs, TPUs).
Prerequisite(s): CE222
Core for: CS

CS342 Advance Database Management Systems (3 0 3): Introduction, overview, advanced data models, database design and normalization, advanced query optimization, transaction management and concurrency control, recovery and backup techniques, distributed database systems, parallel database systems, data warehousing and OLAP, big data management, advanced topics in database security, data mining and analytics, spatial and temporal databases, stream processing and complex event processing, current research and emerging trends.
Prerequisite(s): CS232
Core for: CS

CS372/CS472 Human Computer Interface and Computer Graphics (3 0 3): Introduction, user interface design principles, interaction design, principles, tools and software for graphic design, creating visual hierarchies, information visualization, user research methods, prototyping and wireframing, user experience evaluation, fundamentals of 3D graphics, computer graphics rendering, animation and motion graphics, virtual reality (VR) and augmented reality (AR), human factors in HCI, assistive technologies and accessible design, brain-computer interface (BCI), multimodal interfaces, advanced rendering techniques, GPU programming and shaders, global illumination and ray tracing, simulation and physics-based rendering, current research and emerging trends.
Prerequisite(s): CS325/SE201
Core for: CS, SE

CS417 Parallel Processing and Distributed Computing (3 0 3): High performance architectures and programming languages; graph concepts: control flow graph, dominance frontiers, data dependence in loops and parallel constructs; program dependence graph; loop transformations, inter-procedural transformations; concurrency analysis: synchronization, strength reduction, nested loops; vector analysis; message-passing machines; communicating sequential processes.
Prerequisite(s): CS311
Core for: All Computing Programs

CS424 Compiler Construction (3 0 3): Study and practical implementation of lexical analysis, syntax analysis using top-down and bottom-up approaches, LL, LR, and LALR parsers, semantic analysis using attributed grammars and dependency graphs, intermediate intermediate code generation using three address codes and code optimization. Students are required to implement a small compiler using modern compiler writing tools.
Prerequisite(s): CS224
Core for: CS

CYBER SECURITY

CY201 Cyber Security Principles and Concepts (3 0 3): Introduction to Cyber security; Networks and the Internet; cyber threat landscape; understanding security; information security Principles (Confidentiality, Integrity, Availability); Information Security Terminology; Who are the attackers; Advanced Persistent Threat (APT); Malware, types of malware; Attacks using malware; Malware Attack Lifecycle: Stages of Attack; Social engineering attacks; types of payload; Industrial Espionage in Cyberspace; Basic cryptography; Web application attacks; Database security; Cyber kill chain; Privacy and anonymity; Network security; Software security; Mobile device security; Mobile app security; Cyber Terrorism and Information Warfare; Introduction to Digital Forensics; Digital Forensics Categories.
Prerequisite(s): CS231
Core for: CyS

CY211 Information Security (3 0 3): Information security foundations, security design principles; security mechanisms, symmetric and asymmetric cryptography, encryption, hash functions, digital signatures, key management, authentication and access control; software security, vulnerabilities and protections, malware, database security; network security, firewalls,

intrusion detection; security policies, policy formation and enforcement, risk assessment, cybercrime, law and ethics in information security, privacy and anonymity of data.
Prerequisite(s): CS231
Core for: CyS

CY321 Secure Software Design and Engineering (3 3 4): Secure software concepts; System issues; System properties; Software Project Time Management; Software Project Costing; Software Quality Assurance; Security Concepts in the SDLC; Risk management; Security standards; Best practices; Security methodologies; Security frameworks; Regulations Privacy and Compliance; Security Models; Trusted Computing; Secure Software Requirements; Secure Software Design; Design Processes; Secure Software Implementation/ Coding; Software Development Methodologies; Common Software Vulnerabilities and Controls; Defensive Coding Practices; Code Vulnerabilities and Avoiding Polymorphic Malware Attacks; Secure Software Testing; Security Testing Methodologies; Software Security Testing; Software Acceptance; Legal Protection Mechanisms; Software Deployment-Operations-Maintenance and Disposal.
Prerequisite(s): CS221
Core for: CyS

CY331 Information Assurance (3 3 4): Introduction to (IS) Information System (Concept, Design, Functions, Architecture, Components and applications of IS); Secure System Planning and Administration; Information Security Policies and Procedures; Asset Management; Organizational and Human Security; Cyber Security Management Concepts; NIST Cyber Security Framework; Enterprise Roles and Structures; Strategic Planning; Security Plans and Policies; Contingency Planning; Laws; Laws and Regulatory Requirements; Security Standards and Controls, Risk Management Process, NIST Risk Management Framework, Security Metrics and Key Performance Indicators (KPIs); Physical Security and Environmental Events; Contingency Planning; Security Education, ISO 27001 Compliance, Training, and Awareness.
Prerequisite(s): CY201
Core for: CyS

CY412 Cryptography (3 0 3): Secret key cryptography (Encryption, Stream ciphers, Block ciphers, Chosen plaintext attacks, Message integrity, Message integrity from universal hashing, Message integrity from collision resistant hashing, and Authenticated encryption). Public key cryptography (Public key tools, Public key encryption, Chosen ciphertext secure public-key encryption, Digital signatures, Fast signatures from one-way functions, Elliptic curve cryptography and pairings, Post-quantum

MUHAMMAD FARAE (BS CE)

As someone who has always been passionate about technology and innovation, obtaining a Bachelor's degree in Computer Engineering from GIK Institute was a dream come true for me. The state-of-the-art lab facilities and the comprehensive curriculum provided me with a solid foundation in computer engineering principles. The round-the-clock mentorship from our professors was invaluable, guiding me through complex concepts and encouraging me to push the boundaries of my understanding.

GIKI is a melting pot of people from different cultures in Pakistan. This diversity not only broadened my perspective but also fostered a collaborative and dynamic learning environment. Coming from a diverse educational background, I found the learning environment to be highly supportive. The course structure was designed to cater to students with varying levels of prior knowledge, making it easier to grasp even the most challenging topics. Professors were always approachable, ready to assist with any queries, and the curriculum allowed me to learn at a pace that suited me best.

My time at GIKI has been transformative, offering a perfect blend of theoretical knowledge and practical experience.

cryptography: lattices and isogenies, and Analysis of number theoretic assumptions). Protocols (Identification, login, and signatures from sigma protocols, Proving properties in zero-knowledge, Modern proof systems, Authenticated key exchange, and Two-party and multi-party secure computation).
Prerequisite(s): MT102
Core for: CyS

CY441 Digital Forensics (3 3 4): Introduction, applications, and challenges; Difference between computer experts and digital forensics experts; Investigative process methodologies; Education, training, and awareness; Laws, standards, regulations, ethics and professional conduct; Digital evidence management; Collecting evidence; Antiforensics; Network, cloud, internet, social media, mobile and embedded forensics; Investigation methods for collecting digital evidence; Digital forensic readiness; Digital forensics tools; Discovery of computers and storage media; Discovery of audio/video evidence; Data visualization.
Prerequisite(s): CY201
Core for: CyS

DATA SCIENCE

DS211 Theory of Data Science (3 0 3): Introduction to Big Data Analytics, Data Analytics Lifecycle, Advanced Analytical Theory and Methods: Association Rules, Regression, Classification, Time Series Analysis, Text Analysis, MapReduce and Hadoop, Setting up Python for Data Science, Cross validation and optimization, Linear Algebra, Statistics, Probability, Hypothesis and Inference.
Prerequisite(s): CS112
Core for: DS

DS221 Inferential Statistics and Applied Probability (3 0 3): Introduction to statistics, Experimental design, Interpolation/Extrapolation, Chi-square dependency tests, Diversity index, Exponential families; Variance and link functions, Proportion and binary responses; Logistic regression, Count data and Poisson responses; log-linear models, Overdispersion and quasi-likelihood; estimating functions, Mixed models, random effects, generalized additive models and penalized regression; Introduction to SPSS, Probability/ Correlation analysis/ Dependency tests/ Regression in SPSS.
Prerequisite(s): ES111
Core for: AI, DS

DS341 Data Mining (3 0 3): Introduction, Related technologies, methods and applications of knowledge representation, data preprocessing, data cleaning, data transformation, data reduction, discretization, generating concept hierarchies, Weka 3 data mining system, attribute-oriented analysis, generalization, and relevance, class comparison, statistical generalization, and relevance, class comparison, statistical measures, algorithms and association rules, motivation and terminology, item sets, generating item sets and

rules, correlation analysis, classification techniques, basic learning/mining tasks, 1R algorithm, statistical (Bayesian) classification, Cobweb, text mining, web mining, and data mining software and applications.
Prerequisite(s): DS221
Core for: DS

DS351 Data Visualization (2 3 3): Exploratory data analysis and visualization, Types of exploratory graphs, Visualizations of distributions, probability mass functions, cumulative distribution functions, percentile-based statistics, and random numbers; Modelling major distributions; Probability density functions, kernel density estimation; Relationship between variables, scatter plots, correlation, covariance; Estimation and hypothesis testing; Time series and survival analysis; Implementing concepts with R (or similar language).
Prerequisite(s): DS341
Core for: DS

DS431 Data Warehouse and Business Intelligence (3 3 4): Introduction to Data Warehouse and Business Intelligence; Necessities and essentials of Business Intelligence; DW Life Cycle and Basic Architecture; DW Architecture in SQL Server; Logical Model; Indexes; Physical Model; Optimizations; OLAP Operations, Queries and Query Optimization; Building the DW; Data visualization and reporting based on Datawarehouse using SSAS and Tableau; Data visualization and reporting based on Cube; Reports and Dashboard management on PowerBI; Dashboard Enrichment; Business Intelligence Tools.
Prerequisite(s): DS211
Core for: DS

DS461 Big Data Analytics (3 3 4): Introduction and overview of big data systems; Platforms for big data, Hadoop as a platform, Hadoop distributed file systems (HDFS), MapReduce framework, Resource management in the cluster (YARN), Apache Scala Basic, Apache Scala Advances, Resilient Distributed Datasets (RDD), Apache Spark, Apache Spark SQL, Data analytics on Hadoop / Spark, Machine learning on Hadoop / Spark, Spark Streaming, Other Components of Hadoop Ecosystem.
Prerequisite(s): DS221
Core for: DS

FARWA TOOR (BS CS)

Transforming my future, one line of code at a time - that's what studying Computer Science at GIKI has meant to me.
This esteemed institution is dedicated to nurturing exceptional minds, and I've witnessed it firsthand. From the moment I stepped onto campus, I knew I was part of something special. GIKI's academic environment is electric, with a curriculum that challenges and inspires. The faculty are more than just mentors - they're role models, guiding us toward excellence.
Living on campus has been a game-changer, with a vibrant community that encourages me to explore my passions and interests. With access to cutting-edge facilities and a wide range of clubs and societies, I've been able to develop a holistic set of skills that will serve me well in my future career.
My time here has equipped me with technical expertise, critical thinking, and a hunger for lifelong learning. If you're ready to code your way to success, GIKI is the perfect Launchpad

SOFTWARE ENGINEERING

SE211 Software Requirement Engineering (3 0 3): Introduction, Software requirements, classification of requirements, Requirements process, Levels/layers of requirements, Requirement characteristics, Analyzing quality requirements, Software requirements in the context of systems engineering, Requirement evolution, traceability, prioritization, trade-off analysis, risk analysis and impact analysis, Requirement management, interaction between requirement and architecture, Requirement elicitation, elicitation sources and techniques, Requirement specification and documentation, specification sources and techniques, Requirements validation and techniques, Management of requirements, Requirements management problems, Supplier Organizations, Product Organizations, Requirements engineering for agile methods.
Prerequisite(s): SE201
Core for: SE

SE322 Software Design & Architecture (3 3 4): Software Design Concepts, Design principles, Object-Oriented Design with UML, System design and software architecture, Object design, Mapping design to code, User interface design, Persistent layer design, Web applications design, State machine diagrams and modeling, Agile software engineering, Design Patterns, Exploring inheritance, Interactive systems with MVC architecture, Software reuse. Architectural design issues, Software Architecture, Architectural Structures & Styles-, Architectural Patterns, Architectural & Design Qualities, Quality Tactics, Architecture documentation, Architectural Evaluation, Model driven development.
Prerequisite(s): SE211
Core for: SE

SE351 Web Engineering (3 3 4): I Web programming languages (e.g., HTML5, CSS 3, Java Script, and JS Frameworks), Responsive Design with Bootstrap. Design principles of Web based applications, Web platform constraints, Software as a Service (SaaS), Web standards, Responsive Web Design, Web Applications, Browser/Server Communication, Storage Tier, Cookies and Sessions, Input Validation, Full stack state management, Web App Security - Browser Isolation, Network Attacks, Session Attacks, Large scale applications, Performance of Web Applications, Data Centers, Web Testing and Web Maintenance.
Prerequisite(s): SE201
Core for: SE

SE423 Software Construction and Development (3 3 4): Software development process, Software engg. process infrastructure & process improvement, Systems engineering life cycle models, Process implementation, Levels of process definition, Life cycle model characteristics, Individual and team software process, Lehman's Laws, code salvaging, and configuration management. Martin Fowler's refactoring concepts and their application to small projects. Michael Feathers' "legacy code" concepts. Software configuration & Release management, Software configuration management processes, Software deployment processes, Distribution and backup, Evolution processes and activities, maintenance, legacy systems, Refactoring, Error handling, exception handling, & fault tolerance. Personal & Peer reviews.
Prerequisite(s): SE322
Core for: SE

SE431 Software Quality Assurance (3 0 3): Software Quality, Software Quality Attributes, Quality Engineering, Testing: Concepts, Issues, and Techniques. Testing lifecycle, scopes, documentation, approaches, concepts, techniques, and planning process. Requirement of software test planning, Reporting and historical data recording. Model based testing, Domain and combinatorial testing, Unit and integration testing, Acceptance testing, Test automation, Slicing, Software reliability models and engineering, Exponential model, Reliability growth models, Modeling process, Software inspections & reviews, Inspection checks and metrics, Quality models, Models for quality assessment, Product quality metrics, Quality measurements, In-process metrics for software testing and quality management, Effort/outcome models, System testing, sub-system testing, Specification-based testing, Open issues on software testing.
Prerequisite(s): SE201
Core for: SE

DOMAIN SPECIFIC TECHNICAL ELECTIVE COURSES

ARTIFICIAL INTELLIGENCE

AI432 Deep Reinforcement Learning and Control (3 0 3): Introduction to autonomous systems, self and reinforcement learning, core challenges and approaches to meet challenges, generalization and exploration, algorithms for control policies guided by reinforcement, demonstrations and intrinsic curiosity, evaluating complexity, generalization and generality of algorithms, examples of autonomous tasks, e.g., robotics, game playing, consumer modelling, healthcare, etc.
Prerequisite(s): AI331

AI442 Medical Image Processing (3 0 3): Introduction, texture analysis, basic principles of medical image communication, history, terminology, algorithms, image formation and medical imaging, imaging modalities, image enhancement, image statistics, histograms, visualization of medical images, surface and volume-based approaches, illumination, image segmentation, robustness, watershed transform, active contours, live wire, active shapes, texture analysis, texture localization and delineation, digital representation of color, image data management, standards, components of PACS, lossy and lossless compression, ImageJ.
Prerequisite(s): AI341

AI443 Visual Perception for Self-Driving Cars (3 0 3): Major building blocks of the perception system for self-driving cars, autonomous driving, static and dynamic object detection, main perception tasks, survey of common computer vision methods, pinhole camera model, intrinsic and extrinsic camera calibration, detect, describe and match image features, design convolutional neural networks, application to visual odometry, object detection and tracking, and semantic segmentation for drivable surface estimation.
Prerequisite(s): AI341

AI461 Soft Computing (3 0 3): Overview of the theoretical and the practical aspects of the soft computing paradigm, theory and applications of probabilistic graphical models and related topics, e.g., knowledge elicitation issues, belief updating in singly and multiply connected networks, simulation schemes for belief updating, parameter and structure learning of Bayesian networks, integration of time and uncertainty, models of uncertain reasoning including belief function theory and fuzzy logic and biologically inspired computational models (neural networks and evolutionary algorithms).
Prerequisite(s): AI311

AI462 Nature Inspired Computing (3 0 3): Introduction, characteristics of biological systems, adaptability, reactivity, distributivism, comparison with traditional human-engineered approaches to problem solving, handling complex problems using computational methods modeled after design principles encountered in nature, foundations of complex systems and theoretical biology, distributed architectures of natural complex systems, production of informatics tools with enhanced robustness, scalability, flexibility, interface with humans, principles of biology, informatics, cognitive science, robotics, cybernetics, etc., applied for computing problems.
Prerequisite(s): AI321

AI463 Computational Neuroscience (3 0 3): Mathematical introduction to neural coding and dynamics, convolution, correlation, linear systems, game theory, signal detection theory, probability theory, information theory, reinforcement learning, applications to neural coding, visual system,

Hodgkin-Huxley and other models of neural excitability, stochastic models of ion channels, cable theory, and models of synaptic transmission, basic computational methods for understanding nervous systems and their function, computational principles governing various aspects of vision, sensory-motor control, learning, and memory, representation of information by spiking neurons, processing of information in neural networks, and algorithms to adapt and learn, computational neuroscience: descriptive, mechanistic and interpretive models.
Prerequisite(s): AI341

AI464 Edge AI (3 0 3): Introduction and overview, comparison with traditional AI and cloud-based AI, edge devices and platforms, edge AI fundamentals, model optimization techniques for edge deployment, quantization and pruning, edge AI deployment strategies, offline vs. online edge deployment, federated learning and distributed inference, containerization and microservices for edge deployment, edge AI model development, edge AI accelerators, edge AI security and privacy, edge AI communication protocols, IoT applications, robotics, autonomous vehicles, smart infrastructure, healthcare, retail and marketing, emerging trends.
Prerequisite(s): AI341

AI465 Reinforcement Learning (3 0 3): Introduction and overview, Markov Decision processes (MDPs), key components, exploration vs. exploitation tradeoff, dynamic programming for RL, value iteration and Q-learning, Monte Carlo methods, temporal difference (TD) learning, Deep Q-Networks (DQN), policy gradient methods, proximal policy optimization (PPO), asynchronous methods for RL, multi-agent RL, model-based RL, exploration strategies, transfer learning in RL, meta RL, real-world applications, challenges, and limitations of RL (autonomous vehicles, game playing, robotics), emerging trends.
Prerequisite(s): AI341

AI466 Fuzzy Logic (3 0 3): Introduction and overview, crisp logic vs. fuzzy logic, fuzzy sets, relations, and membership functions, fuzzy logic operations, fuzzy inference systems (FIS), fuzzy logic controllers(FLC), fuzzy reasoning and approximate reasoning, fuzzy clustering and classification, fuzzy logic in applications (pattern recognition, control systems, image processing, natural language processing, decision making, finance, and biomedical engineering), future directions, challenges, and emerging trends.
Prerequisite(s): AI341

COMPUTER ENGINEERING

CE453 Robotic Vision (3 0 3): Vision tasks and applications, Cameral models and image acquisition, image segmentation, feature detection and matching, image recognition, 3D visualization, robot perception (robot and sensors), visual navigation, localization and other topics in robotic vision.
Prerequisite(s): CS221

CE463 Wireless & Mobile Networks (3 0 3): Introduction to wireless environment, wireless network architectures,

wireless local area networks (WLANs), wireless personal area networks, middleware for wireless and mobile networks, mobile IP, TCP in wireless environments, mobile ad-hoc networks and their routing, nomadic services, security in wireless networks, mobile data services, pervasive computing applications.
Prerequisite(s): CE313

CE465 ASIC Design (3 0 3): Introduction to application specific Integrated circuits (ASIC) design methodologies, design and implementation using FPGAs, design verification, digital design using hardware description language, VLSI Basics, libraries, utilities for high level description, data flow description, timing and delays, modeling techniques.
Prerequisite(s): CE222

CE471 Multimedia Systems (3 0 3): Introduction to multimedia systems, software, hardware, various equipment, video and audio capture, annotation, storage and playback techniques, multimedia software development tools, multimedia applications, procedures to develop multimedia systems: (specification, design, testing, and prototyping), multimedia standards, Student projects - developing multimedia systems in the laboratory.
Prerequisite(s): CE341

CE475 Real Time Embedded Systems (3 0 3): Introduction to real time systems, embedded systems, interrupts, performance and optimization, simple single task operating system, real time operating system and scheduling, concurrency, communication, real time benchmarks, adaptive and real time systems, real time control over the internet/remotely.
Prerequisite(s): CE324

COMPUTER SCIENCE

CS313/CS413 Systems Programming (2 1 3): Programming over Linux, gcc and associated tools, file I/O with low-level file descriptors, the standard I/O library, error reporting mechanisms, kernel statistics and parameter modifications, process creation and management system calls, signals and associated system calls, pipes, FIFOs, single & multiple reader/writers, semaphores, shared memory and message-queues, sockets, attributes and addressing schemes, multiple client connections, and connectionless socket communication.
Prerequisite(s): CS311

CS323/CS423 Object Oriented Analysis and Design (2 1 3): Evolution of Object Oriented (OO) programming, OO concepts and principles, problem solving in OO paradigm, classes, methods, objects and encapsulation; constructors and destructors, operator and function overloading, virtual functions, derived classes, inheritance and polymorphism, I/O and file processing, exception handling, UML: conceptual model, use case diagrams, object models, class diagrams, system sequence diagram, object-oriented life cycle, modeling user interface requirements, designing and evaluating methods, synchronizing dependent attributes, normalizing classes with dependent data, design at the object, etc.
Prerequisite(s): CS221

CS325/CS425 Design of Programming Language (3 0 3): Programming practices: program analysis and construction practices, programming language classification, data types, structured data types, subprograms, control statements scooping, and storage management.
Prerequisite(s): CS224

CS326/CS426 Real-Time Programming (3 0 3): Introduction to real-time systems, design issues, programming languages for real-time systems, fault tolerance and reliability issues, exception handling, concurrent programming, synchronization, communication, scheduling.
Prerequisite(s): CS311

CS327/CS427 Structure and Interpretation of Computer Programs (3 0 3): Introduction to programming concepts, Procedures and control structures, Data abstraction, Higher-order procedures, Compound data and recursive data structures, Streams and delayed evaluation, Object-oriented programming in Scheme, Macros and metaprogramming, Parallel and concurrent programming, Program design and optimization, Domain specific languages, and Functional programming paradigm.
Prerequisite(s): CS311

CS332/CS432 Software Engineering II (3 0 3): Product and process, objected oriented analysis, formal methods, algebraic approaches, verification, introduction to Z language and formal specification, function point analysis, refactoring, clean room software engineering, component bases software development, software re-engineering, architecture and estimation.
Prerequisite(s): CS325

CS434 Design Patterns (3 0 3): Overview of object-oriented design, software reusability, classification of design patterns, pattern description formats, design and implementation issues in: creational patterns, structural patterns, behavioral patterns; patterns in software architecture; patterns for user-interface design; pattern languages.
Prerequisite(s): CS325

CS435 Software Testing and Quality Engineering (3 0 3): Introduction, quality challenge, quality control v/s quality assurance, quality assurance in software projects, quality management, quality assurance, standards, planning, and control, verification and validation, critical system validation, reliability validation, safety assurance, security assessment, inspections and reviews, software quality assurance (SQA), plans, SQA-organizational level initiatives, software testing, specification based test construction techniques, white-box and grey-box testing, testing techniques for SDLC, control flow oriented test construction techniques, data flow oriented test construction techniques, clean-room approach to quality assurance, product quality and process quality standards, walkthroughs and inspections, structure, checklist, audits, roles and responsibilities.
Prerequisite(s): CS325

CS453 Artificial Neural Networks (3 0 3): Neural network basics, Hebb net, perceptron, Adaline and Madaline, Hetero-associative and auto-associative networks, discrete Hopfield network, bi-directional associative memory (BAM), backpropagation neural network (BPN), variants of BPN, simulations using backpropagation, radial basis function networks, neural nets based on competition, self-organization aps (SOMs), learning vector quantization (LVQ), counter propagation networks, adaptive resonance theory (ART), probabilistic neural networks, temporal processing using feedforward nets, and genetic algorithms.
Prerequisite(s): CS351

CS465 Distributed Systems (3 0 3): Introduction to distributed systems, communication, naming and name services, processes, synchronization, fault tolerance, distributed file systems, distributed transaction processing, replication, object-based systems, document-based systems, coordination-based systems, security in distributed systems.
Prerequisite(s): CS311

CYBER SECURITY

CY351 Vulnerability Assessment (3 3 4): Understanding the need for security assessments; Classifying vulnerabilities; Software vulnerabilities; Network vulnerabilities; Vulnerability assessment versus penetration testing; Vulnerability Assessment Tools; Vulnerability management Regulatory compliance; Calculating ROIs; Application review process; Pre-assessment; Code navigation; Code auditing tactics; Memory corruption; understanding issues in programming languages; Steps in Reverse engineering, Common tools used for Reverse engineering; Binary Obfuscation techniques; Understanding core assembly concepts to perform malicious code analysis, Identifying key assembly logic structures with a disassembler, Malware analysis Types of malware analysis; Malware Taxonomy; Static analysis; Dynamic analysis; Malware Inspection; Malware analysis tools; Sandboxing and virtualization.
Prerequisite(s): CY321

CY461 Penetration Testing (3 0 3): Using a virtual machine–based applications that includes Kali Linux and vulnerable operating systems, you'll run through a series of practical lessons with tools like Wireshark, Nmap, and Burp Suite. As you follow along with the labs and launch attacks, you'll experience the key stages of an actual assessment—including information gathering, finding exploitable vulnerabilities, gaining access to systems, post exploitation, and more. The main contents are Crack passwords and wireless network keys with brute-forcing and wordlists, Test web applications for vulnerabilities, Use the Metasploit Framework to launch exploits and write your own Metasploit modules,

Automate social-engineering attacks, Bypass antivirus software, and Turn access to one machine into total control of the enterprise in the post exploitation phase.
Prerequisite(s): CS231

CY471 Malware Analysis (3 0 3): Analysis of code and behavior of malicious programs. Basic static analysis of malware interaction with file systems, registry, networks, and other processes in a Windows environment. Basic dynamic analysis of malicious JavaScript. Malicious code analysis and code debugging. Reverse engineering for malware analysis. Self Defending Malware: Packer and unpacking, Packer identification methods, Unpacking complexities, Structured exception handlers, Original Entry Point (OEP). Bypassing analysis defences: Multiple malware defensive techniques, Anti-disassembly, Anti-debugging, Anti-virtual machine.
Prerequisite(s): CS231

CY472 Cryptanalysis (3 0 3): Introduction, Kerckhoffs' principle, Notions of security, Models & targets of attack, Theoretical vs. practical attacks. Cryptanalysis of block ciphers. Meet-in-the-Middle attack & TMTO. Basic differential & Linear analysis. Wide-trail strategy and AES. Truncated differential attack. Higher order differential attack. Boomerang & rectangle attacks. Impossible differential attack. Multi-dimensional linear attack. Zero-correlation linear attack. Division property. Demirci-Selcuk MitM attack. Subspace trail cryptanalysis. Cryptanalysis of stream ciphers. Guess-and-determine attack on stream ciphers. Time-Memory-Data trade off attack. Linear distinguisher and correlation attacks. Cryptanalysis of hash functions. Birthday attacks. MD & Sponge. Meet-in-the-Middle Pre-image attack. Integral, Differential, Computer-aided, MILP-based, Algebraic, & SAT-based cryptanalysis. Interpolation attack. Cube attacks and Higher order differential attack. Linearization. Merkle-Hellman Knapsack, Diffie-Hellman Key Exchange and MitM. Discrete Log algorithms: Baby-step giant-step. Factoring algorithms, Dixon's Algorithm. Quadratic Sieve. Quantum algorithms.
Prerequisite(s): CS231

CY473 Embedded System Security (3 0 3): VULNERABILITIES: Assessment of embedded devices. Embedded hardware and firmware security. Analysis methodology and examples. ATTACKS: Networking and network attacks. Tactical and industrial wireless attacks. EXPLOITATION: Case studies and hands-on labs.
Prerequisite(s): CE222

CY474 Wireless and Mobile Security (3 0 3): Security Issues in Mobile Communication: Mobile Communication History, Security – Wired Vs Wireless, Security Issues in Wireless and Mobile Communications, Security Requirements in Wireless and Mobile Communications, Security for Mobile Applications, Advantages and Disadvantages of Application – level Security. Security of Device, Network, and Server Levels: Mobile Devices Security Requirements, Mobile Wireless network level Security, Server Level Security. Application Level Security in Cellular Networks: Generations of Cellular Networks, Security Issues and attacks in cellular networks.
Prerequisite(s): CE313

SOFTWARE ENGINEERING

SE424 Software Re-Engineering (3 0 3): Terminology and the processes pertaining to software evolution, fundamental re-engineering techniques to modernize legacy systems including source code analysis, architecture recovery, and code restructuring, software refactoring strategies, migration to Object Oriented platforms, quality issues in re-engineering processes, migration to network-centric environments, and software integration, reverse engineering, program comprehension, source code transformation and refactoring strategies, software maintenance and re-engineering economics.
Prerequisite(s): SE323
Core for: SE

AREA ELECTIVE COURSES

CS314/CS414 Mobile Computing (2 1 3): State-of-the-art of mobile computing platforms, introduction to mobile computing, architecture of android platform, using emulator, debugging and DDMS, content providers, App. networking, App. multimedia, App. 2D and 3D graphics, using sensors, publishing, designing Apps using XAML, introduction to iPhone platform, iPhone supported development features and tools for developing mobile web applications.
Prerequisite(s): CS221

CS315/CS415 Web Engineering (3 0 3): Internet technology trends, real-time data transmission, security over Internet, introduction to Web applications development, software architecture patterns for Web Apps, MVC, Web browsers, HTTP, DOM and browser engines, client-side development with HTML, CSS & JavaScript, server-side development over Web applications framework, Web App deployment, virtualization, cloud computing, IaaS, PaaS and SaaS models.
Prerequisite(s): CS311
Specialization(s): AI, CE, CS

CS316/CS416 Development Operations (3 0 3): Basics of Development Operations (DevOps), Commonly used Build tools for DevOps, e.g., GIT and Jenkins, Build test automation, containerization using Docker, Docker commands and use cases, Kubernetes, Spinnaker, Skaffold, etc.
Prerequisite(s): CS112
Specialization(s): CE, CS

CS342/CS442 Simulation and Modelling (3 0 3): Introduction to simulation and modeling: definition, objectives, and types of simulations. Mathematical modeling. Discrete-event simulation. Continuous simulation. Monte Carlo simulation. Validation and verification of simulations. Simulation optimization. Agent-based modeling. Simulation in software engineering. Applications of simulation and modeling.
Prerequisite(s): CS221
Specialization(s): SE

CS343/CS443 Data Science (3 0 3): Introduction to Big Data Analytics, Data Analytics Lifecycle, Advanced Analytical Theory and Methods: Association Rules, Regression, Classification, Time Series Analysis, Text Analysis, MapReduce and Hadoop, Setting up Python for Data Science, Cross validation and optimization, Linear Algebra, Statistics, Probability, Hypothesis and Inference.
Prerequisite(s): CS221
Specialization(s): CE

CS344/CS444 Information Retrieval (3 0 3): Introduction, complications in building a modern web-scale search engine, ranking SVMs, XML, DNS, and LSI. They will also discover the seedy underworld of spam, cloaking, and doorway pages. Study MapReduce and other approaches to parallelism to go beyond megabytes and to efficiently manage petabytes.
Prerequisite(s): CS221
Specialization(s): AI, CS

CS345/CS445 Management Information Systems & Decision Support Systems (3 0 3): Advance topics in systems analysis and software engineering, design and development of large information systems, usefulness to the management, integrated environments, application of artificial intelligence to MIS, development of expert systems and decision support systems.
Prerequisite(s): CS232
Specialization(s): CS, DS

CS346/CS446 Data Warehousing and Data Mining (3 0 3): Concepts of data mining and data warehousing, data preparation techniques: outlier and missing data analysis, data reduction techniques, learning methods, statistical methods, cluster analysis, hierarchical, agglomerative and naïve Bayesian methods, decision trees and decision rules, association rules, other soft computing approaches, artificial neural networks, fuzzy logic, genetic algorithm, and evolutionary algorithms.
Prerequisite(s): CS232
Specialization(s): AI, CS

CS347/CS447 Web Mining and Social Media Analysis (3 0 3): Introduction to mining data from the web and social media, state-of-the-art methods in mining heterogeneous data, association rule mining supervised and unsupervised learning with particular emphasis on web data, methods for information retrieval, e.g., latent semantic indexing, meta-searches, search-based ranking, social media analysis such as link analysis, page rank and HITS algorithms, community discovery, etc.
Prerequisite(s): CS221
Specialization(s): AI, CS, DS

CS348/CS448 Geographic Information Systems (3 0 3): Introduction to Geographical Information System (GIS), fundamental theory of Geographic Information Science, history and evolution of GIS, geo workspace environment, data acquisition, coordinate systems and geo-referencing (QGIS), data structures and models, Raster & Vector levels of measurements in GIS, Vector Data entry operator, concepts of spatial layering, mapping, modeling, management & monitoring, data downloading based on geospatial coordinates, masking, geotiff, analytics, ArcGIS, data analytics, implementing a GIS on a select topic, geo-processing, spatial analysis, map projections and scaling, and cartography.
Prerequisite(s): CS221
Specialization(s): AI, CE, CS

CS352/CS452 Soft Computing (3 0 3): Overview of theoretical and practical aspects of the soft computing paradigm, theory and applications of probabilistic graphical models and related topics, e.g., knowledge elicitation issues, belief updating in singly and multiply connected networks, simulation schemes for belief updating, parameter and structure learning of Bayesian networks, integration of time and uncertainty, models of uncertain reasoning including belief function theory and fuzzy logic, and biologically inspired computational models (neural networks and evolutionary algorithms).
Prerequisite(s): CS232
Specialization(s): CS, DS

CS353/CS453 Artificial Neural Networks (3 0 3): Neural network basics, Hebb net, perceptron, Adaline and Madaline, Hetero-associative and auto-associative networks, discrete Hopfield network, bi-directional associative memory (BAM), backpropagation neural network (BPN), variants of BPN, simulations using backpropagation, radial basis function networks, neural nets based on competition, self-organization aps (SOMs), learning vector quantization (LVQ), counter propagation networks, adaptive resonance theory (ART), probabilistic neural networks, temporal processing using feedforward nets, genetic algorithms, case studies.
Prerequisite(s): CS351
Specialization(s): CE, CS

CS354/CS454 Deep Learning (3 0 3): Introduction to neural networks, convolutional and recurrent networks, deep unsupervised and reinforcement learning, GPU computing, CuDNN, applications and case studies of

Deep Learning in speech recognition, images, vision, etc.
Prerequisite(s): CS351
Specialization(s): CE, CS

CS364/CS464 Internet of Things (3 0 3): Introduction, state-of-the-art in the Internet of Things (IoT), high-level overview of the IoT landscape, domain, architectures, principles, paradigms, building blocks, applications, technologies, development platforms, recent advances and fundamental issues around IoT, origin and enablers of IoT, M2M, architectures, physical and logical designs, communication models, components of IoT systems, IoT levels and deployment templates, technologies, standards, protocols, challenges, and security and privacy hazards.
Prerequisite(s): CS311
Specialization(s): AI, CE, CS

CS367/CS467 Data Security and Encryption (3 0 3): Mathematical background and principle of number theory, probability theory, primes, random numbers, modular arithmetic, cryptographic algorithms and design principles, conventional and symmetric encryption (DES, IDEA, Blowfish, Rijndael, RC-4, RC-5), public key or asymmetric encryption (RSA, Diffie-Hellman), key management, hash functions (MD5, SHA-1, RIPEMD-160, HMAC), digital signatures, and certificates, network security and authentication protocols (X.509, Kerberos), electronic mail security (S/MIME, PGP), web security and protocols for secure electronic commerce (IPSec, SSL, TLS, SET).
Prerequisite(s): CS311
Specialization(s): CE

CS373/CS473 Digital Image Processing (2 1 3): Introduction to digital image processing (DIP) and its applications, image sensing and acquisition, sampling and quantization; mathematical tools for DIP, intensity transformation, spatial filtering; discrete Fourier transform, filtering, image degradation and restoration;

noise models, estimating degradation function, image reconstruction; color models, color image processing, smoothing, sharpening; image segmentation, morphological image processing, image compression, pattern recognition.
Prerequisite(s): CS221

CS374/CS474 Computer Graphics (3 0 3): Computer graphics, fundamental algorithms, graphics input and output, graphics pipeline, sampling and image manipulation, three-dimensional transformations and interactive modeling, basics of modeling and animation, simple shading models and their hardware implementation, fundamental algorithms of scientific visualization, basic structure of interactive graphics systems, characteristics of various hardware devices, control of display devices, implementation of simple packages, device independence, and standard packages, distributed architectures for graphics, hidden line and hidden surfaces algorithms, representation of surfaces, 2-D graphics methods, transformations, and interactive methods, 3-D graphics, transformations, viewing geometry, object modeling, and interactive manipulation methods, basic lighting and shading, video and animation methods.
Prerequisite(s): CS221
Specialization(s): AI, CE, CS

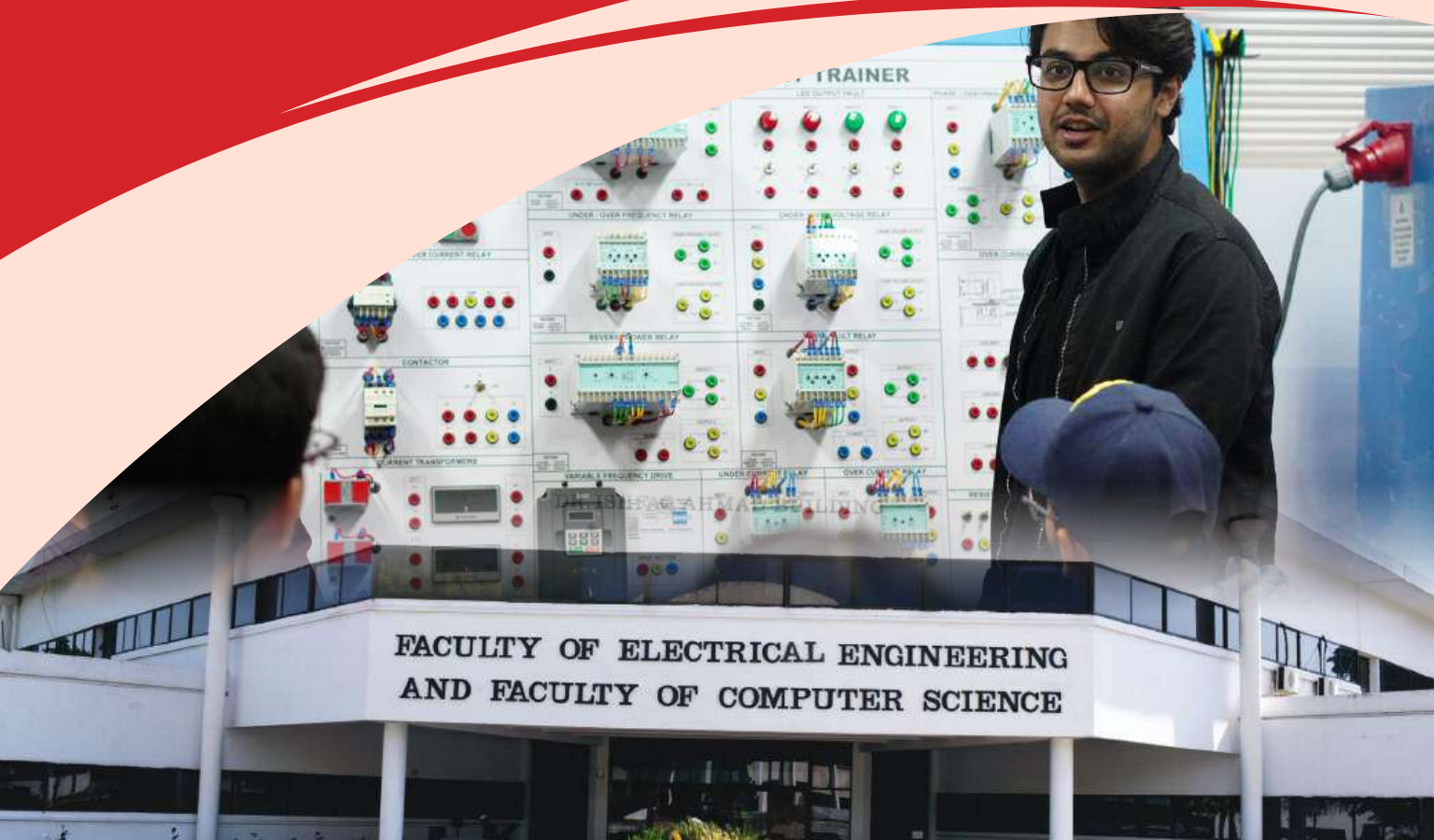
CS375/CS475 Cyber Security (3 0 3): Cybersecurity fundamentals, principles of data and technology that frame and define cybersecurity, importance of cybersecurity and role of cybersecurity professionals, cybersecurity principles, security architecture: processes and architecture, risk management, attacks, incidents: response, categories, and recovery, emerging IT and IS technology, mobile security issues, risks and vulnerabilities, cloud concepts around data and collaboration.
Prerequisite(s): CS221
Specialization(s): CS, DS

CS376/CS476 Bio-Inspired Computing (3 0 3): Introduction, characteristics of biological systems, adaptability, reactivity, distributivism, comparison with traditional human-engineered approaches to problem solving, handling complex problems using computational methods modeled after design principles encountered in nature, foundations of complex systems and theoretical biology, distributed architectures of natural complex systems, production of informatics tools with enhanced robustness, scalability, flexibility, interface with humans, principles of biology, informatics, cognitive science, robotics, cybernetics, etc., applied for computing problems.
Prerequisite(s): CS221
Specialization(s): CE, CS

CS377/CS477 Bio-Informatics (3 0 3): Bioinformatics, sequence analysis, microarray expression analysis, Bayesian methods, control theory, scale-free networks, and biotechnology applications, current real-world examples, actual implementations, engineering design issues, engineering issues from signal processing, network theory, machine learning, robotics and other domains, use of NCBI's Entrez, BLAST, PSI-BLAST, ClustalW, Pfam, PRINTS, BLOCKS, Prosite and PDB, Genomes: biological sequence analysis, hidden Markov models, gene finding, RNA folding, sequence alignment, genome assembly, evolution: comparative genomics, phylogenetics, genome duplication, genome rearrangements, evolutionary theory, rapid evolution.
Prerequisite(s): CS221
Specialization(s): AI, CE, CS, DS

CS378/CS478 Block Chain (3 0 3): Bitcoins and Ethereum protocol, Decentralized peer-to-peer network, Immutable distributed ledger, Trust model (that defines a block chain), Basic components of a block chain (transaction, block, block header, and the chain), underlying algorithms, essentials of trust (hard fork and soft fork), hashing, cryptography foundations, block chain programming, Operations, i.e., verification, validation, and consensus model.
Prerequisite(s): CS221
Specialization(s): AI, CE, CS

FACULTY OF ELECTRICAL ENGINEERING



Introduction

Welcome to the forefront of innovation in Electrical Engineering! At FEE GIKI, we're not just shaping the future; we're defining it. Our modernized Electrical Engineering program, incorporating AI and autonomous systems, provides a dynamic blend of tradition and cutting-edge advancements, meticulously crafted to equip you with the skills and knowledge demanded by today's rapidly evolving technological landscape.

In an era where smart communication and signal processing reign supreme, where digital design and embedded systems form the backbone of innovation, and where AI and autonomous systems are transforming industries, our program stands tall as a beacon of excellence. The advancement in the power sector landscape across the globe integrating renewables and virtual power plants transforming the conventional grid to smart grids in a bid to create a more sustainable future makes Electrical Power Engineering more crucial than ever. We've embraced these modern thrust areas wholeheartedly, infusing our curriculum with the latest developments to ensure that our graduates are not just prepared for the future, but are actively shaping it.

But we don't stop there. Our commitment to staying ahead of the curve is evident in our inclusion of significant portions dedicated to modern technologies, with a special emphasis on AI. As the world embraces the transformative power of artificial intelligence, we ensure that our students are not just spectators but pioneers in this revolution. From smart grids to electric machines and drives, from theoretical concepts to hands-on applications, our program offers a comprehensive journey through the realms of electrical engineering, empowering you to tackle the challenges of tomorrow with confidence and ingenuity.

Join us as we embark on a journey of discovery, innovation, and limitless possibilities. The future of Electrical Engineering begins here.

Thrust Areas

a) Robotics & Autonomous Systems
b) Digital Design & Embedded Systems
c) Smart Communication & Signal Processing
d) Smart Grid

FACULTY OF ELECTRICAL ENGINEERING

Dean
Dr. Arbab Abdur Rahim
PhD, Politecnico di Torino, Italy

Faculty
Prof. Dr. Syed M. Hassan Zaidi
PhD, University of South Florida, USA
Prof. Dr. Mohammad Akbar
PhD, University of Tokyo, Japan
Prof. Dr. Nisar Ahmed
PhD, ICSTM, London, UK
Prof. Dr. Khasan Karimov
PhD, S. Petersburg, Russia
Prof. Dr. Ziaul Haq Abbas
PhD, University of Agder, Norway
Dr. Hadeed Ahmed Sher
PhD, King Saud University, KSA
Dr. Adnan Noor
PhD, University of Manchester, UK
Dr. Shahid Alam
PhD, Chalmers University of Technology, Sweden
Dr. Ahmad Kamal Hassan
PhD, King Abdulaziz University, KSA
Dr. Memoon Sajid
PhD, Jeju National University, South Korea
Dr. Husnul Maab
PhD, QAU, Islamabad, Pakistan
Dr. Dur-e-Zehra Baig
PhD, UNSW, Sydney, Australia
Dr. Ammar Arshad
PhD, Aalto University, Finland
Dr. Waleed Tariq Sethi
PhD, University of Rennes1, France
Dr. Attique Ur Rehman
PhD, Auckland University, New Zealand
Dr. Muhammad Irfan
PhD, City University of Hong Kong, Hong Kong
Dr. Zaiwar Ali
PhD, GIK Institute, Pakistan
Mazhar Javed
MPhil, QAU, Islamabad, Pakistan
Afaq Hussain (On Leave)
MS, GIK Institute, Pakistan
M. Umar Afzaal (On Leave)
MS, UET Taxila, Pakistan

Lab Engineers

Yousaf Ali	MS, GIK Institute, Pakistan
Hamood Ur Rehman	MS, GIK Institute, Pakistan
Muhammad Adeel	MS, GIK Institute, Pakistan
Asad Khalid	BS, GIK Institute, Pakistan
Umar Waleed	MS, UET Taxila, Pakistan
Saleemullah Khan	BS, GIK Institute, Pakistan
Muhammad Hani Mazaheri	MS, GIK Institute, Pakistan

Graduate Assistants (GA)
Abdullah Numani
MS, COMSATS, Pakistan
Saba Tariq
MS, UET, Taxila, Pakistan
Muhammad Ayaz
BS, COMSATS, Islamabad, Pakistan
Sher Nawaz
BS, UET, Peshawar, Pakistan
Aamir Maqbool
BS, IBA, Sukkur, Pakistan
Fayaz Ahmed
BS, IBA, Sukkur, Pakistan
Muhammad Usman Anjum
BS, UET, Lahore, Pakistan
Rabia Khan
BS, UET, Mardan, Pakistan
Haris Khan
BS, UET, Mardan, Pakistan
Abdul Moeed
BS, NUST, Islamabad, Pakistan
Ubaid Afsar Shah
BS, UET, Peshawar, Pakistan
Shameem Siddique
BS, Khawaja Fareed University, Pakistan
Tanzeela
BS, Khawaja Fareed University, Pakistan
Zara Shahid
BS, COMSATS, Abbottabad, Pakistan
Abrar Ahmad Razzaqi
BS, IBA, Sukkur, Pakistan
Saddam Khan
BS, Balochistan University, Pakistan

Personal Secretary to Dean
Ikram Ullah
MA, Gomal University, Pakistan

Mission

The Faculty of Electrical Engineering aims to produce graduates equipped with broad and in-depth knowledge and relevant skills to present effective socio-economical solutions for complex problems. Our focus encompasses not only technical proficiency but also leadership qualities, ensuring graduates are equipped to drive positive change in the field of electrical engineering and beyond.

Accreditation

The Degree of Bachelor of Science in Electrical Engineering is accredited at level 2 by the Pakistan Engineering Council (PEC), the regulatory body of engineering education in Pakistan. Level 2 accreditation signifies OBE implementation under the Washington Accord where the following are the PEOs.

Program Educational Objectives (PEOs)

The Faculty of Electrical Engineering at GIK Institute has formulated the Program Educational Objectives (PEOs) using feedback from the stakeholders. There are three PEOs of the EE program which state that the FEE graduates will become:

PEO-1: Competent Engineers: Demonstrate competence pertinent to the field of Electrical Engineering in industry, research, and academia.
PEO-2: Skillful Managers: Ability to effectively lead, manage, and collaborate in professional pursuits in a diverse and interdisciplinary environment.
PEO-3: Responsible Individuals: Conscientious of societal needs with due consideration of ethical, environmental, and global aspects.

Sustainable Development Goals

In recognition of the fundamental importance of fostering a world where all individuals have the opportunity to thrive, we hereby acknowledge the significance of prioritizing the following pillars of sustainable development:

- Good Health and Well-being
- Quality Education
- Affordable and Clean Energy
- Industry, Innovation, and Infrastructure
- Partnerships to Achieve the Goal

Undergraduate Program

The faculty offers a comprehensive four-year degree program characterized by modular courses evenly spread across eight regular semesters. Extensive hands-on experience is integrated into the curriculum, with 17 well-equipped laboratories complementing over 70% of technical courses. These state-of-the-art facilities serve to reinforce theoretical knowledge acquired in classrooms, providing practical demonstrations of key concepts. Following the second year, students are afforded the opportunity to select from five specialized thrust areas, enriching their educational journey with focused exploration and application.

FEE Laboratories

Keeping in mind the present and future needs, the Faculty of Electrical Engineering has an assortment of equipment and facilities for the students enabling them to cope with fast-moving technology. These facilities provide them with an opportunity to learn and understand the concepts of electronic and power engineering and constructively transform them into practical use. Major laboratory facilities are summarized below:

1. Wave Propagation and Antennas Lab
2. Electric Machines Lab
3. Digital Logic Design Lab
4. Analog Electronics Labs
5. Communication Systems Lab
6. Signal Processing Simulation Lab
7. Linear Control Systems Lab
8. Microprocessor Systems Lab
9. ASIC Design Lab
10. Electrical Measurement and Instrumentation Lab
11. Electrical Simulation Lab
12. Power Electronics Lab
13. Industrial Automation and Controls lab
14. Power Transmission and Energy Labs
15. Power Distribution and Utilization (PDU) Lab
16. Power System Protection Lab
17. High Voltage Engineering Lab

For BS in Electrical Engineering degree, the student must complete the following requirements as detailed in Tables a-g.

FACULTY OF ELECTRICAL ENGINEERING

(a) General Education Requirements (53 Credit Hours)

Course Titles	Course Code	Credit Hour
Basic Engineering	CH101, CH161, PH101, PH101L, MM101, MM141L,	10
Computing	CS101, CS101L, CS112, CS112L, EE222, EE222L, EE321, EE321L	14
English Language	HM101, HM102	6
Humanities	HM211, HM212, HM321, HM322, HM323	9
Management	MS291	2
Mathematics	MT101, MT102, MT201, EE241	12

The courses corresponding to the specific thrust areas will be selected from Tables (b) to (d) as per the following thrust area numbers mentioned in front of each course.

1. Robotics & Autonomous Systems
2. Digital Design & Embedded Systems
3. Smart Communication & Signal Processing
4. Smart Grid

(b) Core Requirements (58* Credit Hours)

Course Titles	Thrust Area	Course Code	Credit Hour
Probability & Statistics	1-4	ES111	3
Linear Circuit Analysis	1-4	EE211	3
Electrical Network Analysis	1-4	EE212	3
Digital Logic Design	1-4	EE221	3
Microprocessor Systems	1-4	EE223	3
Electronic Devices and Circuits	1-4	EE231	3
Electric Machines	1-4	EE311	3
Power System Analysis	4	EE313	3
Electronic Circuit Design	1-3	EE331	3
Power Electronics	1-4	EE332	3
Signals and Systems	1-4	EE341	3
Linear Control Systems	1-4	EE351	3
Communication Systems	1-4	EE361	3
Electromagnetic Field Theory	1-4	EE371	3
Senior Design Project (Part-I)	1-4	EE491	3
Senior Design Project (Part-II)	1-4	EE492	3
Innovation & Makers Lab-1	1-4	IF101L	1

Innovation & Makers Lab-2	1-4	IF102L	1
Linear Circuit Analysis Lab	1-4	EE211L	1
Digital Logic Design Lab	1-4	EE221L	1
Microprocessor Systems Lab	1-4	EE223L	1
Electronic Devices and Circuits Lab	1-4	EE231L	1
Electric Machines Lab	1-4	EE311L	1
Power System Analysis Lab	4	EE313L	1
Electronic Circuit Design Lab	1-3	EE331L	1
Power Electronics Lab	1-4	EE332L	1
Signals and Systems Lab	1-4	EE341L	1
Linear Control Systems Lab	1-4	EE351L	1
Communication Systems Lab	1-4	EE361L	1
Industrial Control & Automation Lab	1-4	EE451L	1

*Follow the Semester wise Breakdown

(c) Specialization Requirement for Electrical Engineering (14* Credit Hours)

Course Titles	Thrust Area	Course Code	Credit Hour
Electrical Instrumentation & Measurement	1	EE314	2
Power generation and Transmission	4	EE411	3
Power System Protection	4	EE412	3
High Voltage Engineering	4	EE413	2
Embedded Systems	2	EE421	2
Digital Signal Processing	1, 2, 3	EE441	3
Digital Systems Design	2	EE422	3
Robotics in Automation	1	EE452	3
Electric Machine Drives and Control	1	EE453	3
Wave Propagation and Antennas	2, 3	EE471	3
Smart Grid	4	EE482	3
Computer Communication Networks	3	EE461	3
Wireless Communication	3	EE462	3
Electrical Instrumentation & Measurement Lab	1	EE314L	1
Power generation and Transmission Lab	4	EE411L	1
High Voltage Engineering Lab	4	EE413L	1
Embedded Systems Lab	2	EE421L	1
Power System Protection Lab	4	EE412L	1
Digital Signal Processing Lab	1, 2, 3	EE441L	1
Robotics in Automation Lab	1	EE452L	1
Wave Propagation and Antennas Lab	2, 3	EE471L	1

*Follow the Semester wise Breakdown

(d) Technical Elective for Electrical Engineering (09* Credit Hours)

Course Titles	Thrust Area	Course Code	Credit Hour
Power System Operation and Control	4	EE481	3
Renewable Electrical Energy Systems	4	EE414	3
Electrical Machine Design and Maintenance	1	EE415	3
Special Types of Electrical Machines	1	EE416	3
Biomedical Instrumentation	1	EE434	3
Advanced Electric Machines	1	EE417	3
Electric and Hybrid Vehicle Engineering	1	EE418	3
Industrial Drives and Actuators	1	EE419	3
Introduction to ASIC Design	2	EE423	3
Digital Integrated Circuit Design	2	EE424	3
Real-Time Embedded Systems	2	EE425	3
Advanced Computer Architecture	2	EE426	3
Reconfigurable Computing and FPGA Architecture	2	EE427	3
Internet of Things	2	EE428	3
Real-time Systems	2	EE429	3
Solid State Electronics	2	EE431	3
Industrial Electronics	1	EE432	3
Optoelectronics	2	EE433	3
VLSI Design	2	EE439	3
Digital Image Processing	3	EE442	3
Introduction to Wavelets	3	EE443	3
Advanced Control Systems	1	EE451	3
Industrial Process Control	1	EE454	3
Digital Control Systems	1	EE455	3
Medical Robotics	1	EE456	3
Robotic Vision	1	EE457	3
Industrial Automation	1	EE458	3
Intelligent Autonomous Robots	1	EE459	3
Communication System Design and Performance Analysis	3	EE463	3
Cellular Mobile Communication Systems	3	EE464	3
Satellite Communication Systems	3	EE465	3

AI Enabled Digital Communication	3	EE466	3
Antenna Theory and Design	3	EE472	3
Microwave Engineering	3	EE473	3
Radar Systems	3	EE474	3
Electrical Estimation, Installation, and Planning	4	EE483	3
Power Plant Engineering	4	EE484	3
Electrical Insulation Materials	4	EE485	3
Power Economics and Management	4	EE486	3
Power System Design	4	EE487	3
AI Applications for Smart Grid	4	EE488	3
Energy Management Systems	4	EE489	3

*Follow the Semester wise Breakdown

(e) Management Elective (03 Credit Hours)

Course Titles	Course Code	Credit Hour
Elective-I	MS49x	3

(f) Summer Training (Pass/Fail grade):
Every student is required to participate in a summer training program of 4-8 weeks during the summer following the junior/3rd Year. A formal written report is required at the end of the internship period.

(g) Total Credit Requirements:
A student is required to complete 137 credit hours for the Bachelor of Science degree in Electrical Engineering.

Electrical Engineering- Semester wise Breakdown

	Course Code	Course Titles	Lec. Hrs	Lab. Hrs	Credit Hours	Pre-req
1st Semester	CH101	Applied Chemistry & Environment	2	0	2	None
	CH161	Occupational Health and Safety	1	0	1	None
	CS101	Computing and AI	2	0	2	None
	HM101	Communication Skills	2	3	3	None
	MT101	Calculus I	3	0	3	None
	MM101	Materials and Nanotechnology	2	0	2	None
	MM141L	Materials Lab 1	0	3	1	None
	IF101L	Innovation and Makers Lab-1	0	3	1	None
	CS101L	Computing and AI Lab	0	3	1	None
		Total	**12**	**12**	**16**	

	Course Code	Course Titles	Lec. Hrs	Lab. Hrs	Credit Hours	Pre-req
2nd Semester	CS112	Object Oriented Programming and Design	2	0	2	None
	AI102	Python Programming and Freelancing Essentials	0	3	1	None
	ES111	Probability and Statistics	3	0	3	None
	HM102	Critical Thinking and Expository Writing	2	3	3	None
	PH101	Applied Physics	3	0	3	None
	PH101L	Applied Physics Lab	0	3	1	None
	MT102	Differential Equations & Linear Algebra	3	0	3	MT101
	CS112L	Object Oriented Programming and Design Lab	0	3	1	None
	IF102L	Innovation & Makers Lab-2	0	3	1	None
		Total	**13**	**15**	**18**	

	Course Code	Course Titles	Lec. Hrs	Lab. Hrs	Credit Hours	Pre-req
3rd Semester	EE211	Linear Circuit Analysis	3	0	3	MT101
	EE221	Digital Logic Design	3	0	3	MT111
	EE222	Data Structures and Algorithms	2	0	2	CS101
	HM211	Ideology and Constitution of Pakistan	2	0	2	None
	HM212	Islamic Studies	2	0	2	None
	MT201	Calculus II	3	0	3	MT101
	EE211L	Linear Circuit Analysis Lab	0	3	1	EE211-Co
	EE221L	Digital Logic Design Lab	0	3	1	EE221-Co
	EE222L	Data Structures and Algorithms Lab	0	3	1	EE222-Co
		Total	**15**	**9**	**18**	

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	Course Code	Course Titles	Lec. Hrs	Lab. Hrs	Credit Hours	Pre-req
4th Semester	EE212	Electrical Network Analysis	3	0	3	EE211
	EE223	Microprocessor Systems	3	0	3	EE221
	EE231	Electronic Devices and Circuits	3	0	3	EE211
	MS291	Engineering Economics	2	0	2	None
	HM221	Sociology and Human Behavior	2	0	2	None
	EE241	Numerical Methods for Electrical Engineering	3	0	3	MT201
	EE223L	Microprocessor Systems Lab	0	3	1	EE223-Co
	EE231L	Electronic Devices and Circuits Lab	0	3	1	EE231-Co
		Total	**16**	**6**	**18**	

a. Robotics & Autonomous Systems

	Course Code	Course Titles	Lec. Hrs	Lab. Hrs	Credit Hours	Pre-req
5th Semester	EE311	Electric Machines	3	0	3	EE212
	EE331	Electronic Circuit Design	3	0	3	EE231
	EE341	Signals and Systems	3	0	3	EE212
	EE371	Electromagnetic Field Theory	3	0	3	PH101
	EE314	Electrical Instrumentation & Measurement	2	0	2	EE331
	EE311L	Electric Machines Lab	0	3	1	EE311-Co
	EE331L	Electronic Circuit Design Lab	0	3	1	EE331-Co
	EE341L	Signals and Systems Lab	0	3	1	EE341-Co
	EE314L	Electrical Instrumentation & Measurement Lab	0	3	1	EE314-Co
		Total	**14**	**12**	**18**	

	Course Code	Course Titles	Lec. Hrs	Lab. Hrs	Credit Hours	Pre-req
6th Semester	EE321	Artificial Intelligence	3	0	3	EE222
	EE332	Power Electronics	3	0	3	EE231, EE311
	EE351	Linear Control Systems	3	0	3	EE341
	EE361	Communication Systems	3	0	3	EE341
	HMXYZ	Civics and Community Engagement	0	3	1	None
	EE332L	Power Electronics Lab	0	3	1	EE332-Co
	EE351L	Linear Control Systems Lab	0	3	1	EE351-Co
	EE361L	Communication Systems Lab	0	3	1	EE361-Co
	EE321L	Artificial Intelligence Lab	0	3	1	EE321-Co
		Total	**12**	**15**	**17**	

	Course Code	Course Titles	Lec. Hrs	Lab. Hrs	Credit Hours	Pre-req
7th Semester	EE441	Digital Signal Processing	3	0	3	EE341
	EE452/ EE/CS/	Robotics in Automation	3	0	3	EE351
	ES4xx	Technical Elective I	3	0	3	None
	EE441L	Digital Signal Processing Lab	0	3	1	EE441-Co
	EE491	Senior Design Project (Part-I)	0	9	3	None
	HM322	Corporate law and Professional Ethics	2	0	2	None
	EE452L	Robotics in Automation Lab	0	3	1	EE452-Co
		Total	**11**	**15**	**16**	

	Course Code	Course Titles	Lec. Hrs	Lab. Hrs	Credit Hours	Pre-req
8th Semester	EE453	Electric Machine Drives and Control	3	0	3	EE311, EE351
	EE492	Senior Design Project (Part-II)	0	9	3	None
	EE/CS/ES4xx	Technical Elective II	3	0	3	None
	EE/CS/ES4xx	Technical Elective III	3	0	3	None
	MS49x	Management Elective I	3	0	3	None
	EE451L	Industrial Control and Automation Lab	0	3	1	EE351
		Total	**12**	**12**	**16**	

b. Digital Design & Embedded Systems

	Course Code	Course Titles	Lec. Hrs	Lab. Hrs	Credit Hours	Pre-req
5th Semester	EE311	Electric Machines	3	0	3	EE212
	EE331	Electronic Circuit Design	3	0	3	EE231
	EE341	Signals and Systems	3	0	3	MT203
	EE371	Electromagnetic Field Theory	3	0	3	PH101
	HM322	Corporate law and Professional Ethics	2	0	2	None
	EE311L	Electric Machines Lab	0	3	1	EE311-Co
	EE331L	Electronic Circuit Design Lab	0	3	1	EE331-Co
	EE341L	Signals and Systems Lab	0	3	1	EE341-Co
		Total	**14**	**9**	**17**	

	Course Code	Course Titles	Lec. Hrs	Lab. Hrs	Credit Hours	Pre-req
6th Semester	EE321	Artificial Intelligence	3	0	3	EE222
	EE332	Power Electronics	3	0	3	EE231, EE311
	EE351	Linear Control Systems	3	0	3	EE341
	EE361	Communication Systems	3	0	3	EE341
	HMXYZ	Civics and Community Engagement	0	3	1	None
	EE332L	Power Electronics Lab	0	3	1	EE332-Co
	EE351L	Linear Control Systems Lab	0	3	1	EE351-Co
	EE361L	Communication Systems Lab	0	3	1	EE361-Co
	EE321L	Artificial Intelligence Lab	0	3	1	EE321-Co
		Total	**12**	**15**	**17**	

	Course Code	Course Titles	Lec. Hrs	Lab. Hrs	Credit Hours	Pre-req
7th Semester	EE421	Embedded Systems	2	0	2	EE223
	EE441	Digital Signal Processing	3	0	3	EE341
	EE471	Wave Propagation and Antennas	3	0	3	EE371
	EE/CS/ ES4xx	Technical Elective I	3	0	3	None
	EE441L	Digital Signal Processing Lab	0	3	1	EE441-Co
	EE471L	Wave Propagation and Antennas Lab	0	3	1	EE471-Co
	EE421L	Embedded Systems Lab	0	3	1	EE421-Co
	EE491	Senior Design Project (Part-I)	0	9	3	None
		Total	**11**	**18**	**17**	

	Course Code	Course Titles	Lec. Hrs	Lab. Hrs	Credit Hours	Pre-req
8th Semester	EE422	Digital Systems Design	3	0	3	EE223
	EE492	Senior Design Project (Part-II)	0	9	3	None
	EE/CS/ ES4xx	Technical Elective II	3	0	3	None
	EE/CS/ ES4xx	Technical Elective III	3	0	3	None
	MS49x	Management Elective I	3	0	3	None
	EE451L	Industrial Control and Automation Lab	0	3	1	EE351
		Total	**12**	**12**	**16**	

c. Smart Communication & Signal Processing

	Course Code	Course Titles	Lec. Hrs	Lab. Hrs	Credit Hours	Pre-req
5th Semester	EE311	Electric Machines	3	0	3	EE212
	EE331	Electronic Circuit Design	3	0	3	EE231
	EE341	Signals and Systems	3	0	3	MT203
	EE371	Electromagnetic Field Theory	3	0	3	PH101
	HM322	Corporate law and Professional Ethics	2	0	2	None
	EE311L	Electric Machines Lab	0	3	1	EE311-Co
	EE331L	Electronic Circuit Design Lab	0	3	1	EE331-Co
	EE341L	Signals and Systems Lab	0	3	1	EE341-Co
		Total	**14**	**9**	**17**	

	Course Code	Course Titles	Lec. Hrs	Lab. Hrs	Credit Hours	Pre-req
6th Semester	EE321	Artificial Intelligence	3	0	3	EE222
	EE332	Power Electronics	3	0	3	EE231, EE311
	EE351	Linear Control Systems	3	0	3	EE341
	EE361	Communication Systems	3	0	3	EE341
	HMXYZ	Civics and Community Engagement	0	3	1	None
	EE332L	Power Electronics Lab	0	3	1	EE332-Co
	EE351L	Linear Control Systems Lab	0	3	1	EE351-Co
	EE361L	Communication Systems Lab	0	3	1	EE361-Co
	EE321L	Artificial Intelligence Lab	0	3	1	EE321-Co
		Total	**12**	**15**	**17**	

	Course Code	Course Titles	Lec. Hrs	Lab. Hrs	Credit Hours	Pre-req
7th Semester	EE441	Digital Signal Processing	3	0	3	EE341
	EE471	Wave Propagation and Antennas	3	0	3	EE371
	EE461	Computer Communication Network	3	0	3	EE361
	EE/CS/ ES4xx	Technical Elective I	3	0	3	None
	EE441L	Digital Signal Processing Lab	0	3	1	EE441-Co
	EE471L	Wave Propagation and Antennas Lab	0	3	1	EE471-Co
	EE491	Senior Design Project (Part-I)	0	9	3	None
		Total	**12**	**15**	**17**	

	Course Code	Course Titles	Lec. Hrs	Lab. Hrs	Credit Hours	Pre-req
8th Semester	EE462	Wireless Communication	3	0	3	EE361
	EE492	Senior Design Project (Part-II)	0	9	3	None
	EE/CS/ ES4xx	Technical Elective II	3	0	3	None
	EE/CS/ ES4xx	Technical Elective III	3	0	3	None
	MS49x	Management Elective I	3	0	3	None
	EE451L	Industrial Control and Automation Lab	0	3	1	EE351
		Total	**12**	**12**	**16**	

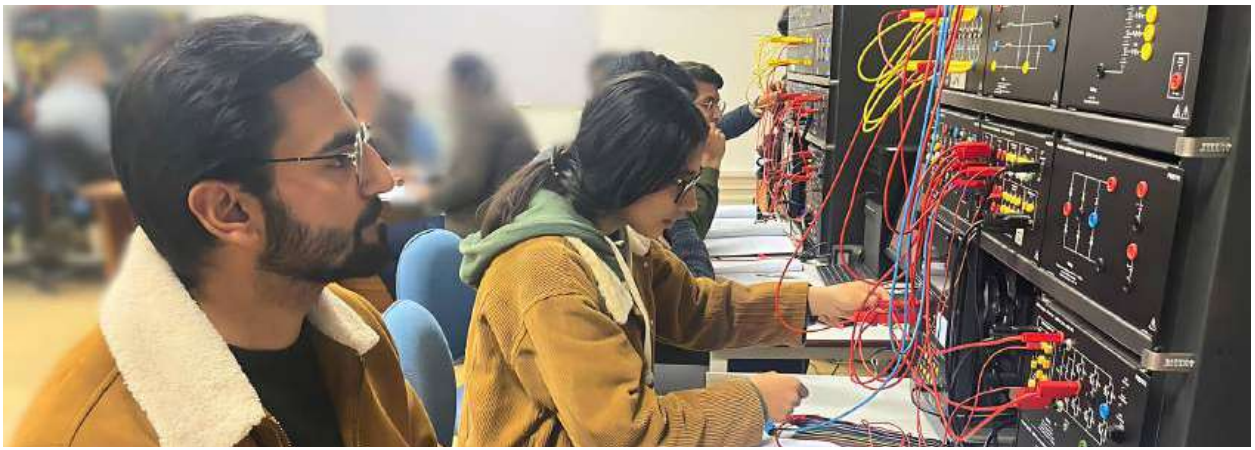
d. Smart Grid

	Course Code	Course Titles	Lec. Hrs	Lab. Hrs	Credit Hours	Pre-req
5th Semester	EE311	Electric Machines	3	0	3	EE212
	EE312	Power Distribution and Utilization	2	0	2	EE212
	EE341	Signals and Systems	3	0	3	MT203
	EE371	Electromagnetic Field Theory	3	0	3	PH101
	EE313	Power Generation and Transmission	3	0	3	EE212
	EE311L	Electric Machines Lab	0	3	1	EE311-Co
	EE312L	Power Distribution and Utilization Lab	0	3	1	EE312-Co
	EE313L	Power Generation and Transmission Lab	0	3	1	EE313-Co
	EE341L	Signals and Systems Lab	0	3	1	EE341-Co
		Total	**14**	**12**	**18**	

	Course Code	Course Titles	Lec. Hrs	Lab. Hrs	Credit Hours	Pre-req
6th Semester	EE321	Artificial Intelligence	3	0	3	EE222
	EE332	Power Electronics	3	0	3	EE231, EE311
	EE351	Linear Control Systems	3	0	3	EE341
	EE361	Communication Systems	3	0	3	EE341
	HMXYZ	Civics and Community Engagement	0	3	1	None
	EE332L	Power Electronics Lab	0	3	1	EE332-Co
	EE351L	Linear Control Systems Lab	0	3	1	EE351-Co
	EE361L	Communication Systems Lab	0	3	1	EE361-Co
	EE321L	Artificial Intelligence Lab	0	3	1	EE321-Co
		Total	**12**	**15**	**17**	

	Course Code	Course Titles	Lec. Hrs	Lab. Hrs	Credit Hours	Pre-req
7th Semester	EE411	Power System Analysis	3	0	3	EE313
	EE413	High Voltage Engineering	2	0	2	None
	EE/CS/ ES4xx	Technical Elective I	3	0	3	None
	EE491	Senior Design Project (Part-I)	0	9	3	None
	HM322	Corporate law and Professional Ethics	2	0	2	None
	EE411L	Power System Analysis Lab	0	3	1	EE411-Co
	EE413L	High Voltage Engineering Lab	0	3	1	None
		Total	**10**	**15**	**15**	

	Course Code	Course Titles	Lec. Hrs	Lab. Hrs	Credit Hours	Pre-req
8th Semester	EE412	Power System Protection	3	0	3	EE311, EE313
	EE482	Smart Grid	3	0	3	None
	EE492	Senior Design Project (Part-II)	0	9	3	None
	EE/CS/ ES4xx	Technical Elective II	3	0	3	None
	MS49x	Management Elective I	3	0	3	None
	EE412L	Power System Protection Lab	0	3	1	EE412-Co
	EE451L	Industrial Control and Automation Lab	0	3	1	EE351
		Total	**12**	**15**	**17**	



COURSE DESCRIPTION

IF101L Innovation and Makers Lab - 1 (0 3 1): Accounting and finance software, electrical workshop, wiring diagrams, electrical safety, PCB design using CAD, PCB fabrication, etching, soldering, troubleshooting, introduction to microcontrollers using Arduino, electron microscopy, traversing and boundary analysis using GPS.

IF102L Innovation and Makers Lab - 2 (0 3 1): Optical instruments, solar cells, prime movers, engineering graphics, sketcher modeling, shapes, solid works, layouts, mechanical workshop, fabrication technology and prototyping, CNC machines, laser engraving, 3D printing, and product assembly.

EE201 Applied Electrical Engineering (3 0 3): Quantities, SI units, electric circuits, charges, current, voltage, resistance, energy and power, series/parallel circuits, KCL, KVL, review of RLC circuit and applications, integrated circuits, microprocessors and applications, AC/DC motors, AC/DC generators, transformers, AC circuits, power factor.
Pre-requisite(s): PH101

EE211 Linear Circuit Analysis (3 0 3): System of units, circuit variables and elements, simple resistive circuits, techniques of circuit analysis, wye-delta transformation, the operational amplifier, superposition, Thevenin's and Norton's theorems, inductors and capacitors, response of first order RL and RC circuits, natural and step response of RLC circuits, sinusoidal and complex forcing functions, phasors.
Pre-requisite(s): MT101

EE212 Electrical Network Analysis (3 0 3): Steady-state power analysis, poly-phase circuits, magnetically coupled networks, frequency characteristics, variable frequency network performance, resonant circuits, the Laplace transform, application of Laplace transform to circuit analysis, and Fourier analysis techniques.
Pre-requisite(s): EE211

EE221 Digital Logic Design (3 0 3): Number systems, operations, different codes, digital logic gates, Boolean algebra and simplification of Boolean functions, combinational logic, functions of combinational logic, sequential logic and state machines, flip-flops and related devices, adders, multiplexers, and applications, registers, counters, shift registers and memories.
Pre-requisite(s): MT111

EE222 Data Structures and Algorithms (3 0 3): Python programming basics, object-oriented programming using Python, file IO, list/array, stack, queue, linked lists, complexity and big oh notation, linear search, binary search, selection sort, merge sort, quicksort, recursion, implementation of a GUI using tinker.
Pre-requisite(s): CS101

EE223 Microprocessor Systems (3 0 3): Register transfer and micro-operation, basic computer organization and design, programming the basic computer, pipelining and instruction scheduling, introduction to PIC microcontrollers, introduction to assembly programming language, I/O ports' programming, and arithmetic/logic functions, PIC18 internal peripherals programming using embedded C language, interfacing external peripheral devices using embedded C language.
Pre-requisite(s): EE221

EE231 Electronic Devices and Circuits (3 0 3): Introduction to semiconductors, n-type and p-type material, diodes, diodes equivalent circuits, types of diodes, Zener regulators, light emitting diodes, load line analysis, parallel and series connections of diodes, gates, half wave and full wave rectifiers, clipper and clamper circuits, voltage doubler circuits, bipolar junction transistor, construction and operation, amplification analysis, common-base, common-emitter, common-collector amplifier configurations, cascade connections of BJT, limits of operation, fixed biasing, emitter biasing and voltage divider biasing configurations, introduction to field effect transistor, characteristics of FET, types of FET, FET applications
Pre-requisite(s): EE211

EE241 Numerical Methods in Engineering (3 0 3): Solution of Non-Linear Equations, Bisection method, Newton's method, Secant method, Finite differences, Difference operators and tables, Differences of polynomials, Jacobi's method, Gauss-Seidal method, Sparse matrices, Solution of differential equation, Euler

and modified Euler methods, Finite Differences, Solution of Linear Simultaneous Equations, Iterative methods, Complex Variables.
Pre-requisite(s):EE211

EE311 Electric Machines (3 0 3): Introduction to electrical machines' principles, single-phase transformer construction and its operational characteristics and equivalent circuits, transformer tests, auto-transformer and three-phase transformers, fundamentals of electromechanical energy conversion, AC machinery fundamentals, synchronous machines, induction machines, DC machines, special purpose motors
Pre-requisite(s): EE212

EE312 Power Distribution and Utilization (3 0 3): Introduction to different types of distribution systems, characteristics and estimation of load, electricity tariff and principles of its calculation, power factor and methods for its improvement, protection, and grounding, heating, and welding, batteries and electrochemical processes and fundamentals of illumination engineering.
Pre-requisite (s): EE212

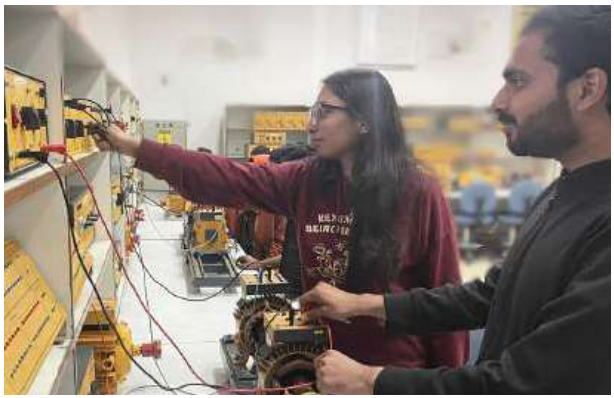
EE313 power generation and transmission: Fundamentals of an electric power system, transmission line parameters, power system operation studies, load-flow studies, symmetrical components, balanced and unbalanced faults on power systems, power system stability.
Pre-requisite (s): EE312

EE314 Electrical Instrumentation & Measurements (2 0 2): Precision measurements technologies, instrument calibration, engineering units and standards; instruments for measurement of electrical properties, signal processing and transmission; modern instrumentation techniques, instrumentation, and signal conditioning circuits; data manipulation, oscilloscope, signal generators, transducers, bridges, power and energy meters; temperature and other measurements.
Pre-requisite (s): EE231

EE321 Artificial Intelligence (3 0 3): Introduction and basics of artificial intelligence, expert systems, state space representation, search strategies with applications, game trees, min-max algorithms, optimization techniques - local hill climbing, simulated annealing, predictive modeling - classification algorithms, neural networks, applications, types, training, validation, feed-forward neural networks, activation functions, backpropagation algorithm, unsupervised learning - clustering algorithms, probabilistic pattern learning algorithms, Markov chains and hidden Markov model with applications, fuzzy logic and applications.
Pre-requisite(s): EE222

EE321L Artificial Intelligence Lab (0 3 1): IDE for the language variables, expressions, operands and operators, loops, control structures, debugging, error messages, functions, strings, lists, object-oriented constructs, and basic graphics in the language, writing production quality clean code in the programming. language using version control, pertinent libraries necessary for interpreting, analyzing, and plotting numerical data and examples of each library using simple use cases and small case studies.

EE331 Electronic Circuit Design (3 0 3): The multistage gain calculation, impedance matching for amplifiers, a hybrid model of BJT, current sources, the frequency response of BJT and FET amplifiers, differential amplifiers, operational amplifiers, design op-amp circuits for various applications, instrumentation amplifier, active filters, power amplifiers, series fed and transformer coupled class A, class B, and class C amplifiers, A/D and D/A converters, phase locked loop, feedback and stability consideration for amplifiers, types of feedback in amplifier circuits, oscillators.
Pre-requisite(s): EE231



EE332 Power Electronics (3 0 3): Introduction to power electronics, power electronic devices: diode, BJT, MOSFET, IGBT, SCR, rectifier circuits: single and three phase controlled and uncontrolled rectifiers, DC-DC converters: buck, boost, buck-boost, and isolated converters: forward and flyback converters, PWM inverters, single and three phase inverters, cycloconverters, matrix converters, AC voltage regulators, power electronics for machine control, power electronics for FACTS and HVDC.
Pre-requisite(s): EE231, EE311

EE341 Signals and Systems (3 0 3): Introduction to signals, basic continuous and discrete time signals, introduction to systems, discrete-time linear time-invariant (DT-LTI) systems, continuous-time linear time-invariant (CT-LTI) systems, properties of CT-LTI systems, Laplace transform and CT-LTI systems, inverse Laplace transform, z-transform and discrete-time LTI systems, Fourier series representation of CT/DT periodic signals, the Fourier transform, selected application of Fourier series and transforms including sampling, filtering, communication, and control system.
Pre-requisite(s): MT203, EE212

EE351 Linear Control Systems (3 0 3): Introduction to control systems, system modeling, transient response analysis, response and pole locations, time domain specifications, effects of adding zeroes and poles, properties of feedback, disturbance rejection, tracking, steady state tracking and system type, types of controllers, stability, root-locus analysis, control systems design by root locus method, frequency response analysis, control systems design by frequency response, Nyquist stability criterion and PID control, modeling and analysis of control systems in state-space.
Pre-requisite(s): EE341

EE361 Communication Systems (3 0 3): Introduction to modern analog and digital communication systems, Fourier analysis of signals and systems and signal transmission, amplitude modulation - generation, demodulation, single side band, double side band,

quadrature amplitude modulation, vestigial sideband, AM receiver and other applications, angle modulation - generation, frequency modulation, demodulation, FM receiver and other applications, sampling and reconstruction, differential pulse code modulation and delta modulation, introduction to principles of digital communication systems.
Pre-requisite: EE341

EE371 Electromagnetic Field Theory (3 0 3): Vector analysis, Coulomb's law and electric field intensity, electric flux density, Gauss's law and divergence, energy and potential, electrical properties of materials, experimental mapping methods, Poison's and Laplace's equations, the steady magnetic field and magnetic properties of materials, time-varying fields, and Maxwell's equations.
Pre-requisite(s): PH101

EE411 Power System Analysis (3 0 3): Fundamentals power stations, diesel electric station, steam power plant, gas power plants, nuclear power plants, hydroelectric stations, introduction to power systems, transmission line parameters, models, steady state and transient analysis of transmission lines, mechanical design of overhead lines.
Pre-requisite(s): EE313

EE412 Power System Protection (3 0 3): Types and effects of faults, power-system transients and over-voltages, principles and characteristics of protective relaying, over-current protection, directional overcurrent protection, distance protection, differential protection of transformers, generator protection, bus bar protection, types and operation of relays and circuit-breakers, switchgears, numerical relays.
Pre-requisite(s): EE311

EE413 High Voltage Engineering (Elective) (3 0 3): Introduction to the subject and important properties of dielectrics and their measurements, high voltage AC, DC and impulse generation, high voltage measurement techniques, electric field distribution in insulation systems and its control, electrical breakdown of gaseous, liquid, and solid insulation systems, procedures of testing high voltage equipment, non-destructive high voltage tests, insulation levels and insulation coordination.
Pre-requisite (s): EE312

EE414 Renewable Electrical Energy Systems (Elective) (3 0 3): Introduction to renewable energy systems, load interface with photovoltaics and wind energy, stand-alone and grid-tied systems, battery storage and stand-alone system design, voltage regulation, renewable energy power system architecture, safety standards, and guidance regulations, maximum power point tracking for wind and solar systems.
Pre-requisite (s): EE311, EE332

EE415 Electrical Machine Design and Maintenance (Elective) (3 0 3): Machine Design: Industrial standardization, design considerations for electrical machines, properties and applications, cooling systems of transformers and rotating machines, duty cycles, ratings, and temperature-rise, mechanical design considerations, design of transformer or induction motor, introduction to CAD and CAM. Installation, maintenance, and troubleshooting of machines: Safety precautions, troubleshooting and emergency repairs, Installation, commissioning, testing, maintenance, and troubleshooting of (i) power transformers and (ii) induction motors. (iii) AC generators.
Pre-requisite (s): EE311

EE416 Special types of Electrical Machines (Elective) (3 0 3): Construction and principles of special types of electrical machines, reference-frame theory, switched reluctance motors, stepper motors, theory of brushless DC machines, linearized machine equations, symmetrical and unsymmetrical 2-phase induction machines, etc.
Pre-requisite (s): EE311

EE417 Advanced Electric Machines (Elective) (3 0 3): Fundamentals of electrical machines include equivalent circuits, voltage regulations, efficiency, types of connections, different types of windings, evaluation, and comparison of performance parameters of machines. Machines covered include transformers, DC and AC machines, induction motors, synchronous motors, special purpose motors like steppers, servos, etc.
Pre-requisite (s): EE311

EE418 Electric and Hybrid Vehicle Engineering (Elective) (3 0 3): Fundamentals of electric vehicle

components and architecture, electric motor and inverter technology, battery requirements, and design, working details of the electric vehicles, parts of the electric vehicles, types of EV batteries in detail, EV battery configurations, types of motors, selection, and sizing of motor, charging technique and charging levels, battery management system, regenerative braking, the lifespan of the EVs and batteries, impacts of EV on the economy & environment.
Pre-requisite (s): EE311

EE419 Industrial Drives and Actuators (Elective) (3 0 3): DC motor drives, inverter-fed induction motor drives, switched reluctance drives, motor/drive selection, and general application considerations.
Pre-requisite (s): EE332

EE421 Embedded Systems (2 0 2): Embedded systems and their classification; various design constraints and properties of embedded systems, real-time embedded systems, scheduling algorithm, real-time schedulers, bare metal programming of 32-bit ARM MCU, introduction to the STM32F407 discovery kit, using STM CUBE-MX and Keil as software programming and debugging tools, peripherals interfacing; universal asynchronous receiver transmitter (UART), free real time operating system (Free RTOS)
Pre-requisite (s): EE223

EE421L Embedded Systems Lab (0 3 1): Hands-on Experiments on real time embedded systems, scheduling algorithms, real time schedulers, bare metal programming of 32-bit ARM MCU, STM32F407 discovery kit, using STM CUBE-MX and Keil as software programming and debugging tools, peripherals interfacing; universal asynchronous receiver transmitter (UART), free real-time operating system (Free RTOS)
Co-requisite (s): EE421

EE422 Digital Systems Design (3 0 3): Arithmetic circuits – data paths, arithmetic/ logic unit (ALU), shifters; computer design fundamentals – introduction to computer design, instructions set architecture (ISA); introductory HDL – 1 (Verilog or VHDL) – timing in combinational circuits, hazards, and glitches, review of sequential logic; HDL behavioral, sequential coding, and modelsim – design using flip-flop and latches, state machines, state reduction, timing issues, design of adders and subtractors, carry-lookahead adders, serial adders, array multipliers, critical paths, booth and radix-4 encoded signed multipliers, further VHDL modeling, parameterization; FPGA implementations – LFSR, BRM, function generators, design examples, faults, and testability – BIST and scan techniques, design for test – JTAG, advanced HDL – memories and register files, design examples.
Pre-requisite (s): EE223

EE423 Introduction to ASIC Design (Elective) (3 0 3): Introduction to FPGA, ASIC technologies, design methodologies, the architecture of FPGA and CPLD, design, implementation, synthesis, and verification of ASIC on FPGA using Verilog hardware description language (HDL), FPGA memories and programming technologies, finite state machines, design and implementation of combinational and sequential circuits on FPGA.
Pre-requisite (s): EE331

EE424 Digital Integrated Circuit Design (Elective) (3 0 3): The introduction to VLSI: (complexity & design, concepts), logic design with Mosfets (switches, gates, complex logic including combinational & sequential, clock & delays), physical structure of CMOS ICs (IC layers, CMOS layers, problems), fabrication of CMOS ICs (silicon processing, CMOS process flow), elements of physical design (structure layouts, cell, FET sizing), digital integrated modules design using Verilog HDL.
Pre-requisite (s): EE331

EE425 Real-time Embedded Systems (Elective) (3 0 3): Systems, interrupts, performance and optimization, simple single task operating system, real time operating system and scheduling, concurrency, communication, real-time benchmarks, adaptive and real-time systems, real-time control over the internet/remotely.
Pre-requisite (s): EE223

EE426 Advanced Computer Architecture (Elective) (3 0 3): Instruction set architecture (ISA), RISC & CISC, pipelining, instruction-level parallelism, super-scalar processors, VLIW architecture, parallel processing, high-speed memory systems, storage systems, and interconnection networks.
Pre-requisite (s): EE223

EE427 Reconfigurable Computing and FPGA Architecture (Elective) (3 0 3): Use of FPGAs and the design of the FPGA architecture, comparison of efficiency and programming effort of FPGA-based signal processing with a DSP processor implementation, the architecture of FPGAs, modeling the area and delay of key circuitry, programmable routing, computer-aided design (CAD) tools for FPGA architecture.
Pre-requisite (s): EE223

EE428 Internet of Things (Elective) (3 0 3): Introduction, state-of-the-art in the Internet of Things (IoT), high-level overview of the IoT landscape, domain, architectures, principles, paradigms, building blocks, applications, technologies, development platforms, recent advances and fundamental issues around IoT, origin and enablers of IoT, m2m, architectures, physical and logical designs, communication models, components of IoT systems, IoT levels and deployment templates, technologies, standards, protocols, challenges, and security and privacy hazards.
Pre-requisite (s): EE223

EE429 Real-time Systems (Elective) (3 0 3): Real-time programming, synchronization and mutual exclusion, real-time kernels and operating systems, periodic controller tasks, computer implementation of control algorithms, discretization of continuous-time controllers, sampling of continuous-time systems, input-output models of discrete-time systems, sequence control using grafcet, scheduling theory, integrated control, and scheduling, implementation aspects, control over networks.
Pre-requisite (s): EE223

EE431 Solid State Electronics (Elective) (3 0 3): Introduction to semiconductor materials, the basic structure and properties, carrier concentration, energy band gap, carrier transport in semiconductor, pn junction, metal-semiconductor contacts, metal oxide semiconductor FET, bipolar transistors, photonic devices, solar cell, semiconductor devices growth, and fabrication techniques.
Pre-requisite(s): EE231

EE432 Industrial Electronics (Elective) (3 0 3): Electric heating: principles and applications; induction and dielectric heating; high-frequency welding, spot welding control, industrial drives: speed control of DC, AC, and servo motors, process control systems, measurement of nonelectrical quantities: temperature, displacement, pressure, time, frequency; digital industrial measuring systems, ultrasonic generation, and applications, photo-electric devices, industrial control using PLCs, data acquisition for industrial processes, the distributed control system in process industries, basic concepts of SCADA.
Pre-requisite (s): EE331, EE351

EE433 Optoelectronics (Elective) (3 0 3): Snell's law, numerical aperture, total internal reflection, Fresnel equations, dispersion, pulse broadening and distortion, resonant cavities. Dielectric slab optical waveguide, optical fiber waveguide. Laser principles, population inversion, threshold conditions, Laser modes. Light emitting diodes and laser diodes: operating characteristics and typical structures, types of laser diodes (monomode/tunable) such as dbr and dfb. Light detectors: principles of photo-detection, types of semiconductor photodiodes. Analog / digital modulation and corresponding opto-electronic circuits. Noise: thermal and shot noise, and signal-to-noise ratio in electro-optical systems. Optoelectronics in energy and telecommunications such as photo-voltaic devices and wavelength division multiplexing
Pre-requisite (s): EE331

EE434 Biomedical Instrumentation (Elective) (3 0 3): Study of various physiological systems, related bio-potentials, and physiological parameters. Invasive and noninvasive measurement techniques and related equipment. Electrocardiography, the measurement of blood pressure, blood flow, and cardiac output. Principles and design, speed and position, temperature, light and pressure transducers, programmable logic controller, PLC interfacing, and memory processor. Patient monitoring equipment. Therapeutic equipment. Radiological equipment. Safety and quality assurance.
Pre-requisite (s): EE314

EE439 VLSI Design (Elective) (3 0 3): CMOS devices and deep sub-micron manufacturing technology, CMOS inverters and complex gates; modeling of interconnect wires, optimization of design concerning several metrics:

HARIS ZEB (POWER)

"As a third-year student at GIKI, I've had the privilege of experiencing its transformative environment firsthand. The dynamic atmosphere and rigorous academics have played a pivotal role in shaping my journey thus far. Engaging with diverse societies has not only enriched my personal development but also allowed me to actively contribute to campus life. Receiving the Chief Minister KPK scholarship was a defining moment, opening doors to pursue my academic aspirations and earning recognition on the Dean's Honor Roll. GIKI's close-knit community, coupled with access to top-notch facilities and a vibrant celebration of diversity, have fostered an environment of collaboration and growth. As I continue my journey at GIKI, I am confident that the skills and experiences gained here will pave the way for future success."

cost, reliability, performance, and power dissipation; sequential circuits, timing considerations, clocking approaches, design of large system blocks including arithmetic, interconnect' memories, and PLA design methodologies.
Prerequisite(s): EE331

EE441 Digital Signal Processing (3 0 3): Analysis and representation of discrete-time signals, discrete-time convolution, discrete-time Fourier transform, difference equations, z-transform, sampling theory, interpolation, and decimation, transform analysis of LTI systems, structures for digital systems, FIR and IIR digital filters, digital filter design techniques, fast Fourier transform algorithm for computation of discrete Fourier transform, introduction to discrete stochastic processes.
Pre-requisite(s): EE341

EE442 Digital Image Processing (Elective) (3 0 3): Introduction to image processing, 2D signals and systems, convolution and correlation, image transforms, image enhancement, image restoration and de-noising, image segmentation, image recognition, image compression, binary image processing, and color-image processing.
Pre-requisite(s): EE341

EE443 Introduction to Wavelets (Elective) (3 0 3): Analysis and synthesis of signals, time-frequency and time-scale analysis, continuous wavelet transform, multi-resolution analysis, filter banks, and discrete wavelet transform, properties of the filters, scale, and wavelet functions, and designing wavelets.
Pre-requisite(s): EE441

EE451 Advanced Control Systems (Elective) (3 0 3): Course description: a review of state space realization; linearization, state-space controller design for regulation and tracking mode using pole placement technique, state space observer design using pole placement technique, introduction to cascade control systems, optimal state controller, design of optimal state controller with integral action, introduction to adaptive state controller with estimator and integral action, fuzzy logic controllers, tuning of fuzzy logic controllers.
Pre-requisite(s): EE351

EE451L Industrial Control and Automation Lab (0 3 1): The industrial automation and controls lab is focused on the programmable logic controllers (plc) and industrial systems based on that. The total integrated automation (TIA) software is introduced as well as Simatic S7-basic human-machine interface (HMI) and real-time interfacing of motors, sensors, and actuators with plc and HMI are covered. This lab also provides the understanding and implementation of SCADA systems using SIEMENS TIA and 3rd party software for interactive GUI implementation.
Pre-requisite(s): EE351

EE452 Robotics in Automation (3 0 3): Introduction to robotics, manipulators, joints and links, rotations and transformations, link parameters, denavit-hartenberg convention, kinematics, Jacobians and velocity kinematics, trajectory planning and robot control, actuators, sensors, workspace consideration, and programming tools for applications in modern automation.
Pre-requisite(s): EE351

EE453 Electric Machine Drives and Control (3 0 3): Electromechanical systems, machine load characteristics, drive system elements, required drive characteristics, DC drives, induction motor drives, current-sourced inverter drives, voltage-sourced inverter drives, advanced control of voltage-sourced inverters, synchronous motor drives, induction motor dynamics, torque (vector) controlled drives.
Pre-requisite(s):EE311, EE351

EE454 Industrial Process Control (Elective) (3 0 3): Introduction to process control, sensors and measurement systems, signal conditioning and processing, estimation of errors and calibration, analog to digital conversion, PID controller design, control structures, introduction to sequence control, sequence controls system, PLCs and relay ladder logic; advanced RLL programming, control of machine tools: introduction to CNC machines; analysis of a control loop, actuators, hydraulic and pneumatic control design, introduction to advance control technique.
Pre-requisite(s): EE331, EE351

EE455 Digital Control Systems (Elective) (3 0 3): Introduction to discrete-time control systems, z-transform, z-plane analysis of discrete-time control systems, design of discrete-time control systems by conventional methods, state space analysis techniques, state space design technique, pole placement and observer-based, quadratic and optimal control systems design.
Pre-requisite(s): EE351

EE456 Medical Robotics (Elective) (3 0 3): Fundamentals of medical robotics, kinematics of medical robots, teleportation, and cooperative manipulation. robot dynamics and simulation, trajectory planning and generation. medical imaging and image-guided interventions. tracking and surgical navigation. Broad spectrum of medical and healthcare robotics.
Pre-requisite(s): EE351

EE457 Robotic Vision (Elective) (3 0 3): Vision tasks and applications, cameral models and image acquisition, image segmentation, feature detection and matching, image recognition, 3d visualization, robot perception (robot and sensors), visual navigation, localization, and other topics in robotic vision.
Pre-requisite(s): EE441, EE321

EE458 Industrial Automation (Elective) (3 0 3): Manufacturing automation. Automation theory; Fordism, Toyotism, driving forces, and manufacturing strategies, designing for automation, opportunities, and pitfalls of automation. computer numerical control (CNC) machining requirements, limitations of conventional machining, the advent of numerical control, the impact of computer technology, building blocks of CNC, CNC programming, machining codes, computer-assisted programming, cad/cam. PLCs architecture, operation, advantages, and programming.
Pre-requisite(s): EE351

EE459 Intelligent Autonomous Robotics (Elective) (3 0 3): System modeling, control system principles, computing, measurement, state, and parameter estimation, decision-making and machine learning, numerical methods for evaluation and search, expert

MARRIUM DAWOOD (POWER)

Studying Electrical Engineering Power at Ghulam Ishaq Khan Institute has been a transformative experience, making it feel like my home away from home. The supportive faculty, vibrant campus life, and focus on holistic development have not only enhanced my academic journey but also nurtured a sense of belonging and community. Ghulam Ishaq Khan Institute will always hold a special place in my heart as a place where I not only learned about electrical engineering but also grew as an individual, creating lasting memories and friendships along the way.

systems, and neural networks for classification and control.
Pre-requisite(s): EE351, EE321

EE461 Computer Communication Networks (3 0 3): Introduction to computer networks, network models and topologies, network layering concepts and protocols, open systems interconnection (OSI) model and internet protocol (IP) and associated control protocols, end-to-end protocols, with TCP and UDP as examples, addressing schemes at the link layer, network layer and transport layer, transmission media and characteristics, switching techniques, channel access techniques, mac routing protocols and multicast, overview of application layer protocols (http, ftp, smtp etc.), multimedia protocols (RTP, RTSP, RTCP), security mechanisms and services, concepts of symmetric and asymmetric cryptography, digital signature, the convergence of communication networks.
Pre-requisite(s): EE361

EE462 Wireless Communication (3 0 3): Fundamentals of wireless communications, generations 1G to 5G and beyond, terrestrial network models and frequency reuse, fading models under path-loss, shadowing, and multi-path environments, performance analysis of digital modulation schemes over fading channels, fading analysis using diversity and multicarrier techniques including OFDM, emerging topics in wireless communications such as adaptive transmission, MIMO, relay, and cooperative and cognitive transmissions.
Pre-requisite(s): EE361

EE463 Communication System Design and Performance Analysis (Elective) (3 0 3): Review of probability fundamentals, system noise analysis, SNR and BER calculations, behavior of analog/digital systems in the presence of noise, optimal receiver design concepts, introductory information theory, coding and multiplexing techniques including source, channel, and line coding techniques, and FDM, TDM, and CDM techniques, introduction to advanced digital modulation/multiplexing techniques such as OFDM, W-OFDM, SDM.
Pre-requisite(s): ES111, EE361

EE464 Cellular Mobile Communication Systems (Elective) (3 0 3): Introduction to wireless communications, basic cellular concepts, frequency reuse, channel assignment and hand-off techniques, interference and system capacity, trunking and grade of service, system capacity improvement techniques, mobile propagation models including large path loss and small-scale fading models, multiple access techniques for cellular systems speech codes and standards, and emerging areas in mobile communications.
Pre-requisite(s): EE361

EE465 Satellite Communication Systems (Elective) (3 0 3): Introduction to satellite communication, space-segment, and ground segment, orbital mechanics, geostationary and non-geostationary orbits, launching and spacecraft subsystems, look angle determination, orbital perturbations, orbital effects in communication system performance spacecraft and its subsystem, satellite link design, propagation characteristics of satellite links, channel modeling, access control schemes, modulation schemes, multiple access schemes, coding, system performance analysis, system design, space standards, earth station technology, satellite applications such as earth observation, weather, and communication, vsats and network architectures, GPS, future trends.
Pre-requisite(s): EE361

EE466 AI Enabled Digital Communication (Elective) (3 0 3): Introduction to digital communication systems, signals, systems, and baseband modulation, inter-symbol interference, equalization and bandpass modulation techniques, channel encoding/decoding with error detection and correction schemes such as convolutional and Viterbi codes, spread spectrum systems, source encoding/decoding including Huffman and Extended Huffman coding, integration of AI in emerging digital communications such as data compression, autoencoders, beamforming, and regression models for channel state information.

EE471 Wave Propagation and Antennas (3 0 3): Wave propagation, transmission line theory, Smith chart, impedance matching and two-port networks, network analysis, s-parameters, strip-type transmission line, rectangular and circular waveguides, antenna fundamental parameters, radiation power density, directivity, elementary dipole antenna.
Pre-requisite (s): EE371

EE472 Antenna Theory and Design (Elective) (3 0 3): Antenna types, applications, basic concepts, radiated power, radiation pattern, directivity, vector potentials, electric and magnetic currents, dipole antenna and loop antenna, equivalent magnetic dipole, derivation of radiated power, radiation pattern and directivity, microstrip dipole antenna, microstrip loop antennas, antenna arrays and their radiation pattern, Horn antenna, Yagi-Uda antenna, aperture antennas, reflector antennas, feed networks and impedance matching.
Pre-requisite (s): EE371

EE473 Microwave Engineering (Elective) (3 0 3): RF behavior of passive components and RF models, chip components, distributed circuit elements, strip lines, microstrip lines, coupled strip lines/coupled microstrip lines, smith chart, impedance and admittance transformation, parallel and series connection, impedance matching networks, analysis of single and multiport networks using network parameters, microwave filter design, microwave amplifier design, mixers and detectors, oscillators, power dividers, directional couplers, circulators, microwave systems.
Pre-requisite (s): EE371

EE474 Radar Systems (Elective) (3 0 3): Basic principles, wave propagation near the earth's surface and atmosphere, radar antennas, radar block diagram, frequencies, radar equation, monostatic and bistatic radar cross-section of various targets, radar signals and networks, pulse compression, radar resolution, probability of detection and false alarm, MTI and doppler radar systems, detection of signal in noise and clutter, microwave sources.
Pre-requisite(s): EE361, EE371

EE481 Power System Operation and Control (Elective) (3 0 3): Introduction to power system control and its importance, modes of power system operation, major tasks of operation, remote terminal unit, characteristics of power generation units, economic dispatch problems with and without consideration of losses, unit commitment, incremental fuel cost, penalty factor, economic power interchange, hydrothermal coordination, voltage, power and frequency control, evaluation of the effect of speed change on droop characteristics, SCADA system.
Pre-requisite (s): EE311, EE351

EE482 Smart Grid (3 0 3): Introduction/fundamentals of smart grid, smart grid development standards, elements/ technologies of smart grids: energy management, control, and ICT technologies, distributed generation in smart grids, smart grid operation, energy storage technologies, and future developments.
Pre-requisite (s):

EE483 Electrical Estimation Installation and Planning (Elective) (3 0 3): The estimating process, components of the electrical system, installation, protection circuits design and testing, planning, system protection, low voltage switchboards and distribution system, grounding system, power factor correction and harmonic filtering, power cables, supply systems, electrical installation equipment and system.
Pre-requisite (s): EE312

EE484 Power Plant Engineering (Elective) (3 0 3): Variable load problem, gas turbine power plants, steam power plants, Rankine with superheat and reheat, steam generators, fire-tube boiler, water-tube boilers, steam turbine types and efficiency, steam condensers, nuclear power plants, PWR and fast breeder reactors, hydroelectric power plant, reaction and impulse turbines, wind turbines and photo-voltaic.
Pre-requisite (s): EE312

EE485 Electrical Insulation Materials (Elective) (3 0 3): Introduction to the subject and important properties of dielectrics and their measurements, computational methods of electrical field analysis, breakdown mechanisms in gaseous, liquid, and solid dielectrics, insulating materials, mechanisms of conduction and polarization in insulation media, dielectric response measurements, insulation systems in practice – organic and inorganic materials for insulation, composite insulation, outdoor insulation, high voltage diagnostic measurement techniques, pollution flashover.
Pre-requisite (s): MM102, EE371

EE486 Power Economics and Management (Elective) (3 0 3): Principles of economics, engineering economy, economic environment, price-supply-demand relationship, elementary financial analysis, break-even analysis, selection between alternatives, value engineering, linear programming, business organization, capital financing, and allocation.
Pre-requisite (s): MS490, EE312

EE487 Power System Design (Elective) (3 0 3): Characteristics, performance and design of transmission lines, design of EHV transmission lines, advantages, and disadvantages of HVAC and HVDC, selection of sizes and locations of generating stations and substations, designs of distribution systems, economics of distribution systems.
Pre-requisite(s): EE312, EE411

EE488 AI Applications for Smart Grid (Elective) (3 0 3): Introduction to AI, machine learning, feature engineering, advanced topics, and their applications: load disaggregation, load forecasting, and AI-based implementation of the advanced topics.
Pre-requisite(s): EE321, EE312

EE489 Energy Management Systems (Elective) (3 0 3): Introduction to energy efficiency and conservation, energy auditing, smart cities and buildings, battery management systems, and electric vehicles (along with the related standards and operations of each component of the course)
Pre-requisite(s): EE312

EE491 and EE492 Senior Design Project (0 18 6): The design project aims to sharpen the electronic/electrical circuit/system design skills of the FEE graduating students by participating in projects that are to be identified in collaboration with industry. Every project will be assigned a faculty advisor. The students may work independently or jointly (in small groups) on the projects. The duration of the project term is one full year. Progress will be monitored through interim presentations and reports. A final report will be due at the end of the term.

EE/CS/ES 4xx Technical Elective I/II/III (3 0 3): This is a description of elective courses. These courses are offered by the faculty in different areas of specialization to meet the changing requirements of technology.

EE xxxL Lab Course (0 3 1): Stands for lab work associated with a theory course having the same code number. A Lab course can be registered only as a co-requisite of

its associated theory course. Experiments performed in a lab course are related to those topics covered in the respective theory course.

Career in Electrical Engineering

The graduates of Faculty of Electrical Engineering have careers in four major fields:

a) Robotics & Autonomous Systems
b) Digital Design & Embedded Systems
c) Smart Communication & Signal Processing
d) Smart Grids

Graduates specializing in smart communication and signal processing possess a skill set highly sought after across industries such as telecommunications, IoT (Internet of Things), and wireless technology. They find opportunities in companies developing next-generation communication devices, optimizing network performance, and innovating in areas like 5G and beyond. Similarly, those focusing on digital design and embedded systems embark on careers in sectors like consumer electronics, automotive, and aerospace, where their expertise is integral to designing efficient and reliable hardware and software solutions. robotics and autonomous systems specialists thrive in fields ranging from robotics and autonomous vehicles to healthcare and manufacturing, where their knowledge drives innovation in automation and decision-making processes. Smart grid specialists play a crucial role in the energy sector, working with utilities, renewable energy companies, and government agencies to enhance the efficiency and reliability of power distribution systems. Lastly, graduates specializing in electrical machines and drives find opportunities in industries such as renewable energy, transportation, and manufacturing, contributing to the development of energy-efficient and sustainable technologies.

FACULTY OF ENGINEERING SCIENCES

Introduction

Bachelor of Science in Engineering Sciences is a unique multidisciplinary Engineering Program in Pakistan, duly recognized by the Pakistan Engineering Council. The 4-year engineering degree encompasses some of the most modern fields of engineering, split into two specializations, namely, (i) Photonics and Microelectronics, and (ii) Modeling, Simulation, and Machine Learning. Both areas of concentration require in-depth exposure to both science and engineering. The goal of this program is to develop each student's ability to think analytically across disciplines and develop a knowledge base well-suited to tackle future technical challenges that will require a thorough understanding of a discipline in the physical sciences combined with engineering. Over the years, Engineering Sciences graduates have gone on to become successful engineers, managers, researchers, and academicians, working in fields such as medical imaging, optical communications, instrumentation, sensors, control, chip design, operations management, data science, artificial intelligence, and software solutions.

The vigorous growth of the photonic industries, lasers, semiconductor and microelectronics, Instrumentation and process control, simulation of systems, data analytics, and machine learning has created a demand for engineers who can completely cope with the present and future demands of the modern industry. Light, in particular, laser, has become the workhorse and the instrument of choice both in research and industry, covering engineering applications from communications to instrumentation. Importance of Semiconductors and Microelectronics continues to grow and the introduction of software-based design of devices as the new "fabless" industry is bringing new opportunities to Pakistan. Simulation and Machine Learning are now the key design and decision-making tools being used across the world.

The graduates of Engineering Sciences will be suitable for industry that is involved not only in production but also in research and development both within the country and abroad. Already, within the country, several organizations are pursuing R&D work and production in engineering field of technologies. At present the main power for such organizations in these fields is either trained or the assistance of foreign consultants is sought. The graduates of this faculty will be well equipped to fill this gap in national expertise and can look forward to highly rewarding careers both locally and globally.

Thrust Areas: The undergraduate program of Faculty of Engineering Sciences is duly accredited under Washington Accord Level-II category of Outcome Based Education (OBE) system by the Pakistan Engineering Council. To complete the degree requirement, students must complete 19 credit hours in one of the specialization fields mentioned below. Students are assigned projects and suitable advanced elective courses to develop expertise in the specialized areas. Students are required to opt for the specialization in the third year (5th Semester) of their undergraduate degree plan. Following are the two specialization streams offered by FES:

- Photonics and Microelectronics
- Modeling, Simulation, and Machine Learning

Faculty Mission: To produce capable engineers working as responsible global citizens, future leaders of society and leading practitioners of Engineering Sciences.

FACULTY OF ENGINEERING SCIENCES

Dean
Engr. Dr. Naveed Razzaq Butt
PhD (LU, Sweden)

Faculty
Sirajul Haq, PhD (University of Liverpool, UK)
Muhammad Zahir Iqbal, PhD (Universitat Politècnica de Catalunya, Spain)
Muhammad Usman, PhD (Hanyang University, South Korea)
Muhammad Omer Bin Saeed, PhD (King Fahd University of Petroleum, Saudi Arabia)
Tahseen Amin Khan Qasuria, PhD (GIK Institute, Pakistan)
Asad Mahmood, PhD (Telecom Paristech, Paris, France)
Fahd Sikandar Khan, PhD (University of Tokyo, Japan)
Usman Habib, PhD (University of Kent, UK)
Minhaj Zaheer, PhD (Lappeenranta University of Technology, Finland)
Nasir Javed, (Rutgers University, USA)
Tahir Naseem, PhD (Koç University, Turkey)
Zahid Ahmad, PhD (Quaid-e-Azam University, Pakistan)
Babar Zaman, PhD (Universiti Teknologi Malaysia)
Fahad Zulfiqar, MS (University of Sheffield, England)
Muhammad Saqib, MS (NUST, Pakistan)
Asif Ahmed, MS (University of Engineering and Technology, Peshawar, Pakistan)
Muhammad Muti Ur Rehman, MS (IIUI, Pakistan)
Ayesha Noreen, MS (GIK Institute, Pakistan)
Muhammad Sadiq, MS (GIK Institute, Pakistan)

Lab Engineers
Hamza Naeem (University of Bradford, UK)
Hussain Tariq (GIK Institute, Pakistan)
Abdul Rafay (GIK Institute, Pakistan)
Naeem Uz Zaman (UET, Peshawar)

Graduate Assistants
Mehboob ul Haq, MS (Mathematics) (COMSATS University, Abbottabad, Pakistan)
Sana Tahir, MPhil (Mathematics) (Quaid-i-Azam University, Islamabad, Pakistan)
Imama Ibrar, MS (Physics) (Comsats Institute of Information Technology, Islamabad, Pakistan)
Nayab Ali, MS (Applied Physics) (COMSATS University, Islamabad, Pakistan, Pakistan)
Mujeeb ur Rahman, MS (Applied Physics) (COMSATS University, Islamabad, Pakistan)
Nadia Anwar, MS (MS (Applied Physics) (GIK Institute, Topi, Pakistan)
Anique Ahmed, MS (Applied Physics) (GIK Institute, Topi, Pakistan)
Hamid Ali, MS (MS (Applied Physics) (International University, Islamabad, Pakistan)
Misbah Shaheen, MS (MS (Applied Physics) (GIK Institute, Topi, Pakistan)
Shazma Ali, MS (Applied Physics) (GIK Institute, Topi, Pakistan)
Aamir Shahzad MS (Applied Mathematics) (Comsats University Islamabad, Wah Campus, Pakistan)
Shah Faisal, MPhil (Applied Physics) (Riphah International University, Islamabad, Pakistan)
Hassan Ali MS (MPhil Mathematics) (Government College University Lahore, Pakistan)
Ali Hyder M.Sc. (Mathematics), (Islamia University, Bahawalpur, Pakistan)
Khowllah Naeem BS (Mathematics), (University of Swabi, Pakistan)
Nayab Khan BS (Mathematics), (Women University, Swabi, Pakistan)
Asma Khizar BS (Physics), (Government Post Graduate College, Kohat, Pakistan)
Laraib Mustafa BS (Physics), (University of Haripur, Pakistan)
Waseef Ullah B.S (Mathematics), (University of Peshawar, Pakistan)
Faraz Mukhtiar B.S (Mathematics), (Quaid e Awam University, Nawabshah, Pakistan)
Anum M.Sc (Physics) (Abbottabad University of Science and Technology, Abbottabad, Pakistan)
Ayesha Zakir BS (Physics) (Abbottabad University of Science and Technology, Abbottabad, Pakistan)
Iqra Anjum BS (Physics) (University of Peshawar, Pakistan)
Jamshad Bashir BS (Physics) (Abbottabad University of Science and Technology, Abbottabad, Pakistan)
Muhammad Huzaifa BS (Physics) (Islamia College University, Peshawar, Pakistan)
Wagma Hidayat BS (Physics) (SBBWU, Peshawar, Pakistan)
Syed Wageeha Shakir BS (Physics) (University of Malakand, Pakistan)
Marva Ajab, BS (Applied Mathematics) (Women University, Swabi, Pakistan)
Dildar Shah, BS (Applied Mathematics) (University of Peshawar, Pakistan)
Usama, BS (Applied Mathematics) (University of Peshawar, Pakistan)
Atika Bibi, BS (Applied Physics) (COMSATS, Islamabad, Pakistan)
Rao Uzair Ahmad, BS (Applied Physics) International Islamic University, Islamabad, Pakistan)
Aneesa Raazaq, BS (Applied Physics) (Abbottabad University of Science and Technology, Abbottabad, Pakistan)
Zoya Noor, BS (Applied Physics) (Khwaja Fareed University of Engineering & Information Technology, Rahim Yar Khan, Pakistan)

PS to Dean, FES
Muhammad Shafiq, MA English (University of Peshawar, Pakistan)

Program Educational Objectives

The Faculty of Engineering Sciences at GIK Institute has formulated the Program Educational Objectives (PEOs) using the feedback from the stake-holders. There are three PEOs for the ES program.

PEO 1: Graduates demonstrating a strong scientific foundation practicing as competent, continuously developing engineers in Engineering Sciences related fields.

PEO 2: Graduates providing leadership in their organizational and technical capacities, working whether as an individual or as part of a team.

PEO 3: Graduates acting as ethical and responsible professionals providing solutions with due consideration to economic, environmental and safety impacts of their work on society.

Program Learning Outcomes

There is a set of twelve Program Learning Objectives (PLOs) of Engineering Sciences program which describe what students are expected to know/perform/attain by the time they graduate from Faculty of Engineering Sciences. These PLOs are set such that all course deliveries encompass these objectives, and are described as follows:

PLO 1: Engineering Knowledge: Ability to apply knowledge of mathematics, science, engineering fundamentals and an engineering specialization to the solution of complex engineering problems.

PLO 2: Problem Analysis: Ability to identify, formulate, research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.

PLO 3: Design/Development of Solutions: Ability to design solutions for complex engineering problems and design systems, components or processes that meet specified needs with appropriate consideration for public health and safety, cultural, societal, and environmental considerations.

PLO 4: Investigation: Ability to investigate complex engineering problems in a methodical way including literature survey, design and conduct of experiments, analysis and interpretation of experimental data, and synthesis of information to derive valid conclusions.

PLO 5: Modern Tool Usage: Ability to create, select and apply appropriate techniques, resources, and modern engineering and IT

PLO 6: The Engineer and Society: Ability to apply reasoning informed by contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to professional engineering practice and solution to complex engineering problems.

PLO 7: Environment and Sustainability: Ability to understand the impact of professional engineering solutions in societal and environmental contexts and demonstrate knowledge of and need for sustainable development.

PLO 8: Ethics: Ability to apply ethical principles and commit to professional ethics and responsibilities and norms of engineering practice.

PLO 9: Individual and Teamwork Ability to work effectively, as an individual or in a team, on multifaceted and /or multidisciplinary settings.

PLO 10: Communication: Ability to communicate effectively, orally as well as in writing, on complex engineering activities with the engineering community and with society at large, such as being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.

PLO 11: Project Management: Ability to demonstrate management skills and apply engineering principles to one's own work, as a member and/or leader in a team, to manage projects in a multidisciplinary environment.

PLO 12: Lifelong Learning: Ability to recognize importance of and pursue lifelong learning in the broader context of innovation and technological developments.

The modern perspective of an engineering curriculum, especially for programs emphasizing OBE, is that it is the most important instrument for grooming the above-mentioned attributes in students. Therefore, it is viewed to consist of a number of Knowledge Profiles (WKs) that inculcate different dimensions of thinking – mathematical, computational, design and creative – among students in Cognitive, Psychomotor and Affective domains. In particular, the institution ensures that at least the following knowledge profiles are incorporated in the curriculum:

WK1 Natural Sciences: A systematic theory-based understanding of natural sciences applicable to the discipline.

WK2 Mathematics and Computing: The concept-based mathematical thinking, numerical analysis, statistics and formal aspects of computer and information science to support analysis and modelling applicable to the discipline.

WK3 Engineering Fundamentals: A systematic, theory-based formulation of engineering fundamentals required in an engineering discipline.

WK4 Engineering Specialization: The knowledge of Engineering specialization that provides theoretical frameworks and bodies of knowledge for the accepted practice areas that are at the forefront in a discipline.

WK5 Engineering Design: The Design Thinking Knowledge that supports engineering design in a practice area of an engineering discipline.

WK6 Engineering Practice: The Knowledge of engineering practices (technology) in different practice areas of an engineering discipline.

WK7 Engineering in Society: A systematic, comprehension-based knowledge of the role of engineers in a society and the professional issues related to practicing engineering profession in a discipline: ethics and the professional responsibility of an engineer to public safety including the impact of an engineering activity i.e. economic, social, cultural, environmental and sustainability

WK8 Research Literature: Engagement with selected knowledge in the research literature of the discipline.

The Engineering Sciences curriculum is designed so as to familiarize the students with the United Nation's Sustainable Development Goals (SDGs), as given below:

Sustainable Development Goals (SDGs):

SDG 1 No Poverty: End poverty in all its forms everywhere.

SDG 2 Zero Hunger: End hunger, achieve food security and improved nutrition and promote sustainable agriculture.

SDG 3 Good Health and Well-Being: Ensure healthy lives and promote well-being for all at all ages.

SDG 4 Quality Education: Ensure inclusive and equitable quality education and promote lifelong learning opportunities for all.

SDG 5 Gender Equality: Achieve gender equality and empower all women and girls.

SDG 6 Clean Water and Sanitation: Ensure availability and sustainable management of water and sanitation for all.

SDG 7 Affordable and Clean Energy: Ensure access to affordable, reliable, sustainable and modern energy for all.

SDG 8 Decent Work and Economic Growth: Promote sustained, inclusive and sustainable economic growth, full and productive employment and decent work for all.

SDG 9 Industry, Innovation and Infrastructure: Build resilient infrastructure, promote inclusive and sustainable industrialization and foster innovation.

SDG 10 Reduced Inequalities: Reduce inequality within and among countries.

SDG 11 Sustainable Cities and Communities: Make cities and human settlements inclusive, safe, resilient and sustainable.

SDG 12 Responsible Consumption and Production: Ensure sustainable consumption and production patterns.

SDG 13 Climate Action: Take urgent action to combat

climate change and its impacts.

SDG 14 Life Below Water: Conserve and sustainably use the oceans, seas and marine resources for sustainable development.

SDG 15 Life on Land: Protect, restore and promote sustainable use of terrestrial ecosystems, sustainably manage forests, combat desertification, and halt and reverse land degradation and halt biodiversity loss.

SDG 16 Peace, Justice and Strong Institutions: Promote peaceful and inclusive societies for sustainable development, provide access to justice for all and build effective, accountable and inclusive institutions at all levels.

SDG 17 Partnerships for The Goals: Strengthen the means of implementation and revitalize the global partnership for sustainable development.

Accreditation:

The BS Degree Program in Engineering Sciences is accredited under Washington Accord Level-II category of Outcome Based Education (OBE) system by the Pakistan Engineering Council (PEC).

Streams Description

Photonics and Microelectronics:

The field of Photonics and Microelectronics lies at the intersection of natural sciences and engineering. Our labs are equipped with cutting-edge facilities , including solar cell fabrication, light-emitting diodes (LEDs), laser diodes (LDs), high-power lasers, and optical communication systems. Our comprehensive course content enables students to delve into the fundamental principles, design, simulation, fabrication, and testing of a diverse array of photonic and microelectronic devices and systems. These include optical fiber communication links, solar cells, sensors, and photodiodes. Additionally, we employ software tools for modeling and simulating various photonic and microelectronic systems.

Careers in Photonics and Microelectronics:

Engineers specializing in photonics have a bright future ahead, with excellent job prospects both nationally and internationally. As the field continues to evolve, graduates with expertise in photonics can explore a wide range of exciting areas:

- LiDAR for Autonomous Vehicles: Photonics plays a crucial role in developing LiDAR (Light Detection and Ranging) systems used in self-driving cars.
- Optical Remote Sensing for Mining: Photonics technology enables precise and efficient monitoring of mining operations using optical sensors.
- Biomedical Applications: Photonics contributes to medical imaging, diagnostics, and therapies, making it essential for healthcare advancements.
- 5G Fronthaul Optical Networks: The rapid expansion of 5G networks relies on photonics for high-speed data transmission.
- Energy Applications: Photonics helps optimize solar cells, LEDs, and other energy-related technologies.
- Instrumentation and Measurements: Engineers use photonics for precise measurements in various scientific and industrial contexts.
- Materials and Nanotechnology: Photonics research drives innovations in materials science and nanoscale devices.
- Microelectronic Devices and Chip Design: Integrating photonics with microelectronics leads to faster and more efficient electronic components.
- Quantum Computing: Photonics is a key player in developing quantum computers, which promise revolutionary computational power.
- Optical Networking and Communications: High-speed optical communication networks rely on photonics for data transmission.

Modeling, Simulation, and Machine Learning:

Modeling, Simulation, and Machine Learning is a

dynamic field that is utilized in engineering, science, health science, business, education, and many other disciplines. This emerging field is based on developments in diverse engineering areas and brings elements of art, engineering, and science together in a complex and unique way that requires domain experts to enable appropriate decisions. This specialization requires designing of mathematical model of actual or theoretical physical systems. executing the model on a computer and analyzing the output. Computer simulations are extensively being used in aerospace industry, automobile systems, financial markets, environment systems and medical sciences. Machine Learning provides a practical treatment of design, analysis, implementation and applications of algorithms, which learn from examples. Modeling, Simulation, and Machine Learning are particularly important because the description of the system behavior by experimentation might not be feasible due to some of the following reasons.

- Some experiments may be very harmful
- Some experiments might take longer time than expected and may also be very costly
- There might be obstructions during experimentation
- We might not have access to inputs and outputs.
- Career in Modeling, Simulation, and Machine Learning:
- Oil and gas industry (e.g., reservoir characterization)
- Space/defense industry (e.g., in national security mission, simulation of universe, space vehicles and missile trajectories)
- Software systems (e.g., simulation software used by Google, IBM)

- Chemical interactions (e.g., paper and pulp industry).
- Engineering Optimization
- Operations Research
- Intelligent Systems
- Logistics and Data Analytics

Research Labs:

A brief introduction to the research labs in FES is presented below.

OGDCL Clean Energy Research Center:

The OGDCL Clean Energy Research Center is a result of the largest industrial funding in the history of Pakistan, sponsored by the Oil and Gas Development Corporation (OGDCL). Researchers are working towards building an ecosystem of expertise in Green Hydrogen. Major milestones involve developing a Solar Hydrogen energy system with an aim to lead the transition in Pakistan towards a sustainable future in line with the United Nations Sustainable Development Goals. Researchers will also work on electrochemical reduction of CO2, purification of wastewater, Artificially Intelligent Load management, Blockchain-based Energy trading and other emerging trends in clean technologies. This venture is a step towards advancing sustainable energy solutions and meeting the UN SDG Targets in Pakistan. The research innovative technology promises to revolutionize our energy landscape, offering a reliable and eco-friendly solution to meet our growing energy needs while reducing carbon emissions.

HBL Center for Blockchain & Applied Research:

The HBL Center for Blockchain and Applied Research is the first National Industry-Academia partnership of its kind and is the first research center in the country dedicated to harness the expertise of academics in futuristic technologies of blockchain, machine learning and cyber-security, for addressing industry-proposed problems. This landmark agreement between Pakistan's largest bank – Habib Bank Ltd and GIKI is expected to provide a template for industry-academia partnerships and further the Blockchain-based Supply Chain Management, Predictive modeling of Agro-produce, AI-based vulnerability detection in Smart Contracts and Blockchain-enabled cross-border remittances.

Functional Optoelectronics and Renewable Energy Laboratory (FOREL):

FOREL Lab is equipped with the state-of-the-art materials synthesis instruments that facilitates the creation of diverse and customized materials. With versatile synthesis and processing tools, FOREL provides the possibilities to explore diverse materials with a specialized focus on energy application, and a collaborative workspace promotes interdisciplinary innovations.

Photonics laboratory:

The laboratory is currently engaged in numerous research areas of photonics including fiber optics communication, fiber optic sensors and designing of LIDAR systems. Laboratory facilities include Michelson interferometer kits, advanced optics kits, Newport fiber optics kits, spectrometers, DSP lock-in-amplifiers, fiber optics patch cards, optical modulators, WDM and directional couplers, He-Ne lasers, high power Nd:YAG laser, diode lasers, laser power meters, PIN diodes, APDs, phototransistors, computers with DAQ cards, Oscilloscopes, analog & digital trainers, optoelectronic device fabrication & characterization and a wide range of other electronic and optics component. The characterization of LEDs, Laser diodes, fiber transmission, laser beams, optical systems (cameras, scanners, sensors), polarization devices, and photodiodes is performed. Other facilities include emission & photoabsorption spectroscopy, demonstration and use of high power laser, demonstration and use of Keithley 4200-SCS Semiconductor Characterization System for study of electronic and photonic devices, modeling and simulation of photonic devices. This lab also deals with the geometric optics for experiments involving optical bench, optical component holders, mirrors, lenses, beam splitters, screens, free space photodiodes, etc. It is also used for free-space laser communication and experiments involving amplitude splitting.

Renewable Energy Research Laboratory:

This lab is a dynamic and innovative team committed to advancing energy conversion and storage technologies. We are at the forefront of developing cutting-edge solar cells to harness solar power efficiently. Additionally, research in the field of supercapacitors and batteries aims to revolutionize energy storage solutions, enabling grid stability and seamless integration of renewable energy sources.

Nanotechnology Research Laboratory:

This lab specializes in developing nanoelectronic devices. They also focus on fabricating nanoelectronic devices, particularly Field-Effect Transistors (FETs), quantum and spintronic devices. Their work includes precise material characterization and testing to exploit the potential of nanoscale materials for applications ranging from advanced sensors to cutting-edge electronics. The lab is involved in chip design, fabrication, and integrating nanoelectronic components into their designs. Additionally, the lab focuses on the computational studies of these nanoelectronic devices.

Electric Vehicle Laboratory:

The Electric Vehicle Lab (EV Lab) supports a wide array of EV integration and technology services. The objective is to improve the efficiency, sustainability and economics of EVs by optimizing and accelerating integration from components to entire mobility systems through real-world & lab tests, as well as advanced simulations. The focus is on EV Powertrain (battery management system, battery pack design, AI-based motor controller, motor design and fabrication, traction control), thermal management system and fast chargers.

Computational Physics and Quantum Engineering Lab:

The laboratory is established with the assistance of an HEC/GIK grant. It is equipped with two SUN Ultra Workstation Optren Module 2.8 GHz dual-core processors

and the latest networked PCs. Our state-of-the-art simulation tools are at the forefront of research in III-V semiconductor devices, including light-emitting diodes, laser diodes, high electron mobility transistors, and solar cells. Our lab focuses on the emission and detection of the visible spectrum and beyond, from ultraviolet to infrared. Over the years, the laboratory has produced numerous research graduate students.

Photolithography Lab:

Recently lithography lab has been refurbished in the faculty of Engineering Sciences. This lab is equipped with the MJB3 optical lithographic setup. It provides the resolution up to 2 µm. In this lab we also have the programmable spin coater for the deposition of photoresist and for the characterization we have the lock-In amplifier. In addition to this equipment one temperature controller is also available for the controlled environment characterization. Both the undergrad and graduate students are given hands on photolithography setup. Students from the Faculty of Engineering Sciences, Faculty of Electronics Engineering and Faculty of Materials Science and Engineering come and work on photolithography.

Circuit Analysis Laboratory:

This laboratory has a considerable amount of equipment and components to conduct research on IoT, digital electronics, power electronics, etc. Research and development based FYPs make use of the digital trainer boards, oscilloscopes, digital multimeters (DMM), function generators, design software and related accessories.

Coursework Requirements

A student majoring in Engineering Sciences must complete the following courses:

(a) General Education Requirements (52 Credit Hours)

Course Titles	Course Codes	Credit Hours
Basic Engineering	MM101, MM141, CH161, IF101, IF102	06
Computing	CS101, CS101L, CS112, CS112L, AI102	07
English Language	HM101, HM102	06
Humanities	HM211, HM321, HM322, HM2XX, HMXXX	09
Mathematics	MT101, MT102, ES111, MT202, MT203, ES304	18
Sciences	PH101, PH101L, CH101	06

(b) Core Requirements (50 Credit Hours)

Course Titles	Course Codes	Credit Hours
Circuit Analysis I	ES211/EE211	3
Circuit Analysis Lab	ES211L/EE211L	1
Logic Design	ES212/EE221	3
Logic Design Lab	ES212L/ES221L	1
Computer Architecture	ES213/EE222	3
Computer Architecture Lab	ES213L/EE222L	1
Circuit Analysis II	ES214/EE212	3
Data Structures and Algorithms	ES221/CS221	3
Electronics I	ES231/EE231	3
Electronics I Lab	ES231L/EE231L	1
Thermodynamics	ES232/ME231	3
Microprocessor Systems and Interfacing	ES314/EE221/CE324	3
Microprocessor Systems and Interfacing Lab	ES314L/EE221L	1
Signals and Systems	ES332/CS341	3
Signals and Systems Lab	ES332L/CS341L	1
Numerical Analysis	ES341	3
Numerical Analysis Lab	ES341L	1
Engineering Electromagnetics	ES371	3
Instrumentation and process control	ES322/EE213/ME202	3
Instrumentation and process control Lab	ES322L/EE213L/ME243L	1
Senior Design Project Part-I and II	ES481/ES482	6

(c) Specialization Requirement (19 Credit Hours)

1. Photonics and Microelectronics

Course Titles	Course Codes	Credit Hours
Foundations of Photonics	ES334	3
Foundations of Photonics Lab	ES334L	1
Solid State Electronics	ES361	3
Solid State Electronics Lab	ES361L	1
Optoelectronics	ES474	3
Optoelectronics Lab	ES474L	1
Fiber-Optic Communications	ES425	3
Fiber-Optic Communications Lab	ES425L	1
VLSI Design	ES426	3

2. Modeling, Simulation, and Machine Learning

Course Titles	Course Codes	Credit Hours
Discrete System Modeling and Simulation	ES324	3
Discrete System Modeling and Simulation Lab	ES324L	1
Advanced Statistics	ES325	3
Model Engineering	ES471	3
Model Engineering Lab	ES471L	1
Engineering Optimization	ES441	3
Engineering Optimization Lab	ES441L	1
Machine Learning	ES442	3
Machine Learning Lab	ES442L	1
Instrumentation and process control Lab	ES322L/EE213L/ME243L	1
Senior Design Project Part-I and II	ES481/ES482	6

(d) Specialization Technical Electives (06 Credit Hours)

1. Photonics and Microelectronics (Any Two)

Course Titles	Course Codes	Credit Hours
Laser Engineering	ES443	3
Geometric Optics	ES444	3
Biophotonics	ES445	3
Imaging & Displays	ES461	3
Semiconductor Devices and Applications	ES465	3
Introduction to ASIC Design	EE422	3
Digital Integrated Circuit Design	EE423	3
Materials Characterization	MM494	3
Electronic and Magnetic Materials	ES463/MM393	3
Nanomaterials and Nanotechnology	ES462/MM391	3
Nanotechnology for Energy	MM499	3
Microelectronics Manufacturing Engineering	ES466	3
Nanosystems and Devices	MM495	3

Other relevant course from the other Faculty/department with equivalent level may be taken with the recommendation of concern course instructor, Advisor, and approval of the Dean.

2. Modeling, Simulation, and Machine Learning (Any Two)

Course Titles	Course Codes	Credit Hours
Analysis for Modeling and Simulation	ES467	3
Heat Transfer and Modeling	ES446	3
Financial Engineering Models	ES447	3
Data Science	CS439	3
Big Data Analytics	DS461	3
Web Mining and Social Media Analysis	CS438	3
Web Engineering	CS463	3
Computer Graphics	CS433	3
Cloud Computing	AI408	3
Introduction to Mobile Computing	AI426	3
Cyber Security	CS420	3
Block Chain	CS411	3
Bio-Inspired Computing	CS472	3

Medical Image Processing	AI420	3
Computational Biology	CS476	3
Business and Economic Forecasting	MS446	3
Investment and Portfolio Management	AF453	3
Financial Risk Management	AF454	3
Business Logistics Strategy	SC462	3

Other relevant course from the other Faculty/department with equivalent level may be taken with the recommendation of concern course instructor, Advisor, and approval of the Dean.

(e) Management Electives (Any Two) (06 Credit Hours)

Course Titles	Course Codes	Credit Hours
Operations Management	MS492	3
Industrial Safety	MS493	3
Total Quality Management	MS494	3
Maintenance Management	MS495	3
Project Management	MS496	3
Technology Management	MS426	3
Industrial Management	MS449	3
Supply Chain Management	MS491	3
Accounting and Finance	MS447	3

Apart from the recommended list above, any other management course MS4XX may be chosen with the consultation of the advisor.

(f) Inter-Faculty Electives (03 Credit Hours)

These electives have to be chosen from faculties other than that of Engineering Sciences with the consultation of the advisor.

(g) Summer Training/4-8 Weeks Internship (Pass/Fail Grade; Nil Credits)

Every student is required to participate in a program of practical training in industry or an R&D organization and submit a formal written report during the summer of Junior Year.

(h) Total Credit Requirements (136 Credit Hours)

For the BS degree in Engineering Sciences a student is required to complete 136 credit hours

Degree Plan

	Course Code	Course Titles	Lec. Hrs	Lab. Hrs	CH	Pre-req	Co-req
1st Semester	CH161	Occupational Health and Safety	1	0	1	None	None
	CS101	Computing and AI	2	0	2	None	CS101L
	CS101L	Computing and AI Lab	0	3	1	None	None
	HM101	Communication Skills	1	6	3	None	None
	IF101	Innovation and Makers Lab I	0	3	1	None	None
	CH101	Chemistry, Environment, and Climate Change	2	0	2	None	None
	MT101	Calculus I	3	0	3	None	None
	PH101	Applied Physics	3	0	3	None	PH101L
	PH101L	Applied Physics Lab	0	3	1	None	None
	Total		**12**	**15**	**17**		

	Course Code	Course Titles	Lec. Hrs	Lab. Hrs	CH	Pre-req	Co-req
2nd Semester	CS112	Object Oriented Programming and Design	2	0	2	CS101	None
	CS112L	Object Oriented Programming and Design Lab	0	3	1	None	CS112
	AI102	Python Programming & Freelancing Essentials	0	3	1	None	None
	HM102	Critical Thinking and Expository Writing	2	3	3	None	None
	MM101	Materials and Nanotechnology	2	0	2	None	None
	MM141	Materials Lab	0	3	1	None	MM101
	MT102	Differential Equations and Linear Algebra I	3	0	3	MT101	None
	ES111	Probability and Statistics	3	0	3	MT101	None
	IF102	Innovation and Makers Lab II	0	3	1	IF101	None
	Total		**12**	**15**	**17**		

FACULTY OF ENGINEERING SCIENCES

	Course Code	Course Titles	Lec. Hrs	Lab. Hrs	CH	Pre-req	Co-req
3rd Semester	ES211/EE211	Circuit Analysis I	3	0	3	MT102	None
	ES211L	Circuit Analysis Lab	0	3	1	None	ES211
	ES212/EE221	Logic Design	3	0	3	None	None
	ES212L/ EE221L	Logic Design Lab	0	3	1	None	ES212/ EE221
	ES232	Thermodynamics	3	0	3	MT101	None
	HM211	Islamic Studies	2	0	2	NONE	NONE
	HM2XX	Ideology and Constitution of Pakistan	2	0	2	NONE	NONE
	MT202	Calculus II	3	0	3	MT101	None
	Total		**16**	**6**	**18**		

	Course Code	Course Titles	Lec. Hrs	Lab. Hrs	CH	Pre-req	Co-req
4th Semester	ES221/CS211	Data Structure and Algorithms	3	0	3	CS112	None
	ES214/EE212	Circuit Analysis II	3	0	3	ES211/ EE211	None
	ES213/EE222	Computer Architecture	3	0	3	CS101, ES212	None
	ES213L/ EE222L	Computer Architecture Lab	0	3	1	None	ES213/ EE222
	MT203	Complex Variables and Transforms	3	0	3	MT202	None
	ES231/EE231	Electronics I	3	0	3	ES211/ EE211	None
	ES231L/ EE231L	Electronics I Lab	0	3	1	None	ES231/ EE231
	Total		**15**	**6**	**17**		

Specializations (Thrust Areas):

1. Photonics and Microelectronics Stream

	Course Code	Course Titles	Lec. Hrs	Lab. Hrs	CH	Pre-req	Co-req
5th Semester	ES304	Linear Algebra II	3	0	3	MT102	None
	ES314/EE323	Microprocessor Systems and Interfacing	3	0	3	ES213	None
	ES314L/ EE323L	Microprocessor Systems and Interfacing Lab	0	3	1	None	ES314/ EE323
	ES332/CS341	Signals and Systems	3	0	3	ES211/ EE211	None
	ES332L/ CS341L	Signals and Systems Lab	0	3	1	None	ES332/ CS341
	ES334	Foundations of Photonics	3	0	3	PH101	None
	ES334L	Foundations of Photonics Lab	0	3	1	None	ES323
	HM321	Sociology and Human Behavior	2	0	2	None	None
	HMXXX	Civics and Community Engagement	0	3	1	None	None
	Total		**14**	**12**	**18**		

	Course Code	Course Titles	Lec. Hrs	Lab. Hrs	CH	Pre-req	Co-req
6th Semester	ES361	Solid State Electronics	3	0	3	PH101	None
	ES361L	Solid State Electronics Lab	0	3	1	None	ES361
	ES322/EE213/ ME202	Instrumentation and process control	3	0	3	ES211	None
	ES322L/ EE213L/ ME243L	Instrumentation and process control Lab	0	3	1	None	ES322
	ES371	Engineering Electromagnetics	3	0	3	PH101, MT102	None
	ES341	Numerical Analysis	3	0	3	MT102	None
	ES341L	Numerical Analysis Lab	0	3	1	None	ES341
	HM322	Corporate Law and Professional Ethics	2	0	2	None	None
	Total		**14**	**9**	**17**		

	Course Code	Course Titles	Lec. Hrs	Lab. Hrs	CH	Pre-req	Co-req
7th Semester	ES474	Optoelectronics	3	0	3	ES361	None
	ES474L	Optoelectronics Lab	0	3	1	None	ES474
	ES425	Fiber-Optic Communications	3	0	3	ES323	None
	ES425L	Fiber-Optic Communications Lab	0	3	1	None	ES425
	ES426	VLSI Design	3	0	3	ES361	None
	ES481	Senior Design Project Part I	0	9	3	None	None
	MS4XX	General Management Elective I	3	0	3	-	-
	Total		**12**	**15**	**17**		

	Course Code	Course Titles	Lec. Hrs	Lab. Hrs	CH	Pre-req	Co-req
8th Semester	ES4XX	Specialization Technical Elective I	3	0	3	-	-
	ES4XX	Specialization Technical Elective II	3	0	3	-	-
	ES482	Senior Design Project Part II	0	9	3	None	None
	MS4XX	General Management Elective II	3	0	3	-	-
	XX4XX	Interfaculty Elective	3	0	3	-	-
	Total		**12**	**9**	**15**		

2. Modeling, Simulation, and Machine Learning Stream

	Course Code	Course Titles	Lec. Hrs	Lab. Hrs	CH	Pre-req	Co-req
5th Semester	ES304	Linear Algebra II	3	0	3	MT102	None
	ES314/EE323	Microprocessor Systems and Interfacing	3	0	3	ES213	None
	ES314L/ EE323L	Microprocessor Systems and Interfacing Lab	0	3	1	None	ES314/ EE323
	ES332/CS341	Signals and Systems	3	0	3	ES211/ EE211	None
	ES332L/ CS341L	Signals and Systems Lab	0	3	1	None	ES332/ CS341
	ES324	Discrete System Modeling and Simulation	3	0	3	ES111	None
	ES324L	Discrete System Modeling and Simulation Lab	0	3	1	None	ES324
	HM321	Sociology and Human Behavior	2	0	2	None	None
	HMXXX	Civics and Community Engagement	0	3	1	None	None
	Total		**14**	**12**	**18**		

	Course Code	Course Titles	Lec. Hrs	Lab. Hrs	CH	Pre-req	Co-req
6th Semester	ES325	Advanced Statistics	3	0	3	ES111	None
	ES322/EE213 /ME202	Instrumentation and Process Control	3	0	3	ES211	None
	ES322L/ EE213L/ ME243L	Instrumentation and Process Control Lab	0	3	1	None	ES322
	ES371	Engineering Electromagnetics	3	0	3	PH101, MT202	None
	ES341	Numerical Analysis	3	0	3	MT102	None
	ES341L	Numerical Analysis Lab	0	3	1	None	ES341
	HM322	Corporate Law and Professional Ethics	2	0	2	None	None
	Total		**14**	**6**	**16**		

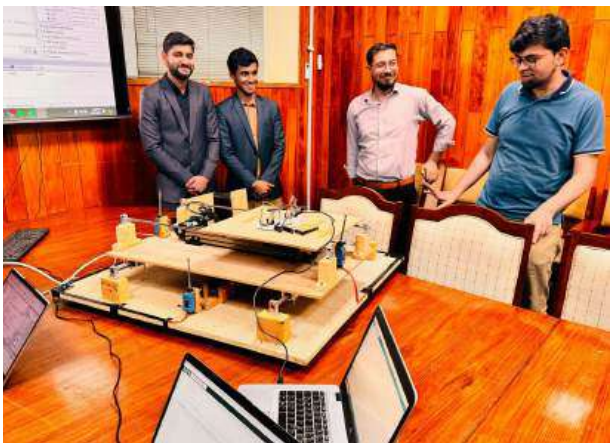
	Course Code	Course Titles	Lec. Hrs	Lab. Hrs	CH	Pre-req	Co-req
7th Semester	ES471	Model Engineering	3	0	3	MT202	None
	ES471L	Model Engineering Lab	0	3	1	None	ES471
	ES441	Engineering Optimization	3	0	3	MT202	None
	ES441L	Engineering Optimization Lab	0	3	1	None	ES441
	ES442	Machine Learning	3	0	3	ES325	None
	ES442L	Machine Learning Lab	0	3	1	None	ES442
	ES481	Senior Design Project Part I	0	9	3	None	None
	MS4XX	General Management Elective	3	0	3	None	None
	Total		**12**	**18**	**18**		

	Course Code	Course Titles	Lec. Hrs	Lab. Hrs	CH	Pre-req	Co-req
8th Semester	ES4XX	Specialization Technical Elective I	3	0	3	-	-
	ES4XX	Specialization Technical Elective II	3	0	3	-	-
	ES482	Senior Design Project Part II	0	9	3	None	None
	MS4XX	General Management Elective	3	0	3	None	None
	XX4XX	Interfaculty Elective	3	0	3	None	None
	Total		**12**	**9**	**15**		

Course Contents

MT101 Calculus I (3-0-3): Functions, Limit and Continuity, Differential Calculus I, Differential Calculus II, Applications of Derivatives, Integral Calculus, Applications of Integral Calculus, Techniques of Integration, Infinite Series
Pre-requisite(s): None

MT102 Differential Equations and Linear Algebra I (3-0-3): Matrix algebra and general properties of matrices, elementary row operations, reduction of matrices into echelon and reduced echelon form, rank of a matrix, determinants and their properties, solution of system of linear algebraic equations, Gaussian elimination and Gauss-Jordan method, eigenvalues, eigenvectors and their applications, diagonalization, basic definitions involving differential equations, first order ordinary differential equations and their solution techniques, applications of first order differential equations, second and higher order differential equations, superposition principle, some special types of second order differential equations and their solution techniques, applications of second order differential equations , higher order linear differential equations with constant coefficients, complimentary and particular solutions, solutions by undetermined coefficients and variation of parameters, Cauchy-Euler equations, applications of higher order differential equations, systems of linear differential equations, series solutions of ODEs, solutions about ordinary points, Solutions about singular points, Laplace Transforms, Transforms of Derivatives, Application of Transforms in ODEs.
Pre-requisite(s): None



PH101 Applied Physics (3-0-3): Introduction to engineering mechanics problems, Vector Operations, Force Vectors, Motion in one, two and three dimensions, Newton Laws and its applications, Momentum, Rotational dynamics and kinematics, Moment of Force, Principle of Moments, Moment of a Couple, Work and Energy, Electrostatics, Electric Potential, Magnetic Field.
Pre-requisite(s): None
co-requisite (s): PH101L

PH101L Applied Physics Lab (0-3-1): In this laboratory students perform the experiments related to the Forces (Addition and Resolution), Acceleration due to Gravity, Conservation of Energy using Projectile Launcher, Translational Equilibrium, Study of Average Velocity using Air Track System, Ballistic Pendulum, Variable "g" Pendulum, Rotational Dynamics, Introduction to Electricity &Magnetism Lab, Magnetic Moment in Magnetic Field and Measurement of EMF and Internal Resistance.
Pre-requisite(s): None
co-requisite (s): PH101

ES111 Probability and Statistics (3-0-3): Introduction to Statistics and Data Analysis. Probability Basics, Conditional Probability, Independence, and the Product Rule, Bayes' Rule. Random Variables and Probability Distributions. Mathematical Expectation: Mean, Variance, Covariance. Chebyshev's Theorem. Discrete Probability Distributions. Continuous Probability Distributions. Single Sample Sampling Distributions. Single Sample Tests of Hypotheses. Linear Regression and Correlation. Least Squares and the Fitted Model. Tools: Excel, R, Stata or similar tools.
Pre-Requisite: MT101

MT202 Calculus II (3-0-3): Parametric representation of plane curves; Calculus with parametric curves; Polar coordinates; Graphing polar equations; Conic sections in polar coordinates; Areas and arc lengths in polar coordinates. Vectors in three dimensions. Dot and cross product. Lines and planes. Surfaces. Limits, continuity, Partial derivatives. Increments and differentials, Chain

rules. Directional derivatives, gradient. Tangent planes and normal lines to surfaces. Taylor series for functions of several variables. Extrema of functions of several variables. Relative extrema, Lagrange multipliers. Double integrals, Definition, and evaluation. Area and volume. Double integrals in polar coordinates. Surface area. Triple integrals in Cartesian, Cylindrical, and spherical coordinates. Applications to engineering and science.
Pre-requisite(s): MT101

MT203 Complex Variables and Transforms (3 0 3): Introduction to Complex Number System, Argand diagram, De Moivre's theorem and its Application Problem Solving Techniques, Complex and Analytical Functions, Harmonic Function, Cauchy-Riemann Equations, Cauchy's theorem and Cauchy's Line Integral, Power series, Taylor series, Laurent series, Residual integration, Singularities, Poles, Residues, Contour Integration, Laplace transform definition, Laplace transforms of elementary functions, Properties of Laplace transform, Periodic functions and their Laplace transforms, Inverse Laplace transform and its properties, Convolution theorem, Inverse Laplace transform by integral and partial fraction methods, Heaviside expansion formula, Solutions of ordinary differential equations by Laplace transform, Applications of Laplace transforms, Fourier theorem and coefficients in Fourier series, Even and odd functions, Complex form of Fourier series, Fourier transform definition, Fourier transforms of simple functions, Magnitude and phase spectra, Fourier transform theorems, Inverse Fourier transform, Series solution of differential equations, Validity of series solution, Ordinary point, Singular point, Forbenius method, Indicial equation, Bessel's differential equation, its solution of first kind and recurrence formulae, Legendre differential equation and its solution, Rodrigues formula.
Pre-requisite(s): MT102

ES211/EE211 Circuit Analysis I (3-0-3): Basic Concepts, resistive circuits, nodal and loop analysis techniques, operational amplifiers, additional analysis techniques such as using superposition, Thevenin's and Norton's Theorems, capacitance, and inductance, first- and second-order transient circuits, phasors, AC steady state analysis.
Pre-requisite(s): MT102

ES211L Circuit Analysis Lab (0-3-1): This lab enables the students to analyze DC and AC circuits, variable frequency network performance and sensor network circuits. Students get a hands-on experience of soldering and PCB designing, and demonstrate their ability to design circuits for practical applications.

ES212/EE221 Logic Design (3-0-3): Number systems, codes, set theory, relations, functions, Boolean Algebra, Logic gates, combinational logic, programmable logic devices, sequential logic, latches, flip-flops, finite state machines, counters, shift registers, pseudorandom sequence generators, memories, adders, subtractors, multiplication, division, comparators, fault detection, introduction to programmable logic devices and implementation of the digital circuit using Verilog/HDL.
Pre-requisite(s): None

ES212L Logic Design Lab (0-3-1): This lab introduces logic design and basic building blocks used in digital systems. A study of basic and complex digital logic circuit design, and their implementation is done. Circuit schematic development simulation of digital systems is also performed. Experiments explore designs with combinational and sequential logic. Students work through design activities, which include testing, implementing, troubleshooting, and a final lab project.
ES213 Computer Architecture (3-0-3): Review of Verilog HDL, registers and register transfers, memory basics, computer design basics, instruction set

ABDUL RAFAY

GIKI's commitment to excellence in engineering education is evident in its rigorous curriculum, cutting-edge research opportunities, and a faculty that is not only highly qualified but also deeply invested in the success of its students. The institute's emphasis on hands-on learning and practical applications has provided me with invaluable skills that extend beyond the classroom.

What sets GIKI apart is its vibrant and inclusive community. The collaborative environment fostered by both faculty and fellow students has enriched my learning experience and encouraged me to explore my interests beyond the academic realm. The diverse range of extracurricular activities and clubs has allowed me to develop leadership skills, teamwork, and a sense of responsibility.

The state-of-the-art facilities and resources at GIKI have played a pivotal role in enhancing my education. From well-equipped laboratories to a comprehensive library, the institute ensures that students have access to the tools and knowledge necessary to excel in their studies.

architecture, central processing units, input—output and communication and memory systems.
Pre-requisite(s): CS101, ES212

ES213L Computer Architecture Lab (0-3-1): This lab will give students the ability to simulate combinational and sequential logic using Verilog HDL as well as to design logic and digital computer systems having RISC Based Architecture.

ES214 Circuit Analysis II (3-0-3): AC steady state power analysis, variable-frequency network performance, the Laplace transform and its application to circuit analysis, Fourier analysis techniques and two-port networks.
Pre-requisite(s): ES211/EE211

ES221/CS211 Data Structures and Algorithms (3-0-3): Introduction to data structures and algorithms, arrays, stacks, binary search, queues, linked lists, trees, graphs and operations, algorithm performance, dynamic memory management.
Prerequisite(s): CS112/CS102L

ES231/EE231 Electronics I (3-0-3): Introduction to electronics, semiconductor diode, diode applications, bipolar junction transistor, transistor configuration, DC biasing, field effect transistor, BJT and FET small signals equivalent circuit models, design of BJT and FET amplifiers and differential amplifiers.
Pre-requisite(s): ES211/EE211

ES231L Electronics I Lab (0-3-1): This lab will demonstrate will help students to analyze and demonstrate the diode-based circuits in various configurations, the operational principle of circuits for bipolar junction transistor (BJT) and field effect transistor (FET).

ES232 Thermodynamics (3-0-3): Fundamentals of thermodynamics including work and heat, laws of thermodynamics, properties of purse substances, energy analysis of closed systems, mass and energy analysis of control volumes, entropy, enthalpy, reversibility, irreversibility, study of some processes and cycles.
Pre-requisite(s): MT101

ES304 Linear Algebra II (3-0-3): Matrices algebra, determinants, linear systems and solutions, vectors in 2 space and 3 space, vector algebra and related theorems, vector spaces, subspaces and related theorems, linear combinations and related theorems, linear dependent and independent vectors, basis and related theorems, rank and nullity, Gram-Schmidt Process, inner product spaces, eigenvalues and eigenvectors, diagonalization of matrices and related theorems, linear transformation, kernel and range of linear transformation, applications to engineering and science.
Pre-requisite(s): MT102

ES314/EE221/CE324 Microprocessor Systems and Interfacing (3-0-3): Introduction to microprocessors; general purpose and embedded features, architecture and assembly language programming of typical micro controllers (such as 8051, PIC, AVR, Raspberry Pi), different types of instructions, addressing modes, time delay, crystal oscillator, I/O port and timer/counter

programming, serial port programming, interrupts programming, interfacing to external memory, real world interfacing, LCD, ADC, sensors, and keyboard interfacing, interfacing with 8255 and RTC interfacing, motor control. Introduction to Arduino and Raspberry Pi development boards, their interfacing and programming.
Pre-requisite(s): ES213

ES314L Microprocessor Systems and Interfacing Lab (0-3-1): This lab is meant for the students to learn about typical microprocessor and microcontroller-based systems. It is used in two courses, computer architecture and microprocessor/microcontroller Interfacing. The laboratory is equipped with oscilloscopes, digital trainers, Burners (Programmers), digital multimeters and support electrical and electronics accessories.

ES332/EE351 Signals and Systems (3-0-3): Introduction to continuous and discrete time systems, analysis of continuous time (CT) system using Fourier and Laplace Transforms, ideal and practical CT filters, sampling analysis of discrete time (DT) systems, difference equations and unit sample response, z-transform, DT Fourier transform and linear feedback systems.
Pre-requisite(s): ES211/EE211

ES332L Signals and Systems Lab (0-3-1): This lab is performed in computer simulation lab. All computers are installed with MATLAB software and connected with centralized printer. Student performed signals and systems analysis in frequency and time domain using Signals and Systems toolbox.

ES334 Foundation of Photonics (3-0-3): Introduction to photonics engineering, Optical waveguides and fibers, Fiber optic telecommunication, Nature and properties of light, Light sources and laser safety, Interference, Diffraction, Polarization, Basic geometrical optics, Basic physical optics, Optical instruments, Lasers and applications, Optical modulation and detection, Integrated optics, Nonlinear optics, Organic/inorganic and hybrid photovoltaics, Holography.
Pre-requisite(s): PH101

ES334L Foundation of Photonics Lab (0-3-1): Laboratory experiments introducing geometrical and physical optics, characterization of LEDs & Laser diodes, fiber transmission, laser beams, interferometers, optical systems (cameras, scanners, sensors), polarization devices, emission & photoabsorption spectroscopy, photo luminance, demonstration and use of high power laser, demonstration and use of Keithley 4200-SCS Semiconductor Characterization System for study of electronic and photonic devices, modeling and simulation of photonic devices.

ES341/CSE342 Numerical Analysis (3-0-3): Error and computer arithmetic, Root-finding for non-linear equations, interpolation and polynomial approximation, solution of system of linear equations, numerical differentiation and integration and numerical solution of ordinary differential equations.
Pre-requisite(s): MT102

ES341L Numerical Analysis Lab (0-3-1): The goal of this lab is to get familiar with discrete Simulation techniques and their uses in various science and engineering applications. It also aims to provide basic knowledge of designing simulation models, simulation algorithms and their implementation on PCs.

ES361/EE333 Solid State Electronics (3-0-3): Introduction to semiconductor materials, band theory of solids, carrier transport in semiconductor, Schrodinger's equation and wavefunctions, Fermi-Dirac probability, Kronig-Penny model, E-k diagram, pn-junction and

HALEEMA FIDA

Life at GIK is an exciting journey marked by personal development and strong bonds. At GIK, every day feels like a step forward on a remarkable journey. The blend of challenging academic pursuits, vibrant campus life, and a close-knit community creates an environment where growth and learning are inevitable. I am grateful for the opportunities, friendships, and mentorship I've received, which have prepared me for the challenges and opportunities that lie ahead.

metal-junction devices, metal-oxide semiconductor devices, and bipolar junction transistor.
Pre-requisite(s): PH101

ES361L Solid State Electronics Lab (0-3-1): Students are trained to measure material characteristics such as resistivity measurement, conductivity type and carrier concentration using state-of-the-art modeling software. Experiments on Solar Cell I-V characterization and thermoelectric generator are also conducted in this lab. Major equipment includes Hall Effect board (P/nGe), Hal Effect board (Zn/Cu), Universal Measuring Amplifier and support accessories.

ES371 Engineering Electromagnetics (3-0-3): Vector analysis, static electric and magnetic fields, Maxwell's equations, electric and magnetic boundary value problems, Poisson's and Laplace's equation, displacement current.
Pre-requisite(s): PH101, MT102

ES325 Advanced Statistics (3-0-3): Statistical methods are used for the analysis of different datasets for forecasting the values, predicting the unknowns, relating the variables for getting deeper insights, and relating data differences with real-world complexities. Data Science extracts knowledge from data on the basis of hidden patterns which can be made explicit by incorporating the statistical algorithms in it. This course is designed to prepare students on statistical techniques with a purview of artificial intelligence and data science.
Pre-requisite(s): ES111

ES324 Discrete System Modeling and Simulation (3-0-3): This course covers "Discrete-Event" simulation at an introductory level, preparing students for advanced studies in these fields. The main purpose of the course is to provide an introduction to the modeling and simulation of discrete-state, discrete-event systems (DES). This course will provide an investigation of the steps of a DES simulation study, including problem formulation, conceptual model design, simulation model development, input data modeling, output data analysis, verification and validation, and design of simulation experiments.
Pre-requisite(s): ES111

ES324L Discrete System Modeling and Simulation Lab (0-3-1): This lab is used to simulate and analyze different models of System Design and Engineering Management. The lab is equipped with 20 Core i7 PCs running on Windows 10 operating system. These PCs are interconnected via broadband network and students have access to internet, e-mail, and a high-speed laser printer. Different software tools such as MATLAB and Simulink are used to perform simulations of various engineering designs. Arena, SPSS, and Excel packages are used to perform discrete-event simulations and analysis of output data to solve problems of engineering management.

ES322/EE213/ME202 Instrumentation and Process Control (3-0-3): Precision measurements terminologies principles of different measurement techniques; instruments for measurement of electrical and non-electrical quantities; systems for signal processing and signal transmission; modern instrumentation techniques; static and dynamic responses of instrumentation and signal conditioning; data acquisition systems; principles of operation, construction and working of different analog and digital meters, Advanced Testing & Measuring instruments recording instruments, signal generators, Input and output transducers; types of bridges for measurement of resistance, inductance, and capacitance; power and energy meters; voltage / current measurements. Programmable Logic Controllers (PLC), SCADA and communication are introduced. After

learning the principles of developing PLC programs, examples of control systems are presented.
Pre-requisite(s): ES211

ES322L Instrumentation and process control Lab (0-3-1): In this lab students are trained how to interface the physical world with the computer by using the LabView software. The students are given tasks of sensors interfacing including thermal, mechanical, and optical sensors. They also learn how to develop the graphical user interface. At the end of the semester students are also given the open-ended problem of any electro-mechanical system.

ES426 VLSI Design (3-0-3): Transistor topology, transistor equations, CMOS process steps, design rules, for custom layout; CMOS logic design, complex gates, BiCMOS circuits, pseudo, NMOS, dynamic logic, dynamic cascaded logic, domino logic, 2 and 4 phase logic, pass transistor logic; control and timing, synchronous and asynchronous, self-timed system, multiphase clocks, examples of ALU, shifters and registers; layout, hand layout, graphical layout, low-level languages, design rule checking, placement of cells, simulation of design, test pattern generation, high-level languages, structured design methodology for FLSI, hierarchical design techniques and examples. ultra-fast VLSI circuits and systems, and their design; digital and analog architectures, serial addition, bitserial multipliers, systolic arrays, future integrated circuit processing, effect of scaling circuit dimensions, physical limits of device fabrication. Clocking and Timing Issues. Layout of digital circuits. HDL Programming in Verilog.
Pre-requisite(s): ES361

ES441 Engineering Optimization (3-0-3): Brief review of LP models and simplex algorithm, general transportation model, network models and their tabular representation, transportation and transshipment models, transportation algorithms, assignment models and their various ramifications, Hungarian algorithm, integer linear programming and related models, zero-one programming, standard examples, modeling of various situations occurring in real world, network models, basic terminology of graph theory, spanning tree, minimum path, and maximum flow problems, network optimization algorithms, project management, PERT and CPM, queuing models, distribution of inter-arrival and service times and simple M/M/k systems.
Pre-requisite(s): MT202

ES441L Engineering Optimization Lab (0-3-1): The goal of this lab is to train students to solve real-world optimization problems. In the planning or operation of an engineering system, engineers have to make technological and managerial decisions at several stages. The ultimate objective of all such decisions is to make optimal actions that result in a minimum effort required or to maximize the desired outcomes. This lab will introduce optimization tools, which will help students model an engineering design problem as an optimization problem, and then solve them with appropriate optimization methods.

ES442 Machine Learning (3-0-3): Introduction to machine learning; concept learning: General-to-specific ordering of hypotheses, Version spaces Algorithm, Candidate elimination algorithm; Supervised Learning: decision trees, Naive Bayes, Artificial Neural Networks, Support Vector Machines, Overfitting, noisy data, and pruning, Measuring Classifier Accuracy; Linear and Logistic regression; Unsupervised Learning: Hierarchical Agglomerative Clustering. k-means partitional clustering; Self-Organizing Maps (SOM) k-Nearest-neighbor algorithm; Semisupervised learning with EM using labeled and unlabeled data; Reinforcement Learning: Hidden Markov models, Monte Carlo inference

Exploration vs. Exploitation Trade-off, Markov Decision Processes; Ensemble Learning: Using committees of multiple hypotheses. Bagging, boosting
Pre-requisite(s): ES325

ES442L Machine Learning Lab (0-3-1): Artificial Neural Networks, Support Vector Machines, Overfitting, noisy data, and pruning, Measuring Classifier Accuracy; Linear and Logistic regression; Unsupervised Learning: Hierarchical Agglomerative Clustering. k-means partitional clustering; Self-Organizing Maps (SOM) k-Nearest-neighbor algorithm; Semisupervised learning with EM using labeled and unlabeled data; Reinforcement Learning: Hidden Markov models.

ES471 Model Engineering (3-0-3): The goal of this course is to develop an understanding of the various modeling paradigms appropriate for capturing system behavior and conducting digital computer simulations of many types of systems. The techniques and concepts discussed typically include mathematical modeling of engineering systems based on Linear System of Equations, Nonlinear System of Equations. The course will also cover modeling of Complex Engineering Systems as a set of Differential-Algebraic-Equations (DEAs) models, Graphical Models, Integer Programming, and Stochastic Models.
Pre-requisite(s): MT202

ES471L Model Engineering Lab (0-3-1): The purpose of this lab is to equip students with a set of skills that will enable them to model complex engineering problems as mathematical models. Subsequently, modeling engineering systems as a set of Linear/Nonlinear equations, Differential-Algebraic Equations (DAEs), Differences equations, or stochastic models. In this lab, students will also learn different modeling toolboxes such as Simulink and Mathematica.

ES463 Electronic and Magnetic Materials (3-0-3): Molecular Collisions, Thermal Fluctuations and Noise, The Crystalline State, Defects and their significance, Drude Model, Temperature dependent Resistivity, Matthiessen's Rule, Nordheim's Rule, Thermal Conductivity, Electrical Conductivity of nonmetals etc. Origin of magnetic moment of atoms, theories of magnetism such as molecular theory and electron theory, hysteresis and magnetization curve, magnetic domains, domain walls, methods of observation of domains, classification of magnetic materials according to magnetic properties.
Pre-requisite(s): ES361

ES465 Semiconductor Devices and Applications (3-0-3): Semiconductor device fabrication, metal-semiconductor and metal-insulator-semiconductor junctions and devices, photonic devices, transferred-electron devices, switching devices, other semiconductor devices, amorphous semiconductors, band models of amorphous semiconductors, electronic applications, optical applications, magnetic applications, super conductive materials, and devices.
Pre-requisite(s): ES361

ES466 Microelectronics Manufacturing Engineering (3-0-3): Designing of electronic devices and integrated circuits, manufacturing process of electronic devices and integrated circuits, electronic devices processing equipment's and their manufacturing limit, microlithography masking and pattering by UV lithography technique, electron beam lithography: design and patterning, positive and negative resist systems and resist-materials characterization, oxidation, diffusion, ion implantation, metallization and plasma etching processes.
Pre-requisite(s):

ES425 Fiber Optic Communication: This course is related to the principles of optical fiber communication systems.

The course covers three topics: 1) The optical fiber as a transmission channel. 2) Optoelectronic devices used in transmitters, receivers, and multiplexers. 3) Design of the overall communication system and assessment of its performance. In part 1, step-index and graded-index multimode and single-mode optical fibers are described and their attenuation and dispersion characteristics are determined. The transfer function of the fiber system is determined. Part 2 introduces the basic principles of interaction of light with semiconductor materials, including absorption and electroluminescence. Light emitting diodes, laser diodes, and photodiodes are introduced as the basic components of optical transmitters and receivers. Semiconductor and fiber optical amplifiers are also introduced. Part 3 deals with the design of the digital fiber communication system, including derivation of the bit error rates for attenuation- and dispersion-limited systems and determination of the maximum data rates possible for a given length. Introductions to wavelength-division multiplexing (WDM) and optical fiber networks are also provided.
Pre-requisite(s): ES323

ES425L Fiber Optic Communication Lab (0-3-1): In this lab students are trained fiber optics patch cards, optical modulators, WDM and directional couplers. They also learn how to develop the graphical user interface based simulations for optical systems. The facilities include Newport fiber optics kits, fiber optics patch cards, optical modulators, WDM and directional couplers.

ES443 Laser Engineering (3-0-3): It is an introductory course on lasers which covers principles of laser amplification and oscillations, design of lasers, and general characteristics of excitation systems. It is suitable for students with backgrounds in physics, electrical engineering, materials and other disciplines who require a fundamental knowledge of lasers and how they operate. The course covers the basic physics of laser operation, and includes understandings of resonator theory, pulsed and continuous wave operation of lasers. Most popular lasers are described, as well as a pulsed techniques such as Q-switching, mode-locking and harmonic generation. The student is also introduced to the exciting types of new lasers being developed.
Pre-requisite(s): ES334

ES444 Geometric Optics (3-0-3): Geometric optics is the study of light in its simplest form by treating light as rays. Light rays travel in straight lines until they encounter an interface (such as a mirror or a lens) where they may be redirected by reflection and refraction. This course describes the physical principles that determine how rays behave at various interfaces. These principles are then used to model simple optical systems with varying degrees of fidelity. Natural optical phenomena (rainbows, mirages, total-internal reflection, etc.) and classic optical systems (prisms, telescopes, cameras, etc.) will be analyzed throughout the course. Linear systems will be introduced to analyze more complex optical systems. This course provides the fundamentals needed for optical system design.
Pre-requisite(s): ES334

ES445 Biophotonics (3-0-3): This course is an introduction to photobiology (interaction of light with biological matter), tissue optics, light-induced cellular processes, optical biosensors, and cellular and molecular imaging. Biophotonics is an emerging multidisciplinary field where light-based methods are utilized to reveal biological mechanisms and diagnose or treat several diseases. This course introduces the basics of biology and photonics and provides the most relevant and important application examples selected from chemistry, biology, pharmacology and medicine. For examples, it includes how to detect and identify new viruses and how to manipulate the brain of mouse with light, etc.
Pre-requisite(s): ES334

ES461 Imaging & Displays (3-0-3): This course introduces the basic principles of two- and three-dimensional imaging systems. It begins with the mathematical description of image formation as a linear system and draws on the student's knowledge of signals and systems to introduce the concepts of point spread function, transfer function, resolution, and restoration. Actual physical imaging systems (such as microscopes, telescopes, and copiers) operating in the gazing and scanning configurations are subsequently modeled and their resolution assessed. Interferometric imaging systems and their applications in metrology are described. Techniques for depth profiling are then introduced including point-by-point scanning (as in laser scanning fluorescence microscopy), echo ranging (as in sonar and radar imaging), and interferometry (as in optical coherence tomography). This is followed by an introduction to computational imaging, including the techniques of computed tomography (CT), range tomography, and magnetic resonance imaging (MRI). Hyperspectral imaging systems and their various configurations are then described including applications in detection (of tumors, for example) and classification (of different targets). Performance measures such as sensitivity and specificity are introduced. Applications for remote sensing, nondestructive testing, and biology and medicine are highlighted.
Pre-requisite(s): ES334

ES462/MM391 Nanomaterials and Nanotechnology (3-0-3): Introduction to Nanoscience and Nanotechnology, Physical chemistry of solid surfaces, surface energy, electrostatic stabilization, steric stabilization,

zero-dimensional nanostructures: nanoparticles, quantum dots, one dimensional nanostructures: nanowires and nanorods, template-based synthesis, two dimensional nanostructures. Thin films by physical and chemical methods, three-dimensional nanostructures: nano-carbons, fullerenes, CNTs and graphene, core shell nanostructures, nanomaterials hazards and safety procedures.
Pre-requisite(s): ES361

ES474 Optoelectronics (3-0-3): This module introduces the main components of modern day optoelectronic systems. This will include active devices for the generation, detection, amplification and modulation of optical signals and the key passive components in modern optical communication systems. The working principle for different types of optoelectronic devices such as optical modulators, LCDs, etc are studied in detail. The optoelectronic characteristics of transmitters (LED, Lasers, Laser diodes, optical amplifiers) and receivers (pin photodiode, avalanche PD, heterojunction PD, solar cell) are analyzed. This module also covers modeling and analysis of optoelectronic devices via a series of lab sessions.
Pre-requisite(s): ES361

ES474L Optoelectronics Lab (0-3-1): Laboratory experiments introduce principles of optical waveguiding, optical network analysis, characterization of lasers, optical modulators, and WDM components. Laboratory facilities include Michelson interferometer kits, advanced optics kits, spectrometers, DSP lock-in-amplifiers, He-Ne lasers, high power Nd:YAG laser, diode lasers, laser power meters, PIN diodes, APDs, phototransistors, computers with DAQ cards, Oscilloscopes, analog and digital trainers, photonic device fabrication & characterization, software tools for the modeling & simulation photonic devices and systems, and a wide range of other photonic components and kits.

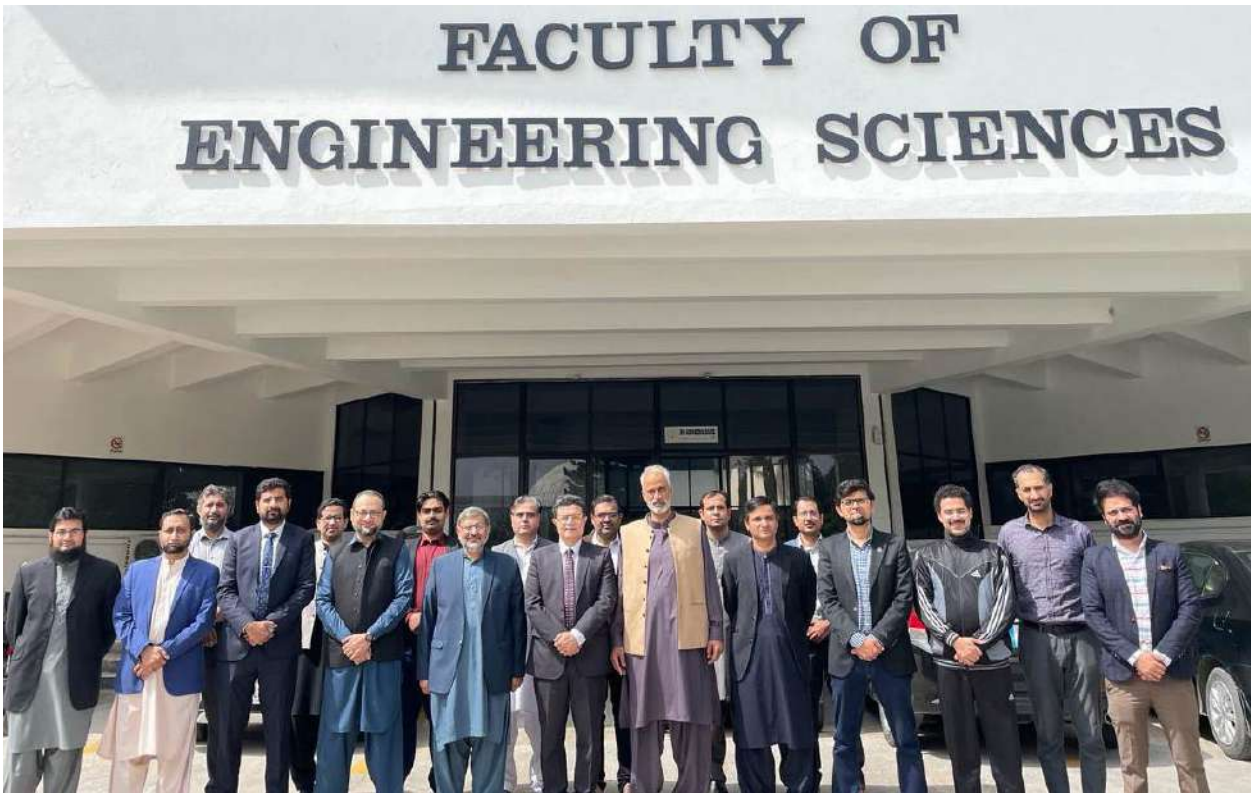
ES467 Analysis for Modeling and Simulation (3-0-3): An introduction to analysis techniques appropriate to the conduct of modeling and simulation studies. Topics include input modeling, random number generation, output analysis, variance reduction techniques, and experimental design. In addition, techniques for verification & validation are introduced. Course concepts

are applied to real systems and data.
Pre-requisite(s): ES111

ES446 Heat Transfer and Modeling (3-0-3): Introduction and basic concepts of heat and mass transfer mechanisms and their physics, Modeling and simulation of heat and mass transfer mechanisms using the modern tools, Analysis of heat and mass transfer mechanisms using mathematical models and equations, Impacts and applications of heat and mass transfer mechanisms on humans and environment and Recent trends and innovations in the heat and mass transfer mechanisms.
Pre-requisite(s): MT102

ES447 Financial Engineering Models (3-0-3): Corporate finance and financial evaluation, financial statements modeling, building a pro forma model, portfolio models, calculating efficient portfolios, efficient portfolios without short sales, portfolio optimization, the binomial option pricing model, the Black-Scholes model, immunizing strategies, modeling the term structure, Monte Carlo methods, simulating stock prices, Monte Carlo simulations for investments, simulating options and option strategies and Monte Carlo methods for option pricing.
Pre-requisite(s): ES441

ES481 and ES482 Senior Design Project Part - I and II (0-18-6): The aim of this course is to sharpen the skills of the engineering science students by participating in projects that are to be identified in collaboration with the industry. Every project will be assigned a faculty advisor. The students may work independently or jointly (in small groups) on the projects. The duration of the project team is one full year. The progress will be monitored through interim presentations and reports. A final report will be due at the end of the term.



FACULTY OF MATERIALS AND CHEMICAL ENGINEERING

Introduction

The Faculty of Materials and Chemical Engineering (FMCE) is one of the six faculties at GIK Institute of Engineering Sciences and Technology. There are two departments in the faculty:

(i) Department of Materials Science and Engineering
(ii) Department of Chemical Engineering

The faculty offers both Materials Engineering and Chemical Engineering programs at undergraduate and graduate level. FMCE employs highly qualified teaching faculty from universities of international repute and possess state-of-the-art laboratories to provide students with a conducive learning experience. The faculty has a history of academic achievements, which is manifested by commitment to excellence in teaching and pursuance of high-quality research that addresses multidisciplinary challenges.

Department of Materials Science and Engineering

Engineers create the world that never had been and all of it is not possible without advancement in materials engineering. Materials Engineering is a challenging, rewarding, and highly respected profession and is regarded as one of the broadest engineering disciplines dealing with production, processing, characterization, selection and design of new and exotic materials for micro to nanoscale applications. It encompasses metals, alloys, ceramics, semiconductors, polymers, glasses, composites, biomaterials and recently developed nanomaterials. Typical job functions of materials engineers include selection and designing of various classes of materials, developing innovative structures through advanced manufacturing processes, corrosion and failure analysis and characterization of materials and nanostructures.

Talented faculty with international qualifications has been hired and state of the art materials synthesis and characterization equipment like Atomic Force Microscope (AFM), Nanoindenter, Thermomechanical Analyzer (TMA), Simultaneous Thermal Analyser (TGA/DSC), Magnetron Sputtering unit, Scanning Electron Microscope (SEM), X-ray Diffractometer (XRD), latest Computerized Potentiostat and lab scale Electric Arc furnace, Heat treatment box and tube furnaces, Vacuum oven, Hot Iso-Static Press (HIP), Cold Iso-Static Press (CIP) Hydrothermal Reactor (~1100 °C) Probe Sonicator, Spin Coater, Programmable dip coater, Doctor Blade Coater/Tape Casting Unit etc. are available to provide practical hands-on experience to support teaching and research in specialized areas of Nanotechnology and Manufacturing of materials.

Materials graduates are engaged in a very wide range of industries, not only the materials production but also manufacturing industries, where materials are becoming an increasingly important factor in terms of the competitive edge of many advanced applications such as in transportation, health care, energy production, biomedical engineering, and aerospace industry. Mechanical, thermal, electrical, magnetic, optical and chemical properties of materials are continuously being improved by materials engineers globally which in turn leads to improvements in our lifestyle.

Thrust Areas

Materials processing, manufacturing and characterization, surface engineering and coating technology, advanced engineering materials, materials for energy conversion and storage, nanotechnology and nanomaterials, polymers, ceramics and composites, biomaterials, corrosion and degradation.

Faculty list

Fazal Ahmad Khalid SI, DPhil (University of Oxford, UK)
Fahd Nawaz Khan, PhD (University of Northumbria, New Castle upon Tyne)
Muhammad Imran Khan, PhD (University of Tsukuba, Japan)
Ramzan Abdul Karim, PhD (Politecnico di Torino, Torino, Italy)
Rashid Ali, PhD (University of Roma Tre, Rome, Italy)
Syed Zameer Abbas, PhD (GIK Institute, Pakistan)
Shanza Rehan, PhD (UST, Daejeon, South Korea)

Faculty of Materials and Chemical Engineering

Dr Mohsin Ali Marwat, PhD (Hauzhong University, China)
Hamza Mohsin, PhD (Ecole Polytechnique, IP Paris)
Tauheed Shehbaz, PhD (GIK Institute, Pakistan)
Muhammad Umair Naseer MS (SKOLTECH, Moscow, Russia)

Lab Engineer and Graduate Assistant List

Lab Engineers

Huzaifa Asif, MS Engg (GIK Institute, Topi, Pak)
Yousaf Haroon, BS Engg (GIK Institute, Topi, Pak)
Areeb Ahmed, BS Engg (GIK Institute, Topi, Pak)
M. Jawad Arif, BS Engg (GIK Institute,Topi, Pak)
Usama Raja, BS Engg (IST Islamabad, Pak)

Graduate Assistants

Rida Batool Naqvi, MS Engg (GIK Institute, Topi, Pak)
Urooj Beenish, MS Engg (GIK Institute, Topi, Pak)
Ali Ahsan, MPhil (COMSAT Lahore, Pak)
Irshad Ali, MS (Peshawar University, Pak)
S. M. Abdullah, BS Engg (IST Islamabad, Pak)
Esha Ghazanfar, BS Engg (IST Islamabad, Pak)
M. Ashmeel Rafi, BS Engg (GIK Institute, Topi, Pak)
Haleema Saadia, MS (COMSAT Wah Cantt Pak)
M. Arqam Karim, BS Engg (NUST Islamabad, Pak)
Muhammad Tariq, BS Engg (NED Karachi, Pak)
Anusha Arif, BS Engg (PIEAS Islamabad, Pak)
Areeba Sajid, MS (Peshawar, Pak)
Lyba Siddiqui, MS (Baluchistan, Pak)
Shayan Ahmad, MS (AWKUM, Mardan Pak)

Personal Secretary or Personal Assistant

Mohajir Shah, MA (Peshawar University, Pak)

Faculty Mission

The faculty strives to train and educate students in the fields of Materials Science & Engineering and Chemical Engineering for their future role to contribute in academia, research, business and industry.

Mission of Department of Materials Science and Engineering

The mission of the department of materials science and engineering is to develop and disseminate the understanding of structure, property, processing and performance of materials so that our graduates could lead and excel in academia, research, business and industry in ethical and professional manner.

Materials Engineering Undergraduate Program

The department offers a four-years BS in Materials Engineering degree program with specialization in Nanotechnology or Manufacturing based on theory and laboratory work. The first two years in the program are devoted to establishing a sound foundation in mathematics, science and basic engineering. The final two years establish the structure-processing-properties relationships for all the major classes of materials. Specialization tracks and combination of electives allow a student to develop concentration in a particular area of materials. A final year design project (FYDP) serves as a capstone design experience for the program.

The BS program in Materials Engineering has a very favorable student/faculty ratio and students have significant personal interaction with the faculty. To sustain the quality of teaching, outcome-based education (OBE) system has been in place is since fall 2014 and the engineering program curriculum is frequently updated and internationally benchmarked after consultation with academia and industry representatives.

Table 1: Knowledge profiles of various courses offered in Materials Engineering program

	Description	Courses
WK1	Natural Sciences	Applied Physics, Applied Chemistry and Environment, Materials Chemistry.
WK2	Mathematics and Computing	Calculus I, Differential Equations and Linear Algebra I, Calculus II, Object Oriented Programming and Design, Object Oriented Programming and Design Lab, Computing and AI Lab, Python Programming and Free-Lancing Essentials, Probability and Statistics, Engineering Economics, Numerical Analysis. Computational Tools in Materials Science Lab
WK3	Engineering Fundamentals	Materials and Nanotechnology, Applied Electrical Engineering, Thermodynamics of Materials, Materials Evaluation Techniques & instrumentation, Phase Equilibria and Microstructure, Alloy Production and casting design, Strength of Materials, X-Ray Diffraction and electron microscopy, Heat treatment and Processing, Deformation and Fracture, Polymer and Composite, Ceramics and Glasses, Corrosion Degradation and Protection, Materials Characterization, Mineral Processing & Extractive Metallurgy.
WK4	Engineering Specialization	Joining of Materials, Manufacturing Processes - I, Manufacturing Processes - II, Smart and Functional Materials, Nanomaterials and Nanotechnology - I, Nanomaterials and Nanotechnology – II, Electronic and Magnetic Materials, Nano-systems and Devices, Nanotechnology for Energy, Surface Engineering, Advanced Materials, Automobile Engineering and Materials, Biomaterials.
WK5	Engineering Design	Casting Design and Foundry Technology, CAD/CAM, Finite Element Methods, Standards and Quality Assurance
WK6	Engineering Practice	Applied Physics Lab, Innovation and Makers Lab I, Innovation and Makers Lab II, Occupational Health and Safety, Materials and Nanotechnology Lab (Materials Lab I), Materials Labs II, III, IV, V, VI, VII and VIII.
WK7	Research Literature	Senior Design Project - I, Senior Design Project – II.

Program Educational Objectives

Program Educational Objectives (PEOs) are extensive statements that define what graduates are likely to achieve within three to four years after graduation.

PEO-1: Pursue successful career in industry, research organizations, academia and allied professions.

PEO-2: Demonstrate creativity and innovation in addressing engineering problems in a sustainable way.

PEO-3: Use leadership, entrepreneurial and team working skills in an ethical and professional manner.

Program Learning Outcomes (PLO's)

Program Learning Outcomes are measurable expectations and anticipated outcomes. A comprehensive and well developed list provides information about student learning, curriculum and teaching. Assessing or measuring learning outcomes can inform the institution about the educational environment. The twelve graduate attributes provided by the Pakistan Engineering Council (PEC) as per Manual of Accreditation 2019 have been adopted by the Department of Materials Science and Engineering, GIK Institute, as the PLOs for its Bachelor in Materials Engineering Program. It is ensured that these PLOs are achieved by respective CLOs of Materials Engineering curriculum as assessed through both direct and indirect methods.

PLO-1: Engineering Knowledge

Students shall have the ability to apply knowledge of mathematics, science, engineering fundamentals and materials engineering specialization to the solution of complex engineering problems.

PLO-2: Problem Analysis
Students shall have the ability to identify, formulate, research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences and engineering sciences.

PLO-3: Design/Development of Solutions
Students shall have the ability to design solutions for complex engineering problems and design systems, components or processes that meet specified needs with appropriate consideration for public health and safety, cultural, societal, and environmental considerations.

PLO-4: Investigation
Students shall have the ability to investigate complex engineering problems in a methodical way including literature survey, design and conduct of experiments, analysis and interpretation of experimental data, and synthesis of information to derive valid conclusions.

PLO-5: Modern Tool Usage
Students shall have the ability to create, select and apply appropriate techniques, resources, and modern engineering and IT tools, including prediction and modelling, to complex engineering activities, with an understanding of the limitations.

PLO-6: The Engineer and Society
Students shall have ability to apply reasoning informed by contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to professional engineering practice and solution to complex engineering problems.

PLO-7: Environment and Sustainability
Students shall have the ability to understand the impact of professional engineering solutions in societal and environmental contexts and demonstrate knowledge of and need for sustainable development.

PLO-8: Ethics
Students shall have the ability to apply ethical principles and commit to professional ethics and responsibilities and norms of engineering practice.

PLO-9: Individual and Teamwork
Students shall have the ability to work effectively, as an individual or in a team, on multifaceted and /or multidisciplinary settings.

PLO-10: Communication
Students shall have the ability to communicate effectively, orally as well as in writing, on complex engineering activities with the engineering community and with society at large, such as being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.

PLO-11: Project Management
Students shall have the ability to demonstrate management skills and apply engineering principles to one's own work, as a member and/or leader in a team, to manage projects in a multidisciplinary environment.

PLO-12: Lifelong Learning.
Students shall have the ability to recognize importance of, and pursue lifelong learning in the broader context of innovation and technological developments.

Career in Materials Engineering
Most of our graduates are hired by national and multinational research/academic institutions and industry within one year of graduation. They are also well prepared for graduate work so that they can choose to continue their education leading to MS and PhD degree. More specifically, our engineers are employed in a broad range of technical areas such as national research organizations and industries, multinational companies, and academia. Private organizations and engineering consultancy companies also hire a significant number of GIKI materials graduates for their ongoing projects. A considerable number of our graduates have chosen to become successful entrepreneurs of Pakistan in their respective fields.

Laboratories
The department houses modern engineering laboratories comprising of state of the art equipment material synthesis and characterization like scanning electron microscope, X-ray diffractometer, simultaneous thermal analyzer, nanoindenter and atomic force microscopy,

metallography and optical microscopes, thin film units, nano-synthesis and corrosion testing, mechanical testing equipment, heat treatment furnaces, mechanical workshop, melting and casting facilities.

Course Work Requirements

For BS in Materials Engineering a student must complete the following requirements as per details given in Table a-g.

(a) General Education Requirements (54 Credit Hours)

Course Title	Course Code	CH
Basic Engineering	IF101, IF102, EE213, CH161	6
Sciences	PH101, PH101L, CH101, MM101, MM201	11
Computing	CS101, CS112, CS112L, AI102L	8
English Language	HM101, HM102	6
Humanities	HM211, HM322, HM321, HM323, HM212	9
Management	MS291	2
Mathematics	MT101, MT102, MT202, ES341	12

(b) Core Requirements (52 Credit Hours)

Course Title	Course Code	CH
Materials and Nanotechnology	MM101	2
Thermodynamics of Materials	MM231	3
Materials Evaluation Techniques & Instrumentation	MM212	3
Phase Equilibria and Microstructures	MM232	3
Strength of Materials	MM222	3
Alloy Production and Casting Design	MM233	3
Mineral Processing and Extractive Metallurgy	MM214	2
X-Ray Diffraction and Electron Microscopy	MM323	3
Heat Treatment and Processing	MM334	3
Deformation and Fracture	MM324	3
Polymers and Composites	MM365	3
Ceramics and Glasses	MM362	3
Corrosion Degradation and Protection	MM435	3
Senior Design Project	MM481, MM482	6
Laboratory Sessions (Materials Labs I to VII)	MM141L, MM242L, MM243L, MM344L, MM345L, MM446L, MM447L, MM244L	9

(c) Specialization Requirement in Manufacturing (15Credit Hours)

Course Title	Course Code	CH
Joining of Materials	MM351	3
Manufacturing Processes-I	MM352	3
Manufacturing Processes-II	MM451	3
CAD/CAM	M M453/ME418	3
Entrepreneurship and Marketing	MS434	3

(d) Specialization Requirement in Nanotechnology (15Credit Hours)

Course Title	Course Code	CH
Nanomaterials and Nanotechnology-I	MM391	3
Nanomaterials and Nanotechnology-II	MM392	3
Materials Characterization	MM494	3
Nanosystems and Devices	MM495	3
Nanotechnology for Energy	MM499	3

(e) Technical Elective (06 Credit Hours)

Course Title	Course Code	CH
Manufacturing Processes I (Elective Nano-technology)	MM352	3
Nanomaterials and Nanotechnology I (Elec-tive Manufacturing)	MM391	3
Smart and Functional Materials	MM453	3
Electronic and Magnetic Materials	MM463	3
Casting Design and Foundry Technology	MM416	3
Surface Engineering	MM436	3
CAD/CAM	MM453/ME418	3
Powder Metallurgy	MM454	3
Finite Element Methods	MM455	3
Nuclear Materials	MM464	3
Nanostructured Materials	MM467	3
Automobile Engineering and Materials	MM469	3
Standards and Quality Assurance	MM472	3

Materials Characterization	MM494	3
Nanosystems and Devices	MM495	3
Advanced Materials	MM496	3
Biomaterials	MM497	3
Electronic and Magnetic Materials	MM393	3

(f) Management Elective (06 Credit Hours)

Course Title	Course Code	CH
Fuel and Energy Management	MM479	3
Technology Management	MS498	3
Operations Management	MS492	3
Industrial Safety	MS493	3
Total Quality Management	MS494	3
Maintenance Management	MS495	3
Project Management	MS496	3
Lean Enterprise Management	MS489	3
Human Resource Management	MS412	3
Supply chain Management	MS491	3
Entrepreneurship and Marketing	MS434	3
Industrial Management	MS449	3

(g) List of Laboratory Courses in Each Semester (09 Credit Hours)

Course Title	Course Code	CH
Materials and nanotechnology Lab (Lab-1)	MM141L	1
Materials Lab-II	MM 242L	1
Materials Lab-III	MM243L	1
Computational tools in Materials Science	MM244L	1
Materials Lab-IV	MM344L	2
Materials Lab-V	MM345L	1
Materials Lab-VI	MM446L	1
Materials Lab-VII	MM447L	1

(h) Summer Internship (Pass/Fail)

As a mandatory requirement from PEC, every student is required to participate in a summer internship program (eight weeks) during the summer of their third year and submit a formal written report along with a presentation at the end of the internship period.

(i) Total Credit Requirements

For the award of BS degree in Materials Engineering, a student must complete 133 credit hours.

Degree Plan

The first four semesters are common for both Manufacturing and Nanotechnology streams. In the last four semesters there are specialization, elective and common courses.

	Course Code	Course Title	Lec. Hrs	Lab. Hrs	CH	Pre-req	Co-req
1st Semester	CH101	Applied Chemistry and Environment	2	0	2	None	None
	CH161	Occupational Health and Safety	1	0	1	None	None
	CS101	Computing and AI	2	0	2	None	CS101L
	CS101L	Computing and AI Lab	0	3	1	None	None
	HM101	Communication Skills	1	6	3	None	None
	IF101	Innovation and Makers Lab I	0	3	1	None	None
	MT101	Calculus I	3	0	3	None	None
	MM101	Materials and Nanotechnology	2	0	2	None	None
	MM141L	Materials and Nanotechnology Lab I	0	3	1	None	MM101
	Total		**12**	**15**	**16**		

	Course Code	Course Title	Lec. Hrs	Lab. Hrs	CH	Pre-req	Co-req
2nd Semester	CS112	Object Oriented Programming and Design	2	0	2	None	None
	CS112L	Object Oriented Programming and Design Lab	0	3	1	None	CS112
	AI102	Python Programming and Free Lancing Essentials	0	3	1	None	None
	ES111	Probability and Statistics	3	0	3	MT101	
	HM102	Critical Thinking and Expository Writing	1	2	3		
	IF102	Innovation and Makers Lab II	0	3	1		
	PH101	Applied Physics	3	0	3		
	PH101L	Applied Physics Lab	0	3	1		PH101
	MT102	**Differential Equations and Linear Algebra I**	**3**	**0**	**3**	MT101	
	Total		**12**	**14**	**18**		

	Course Code	Course Title	Lec. Hrs	Lab. Hrs	CH	Pre-req	Co-req
3rd Semester	MT202	Calculus II	3	0	3	MT102	
	MM212	Materials Evaluation Techniques and instrumentation	3	0	3	MM101	
	MM231	Thermodynamics of Materials	3	0	3		
	MM214	Mineral Processing and Extractive Metallurgy	2	0	2		
	EE213	Applied Electrical Engineering	3	0	3	MT101	
	HM211	Islamic Studies	2	0	2		
	ME245	Materials Lab II	0	3	1	MM101	
	Total		**16**	**3**	**17**		

	Course Code	Course Title	Lec. Hrs	Lab. Hrs	CH	Pre-req	Co-req
4th Semester	MM232	Phase Equilibria and Microstructures	3	0	3	MM231	
	MM222	Strength of Materials	3	0	3		
	MM233	Alloy Production and Casting Design	3	0	3	MM101	
	MM201	Materials Chemistry	3	0	3		
	MS291	Engineering Economy	2	0	2		
	MM244L	Computational Tools in Materials Science	0	3	1		
	MM243L	Materials Lab III	0	3	1	MM101	
	Total		**16**	**6**	**16**		

Manufacturing Stream

	Course Code	Course Title	Lec. Hrs	Lab. Hrs	CH	Pre-req	Co-req
5th Semester	MM323	X-ray Diffraction and Electron Microscopy	3	0	3	MM101	
	MM324	Deformation & Fracture	3	0	3	MM222	
	MM334	Heat Treatment and Processing	3	0	3	MM232	
	MM351	Joining of Materials	3	0	3	MM212	
	HM321	Sociology and Human Behavior	2	0	2		
	HM323	Civics and Community Engagement	0	3	1		
	MM344L	Materials Lab IV	0	6	2	MM101	
	Total		**14**	**9**	**17**		

	Course Code	Course Title	Lec. Hrs	Lab. Hrs	CH	Pre-req	Co-req
6th Semester	MM352	Manufacturing Processes I	3	0	3	MM324	
	MM365	Polymers and Composites	3	0	3	MM101	
	MM362	Ceramics and Glasses	3	0	3	MM101	
	ES341 / CS342	Numerical Analysis	3	0	3	MT202	
	HM322	Corporate Law and Professional Ethics	2	0	2		
	HM212	Ideology and Constitution of Pakistan	2	0	2		
	MM345L	Materials Lab V	0	3	1	MM101	
	Total		**14**	**3**	**17**		

	Course Code	Course Title	Lec. Hrs	Lab. Hrs	CH	Pre-req	Co-req
7th Semester	MM345	Corrosion Degradation and Protection	3	0	3	CH101	
	MMxx	MM Technical Elective	3	0	3		
	M453 / ME418	CAD / CAM	3	0	3		
	MSxx	Management Elective	3	0	3		
	MM481	Senior Design Project-I	0	9	3		
	MM446L	Materials Lab VI	0	3	1	MM101	
	Total		**12**	**12**	**16**		

	Course Code	Course Title	Lec. Hrs	Lab. Hrs	CH	Pre-req	Co-req
8th Semester	MM451	Manufacturing Processes II	3	0	3	MM352	
	MS434	Entrepreneurship and Marketing	3	0	3		
	MM4xx	MM Technical Electives	3	0	3		
	MS4xx	Management Elective	3	0	3		
	MM482	Senior Design Project-II	0	9	3		
	MM447L	Materials Lab VII	0	3	1	MM101	
	Total		**12**	**12**	**16**		

Nanotechnology Stream

	Course Code	Course Title	Lec. Hrs	Lab. Hrs	CH	Pre-req	Co-req
5th Semester	MM323	X-ray Diffraction and Electron Microscopy	3	0	3	MM101	
	MM324	Deformation & Fracture	3	0	3	MM222	
	MM334	Heat Treatment and Processing	3	0	3	MM232	
	MM391	Nanomaterials and Nanotechnology I	3	0	3		
	HM321	Sociology and Human Behavior	2	0	2		
	HM323	Civics and Community Engagement	0	3	1		
	MM344L	Materials Lab IV	0	6	2	MM101	
	Total		**14**	**9**	**17**		

	Course Code	Course Title	Lec. Hrs	Lab. Hrs	CH	Pre-req	Co-req
6th Semester	MM392	Nanomaterials and Nanotechnology II	3	0	3	MM391	
	MM365	Polymers and Composites	3	0	3	MM101	
	MM362	Ceramics and Glasses	3	0	3	MM101	
	ES341 / CS342	Numerical Analysis	3	0	3	MT202	
	HM322	Corporate Law and Professional Ethics	2	0	2		
	HM212	Ideology and Constitution of Pakistan	2	0	2		
	MM345L	Materials Lab V	0	3	1	MM101	
	Total		**14**	**3**	**17**		

	Course Code	Course Title	Lec. Hrs	Lab. Hrs	CH	Pre-req	Co-req
7th Semester	MM435	Corrosion Degradation and Protection	3	0	3	CH101	
	MMxx	MM Technical Elective	3	0	3		
	MM494	Materials Characterization	3	0	3	MM101	
	MSxx	Management Elective	3	0	3		
	MM481	Senior Design Project-I	0	9	3		
	MM446L	Materials Lab VI	0	3	1		
	Total		**12**	**12**	**16**		

	Course Code	Course Title	Lec. Hrs	Lab. Hrs	CH	Pre-req	Co-req
8th Semester	MM495	Nanosystems and Devices	3	0	3	MM391	
	MM499	Nanotechnology for Energy	3	0	3	MM391	
	MM4xx	MM Technical Electives	3	0	3		
	MS4xx	Management Elective	3	0	3		
	MM482	Senior Design Project-II	0	9	3		
	MM447L	Materials Lab VII	0	3	1	MM101	
	Total		**12**	**12**	**16**		

Total Credit Hours: 133

Course Description

CH101 Applied Chemistry and Environment (2-0- 2): Chemistry and its industrial applications, stoichiometry, Quantitative titration, electrochemistry, batteries, corrosion and prevention, purification of silicon, polymers, fossil fuels, clean combustion, integrated gasification, Syngas from coal, green chemistry, environmental chemistry, photochemistry, acid rain, urban smog, purification of water, wastewater treatment.
Pre Req: Nil

MM101 Materials and Nanotechnology (2-0-2): Structure of crystalline materials, crystal imperfections, diffusion in solids, ceramics and composite materials, nano materials and its impact on industry, optical, electrical and magnetic properties of bulk and nanomaterials, thermal and mechanical properties of bulk and nanomaterials.
Pre Req: Nil

MM201 Materials Chemistry (3-0-3): Solutions, colloids, emulsions, surfactants, lattice energy, intermolecular forces, solvents, ionic liquids, electronic structure of transition metals, inter-metallic compounds, non stoichiometric compounds, polymerization, biological molecules, nano-chemistry, interaction between radiation and molecules, corrosion, preparation of large single crystal, zone refining, cooling mixtures, quantum theory.
Pre Req: Nil

MM212 Materials Evaluation Techniques and Instrumentation (3-0-3): Evaluation and quality assurance, standard specifications of materials, tensile and compression test, bend test, hardness tests, shear and torsion tests, sheet metal testing, impact testing, fatigue and creep testing, visual inspection (VT), liquid penetrant test (LPT), radiographic examinations (RT), magnetic particles inspection (MPI), ultrasonic testing (UT), Optical Microscopy, Thermal analysis, and Instrumentation.
PreReq:MM101

MM222 Strength of Materials (3-0-3): Normal and shear stress and strains, simple loading, tension, torsion and bending, true stress & true strain, elastic vs plastic behavior, deformation under axial loading, stress-strain in circular shaft, shear force & bending moment diagram, moment of a force & inertia, symmetric members in pure bending, shear force and bending moment diagram, design of prismatic beam for bending, transformation of stress and strain, failure theories.
Pre Req: Nil

MM231 Thermodynamics of Materials (3-0-3): First law of thermodynamics, reversible and irreversible processes, statistical thermodynamics, partition function, Second law, Third law, heat engines, Maxwell relations, Gibbs and Helmholtz free energies, Vant Hoff's isotherm, behavior of gases, ideal and non-ideal solutions, chemical equilibria, activity/fugacity and chemical potential, gas-solid equilibria, Ellingham diagrams, phase equilibria (single and multicomponent systems).
Pre Req: Nil

MM214 Mineral Processing and Extractive Metallurgy (2-0-2): Importance, significance, and Classification of minerals, Mineral resources in Pakistan, Comminution of ores, gravity and magnetic concentration techniques, Froth Flotation and selective flocculation, general extraction processes for nonferrous metallic ores such as Ti, Al, Mg, Ni, Li, Cu, Ag and others.
Pre Req: CH101

MM232 Phase Equilibria and Microstructures (3-0-3): Free energy, solid solution, Gibbs phase rule, one-component diagram, phase diagrams of isomorphous and eutectic systems, Eutectoid and peritectic reactions. congruent phase transformations, Iron-Iron carbide phase diagram, precipitation, ternary phase diagrams, homogenous and heterogeneous nucleation, kinetics of phase transformations, diffusional and diffusionless transformations.
Pre Req: MM231

MM233 Alloy Production and Casting Design (3-0-3): Types of patterns and cores, testing of molding sands, molding processes and materials, casting techniques, gating system design, melting furnaces, solidification of pure metals and alloys, casting defects, steel and cast iron production, charge calculations, Ellingham diagram, centrifugal casting, metallurgy of cast iron, modern foundries, finishing operations.
Pre Req: MM101

MM244L Computational Tools in Materials Science Lab (0-3-1): Python using various mathematical algorithms, data sorting and its graphical representation, designing of dashboard, use of origin, engineering analysis of melting and casting, histogram data plotting techniques etc., ANSYS workbench for mechanical, thermal, and electrical analysis, casting simulation using SolidCast.

MM323 X-Ray Diffraction and Electron Microscopy (3-0-3): Atomic packing and crystal systems, group symmetries, zone axis, reciprocal lattices, X-ray diffraction of polycrystalline materials and analysis of results, stereographic projections, Scanning Electron Microscopy, imaging modes, EDX and WDX, Transmission Electron Microscopy, Electron diffraction, Dark Field and Bright Field Imaging, High Resolution TEM.
Pre Req: MM101

MM324 Deformation and Fracture (3-0-3): Elastic and plastic deformations, 2D and 3D stress and strain, generalized Hooke's law, anisotropy of elasticity, dislocation and its types, mechanisms of deformation, twinning, strain hardening, strengthening mechanisms, creep and fatigue, Theories of fracture and fractography, fracture mechanics, stress corrosion cracking, failure analysis.
Pre Req: MM222

MM334 Heat Treatment and Processing (3-0-3): Fe-Fe_3C Phase diagram, kinetics of transformation, IT, CCT and TTT diagrams, formation and morphologies of phases in steel, HT defects and remedies, quenching rates and media, hardenability, surface hardening and modification processes, HT of HSLA and microalloyed steels, stainless steels and tool steels, heat treatment equipment.
Pre Req: MM232

MM351 Joining of Materials (3-0-3): Joining types, joint design, fastener types and their uses. Adhesive types and joints, preparation and testing. Principles of soldering and brazing, types, fillers, fluxes, applications and joints. Fusion and non-fusion welding processes, defects and tests, microstructure and defects in welds, variant and hybrid joining processes.
Pre Req: MM212

MM352 Manufacturing Processes-I (3-0-3): Manufacturing principles, processing, and materials: review and classification and properties. Engineering materials in manufacturing. Forging, rolling, extrusion, drawing of rods, wires and tubes, sheet metal forming, machining of metals and alloys, machining operations and tools, machining and turning centers, machining operations for special geometries, high-speed machining.
Pre Req: MM324

MM362 Ceramics and Glasses (3-0-3): Silicates and clay minerals, powder production and its characterization, traditional ceramics and their processing, glazing, sintering, RBS, SPS, HIPING, refractories, sintering kilns, silicon carbide, silicon nitride, sialon, bioceramics, piezo ceramics and biomimetics, cement, glass-ceramics, glass and its processing, optical fibers, characterization of glasses and ceramics.
Pre Req: MM101

MM365 Polymers and Composites (3-0-3): Polymer types and application, polymerization and kinetics, molecular weight, structure and morphology, transition temperatures, mechanical properties, and processing. Composites classification, applications, matrices and reinforcements, testing of composites, production of fibers, MMCs, CMCs, PMCs, processing and applications of carbon-carbon composites, mechanics of composites.
Pre Req: CH101 & MM101

MM391 Nanomaterials & Nanotechnology I (3-0-3): Introduction to nano science and nanotechnology, physical chemistry of solid surfaces, surface energy, electrostatic and steric stabilization, zero dimensional nanostructures, one dimensional nanostructure, template-based synthesis, two dimensional nanostructures. Thin film, three-dimensional nanostructures: nano-carbons, fullerenes, CNTs and graphene, core shell nanostructures, nanomaterials hazards and safety procedures.
Pre Req: Nil

MM392 Nanomaterials & Nanotechnology- II (3-0-3): Nanotechnology and prospects for business and industry, nano materials characterization methods, nano fabrication methods, nanometrology, nano electronics, nano optics, nano structure and nanofilms, nanocatalysis, nanobiotechnology, biomimetics, medical nanotechnology, environmental nanotechnology, societal implications of nano.
Pre Req: MM391

MM453 Smart and Functional Materials (3-0-3): Shape memory materials, superelastic materials, magnetic shape memory alloys, photomechanical materials, self-healing materials, superhard materials, piezoelectric materials, thermo-electric materials, magnetostrictive materials, functionally graded materials, chromogenic systems, electro-active polymers, temperature responsive polymers Self-healing materials, hydrophobic/hydrophilic materials, functional HEAs and BMGs.
PreReq: Nil

MM435 Corrosion Degradation and Protection (3- 0-3): Corrosion classification, electrochemical theory and thermodynamics of corrosion, Nernst equation, Pourbaix diagrams. Faraday's laws, corrosion rate determination. Electrode kinetics, polarization, mixed potential theory, passivity. Corrosion prevention. electrochemical corrosion testing. Cathodic/Anodic protection, coatings and inhibitors, synergistic mixtures, design considerations, corrosion of ceramics and degradation of polymers.
PreReq:CH101 &MM231

MM 436 Surface Engineering (3-0-3): TLK model, surface defects and crystallography, adsorption, physisorption, and chemisorption, contact mechanisms, wear in

DANYA GANDAPUR
SENIOR YEAR

In the world of materials engineering, gender is no barrier to success. As a woman in STEM, I've discovered that perseverance and self-belief are the keys to overcoming any obstacle. The unwavering support from our faculty has been instrumental in nurturing my passion for materials science. Through engaging lectures and hands-on lab sessions, I've gained invaluable knowledge and practical skills that have prepared me for the challenges ahead. With each experiment and discovery, I've grown more confident in my ability to contribute meaningfully to the field. My journey reaffirms that women play a pivotal role in shaping the future of STEM disciplines. In materials engineering, as in life, the sky is truly the limit when one embraces determination and resilience.

tribocontacts, residual stresses and measurement, friction surfacing, gas- spraying. Electrolytic, electrophoretic and electroless deposition. Anodizing, phosphating, HVOF, plasma spraying, CVD, PECVD, PVD, hybrid processes, adhesion & scratch testing, surface acoustic wave spectroscopy, impact excitation.
Pre Req: MM101

MM451 Manufacturing Processes-II (3-0-3): Component design, non traditional and machining, manufacturing operations, group technology, chemical machining, electro-chemical machining, electric discharge machining, laser and electron beam machining, sawing, flexible Automation, sensors and actuators, materials handling and storage, quality control systems, agile manufacturing, assembly techniques, rapid prototyping, micro and nano fabrication, lithography.
Pre Req: MM352

MM453/ME418 CAD/CAM (3-0-3): Geometric modelling, CAD hardware and software, 2D and 3D graphics, assembly modelling and analysis, concurrent engineering, axiomatic design, DFM, DFA, group technology, CE tools, manual, variant, generative and hybrid approaches, cellular and JIT manufacturing, NC programming, CNC, DNC, robotics, CIM, Creo based labs - design, assembly and manufacturing.
Pre Req: Nil

MM455 Finite Element Methods (3-0-3): Computational modeling and applications of FEM, finite element modeling, Computer programs for FEM, direct stiffness method, potential energy approach, plane stress, plane strain and axisymmetric elements, thermal and structural analysis. Use of ANSYS. SolidCast - Casting design, solidification simulation. Microstructure-based modeling (OOF-open source), statistical modeling and regression analysis.
Pre Req: Nil

MM463 Electronic and Magnetic Materials (3-0- 3): Introduction to magnetic materials, diamagnetism, paramagnetism, ferromagnetism, anti-ferromagnetism, ferrimagnetism, domains and the magnetization process, soft magnetic and hard magnetic materials and their applications, electronic materials, elementary quantum physics, semiconductors and devices, processing and packaging of devices.
Pre Req: Nil

MM469-Automobile Engineering and Materials (3-0-3): Introduction to automobiles (layout and components, engine, chassis frame and body, wheels and tyres etc.) Materials for automotive body structures, advanced materials automotive structures (advanced steels, aluminum and magnesium alloys, polymers and composites etc.). Manufacturing and design of lightweight automotives. Corrosion, protection and recycling of the automotive structures.
Pre Req: Nil

MM494 Materials Characterization (3-0-3): Physical characterization of materials, particle size distribution by laser diffraction, dynamic light scattering, centrifugal sedimentation, BET specific surface area, laser confocal fluorescence microscopy, NSOM and STED, Ion milling, FIB, AFM and STM, chemical spectroscopy of materials by XRF, EDX, WDX, XPS/AES, FTIR, Raman spectroscopy, Nano-indentation.
Pre Req: MM101

MM495 Nanosystems and Devices (3-0-3): Microtechnological foundations, clean room technology, components, operation and maintenance, preparation of nanostructures, nanotechnical structures, nanotransducers, technical nanosystems, NEMS and MEMs, nanodiodes, nanotransistors, nanoswitches, nanomagnets, nanostructures as optical sensors.
Pre Req: MM391

MM496 Advanced Materials (3-0-3): Review of engineering materials, advanced materials requirement and applications, shape memory alloys (SMA): thermally activated and magnetic, magnetostrictive and piezoelectric materials, intermetallics, bulk metallic glasses, modern steels, functionally graded materials, super alloys, Ti alloys, advanced Coatings and composites, metallic foams, biomaterials.
Pre Req: MM101

MM497 Biomaterials (3-0-3): Materials for biomedical applications, types, synthesis and fabrication. Materials for production of hip joints, prostheses, and implants, surface properties and cells interaction, Hydroxyapatite (HA) surface coatings, dental materials, biocompatibility, polymers and bio-composites for tissue engineering, next generation biomaterials and emerging manufacturing technologies.
Pre Req: MM101

MM499 Nanotechnology for Energy (3-0-3): Nanotechnology in clean and renewable energies: solar cells and thin film photovoltaics, nanotechnologies in rechargeable batteries: Li- ion batteries, Li-Polymer batteries, energetic materials, nanotechnologies in thermoelectricity, fuel cells and supercapacitors, nanotechnology in hydrogen production and storage, energy sustainability, green nanofabrication, safety and economics.
Pre Req: MM391

IBRAHIM MUHAMMAD
SENIOR YEAR

Being in my final year as an undergraduate student at Ghulam Ishaq Khan Institute, studying Materials Science has been an enriching journey. The sense of community here is palpable; I've found not just mentors in my professors, but friends among my peers who share my passion for innovation. The hands-on approach to learning, coupled with access to cutting-edge technology, has not only expanded my understanding of materials science but has also fostered a sense of curiosity and creativity within me. GIK Institute isn't just a place of education; it's become a second home where I've grown both academically and personally, and I'm excited to see where this journey takes me beyond graduation.

Laboratory Courses:

MM141L Materials and Nanotechnology Lab: The complementary laboratory course to the MM102 theory course. Experiments and demonstrations to give a basic understanding of the structure and properties of materials at macro, micro and nanoscale and an introduction to their fabrication and testing.
Pre Req: Nil

MM242L Materials Lab-II (0-3-1): Experiments using some of the main techniques for the destructive and non-destructive evaluation of materials.
Pre Req: MM101

MM243L Materials Lab-III (0-3-1): Experiments Involving casting of different metallic materials and optical microscopic techniques for the study and evaluation of microstructure of materials.
Pre Req: MM101

MM344L Materials Lab-IV (0-6-2): Exercises concerning crystallography, and experiments demonstrating the use

of XRD. Experiments to examine the effect of processing parameters and phase transformations on steels and other alloys. Also includes experiments related to joining of materials through various techniques. Synthesis and characterization of nanomaterials is also a part of this lab course.
Pre Req: MM101

MM345L Materials Lab-V (0-3-1): Experiments related to polymers, composites and their properties, mechanical working, synthesis of nanomaterials and thin films are included in this lab.
Pre Req: MM101

MM446L Materials Lab-VI (0-3-1): Experiments related to surface engineering, characterization of materials using advanced techniques, corrosion testing & analysis and case studies.
Pre Req: MM101

MM447L Materials Lab-VII (0-3-1): Experiments related to powder metallurgy, advanced materials, semiconductor and energy storage devices.
Pre Req: MM101

Senior Design Project:

MM481 Senior Design Project I
Students form small groups and select a project (research or industrial) under supervision of a faculty member. The problem is identified and stated. Objectives are defined and literature survey is carried out. Experimentation/ survey and characterization is done. Two presentations of the projects are held in the semester.

MM482 Senior Design Project II
In continuation of MM481, further experimentation/ survey and characterization is performed as required. The group writes a report that is submitted at the successful completion of the course. Progress is monitored through presentation and poster sessions. Students are encouraged to make a display and present their achievements.

Department of Chemical Engineering

Welcome to the Department of Chemical Engineering (DChE) at GIK Institute, where we blend a rich history with forward-looking innovation. Established in 2012, DChE has consistently upheld academic excellence and nurtured a culture of innovation. With the graduation of 09 batches of skilled individuals, our department stands as a testament to producing professionals well-prepared to excel in their chosen fields.

Rooted in tradition yet embracing the future, the curriculum is carefully designed to equip students with a comprehensive understanding of core principles and practical skills vital for addressing contemporary challenges in chemical engineering. Major courses such as Heat and Mass Transfer, Fluid Mechanics, Thermodynamics, Reaction Engineering, and Process Control form the cornerstone of the educational approach.

As we look towards the future, the department remains committed to staying abreast of new emerging developments in the field. Faculty members, esteemed for their research contributions, actively mentor and guide students, fostering a culture of critical thinking and innovation. State-of-the-art laboratories and research facilities complement classroom learning, providing hands-on experience with cutting-edge technologies.

In recognition of industry relevance, DChE has forged strong partnerships with leading organizations such as Fatima Fertilizer, Fauji Cement, Engro Fertilizers, OGDCL, LCI, PARCO and Attock Oil Refinery. These collaborations offer students invaluable opportunities for internships, industrial projects, and exposure to real-world challenges, ensuring they are well-prepared for diverse career paths in industries such as petrochemicals, pharmaceuticals, energy, and environmental engineering.

Furthermore, the department encourages participation in extracurricular activities and industry-led initiatives to broaden students' horizons and enhance their skillsets. As graduates, students emerge as confident professionals ready to make impactful contributions to society.

With a steadfast focus on innovation, sustainability, and shaping a better future, the Department of Chemical Engineering invites individuals to embark on a transformative educational journey and explore the boundless possibilities of the field. Welcome to our community!

Thrust Areas:

Energy & Sustainable Development, Process Modeling & Simulation, Separation Processes & Reaction Engineering, Carbon Capturing & Utilization, Nanotechnology, Polymer Engineering, and Polymer-based Materials.

HOD

Prof. Dr. Javaid Rabbani Khan
PhD Chemical Engineering
University of New Castle upon Tyne, UK

Faculty:

- Prof. Dr. Javaid Rabbani Khan (HoD), PhD Chemical Engineering (University of New Castle upon Tyne, UK)
- Sajjad Hussain, PhD (University of Sao Paulo, Brazil),
- Hammad Amjad Khan, PhD Environmental Engineering (Hanyang University, South Korea)
- Muhammad Shozab Mehdi, PhD Chemical Engineering (PIEAS, Pakistan)
- Khurram Imran Khan, PhD Chemical Engineering (Politecnico di Torino, Italy)
- Muhammad Usman Farooq, PhD Chemical Engineering, (University of Waterloo, Canada)
- Ramesha Tariq, MS Chemical Engineering (UET Lahore, Pakistan)
- Abdul Wahab, MS Chemical Engineering (GIK Institute, Pakistan)
- Hamza Nasir, MSc Advanced Chemical Engineering (University of Strathclyde, UK)
- Fazal Wahab, MS Chemical Engineering (GIK Institute, Pakistan)

Lab Engineers:

- Sahibzada Mansoor , BS, GIK Institute
- Amina Bibi, BS, UET Peshawar
- Abdullah Shakil, BS, PIEAS, Islamabad

Graduate Assistants:

- Iqra Yasmin, MS, CUI, Lahore
- Sundas Khusnood, MS, NUST, Islamabad
- Kamran Alam, MS, US-PCASE, UET Peshawar
- Muhammad Umar, MS, GIK Institute
- Shafiq Uz Zaman, MS, CUI, Lahore
- Arsalan Maqbool, MS, NUST, Islamabad

Personal Secretary to HoD:

- Mr. Asad ur Rehman

BS in Chemical Engineering Program:

The BS in Chemical Engineering program provides students with a thorough comprehension of chemical processes and their diverse applications across industrial sectors. Our vision is to cultivate skilled engineers who can address global challenges responsibly, while fostering innovation, ethical leadership, and a commitment to lifelong learning. Emphasizing experiential learning methodologies encompassing laboratory experimentation, project work, and internships, our curriculum ensures graduates are suitably equipped for professional endeavours. Accredited by the Pakistan Engineering Council (PEC) at level II, our program encompasses essential knowledge domains such as thermodynamics, kinetics, transport phenomena, and process control.

The program also offers Chemical Engineering with technical electives in Oil and Gas Engineering covering specialised courses like Natural Gas Processing and Pipeline Management, Petroleum Refinery Engineering, Field Operations and Production, and Principles of Enhanced Oil Recovery. Practical training is facilitated through cutting-edge labs sponsored by OGDCL, providing hands-on experience in Natural Gas Processing and Piping, Integrated Petroleum Engineering, and Petroleum processes simulation. The laboratories, generously sponsored by OGDCL, feature High-Speed Computers for EBSILON® Professional, geo SCOUT, GIS, facilitating sophisticated testing and analysis. Moreover, specialized equipment such as Rapid-quench cold seal apparatus, and Mercury Injection Capillary Pressure Apparatus facilitate comprehensive exploration and experimentation within Oil and Gas Engineering. The program also fosters a well-rounded educational experience. An 8-week field training program, conducted by OGDCL, providing practical exposure to real-world operations and challenges. This is further complemented by an 8-week summer internship where students gain practical experience in various company departments, encompassing exploration, production, and marketing aspects. Through this unique collaboration with OGDCL, the program bridges theory and practice, equipping graduates with the skills and knowledge to excel in Petroleum and Gas Engineering careers.

Mission of The Department:

The mission of the department is to develop and disseminate the understanding of designing and operations of chemical processes so that our graduates can excel in academia, research, business, and industry to contribute ethically for the humanistic development of the society.

Knowledge Profiles (WK):

The Washington Accord facilitates:

	Description	Courses
WK1	Natural Sciences	Applied Physics, Applied Chemistry and Environment, Materials and Nanotechnology, Inorganic and Organic Chemistry.
WK2	Mathematics & Computing	Calculus I, Calculus II, Differential Equations and Linear Algebra I, Computing and AI Lab, Object Oriented Programming and Design, Object Oriented Programming and Design Lab, Probability and Statistics, Engineering Economics, Numerical Analysis.
WK3	Engineering Fundamentals	Applied Electrical Engineering, Physical and Analytical Chemistry, Chemical Process Industries, Energy Engineering, Petrochemical Engineering, Chemical Engineering Principles, Particle Technology, Chemical Engineering Thermodynamics, Fluid Mechanics, Environmental Engineering, Transport Phenomenon, Instrumentation and Process Control.

WK4	Engineering Specialization	Natural Gas Processing and Pipeline Management, Petroleum Refinery Engineering, Field Operations and Production, Principles of Enhanced Oil Recovery, Food Technology, Petroleum Refinery Engineering, Pharmaceutical Engineering, Nuclear Engineering, Water Treatment and Purification, Drilling Engineering, Reservoir Engineering Management, Petroleum Geology and Geophysics, Sustainability in Process & Energy System, Production Engineering Petroleum Economics & Risk Analysis, Properties of Reservoir Fluids, Fuel and Energy Management, Biochemical Engineering, Technology, Product Design and Development, Heterogeneous Catalysis, Piping Design, Environmental Impact Assessment, Fuel and Clean Technology, Industrial Waste Management.
WK5	Engineering Design	Heat Transfer, Mass Transfer, Reaction Kinetics and Reactor Design, Simultaneous Heat and Mass Transfer, Process Modelling & Simulation, Chemical Engineering Plant Design
WK6	Engineering Practice	Applied Physics Lab, Innovation and Makers Lab I, Innovation and Makers Lab II, Occupational Health and Safety, Applied Chemistry and Process Industries Lab, Energy and Thermodynamic Lab, Fluid Mechanics Lab, Heat and Mass Transfer Lab, Particle Technology Lab, Environment and Reaction Engg. Lab, Instrumentation and Process Control Lab, Separation Processes Lab, Process Modelling and Simulation Lab.
WK7	Engineering in Society	Communication Skills, Critical Thinking and Expository Writing, Pakistan and Islamic Studies, Sociology and Human Behaviour, Corporate Law and Professional Ethics.
WK8	Research Literature	Chemical Engineering Project Design I, Chemical Engineering Project Design II.

Program Educational Objectives (PEOs):

Program Educational Objectives (PEOs) are extensive statements that define what graduates are likely to achieve within three to four years of graduation.

PEO-1: Exerting for carrier growth in Industry, Consultancy, R&D or Academia for sustainable development of society.
PEO-2: Contributing as persistent work force to develop strategies by addressing engineering problems for maintaining quality assurance.
PEO-3: Possessing entrepreneurial and communication skills to conduct and contribute in professional and ethical manner while exhibiting teamwork.

Careers in Chemical Engineering:

In the dynamic landscape of modern living standards, the demand for various utilities, necessities, and amenities has surged, leading to an unprecedented growth in the process and processing industry since the 18th century. This expansion is further fuelled by population trends and the continuous introduction of new and modern products. Developing nations like Pakistan are increasingly emphasizing the processing of their raw materials within their own facilities. Chemical engineers play a pivotal role in this scenario, contributing to the layout, establishment, and smooth operation of new production lines. They are indispensable for troubleshooting existing plants, necessitating close collaboration with scientists and engineers from diverse fields. Our faculty resources are dedicated to equipping graduates with the essential knowledge, practices, and behavioural skills required for professional responsibilities. Chemical engineers find employment opportunities in a wide array of industries, including chemical and petrochemical, nuclear, energy, oil & gas, food, pharmaceutical, cosmetics, and defense

sectors. Additionally, they are well-positioned to engage in emerging research and innovation fields. With technical electives in Oil and Gas Engineering, graduates can explore lucrative career opportunities in the petroleum and gas industry, including roles in exploration, production, and distribution, as well as in research and development, environmental protection, and regulatory compliance. They are trained to collaborate effectively with management, utility engineers, technicians, and plant operators, ensuring seamless operations and addressing challenges in the field.

Chemical Engineering Laboratories

The Department of Chemical Engineering boasts cutting-edge laboratories tailored for core chemical engineering courses which include Particle Technology, Thermodynamics, Reaction engineering, Heat and Mass transfer operations, Fluid mechanics, Environmental Engineering, Instruments and Process control, Process Modeling and Simulation, along with a Mechanical workshop. Moreover, technical electives in Oil and Gas Engineering features hands-on experience in Natural Gas Processing and Piping, Integrated Petroleum Engineering, and Petroleum processes simulation, offering indispensable hands-on training encompassing, piping systems, reservoir simulation, gas permeameter testing, and rheology analysis, all integral for achieving success in the Oil & Gas industry.

Course Work Requirements

For BS in Chemical Engineering degree student must complete the following requirements as per details given in Table a-g.

(a) General Education Requirements (54 CHs)

Course Title	Course Code	CH
Mathematics	ES111, ES341, MT101, MT102, MT202.	15
Sciences	CH101, PH101, PH101L.	06
Comp. System Eng.	CS101, CS101L, CS112, CS112L.	07
Basic Engineering Courses	CH161, EE201, IF101L, IF102L, MM101, MM101L.	09
Humanities/Social Sciences/Management	HM101, HM102, HM211, HM212, HM321, HM322, HM323, MS291	17

(b) Core Requirements (63 CHs)

Course Title	Course Code	CH
Physical and Analytical Chemistry	CH201	2
Inorganic and Organic Chemistry	CH202	3
Chemical Process Industries	CH211	2
Energy Engineering	CH212	3
Chemical Engineering Thermodynamics I	CH214	3
Chemical Engineering Principles	CH231	3
Fluid Mechanics I	CH241	3
Heat Transfer	CH311	3
Mass Transfer	CH313	3
Chemical Engineering Thermodynamics II	CH321	3

Reaction Kinetics and Reactor Design	CH322	3
Fluid Mechanics II	CH342	2
Environmental Engineering	CH361	2
Petrochemical Engineering	CH391	2
Simultaneous Heat and Mass Transfer	CH411	3
Transport Phenomenon	CH412	3
Instrumentation and Process Control	CH415	3
Chemical Engineering Plant Design	CH441	3
Chemical Engineering Project Design	CH481, CH482	6
Chemical Engineering Labs	CH251L, CH252L, CH253L, CH351L, CH353L, CH451L, CH452L, CH453L	8

(c) Chemical Engineering (12 CHs)

Course Title	Course Code	CH
Technical Electives*	CHXXX	6
Particle Technology	CH341	3
Process Modelling & Simulation	CH331	2
Particle Technology Lab	CH352L	1

(d) Technical Electives in Oil and Gas Engineering (12 CHs)

Course Title	Course Code	CH
Natural Gas Processing and Pipeline Management	CH362	2
Petroleum Refinery Engineering	CH323	2
Field Operations and Production	CH478	2
Principles of Enhanced Oil Recovery	CH475	3
Oil and Gas Engineering Labs	CH362L (Natural Gas Processing and Piping), CH372L (Integrated Petroleum Engineering Laboratory), and CH474L (Petroleum processes simulation lab)	3

(e) *Technical Electives (06 CHs)

Course Title	Course Code	CH
Food Technology	CH413	3
Petroleum Refinery Engineering	CH414	3
Pharmaceutical Engineering	CH417	3
Nuclear Engineering	CH418	3

Water Treatment and Purification	CH419	3
Biochemical Engineering	CH420	3
Product Design and Development	CH421	3
Heterogeneous Catalysis	CH422	3
Piping Design	CH442	3
Environmental Impact Assessment	CH461	3
Fuel and Clean Technology	CH462	3
Industrial Waste Management	CH471	3
Drilling Engineering	CH474	3
Reservoir Engineering Management	CH479	3
Petroleum Geology and Geophysics	CH480	3
Sustainability in Process & Energy System	CH492	3
Production Engineering	CH493	3
Petroleum Economics & Risk Analysis	CH494	3
Properties of Reservoir Fluids	CH495	3
Fuel and Energy Management	CH496	3
Polymers and Composites	MM365	3
Nanomaterials and Nanotechnology I	MM391	3
Biomaterials	MM497	3
Corrosion Degradation and Protection	MM435	3

(f) Engineering Management Electives (06 CHs)

Course Title	Course Code	CH
Maintenance Engineering and Industrial Management	CH416	3
Operation Management	MS492	3
Industrial Safety	MS493	3
Total Quality Management	MS494	3
Maintenance Management	MS495	3
Project Management	MS496	3

(g) Summer Training (Pass/Fail Grade, NIL Credit)

Every student is required to complete an industrial internship or training program (eight weeks) during the summer of third year and submit a formal written report.

(h) Total Requirement (135 Credit Hours)

Faculty of Materials and Chemical Engineering

Semester-wise Degree Plan:

	No.	Course Titles	Lec. Hrs	Lab. Hrs	CH	Pre-req.	Co-req.
1st Semester	CH101	Chemistry, Environment and Climate Change	2	0	2	None	None
	CH161	Occupational Health and Safety	1	0	1	None	None
	CS101	Computing and AI	2	0	2	None	None
	CS101L	Computing and AI Lab	0	3	1	None	CS101
	HM101	Communication Skills	1	2	3	None	None
	IF101	Innovation and Makers Lab I	0	3	1	None	None
	MT101	Calculus I	3	0	3	None	None
	MM101	Materials and Nanotechnology	2	0	2	None	None
	MM141L	Materials Lab-I	0	3	1	None	MM101
	Total		**11**	**11**	**16**		

	No.	Course Titles	Lec. Hrs	Lab. Hrs	CH	Pre-req.	Co-req.
2nd Semester	CS112	Object Oriented Programming and Design	3	0	3	None	None
	CS112L	Object Oriented Programming and Design Lab	0	3	1	None	None
	ES111	Probability and Statistics	3	0	3	MT101	None
	HM102	Critical Thinking and Expository Writing	3	0	3	None	None
	IF102	Innovation and Makers Lab II	0	3	1	None	None
	MT102	Differential Equations and Linear Algebra I	3	0	3	MT101	None
	PH101	Applied Physics	3	0	3	None	None
	PH101L	Applied Physics Lab	0	3	1	None	PH101
		Total	15	9	18		

	No.	Course Titles	Lec. Hrs	Lab. Hrs	CH	Pre-req.	Co-req.
3rd Semester	CH201	Physical and Analytical Chemistry	2	0	2	None	None
	CH211	Chemical Process Industries	2	0	2	CH101	None
	CH231	Chemical Engineering Principles	3	0	3	None	None
	CH251L	Applied Chemistry and Process Industries Lab.	0	3	1	None	CH211, CH202
	EE201	Applied Electrical Engineering	3	0	3	PH101	None
	HM211	Islamic Studies	2	0	2	None	None
	MT202	Calculus II	3	0	3	MT101	None
	Total		15	3	16		

	No.	Course Titles	Lec. Hrs	Lab. Hrs	CH	Pre-req.	Co-req.
4th Semester	CH202	Inorganic and Organic Chemistry	3	0	3	CH211	None
	CH212	Energy Engineering	3	0	3	None	None
	CH214	Chemical Engg. Thermodynamics I	3	0	3	None	None
	CH241	Fluid Mechanics I	3	0	3	None	None
	CH252L	Energy and Thermodynamic Lab.	0	3	1	None	CH212, CH214
	CH253L	Fluid Mechanics Lab.	0	3	1	None	CH241
	MS291	Engineering Economy	2	0	2	None	None
	Total		14	6	16		

Section A: Chemical Engineering

	No.	Course Titles	Lec. Hrs	Lab. Hrs	CH	Pre-req.	Co-req.
5th Semester	CH311	Heat Transfer	3	0	3	None	None
	CH313	Mass Transfer	3	0	3	CH214	None
	CH321	Chemical Engg. Thermodynamics II	3	0	3	CH214	None
	CH341	Particle Technology	3	0	3	None	None
	CH351L	Heat and Mass Transfer Lab.	0	3	1	None	CH311, CH313
	CH352L	Particle Technology Lab.	0	3	1	None	CH341
	HM321	Sociology and Human Behavior	2	0	2	None	None
	HM323	Civics and Community Engagement	0	3	1	None	None
	Total		14	9	17		

	No.	Course Titles	Lec. Hrs	Lab. Hrs	CH	Pre-req.	Co-req.
6th Semester	CH322	Reaction Kinetics and Reactor Design	3	0	3	CH321	None
	CH331	Process Modelling & Simulation	1	3	2	None	CH322
	CH342	Fluid Mechanics II	2	0	2	CH241	None
	CH353L	Environment and Reaction Engg. Lab.	0	3	1	None	CH322, CH361
	CH361	Environmental Engineering	2	0	2	None	None
	CH391	Petrochemical Engineering	2	0	2	None	None
	ES341	Numerical Analysis	3	0	3	MT202	None
	HM322	Professional Ethics	2	0	2	None	None
	Total		15	6	17		

	No.	Course Titles	Lec. Hrs	Lab. Hrs	CH	Pre-req.	Co-req.
7th Semester	CH411	Simultaneous Heat and Mass Transfer	3	0	3	CH311, CH313	None
	CH415	Instrumentation and Process Control	3	0	3	None	None
	CH451L	Separation Processes Lab.	0	3	1	None	CH411
	CH453L	Instrumentation and Process Control Lab.	0	3	1	None	CH415
	CH481	Chemical Engg. Project Design-I	0	9	3	None	None
	XXXXX	Technical Elective I	3	0	3	None	None
	XXXXX	Management Elective I	3	0	3	**	**
	Total		**12**	**15**	**17**		

	No.	Course Titles	Lec. Hrs	Lab. Hrs	CH	Pre-req.	Co-req.
8th Semester	CH412	Transport Phenomena	3	0	3	CH411	None
	CH441	Chemical Engg. Plant Design	3	0	3	CH411, MS291	None
	CH452L	Process Modelling and Simulation Lab.	0	3	1	CH331	None
	CH482	Chemical Engg. Project Design-II	0	9	3	None	None
	HM212	Ideology and Constitution of Pakistan	2	0	2	None	None
	XXXXX	Technical Elective II	3	0	3	None	None
	XXXXX	Management Elective II	3	0	3	None	None
	Total		**14**	**12**	**18**		

Section B: Chemical Engineering with Technical Electives in Oil and Gas Engineering

	No.	Course Titles	Lec. Hrs	Lab. Hrs	CH	Pre-req.	Co-req.
5th Semester	CH311	Heat Transfer	3	0	3	None	None
	CH313	Mass Transfer	3	0	3	CH214	None
	CH321	Chemical Engg. Thermodynamics II	3	0	3	CH214	None
	CH362	Natural Gas Processing and Pipeline Management	2	0	2	None	None
	CH351L	Heat and Mass Transfer Lab.	0	3	1	None	CH311,
	CH336L	Natural Gas processing and Piping lab	0	3	1	None	CH362
	HM321	Sociology and Human Behavior	2	0	2	None	None
	HM323	Civics and Community Engagement	0	3	1	None	None
	Total		**13**	**9**	**16**		

6th Semester	No.	Course Titles	Lec. Hrs	Lab. Hrs	CH	Pre-req.	Co-req.
	CH322	Reaction Kinetics and Reactor Design	3	0	3	CH321	None
	CH323	Petroleum Refinery Engineering	2	0	2	None	None
	CH342	Fluid Mechanics II	2	0	2	CH241	None
	CH353L	Environment and Reaction Engg. Lab.	0	3	1	None	CH322, CH361
	CH361	Environmental Engineering	2	0	2	None	None
	CH372L	Integrated Petroleum Engineering lab.	0	3	1	None	None
	CH391	Petrochemical Engineering	2	0	2	None	None
	ES341	Numerical Analysis	3	0	3	MT202	None
	HM322	Professional Ethics	2	0	2	None	None
	Total		**16**	**6**	**18**		

7th Semester	No.	Course Titles	Lec. Hrs	Lab. Hrs	CH	Pre-req.	Co-req.
	CH411	Simultaneous Heat and Mass Transfer	3	0	3	CH311, CH313	None
	CH415	Instrumentation and Process Control	3	0	3	None	None
	CH451L	Separation Processes Lab	0	3	1	None	CH411
	CH453L	Instrumentation and Process Control Lab.	0	3	1	None	CH415
	CH481	Chemical Engg. Project Design-I	0	9	3	None	None
	CH478	Field Operations and Production	2	0	2	None	None
	CH474L	Petroleum Processes Simulation Lab	0	3	1	None	None
	XXXXX	Management Elective I	3	0	3	**	**
	Total		**11**	**18**	**17**		

8th Semester	No.	Course Titles	Lec. Hrs	Lab. Hrs	CH	Pre-req.	Co-req.
	CH412	Transport Phenomena	3	0	3	CH411	None
	CH441	Chemical Engg. Plant Design	3	0	3	CH411, MS291	None
	CH452L	Process Modelling and Simulation Lab.	0	3	1	CH331	None
	CH482	Chemical Engg. Project Design-II	0	9	3	None	None
	CH475	Principles of Enhanced Oil Recovery	3	0	3	None	None
	HM212	Ideology and Constitution of Pakistan	2	0	2	None	None
	XXXXX	Management Elective II	3	0	3	None	None
	Total		**14**	**12**	**18**		

COURSE DESCRIPTION

CH101- Chemistry, Environment and Climate Change (2-0-2): Chemistry, Environment & Climate Change explores chemistry's critical role in engineering and science, covering essential topics such as chemical calculations, stoichiometry, and solution stoichiometry. The course delves into mass spectrometry's industrial applications and examines electrochemical energy devices like batteries and fuel cells. It also includes advanced topics such as silicon purification for electronic chip manufacturing, thin film technology, and the development of nanomaterials. Additionally, the course investigates the petrochemical industry, focusing on the production of chemicals from fossil fuels. On the environmental front, it provides an in-depth understanding of the climate system, atmospheric chemistry, the interaction of chemical species with solar radiation, greenhouse gases, and ozone depletion. The course also examines the natural, social, economic, and territorial consequences of climate change and explores engineering solutions, including renewable energy technologies, energy efficiency measures, greenhouse gas reduction strategies, and carbon capture and storage technologies.

CH161- Occupational Health and Safety (1-0-1): Occupational Health and Safety addresses environment, health, and safety management, chemical and biological hazards, mechanical and electrical safety, construction and fire hazards, workplace risks, accident investigation, permit-to-work systems, environmental toxicants, employee and employer responsibilities, first aid procedures, CPR, and climate change impacts and controls on industrialization.

CH201- Physical and Analytical Chemistry (2-0-2): This course explores reaction rates, order determination, solution chemistry covering ideal and non-ideal solutions, Raoult's law, vapor pressure, freezing points, osmotic pressure, Henry's law. It also delves into dynamic equilibrium, thermodynamics, colloid and surface chemistry including adsorption, polymer chemistry, and instrumental methods like chromatography and spectroscopy.

CH202- Inorganic and Organic Chemistry (3-0-3) Pre-requisite(s): CH211: The course delves into atomic structure, redox reactions, organic compound structure, and reaction mechanisms. It equips students with essential knowledge for tackling chemical engineering challenges related to polymers, biologically important compounds, and more.

CH211- Chemical Process Industries (2-0-2) Pre-requisite(s): CH101: This course explores well-established chemical manufacturing processes and trends, including fertilizer production, insecticides, soaps, detergents, sugar, cement, soda ash, caustic soda, chlorine, sulfuric acid, water treatment, fermentation, food processing, tannery processing, pulp and paper, and basic pharmaceutical industries, providing a comprehensive understanding of industrial practices and applications.

CH212- Energy Engineering (3-0-3): It covers conventional energy resources, fuel classification, combustion principles, combustion of solid, liquid, and gaseous fuels, fluidized bed combustion, combustion calculation, industrial burner efficiency, fuel economy measures, alternative energy resources (solar, wind, wave, tidal, geothermal, nuclear, hydel), biomass densification and calorific value upgradation, carbonization and gasification, municipal waste energy generation, fuel cells development, environmental and global impact, industrial fuel selection, energy audit, conservation, and waste heat recovery.

AYLA FAROOQ MALIK | Operations - Procurement Executive at PTC | Batch 28

As an alumnus of Ghulam Ishaq Khan Institute (GIKI), graduating with a degree in Chemical Engineering, I attribute much of my success to the transformative experience I had during my time at the university. The rigorous academic curriculum combined with the guidance and support of my professors equipped me with the skills and knowledge necessary to excel in my field.

Upon graduation, I was selected for the prestigious Global Graduate Program at British American Tobacco (BAT), a testament to the quality of education and preparation I received at GIKI. Throughout my tenure in the program, I consistently performed at the top of my cohort, a reflection of the solid foundation laid during my university days.

The values instilled in me at GIKI, such as perseverance, critical thinking, and teamwork, were instrumental in navigating the challenges of the global corporate environment. Overall, my journey from GIKI to BAT exemplifies the power of education and mentorship in shaping individuals into capable professionals. I am grateful for the support of my teachers and the nurturing environment at GIKI, which played a pivotal role in my career success.

CH214- Chemical Engineering Thermodynamics I (3-0-3): In "Chemical Engineering Thermodynamics I," students explore thermodynamic systems and processes, reversible and irreversible processes, the laws of thermodynamics, ideal and non-ideal gas models, equations of state, property relations, entropy, isentropic efficiencies of turbines and nozzles, and applications of thermodynamics to flow processes such as turbines, compressors, heat engines, refrigeration, air conditioning, and gas liquefaction.

CH231- Chemical Engineering Principles (3-0-3): "Chemical Engineering Principles" introduces composition of mixtures, stoichiometric combination principles, input-output relationships, steady-state considerations, interconnections, and balances for plant items. It covers overall and component balances, limiting and excess reactants, balances for systems with recycle, purge, by-pass streams, reactive processes, batch, continuous plant, and energy balance, as well as mass and energy balances for reacting systems and combustion processes.

CH241- Fluid Mechanics I (3-0-3): "Fluid Mechanics I" explores pressure measurement, manometry, buoyancy, basic physical laws, conservation of mass, momentum, energy, Bernoulli's Equation, dimensional analysis, and similitude. Additionally, it discusses viscous flow, laminar and turbulent flow, friction and pressure drop, flow measuring devices, boundary layer concept, and external flows in fluid mechanics.

CH31- Heat Transfer (3-0-3): Heat Transfer course delves into thermal energy fundamentals, modes of heat transfer, steady and unsteady state conduction in various coordinates, convective heat transfer with and without phase change, momentum-heat transfer analogy, radiation heat transfer, and extended surface heat transfer. It further explores equipment selection criteria, and design considerations for various heat transfer equipment along with heat transfer augmentation techniques.

CH313- Mass Transfer (3-0-3) Pre-requisite(s): CH214: "Mass Transfer" builds upon prerequisites like diffusion in fluids and covers molecular and eddy diffusion, diffusion under various flow conditions, and interface mass transfer. It further delves into mass transfer theory, analogies between momentum, heat, and mass transfer coefficients. It also covers the separation processes based on mass transfer which includes absorption, leaching and liquid-liquid extraction in detail and adsorption, ion-exchange, membrane technology and chromatography in general.

CH321- Chemical Engineering Thermodynamics II (3-0-3) Pre-requisite(s): CH214: This course expands upon advanced principles of thermodynamics, focusing

SYED SAMEET SHAH
BATCH 31

Joining GIK Institute has been a profoundly impactful experience. Upon arriving on campus, I found myself welcomed by a community that highly prioritizes knowledge, innovation, and academic excellence. As a student at GIK, I have had the exceptional opportunity to receive guidance from distinguished academic minds. I have actively participated in practical projects that have honed my critical thinking and creativity. Moreover, I have established valuable friendships with like-minded individuals who share my unwavering commitment to learning and intellectual growth. Beyond academic pursuits, GIK fosters character development, leadership abilities, and a strong moral compass. Here, I've not only refined my technical knowledge but also acquired the resilience, adaptability, and compassion essential for success in a dynamic world.

on phase equilibria, Maxwell relationships, and thermodynamics of separation processes. It covers two-component systems, liquid-vapor equilibria, ideal and non-ideal solutions, vapor composition in equilibrium, azeotropes, and liquid-solid equilibria. Additionally, it analyzes thermodynamics of power plants, liquefaction, refrigeration systems, and chemical reaction equilibrium.

CH322- Reaction Kinetics and Reactor Design (3-0-3) Pre-requisite(s): CH321: "Reaction Kinetics and Reactor Design" covers equilibrium, heat effects on reactions, and reaction rates. It covers topics like molecularity, reaction order, and reactor sizing. It also explores rate laws, stoichiometry for single and multiple reactions/ reactors, and their applications. Additionally, it addresses collection and analysis of rate data, catalytic reactors, and catalysis.

CH323- Petroleum Refinery Engineering (2-0-2): This course offers a comprehensive exploration of petrochemical industry, production processes, key technologies, and applications of various petrochemicals. It covers feedstocks like natural gas and petroleum, their derivatives, and production processes like cracking and polymerization, feedstock preparation, hydrocarbon sources, chemical production from different types of hydrocarbons, and safety considerations in petrochemical plants. Safety considerations in petrochemical plants will be a crucial component, ensuring a well-rounded understanding of responsible industry practices. Finally, the course will culminate in a discussion of case studies, emerging trends within the field, and innovations driving a more sustainable future for the petrochemical industry.

CH331- Process Modelling & Simulation (2-0-2) Pre-requisite(s): CH322, CH241: This course covers MATLAB introduction, numerical differentiation (ODE solution), integral calculations, first and second-order transfer functions, stability analysis plots, mathematical modeling in chemical engineering, pinch analysis, optimization, process flow diagram development, debottlenecking with ASPEN simulation software, and economic process evaluation.

CH341- Particle Technology (3-0-3): "Particle Technology" covers solid handling fundamentals, transportation, and storage. It explores size reduction, enlargement, crystallization, granulation, screening, sieving, coagulation, flocculation, fluidization, mixing, filtration, statistics of particle size and distribution, classification, solid handling, powder technology, and powder characterization and handling for pharmaceutical industries.

CH342- Fluid Mechanics II (2-0-2) Pre-requisite(s): CH241: It explores centrifugal pumps, NPSH, specific speed, and pumps in series and parallel. It covers positive displacement pumps, turbine classification, compressible flow, choked flow in CD nozzle, and compressors classification, characteristics, and selection.

CH361- Environmental Engineering (2-0-2): "Environmental Engineering" introduces environment and ecology, environmental measurements, pollution types, environmental policy, and standards. It covers environmental monitoring of air, water, and soil, including sampling techniques. Additionally, the course addresses

environmental risk assessment, water pollution, wastewater treatment, solid waste management, air pollution control, noise pollution control, and soil pollution control technologies.

CH362- Natural Gas Processing and Pipeline Management (2-0-2): Natural Gas Processing and Pipeline Management, delves into natural gas properties, flow calculations, gas transmission, sweetening, dehydration, city gas distribution, gas station operations, pipeline welding techniques, testing, defects, and flow measurements. It also covers corrosion principles, mechanisms, causes, polarization factors, stress corrosion cracking, and corrosion control methods like detection, inhibitors, and anodic protection.

CH391- Petrochemical Engineering (2-0-2): This course introduces natural gas composition, properties, natural gas liquids, condensate, and gas hydrates. It covers petroleum derivatives like opportunity Crude oil, Tight oil, and Naphtha. Additionally, it explores other feedstocks such as coal, oil shale, biomass, and waste. The curriculum includes feedstock preparation for gas and petroleum streams, refinery configurations, cracking processes, and gasification chemistry. Further topics include hydrocarbon sources, raw materials, chemical production processes, and polymerization.

CH411- Simultaneous Heat and Mass Transfer (3-0-3) Pre-requisite(s): CH311, CH313: This course explores industrial distillation methods like binary, extractive, molecular, azeotropic, steam, reactive, and multi-component distillation. It emphasizes key components in mixtures and recovery fraction. The course covers flash distillation, column and tray design, batch distillation, and drying methods such as diffusion, drying, humidification, cooling towers, and crystallization operation and equipment.

CH412- Transport Phenomena (3-0-3) Pre-requisite(s): CH411: In "Transport Phenomena," transfer processes are reviewed, encompassing momentum, energy, and mass transport mechanisms, their mechanism at molecular level, micro level, and macro level. Momentum transport involves the deriving equations of continuity and motion and applying them to laminar flow problems. Energy transport includes deriving energy equations and applying them to heat transfer problems such as conduction, forced and free convection, in laminar flows.

ZAINAB HAROON
BATCH 32

As a sophomore studying at GIKI, I can confidently say that my experience here has exceeded all expectations. The challenging yet enriching academic curriculum has pushed me to explore new horizons and expand my knowledge beyond boundaries. The supportive faculty members have not only provided invaluable guidance but have also inspired me to strive for excellence in every endeavour. Beyond academics, the vibrant campus life and diverse student community have enriched my personal growth and provided countless opportunities for networking and collaboration. GIKI isn't just a university; it's a nurturing environment where dreams are encouraged, and aspirations are realized. I am grateful for the privilege to be a part of this esteemed institution and eagerly anticipate the journey that lies ahead."

CH413- Food Technology (3-0-3): Food Technology explores biotechnology applications in the chemical industry, focusing on biodegradation, biomass productivity, aerobic and anaerobic processes. It delves into biochemical processes for producing food products, beverages, organic acids, industrial solvents, pharmaceuticals, antibiotics, and commercial enzymes. Additionally, it covers fermentation industries like industrial alcohol and biodiesel, waste treatment, bioremediation, food preservation, hygiene, sanitation, and Pakistan's significant food industries alongside relevant legislation.

CH414- Petroleum Refining Engineering (3-0-3): Petroleum Refining Engineering explores the origin, composition, and properties of petroleum, along with refining processes. Topics include crude oil evaluation,

preheating, desalting, distillation, steam stripping, and tower arrangement. Modern processes like thermal and catalytic cracking, hydrocracking, and blending techniques are discussed, alongside refinery corrosion, product design, marketing, and the use of linear programming for production optimization. The course also offers an overview of petroleum regulations.

CH415- Instrumentation and Process Control (3-0-3): "Instrumentation and Process Control" explores instrument terminologies, P&I diagrams, sensors, mathematical modeling, and transfer functions. It delves into dynamic behavior of chemical processes, control loops, feedback control, stability analysis, frequency response, controller design, tuning, computer control introduction, and laboratory simulations. Additionally, it covers cascade, ratio, split range, and feed forward control applications.

CH416- Maintenance Engineering and Industrial Management (3-0-3): In this course, students delve into strategies like preventive, predictive, breakdown, and total productive maintenance. It compares individual versus group replacement, maintenance, and discusses scheduling techniques including computerized maintenance. The course explores inspection and non-destructive testing methods, lubrication, industrial management, production planning, quality and inventory control, human resource management, and project management principles.

CH417- Pharmaceutical Engineering (3-0-3): "Pharmaceutical Engineering" integrates engineering principles with life sciences for pharmaceutical industries, covering primary and secondary production, sterilization techniques, and pharmaceutical packaging. It emphasizes process engineering in drug discovery and delivery, high-throughput optimization of new chemical entities, solid-state engineering, intelligent manufacturing systems, and the environmental impact of pharmaceuticals.

CH418- Nuclear Engineering (3-0-3): This course explores the role and significance of nuclear energy, reactor cross-sections, reaction rates, fission, and chain reactions. It covers critical conditions, reactor components, classification, design, production, power reactors, fast and fusion systems, fuel cycles, uranium enrichment, fuel fabrication, reprocessing, fuel cycle performance, in-core fuel management, and nuclear waste handling. This comprehensive study equips students with essential knowledge for the nuclear energy sector.

CH419- Water Treatment and Purification (3-0-3): The course covers primary and secondary treatment methods for fresh feed water, including clarification, sedimentation, flocculation, and coagulation. It also explores filtration, ion exchange, membrane separation, and reverse osmosis. Advanced technologies, cooling water treatment, biocide use, bacterial count importance, sea water treatment, desalination, and biological wastewater treatment are discussed comprehensively.

CH420- Biochemical Engineering (3-0-3): In "Biochemical Engineering," students learn microbiology basics, enzyme classification, kinetics of single-substrate reactions, enzyme inhibition, and non-ideal kinetics. They explore enzyme isolation, immobilization, and applications in bio-catalysis. The course also covers transport phenomena in microbial systems, design and analysis of biochemical reactors, and the role of biochemical engineering in future technology development.

CH421- Product Design and Development (3-0-3): "Product Design and Development" explores innovation

challenges and opportunity generation for new products. It covers user needs analysis, concept selection, and various manufacturing methods, including prototyping. The course delves into industrial product development strategies, product planning, and managing customer and technical specifications. Additionally, it addresses advanced product modeling in 3D-CAD, simulation of product dynamics, animation, photo rendering, top-down design, and drawing generation using SolidWorks and associated modules.

CH422- Heterogeneous Catalysis (3-0-3): In "Heterogeneous Catalysis," students explore foundational concepts, adsorption, and kinetic models of catalytic reactions. They delve into catalyst preparation, physicochemical properties characterization, surface analysis, supported metal catalysts, acid-base catalysts, zeolites, metal oxide catalysts, and catalytic oxidation. The course highlights key examples of significant heterogeneous catalytic reactions, providing a comprehensive understanding of catalysis principles and applications.

CH441- Chemical Engineering Plant Design (3-0-3) Pre-requisite(s): CH411, MS291: This course covers general design considerations, health and safety, HAZOP studies, and contingency plans. Additionally, it includes design codes, economics, optimization, materials selection, fabrication, vessel design, heat and mass transfer equipment design, piping and pipeline design, basic optimization concepts, and computer-aided design applications, along with engineering ethics and impact analysis.

CH442- Piping Design (3-0-3): "Piping Design" delves into process plant layout, ASME B31.4/B31.8-compliant oil & gas pipeline design, piping stress analysis, and process piping drafting. It also covers liquid pipeline hydraulics, fire safety piping, and utilization of design software such as Piping Systems Fluid Flow.

CH461- Environmental Impact Assessment (3-0-3): Environmental Impact Assessment educates on IEE and EIA principles, their societal significance, and cost-benefit analysis. It covers EIA stages, emphasizing public consultation and participation. Various methods and techniques for impact prediction and evaluation are explored for comprehensive understanding.

CH462- Fuel and Clean Technology (3-0-3): It explores fossil fuel processing for green technologies, CO2 sequestration, and pollution monitoring. It delves into biomass resources, waste technologies, heat digestion, gasification, anaerobic digestion, biofuel technologies, environmental concerns, and economics. Additionally, the course covers wind, solar, tidal, geothermal energy, hydroelectric power plants, and applications of clean technology.

CH471- Industrial Waste Management (3-0-3): It covers the environmental management standards like ISO 14001 and EMAS, alongside environmental auditing and regulatory policies. It covers various eco-labelling types, pollution prevention strategies, and material recycling techniques. The course also addresses treatment methods for liquid and solid waste, including incineration, composting, and biogas production. Additionally, it delves into anaerobic digestion, air pollution management, and other stabilization methods.

C474- Drilling Engineering (3-0-3): The topics include rotary drilling operations, rig components and functions, bit type selection, drilling fluids' functions, types, and compositions, cementing for strengthening, drilling hydraulics, formation pore pressure, casing design, drilling hazards, and their remedies. Discussions encompass mud properties, calculations, pump ratings,

cement types and composition, hydraulics, formation pore pressure, casing manufacturing, and pressure relationships in formations and boreholes.

CH475- Principles of Enhanced Oil Recovery (3-0-3): This course covers basic concepts of Enhanced Oil Recovery (EOR) including linear, two- and three-dimensional displacements, and the role of reservoir geology. It explores water flooding, immiscible displacement by gas injection, thermal recovery methods like steam and hot water displacement, and in-situ combustion. Additionally, it delves into miscible flooding, including thermodynamic miscibility and various chemical injection methods such as polymers, miscellar polymer, alkaline, and surfactants.

CH478 - Field Operations and Production (2-0-2): It delves into production operations and geologic considerations, reservoir aspects in well completions, fluid and rock properties, formation pressure regimes, and reservoir fluid flow. It also covers well-test analysis in determining reservoir properties, drive mechanisms, wireline operations, production logging, coiled tubing applications, primary cementing, well completion design, and workover systems. Additional topics include remedial cementing, sand control, acidizing, hydraulic fracturing, scale deposition, and corrosion control.

CH479 - Reservoir Engineering Management (3-0-3): In Reservoir Engineering Management, students delve into primary production and reservoir life cycles, business planning, and goal alignment. The course focuses on maintaining well count, business development planning, and implementing production strategies. Through reservoir surveillance, students learn about data collection, validation, and analysis for production potential estimation. They also study reservoir performance analysis, reserve estimation techniques, reservoir management economics, risk assessment, and case studies on field management planning.

CH480- Petroleum Geology and Geophysics (3-0-3): Petroleum Geology and Geophysics offers practical insights into subsurface resource exploration techniques. It discusses geological and geophysical analysis methods, focusing on reservoir rock characteristics and fluid behavior. Students gain knowledge on reserve estimation, enhanced oil recovery, and unconventional reservoirs. The geophysics segment introduces seismic surveying principles, emphasizing data interpretation for reservoir evaluation and production monitoring, with hands-on exercises to reinforce learning.

CH492- Sustainability in Process & Energy System (3-0-3): In this course, students delve into sustainable energy sources such as solar, wave, wind, and geothermal power, while mastering computational skills for fluid dynamics system efficiency analysis and modeling. Ethical considerations, regulatory factors, lifecycle management, and end-of-life considerations in energy system design are explored. Additionally, the curriculum includes electricity generation, distribution, storage, and consumption aspects for a comprehensive understanding of energy systems.

CH493- Production Engineering (3-0-3): This course features an introduction to the techniques used in the production of oil and natural gas. Topics include an introduction to petroleum geology, properties of reservoir rocks and petroleum fluids, inflow performance of vertical and horizontal wells, wellbore hydraulics, well testing, and well stimulation.

CH494- Petroleum Economics & Risk Analysis (3-0-3): This course provides an introduction to economic analysis standards in the petroleum industry. Students learn about economic evaluation principles, including

time value of money, present value, and net present value. Risk and uncertainty in decision-making are explored through decision tree analysis and estimation of future money values. The curriculum covers resource estimation, forecasting, petroleum taxation regulations, advanced capital budgeting techniques, engineering economics, and their application to exploration, drilling, and production operations.

CH495- Properties of Reservoir Fluids (3-0-3): This course introduces petroleum chemistry and thermodynamic concepts. Students explore phase behavior in petroleum systems, including single, binary, and multicomponent systems. They learn equations of state for real fluids and phase equilibrium calculations. Additionally, they study sampling procedures for reservoir fluids and utilize fluid analysis data in engineering calculations.

CH496- Fuel and Energy Management (3-0-3): This course covers fuel classification, properties, and characterization, including storage and handling. It explores combustion principles, fluidized bed combustion boilers, and waste heat recovery. Additionally, it delves into energy conversion technologies like steam turbine combined heat and power (CHP) and gas turbine CHP. Students also learn about emissions control measures, alternative energy resources like biomass and solar energy, and energy conservation methodologies.

Final Year Project Design:

CH481- Chemical Engineering Project Design -I (0-9-3): In "Chemical Engineering Project Design-I," students apply theoretical knowledge practically. Assigned industrial projects, supervised by faculty and/or industrial collaborator, involve literature surveys, flow sheet development, material and energy balances, unit design, instrumentation, materials selection, cost estimation, economic analysis, and safety considerations. Progress is tracked through interim presentations and reports, ensuring thorough project understanding and application.

CH482- Chemical Engineering Project Design -II (0-9-3): In Chemical Engineering Project Design -II (0-9-3), students advance their work from CH481. They might fabricate small units for practical learning. Progress is tracked through interim presentations and reports, with a final report due by term-end.

Laboratory Courses:

CH251L- Applied Chemistry and Process Industries Lab (0-3-1) Co-requisite(s): CH211, CH202: In this Lab, students gain insight into analytical methods' applications and limitations. They hone laboratory skills for precise chemical analyses. Experiments demonstrate quantitative analysis of water, milk, and soap samples, fostering practical understanding.

CH252L- Energy and Thermodynamic Lab (0-3-1) Co-requisite(s): CH212, CH214: Here students conduct experiments focusing on fuel properties, chemical engineering thermodynamics, and energy engineering. They explore various aspects such as fuel characteristics and behavior, along with practical applications of thermodynamic principles in energy systems. Through hands-on activities and data analysis, students gain valuable insights into the practical aspects of energy and thermodynamics within the context of chemical engineering.

CH253L- Fluid Mechanics Lab (0-3-1) Co-requisite(s): CH241: Fluid Mechanics Lab demonstrates fluid flow phenomena through various experiments. Each experiment elucidates different aspects of fluid mechanics, providing hands-on experience and reinforcing theoretical concepts. Students gain practical insights into topics like flow visualization and fluid properties, enhancing their understanding and skills in fluid mechanics.

CH351L- Heat and Mass Transfer Lab (0-3-1) Co-requisite(s): CH311, CH313: In the Heat and Mass Transfer Lab, experimental benches facilitate hands-on learning of heat and mass transfer principles. These setups allow students to conduct experiments on heat conduction, convection, and radiation, as well as mass transfer phenomena such as diffusion, absorption, adsorption, and extraction.

CH352L- Particle Technology Lab (0-3-1) Co-requisite(s): CH341: This lab offers experiments focusing on particle technology and vapor-liquid equilibrium. Through hands-on activities, students explore particle size analysis, characterization techniques, and behaviour in different environments. Additionally, they investigate vapor-liquid equilibrium phenomena, enhancing their understanding of phase equilibria and its industrial applications.

CH353L- Environmental and Reaction Engineering Lab (0-3-1) Co-requisite(s): CH322, CH361: In this lab, students utilize chemical reactors and equipment for environmental engineering experiments. These facilities enable hands-on exploration of reaction kinetics, reactor design, and environmental processes such as water and air treatment. Through practical experimentation, students gain insights into the interplay between chemical reactions and environmental concerns.

CH362L- Natural Gas Processing and Piping Lab (0-3-1): Natural Gas Processing and Piping Lab involves: Calorific Value, Concentration of sulphur compounds, Hydrocarbon Dew Point and Water Dew Point, Physical properties of gas condensate, Gas piping systems, and Corrosion.

CH372L- Integrated Petroleum Engineering Lab (0-3-1): Integrated Petroleum Engineering Lab, involves density, specific gravity, and API gravity measurement. Students also use Brookfield and U-tube viscometers for viscosity, distillation and centrifuge for water content determination, conductivity for total salts, and GC chromatography for natural gas composition analysis.

CH451L- Separation Process Lab (0-3-1) Co-requisite(s): CH411. In the Separation Process Lab, experiments encompass cooling tower, distillation, drying, and crystallization. Through hands-on activities, students explore the principles and applications of these separation techniques. The lab provides a practical understanding of separation processes crucial in various industries, enhancing students' skills in chemical engineering.

CH452L- Process Modelling and Simulation Lab (0-3-1) Pre-requisite(s): CH331: In the Process Modelling and Simulation Lab, students gain proficiency in Aspen HYSYS and MATLAB for process simulation. Through hands-on exercises, they learn to model and simulate chemical engineering processes, gaining practical insights into system behavior, optimization, and design. This lab equips students with essential skills for process analysis and decision-making in industrial settings.

CH453L- Instrumentation and Process Control Lab (0-3-1) Co-requisite(s): CH415: The Instrumentation and Process Control Lab offers hands-on practice with instruments for measuring process variables such as pressure, temperature, and flowrates. Students learn to implement various control loops to regulate industrial processes effectively. Through experimentation, they gain practical insights into instrumentation techniques and process control strategies, enhancing their skills in monitoring and optimizing industrial operations.

CH474L- Petroleum Processes Simulation Lab (0-3-1): The experiments included reservoir simulation, grid and rock property simulation, operational component alignment, major well component simulation, well shut-in procedures, drill stem testing, gas permeameter testing, surface tension and contact angle measurement, viscosity and rheology analysis, resistivity, formation factor, cementation exponent determination, and capillary pressure curve generation via centrifuge.

FACULTY OF MECHANICAL ENGINEERING

Introduction

Mechanical engineering encompasses a variety of sophisticated engineering solutions that require the integration of scientific, engineering, and socio-economic knowledge. Mechanical engineering has been evolving rapidly in line with modern trends, driven by advancements in technology, sustainability concerns, and the emergence of new fields. Mechanical Engineers are trained to solve real-world engineering problems arising in the fields of renewable energy, additive manufacturing, green technology, and e-transportation systems. They design complex machines, manufacturing processes and translate them into real products that address societal issues. However, with recent advances, mechanical systems are increasingly integrated with sensors, actuators, micro-controllers, and artificial intelligence. Additive manufacturing has revolutionized traditional production methods, enabling intricate designs and material efficiencies, previously unattainable. Similarly, mechanical engineers play a key role in the design, development and operations of thermal refrigeration and power systems, internal combustion engines, hydel and wind energy converters. In this multifaceted landscape, the curriculum of mechanical engineering resonates with the ethos of innovation, sustainability, and transformative technologies, poised to shape the future of industries and societies worldwide.

The curriculum of the Faculty of Mechanical Engineering (FME) is periodically upgraded by the experienced engineering professionals and experts, and encompasses various fields including robotics and automation, renewable energy, computer-aided design, additive manufacturing, electric vehicle technology, industry 4.0 and internet of things. Moreover, the integration of artificial intelligence elevates automation and decision-making processes to unprecedented levels of sophistication, optimizing performance across various mechanical systems. To cope with modern electro-mechanical systems, courses and labs on robotics, instrumentation, electrical circuits and devices, electrical machines and drives, embedded systems, micro-controllers and mechatronics are also tightly integrated in the curriculum. The courses are delivered by research active faculty members who infuse life into classroom through real-world examples and stimulating complex engineering problems. Covering a gamut of applications ranging from tiny printed electronics, micro-fluidics, composite materials, advanced manufacturing, computer-controlled machines, natural fluid refrigeration, power plants, high speed rotating machines, frictionless bearings to industrial robots and unmanned air, underwater and ground vehicles. The curriculum is tightly knitted with modern well-equipped labs that takes students beyond the realm of theory and displays marvels of mechanical engineering in action. Inspiring enthusiastic young enquiring minds to unravel the mysteries, discover, explore and grow.

Thrust Areas:

Design and Manufacturing Engineering
Thermo-Fluid Engineering
System Dynamics and Controls

DEAN

Taqi Ahmad Cheema, PhD
Kyungpook National University, S. Korea

Faculty

- Dr. Wasim Ahmed Khan, University of Sheffield, UK
- Dr. Khalid Rehman, JEJU National University, S. Korea
- Dr. Massab Junaid, GIK Institute, Pakistan
- Dr. Ali Turab Jafry, Sungkyunkwan University, S. Korea
- Dr. Hassan Raza, UST, S. Korea
- Dr. Abid Imran, Hanyang University, S. Korea
- Dr. Arsalan Arif, Hanyang University, S. Korea
- Dr. Muhammad Bilal Khan, Beijing Institute of Technology, China.
- Dr. Taimoor Hassan Shah, Scuola Superiore Sant'Anna, Italy
- Dr. Ahmad Abbas, GIK Institute, Pakistan
- Dr. Muhammad Qasim Zafar, Tsinghua University, China
- Mr. Faheem Ahmad, MS, INHA University, S. Korea
- Mr. Muhammad Shoaib Ijaz, MS, KAIST, S. Korea

Faculty on study leave for PhD

- Ghulam Hussain, PhD, Nanjing University of Aeronautics & Astronautics, China

Lab Engineers

- Samar Abbas, BS, University of WAH
- Muhammad Fahad Zahid, BS, NUST
- Shahab Uddin, BS, UET Peshawar.
- Ali Murtaza, BS, International Islamic University
- Talha Asif, BS, GIK Institute
- Uzma Bibi, BS, UET, Peshawar
- Anas Wazir, BS, UET, Peshawar

Graduate Assistant

- Babar Ashfaq (MS I.I.U.I Islamabad)
- Atif Muzaffar (MS GIK Institute)
- Hafiz Muhammad Rizwan (MS UET Lahore)
- Hammas Ullah (MS NUST)
- Muhammad Arsalan (MS UET Peshawar)
- Muhammad Waseem (MS UET Taxlia)
- Ziaullah Jan (BS UET Peshawar)
- Hilal Ahmad (BS UET Peshawar)
- Rahmat Ullah (BS UET Khuzdar)
- Shafi Ullah (BS UET Peshawar)
- S. M. Wasi ul Hassan Naqvi (BS HITEC Taxila)
- Shamoon Khan (BS UET Peshawar)
- Moazzam Ali (BS HITEC Taxila)
- Nauman Naeem (BS HITEC Taxila)
- Sudhair Shah (BS UET Peshawar)
- Syed Salman Shah (BS UET Peshawar)
- Muhammad Akif (EME NUST)
- Mohammad Fazail Bangash (BS UET Peshawar)

Personal Secretary to Dean

- Nizakat Ali Khan, MBA, Virtual University.
- Muhammad Tofiq, Students Section

Faculty Mission

The faculty is aimed at producing professionals with sound knowledge-base, leadership qualities, and social rectitude. They are capable to intelligently respond and adapt to technological advancements in the field of Mechanical Engineering.

Outcome Based Education (OBE)

The Faculty of Mechanical Engineering (FME) has implemented an Outcome-Based Education (OBE) system that places the student at the center of the learning process, resulting in improved learning outcomes. Additionally, the system places great emphasis on continuous quality improvement. Moreover, curriculum is continuously revised keeping in view the country's industrial needs as well as adopting best international practices. Our students are thus equipped with twelve key graduate attributes or Program Learning Outcomes. These attributes or learning outcomes groom students with sound intellectual, theoretical and practical experiences that qualify them to address a variety of societal needs ethically. Thus, enabling graduating students to step with confidence into industry, research organizations or in the domain of higher education. FME firmly believes the education we provide will enable our graduates to stand out from the crowd and has the potential to rise and shine.

Undergraduate Program

The Faculty of Mechanical Engineering (FME) provides a comprehensive Bachelor of Science (BS) degree program in mechanical engineering that spans four years. This interdisciplinary program aims to equip students with a strong understanding of fundamental engineering principles, as well as foster their communication and practical skills that are essential in today's industry driven by knowledge and innovation. Classroom theory is reinforced through extensive laboratory work, problem-based learning, and complex engineering problem. FME is focused on three thrust areas of design and manufacturing, thermo-fluids as well as system dynamics and control, thus, enabling students to pursue their final year design projects in-line with their future career aspirations.

Program Educational Objectives (PEO)

PEO-1: Graduates practicing in a variety of Mechanical engineering and allied disciplines.

PEO-2: Graduates performing in a responsible, professional and ethical manner as an individual and as part of a team.

PEO-3: Graduates advancing their knowledge and excelling in their chosen domain.

Program Learning Outcomes (PLOs):

Program Learning Outcomes are given below:

Engineering Knowledge: An ability to apply knowledge of mathematics, science, engineering fundamentals and an engineering specialization to the solution of complex engineering problems.

Problem Analysis: An ability to identify, formulate, research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences and engineering sciences.

Design/Development of Solutions: An ability to design solutions for complex engineering problems and design systems, components or processes that meet specified needs with appropriate consideration for public health and safety, cultural, societal, and environmental considerations.

Investigation: An ability to investigate complex engineering problems in a methodical way including literature survey, design and conduct of experiments, analysis and interpretation of experimental data, and synthesis of information to derive valid conclusions.

Modern Tool Usage: An ability to create, select and apply appropriate techniques, resources, and modern engineering and IT tools, including prediction and modeling, to complex engineering activities, with an understanding of the limitations.

The Engineer and Society: An ability to apply reasoning informed by contextual knowledge to assess societal, health, safety, legal and cultural issues and the

consequent responsibilities relevant to professional engineering practice and solution to complex engineering problems.

Environment and Sustainability: An ability to understand the impact of professional engineering solutions in societal and environmental contexts and demonstrate knowledge of and need for sustainable development.

Ethics: Apply ethical principles and commit to professional ethics and responsibilities and norms of engineering practice.

Individual and Teamwork: An ability to work effectively, as an individual or in a team, on multifaceted and /or multidisciplinary settings.

Communication: An ability to communicate effectively, orally as well as in writing, on complex engineering activities with the engineering community and with society at large, such as being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.

Project Management: An ability to demonstrate management skills and apply engineering principles to one's own work, as a member and/or leader in a team, to manage projects in a multidisciplinary environment.

Lifelong Learning: An ability to recognize importance of and pursue lifelong learning in the broader context of innovation and technological developments.

Knowledge Profiles:

WK1 Natural Sciences: A systematic theory-based understanding of natural sciences applicable to the discipline.

WK2 Mathematics and Computing: The concept-based mathematical thinking, numerical analysis, statistics and formal aspects of computer and information science to support analysis and modelling applicable to the discipline.

WK3 Engineering Fundamentals: A systematic, theory-based formulation of engineering fundamentals required in an engineering discipline.

WK4 Engineering Specialization: The knowledge of Engineering specialization that provides theoretical frameworks and bodies of knowledge for the accepted practice areas that are at the forefront in a discipline.

WK5 Engineering Design: The Design Thinking Knowledge that supports engineering design in a practice area of an engineering discipline.

WK6 Engineering Practice: The Knowledge of engineering practices (technology) in different practice areas of an engineering discipline.

WK7 Engineering in Society: A systematic, comprehension-based knowledge of the role of engineers in a society and the professional issues related to practicing engineering profession in a discipline: ethics and the professional responsibility of an engineer to public safety including the impact of an engineering activity i.e. economic, social, cultural, environmental and sustainability

WK8 Research Literature: Engagement with selected knowledge in the research literature of the discipline.

Sustainable development goals (SDGs):

Students are encouraged to demonstrate an adherence to all the sustainable development goals (SDGs) during the Mechanical Engineering Program. Particularly, the following SDGs are the focus in the execution of their senior design projects.

- Quality Education,
- Clean Water and Sanitation
- Affordable and Clean Energy
- Industry, Innovation and Infrastructure
- Sustainable Cities and Communities
- Responsible Consumption and Production
- Climate Action

Re-Accreditation

The BS degree program in Mechanical Engineering is re-accredited by Pakistan Engineering Council (PEC)

under level II i.e., OBE.

Laboratories

In order to reinforce the classroom learning environment, FME arranges laboratory sessions for its students within various courses. The purpose of these laboratories is to make sure that the theory and principles learnt during the lecture hours are practically verified. Each lab session is comprised of 3 hours. The labs are supervised by the course instructor and conducted by expert lab engineers. The various labs at FME are:

1. Computational Mechanics Lab
2. Fluid Mechanics Lab
3. Heat Transfer, Refrigeration and Air Conditioning Lab
4. Heat Engine Lab
5. Solid Mechanics Lab
6. Sub and Super-Sonic Wind Tunnel Labs
7. CNC Training Lab
8. CNC Industrial Lab
9. Mechanical Workshop
10. Mechanical Vibration and Control Systems Lab
11. Electronics and Instrumentation Lab
12. Mechatronics Design Lab
13. Composite Structures Lab
14. Welding and Metal Printing Lab
15. Printed Electronics Lab
16. 3D Printing Lab
17. Robotics and Automation Lab

Student Chapters:

FME encourages the participation of students in different national and international competitions and events. FME hosts a number of student chapters of various technical societies which organize different events and student participation activities. Details are given below.

- IMechE organizes International Workshop on Functional Reverse Engineering (WRE) and other technical events
- AIAA GIKI Chapter organizes annual Design, Build, & Fly Competition/Airex Innovation Challenge
- ASME GIKI Chapter organizes annual All Pakistan Event International Mechanical Engineering Convention (IMEC).
- SMEP organizes technical events/ TechFest & Resistance.
- ASHRAE organizes Thermocon and other technical events.

Course Work Requirements

A student majoring in Mechanical Engineering must complete the following courses:

(a) General Education Requirements (51 Credit Hours)

Course Title	Course Code	CH
Computer Science & Engineering	CS101, CS101L, CS112, CS112L	7
Humanities	HM101, HM102, HM2xx, HM321, HM322, HM4xx	15
Basic Engineering	CH101, CH161, MM101, MM141, IF101, IF 102, MS291	10
Mathematics	MT101, MT102, MT202, ES111, ES341/CS342	15
Sciences	PH101, PH101L	4

(b) Core Requirements (70 Credit Hours)

Course Title	Course Code	CH
Circuits and Electronic Devices	ME203	3
Engineering Graphics	ME204	2
Electrical Machines and Drives	ME205	3
Instrumentation and Digital Twin	ME202	2
Engineering Mechanics (Statics, Dynamics)	ME211, ME212	5
Mechanics of Solids	ME213, ME314	5
Thermodynamics	ME231, ME232	6
Fluid Mechanics	ME321, ME322	6
Theory of Machines	ME313	3
Heat Transfer	ME333	3
Computer Aided Engineering	ME411	2
Design of Machine Elements	ME363, ME364	4
Manufacturing Processes	ME354	2
Mechanical Vibrations	ME315	3
Design Project	ME481, ME482, ME380	6
System Dynamics & Control	ME464	3
Robotics and Automation	ME461	2
Finite Element Analysis	ME467	3
Mechanical Eng. Lab. Courses	ME243, ME244, ME245, ME348, ME346, ME347, ME446	7

(c) Technical Electives (9 Credit Hours)

Design and Manufacturing

Course Title	Course Code	CH
CAD/CAM	ME418	3
Introduction to Automobile Engineering	ME465	3
Introduction to Finite Element Methods	ME466	3
Fundamental of Composite Materials	ME419	3
Mechanical Engineering Design	ME468	3
Additive Manufacturing	ME453	3
Micro & Nano Fabrication	ME454	3
Stress Analysis	ME416	3
Microelectromechanical Systems	ME455	3

Thermo Fluids

Course Title	Course Code	CH
Introduction to Computational Fluid Dynamics	ME423	3
Gas Dynamics	ME424	3
Combustion	ME434	3
Refrigeration & Air-conditioning	ME439	3
Power Plants	ME471	3
Gas Turbine	ME473	3
I.C. Engines	ME474	3
Energy Management & Conservation	ME475	3
Thermo-Fluids Systems Design	ME425	3
Renewable Energy	ME476	3
Fuel Cell Technology	ME477	3

System Dynamics and Control

Course Title	Course Code	CH
Robotics	ME452	3
Design of Experiments in Mechanical Engineering	ME469	3
Industrial Automation	ME493	3
Flight Dynamics and Control	ME494	3
Artificial Intelligence for Mechanical Engineers	ME404	3
Structural Health Monitoring Using AI	ME405	3
Electric Vehicle Technology	ME406	3

(d) Management Elective (At Least 6 Credit Hours)

Course Title	Course Code	CH
Operation Management	MS492	3
Industrial Safety	MS493	3
Total Quality Management	MS494	3
Maintenance Management	MS495	3
Technology Management	MS426	3
Project Management	MS496	3
Industrial Management	MS449	3
Supply Chain Management	MS491	3
Accounting and Finance	MS447	3
Entrepreneurship and Marketing	MS434	3
Macro and International Economics	MS448	3

(e) Summer Internship (Pass/Fail grade; NIL Credit)

Every student is required to participate in a compulsory industrial training of 4-6 weeks during the summer of Junior Year and submit a formal written report/presentation.

(f) Total Credit Requirements

For the B.S. degree in Mechanical Engineering, a student has to complete 136 credit hours.

Degree Plan

	No.	Course Titles	Lec. Hrs	Lab. Hrs	CH	Pre-req.	Co-req.
1st Semester	CH101	Chemistry Environment and Climate Change	2	0	2	None	None
	CH161	Occupational Health and Safety	1	0	1	None	None
	CS101	Computing and AI	2	0	2	None	None
	CS101L	Computing and AI Lab	0	3	1	None	None
	HM101	Communication Skills	1	6	3	None	None
	IF101	Innovation and Makers Lab I	0	3	1	None	None
	MT101	Calculus I	3	0	3	None	None
	PH101	Applied Physics	3	0	3	None	None
	PH101L	Applied Physics Lab.	0	3	1	None	None
	Total		**12**	**15**	**17**		

	No.	Course Titles	Lec. Hrs	Lab. Hrs	CH	Pre-req.	Co-req.
2nd Semester	AI102	Python Programming & Freelancing Essentials	0	3	1	None	None
	CS112	Object Oriented Programming and Design	2	0	2	CS101	None
	CS112L	Object Oriented Programming and Design Lab.	0	3	1	CS101L	None
	ES111	Probability and Statistics	3	0	3	None	None
	HM102	Critical Thinking and Expository Writing	2	3	3	HM101	None
	IF102	Innovation and Makers Lab II	0	3	1	IF101	None
	MM101	Materials and Nanotechnology	2	0	2	None	None
	MM141	Materials Lab I	0	3	1	None	None
	MT102	Differential Equations and Linear Algebra I	3	0	3	MT101	None
	Total		**12**	**15**	**17**		

	No.	Course Titles	Lec. Hrs	Lab. Hrs	CH	Pre-req.	Co-req.
3rd Semester	MT202	Calculus II	3	0	3	MT101	None
	MS291	Engineering Economy	2	0	2	None	None
	ME211	Statics	2	0	2	PH101	None
	ME204	Engineering Graphics	1	3	2	None	None
	HM2xx	Ideology and Constitution of Pakistan	2	0	2	None	None
	ME203	Circuits and Electronic Devices	3	0	3	PH101	None
	ME245	Workshop Practice	0	3	1	None	None
	ME231	Thermodynamics I	3	0	3	MT101	None
	Total		**16**	**6**	**18**		

	No.	Course Titles	Lec. Hrs	Lab. Hrs	CH	Pre-req.	Co-req.
4th Semester	ME212	Dynamics	3	0	3	PH101	None
	ME213	Mechanics of Solids I	3	0	3	ME211	None
	ME205	Electrical Machines and Drives	3	0	3	ME203	None
	ME243	Electronics and Electrical Machines Lab	0	3	1	ME203	ME205
	ME244	Mechanics and Design Lab.	0	3	1	ME211	ME212
	HM2xx	Islamic Studies	2	0	2	None	None
	ME232	Thermodynamics II	3	0	3	ME231	None
	ME202	Instrumentation and Digital Twin	2	0	2	None	None
	Total		**16**	**6**	**18**		

	No.	Course Titles	Lec. Hrs	Lab. Hrs	CH	Pre-req.	Co-req.
5th Semester	ME321	Fluid Mechanics I	3	0	3	MT101 ME212	None
	ME363	Design of Machine Elements I	2	0	2	ME245, ME213	None
	ME313	Theory of Machines	3	0	3	ME212	None
	ES341/ CS342	Numerical Analysis	3	0	3	MT102	None
	ME346	Thermo-Fluid Lab-I	0	3	1	ME232	ME321
	HM322	Corporate Law and Professional Ethics	2	0	2	None	None
	ME314	Mechanics of Solids-II	2	0	2	ME213	None
	ME348	Mechanics of Solids and Machines Lab	0	3	1	ME213	ME313 ME314
	Total		**15**	**6**	**17**		

	No.	Course Titles	Lec. Hrs	Lab. Hrs	CH	Pre-req.	Co-req.
6th Semester	ME322	Fluid Mechanics II	3	0	3	ME321	None
	ME333	Heat Transfer	3	0	3	ME231 ME321	None
	ME315	Mechanical Vibration	3	0	3	MT102 ME212	None
	ME364	Design of Machine Elements-II	2	0	2	ME363	None
	ME354	Manufacturing Processes	2	0	2	None	None
	ME347	Thermo-Fluid Lab-II	0	3	1	None	ME322 ME333
	HM321	Sociology and Human Behavior	2	0	2	None	None
	ME380	Senior Design Project-I	0	3	1	None	None
	Total		**15**	**6**	**17**		

	No.	Course Titles	Lec. Hrs	Lab. Hrs	CH	Pre-req.	Co-req.
7th Semester	MS49x	Management Electives I	3	0	3	**	**
	ME4xx	Technical Elective I	3	0	3	**	**
	ME464	System Dynamics and Control	3	0	3	MT102	None
	ME446	Mechanical Vibration and Control Systems Lab	0	3	1	ME315 MT102	ME464
	ME481	Senior Design Project-II	0	9	3	ME380	None
	ME411	Computer Aided Engineering	1	3	2	ME354	None
	ME461	Robotics and Automation	2	0	2	ME315	None
	Total		**12**	**15**	**17**		

	No.	Course Titles	Lec. Hrs	Lab. Hrs	CH	Pre-req.	Co-req.
8th Semester	MS49x	Management Elective II	3	0	3	**	**
	ME467	Finite Element Analysis	2	3	3	None	None
	ME4xx	Technical Electives II	3	0	3	**	**
	ME4xx	Technical Elective III	3	0	3	**	**
	ME482	Senior Design Project-III	0	6	2	ME481	None
	HM4xx	Civics and Community Engagement	0	3	1	None	None
	Total		**11**	**12**	**15**		

Total Credit Hours: 136

M ASAD MAZHAR

Life at GIK Institute was an exhilarating journey filled with challenges and growth. Balancing social activities with academic pursuits was a skill I honed daily, fostering a holistic development. The dedicated instructors ignited my passion for engineering, shaping my trajectory towards realizing my dreams. Through the rigors of the academic schedule, I learned invaluable lessons in time management and resilience, preparing me for the professional realm. Immersed in its diverse culture, I not only flourished academically but also grew personally, equipped with the confidence and motivation to navigate any path ahead.

Course Description

IF101 INNOVATION AND MAKERS LAB I (0-3-1): Algorithm Design & Lab experiments in Python, Business Innovation, Experiments in Electrical Workshop, Experiments in Process Industry, Advance Topics-Electron Microscopy, Advance Topics-GPS Interfacing.

IF102 INNOVATION AND MAKERS LAB II (0-3-1): Advance Topics- Optical Instrumentation, Prime Movers Operation, Engineering Graphics, Experiments in Fabrication Technology & Prototyping, Project Assembly, Demonstration & Assessment.

ME204 ENGINEERING GRAPHICS (1-3-2): Introduction to Engineering graphics, drawing instruments, projection theory, orthographic projections, projection of points and lines, dimensioning and tolerance, engineering geometry, sectioning, orthographic reading and writing, engineering curves, development of surfaces, fastening method and connectors, production engineering drawing, Computer-aided drawing.

ME202 INSTRUMENTATION AND DIGITAL TWIN (2-0-2): Significance of measurement, general measurement system. Instrument characteristics and calibration, Analog and digital signals, static and dynamic characteristics of signals, Impedance, Operational amplifiers, Active and passive filters, Digital to analog conversion (DAC), analog to digital conversion (ADC), N-bit digital signals, resolution, accuracy, error, and bandwidth, Sensor Types and selection, potentiometer, Motion and effort sensors, Variable inductance transducers, Piezoelectric sensors, Strain gauges and torque sensors, Thermofluidic sensors, Analog vs Digital sensing, Shaft Encoders, Optical encoder, MEMS sensors, Introduction to Digital Twins, Principle Architecture of Digital Twins, Integration of Digital Twins & Internet of Things, Digital Twin Data Types and Analytics, Simulation-enabled digital twins.

ME203 CIRCUITS AND ELECTRONIC DEVICES (3-0-3): Introduction to electrical circuits, KVL and KCL, Norton Thevenin theorems, AC and DC characteristics of RL, RC and RLC circuits, Introduction to diodes, structure, properties, types and applications, Silicone controlled Rectifier (SCR), Introduction to BJTs, structure, types and applications, Introduction to MOSFETs, structure, types and applications, Introduction to IGBTs, Number systems, operations, conversion, 1's & 2's complements, Digital logic gates, Boolean algebra, Karnaugh mapping.
Pre-requisite(s): PH104.

ME211 STATICS (2-0-2): Review of basic concepts of scalars, vectors, Newton's law, forces, rectangular components, moment, couple, resultants. Equilibrium: System isolation and the free-body diagram, equilibrium conditions in 2-D and 3-D. Structures: Plane trusses, method of joints, method of sections, space trusses, frames and machines. Distributed Forces: Center of mass, centroids of lines, areas, and volumes, composite bodies and figures. Beams: External effects, internal effects, flexible cables. Friction: Introduction, types of friction, dry friction, wedges.
Pre-requisite(s): PH101

ME212 DYNAMICS (3-0-3): Introduction to Dynamics: Basic concepts, Newton's laws, units, solving problems in dynamics, rectangular coordinates (x-y), normal and tangential coordinates (n-t), polar Coordinates (r-Θ), and space. Types of Motion: Curvilinear motion, relative motion (translating axes), constrained motion of connected particles, force, mass, and acceleration, Newton's second law, equation of motion. Work and Energy: Work, kinetic energy, potential energy. Impulse and Momentum: Linear impulse and linear momentum, angular impulse and angular momentum, special applications, impact, central-force motion. Kinetics of Systems of Particles: Introduction, generalized Newton's second law, work-energy, impulse-momentum, conservation of energy and momentum, steady mass flow, variable mass. Plane Kinematics of Rigid Bodies: Introduction, rotation, absolute motion, relative velocity, instantaneous center of zero velocity, relative acceleration, and motion relative to rotating axes.
Pre-requisite(s): ME111

ME213 MECHANICS OF SOLIDS I (3-0-3): Concepts: Normal and shear stress, strain, material, factor of safety, stress concentration, pressurized thin-walled cylinder, simple loading tension, torsion and bending, deflection with simple loading, superposition techniques, statistically indeterminate member, thermal stresses, combined stresses, Mohr's circle, combined loading
Pre-requisite(s): ME111

ME231 THERMODYNAMICS-I (3-0-3): Introduction to Thermodynamics: System and boundary, specific volume, pressure and temperature, equilibrium state, processes, methods to solve thermodynamics problems. Understanding Heat and Work Interactions: First law of thermodynamics and its applications, energy balance of closed system, energy analysis of power, refrigeration and heat pump cycles. Phase and Pure Substance: Phase change processes, p-v-T relation, property diagrams, equation of state, specific heats, compressibility poly-tropic process relation. Conservation of Mass for Control Volume: Evaluating mass rate balance, 1-D flow, conservation of energy for control volume, applications to practical devices. Introduction to Second Law: Spontaneous and non-spontaneous processes, thermodynamic cycles, irreversible and reversible process, Carnot cycle, Calusius inequality. Entropy: Entropy change, T-s diagram, entropy generation, increase of entropy principle, entropy rate balance of closed systems and control volumes, isentropic efficiencies.
Pre-requisite(s): MT101.

ME232 THERMODYNAMICS-II (3-0-3): Review of Thermodynamics I: Energetics, efficiency. Vapor Power Systems: Modeling and analyzing vapor power systems, superheat and reheat, regenerative vapor power cycle, other vapor cycle aspects. Gas Power Systems: Air-standard-Otto cycle, diesel cycle, dual cycle, Brayton cycle, regenerative gas turbines with reheat & inter cooling, gas turbines for aircraft propulsion, combined cycles, Ericsson and Stirling cycle. Refrigeration and Heat Pump Systems: Vapor compression refrigeration systems, cascade and multistage systems, absorption

AHMAD ADIL

As I stand on the brink of bidding farewell to my beloved alma mater, my heart swells with emotions that are as vast and intricate as the engineering marvels we've learned to create within GIKI. But beyond the academic rigor and technical prowess, it is the intangible essence of GIKI that truly sets it apart. It is the camaraderie forged during late-night study sessions and the bonds formed through shared triumphs and setbacks. It is the spirit of innovation that permeates every corner of the campus, inspiring us to dream big and reach for the stars. It is the palpable sense of belonging that makes GIKI not just a university, but a home away from home. To GIKI, I say thank you for shaping me into the engineer, the thinker, and the person I am today. You will always hold a special place in my heart, and I will forever cherish the memories of my time spent within your walls.

refrigeration, heat pump systems, gas refrigeration systems. Ideal Gas Mixtures: Mixture composition, p-V-T relations for ideal gas mixtures, U, H, S and specific heats for ideal gas mixtures. Psychometric Principles and Psycho-meters: Psychometric charts, analyzing air-conditioning processes, cooling towers. Reacting Mixtures and Combustion: Combustion process, conservation of energy in reacting systems, adiabatic flame temperature, thermodynamic relations, equations of state, important mathematical relations.
Pre-requisite(s): ME231.

ME354 MANUFACTURING PROCESSES (2-0-2): Traditional Machining Operations, Cutting Tool Technology. Non-Traditional Machining Operations: Mechanical, Electrical & Thermal Processes. Metal Forming Technology: Extrusion, Drawing, Sheet Metal Forming. Welding Technology: Fusion Welding Processes and Solid-State Welding Processes. Processing of Polymers and Composites, 3D Printing.
Pre-requisite(s): -

ME313 THEORY OF MACHINES (3-0-3): Introduction to Theory of Machines: Linkage synthesis and analysis (Graphical and Analytical position, velocity and acceleration analysis). Cams: Terminology, S V A J diagrams, double dwell cam design, single dwell cam design. Mechanical drives: chains drives and belt drives. Balancing: Static and dynamic balancing, introduction and types of Gears trains. Gyroscopes: Gyroscopic couple, effect of gyroscopic couple on navigation.
Pre-requisite(s): ME212

ME314 MECHANICS OF SOLIDS II (2-0-2): Analysis of stress in two and three dimensions, Principal stresses, Mohr's circle for stress, Thick-walled pressure vessels, Symmetrical and asymmetrical loading, Introduction to fracture mechanics, Impact loading, Fatigue and creep, Virtual work, Theories of elastic failure, Theory of columns.
Pre-requisite(s): ME 213

ME315 MECHANICAL VIBRATIONS (3-0-3): Introduction to Vibrations: Harmonic motion, damping, modeling and energy methods, stiffness, measurement, design considerations, stability. Harmonic Excitation: Un-damped system, damped system, alternative representations, base excitation, rotating unbalance, measurement devices, damping. Impulse Response: Response to arbitrary input, response to arbitrary periodic input. Transformation Methods: Random inputs, shock spectrum, measurements, stability. 2 DOF System: Eigenvalues and natural frequencies, modal analysis. Multiple DOF: Viscous damping, modal analysis, Lagrange equations, acceptable levels of vibrations, vibration isolation, vibration absorbers, damping, optimization, viscoelastic damping, critical speed, active suppression.
Pre-requisite(s): MT201, ME212.

ME321 FLUID MECHANICS-I (3-0-3): Introduction to Fluids: Fluid behavior and properties, specific weight, viscosity, compressibility, vapor pressure, surface tension. Fluid Statics: Pressure at a point, pressure variation in a fluid at rest, measurement of pressure, hydrostatic forces on plane and curved surfaces, buoyancy, pressure variation in fluids with rigid body motion. Fluids Dynamics: Newton's second law along and normal to a streamline, static, stagnation, dynamic and total pressure. Bernoulli's Equation: The energy line and hydraulic grade line, velocity and acceleration field, control volume and system representation, Reynolds transport theorem. Conservation Equations: The continuity equation, conservation of momentum: Newton's second law, the energy equation. Dimensional Analysis: Buckingham Pi Theorem, determination of Pi terms. Pipe flow: Fully developed laminar and turbulent flow, dimensional analysis of pipe flow.
Pre-requisite(s): MT 101, ME 212

ME322 FLUID MECHANICS II (3-0-3): Introduction: Fluid mechanics I review. Differential Analysis of Fluid Flow: Fluid element kinematics, conservation of mass and linear momentum. Inviscid and Potential Flows: Uniform flow, source and sink, vortex, doublet, superposition of basic potential flows, half body, Rankine ovals, flow over circular cylinder. Viscous Flow: Navier-Stokes equation, flow between fixed parallel plates, Couette flow, steady, laminar flow in circular tubes, flow in annulus. Flow Over Immersed Bodies: Boundary layer characteristics, Prandtl/Blasius solution, momentum integral estimates, turbulent boundary layer flow, effects of pressure gradient, friction drag, pressure drag, lift. Compressible Flow: Ideal gas relationships, Mach number, types of compressible flow, isentropic flow of an ideal gas,

converging-diverging duct flow, nonisentropic flow of ideal gas, Fanno and Rayleigh flow, normal shock waves. Turbomachines: Basic energy and angular momentum consideration, centrifugal pumps, pump performance curves and pump selection, dimensional parameters and similarity laws, Introduction of Machine Learning in Turbomachines with examples, impulse turbines, reactive turbines, compressors, compressible flow turbines, windmills.
Pre-requisite(s): ME 321

ME333 HEAT TRANSFER (3-0-3): Introduction of Heat Transfer: Physical origins of conduction, convection and radiation, The conservation of energy. Conduction: The conduction rate equation, steady-state conduction in the plane wall and radial systems, conduction with thermal energy generation, finned surfaces, 2-D conduction: Shape factor, numerical methods, transient conduction: The lumped capacitance method. Convection: Boundary layers, laminar and turbulent flow, external flow convection, internal flow convection, the energy balance, free and forced convection. Heat Exchangers: Types, use of the LMTD method, the effectiveness-NTU method. Radiation: Processes, radiation intensity, blackbody radiation, emission, absorption, reflection, and transmission by real surfaces, radiation exchange between surfaces, multi-mode heat transfer. Diffusion Mass Transfer: Physical origins and rate equations, mass transfer in non-stationary media, The stationary medium approximation, conservation of species for a stationary medium, homogeneous chemical reactions.
Pre-requisite(s): ME231, ME321.

ME363 DESIGN OF MACHINE ELEMENTS I (2-0-2): Philosophy and concept of engineering design, Design codes and standards, determination of permissible and actual stresses, factor of safety, Design of keys, cotters, and couplings, Design of brakes and clutches, Flywheel, Design of welded, riveted and bolted joints, Design of translation screws, Mechanical springs, Flexible mechanical elements.
Pre-requisite(s): ME245, ME213

ME364 DESIGN OF MACHINE ELEMENTS II (2-0-2): Design of shafts, tolerances, standards of fits & tolerances, Design of rolling contact bearings, hydrodynamic theory of lubrication, journal bearings, Gear trains, Design of spur, helical, bevel and worm gears: kinematics, force analysis, AGMA equations
Pre-requisite(s): ME363

ME403 ELECTRICAL MACHINES AND DRIVES (3-0-3): Introduction to fundamental laws of electromagnetism, magnetization, magnetic and electric circuit analogy and analysis, energy conversion principles, rotary and linear machines, AC and DC machines, Introduction to Microcontroller Programming especially the features to drive and control the electrical machines, design and specifications of solenoids and transformers,

Introduction to DC motors, construction, operating principle, Introduction to half and full-bridge circuits, types of stepper motors, construction and drive, BLDC motors and drives, linear motors and actuators, rotary to linear motion conversion mechanisms, types of linear motors, advantages of linear motors, construction Introduction to AC machinery, single phase and polyphase machines, synchronous and asynchronous machines, construction, types and characteristics, single and three phase inverters, Introduction to generators.
Pre-requisite(s): ME 203

ME404 ARTIFICIAL INTELLIGENCE FOR MECHANICAL ENGINEERS (3-0-3): Introduction, Optimization in engineering, optimization fundamentals, Graphical optimization, Linear programming and Numerical techniques, Fuzzy Logic, Algebras of Fuzzy Sets, Introduction to Fuzzy Control, Artificial Neural Networks, Introduction to Artificial Intelligence Systems, fundamentals of neural networks, neural network control, Hands-on session with Matlab/Simulink.
Pre-requisite(s): MT 201, ES202

ME405 STRUCTURAL HEALTH MONITORING USING AI (3-0-3): Data acquisition, storage and manipulation in the context of SHM, Introduction to data driven SHM, Low Dimensional Visualization and Clustering of Data, Supervised Machine Leaning/Shallow Learning, Improving the Predictive Performance of Machine Learning Models, Deep Convolutional Neural Network (CNN), Improving the Performance of CNN, Recurrent Neural Network, Transfer Learning for Autonomous Features
Pre-requisite(s): ME315

ME406 ELECTRIC VEHICLE TECHNOLOGY (3-0-3): Introduction: Basic Structure of different EVs, Comparison of different powertrains: Hybrid & plugin hybrid electric vehicles, full electric vehicles, Sizing of EV Powertrain: Regenerative braking of the vehicle, traction motor characteristics, Electric Motors for EV Applications: DC machines, generating/braking using a PM DC machine, Battery Technologies for EVs: Battery parameters, efficiency & battery storage units. EV Charging: AC & DC charging, levels of charging (L_1,L_2, L_3), ICT for charging. Magnetic levitation (Maglev): Linear motors, magnetic levitation, Hyperloop. Future Trends in Electric Cars: Solar powered & self-driving EVs, wireless charging, battery swap technology and its issues. V2G technology, Hands On: Motor Testing, No load and Load testing, Battery health monitoring, Switching and non-switching
Pre-requisite(s): ME205

ME411 COMPUTER AIDED ENGINEERING (1-1-2): Engineering design and manufacturing; Introduction to CAD/CAM; Conventional Vs. non-conventional machine tool; Geometric modelling; Feature based design; 2D and 3D graphics and transformations; assembly modelling; Computer Numerical Control; Machine Tool Configuration ISO-841; CNC Programming and Digital Manufacturing.
Pre-requisite(s): ME251

ME416 STRESS ANALYSIS (3-0-3): Review of mechanics of materials, Stress transformations, general 3Dstress state, Mohr's circle in 3D, strain transformations, generalized stress-strain relationship, equilibrium and compatibility, introductory topics from theory of elasticity, Airy stress functions, Prandtl's stress functions for torsion, shear flow, torsion of thin-walled tubes, bending of unsymmetrical beams: stress & deflection, bending of thin flat plates, axisymmetric circular plates in bending, thick-walled cylinders & rotating disks, contact stresses. Overview of Experimental Stress Analysis, Stress analysis –Experimental approaches, Specific domain of these approaches, Advantages and disadvantages.
Pre-requisite(s): ME213, ME314

ME418 CAD/CAM (2-3-3): Introduction and history, geometric modeling; feature and design, CAD hardware and software; 2D and 3D graphics and transformations; assembly modeling and analysis, concurrent engineering; axiomatic design; DFM; DFA; Taguchi method; group technology; value engineering; CE tools, process planning; manual, variant, generative and hybrid approaches; tolerance charts, manufacturing planning and control, cellular and JIT manufacturing; MRP II. Numerical control; NC programming; CNC; DNC, robotics, computer- integrated manufacturing.
Pre-requisite(s): ME101, CS101

ME419 FUNDAMENTALS OF COMPOSITE MATERIALS (3-0-3): History and introduction, Nomenclature and classification, Fundamental equations, Symmetric, asymmetric and other characteristic layering setups,

Classical lamination theory, Failure criteria, laminated structures

ME423 INTRODUCTION TO COMPUTATIONAL FLUID DYNAMICS (2-1-3): Governing Equations, Finite Difference Method, Truncation Error, Finite Volume Method, Conversion of Governing Equations to Algebraic Equations, Numerical Solutions to Algebraic Equations, Solution Analysis, Consistency, Stability, Convergence, Residuals and Convergence Tolerance, Accuracy, Sources of Errors, Controlling the Solution Errors, Efficiency, Case Studies from internal and external flow, heat transfer and turbulence modeling
Pre-requisite(s): ME333, ME322

ME424 GAS DYNAMICS (3-0-3): Flow of compressible fluids; one-dimensional flows including basic concepts; isentropic flow; normal and oblique shock waves; Rayleigh line; Fanno flow and simple waves; multidimensional flows; small perturbation theory for linearized flow; method of characteristics for nonlinear flows.
Pre-requisite(s): ME321, ME322

ME425 THERMO-FLUIDS SYSTEMS DESIGN (3-0-3): Engineering Design Process, Design of Thermal Systems, Design for Environment, Safety and Reliability, Air Distribution Systems, Liquid Piping Systems, Heat Exchanger Selection and Design, Power Generation, Refrigeration and HVAC Systems, Mathematical Modeling of Thermal Equipment and Systems, System Simulation and Computer-Aided Design, Design Optimization and System Performance Evaluation, Exergy and Thermo-economic Analysis, Life Cycle Cost, Cost Estimation.

ME434 COMBUSTION (3-0-3): Combustion thermodynamics; chemical kinetics; reaction rate; explosion in gases; detonation; laminar and turbulent flames in pre-mixed gases; diffusion flames; liquid droplet combustion; theory of thermal ignition; combustion of particles; propellant and rocket propulsion.
Pre-requisite(s): ME232, ME333

ME439 REFRIGERATION & AIR-CONDITIONING (3-0-3): Psychrometric principles and design of air-conditioning equipment and ducts; consideration of human comfort in heating and cooling; heating and cooling calculations and design; principles of refrigeration; cycles; refrigerants; absorption refrigeration; multi-pressure systems.
Pre-requisite(s): ME232, ME333

ME452 ROBOTICS (3-0-3): An overview of robotics; forward kinematics; inverse kinematics; Denavit-Hartenberg coordinate transformations; motion kinetics; force/torque relations; trajectory planning, Lagrange equations; position control; PID control; inverse dynamics feed forward control; nonlinear control; Applications of Artificial Intelligence (AI) in Robotics.
Pre-requisite(s): ME212, ME313

ME453 ADDITIVE MANUFACTURING (3-0-3): Introduction and Basic Principles of various additive manufacturing techniques, history, current development and fundamental engineering aspects. Techniques, printing mechanisms, advantages and limitations of Polymer, Metal, Ceramic and other additive manufacturing technologies. Principles and strategies for additive manufacturing process. Additive manufacturing applications. Future of additive manufacturing.

ME454 MICRO AND NANO FABRICATION (3-0-3): Introduction to micro and Nano fabrication, Basic Micro fabrication Techniques (lithography, etching), Thin film deposition (Chemical vapor deposition (CVD), sputtering, Physical vapor deposition (PVD), Surface modification, Micromachining (drilling, milling, electric discharge machining, turning), Micro fabrication using 3D Printing and Photo catalytic reaction, Micro joining (solid-state bonding, soldering and brazing, fusion micro-welding, adhesives), Assembly and automation, Applications of micro fabrication, Introduction to Nanofabrication and Materials, Nanofabrication Techniques (E-Beam Nanofabrication, Scanning Probe Techniques, rapid prototyping, X-ray lithography, nano grooving), Nano joining (Bonding using nanoparticles, Focused ion beam machining, growth patterning, welding using electron beam, Indirect joining by SEM and TEM, Ion beam, resistance, ultrasonic, laser), Self-Assembly and Template Manufacturing, Applications of nanofabrication and materials.

ME455 MICROELECTROMECHANICAL SYSTEMS (3-0-3): Overview of MEMS and microsystems, Working principles of microsystems, Engineering science for microsystems design and fabrication, Engineering mechanics for

microsystems design, Thermo-fluid engineering and microsystems design, Scaling laws in miniaturization, Materials for MEMS and microsystems, Microsystems fabrication processes, Microsystems design, Assembly, packaging, and testing of microsystems
Pre-requisite(s): Nil

ME461 ROBOTICS AND AUTOMATION (2-0-2): Type of manipulators, Applications of automation and manipulators in manufacturing industry, changing descriptions from frame to frame, rotations, transformations. Transformation arithmetic. Convention for affixing frames to links. Denavit-Hartenberg notation, manipulator kinematic, DH table of different industrial manipulator, Solvability. Algebraic solution. Inverse kinematic examples of 3-DOF manipulators. Velocities and Static Forces: Introduction. Jacobians. Singularities analysis. Planar and 3DOF spatial case examples, Static forces in manipulators. Jacobians in the force domain. Trajectory Generation for automation: Joint space schemes. Cartesian space schemes. Cubic polynomial for a path with via points Case study: Trajectory planning for industrial tasks such assembly, drilling, and welding etc. Automation System Components, Robotics Automation Systems: End-effectors, Sensors, and actuators. Industry 4.0. Dynamic and Design: Lagrangian formulation of manipulator dynamics, DOF, redundant and non-redundant robot, workspace analysis, Accuracy, and precision requirement for manufacturing process. manipulability measure. Control and Digital Twin: Feedback and closed loop control. Second-order linear systems. Control of second order systems. Control law partitioning. Trajectory-following control, Basic concept of Digital Twin. Process Automation through Digital Twin
Pre-requisite(s): ME315

ME464 SYSTEM DYNAMICS AND CONTROL (3-0-3): Introduction to Control Systems: dynamic systems, modeling and simulation, utility and application. Mathematical Models of Systems and Simulation: Review of mathematical modeling techniques, modeling of mechanical-electrical, electro-mechanical and process control systems, linearization, case studies. System Response Analysis: Time response of dynamical systems, classical solution of ODEs, Time domain solution of ODEs, frequency response. Feedback Control Characteristics: Why feedback, error signal analysis, disturbance signals in a feedback control system, control of transient response, steady-state error. Performance of feedback control system: Introduction to second-order systems, effect of poles and zeros, s-plane root location, steady-state error of feedback control system. Stability of linear system: Routh-Hurwitz stability criteria for dynamical systems, Introduction to feedback control System: Performance specifications, design of different classical control laws/ algorithms to control a dynamical system, performance analysis and improvement. Frequency response analysis of linear systems.
Pre-requisite(s): MT201

ME465 INTRODUCTION TO AUTOMOBILE ENGINEERING (3-0-3): Introduction, layout and components; power generation (engine, engine systems and testing), transmission, wheel and tire, chassis frame and body, suspen system, control systems (steering, brake); vehicle design (performance, axle loading, chassis design, vehicle mechanics); ergonomics, legislation, automobile industry in Pakistan.

ME466 INTRODUCTION TO FINITE ELEMENT METHODS (2-3-3): Introduction; stress analysis by FEM; direct stiffness method, energy, variational principles and Ritz method; co-ordinate transformation; iso-parametric formulation; solution of Eigenvalue, boundary value, discretized time dependent problems.

ME467 FINITE ELEMENT ANALYSIS (2-3-3): Introduction, Direct Stiffness method, Variational methods/Weighted Residual methods, Formulation of equations for 1D and 2D elements, Shape Functions, Iso parametric formulation, FEA applications in Structural mechanics, Fluid mechanics and Heat transfer using commercial code.
Pre-requisite(s): NIL

ME468 MECHANICAL ENGINEERING DESIGN (3-0-3): Philosophy and concept of engineering design, engineering creativity, phases and procedures in design, management of engineering projects, computer-aided design (CAD), case studies in design with emphasis on system modeling, optimization and reliability, application of industrial design codes.
Pre-requisite(s): ME261

ME469 DESIGN OF EXPERIMENTS IN MECHANICAL ENGINEERING (3-0-3): Introduction and importance

experimental design, Statistics, Random variables and probability distributions, Distributions of sampling statistics, Hypothesis testing and decision making for single and multiple samples, Regression/building empirical models, Analysis of Variance (ANOVA), Introduction to uncertainty and error analysis of experimental data causes and types of experimental errors, Choice of sample size in designed experiments, Factorial Designs

ME471 POWER PLANTS (3-0-3): Energy and environment, gas power plants, hydroelectric power plants, vapor power plants, nuclear reactors, fuels, combustion, turbines, compressors, pumps, boilers, exhaust analysis, renewable energy resources (geothermal, wind, biomass, solar, etc.), waste water treatment, environmental impacts, feasibility, cost analysis.
Pre-requisites: ME321, ME232, ME333

ME473 GAS TURBINES (3-0-3): Thermodynamic analysis and analytical design of gas turbine engines; topics in combustion, internal compressible flow, boundary layer, thrust determination for ramjets and turbojets, axial and centrifugal compressor, axial and centripetal turbines.
Pre-requisite(s): ME321, ME232

ME474 INTERNAL COMBUSTION ENGINES (3-0-3): Fundamentals of internal combustion engines; study of fluid flow, thermodynamics, combustion, heat transfer, friction phenomenon, and fuel properties relevant to engine power, efficiency and emissions; examination of design features and testing characteristics of different types of engines.
Pre-requisite(s): ME321, ME232

ME475 ENERGY MANAGEMENT & CONSERVATION (3-0-3): Energy and environment, fuels and materials, energy auditing and surveying, energy consumption in manufacturing, heat transfer, heat balance and energy flow charts, heat recovery, energy technologies, instrumentation and measurements, sustained reductions in energy use, economics, waste heat recovery.

ME476 RENEWABLE ENERGY (3-0-3): Thermodynamic Laws & systems, Renewable energy resources, Technoeconomic and sustainability analysis, Fuel Cells: Classification, Reaction, Configurations, Hydrogen: production, Hydrogen storage, Solar: Irradiance, Types of Solar Collectors, Solar Thermal Plant Configurations, Thermophotovoltaic cells, Solid State Junction Photodiode, Dye Sensitized Solar Cells, Organic Photovoltaic Cells, Perovskite Solar Cells, Biomass, Microalgae, Biodiesel, Wind Machine configurations, Ocean: Wave energy, Tidal Energy, Salination Energy, Osmosis, Nuclear: Fission reactors, Power cycles and reactors, Fusion Reactors, Hydropower, Thermoelectric Generators: Physics, Designing, Performance of Storage of Energy: Electrochemical Storage (Batteries), Capacitive Storage, Thermal energy storage.
Pre-requisite(s): ME321, ME232

ME477 FUEL CELL TECHNOLOGY (3-0-3): Introduction, types of fuel cell, Basic FC Operation, performance, and environment. Fuel cell Thermodynamics, Concentration

cell, Fuel cell efficiency, Reaction Kinetics, Catalyst-Electrode design, Catalysis in Fuel Cell. Charge transport in fuel cells, Mass transport in fuel cell, Flow structure design, Modeling of fuel cells: Basics to Heat transfer, Fuel cell energy balance, Fuel cell heat managements, Types of fuel cells: Phosphoric acid fuel cell, PEMFC, Alkaline fuel cell, Molten carbonate fuel cell, SOFC. Peripheral/ Subsystem design for fuel cells, Fuel subsystem-internal and external reforming, Balance of plant/system process modeling, incorporate the thermal management for optimal configuration of the process.
Pre-requisite(s): ME231, ME321

ME380 SENIOR YEAR DESIGN PROJECT - I (0-3-1): Senior Design Project is offered to the students during the 6th semester and is a three semesters long activity performed in a group of not more than four members. Each group decides on a project under the supervision of a PhD faculty member. The scope of the first part of the project includes an introduction, literature review, theoretical design, and analysis of the intended system/product/process with or without the help of computational software.

ME481 SENIOR YEAR DESIGN PROJECT - II (0-9-3): In the second phase, the students carry out physical model (prototype) development and testing. The results of the experiments/testing are reported, analyzed, and discussed.
Pre-requisite(s): ME380

ME482 SENIOR YEAR DESIGN PROJECT - III (0-6-2): In the third phase, students are required to work on product development and commercialization or research publication depending on the nature of their project. The students are also required to analyze the socio-economic impact of their project with environmental and sustainability considerations.
Pre-requisite(s): ME481

ME493 INDUSTRIAL AUTOMATION (3-0-3): Automation, Analog and Digital Electronics, ASCII, Unicode, Number Systems, Sensor Transducers & Actuators, Microprocessors and Microcontrollers, Computer Interfacing, electronic communication, Electrical Power, Pneumatics, Hydraulics, Machines and Processes, CNC, PLC, SCADA, Reliability Availability Maintainability and Safety (RAMS), Industry 4.0, ERP, e-Commerce

ME494 FLIGHT DYNAMICS AND CONTROL (3-0-3): Systems of axes and notation, Static equilibrium and trim, the equation of motions, longitudinal dynamics, Lateral dynamics, Flight stability, Flight control.

Lab Courses

ME245 WORKSHOP PRACTICES (0-3-1): Applications of various workshop equipment and machines, Hands on experience with conventional machining operations such as drilling, turning, milling, shaping, grinding

etc, Physical exposure to arc welding, gas welding, spot welding and soldering process, Electro discharge machining, Sand casting, cold rolling, Injection molding processes etc.
Pre-requisite(s): -

ME243 ELECTRONICS AND ELECTRIC MACHINES LAB (0-3-1): Laboratory experiments related to circuits, electronic devices, electrical machines and instrumentation.
Pre-requisite(s): ME203; Co-requisite(s): ME205

ME244 MECHANICS AND DESIGN LAB (0-3-1): Laboratory experiments related to Mechanics and Design.

Pre-requisite(s): ME211; Co-requisite(s): ME212

ME346 THERMO-FLUID LAB-I (0-3-1): Laboratory experiments related to Thermodynamics, and Fluid Mechanics I.

Pre-requisite(s): ME232; Co-requisite(s): ME321

ME347 THERMO-FLUID LAB-II (0-3-1): Laboratory experiments related to Heat Transfer and Fluid Mechanics II.
Co-requisite(s): ME333, ME322

ME348 MECHANICS OF SOLIDS AND MACHINES LAB (0-3-1): Laboratory experiments related to mechanics of solids and theory of machines.
Pre-requisite(s): ME213, Co-requisite(s): ME313, ME314,

ME446 MECHANICAL VIBRATIONS AND SYSTEM DYNAMICS AND CONTROL LAB (0-3-1): Laboratory experiments related to Mechanical Vibrations and System Dynamics and Controls.
Pre-requisite(s): ME315, MT201; Co-requisite(s): ME464

Careers in Mechanical Engineering

Careers in mechanical engineering have evolved significantly in response to modern trends that redefine the industry landscape. With a focus on renewable energy, mechanical engineers play pivotal roles in the design, development, and optimization of sustainable power generation systems such as wind turbines, solar panels, and hydroelectric facilities. Additive manufacturing has opened new avenues for mechanical engineers to innovate in product design, prototyping, and manufacturing processes, driving efficiency and customization. The integration of artificial intelligence empowers mechanical engineers to enhance product performance, optimize manufacturing processes, and develop autonomous systems for various applications. In the realm of electric vehicle technology, mechanical engineers lead the charge in developing next-generation batteries, transmission systems, and infrastructure solutions, shaping the future of transportation towards sustainability. Moreover, in the era of Industry 4.0, mechanical engineers harness the power of data analytics, cyber-physical systems, and smart technologies to drive advancements in manufacturing automation, predictive maintenance, and supply chain management. As such, careers in mechanical engineering offer diverse opportunities to engage with cutting-edge technologies and contribute to solving complex challenges making it an exciting and rewarding field for aspiring engineers. Washington Accord (WA) accredited engineering degree, implies that the BS degree is recognized as equivalent to a degree from WA signatory countries. This provides an additional mobility to our graduates across the world as it makes easier for engineers to gain professional registration in other countries.

DEPARTMENT OF CIVIL ENGINEERING

Introduction

Civil Engineering is an ever-green field and plays an essential role in shaping our communities across the globe. With a growing population, the need for strong structures and sustainable solutions has never been greater. From constructing buildings to ensuring clean water, from designing transportation systems to preserving our natural environment besides erecting colossal embankment structures and skyscrapers, Civil Engineering is at the heart of all these developments.

BSc Civil Engineering Program at GIKI: Where Innovation Meets Tradition

Our Civil Engineering program provides the knowledge and skills required to become a leader in shaping the built environment. We offer a dynamic learning experience that combines a comprehensive curriculum with real-world applications.

- **Advanced Curriculum:** Our curriculum stays ahead of the curve, incorporating disruptive technologies such as Artificial Intelligence (AI) in fields like sustainable materials, computational modeling, and smart infrastructure.
- **Cutting-Edge Design Projects:** Final year projects tackle real-world problems, preparing students to tackle complex issues through innovative solutions. Imagine designing a smart bridge or a resilient building for a disaster zone!
- **In-Depth Electives:** Liberty to deepen the knowledge in specialized areas with our comprehensive electives. Here are two exciting examples:
  - **Earthquake Engineering:** Gain a thorough understanding of seismic analysis, design principles, and mitigation strategies for earthquake-prone regions.
  - **Building Information Modeling (BIM):** Master cutting-edge software for 3D modeling, collaboration, and project management used throughout the construction lifecycle.
  - **Tunneling and Underground Space Structures:** Master the design, construction, and management of subterranean infrastructure, developing essential skills and exploring cutting-edge technologies to navigate the complexities of underground projects effectively.
- **Modern Tools for Success:** The Program is designed to foster proficiency in industry-standard software's and tools that give a competitive edge, including
  - Finite Element analysis and modelling for complex structures
  - 3D printing facilities for rapid prototyping and visualization
  - Augmented and Virtual reality setup for immersive design experiences
- **High Tech Labs:** Our department features state-of-the-art labs and simulation facilities, enabling hands-on experience with the latest tools and technologies in civil engineering. Through simulation-based labs, students experiment with design principles, construction methods, and materials without real-world risks. These experiences deepen their understanding, enhance critical thinking, and foster innovation, preparing them for success in the dynamic field of civil engineering. Further all our labs and associated processes are ISO 9001:2015 certified, guaranteeing adherence to rigorous quality standards.

The program prioritizes sustainability, resilience, interdisciplinary collaboration, and adaptability to tackle pressing global issues such as climate change and resource scarcity. This emphasis fosters innovation and contributes to the achievement of Sustainable Development Goals (SDGs).The Civil Engineering program at GIK Institute offers specialization to its students in the following seven major thrust areas.

Thrust Areas

- Water Resources Engineering
- Geotechnical Engineering
- Transportation Engineering
- Structural Engineering
- Environmental Engineering
- Construction Management and Engineering
- Geomatics Engineering

The program trains its graduates to participate effectively in development challenges by getting involved in multiple projects of national and international scopes.

The department aims to train its graduates to gain a practical understanding of the theoretical knowledge obtained in a class by applying them in the department's immaculate laboratories. The campus of GIK Institute provides necessary field areas for understanding the application, and integration of field and laboratory outcomes.

We invite you to embark on an exciting educational adventure with us at the Department of Civil Engineering, GIK. Prepare to challenge yourself, unlock your potential, and shape a sustainable future through the art and science of civil engineering.

Department of Civil Engineering

Prof. Dr. Muhammad Ashraf Tanoli
HOD Department of Civil Engineering

Faculty

Prof. Dr. Muhammad Ashraf Tanoli
PhD (Tottori University, Japan)
Dr. Muhammad Faisal Javed
PhD (University of Malaya, Malaysia)
Dr. Khawar Rehman
PhD (Hanyang University, Republic of Korea)
Dr. Muhammad Arsalan Khan
PhD (University of Hasselt, Belgium)
Dr. Shiraz Ahmed
PhD (University of Hasselt, Belgium)
Dr. Hafiz Ahmed Waqas
PhD (University of Tokyo, Japan)
Dr. Mehtab Alam
PhD (University of Chinese Academy of Sciences, China)
Dr. Numan Khan
PhD (Chung-Ang University, Republic of Korea)
Dr. Muhammad Waseem
PhD (University of Rostock, Germany)
Mr. Adil Poshad Khan
MS (Budapest University of Technology and Economics, Hungary)
Mr. Haidar Ali
MS (Tianjin University, China)
Mr. Zeeshan Asghar
(University of Utah, USA)
Mr. Aizaz Haider
MS (University of Pittsburgh, USA)

Faculty on Leave

Muhammad Farjad Iqbal
PhD Scholar (UIUC, USA)
Muhammad Naveed
PhD Scholar (University of Wollongong, Australia)

Lab Engineers

Hamza Ahmad Qureshi
BS Eng. (UET Peshawar, Pakistan)
Mehran Sahil
BS Eng. (GIKI, Pakistan)
Muhammad Azeem
BS Eng. (UET Peshawar, Pakistan)
Shah Faisal
BS Eng. (UET Peshawar, Pakistan)
Saad Ilyas
BS Eng. (UET Taxila, Pakistan)

Graduate Assistants

Waheed Ali
MS Eng. (NUST, Pakistan)
Izhar Ahmad
BS Eng. (UET Peshawar, Pakistan)
Sareer Ahmad
BS Eng. (UET Peshawar, Pakistan)
Munir Iqbal
BS Eng. (GIKI, Pakistan)
Abdul Qadeer Khan
BS Eng. (GIKI, Pakistan)
Zulqarnain Jahan
BS Eng. (IIUI, Pakistan)

PS to HoD

Sehrish Mazhar
M.Com (UoS Sargodha, Pakistan)

Department Mission

The department aims to produce competent engineers who can work in the society, both as field professionals and academic researchers. The department also aspires to produce engineers who are able to integrate theories and practices of civil engineering being exposed to the contemporary issues in the industries.

Program Educational Objectives (PEOs)

Main emphasis of BS Civil Engineering Program is to produce graduates with the following credentials.

PEO1: Graduates become professional engineers to work in leading national and international organizations to address challenging issues.

PEO2: Graduates engage in profession, academics, and research to keep abreast with latest developments and sustainable practices in the field.

PEO3: Graduates demonstrate the fundamentals of the professionalism, ethics, and quality performance that will enable them to be leaders and contributors to the society.

Program Learning Outcomes (PLOs)

At the time of graduation, students must possess the following attributes:

PLO-1 Engineering Knowledge: Apply knowledge of mathematics, natural science, engineering fundamentals and Engineering specialization to the solution of complex engineering problems.

PLO-2 Problem Analysis: Identify, formulate, conduct research literature, and analyse complex Engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences and engineering sciences.

PLO-3 Design/Development of Solutions: An ability to design solutions for complex engineering problems and design systems, components or processes that meet specified needs with appropriate consideration for public health and safety, cultural, societal, and environmental considerations.

PLO-4 Investigation: Conduct investigation of complex Engineering problems using research-based knowledge and research methods, including design of experiments, analysis and interpretation of data, and synthesis of information to provide valid conclusions.

PLO-5 Tool Usage: Create, select and apply appropriate techniques, resources, and modern engineering and IT tools, including prediction and modeling, to complex Engineering problems, with an understanding of the limitations

PLO-6 The Engineer and the World: Analyze and evaluate sustainable development impacts to society, the economy, sustainability, health and safety, legal frameworks, and the environment while solving complex engineering problems.

PLO-7 Ethics: Apply ethical principles and commit to professional ethics and norms of engineering practice and adhere to relevant national and international laws. Demonstrate an understanding of the need for diversity and inclusion.

PLO-8 Individual and Collaborative Team Work: Function effectively as an individual, and as a member or leader in diverse and inclusive teams and in multi-disciplinary, face-to-face, remote and distributed settings.

PLO-9 Communication: Communicate effectively and inclusively on complex engineering activities with the engineering community and with society at large, such as being able to comprehend and write effective reports and design documentation, and make effective presentations, taking into account cultural, language, and learning differences.

PLO-10 Project Management and Finance: Demonstrate knowledge and understanding of engineering management principles and economic decision-making and apply these to one's own work, as a member and leader in a team, to manage projects in multidisciplinary environments.

PLO-11 Lifelong Learning: Recognize the need for, and have the preparation and ability for i) independent and life-long learning ii) adaptability to new and emerging technologies and iii) critical thinking in the broadest context of technological change.

Knowledge Areas

	Description	Courses
WK1	Natural Sciences	Applied Physics, Applied Chemistry and Environment, Engg. Geology
WK2	Mathematics and Computing	Calculus, Differential Equations and Linear Algebra, Probability and Statistics, Numerical Analysis, Finite Element Analysis, Computing and AI, OPP and Design.
WK3	Engineering Fundamentals	Mechanics of Solids, Surveying, Construction Materials, Fluid Mechanics, Transportation Engineering, Structure Analysis, Soil Mechanics, Hydrology, Drawing and Graphics,
WK4	Engineering Specialization	Pre-stressed Concrete, Earthquake Engineering, Hydraulic Engineering Design, Traffic Engineering, Geometric Design of Highways, Contract Management, Underground Space Structures, Remote Sensing, Watershed Modeling, Climate Change, Machine Learning Applications in Civil Engineering, Slope Stability
WK5	Engineering Design	Geotechnical and Foundation Engineering, Reinforced Concrete Design, Environmental Engineering, Highway Engineering, Design of Steel Structures, Design of Structures
WK6	Engineering Practice	Innovation and Makers Labs, Mechanics of Solids Lab, Surveying Labs, Construction Materials Lab, Fluid Mechanics Labs, Soil Mechanics Lab, Geotechnical Lab, Hydrology Lab, Drawing and Graphics Lab, Geo Informatics Lab, Reinforced Concrete Design lab, Environmental Engineering Lab, Quantity Surveying Lab, Highway Engineering Lab
WK7	Engineering in Society	Occupational Health and Safety, Ideology of Pakistan, Islamic Studies, Professional Ethics, Engineering Economics, Communication Skills, Critical Thinking and Expository Writing
WK8	Research Literature	Senior Design Project I, Senior Design Project II, Courses including CEPs

Sustainable Development Goals (SDGs)

Civil Engineering being a diverse field directly caters to society and environment in their development and conservation needs, therefore it targets all the SDGs defined by the UN. The curriculum of BS Civil Engineering program at GIK Institute is set to enable its graduates to identify the potential for achievement of SDGs in their respective professions.

Accreditation

Accredited for full cycle of four years by PEC under Second schedule Washington Accord (Level II)

Laboratories

Theory of Structures Lab

This lab provides latest facilities to idealize structural response, function of individual members and the behavior of structures under different scenarios and loading conditions. The equipment can be used to observe the elastic behavior of structural elements and the strain energy that a member can absorb at the ultimate loading.

Highway Engineering Lab

This lab is used for the testing of pavement materials, consisting of both the binder and the aggregates. Lab facilities allow bitumen testing which includes penetration and grading, flash and fire point, and ductility tests. Equipment is also utilized for aggregate testing such as impact, abrasion, fatigue resistance, flakiness index, and the elongation numbers. The lab also has its own plate load testing and California Bearing Ratio (CBR) equipment.

Geotechnical Engineering Lab

This lab has one of the most advanced Tri-axial testing machine and direct shear test machine. The lab also has the sufficient gear to analyze the properties of soil, their gradation, moisture values and the Atterberg limits. The installed equipment can determine permeability of soil, verify Darcy's law, and calculate the dry density as well as the bulk density of the soil for the optimum moisture content.

Mechanics Lab

The mechanics lab helps the students to visualize the actions and reactions of the forces and the portions of an object responsible for producing resistance to these forces. The lab clearly describes the changes occurring in the objects due to difference in their materials and dimensions. The center of gravity apparatus, the polygon of forces apparatus, the friction value determination apparatus, the moment balancing and the virtual work apparatus etc. are few of the equipment from this lab.

Materials Engineering and Concrete Lab

The materials lab has a very high quality Universal testing machine (UTM) that is computer controlled and also gives output in the form of digital data. The Machine is latest and highly efficient. It can perform the tensile as well as the compression tests on both; concrete and steel specimens. The lab also contains the equipment for testing the properties of fresh and hardened concrete. In this lab, different tests on aggregates necessary for mix proportioning are carried out as well.

Engineering Surveying Lab

This lab covers both basic and advanced surveying techniques for recording measurements, including precision steel taping methods to calculate horizontal measurements, digital theodolites to perform angular measurements, and automatic levels for elevation measurements. In addition, the labs are also equipped with numerous total stations, which enable horizontal, vertical, and angular measurements to be made in a single operation.

Environmental Engineering Lab

This lab is well equipped for conducting water chemistry and environmental microbiology experiments. In addition to standard laboratory equipment such as pH meters, turbidity meters, dissolved oxygen meters, and ovens, there are several key analytical instruments available for research. The lab has testing facility for both fresh and waste water contamination and can be utilized to assess the physical, chemical and biological contaminants. Furthermore, commercial testing can also be rationally carried out in the lab.

Fluid Mechanics and Hydraulics Lab

This lab has equipment including state of the art 10 m long hydraulic flume with advanced experimental capabilities for studying open channel and coastal

engineering processes. The lab is equipped with pressure gauges, venturi flume, Bernoulli's theorem apparatus, turbines and pumps to conduct all basic and depth level fluid mechanics experiments. The equipment is digitized to accurately measure the head losses in different cases including various materials and types of bends.

Engineering Hydrology Lab

The laboratory has facilities to study the natural hydrological cycle. The equipment in the laboratory can be used to simulate hydrologic conditions by using an advanced hydrology system, a precipitation simulator, a hydrograph tank, and a drainage/water table management tank. Furthermore, the seepage flow, ground water flow and water table can also be observed in the lab.

Drawing and Computer Aided Design Lab

The drawing lab enhances the skills of the students by interaction with architectural models and advanced instruments. The CAD lab teaches the students to use different software to draw, model and design multiple components. The basic drawing and graphics courses are incorporated and practically demonstrated to the students using AutoDesk suite. The students are also taught to design water supply channels using EpaNET and GIS, Structural designing using SAP 2000, ETABS and SAFE, managerial design by Primavera and geotechnical hazard assessment using OpenQuake.

Student Societies

The Department of Civil Engineering has an active student society called 'Institution of Civil Engineers'. The society attracts active participation from students who arrange trainings, workshops, and seminars to work together on diverse contemporary issues such as digital automation, green construction, sustainability, and AI in Civil Engineering. The objective of the society is to promote personal and academic growth of students.

A. General Education requirements (58)

Subject Area	Course Code	CH
Computer Sciences	CS101, CS101L, CS112, CS112L	7
Humanities	HM101, HM102, HM211, HM322,	13
Management Sciences	CV323, CV323L, CV407, CV452	8
Natural Sciences	MT101, MT102, MT202, ES111, ES341, CH101	17
Basic Engineering	PH101, PH101L	4
Interdisciplinary Engineering	MM101, CH161, MM141, IF101, IF102, CV408	9

B. Core requirements (73)

Subject Area	Course Code	CH
Surveying and Geo Informatics	CV201, CV201L, CV202, CV202L, , CV305L	6
Geotechnical Engineering	CV230, CV231, CV231L, CV332, CV332L	10
Structural Engineering	CV211, CV212, CV212L, CV213, CV313, CV315	15
Concrete Engineering	CV215, CV215L, CV314, CV314L, CV414, CV414L	11
Hydraulic Engineering	CV221, CV221L, CV322, CV322L, CV425	10
Transportation Engineering	CV241, CV442, CV442L	7
Construction Engineering	CV351, CV452	2
Environmental Engineering	CV361, CV361L	4

Civil Engineering Drawing	CV210L	1
Quantity Surveying and Cost Estimation	CV403L	1
Project	CV481, CV482	6

C. Technical electives (6)

1. Structural Engineering		
CV413	Matrix Methods of Structural Analysis	3
CV415	Structural Dynamics	3
CV416	Pre-stressed Concrete	3
CV417	Design of Strcutures	3
CV418	Fundamentals of Earthquake Engineering	3
CV419	Design of Bridges	3
2. Water Resources Engineering		
CV422	Hydraulic Engineering Design	3
CV424	Applied Hydrology	3
CV426	Hydropower Engineering	3
3. Geotechnical Engineering		
CV435	Rock Mechanics	3
CV433	Slope Stability	3
CV434	Design and Construction of Earthen Dams	3
CV436	Tunneling and Underground Space Structures	3
4. Highway and Transportation Engineering		
CV443	Traffic Engineering	3
CV444	Pavement Materials and Design	3
CV445	Geometric Design of Highways	3
5. Construction Management and Engineering		
CV453	Architectural and Building Information Modeling	3
MS426	Project Management	3
MS434	Entrepreneurship	3
MS362	Supply Chain Management	3
6. Environmental Engineering		
CV464	Environmental Impact Assessment	3
CV465	Water and Wastewater Engineering	3
CV466	Solid Waste Management	3

7. Geo Informatics Engineering		
CV472	Remote Sensing	3
CV473	Watershed Modeling Using GIS	3
CV474	Climate Change	3
8. Interdisciplinary		
ME467/CV419	Finite Element Analysis	3
ME423/CV427	Introduction to Computational Fluid Dynamics	3
CV408	Machine Learning Applications in Civil Engineering	3

E. Summer Internship (Pass/Fail Grade; NIL Credit)
Every student is required to complete a compulsory training program of cumulative 6 to 8 weeks after the 6th semester (3rd academic year).

F. Survey Camp (Pass/Fail Grade; NIL Credit)
A survey camp after 4th semester (2nd academic year) is mandatory for all BS Civil Engineering students.

G. Total Requirements (137 Credit Hours)
For the BS degree in Civil Engineering, a student has to complete 137 credit hours of course work, survey camp and a cumulative six to eight weeks' internship after 6th semester.

CIVIL ENGINEERING - SEMESTER WISE BREAKDOWN

	Course Code	Course Title	Class Hrs	Lab Hrs	Credit Hrs	Pre-requisite	Co-requisite
1st Semester	MT101	Calculus I	3	0	3	None	None
	PH101	Applied Physics	3	0	3	None	None
	PH101L	Applied Physics Lab	0	3	1	None	None
	CS101	Computing and AI	2	0	2	None	None
	CS101L	Computing and AI Lab	0	3	1	None	CS101
	CH101	Chemistry, Environment and Climate Change	2	0	2	None	None
	CH161	Occupational Health and Safety	1	0	1	None	None
	HM101	Communication Skills	1	2	3	None	None
	IF101	Innovation and Makers Lab I	0	3	1	None	None
	Total		**12**	**11**	**17**		

	Course Code	Course Title	Class Hrs	Lab Hrs	Credit Hrs	Pre-requisite	Co-requisite
2nd Semester	MT102	Differential Equations and Linear Algebra I	3	0	3	None	None
	ES111	Probability and Statistics	3	0	3	None	None
	CS112	Object Oriented Programming and Design	2	0	2	None	None
	CS112L	Object Oriented Programming and Design Lab	0	3	1	None	None
	AI102	Python Programming & Freelancing Essentials	0	3	1	None	None
	MM101	Materials and Nanotechnology	2	0	2	None	None
	MM141	Materials Lab 1	0	3	1	None	MM101
	HM102	Critical Thinking and Expository Writing	3	0	3	None	None
	IF102	Innovation and Makers Lab II	0	3	1	None	None
	Total		**13**	**12**	**17**		

	Course Code	Course Title	Class Hrs	Lab Hrs	Credit Hrs	Pre-requisite	Co-requisite
3rd Semester	MT202	Calculus II	3	0	3	MT101	None
	CV201	Engineering Surveying	2	0	2	None	None
	CV201L	Engineering Surveying Lab	0	3	1	None	CV201
	CV210L	Civil Engineering Drawing and Graphics	0	3	1	None	None
	CV211	Mechanics of Solids I	3	0	3	None	None
	CV215	Construction Materials and Concrete Technology	2	0	2	None	None
	CV215L	Construction Materials & Concrete Technology Lab	0	3	1	None	CV215
	CV221	Fluid Mechanics	2	0	2	None	None
	CV221L	Fluid Mechanics Lab	0	3	1	None	CV221
	HM212	Ideology and Constitution of Pakistan	2	0	2	None	None
	Total		**14**	**12**	**18**		

	Course Code	Course Title	Class Hrs	Lab Hrs	Credit Hrs	Pre-requisite	Co-requisite
4th Semester	CV202	Advanced Engineering Surveying	1	0	1	CV201	None
	CV202L	Advanced Engineering Surveying Lab	0	3	1	None	CV202
	CV213	Basic Structural Analysis	3	0	3	None	None
	CV230	Geology for Engineers	2	0	2	None	None
	CV231	Soil Mechanics	3	0	3	None	None
	CV231L	Soil Mechanics Lab	0	3	1	None	None
	CV241	Transportation Engineering	3	0	3	None	None
	HM211	Islamic Studies	2	0	2	None	None
	Total		**14**	**6**	**16**		

	Course Code	Course Title	Class Hrs	Lab Hrs	Credit Hrs	Pre-requisite	Co-requisite
5th Semester	CV312	Mechanics of Solids II	2	0	2	CV211	None
	CV312L	Mechanics of Solids Lab	0	3	1	None	CV212
	ES341	Numerical Analysis	3	0	3	None	None
	CV313	Indeterminate Structural Analysis	3	0	3	CV213	None
	CV322	Advanced Fluid Mechanics	3	0	3	CV221	None
	CV322L	Advanced Fluid Mechanics Lab	0	3	1	None	CV322
	CV332	Geotechnical and Foundation Engineering	3	0	3	CV231	None
	CV332L	Geotechnical and Foundation Engineering Lab	0	3	1	None	CV332
	Total		**14**	**9**	**17**		

	Course Code	Course Title	Class Hrs	Lab Hrs	Credit Hrs	Pre-requisite	Co-requisite
6th Semester	CV303L	Quantity and Cost Estimation	0	3	1	None	None
	CV314	Reinforced Concrete Design I	3	0	3	CV215	None
	CV314 L	Reinforced Concrete Design I Lab	0	3	1	CV215	None
	CV315	Design of Steel Structures	3	0	3	None	None
	CV323	Engineering Hydrology	2	0	2	None	None
	CV323L	Engineering Hydrology Lab	0	3	1	None	CV323
	CV351	Construction Engineering	2	0	2	None	None
	CV361	Environmental Engineering	2	0	2	CV221	None
	CV361L	Environmental Engineering Lab	0	3	1	None	CV361
	HM322	Professional Ethics	2	0	2	None	None
	Total		**14**	**12**	**18**		

	Course Code	Course Title	Class Hrs	Lab Hrs	Credit Hrs	Pre-requisite	Co-requisite
7th Semester	CV405	Geo Informatics	1	0	1	None	None
	CV405L	Geo Informatics Lab	0	3	1	None	None
	MS291	Engineering Economics	2	0	2	None	None
	CV414	Reinforced Concrete Design II	3	0	3	CV314	None
	CV414L	Reinforced Concrete Design II Lab	0	3	1	None	CV414
	CV442	Highway Engineering	3	0	3	None	None
	CV442L	Highway Engineering Lab	0	3	1	None	CV442
	CVxxx	Technical Elective I	3	0	3	None	None
	CV481	Senior Design Project I	0	9	3	None	None
	Total		**12**	**18**	**18**		

	Course Code	Course Title	Class Hrs	Lab Hrs	Credit Hrs	Pre-requisite	Co-requisite
8th Semester	CV408	Machine Learning Applications in Civil Engineering	3	0	3	None	None
	CV425	Hydraulics & Irrigation Engineering	3	0	3	None	None
	CV452	Construction Management	2	1	3	None	None
	CVxxx	Technical Elective II	3	0	3	None	None
	CV482	Senior Design Project II	0	9	3	CV481	None
	HM323	Civics and Community Engagement	1	0	1	None	None
	Total		**12**	**10**	**16**		

COURSE DESCRIPTION

CV201 Engineering Surveying: (2-0-2) Error Theory, Distance measurement, Base line measurement, Electronic Disitance Measurement, Calculation of Area and Volumes using different methods, Theodolite Traversing and Triangulation, Measurement of horizontal and vertical angles, Independent and consecutive coordinates using Gale's table, Types, principles and errors in Leveling, Tacheometry, Contouring and Modern Tools usage in surveying.

CV202 Advanced Engineering Surveying: (1-0-1) Horizintal and Vertical Curves. Different types of curves and their components, Computations and setting out by different methods. Photogrammetry, Computations in arial survey and photogrammetry, Field Astronomical surveying, Hydrographic surveying, Sounding in Hydrographic Survey, Equipment and methods of underwater sounding, Global Positioning System, Geographic Information System, Remote Sensing, Tunnel Surveying.

CV211 Mechanics of Solids I: (3-0-3) Hooke's law, Moduli of elasticity, Lateral strain, Volumetric strain, Poisson's ratio, Temperature stresses. Shear Force and Bending Moment Diagrams. Theory of simple bending, Applications of flexure formula, Computation of shear stresses in beams, Shear center and shear flow. Strain energy due to direct loads, Stresses due to impact loads; Application of strain energy.

CV312 Mechanics of Solids II: (2-0-2) Analysis of stresses and strains due to combined effect of axial

ABDUL REHMAN

As a senior year civil engineering student at GIKI, my journey here has been incredibly rewarding. The lush, green campus set against the serene hills of Topi provides an inspiring backdrop for both academic and personal growth. One of my most memorable experiences was being selected for the prestigious Global UGRAD exchange program at Boise State University USA, where I proudly represented GIKI as the only civil engineering student from the country in my cohort. GIKI's rigorous curriculum, combined with hands-on learning opportunities, has equipped me with the skills to tackle real-world challenges. The supportive faculty and vibrant student life, filled with diverse clubs and activities, have made my time here truly unforgettable. GIKI is more than just a place of learning; it's a community that fosters innovation, leadership, and lifelong friendships.

force, shear force and bending moment. Mohr's circle for stresses & strains. Theories of Failure. Unsymmetrical Bending. Introduction to cylindrical pressure vessels, Stresses and strains in thick and thin cylinders, Analysis of Curved Beams. Deflections and bending moments in eccentrically loaded column, The Secant Formula.

CV213 Basic Structural Analysis: (3-0-3) The course covers structural redundancy/stability, structural idealization and loads, analysis of determinate structures, plane frames, and influence lines for reactions, shear force, bending moment, and member forces. Maximum stress function (reaction, shear, bending moment, axial force) in structures. Methods include moment area, conjugate beam, double integration, Castigliano's theorem, virtual work, and graphical approaches.

CV215 Construction Materials and Concrete Technology: (3-0-3) Tiles and Bricks, Plastics, Glass, Wood composites, Paints and varnishes. Concrete and Concrete Materials. Workability of Concrete. Admixtures. Mixing, Transporting, Placing & Compaction of Concrete. Curing of Concrete. Mix Design (Provision of ACI Code and Mix Design by ACI Method). Testing of hardened concrete (Compression test, Cubes test, Cylinder test, Relation between cube and Cylinder strength, Prism test, Strength and Durability of Concrete.

CV221 Fluid Mechanics: (2-0-2) Properties of Fluids. Pascal's law for pressure at a point, Variation of pressure in a static fluid under gravity, Absolute and gauge pressure. Pressure measuring instruments. Hydrostatics. Kinematics of Flow. Fundamental Equations of Fluid Motion. The Continuity equation, The momentum equation, The Energy equation. Flow through a tapering pipe, Venturi meter, Notches, Orifices, Pitot tube, Sharp-crested weir. Flow in a curved path, Forced vortex.

CV230 Geology for Engineers: (2-0-2) Geology, Minerals and crystal systems. Rock cycle, igneous, sedimentary, and metamorphic rocks, importance of minerals and ores, rock cycle. Weathering agent and processes. Agents of Denudation and resulting formations, Structural Features such as folds and faults, , joints, unconformities, effects of structural features on civil engineering projects. Earthquakes and volcanic activities, landslides, Glaciers and Glaciations. Tunneling, Geological Surveying, Engineering Applications.

CV231 Soil Mechanics: (3-0-3) Basic Properties of Soil, Mechanical analysis of soil Hydrometer analysis, Consistency limits of soil. Soil Classification Systems. Moisture density relationships, Properties and structures of compacted soils, Hydraulic gradients, Darcy's law, Coefficient of permeability, Capillarity, shrinkage and swelling, Frost heave and collapsible soils, Settlement and Consolidation, In-situ tests; Types of soil samples, samplers and soil sampling.

CV241 Transportation Engineering: (3-0-3) Introduction to Transportation Systems. Highway Engineering: Highway Planning and functional classification, mobility and accessibility concept, drainage requirement of highways. Airport Engineering: Airport elements, Aircraft Characteristics and Computation of Runway Length, Airport Configurations. Railway Engineering: Rail Gauges, Rails and Rail Fastenings, structural Elements,

wear, and creep. Coastal Engineering: Port/Harbor Planning and associated Structures, Navigational aids, Harbour protection structures.

CV313 Indeterminate Structural Analysis: (3-0-3) Method of Consistent Deformations. Application of virtual work method to deflection of trusses, Method of least work for Beams and trusses. Slope-Deflection Method. Moment Distribution Method. Rotation Contribution Method for analysis of Indeterminate beams and frames. Three-Moment Equation. Analysis of Arches. Influence lines for indeterminate beams. Column Analogy Method Analysis of prismatic and non-prismatic beams and frames.

CV323 Engineering Hydrology: (2-0-2 Hydrological cycle, Hydrologic equation and Importance and practical applications of hydrology. Precipitation, Water Losses, Evaporation, Transpiration, Evapotranspiration. Characteristics of hydrograph, Components of a hydrograph, Unit Hydrograph, S-curve and Discharge estimation. Stream Flow Measurement. Ground water hydrology. Steady Radial Flow to Well in Confined & Unconfined Aquifers – Dupuits Theory and its Assumptions & Limitations.

CV332 Geotechnical and Foundation Engineering: (3-0-3) Shear Strength of Soil, Terzaghi's bearing capacity theory; Meyerhoff's method; Vesic's method Factors affecting bearing capacity, Types of Foundations. Geotechnical design of shallow foundation, Deep Foundations, Lateral Earth Pressure, Rankine and Coulomb's theories; External stability of gravity and cantilever retaining walls). Stresses in soil, Slope Stability and its Types of failure Methods of analysis. Taylor's slope stability number and Bishop's Methods.

CV351 Construction Engineering: (2-0-2): Construction projects encompass goals, objectives, permits, codes, sustainability, equipment, costs, productivity, site selection, grading, layout techniques, methodologies for excavation, in-situ and pre-cast concrete, formwork design, concreting methods, construction joints, mass concreting, and site reactions processes. Types of floor finishes, interior and exterior finishes. Use of scaffolding, Woodwork in building construction. Defects in building construction.

NOOR FATIMA NAEEM

Halfway through my civil engineering journey at GIKI, the past two years have been both rewarding and challenging. Amid the challenges of adjusting to a male-dominant class, the hurdles became stepping stones to personal growth. Life at GIKI is no easy feat, but the soul-soothing longboarding sessions, the breathtaking skies and the beauty of the campus became emotional support through tough times. These two years have been exceptional academically and have also sculpted me into a more resilient and capable individual. The rigorous academic environment has driven me to excel, while the supportive community has fostered lasting friendships and invaluable experiences. GIKI is a home far away from home.

CV314 Reinforced Concrete Design I: (3-0-3) Basic principles of RC design, Behavior of RC members in flexure, Working stress method. Serviceability criteria and checks for deflection and cracks. Ultimate Strength Design method. Analysis of one-way solid and ribbed slabs with general discussion on other slab systems, Shear stress in RC sections, Design for diagonal tension. Design and detailing for bond, anchorage, development length, laps, and splices. Short Columns. Analysis and Design of Staircases.

CV315 Design of Steel Structures: (3-0-3) Structural Steel Design, Stress-strain Relationship in Structural Steel, Introduction to ASD and LRFD methods, Fabrication, and erection methods of steel structures. Design of Tension Members. Design of Compression Members. Design of Beams. Connection Design, Roof Trusses, Design loads and load combinations, Roof truss analysis and Design of roof trusses members and Introduction to Relevant

Software Packages. Plastic Analysis and Design.

CV322 Advanced Fluid Mechanics: (3-0-3) Dimensional Analysis and Similitude. Laminar Flow Through Pipes, Turbulent Flow Through Pipes. Steady, Incompressible Flow in Pipelines, Steady, Uniform Open-Channel Flow. Incompressible flow around a body. Velocity diagrams for fluid machines; Pelton wheel turbine, working principal, construction and regulation; Francis turbine, working principal, construction; Performance of fluid machines, sources of losses and efficiencies.

CV361 Environmental Engineering : (2-0-2) Sources of Water Supply. Water Quantity Population Forecast, Rural Water Supply & Urban Water Supply. Collection and Conveyance of Water and Distributions. Water Quality, Water Supply Sampling and Testing. Estimation of Sewage Quantities, Design, construction and maintenance of sewage system, Separate and combined Systems, Types, Shapes, Size and materials of Sewers, Sewer appurtenances, Pipe Strengths and Tests, Construction and Maintenance of Sewer System.

CV414 Reinforced Concrete Design II: (3-0-3) Two-way slab, Analysis and design of flat plate, flat slabs and waffle slabs, for flexure and shear under gravity loading. Analysis and design of slender columns subjected to combined flexure and axial loading. Guidelines for design of shear walls. Design of Different Types of Foundations. Introduction to earthquake resistant design of structures. Design of cantilever retaining walls. Introduction to Pre-stressing principles & design philosophy.

CV442 Highway Engineering: (3-0-3) Pavement Materials, Highway components, typical cross sections. Elements of Road Cross-section, Drainage channels, curves and traffic barriers; Right of way. Road Construction and Maintenance, Pavement Structural Design, Geometric Design, Traffic Engineering: Properties of Traffic Engineering Elements (Vehicle characteristics, Human factor and driver's characteristics and Road characteristics), Traffic Flows, Traffic Facilities, Traffic Safety and Management.

CV481 Senior Design Project I: (0-9-3) To acquaint students to have experience to design, fabricate, assess, evaluate and present their final year project.

CV408 Machine Learning Applications in Civil Engineering: (3-0-3) Introduction to data driven modeling, Introduction to big data analytics: preprocessing, imputation, outlier detection. Introduction of exploratory data analysis and visualization: estimates of location, variability, data distribution, binary and categorical data, correlation, visualizations. Regression and classification problems. Supervised Learning: k-Nearest Neighbors, Support vector machine, Decision trees bagging and boosting, artificial neural networks: 1-layer and multi-layer networks, backpropagation and stochastic gradient descent algorithms, convolutional neural networks. Unsupervised Learning: Clustering. Case studies. Optional: Cross validation and optimization.

CV425 Hydraulics and Irrigation Engineering (3-0-3) Indus Basin Irrigation System. Canal Irrigation Components and functions. Design of weirs on permeable foundations. Sheet piles and cut off walls. Crop water requirements. Design of irrigation channels. Comparison of various methods. Dams Engineering, Sedimentation. Canal head regulators. Falls. Flumes. Cross drainage works, types and functions. Water Logging and Salinity.

CV452 Construction Management: (2-3-3) Project life cycle, constraints, engineering costs, estimating, life-cycle cost, economic decision-making, delivery

methods, value engineering, scheduling techniques (CPM, PERT), crashing, contract management, procurement types, contract terminology, risk management, human resource management, workplace relationships, emotional intelligence, CSR, quality management, BIM, Primavera P6, MS Project.

CV482 Senior Design Project II: (0-9-3) To prepare the students to finalize their final year project and present it in a reasonable and respectable manner.

Technical Electives:

CV413 Matrix Methods of Structural Analysis: (3-0-3) Virtual displacement principle and displacement method, element stiffness matrix for bar, beam and plane frame. Coordinate transformation. Compatibility and equilibrium. Assembly of structure stiffness matrix. Analysis by stiffness method of 2D trusses, beams and frames. Virtual force principle and flexibility method, analysis of 2D framed structures with temperature, support settlement and lack of fit. Reliability of computer results. Computer applications of above using interactive computer programs and introduction to Finite Element Methods.

CV415 Structural Dynamics: (3-0-3) Structural dynamics fundamentals (Introduction to equation of motion and solution methods, Degrees of freedom and their inclusion in equation of motion. Introduction damping, Undamped and damped free vibration, critical damping, overdamped and underdamped system, equation of motion for each type of system. D'Alembert's Principle, free body diagram, frequency, period, amplitude of motion, natural frequency, Introduction to SDOF system, undamped SDOF system, damped SDOF system.

CV416 Prestressed Concrete: (3-0-3) Methods of pre-stressing, Pre-tensioning and Post-tensioning. Pre-stressing principles and design philosophy, Response of prestressed members to Axial Loading, Response of prestressed Members to Flexural loading, prestressed Members subjected to Shear, Analysis and design of Prestressed concrete members to resist flexure, Design of Prestressed concrete members to resist shear, Camber and deflection in Prestressed members, Pre-stressing losses, creep and shrinkage, short and long term effects of pre-stressing.

CV417 Design of Structures: (3-0-3) Basics of structural systems, design methods and application of Software. Manual design of masonry residential building. Manual design of water retaining structures. 3-dimensional models and engineering drawings of structures. Model topography and conceive architectural and structural features in modeling tasks. Conceptual designs of civil engineering systems in modern Computer Aided Design (CAD) and Building Information Management (BIM) software. Engineering codes and limit states design, and load calculation according to the applicable international engineering practices.

CV418 Fundamentals of Earthquake Engineering: (3-0-3) Seismology and earthquake engineering. Major tectonic plates and its major features in Pakistan. Introduction to some major earthquakes in the Pakistan and world. Introduction to Seismic hazard assessment. General seismic design considerations: common mistakes in practice, regularity, lateral force resisting mechanisms and ductility. Introduction to earthquake excitation. Response spectrum analysis for SDOF system. Introduction of Seismic design and detailing of reinforced concrete buildings for earthquake resistance, according to provisions of ACI and BCP-SP 2021 (SMRF Provisions).

CV419 Design of Bridges: (3-0-3) Basics structural configuration, types of loads (AASHTO code, code of

practice in Pakistan). Design examples of RC Bridge components. Components of a real bridge and complete Design example of an existing RC Bridge. Complete Design example of Steel Truss Bridge. Design and Analysis of Steel Composite Bridge. Complete Design example of Steel Composite Bridge.

CV422 Hydraulic Engineering Design: (3-0-3) Gradually Varied Flow computations (Solution of GVF method for uniform channels by direct integration, Step method-distance calculated from depth, Step method-depth calculated from distance, Extension of the methods of GVF equation to irregular channels), Channel Controls (Sharp-crested weirs, The overflow spillway, The drop structure, The underflow gates, Drowned outflow, Broad crested weir and The Parshall flume). The Basics of River Engineering.

CV426 Hydropower Engineering (3-0-3) Hydropower's significance, compared to other energy sources, involves stages from planning to operation. Components differ for low, medium, and high head schemes. Hydraulic transients are managed using surge tanks, air chambers, valves. Layout considerations include powerhouse, power canal, intake waterways, pressure-relieving structures, and dewatering techniques.

CV435 Rock Mechanics: (3-0-3) Stress, strain, principal stresses, plane problems, displacement, and strain are crucial in geomechanics. Rock mass structure, discontinuity properties, and classification play key roles. Rock strength, behavior, and factors affecting in-situ stress are considered. Various analysis methods, including closed-form solutions and numerical techniques, are utilized in excavation design.

CV433 Slope Stability: (3-0-3) Soft ground behavior principles, instrumentation examples, and applications are explored. Clay foundation soils' behavior, drained and undrained analysis, slope failures, identification methods, and stability analysis techniques are covered. Geosynthetics fundamentals and their applications, including retaining walls, embankments, foundations, slopes, and dams, are discussed with case studies.

CV434 Design and Construction of Earthen Dams: (3-0-3) General Design Criteria, Theoretical Aspects of Seepage. Control of Seepage Through Embankments. Control of Seepage Through Foundations. Section details, Cracking and its control, Dams in fault zones, River

CCETC: Chief Guest, Mr. Jawed Akhtar Latif, member Water WAPDA, apprised the audience about their efforts to develop infrastructure for climate change mitigation and adaptation.

Rector, Prof. Dr. Fazal A. Khalid, SI appreciated organizers, participants, scholars and distinguished guests of CCETC particularly Prof. Dr. Ashraf Tanoli HoD, Department of Civil Engineering.

diversion, Conduits through earth dams and Dispersive and expansive soils. Quality Control of Earthen Dams i.e. Compaction, Placement control, Field tests, Borrow area control, Foundation preparation and treatment and Contact treatment.

CV436 Tunneling and Underground Space Structures: (3-0-3) Types of Underground Excavations: Tunnel, audit, decline, shaft; parameters influencing location, shape and size; geological aspects; planning and site investigations. Tunneling Methods. Shallow tunnels. mucking and transportation equipment selection. Tunneling by Tunnel Boring Machines. Supports in Tunnels: Principal types of supports and applicability. Ground Treatment in Tunneling. Tunnel Services: Ventilation, drainage and pumping. Methods of Sinking Shafts. Tunneling Hazards

CV443 Traffic Engineering: (3-0-3) Elements of traffic engineering, Traffic characteristic, Traffic studies. Traffic Flow parameters, Traffic stream models, Interrupted and uninterrupted traffic flow models and Queuing theory and shock wave theory. Traffic regulation and control, Traffic signs, Clear roadside recovery areas, Guardrail design, Median barriers and Safety considerations in highway design, Signal design/control for arterial roads and delays at isolated traffic signals

CV444 Pavement Materials and Design: (3-0-3) Materials and Characterization, Asphaltic Materials (Chemical composition of asphalt binders, Asphalt binder properties, Asphalt grades, Sampling and handling, Marshall mix design, Asphalt concrete properties, Batch mixing, transporting and handling of asphalt), Portland Cement Concrete. Asphalt and Concrete Batching Plants, (Material calculations, Layout and material handling. Pavement Systems (Pavement types, Wheel loads, Design factors, Layered system concept). Pavement Design.

CV445 Geometric Design of Highways: (3-0-3) Principles of geometric design. Geometric Design of Highways. Design of Curves (Horizontal curves, Transition curves, Vertical curves, Super-elevation, Analysis of super-elevation, Steps in design of super-elevation, Extra widening of road on horizontal curves). Geometric Design of Railway Track (Necessity of geometric design of track, Gradient and grade compensation, Ruling gradient, Momentum gradient, Pusher gradient, Gradient in station yards, Grade on curves, Super-elevation or cant).

CV453 Architectural and Building Information Modeling: (3-0-3) Concept of integrated building design. Significance of building system integration at planning and design stage of an architectural project. Building management system. Sustainable architecture. Architectural design and planning of appropriate: Structural System, Mechanical System, Electrical Systems, Fire Safety Systems, Lighting, and Illumination Systems. Introduction to Building information modeling and usage of its tool. Software Application: Advanced Application of Autodesk Revit Architecture, Revit MEP, Navis Works.

CV464 Environmental Impact Assessment: (3-0-3) Environmental management, National environmental policy. Environmental legislation, Environmental Impact Assessment (EIA) process, Environmental Impact Prediction and Evaluation during construction & operation of projects, Mitigation measures, Modeling, Environmental monitoring & auditing, Environmental management issues, Methods of impact analysis. Environmental Decision Making. Writing Impact Statement. Future of Environmental Impact Assessment. Mitigation of environmental impacts.

CV465 Water & Wastewater Engineering : (3-0-3) Water Treatment processes. Water softening Methods. Water Disinfection and Chemicals. Introduction to Relevant Software Packages. Testing of Sewers, Municipal and Industrial Wastes, Pakistan National Environmental Quality Standards NEQS. Primary Treatment System. Secondary Treatment Systems. Trickling filter, classification and efficiency of trickling filters; Design of trickling filters, final clarifier design, Aeration processes, mixing techniques, analysis and operational problems; Design of aeration tank, secondary clarifier, Oxidation ponds & aerobic, anaerobic and facultative ponds. Sludge Treatment.

CV466 Solid Waste Management: (3-0-3) Pakistan National Environmental Quality Standards (NEQS). Solid Waste Management: Types, characteristics, sources and quantities of solid waste; Collection, disposal, and recycling of solid waste. Sewage Disposal and Sludge Treatment: Amount and characteristics of sludge; Sludge conditioning methods; Anaerobic and aerobic digestion. Regulatory requirements for management and disposal of waste. Waste minimization (reduce, recover, reuse and recycle).

CV472 Remote Sensing: (3-0-3) Basic Principles of Remote Sensing, Optical Remote Sensing, Thermal Infrared Remote Sensing, Radar and Sonar Remote Sensing, Digital Processing of Remote-Sensing Imagery, Applications 1-Meteorology, Oceanography, and Environment, Applications 2-General Land Use and Land Cover, Applications 3-Geology, Applications 4-Vegetation: Forestry and Agriculture, Comparison of Sensors and Image Types, Hyper-spectral Remote Sensing, Digital Image Processing and Geographic Information Systems.

CV473 Watershed Modelling Using GIS: (3-0-3) Concepts of watershed modelling, Common GIS applications in hydrology (exercise), Calibration and validation of watershed models, Build your own simple “bucket” model (MATLAB), Semi-distributed modelling (exercise), Fully-distributed modelling (TOPKAPI model, exercise), Modelling case studies. Watershed delineation, watershed area, rainfall drainage, common outlet,

storage area estimation, storage volume capacities, elevation range, dam heights, watershed map layout design.

CV474 Climate Change: (3-0-3) Greenhouse Gases, Global Warming and Environmental Change, Climate Scenarios and Representative Concentration Pathways (RCP's), Climate Change Projections, Statistical and Dynamic Downscaling, Integrated Assessments, Risk and Vulnerability Analysis, Methods in Adaptation, Methods in Mitigation, Disaster Risk Reduction and Climate Change, Costing Climate Change and Adaptation, Communicating Climate Change.

ME467/CV419 Finite Element Analysis: (2-1-3) Matrix theory, Direct Stiffness method, Energy method, Development of truss and beam elements, Plane stress and strain elements, Isoperimetric formulation, Application of FEM in major streams of mechanical engineering with the aid of examples. Errors during FEM, Use of computational commercial codes (MATLAB, ANSYS or APEX) to apply on different case studies.

ME423/CV427 Introduction to Computational Fluid Dynamics: (2-1-3) Continuity Equation, Momentum equations, Energy Equation, Turbulent Flow. CFD-Techniques: Finite Difference Method, Finite Volume Method, Structured/Unstructured Mesh, Finite Element Method, Conversion of Governing Equations to Algebraic Equations, Comparison of Finite difference and Finite Volume Method, Steady convection-diffusion process, Unsteady convection-diffusion process, Numerical Solutions to Algebraic Equations, Direct Method, Interactive Method, Jacobi-Gauss Siedel Method, Pressure. CFD Solution Analysis: Consistency, Stability, Convergence, Residuals, Convergence Tolerance.

Careers in Civil Engineering

Civil engineering is a venerable and ever-evolving discipline, encompassing the design, construction, and maintenance of vital infrastructure such as roads, bridges, buildings, dams, railways, and airports. The profession offers a diverse range of career opportunities, enabling individuals to engage in projects that significantly influence both communities and the environment. A career in civil engineering is not only intellectually stimulating but also deeply fulfilling, as it allows professionals to leave a lasting mark on society. By leveraging expertise in construction automation, machine learning, seismic hazard mitigation, and high-rise design, civil engineers contribute to innovative and sustainable infrastructure, leaving a lasting legacy.

SCHOOL OF MANAGEMENT SCIENCES

Introduction

Welcome to a transformative learning experience at GIKI School of Management Sciences. Our meticulously crafted Bachelor of Science in Management Sciences program equips you with the knowledge and skills required to thrive in the dynamic world of business.

This rigorous curriculum delves into the fundamental principles of contemporary business models, emphasizing their impact on both society and the economy. This program is accredited from the National Business Education Accreditation Council (NBEAC) of Pakistan, ensuring adherence to the highest standards of teaching and learning. Recognizing the crucial role Management Sciences plays in fostering economic development, the program equips you with the latest knowledge and best practices in this vital field. With a particular focus on the Pakistani and South Asian context, graduates gain the necessary understanding to excel in the regional and international business landscape.

This program goes beyond traditional academics, offering a unique blend of interdisciplinary learning, practical case studies, labs, seminars, and enriching co-curricular activities. This holistic approach fosters not only a strong academic foundation but also hones essential future-ready skills including:

- Lifelong learning: Cultivate the ability to continuously adapt and acquire new knowledge throughout your career.
- Critical thinking: Develop analytical reasoning and problem-solving skills necessary for informed decision-making.
- Digital literacy: Master the tools and technologies essential for success in today's digital landscape.
- Communication skills: Refine your ability to effectively communicate ideas and collaborate with diverse teams.
- Analytical reasoning: Sharpen your skills to interpret data, draw insights, and make sound business judgments.

Investing in your future at GIKI School of Management Sciences provides you with several key advantages:

- Faculty engagement: Benefit from extensive interaction with our esteemed faculty, fostering a dynamic and intellectually stimulating learning environment.
- Real-world applications: Gain practical experience through engaging case studies, business simulations, solidifying your theoretical knowledge and refining your analytical and problem-solving abilities.
- Personalized guidance: Our batch advisors provide individualized support to ensure your academic success and personal growth.
- Executive development: We equip you with the essential skills and confidence to excel in the professional arena, preparing you for a rewarding leadership journey.

Join us and embark on a transformative journey. Become a leader who not only adapts to change but actively shapes the future of business.

Innovative Features

Our Bachelor of Science in Management Sciences program is renowned for its exceptional combination of academic excellence and hands-on learning experiences:

- Experiential Learning: Our curriculum seamlessly integrates captivating case studies and business simulations, providing you with opportunities to apply theoretical concepts to real-world situations. This methodology sharpens your analytical abilities and problem-solving skills, preparing you to tackle intricate business dilemmas with confidence. In addition, our school embraces a diverse teaching methodology that blends group activities, case studies, online learning, software utilization, and traditional teaching approaches.
- Interdisciplinary Approach: We transcend conventional boundaries by incorporating courses from diverse fields such as business leadership, sustainability, and technology. This interdisciplinary approach fosters a comprehensive understanding of the contemporary business landscape, equipping you with versatile skills to thrive in today's dynamic world.
- Emphasis on Innovation and Sustainability: At GIKI, we prioritize nurturing the entrepreneurial spirit within our students. Our program equips you with the knowledge and expertise needed to initiate and manage successful ventures, empowering you to drive positive change in society. Moreover, recognizing the paramount importance of environmental stewardship, we provide extensive training in sustainability practices, with a particular focus on the unique challenges faced in Pakistan and globally.

This unique combination of academic excellence, practical application, and a forward-thinking approach sets our program apart.

Thrust Area's/Specializations

The program offers three (3) specializations namely:-

- Supply Chain Management
- Accounting and Finance
- Entrepreneurship and Marketing

School of Management Sciences

Faculty Members

Sami Farooq, PhD (University of Nottingham, U.K)
Muhammad Sabir, PhD (Vrije Universiteit Amsterdam, Netherlands)
Yousaf Ali Khan, PhD (University of Macerata, Italy) – On Leave
Abid Ullah, PhD, (Ural Federal University Russia)
Muhammad Zeshan, PhD (University of Paris1, France)
Suhaib, PhD (KoÇ University, Turkey)
Saima Aftab, PhD (Foundation University, Pakistan)
Ubaid Ullah Mumtaz, PhD (University of Western Australia, Australia)
Faisal Rasheed, PhD (Aix-Marseille University, France)
Shakir Sardar, PhD (IAE Aix Marseille University, France)
Sajid Khan, PhD (Massey University, New Zealand)
Noshaba Zulfiqar, PhD (COMSATS University Islamabad, Pakistan)
Izhar Ali, Juris Doctorate, (Ohio State University, USA)
Waqas Rehman, MS (University of West of Scotland, UK) (on leave)
Hassaan Tariq, MSc (University of Warwick, UK)
Umme Rabab Syed, M.S. (Sodertorn Hogskola, Stockholm, Sweden)
Atta ur Rehman Jadoon, MS (Foundation University, Islamabad)
Hira Ahad, M.Phil. (Forman Christian College, Lahore)
Abrar Ahmad, MS (International Islamic University, Islamabad)
Haseeb Ahsan, M.Phil. (National University of Modern Languages, Islamabad)
Muhammad Shahzeb Fayyaz, MS (IMSciences Peshawar) - On study Leave
Haroon-ur-Rashid, MS (Riphah International University, Islamabad)
Tayyaba Zulfiqar, MPhil. (National College of Business Administration and Economics, Pakistan)
Fida-Ur-Rahman, MPhil. (Qurtaba University, Peshawar)

Research Officers

Sabahat Orakzai MS (COMSATS, Abbottabad, Pakistan)
Ghazal Mohni M.Phil. (KUST, Kohat, Pakistan)
Muhammad Yasir Niaz, M.A. (University of Education, Attock, Pakistan)
Muhammad Sohaib, BS (Abdul Wali Khan University, Mardan, Pakistan)
Mir Zatullah, MS (CUST, Islamabad) (on leave)

Graduate Assistants

Ms. Aimon Sabir
Mr. Afaq Ali Khan
Mr. Sohaib
Ms. Ayesha Hidatullah

P.S to Dean

Mr. Noor ul Bashar

Program Mission

Building upon the program's innovative features and commitment to future-ready skills, the mission of the BS in Management Sciences program is to:

- Educate and develop such business graduates who create value for their stakeholders and society at large.
- Build such a conducive environment for faculty and students which is diverse and inclusive, led by learning, entrepreneurial, and research orientation.

Mode of Delivery

This program is a full-time face-to-face degree program. The program leverages a unique mode of delivery that goes beyond traditional lectures:

- Interactive Learning: Small class sizes facilitate active student participation and encourage critical thinking.
- Collaborative Learning: Group assignments and teamwork foster effective communication and collaboration skills, essential for success in today's business world.
- Case-Based Learning: Real-world case studies allow you to apply theoretical knowledge to practical scenarios, honing your analytical and problem-solving abilities.
- Industry Insights: Guest lectures from alumni and industry professionals provide valuable exposure to real-life business applications and contemporary trends.
- Business Simulations: Immerse yourself in simulated work environments, allowing you to integrate theoretical knowledge and develop practical decision-making skills.

This comprehensive approach ensures graduates are not only equipped with the necessary academic foundation but also possess the critical thinking, problem-solving, and collaborative skills required to thrive in the ever-evolving business landscape.

Program's Educational Objectives

1. Producing quality graduates equipped with comprehensive knowledge, analytical prowess, entrepreneurial acumen, and critical thinking capabilities proficient to analyze, deconstruct and resolve complex business problems.
2. Producing graduates proficient in interpersonal and organizational skills who can leverage modern IT tools to make informed decisions.
3. Producing graduates who prioritize ethical and sustainable business practices, corporate social responsibility, and value exceptional contribution to socio-economic uplift of society at large

Program Learning Outcomes

1. **Domain Knowledge:** Students develop a comprehensive understanding of core business and management principles to analyze real-world scenarios, solve problems, and make informed recommendations.
2. **Critical Thinking and Problem-Solving Skills:** Students value strong analytical and critical thinking skills to evaluate and address complex business problems.
3. **Global Business Acumen:** Students analyze interconnectedness of local and global business environments, considering cultural factors and the Political, Economic, Regulatory, Legal, Technological, and social landscape impacting organizational success.
4. **Teamwork and Leadership:** Students utilize team settings and collaborative leadership to foster a productive work environment based on critical reasoning, negotiation, and team-building strategies.
5. **Effective Communication:** Students execute ideas through diverse communication channels and insightful business documents that effectively articulate the organization's vision and mission.
6. **Ethical Decision-Making:** Students evaluate ethical dilemmas within the business landscape and incorporate them for informed decisions.
7. **Digital literacy:** Students demonstrate expertise in adopting the latest IT tools and technologies, which enhance their digital literacy skills.
8. **Commitment to Lifelong Learning:** Students demonstrate a commitment to ongoing professional advancement and knowledge acquisition, for innovation and successful business development.

Knowledge Area's

Humanities

- Languages and Communication Skills
- Humanities
- Social Sciences

School of Management Sciences

Management Sciences

- Quantities Skills and Allied Technologies
- Environment and Society
- Management
- Entrepreneurship & Marketing
- Economics
- Accounting & Finance
- Operations and Supply Chain Management
- Capstone Project

Sustainable Development Goal's

- **SDG 4 - Quality Education** > The school is committed to provide Quality education for a diverse range of students. We take pride in providing equal opportunities to every student.
- **SDG 5 - Gender Equality** > School of Management Sciences believes in gender inclusiveness. Whether it's recruitment or student selection process, we always aim to maintain gender equality.
- **SDG 9 - Industry, Innovation and Infrastructure** > As a business school we believe that Innovation is the essence to any business/management education. Our efforts to promote Innovation are not only reflected in our coursework, we also lead in providing students the opportunity to innovate through participation in various events.
- **SDG 13 - Climate Action** > At the School of Management Sciences we have introduced various courses that are directly related to sustainability. These courses ensure our commitment towards Climate and Environment.

Degree Nomenclature

a) The Undergraduate Program in Management Sciences is of 4-years duration, spread over 8 regular semesters, and consisting of 135 credit hours after completing twelve years of higher secondary school certificate or equivalent.

b) Capstone Project: Every student is required to take project/research and submit a report of 6 credit hours.

c) Summer internship: Every student is required to participate in a compulsory internship/training program during the summer of junior year and submit a formal written report.

General Education Category (33 Cr. Hrs. Mandatory)		
Course Title	**Course Code**	**Cr. Hr**
Communication Skills	HM101	1
Communication Skills Lab	HM101-L	2
Critical Thinking and Expository writing	HM102	2
Critical Thinking and Expository writing Lab	HM102-L	1
Islamic Studies/Ethics	HM111	2
Ideology and Constitution of Pakistan	HM112	2
Computing and AI	CS101	2
Computing and AI Lab	CS101-L	1
Business Mathematics	MS101	3
Business Statistics	MS102	3
Civics and Community Engagement	HM121	2
Art of Learning	HM222	2
Entrepreneurship	MS234	3
Environmental Sciences	MS211	3
Sociology	HM223	2
Innovation and Makers Lab 1	IF101	1
Innovation and Makers Lab 2	IF102	1
	Total Cr. Hr.	**33**

Interdisciplinary/Allied Courses (12 Cr. Hrs.)

Course Title	**Course Code**	**Cr. Hr**
Business Communication	HM203	3
Corporate Law	HM324	3
Business Analytics	MS304	3
Contemporary Issues in Global Economics	MS445	3
	Total Cr. Hr.	**12**

Major (Disciplinary) Requirement (72 Cr Minimum)

Course Title	**Course Code**	**Cr. Hr**
Fundamentals of Management	MS121	3
Principles of Marketing	MS131	3
Microeconomics	MS141	3
Financial Accounting	MS151	3

Business Research Methods	MS203	3
Organizational Behavior	MS222	3
Marketing Management	MS232	3
Consumer Behavior	MS233	3
Macroeconomics	MS242	3
Management Accounting	MS252	3
Business Finance	MS253	3
Human Resource Management	MS323	3
Business Strategy	MS324	3
Hospitality and Tourism Marketing	MS335	3
Financial Management	MS354	3
Operations and Supply Chain Management	MS361	3
Decision Analysis	MS362	3
Leadership and Change Management	MS427	3
Project Management	MS463	3
Management Elective 1	MS3XX	3
Management Elective 2	MS3XX	3
Management Elective 3	MS3XX	3
Management Elective 4	MS3XX	3
Management Elective 5	MS4XX	3
	Total Cr. Hr.	**72**

Specialization Courses (12 Cr Hr.)

1. Accounting and Finance Specialization

Course Title	Course Code	Cr. Hr	Pre-Requisite
Financial Institutions and Markets	AF451	3	MS151 + MS253
Audit and Assurance	AF452	3	MS151 + MS253
Investment and Portfolio Management	AF453	3	MS253 +MS354
Financial Risk Management	AF454	3	MS253 + MS354

2. Supply Chain Management

Course Title	Course Code	Cr. Hr	Pre-Requisite
Advance Supply Chain Management	SC461	3	MS361
Logistics and Transportation Management	SC462	3	MS361
Purchasing and Procurement	SC463	3	MS361
Service Operations Management	SC464	3	MS361

3. Entrepreneurship and Marketing

Course Title	Course Code	Cr. Hr	Pre-Requisite
Entrepreneurial Marketing	EM431	3	MS131 + MS234
Digital Marketing	EM432	3	MS131 + MS234
Corporate Entrepreneurship and Innovation	EM433	3	MS131 + MS234
Services Marketing	EM434	3	MS131 + MS234
Total Cr		**12**	

Capstone Project (6 Cr. Hr.)

Course Title	Course Code	Cr. Hr	Pre-Requisite
Research project I	MS471	3	MS203
Research Project II	MS472	3	MS203

Management Elective Courses (15 Cr. Hr.)	
Course Title	**Course Code**
E- Commerce	MS305
Emerging Technologies for Business Enterprises	MS306
Corporate Social Responsibility	MS312
Brand Management	MS336
Econometrics	MS343
Developmental Economics	MS344
Legal And Taxation Issues	MS355
Islamic Finance	MS356
Management Consulting	MS407
Organizational Theory and Design	MS425
Performance Management	MS426

Semester-wise Degree Plan

	Course Title	Course Code	Credit Hours	Pre-requisite
1st Semester	Communication Skills	HM 101	1	None
	Communication Skills Lab	HM101-L	2	None
	Computing and AI	CS101	2	None
	Computing and AI Lab	CS101-L	1	None
	Business Mathematics	MS101	3	None
	Islamic Studies/ Ethics	HM111	2	None
	Fundamentals of Management	MS121	3	None
	Principles of Marketing	MS131	3	None
	Innovation and Makers Lab 1	IF 101	1	None
	Total Semester Cr. Hrs.		**18**	

2nd Semester	Course Title	Course Code	Credit Hours	Pre-requisite
	Critical Thinking and Expository Writing	HM102	2	None
	Critical Thinking and Expository Writing Lab	HM102-L	1	None
	Business Statistics	MS102	3	None
	Ideology and Constitution of Pakistan	HM112	2	None
	Civics and Community Engagement	HM121	2	None
	Microeconomics	MS141	3	None
	Financial Accounting	MS151	3	None
	Innovation and Makers Lab 2	IF 102	1	None
	Total Semester Cr. Hrs.		**17**	

3rd Semester	Course Title	Course Code	Credit Hours	Pre-requisite
	Business Communication	HM203	3	HM102
	Art of Learning	HM222	2	
	Organizational Behavior	MS222	3	
	Marketing Management	MS232	3	
	Macroeconomics	MS242	3	
	Management Accounting	MS252	3	
	Total Semester Cr. Hrs.		**17**	

4th Semester	Course Title	Course Code	Credit Hours	Pre-requisite
	Business Research Methods	MS203	3	MS102
	Environmental Sciences	MS211	3	
	Sociology	HM223	2	
	Consumer Behavior	MS233	3	MS131
	Entrepreneurship	MS234	3	
	Business Finance	MS253	3	
	Total Semester Cr. Hrs.		17	

5th Semester	Course Title	Course Code	Credit Hours	Pre-requisite
	Human Resources Management	MS323	3	
	Corporate Law	HM324	3	
	Financial Management	MS354	3	
	Operations and Supply Chain Management	MS361	3	
	Management Elective 1	MS3XX	3	
	Management Elective 2	MS3XX	3	
	Total Semester Cr. Hrs.		**18**	

6th Semester	Course Title	Course Code	Credit Hours	Pre-requisite
	Business Analytics	MS304	3	
	Business Strategy	MS324	3	
	Hospitality and Tourism Marketing	MS335	3	MS131
	Decision Analysis	MS362	3	MS102
	Management Elective 3	MS3XX	3	
	Management Elective 4	MS3XX	3	
	Total Semester Cr. Hrs.		**18**	

7th Semester	Course Title	Course Code	Credit Hours	Pre-requisite
	Project Management	MS463	3	
	Management Elective 5	MS4XX	3	
	Specialization I	AF/EM/SC 4XX	3	
	Specialization II	AF/EM/SC 4XX	3	
	Research Project I	MS471	3	MS203
	Total Semester Cr. Hrs.		**15**	

	Course Title	Course Code	Credit Hours	Pre-requisite
8th Semester	Leadership and Change Management	MS427	3	
	Contemporary Issues in Global Economics	MS445	3	MS242
	Specialization III	AF/EM/SC 4XX	3	
	Specialization IV	AF/EM/SC 4XX	3	
	Research Project II	MS472	3	MS203
	Total Semester Cr. Hrs.		**15**	
	Total Degree Cr. Hrs.		**135**	

Description of Courses

HM101 Communication Skills (1-2-3): Tailored for undergraduates in Engineering, Computing, and Management Sciences, this Communication Skills course covers a diverse range of critical topics. It begins with a thorough exploration of communication processes and the 7Cs of Effective Communication, extending into listening strategies, reading skills, and speaking techniques, including persuasive speech and nonverbal expression. The course delves into grammar, mechanics, and writing skills, emphasizing practical application in crafting paragraphs and essays. Comprehensive coverage of presentation skills includes structure, content, language, and nonverbal elements. Integrating digital technology, the course highlights the use of platforms like MS Teams and Flipgrid and introduces AI tools for communication enhancement. This holistic approach equips students with versatile skills, preparing them for success in their fields and the evolving landscape of professional communication.

HM101 Communication Skills Lab: The lab offers opportunities to students to enhance their verbal and non-verbal communication and provides the platform to improve their receptive and productive skills.

CS101 Computing and AI (2-0-2): This course focuses on a breadth-first coverage of computer science and Artificial Intelligence (AI) disciplines. Broadly, the course covers contents, like introducing computing environments, general application software, basic computing hardware, operating systems, desktop publishing, Internet, software applications and tools and computer usage concepts, supervised and unsupervised learning, text processing and AI applications; introducing Software engineering and Information technology within the broader domain of computing, C/C++ Language

CS101 Computing and AI Lab (0-3-1): This lab introduces the concepts of computing and programming to a freshman, starting from definitions and descriptions of software, hardware, their types and their history, memory and types of memory, and networks and their types. This is then followed by introducing the basic concepts of computer programming, algorithms, and software programming within the broader domain of computing. The course uses C/C++ as the programming language for demonstration and learning but is general enough to be applied to any language.

MS101 Business Mathematics (3-0-3): This course presents math skills and knowledge that students can apply to solve financial problems. The course provides step-by-step guidance through sample problems and solutions related to banking, credit, basic finance, and investment. Students will also gain an understanding of financial instruments and terminology used in business finance such as compound interest, annuities, and promissory notes. The course will cover topics like elements of Algebra; functions and their graphs; ratios, proportions, and percentages; interest and annuities; differentiation, optimization, and integration.

HM111 Islamic Studies (2-0-2): This course is design to provide students with a comprehensive overview of the fundamental aspects of Islam, its beliefs, practices, history and influence on society. it will further familiarize the students with the solid foundation in understanding Islam form an academic and cultural perspective.

Through this course, students will have and enhanced understanding of Islam's multifaceted dimensions which will enable them to navigate complex discussions about Islam's historical and contemporary role, fostering empathy, respect and informed dialogue.

MS121 Fundamentals of Management (3-0-3): This course focuses on basic managerial functions like planning, organizing, leading and controlling. It is specifically designed to orient students to contemporary management practices for successful management of large-scale organizations having diverse workforce and operating in highly dynamic and volatile global, economic, social and technological environments.

MS131 Principles of Marketing (3-0-3): Principles of Marketing is a core course offered to students of Management Sciences and Business administration. The course is designed to understand the process of value creation through creating improved goods and services for achieving company goals and fulfilling consumer needs and wants. The course provides an understanding of fundamental concepts of Marketing and interrelation of elements required by managers to understand consumer behavior, segmentation, target market, positioning and analyze marketing mix. Students will learn about marketing skills and application in local as well as global context that benefit organizations in accomplishing them their market share and growth while staying ahead of competitors. The course will open avenues for participants in the field of Marketing that spearheads the 21st century corporate organizations.

IF101 Innovation and Makers Lab 1 (0-3-1): The aim of the course is to give basic concepts of all the disciplines of engineering and technology. The Innovation Lab provides services to the students with state-of-the-art facilities such as subtractive and additive manufacturing machines and workstations with the latest engineering software packages. The Innovation Lab achieves this under the guidance of specialized faculty. Students shall not only learn the fundamentals of science of engineering with advanced facilities but also use the latest engineering equipment for the execution of innovative ideas. The goal is to enhance the concept of ideation and entrepreneurship skills in students of all areas. This helps in promoting individual growth by providing necessary resources to transform the ideas of students into reality. Course content include topics of:

- Algorithm Design & Lab experiments in Python: The Process flow diagram, programming structures, application development packages, Basics of Python software
- Business Innovation: Innovation and Emerging Technology, Accounting and Finance, Business Strategy & Fintech and Products Introduction and Debate
- Circuit Design: Process flow diagram / flowchart diagram, PCB fabrication, etching, troubleshooting and soldering/de-soldering process
- Experiments in Process Industry: Quality and productivity management in process industry, Process variables and application of Supervisory control and data acquisition (SCADA) system to Monitor & Control the industrial processes
- Advance Topics-Electron Microscopy: Scanning electron microscope (SEM) for microscopic analysis, Basic techniques and necessary conditions for SEM imaging
- Advance Topics-GPS Interfacing: Global GPS for accurate approximation, traversing and boundary analysis, Digital Elevation Model (DEM)

HM102 Critical thinking and Expository Writing (2-1-3): This course is tailored for students in engineering, computing, and management sciences, providing a comprehensive exploration of critical thinking and

expository writing. The curriculum covers foundational aspects of 21st century learning skills such as critical thinking and problem-solving, extending to advanced topics like analyzing diverse audiences, identifying expository writing types, and mastering the traits of effective communication. Students will delve into both general and technical expository writing, honing skills in crafting compelling proposals, reports, and abstracts. The course emphasizes the application of critical thinking in various communication contexts, including email etiquette, professional correspondence, and engaging with potential employers. Practical components, such as creating personalized data records, preparing job-winning resumes and cover letters, and effectively communicating through poster presentations, are integrated. Through a blend of theoretical insights and hands-on activities, this course aims to equip students with a robust foundation in critical thinking and expository writing, essential for success in their academic and professional pursuits.

HM102 Critical Thinking and Expository Writing (L): The lab provides learners a platform to present their technical reports and get feedback from the course instructor to improve their expository writing and develop critical thinking.

IF102 Innovation and Maker Lab 2 (0-3-1): The aim of the lab is to give basic concepts of all the disciplines of engineering and technology. The Innovation Lab provides services to the students with state-of-the-art facilities such as subtractive and additive manufacturing machines and workstations with the latest engineering software packages. The Innovation Lab achieves this under the guidance of specialized faculty. Students shall not only learn the fundamentals of science of engineering with advanced facilities but also use the latest engineering equipment for the execution of innovative ideas. The goal is to enhance the concept of ideation and entrepreneurship skills in students of all areas. This helps in promoting individual growth by providing necessary resources to transform the ideas of students into reality. Course contents include:

- Advance Topics- Optical Instrumentation: Photonics with Python, Simulation, Fabrication, Characterization & Applications of Next-Generation Solar Cells.
- Prime Movers Operation: Control direction and speed of DC motor by using DC motor driver and Arduino, Arduino board, its programming and sensor interfacing.
- Engineering Graphics: Sketcher Mode Sketching of open and close shapes, Visualization and Sketching, SOLIDWORKS Drawing mode and Layout.
- Experiments in Fabrication Technology & Prototyping: Experiments in CNC Milling & CNC Turning part programing, Laser cutting Machine, Woodwork Machine and 3D Printers.
- Project Assembly, Demonstration & Assessment: Design project demonstration, evaluation and assessment.

MS102 Business Statistics (3-0-3): The aim of this course is to introduce the students of BS Management to different techniques in Statistics important to their future needs as managers. The course is designed in a way so that practical examples are discussed along with theory. The basic course content includes Knowledge and understanding of descriptive statistics, Introduction and utility of probability distributions, Introduction and utility of interval estimations and hypothesis test.

HM112 Ideology and Constitution of Pakistan (2-0-2): This course is designed to provide students with a fundamental exploration of the ideology and the constitution of Pakistan. The course focuses on

UZAIR MURAD HADI

Coming from Rawalpindi, I never imagined I would end up at GIKI Management School, but life had different plans. Settling in at GIKI was surprisingly smooth, as I quickly made a close-knit group of friends. After four years of studying at GIKI Management School, I feel equipped with the essential skills, knowledge, and energy to thrive in the corporate world.

the underlying principles, beliefs and aspiration that have been instrumental in shaping the creation and development of Pakistan as a sovereign state. Moreover, the course will enable students to understand the course provisions of the constitution of the Islamic republic of Pakistan concerning the fundamental rights and responsibilities of Pakistani citizens to enable them function in a socially responsible manner.

HM121 Civics and Community Engagement (2-0-2): This course is designed to provide students with fundamental knowledge about civics, citizenship, and community engagement. In this course, the students will learn about the essentials of civil society, government, civic responsibilities, inclusivity, and effective ways to participate in shaping the society which will help them apply theoretical knowledge to the real- world situation to make a positive impact on their communities. ting, Introduction and utility of inferential statistics, Introduction and utility of simple linear, multiple regressions

MS141 Microeconomics (3-0-3): This course introduces key microeconomics concepts and techniques applicable as tools for rational economic decision-making within the microframework. The course aims to demonstrate the relevance and usefulness of economic analysis to real world business situations. Emphasis is placed on optimal decision-making within the firm and the strategic relationship with other businesses. The course would provide an understanding of the principles of microeconomic analysis of business decisions in competitive and non-competitive markets. Using microeconomics theory, the students will be able to understand the concepts of demand and supply, the price determination in the market, firm behavior, and the structure of the markets.

MS151 Financial Accounting (3-0-3): This course builds upon the foundational concepts of Financial Accounting and delves into both theoretical and practical aspects of financial accounting and reporting. It provides an in-depth understanding of the regulatory framework governing the preparation and publication of financial statements for limited companies and groups. The primary focus is on company accounts, contextualized within the framework of IFRS and the Companies Ordinance of 1984. Additionally, this course explores accounting from dual perspectives: financial and managerial. Financial accounting involves maintaining accurate accounting records and preparing financial statements for public disclosure, adhering to GAAP. On the other hand, managerial accounting equips company management with the tools to gather, analyze, and utilize accounting information for decision-making, problem-solving, and effective business operations. These topics are crucial for aspiring managers, enabling them to comprehend their organization thoroughly and make informed business choices.

HM203 Business Communication (3-0-3): This course is a comprehensive exploration of mastering the intricacies of the writing process, composing impactful messages, and navigating electronic communication, to honing the students' abilities in delivering positive, negative, and persuasive messages, each module is crafted to empower in today's dynamic workplace. It delves into reporting workplace data, professionalism, teamwork, meetings, and speaking skills, equipping the students with the tools to thrive in diverse corporate environments. Additionally, it explores the job search process, résumé and cover letter crafting, as well as interviewing and follow-up strategies, ensures that the

student is well-prepared for success in the competitive professional landscape. Through a series of professional correspondences, students gain a deep understanding of the mechanics and conventions of professional writing. The module also covers key aspects such as communication in technical and intercultural workplaces, identifying the purpose of writing, and mastering techniques for document preparation, including brainstorming, outlining, drafting, editing, and proofreading. Emphasis is placed on developing a business writing style, employing brevity, politeness, and accuracy, as well as understanding formatting principles. The course equips students with the ability to tailor documents to various situations and audiences, emphasizing the dynamics of designing business reports and writing various document types such as emails, letters, memos, reports, executive summaries, and more. Additionally, the integration of interviews at the end of the semester provides a holistic approach, blending speaking and writing skills for a well-rounded communication competence.

MS203 Business Research Methods (3-0-3): The module intends to provide opportunities to learn research methods in business and apply them in real business contexts through classroom discussions, assignments, and projects. The module will guide students on how to carry out business research projects by helping them to understand and formulate research questions, design a research plan, develop a survey questionnaire, appropriately use sampling and data collection techniques, analyze the data, interpret the findings, and report writing.

MS211 Environmental Sciences (3-0-3): Sustainability, a watchword of the 21st century for those concerned about the environment, is the overarching theme of business nowadays. To introduce the students with basic concepts of Environmental Science as an academic discipline, its importance in human life, its interdisciplinary nature and provide students with an understanding of the relationships between different components of environment, current global, and national environmental challenges for sustainable development. This course is designed to help students achieve three important goals: first, to explain the basics of environmental science; second, to help in using this scientific foundation to understand the environmental problems that we face and to evaluate possible solutions; and third, to inspire to make a difference in how we treat the earth on which our lives and economies depend, and thus in how we treat ourselves and our descendants.

YUMNA AKMAL

Coming from Qatar, the thought of settling into a Pakistani university was daunting. However, my transition into GIKI's culture and environment was unexpectedly smooth. The vibrant atmosphere, engaging student societies, and supportive teachers have made my experience incredibly rewarding. I am honored to have chosen GIKI School of Management Sciences for the next four years.

HM222 Art of Learning (2-0-2): This course seeks to engage students into a deeper understanding of philosophical aspects of life within the realm of imparting practical skills and provoking deeper understanding of underlying principles of life. Through critical introspection and philosophical inquiry students are encouraged to deconstruct their preconceived notions, cognitive processes and belief systems fostering understanding of philosophy, epistemology, value of goal setting in life, emphasizing physical and mental well-being, emotional intelligence, and mindfulness, emphasizing self-development. This course provides opportunities for students to interrogate implicit assumptions to evolve into more enlightened individuals and effective professionals unveiling the underlying structures that shape their understanding of reality. Students will develop analytical skills and conceptual frameworks necessary for navigating the complexities of human experience.

MS222 Organizational Behavior (3-0-3): This course

on Organizational Behavior examines how differences in individual, small group, and large group behavior impact organizational processes and outcomes as well as their effectiveness. Students will participate in individual and small group experiential activities (e.g. cases, role plays, and group discussions) to develop an understanding of how the course concepts apply to manage situations in an organization. The main focus of this course is on developing interpersonal skills in students and how interpersonal skills are related to leadership and management roles. This course is based on three levels of behavior analysis namely, individual level, group level, and organizational level.

HM223 Sociology (2-0-2): This course is meticulously structured to acquaint students with the foundational principles of sociology and overarching discipline. It will place a particular emphasis on critical concepts such as social systems and structures, socio-economic transformations, and social processes. By offering a comprehensive introduction to these areas, the course aims to lay a solid groundwork for advanced studies within the domain of sociology.

MS232 Marketing Management (3-0-3): This course follows from Marketing Principles to discuss advanced topics in the Marketing domain. The course will introduce you to various concepts of Marketing and demonstrate how they impact the customer from a practical viewpoint. The purpose of this course is not only to advance theoretical understanding but to also allow the students to develop their own opinion on the practice of Marketing Management. The course takes the topics studied in Marketing Principles to an advanced level by introducing case-based learning.

MS233 Consumer Behavior (3-0-3): Consumers occupy a central place in the marketing field, particularly from the market orientation that modern marketing must resolutely adopt. Understanding the consumer's functioning and their reactions to marketing actions is therefore of capital interest. Consumer behavior is much more than buying things; it also embraces the study of how having (or not having) things affects people's lives, and how their possessions influence the way they feel about themselves and about each other - their state of being. Besides understanding why people buy things, consumer behavior also tries to appreciate how tangible products, services, and consumption activities contribute to the broader social world they experience.

MS234 Entrepreneurship (3-0-3): This course is designed to promote entrepreneurial spirit and outlook among students, encouraging them to think critically, identify opportunities and transform their ideas into successful ventures. It aims at imparting them with the requisite knowledge, skills, abilities, enabling them to seize the identified opportunities for initiating ventures and successfully navigating the challenges that come with starting a business and managing it. The course covers topics relevant to entrepreneurship including setting up and initiation of business, market research, opportunity identification, business planning, financial literacy for managing finances and securing funding, marketing and sales, team building and innovation.

MS242 Macroeconomics (3-0-3): In this course, the functioning of the aggregate economy is analyzed starting from basic aggregate data measurement and concepts. This course will provide an overview of macroeconomic issues: the determination of output, employment, unemployment, interest rates, and inflation. Monetary and fiscal policies are discussed, as are public debt and international economic issues. The course finally evaluates the scope for policy interventions to improve macroeconomic performance.

MS252 Management Accounting (3-0-3): Cost accounting identifies the essential data to managers regarding planning and controlling, costing products and services, and customers. The student studies the basic concepts, analyses, uses, and procedures related to types of costs and costing systems. This course will concentrate on examination of the concepts, theories, principles, and practices of cost accounting. Students will develop quantitative and qualitative methods for analyzing raw data that support the business decision-making process and inventory costing. The course is designed for students entering the accounting profession or to simply improve their understanding of the costs of any business. The course provides an introduction to the world of cost accounting and an in-depth view of several key areas including job costing, process costing, activity-based-costing, budgeting, forecasting, and variance analysis.

MS253 Business Finance (3-0-3): Business Finance course aims at imparting knowledge about the very basic concepts and tools of Business Finance. It emphasizes the importance of Business Finance skills to individuals and enterprises. It deals with the finance function in an organization, the role of the finance manager and the financial environment in which the firm operates. The financial environment covers the understanding of financial and capital markets along with the broad orientation of macro-economic factors affecting the business. The emphasis will remain on developing the skills for planning, appraising and evaluating the investment, financing and operating decisions.

HM324 Corporate Law (3-0-3): The Corporate Law is a comprehensive "conversion course" for business students. The concepts of law, statutes, instruments, and case laws contained in this course are objectively reconstructed to configure with the real dynamics of business sciences. Each module explores the complex legal-technical interplays inherent in complex business practice. In furtherance to promote dialogue, discussion, and discourse, the course runs on both modern and classic Socratic methods. The course strives to build the legal abilities of the students and instinctively strengthen their capacity to fix complex legal problems on their own in the hi-tech corporate settings. As the exigency of the corporate world requires, the course judiciously blends both law and complex corporate problems into an organic mix: harnessing the corporate potential with the scale of law and regulations and helps students think, analyze and act like lawyering ways. Thus, figuratively brings the high-tension laboratory into a courtroom culture. To make things easier for beginners, the course helps walk the business students through the gateway of law, logically proceeds from general to particular, and revolves around the entire realm of corporate law and jurisprudence. The course extends its interdisciplinary focus on corporate law to facilitate its workable interaction corporate in both domestic and international settings and includes, but is not limited to, the law of contract and torts law, mercantile law, intellectual property rights patents, and design law and legal writing and research. To promote "legal corporate

adjudication" and further cultivate leadership skills, Alternative Dispute Resolutions (ADR) and moot court components are added. Training students in the winning art of conflict resolution in the personal and professional world through effective trial and negotiation advocacy in formal and informal corporate dispute settlements.

MS323 Human Resource Management (3-0-3): Students are introduced to the management of an organization's workforce through the design and implementation of effective human resources policies and procedures. Current issues and practices are examined. Topics include the need for human resources management and its growing professionalism; human resource planning including job design and analysis; recruitment and selection; compensation; employee development; workplace health and safety; and employee relations.
MS354 Financial Management (3-0-3): This course aims to deepen undergraduate students' understanding of corporate finance, investment, and management. It builds on introductory finance concepts covered in Business Finance, exploring techniques for maximizing firm value. The course blends theory with practical computations, providing insights into finance electives. Students will engage with valuation models, returns, and risk analysis, enhancing their analytical skills for effective financial decision-making.

MS361 Operations and Supply Chain Management (3-0-3): The practice of supply chain management is becoming widespread in all industries around the globe today, and both small and large firms are realizing the benefits provided by effective supply chain management. Operating successfully today requires organizations to become much more involved with their suppliers and customers. This introductory level course introduces students with basic understanding about Supply Chains. Operations management involves the integration of numerous activities and processes to produce products and services in a highly competitive global environment. This course considers the operations from a managerial perspective. We will consider key performance measures of operations (productivity, quality and response time) as well as important concepts for improving the performance of operations along these dimensions. At the end of the course students will have a fair understanding of the role Production/Operations Management plays in business processes. Emphasis is given both to familiarization of various production processes and service systems, and to quantitative analysis of problems arising in the management of operations.

MS304 Business Analytics (3-0-3): This comprehensive Business Analytics course offers a practical blend of theory and hands-on experience, equipping students with the essential skills to navigate the dynamic field of analytics. The curriculum covers a range of analytics tools and techniques, including Excel, Tableau, Power BI, SQL, and Python, complemented by real-world applications. Students will explore key performance indicators, descriptive and diagnostic analytics, predictive and prescriptive analysis, and delve into analytics for operations, supply chain, marketing, and financial domains. The course emphasizes practical applications through projects, lab work, and industry-relevant scenarios, ensuring participants gain proficiency in data analysis, visualization, and decision-making. Notable features include a dedicated lab component, project weeks using various tools, and a seminar with industry experts.

MS324 Business Strategy (3-0-3): This course focuses on corporate policy/strategy formulation and implementation. The knowledge and techniques students learned in other courses in earlier semesters will be applied in an integrated fashion to the process of strategic decision making and organizational change. Among the topics considered in the course will include

relationship of organizations to their environment, the hierarchy of organizational objectives, structural as well as informal approaches to strategic planning, the integration of business functions, organizational structure, and policy implementation and evaluation. Special focus is given to assessing the competitive dynamics of firms.

MS362 Decision Analysis (3-0-3): This course offers a comprehensive exploration of Decision Analysis and Logic within the framework of Operations Research. Students will gain a deep understanding of decision-making fundamentals, probability, linear programming, optimization techniques, network models, sensitivity analysis, dynamic and integer programming, metaheuristics, game theory, queuing theory, Markov decision processes, and simulations. Practical application using Excel enhances problem-solving skills. The course is designed to equip students with both theoretical knowledge and hands-on proficiency in decision analysis methodologies and their real-world applications.

MS335 Hospitality and Tourism Marketing (3-0-3): This course is designed to serve as an introduction to the basic principles of marketing, practices, and the application of these practices in tourism and hospitality industry. Students will learn how marketers deliver value in satisfying customer(tourist/guests) needs and wants, determine which target markets the tourism/ hotels/restaurants organizations can best serve, and decide upon appropriate unique products, services, and programs to serve these markets. This course will also provide students with an overview of the marketing functions with an emphasis on creating value through market research, tourists' behavior, pricing strategies, marketing channels, and various methods of promotion.

MS343 Econometrics (3-0-3): This course is a basic-level econometric course with a focus on techniques for estimating regression models, learning their interpretations and solving various problems commonly encountered in estimating such models. In addition, students are also introduced to some basic time series and cross-sectional data-related models. The goal of this course is to train the students in applied econometrics and to give them experience in estimating econometric models with real-world data. An important requirement of the course will be to train the students in estimation and interpretation of the theoretically studied model of the course using one of the available econometric software (like EViews, Stata, SPSS, R, etc.).

MS355 Legal and Taxation Issues (3-0-3): This course covers the theoretical and numerical aspects of Tax Laws currently in effect in Pakistan for the 2023-2024 period. It includes topics such as types of income, legal definitions, tax exemptions, filing tax returns, Salary Income, Income from Property, Income from business, Capital and revenue, Income from other resources and sales tax. By taking this course, students will gain a comprehensive understanding of tax laws and their practical applications. They will also develop strong analytical skills for interpreting and understanding the tax system in Pakistan and be able to form effective tax management strategies.

MS336 Brand Management (3-0-3): This course is intended for candidates interested in learning how brands are managed and employed as strategic assets. The course uses cases and project work to familiarize students with the issues and challenges commonly faced by brand managers due to globalization as well as in the local context. Topics include assessing brand meaning, evaluating brand extensions, managing extended product lines, assessing brand strength, assessing brand profitability, defending premier brands, repositioning mature brands, and building brands via non-traditional

media. This course examines how to build brand equity, how to measure brand equity and formulate a brand strategy, and other important brand issues including local, global and ethical branding. Candidates pursuing this course would be able to develop successful careers as Brand Managers, Brand Ambassadors, and Brand Auditors.

MS344 Developmental Economics (3-0-3): The course on development economics focuses on the process of economic development including the determinants of underdevelopment and poverty. The idea is to know about various problems faced by developing countries and their citizens. The course also includes various policies used by developing countries for the topic covered in the course. Furthermore, the course presents an overview of economic development and the models economists have developed to understand the process of economic development. In addition, various impediments that hinder developing countries' progress are discussed and how these could be addressed. The course focuses more on the micro level (like health, education and other social issues like urbanization and migration).

MS305 E-Commerce (3-0-3): The concept of e-commerce is all about using the internet to do business better and faster. Electronic commerce or e-commerce refers to a wide range of online business activities for products and services. This course is designed to introduce students to the e-commerce world. They will learn how to do business on different national and internal e-commerce platform like Amazon, eBay, Daraz, Shopify etc. Students will also learn how to successfully use the internet and the tools found on it to grow the business and, at the same time, leverage the ancient brick-and-mortar structure.

MS306 Emerging Technologies for Business Enterprises (3-0-3): This course explores the landscape of emerging technologies and their transformative impact on business operations, strategy, and decision-making. Students will gain a solid understanding of key technologies like Artificial Intelligence, Blockchain, Cloud Computing, and the Internet of Things (IoT). They will learn how these technologies can be used to address real-world business challenges, solve problems, and create new opportunities in various industries. The course equips students with the critical thinking skills to assess the potential of emerging technologies for business transformation and prepares them for careers in management consulting or digital transformation management roles.

MS312 Corporate Social Responsibility (3-0-3): This introductory course will include the principles of private businesses supporting communities and people. The challenge is often to find a balance between doing good and leveraging these practices to benefit the business community and its constituents. This course covers CSR methods, tools, principles, and practices at the organization and society level. The course is designed to give students general know-how of CSR, its general implementation and management in an organization. The contents to be covered in course are legal and economic perspectives on CSR; ownership theory; market and stakeholder's analysis; contemporary public and social issues involving business; global natural environmental issues; technological issues influencing economy and society; community relations and strategic philanthropy; role of government in CSR; and social audit.

MS356 Islamic Finance (3-0-3): This elective course offers a comprehensive exploration of Islamic banking and finance, covering fundamental concepts, financial instruments, and their application in the global and local contexts. Students will understand the theoretical and practical aspects of Islamic finance, including its distinction from conventional finance, the development of financial products under Islamic law, and the role of Islamic finance in economic reform.

MS463 Project Management (3-0-3): This course develops the competencies and skills for planning and controlling projects and understanding interpersonal issues that drive successful project outcomes. Focusing on the ten knowledge areas and 5 process groups, this course guides students through the fundamental project management tools behavioral skills necessary to successfully launch, lead, and realize benefits from projects. This course will equip the students with necessary skills to manage project teams, schedules, risks, and resources to produce a desired outcome. Students explore project management with a practical, hands-on approach through case studies and class exercises.

MS445 Contemporary Issues in Global Economics (3-0-3): The course aims to inform senior business students about contemporary global economic issues and their linkages with the Pakistan economy. The idea is to train students to make their business decisions while considering global and local economic conditions. The topics include contemporary global economic issues and possible linkages with Pakistan's economy and business decision-making. The topic will be updated as per contemporary issues with some to have contents like the recent state of Pakistan's economy, global economic situations, international trade, various trade unions, the role of international institutions, BRICS, CPEC, the fourth industrial revolution, and climate change.

MS427 Leadership and Change Management (3-0-3): This course lays the foundation to gaining competitive advantage in the changing global marketplace by providing hands - on understanding of the "concept of change" and "management of change, risks involved, implementing change and tools to manage resistance to change." This includes general introduction to organizational development, nature of planned change, entering and contracting, diagnosing groups and jobs, collecting, and analyzing, feeding back diagnostics, designing interventions, leading and managing change.

MS425 Organizational Theory and Design (3-0-3): This course provides a comprehensive exploration of Organizational Theory and Design, delving into the fundamental principles that shape the structures and functioning of modern organizations. Students will examine the dynamic interplay between organizational structures, decision-making processes, and environmental factors. The course emphasizes the practical application of organizational theories through real-world case studies, allowing students to analyze and understand how different design elements impact organizational effectiveness. Topics include organizational structures, culture, leadership, and strategic design, providing students with a holistic understanding of the complexities involved in designing and managing organizations in today's business landscape. Through theoretical discussions and practical exercises, students will develop the analytical skills necessary to critically assess and contribute to the design of effective and adaptable organizations.

MS426 Performance Management (3-0-3): This course examines the importance of an effective performance & compensation management system in helping organizations define and achieve short and long-term goals. It explains and reinforces the concept that performance management is not a one-time supervisory event, but an ongoing process of planning, facilitating, assessing, and improving individual and organizational performance. In addition, the course provides an understanding of the process, issues, and techniques involved in developing and administering a compensation system.

MS407 Management Consulting (3-0-3): This course equips BS Management Sciences students with the knowledge and skills to navigate the dynamic world of business consulting, focusing on the increasingly relevant realm of Agile methodologies. It blends theoretical understanding with practical application, covering: Core consulting principles and practices, Essential consultant skills, Problem-solving frameworks and analytical models, Client engagement strategies and proposal writing, Data collection methods and interviewing techniques, IT/IS consulting services and their value, Strategic planning approaches and value creation, Agile project management methodologies (Scrum & Kanban)

AF451 Financial Institutions and Markets (3-0-3): The course is designed to equip students with knowledge of a financial system, its regulatory framework, and environments in Pakistan, and as in other global economies. The course envisages a detailed discussion on Financial Markets. The money markets, capital markets of Pakistan. The International Stock markets and global bond markets shall be discussed and compared with markets in Pakistan. The course will also cover Foreign Exchange, Derivatives, and commodities markets internationally and in Pakistan. The course shall cover the Institutional framework within Pakistan. Various banking and non-banking institutions shall be discussed. A comparative analysis of their functions, roles and impact on the economic system shall be critically examined. Besides revisiting the existing market oriented financial system and its fault lines, the alternate financial systems or paradigms shall be explored and covered in the course. The course is intended also to identify the regulatory compliance initiatives to ethical and prudential issues.

AF452 Audit and Assurance (3-0-3): This course provides managerial understanding of the auditing process and its importance for effective decision making. The course will cover auditing theory and practice; generally accepted auditing standards; code of ethics; systems of internal controls and its evaluation; compliance; and integrity of information. The course will motivate and prepare students to earn prestigious and globally recognized 'Certified Internal Auditor' certification.

AF453 Investment and Portfolio Management (3-0-3): This course helps students understand the key concepts and principles of investment and portfolio management, which build a solid foundation for further study or career pursuit. The topics addressed include the setting of investment and security analysis; efficient market hypothesis; survey of investment instruments and valuation methods; portfolio theories; asset pricing models; bond portfolio management, term structure of interest rates; and measurements of portfolio performance.

AF454 Financial Risk Management (3-0-3): This course covers a comprehensive understanding of financial risks, including market, credit, and liquidity risks. Students will learn techniques to measure and manage these risks, with a focus on financial derivatives and hedging in derivative markets. The curriculum explores exchange-traded options, futures contracts, arbitrage opportunities, and risk management strategies. Additionally, an introduction to BASEL I, II & III, emphasizing changes post the 2007–2009 global financial crisis. By course end, students will adeptly measure, assess, and manage organizational risks, demonstrating the ability to establish effective risk management processes using diverse frameworks and strategies covered throughout the program.

EM431 Entrepreneurial Marketing (3-0-3): This course provides students with a comprehensive understanding of marketing strategies and tactics tailored for entrepreneurial ventures. Students will learn how to develop marketing plans, identify target markets, and

implement cost-effective marketing strategies to drive growth and success in startups and small businesses. This course specifies marketing techniques tailored to address the needs of entrepreneurial start-ups within developing economies and leveraging limited marketing resources to meet marketing challenges. The course aims to allow creativity in the minds of business graduates while strengthening their understanding and practical application of the marketing knowledge they have acquired.

EM432 Digital Marketing (3-0-3): This course introduces students and professionals to digital marketing. Over the sessions, participants will learn about digital platforms like Facebook, Twitter, Google, and YouTube and how to create campaigns on each. Key topics include digital terminology, identifying target audiences, using advertising dashboards, search engine marketing, and optimization. Participants will learn how to develop 360 campaigns, conduct influencer marketing, and facilitate online sales. Assessment methods include creating social media accounts, evaluating online campaigns, and showcasing case studies. The goal is for students to understand digital media and how to engage target audiences across various digital channels.

EM433 Corporate Entrepreneurship and Innovation (3-0-3): This course seeks to equip students with the essential skills needed to formulate innovative ideas and establish successful new ventures within an existing organizational framework. The course also explores the practices and challenges associated with established companies undertaking innovations. Additionally, the course also reviews how companies can leverage strategic innovation to rejuvenate and revitalize themselves, their markets, or their industries.

EM434 Services Marketing (3-0-3): Services marketing course refers to the marketing of intangible products, often called services rather than physical goods. This course explains that, unlike tangible products, services are activities, experiences, or processes performed or delivered by one party to another, usually involving direct interactions between the service provider and the customer. Marketing efforts in the service industry involve promoting the expertise and capabilities of service providers, emphasizing customer testimonials, and highlighting the intangible benefits and outcomes of the service.

SC461 Advance Supply Chain Management (3-0-3): This undergraduate-level course explores advanced concepts and practices in supply chain management, focusing on strategic, technological, and global aspects. Students will delve into current trends, emerging technologies, and innovative strategies that shape the modern supply chain landscape. The course combines theoretical frameworks with real-world applications to equip students with a comprehensive understanding of advanced supply chain management topics.

SC462 Logistics and Transportation Management (3-0-3): This course provides a comprehensive exploration of key concepts and practical applications in Transportation and Logistics Management. The course focuses on theoretical foundations, examining the critical role of logistics, transportation, and global supply chain dynamics. Students delve into topics such as reverse logistics, global logistics strategies, and the practicalities of last-mile delivery. Real-world case studies enhance understanding and enable the application of theoretical knowledge to industry scenarios.

SC463 Purchasing and Procurement (3-0-3): Purchasing and Procurement revolves around identification, acquisition and management of resources required across a supply chain. Procurement function involves

the procurement of marketing, advertising or IT related services. This course aims to emphasize the design and management of procurement processes and control systems in a supply chain. In modern supply chains procurement plays a pivotal role in the success of global firms in ways that old-fashioned purchasing managers could never have imagined. After studying this course, students will be able to understand the role of procurement in today's intense global competitive environment. The procurement content covered in this course includes sourcing processes and strategies, value of collaboration and streamlined information, financial flow in supply chains, supplier-buyer relationship management as well as elementary and advanced methods of analysis and planning of sourcing decisions.

SC464 Service Operations Management (3-0-3): This course provides a focused exploration of Service Operations Management with an emphasis on sustainability. It encompasses theoretical foundations and practical applications through case studies, offering insights into strategic service delivery and sustainable practices. Participants will delve into the analysis of the service concept, integrating Software as a Service (SaaS), Platform as a Service (PaaS), and Service Computing. Emphasis is placed on the efficient management of customer relations, expectations, and supply networks. The course covers the application of Total Quality Management (TQM), Quality Function Deployment (QFD), agile project management, Lean, and Six Sigma for continuous service enhancement. Students will also gain expertise in implementing knowledge and change management within flexible operations. Furthermore, the course delves into formulating and executing strategies for achieving service excellence and sustainability. Practical skills will be homed in auditing, quality improvement, and adherence to ISO standards. The curriculum concludes with aligning service operations with UN Sustainable Development Goals (SDGs) and conducting advanced Life Cycle Assessments.

Service Courses

Introduction: Minors in Management for Engineers: Globalization has brought new challenges of sustainability, health, and environmental protection; therefore, a new breed of managers is required by companies and organizations to cope with these issues. Ghulam Ishaq Khan Institute of Engineering and Technology offers Minors in Management, geared towards helping engineers/technologists develop planning, decision making and managerial skills while receiving advanced technical knowledge. It is intended to prepare graduates with the management skills needed to provide engineering leadership in today's multi-disciplinary business environment. The primary focus of the program is on management and application of business skills to engineering leadership situations. The Management Sciences outlook and approach is interdisciplinary within the variety of engineering pursuits.

Educational Objectives: The courses have been specifically designed to:

1. Prepare managers and leaders for engineering and industrial organizations by exposing students to modern concepts of economics, production sciences, and enable them to manage important human as well as financial resources within the enterprises.
2. Familiarize students with the fundamental principles of manufacturing, risk management, project management, and maintenance management.
3. Teach them innovative techniques which can be utilized to manage modern industries.
4. Instill the spirit of entrepreneurship, which will enable them to forge new avenues in the modern economy, and provide them with better foresight, and greater financial flexibility.
5. Equip students with English Language and communication Skills with special emphasis on business communication and technical writing. Reintroduce them to their history, religion and culture.

Professional Outcomes: Courses prepare students for effectively managing financial, human, and physical resources within the modern economy. They are designed to impart strategic, tactical and operational level knowledge to students in order to enable them to be better managers, analysts, entrepreneurs, and business executives.

The courses also prepare them for academic reading and accurate professional writing. Their presentation skills are improved through class seminars and group discussions which in turn would help them exchange their views and communicate their experience in research with professional colleagues and potential employers.

Seminars: A series of seminars dealing with wide-ranging issues of topical significance are organized at the institute where the students are provided with the platform to hold brainstorming sessions and interact with eminent scholars from various disciplines. The seminars aim at arousing interest of students in current problems, helping them form enlightened opinions about them, and develop skills for rational discourse and argumentation.

Course Title	Course Code	Cr. Hr
Communication Skills	HM101	1
Communication Skills Lab	HM101	2
Critical Thinking and Expository Writing	HM102	2
Critical Thinking and Expository Writing Lab	HM102	1
Islamic Studies	HM211	2
Ideology and Constitution of Pakistan	HM212	2
Engineering Economy	MS291	2
Sociology	HM321	2
Professional Ethics	MS322	2
Human Resource Management	MS412	3
Technology Management	MS426	3
Entrepreneurship and Marketing	MS434	3
Accounting and Finance	MS447	3
Macro and International Economics	MS448	3
Industrial Management	MS449	3
Lean Enterprise Management	MS489	3
Supply Chain Management	MS491	3
Operations Management	MS492	3
Industrial Safety	MS493	3
Total Quality Management	MS494	3
Maintenance Management	MS495	3
Project Management	MS496	3

Description of Courses

HM101 Communication Skills (1-2-3): The course aims to equip the students with the necessary language and communication skills to cope with their academic and professional needs. The module effectively integrates the four basic skills of language i.e. reading, writing, listening and speaking. The oral communicative competence of the students is enhanced by focusing on the phonological aspects of language. The students are motivated to take part in the classroom sessions where they are encouraged to take the dynamics of stress and intonation into consideration while speaking. The learners are also introduced to the principles of effective writing the sentence level to full-length texts with special emphasis on logical organization of materials.

HM101 Communication Skills Lab: The lab offers opportunities to students to enhance their verbal and non-verbal communication and provides the platform to improve their receptive and productive skills.

HM102 Critical Thinking and Expository Writing (2-1-3): The course develops critical thinking and offers expository writing opportunities in order to produce technical and scientific report writing competence amongst the students. The students are effectively introduced to the underlying mechanics and conventions of technical or professional writing through a series of

professional correspondence. The module effectively covers the topics of introduction to communication in technical and intercultural workplaces; identification of purpose of writing, techniques for the preparation for writing a document such as brainstorming outlining, drafting, editing and proofreading; technical writing style and strategies; use of brevity, politeness and accuracy in writing; formatting and activities. It also equips the students with the techniques of tailoring the content of technical documents to the needs of various kinds of situations and audiences. The course focuses on the dynamics of designing technical reports and writing documents; writing emails, letters, memos, short reports, formal reports, executive summaries, abstracts, progress reports, white papers, and proposals; and presentation of information in oral and written format. The module effectively blends speaking and writing skills as the students are motivated to present their written reports orally in class at the end of the semester.

HM102 Critical Thinking and Expository Writing (L): The lab provides learners a platform to present their technical reports and get the feedback from the course instructor to improve their expository writing and develop critical thinking

HM211 Islamic Studies (2-0-2): Islamic Studies presents Islam as a rational code of life with emphasis on Islamic perspectives on fundamental human rights, rule of law, brotherhood and equality of mankind, empirical and rational basis of knowledge and harmony between the religious and the scientific domains of experience.

HM212 - Ideology and Constitution of Pakistan (2-0-2): This course is designed to provide students with a fundamental exploration of the ideology and the constitution of Pakistan. The course focuses on the underlying principles, beliefs and aspiration that have been instrumental in shaping the creation and development of Pakistan as a sovereign state. Moreover, the course will enable students to understand the course provisions of the constitution of the Islamic republic of Pakistan concerning the fundamental rights and responsibilities of Pakistani citizens to enable them function in a socially responsible manner.

MS291 Engineering Economy (2-0-2): This course delves into the areas of cost concepts, time value of money relationships, Measures of worth, Performance analysis form final accounts, Decision-making, Brief introduction of the quantitative techniques and of the behavioural aspects.

HM321 - Sociology - (2-0-2): The purpose of the course is to familiarize students with Pakistani parameters with factors that shape a society, theories about personality development, cultural change, socialization, functioning of normative systems, cultural diffusion, social mobility, sub-cultures and countercultures, cultural relativism, social stratification, and social institutions.

HM322 Professional Ethics - (2-0-2): This course covers a range of essential topics including the interplay between ethics, engineering, and society, and the impact of engineering on the environment. It explores global versus Pakistan-specific engineering ethics, strict engineering liability, and the intersection of engineering torts and ethical considerations. The course also examines ethical compliance within the PEC regulatory framework, the global economy's role in ethical enforcement, and the influence of international bodies, standards, and procedures. Additionally, it delves into the role of whistle-blowers and ethics in organizational disobedience, and reviews leading cases in engineering ethics.

MS412 Human Resource Management (3-0-3): The course focuses on the topics of Design and execution of Human resource management strategies, Systematic and strategic thinking about aspects of managing an organization's human assets, Implementation of policies to achieve competitive advantages, Reward systems, Performance management, High-performance human resource systems, Training and development, Recruitment, Retention, Equal employment, Opportunity laws, Work force diversity, and Union management relationships.

MS426 Technology Management (3-0-3): The course focuses on the topics of Industrial networks, Fundamentals of product and process development, Business community and new generations of managers, Practical skills, Knowledge and experience in commercialization of new technological innovations, Use of multidisciplinary science based knowledge, Problem-solving, Teamwork, Outreach activity, Major steps in proof of concept to intellectual property protection, Prototype development, Fabrication and assembly routes, Materials procurement, Identification and Creation of new markets, Development of business plan, Appropriate technology and marketing, Distribution and financing, Routes and strategies for specific technology under development.

MS434 Entrepreneurship and Marketing (3-0-3): The module focuses on the topics of Industrial economic strategy, Preparation of a business plan for new ventures and financing options for start-up business, Barrier to entry, Corporate governance, Mergers information gained through environmental scans on new business opportunities, Case studies, Sharing the experiences of entrepreneurs and investors, Consulting for inventing start-up or entrepreneurial businesses and for professionals.

MS447 Accounting and Finance (3-0-3): The module focuses on the topics of Financial reporting, Financial Statements, Financial statements as management planning tool, Statements of cash flows, Revenue and expense reorganization, Account receivables,

Inventories, Tangible and intangible assets, Liabilities, Bonds, Income taxes, Shareholder's equity, Accounting control, EVA, LIFO, FIFO.

MS448 Macro and International Economics (3-0-3): The module focuses on the topics of International fiscal policies, Macro-environment for firms and organizations, Basic tools of macro-economic management, monetary policy, and Exchange rate policy. Evaluation of the different strategies for economic development including Trade policy, Industry policy, and Natural resource policy. Market crises, Risk management and strategies for future. Major challenges in developed and underdeveloped countries for global integration, Inequality and asset price bubble.

MS449 Industrial Management (3-0-3): The course deals with the principles of industrial management. It focuses on effective and innovative ways of managing physical, human, financial and time resources of industrial and business organizations. It aims at preparing the students to develop a greater awareness of the contemporary trends in organizational management. The course makes an attempt to equip the students with theoretical knowledge and practical skills necessary for a good manager.

MS489 Lean Enterprise Management (3-0-3): The module addresses some of the important issues involved with planning, development, and implementation of lean enterprises. The dimensions of People, Technology, Process, and Management of an effective learn manufacturing company are considered in a unified framework. Particular emphasis is on the integration of these dimensions across the entire enterprise, including Product development, Production, and Extended supply chain. Analysis tools as well as future trends and directions are explored. A key component of this subject is a team project.

MS491 Supply Chain Management (3-0-3): Supply Chain Management includes the materials and information flow among all firms that contribute significantly to a product, from the point of scratch to final product. Elements of supply chain management have been studied and practiced for some time in marketing, logistics, and operations management. This course will integrate different perspectives from various functions of management to develop a broad understanding of how to manage a supply chain. Topics include Value Chains, Supply chains, Supply chain lifecycle, Supply chain strategy, Resource planning, Procurement, Inventory models, Inventory management, Automated Inventory Tracking System, Sales & Operations Planning, Forecasting, Scheduling, logistics, Contracts, Supply Chain Technology, Distributed Requirement Planning.

MS492 Operations Management (3-0-3): This course will provide the students with the necessary knowledge of the basics of managing, manufacturing and Service organization, Strategic decision making, Facility location and layout, Job design and work compensation, Demand forecasting, Capacity and material planning, Scheduling in various environments, Emerging trends in managing operations, focus on selection and use of quantitative management tools after introducing the fundamental concepts.

MS493 Industrial Safety (3-0-3): The course aims to focus on the topics of safety regulations and safety management, office safety and manual handling safety of chemical, Fire safety, Radiation safety, Shop floor safety, Machine guarding and robotics safety, Construction safety, Electrical and pressure safety, Environmental protection, Occupational health, First aid basics, and Risk evaluation and management.

MS494 Total Quality Management (3-0-3): The course contents include Fundamental principles of quality, Standards, Techniques for quality analysis and improvements, Statistical methods to measure quality, and SPC (Statistical Process Control). Acceptance sampling; QFD (Quality Function Deploying), Value engineering, Cross functional management, and benchmarking. ISO-9000 application, clauses and implementation issues.

MS495 Maintenance Management (3-0-3): The module aims to develop an underlying knowledge of the organization and control of maintenance systems, Maintenance policies and strategies, Preventive maintenance, Predictive maintenance and condition improvement, Total productive maintenance, Reliability and failure analysis, Scheduling maintenance, Unique challenges of software maintenance, Maintenance performance measure benchmarking and improvement.

MS496 Project Management (3-0-3): The module focuses on the topics of fundamental principles, Project life cycle, Project organizations and human resource management, PM planning, Work breakdown structure, Estimating time and cost, Precedence relationships, Project scheduling and control technique, Project risk analysis, Time compression and resource levelling, Computerized project management, Special issues in software projects.

Career Opportunities with a BS degree in Management Sciences

Our recent graduates have been placed in well-known Multi-National and National companies. Graduates with a BS Management Sciences degree are highly sought in the Industry. The degree opens up multiple avenues for students where they can place themselves. Apart from student startups, our graduates have been hired by the following companies.

- Reckitt
- Unilever
- Talabat, UAE

- Careem, UAE
- Telenor
- Mobilink - Jazz
- Philip Morris International
- British American Tobacco
- State Bank of Pakistan
- Pakistan Telecommunication Company (PTCL)
- Oil and Gas Development Company Limited (OGDCL)
- Pakistan State Oil (PSO)
- Foodpanda
- Daraz
- Johny and Jugnu
- Zones
- FF Steel
- Pfizer
- Glaxo-Smith Kline (GSK)
- Noon
- NatWest Bank, UK
- Sanofi
- And many more
- DHL, USA
- PTSB, Ireland
- Williams-Sonoma Inc., USA
- PrismTeck, Canada

GIK IT Training Center at F-7/4 Islamabad (In collaborative project with Ministry of Federal Education and NAVTTC under Prime Minister's High Impact Technology Initiative):

Program Introduction

The GIK Institute, in collaboration with Ministry of Federal Education and Professional Training and National Vocational and Technical Training Commission (NAVTTC), has established an IT Training Center in F-7, Islamabad under the Prime Ministers High Impact Technology Initiative for free 6 months IT Training Program (Focus areas: AI, Data Science & Blockchain) for unemployed youth. This program represents GIKI's commitment to excellence in education, specifically designed to equip both IT and non-IT graduates with the cutting-edge skills necessary to thrive in today's fast-paced and ever-evolving technology landscape. This initiative is poised to set a new standard for advanced IT training in Pakistan.

Program Objectives

The program is based on a forward-looking approach in recognition of the tilt towards skill-based education, aimed at bridging the gap between academic learning and industry demands, enhancing employability and fostering critical thinking among participants. Graduates will be equipped to secure high-quality jobs, advance in current roles, or excel in the field of freelancing and other streams for professional career.

State-of-the-Art Facilities

The IT Center in Islamabad is equipped with cutting-edge technology and facilities to support an optimal learning environment. From 85-inch LED screens in classrooms to ergonomic furniture, each aspect of the center is designed to enhance both teaching and learning experiences. Instructors have access to the latest tools and software, while students benefit from an environment that combines comfort, security, and advanced learning technologies.

Curriculum and Practical Labs

The GIKI High Impact IT Training Program is an intensive, six-month, full-time course that demands rigorous engagement from participants. Structured around a comprehensive curriculum, the program blends theoretical learning with practical application, ensuring students gain hands-on experience through real-world case studies and projects. The curriculum covers essential areas including Data Science, Machine Learning, Blockchain technologies, mathematics, programming, and crucial soft skills like communication and problem-solving. GIKI have enhanced the components of entrepreneurship and freelancing. Additionally, we emphasize nurturing soft skills such as emotional intelligence, communication skills, and team building to make students more capable of acquiring jobs in the IT industry.

Strategic Impact and Opportunities

This initiative marks a significant milestone in GIKI's strategic expansion efforts. By establishing this advanced training program in Islamabad, GIKI aims to not only expand its footprint nationally but also reinforce its positive image and brand as a leading engineering and technology institute. The program is expected to open new opportunities of partnerships, industry collaborations, and further educational initiatives, solidifying GIKI's role as a catalyst for technological Structured around a comprehensive advancement in Pakistan.

Abdul Salam Khan
Director IT Department

Information Technology (IT) Department

Introduction

The IT department at GIK Institute plays a crucial role in fostering a supportive educational environment. It ensures the smooth functioning of technology infrastructure, enabling faculty and students to access essential resources and tools. From managing networks and data security to providing technical support and facilitating online learning platforms, the IT department enhances the overall academic experience. By promoting innovation and integrating new technologies, it empowers the campus community to adapt to evolving educational demands and prepares students for a digitally driven future.

Being a fully residential campus, the Institute understands the importance of facilitating round-the-clock connectivity, access to digital resources and computing services, and other information and communication facilities. The IT Department at GIK Institute is responsible for providing students, faculty, staff, and residents with the technological resources to support the Institute's vision and mission of imparting high-quality education and providing excellent teaching and research environment. To fulfill this objective, the IT Department provides a conducive IT infrastructure campus-wide for teaching, learning, and research. More specifically, the following IT facilities are provided by the GIK Institute and through these facilities the IT Department provides numerous services.

Information Technology (IT) Facilities at GIK Institute

Information Technology (IT) facilities at GIK Institute play a crucial role in enhancing the educational experience, supporting research, and streamlining administrative processes. As a modern universities GIK Institute invests significantly in IT infrastructure to ensure that students, faculty, and staff have access to the latest technologies.

1. Data Center

GIK Institute has its own Enterprise Datacenter for providing IT facilities to its faculty, staff, students and residents of the campus. The Data Center is equipped with next-generation firewall, High-end routers, Core switches, Servers and power backup of UPS and power generator. It serves as a critical hub for managing and storing vast amounts of academic and administrative data. It supports research initiatives, provides robust computational resources (HPC), and ensures reliable data access for faculty, students and staff. With advanced infrastructure, the data center enhances collaboration, facilitates innovative projects, and plays a vital role in the institution's digital transformation and strategic initiatives.

2. Hi-Speed Internet Bandwidth

GIK Institute has acquired the Internet bandwidth from two different ISPs (Internet Service Providers), namely, the PERN (Pakistan Education & Research Network) and PTCL (Pakistan Telecommunication Company Ltd.). PERN connects universities and research institutes through high-speed Internet these includes backup links, video conferencing, digital libraries, unified communication and Turnitin Software access to assist the students in their research and academic activities. PERN is currently providing a CIR Internet bandwidth of 500 Mbps, while PTCL is providing 330 Mbps.

3. Wi-Fi and Network Infrastructure

Reliable Wi-Fi and network infrastructure are fundamental to supporting the digital needs of the

campus community. GIK Institute ensures comprehensive Wi-Fi coverage across all buildings, including classrooms, libraries, hostels, and outdoor spaces. High-speed and reliable Internet connections support online learning, research, and administrative tasks. Robust network security measures, including firewalls and encrypted connections, protect sensitive data and maintain network integrity.

The IT Department provides both wired and wireless gigabit network connectivity to the entire campus that connects all the academic departments, hostels, central library, administrative departments, lecture halls, auditorium, guest house, and residences. All buildings, including the academic blocks, administration block, faculty club, guest house, sports complex, medical center, hostels and residential area are connected to the Date Center using fiber optic cables. Ethernet connectivity is provided within all buildings and approximately 300+ campus-wide Wi-Fi access points are deployed for roaming free Internet access.

4. Computer Labs

Computer labs provide students with access to computers and specialized software required for their coursework. These labs are equipped with high-performance PCs, Macs, and various peripherals. These Labs offer a wide range of software, from basic applications like Microsoft Office to specialized tools for engineering, programming, graphic design, and data analysis. These Labs are often open for extended hours to accommodate students' schedules, ensuring that everyone has access to the necessary resources.

5. LMS, CMS, ERP and E-Office Software at GIK Institute

Learning Management System (LMS) is integral to modern education, enabling the digital delivery of course materials and facilitating communication between students and instructors. Instructors can upload Course Materials (lectures, readings, and assignments,) making them easily accessible to students. LMS platforms support Online Assessments (quizzes, exams, and assignment submissions,) streamlining the evaluation process. Features like discussion boards, messaging, and announcements keep students engaged and informed.

A Campus Management System (CMS) is an integrated software solution designed to streamline various administrative and academic processes within educational institutions. It facilitates efficient management of student information, course registrations, attendance tracking, and financial transactions. By centralizing data and automating workflows, the system enhances communication among students, faculty, and staff, ultimately fostering a more organized and collaborative campus environment.

The IT Department maintains the Institute's campus management system (CMS) and provides technical support to faculty and students via CMS focal persons and admissions department. The responsibilities also include technical support in semester offering and conclusion, focal persons' training and support, analytics and reporting, and coordination with the stakeholders.

Enterprise Resource Planning (ERP) is a comprehensive software system that integrates core business processes across an organization into a unified platform. It streamlines operations by consolidating data from various departments, such as finance, HR, supply chain, and customer relationship management. By improving visibility and efficiency, ERP enables organizations to make informed decisions, optimize resource utilization, and enhance overall productivity, ultimately driving growth and competitiveness in the marketplace.

E-Office or Electronic Document Management System (EDMS) software is designed to manage, store, and track electronic documents and images of paper-based information. It facilitates the digitization, organization, and retrieval of documents, providing features like version control, access permissions, and search capabilities. EDMS enhances efficiency by reducing the need for physical storage, improving collaboration, and ensuring regulatory compliance through secure and systematic document handling. By centralizing document management, EDMS software helps organizations streamline workflows, improve data accuracy, and ensure quick access to critical information.

6. Smart Classrooms

GIK Institute Smart classrooms are equipped with advanced technologies to enhance the teaching and learning experience. Interactive Whiteboards or digital

boards allow instructors to display and interact with content dynamically. It has also High-quality Camera and sound systems ensure that all students can see and hear the lecture material clearly. These smart classrooms have Lecture Capture / Recording systems which enable the capture of lectures for later review, aiding in student learning and retention. Smart classrooms are one such facility that enhances the qualities of teaching and learning to make them more innovative and enjoyable.

GIK has acquired smart classroom solutions for its lecture halls. These smart facilities offer the most advanced interactive digital boards, AI enabled tracking cameras, lecture recorders, along with other additional equipment. The facility offers students a highly interactive classroom environment with a provision of attending lectures and scholarly sessions in a blended mode at the campus and from anywhere outside the campus.

7. Research Computing Facilities

GIK Institute provides specialized IT resources to support research activities across various disciplines. High-Performance Computing (HPC) clusters facilitate complex computations and large-scale data analysis. Secure and scalable data storage solutions are essential for handling the vast amounts of data generated by research projects. Platforms for data sharing and collaborative research foster partnerships within and outside the campus.

The high-performance computing (HPC) facility is located at the Data Center. The facility consists of 160 CPU cores, 1024 GPU cores, 10GB Ethernet switch Interconnection and 640 GB RAM. The facility is aimed at serving highly compute intensive research projects not only for the faculty and students of GIK Institute but also for the higher education sector country-wide through PERN.

8. Impact on Education and Research

GIK Institute provides Enhanced Learning Experiences through IT facilities that enable innovative teaching methods and personalized learning experiences. Interactive tools and digital resources cater to diverse learning styles, making education more engaging and effective.

GIK Institute provides Improved Research Capabilities through the advanced IT infrastructure that allows researchers to tackle complex problems and analyze large datasets, leading to groundbreaking discoveries and contributions to their fields.

Administrative Efficiency is possible through automated systems and digital platforms that streamlines administrative processes, from admissions and enrollment to grading and student services, improving overall efficiency and reducing paperwork.

9. Digital Library

HEC National Digital Library is a program to provide researchers within public and private universities in Pakistan and non-profit research and development organizations with access to international scholarly literature based on electronic delivery, providing access to high quality, peer-reviewed journals, databases, articles and e-books across a wide range of disciplines. The e-books support program allows researchers to access text and reference books electronically in a variety of subject areas. Around 75,000 number of electronic contents has been made available through the Digital Library Program. GIK Institute has a rich collection of e-books which are accessible within the campus. These books are related to a variety of subjects, such as computer hardware & software engineering, engineering sciences, mechanical engineering, electronic engineering and humanities/management science, and are accessible through the intranet. GIK also has a rich collection of e-books which are accessible within the campus. These e-books are related to all disciplines of GIK Institute. Apart from this, faculty publications, final year project reports and PhD theses are also available online.

10. Website and Social Media Platforms

A website serves as the public face of an institution and the IT Department maintains the GIK Institute website which is vital for providing essential information and resources to prospective and current students, faculty, and staff. It serves as a centralized hub for accessing academic programs, admission requirements, campus news, and events. The website enhances the institute's visibility and reputation by showcasing achievements, research, and community engagement. Additionally,

it offers convenient access to online services, such as course registration and academic advising, streamlining administrative processes. In essence, a well-designed university website is crucial for effective communication, accessibility, and overall institutional success.

The marketing department maintains the social media accounts of the GIK Institute. Social media plays a crucial role in today's society by facilitating instant communication and information sharing across the globe. It allows individuals and businesses to connect with diverse audiences, fostering relationships and creating communities. Social media platforms serve as powerful tools for marketing, enabling brands to reach potential customers and engage with them directly. Additionally, social media can drive social change by raising awareness about important issues and mobilizing support for various causes. Overall, its impact on communication, marketing, and social activism highlights the profound importance of social media in the modern world.

11. Software

The IT Department has access to licensed Software which comes under the PERN plans (Education Program) for students and faculties. Under this plan following licensed software are available: Microsoft Windows, Microsoft Office 365, Visual Studio, Mahine Learning Server, Azure DevOps Server, Visio Professional, Project Professional, and SQL Server. Under this program, our faculty and students can also join Microsoft Learning Paths in the fields of software development, databases, AI, data science and others. Additionally, GIK Institute has also established an in-house software cell which develops customized software and web applications in coordination with the faculties and departments to meet their requirements and facilitate them using modern tools.

12. CCTV

Safe and secure environment for students, faculty and staff at GIK is of utmost priority. Therefore, GIK has placed special emphasis on the security and surveillance of the campus to make it safe and secure for the whole community. Dedicated IP surveillance CCTV cameras installed across the campus and command and control system are one of the primary secure-campus strategies which prevents both internal and external threats and provide strict security protocols within the campus. Campus security addresses all kinds of challenges including prevention of violence, managing students' diversity, maintaining access control check points and 24/7 surveillance.

13. IT Helpdesk

IT Helpdesk provides seamless technical support to the faculty, administrative staff, students, and residents of the campus. The IT Helpdesk is the central point of contact for the GIK community for their queries and issues pertaining to facilities provided by the IT Department. The IT Helpdesk receives, processes, and responds to service requests during working hours. To facilitate users with IT facilities on a timely basis, the Helpdesk responds to various complaints through an online helpdesk management system. The Helpdesk team provides maintenance and repair services related to computing equipment, technical support in online and offline meetings, webinars etc. and photography of official events. The IT Helpdesk, located on the 1st floor of the New Academic Block building, is open 08:00–17:00 to answer queries and provide support through phone, email or in person. The IT Helpdesk can be contacted by dialing 6-2010 from within GIK, or by email at ithelpdesk@giki.edu.pk

OFFICE OF STUDENT AFFAIRS

Dean Student Affairs

Dr. Muhammad Imran Khan
Ph. D. (University of Tsukuba, Japan)

Mr. Sabahat Hussain, Deputy Director Student Affairs
Ms. Iqra Siddiqui, Student Wellness Counselor
Warden Girls Hostel

The Student Affairs Office serves as a liaison between students, faculty and administration. The primary function of Student Affairs Office is to be of assistance to students in any way possible. It leads, directs, and administers overall functions of student counseling, hostel residence, student societies and discipline. The important function of Student Affairs Office is to enhance the quality of student life both in and outside of the classroom.

Overseen by Dean Student Affairs, this office is a central place for students where they can express and get help about any situation they encounter on campus whether it is academic, personal or emotional.

The Student Affairs Office has a full-time Deputy Director Student Affairs, who is readily available to students for advice and help. The students are encouraged to have recourse to him for advising and guidance. Further, guidance is provided as to how our students can spend an enriched all-round intellectual life on campus because we prepare students not only for hours they spend in their classrooms but also for the many more hours of their leisure time for their personal lives. Outside of classrooms, thoughtful efforts are made to groom our students and provide enriching experience.

The Student Affairs Office functions as a friend and guide of students, it administers their needs from the time they step in the Institute for admission, to the time they graduate from the Institute. It provides forums for cultivation of their literary and artistic potentialities and furnishes them healthy outlets in
sports and games which make their stay on campus, a rich experience of multi-dimensional growth.

The student Affairs Office provides proactive support and capacity building services to promote co curricular activities in the Institute which could enrich our graduates at every stage of their life as well as they could build strong relationships with their peers, faculty, administration and other stakeholders.

Student Counseling Services

The Office of Student Affairs promotes a sense of community and belongingness among students. The student counselor works regularly with students to help them in their personal issues. Further, they are motivated in their academic matters and encouraged how to nourish their life with plentiful intellectual activities. Also, relaxation methods are offered to deal with academic pressures if any. We assure the students the complete confidentiality of their concerns.

Societies and Clubs

The institute is situated in calm and tranquil countryside. The campus of the institute is a self contained cosmos. Here the students generate a fullness of life for themselves, and their superabundant energies find outlets in socio-cultural activities. Through generous financial allocations and faculty supervision, the institute supports all modes of constructive self expression for the students. There is thus much on the campus by way of recreational facilities, which mitigate the rigors of very demanding academic engagements. To nurture the intellectual and recreational activities, students are encouraged to join student societies in GIK Institute which are managed by students with the support of faculty and administration. Each society is assisted by a faculty advisor. Different kinds of technical and recreational events are organized by these societies which range from scientific to art competitions.

Student Societies at GIK Institute

GIK Institute recognizes a wide variety of student societies to facilitate diverse interests of the student body. Office of Student Affairs is the governing body for all societies that are administered by student representatives. Societies are granted certain privileges to promote student participation in a variety of physical, intellectual and recreational activi ties. There are many student societies in GIK Institute which support contemporary scientific and engineering perspectives as well, and are devoted to advance theory and practice of their respective fields. Few of student societies which have contributed to GIK Institute, are discussed below:

1. Science Society

The GIKI Science Society is one of the biggest and oldest society in the Institute, working towards promotion of interest in all general sciences in a predominantly technical environment. It has a full calendar of events comprising of an intra event at GIK Institute, Science Marathon, All Pakistan Science Fair and International Science and Youth Symposium annually, with the ultimate mission of scientific prosperity and social development in the country. GIK Science Society annually publish a Science Magazine called 'Aurora', which keeps the students updated to the enthralling news and developments, especially in the world of science.

2. AIAA - (American Institute of Aeronautics and Astronautics) GIK Chapter

The American Institute of Aeronautics and Astronautics (AIAA) is a prominent technical society at GIK Institute. Formerly known as the GIKI Aerotech Club, it has made its mark by projecting an image that makes this technical society appealing to the masses. The society

is a platform for Aerospace enthusiasts and it conducts various events, seminars and workshops each year. AIAA also maintains a fleet of Radio Controlled Aircraft which are used for both technical and recreational purposes.

3. ASM/TMS - (The Mineral, Metal & Material Society/American Society of Materials) GIK Chapter

The mission of ASM/TMS is to promote the science and engineering professions concerned with minerals, metals and materials. The objective of this TMs chapter is to make students aware of the role of materials and metallurgical engineering in today's international market place. TMS also helps students from other disciplines of engineering to better understand and perform in their disciplines of engineering materials.

4. ACM - (Association for Computing Machinery) GIKChapter

ACM is a worldwide professional organization devoted to advancing the theory and practice of computer science. Its student chapter at GIKI is involved in activities ranging from arranging students workshops, special courses and introductory seminars to holding software and computer games competitions.

5. Women Engineering Society (WES)

The Women Engineering Society has undertaken the task of exploring the reasons behind the low representation of women in the field of engineering and seeking remedial measures to make this profession more viable for women. To fulfill this need, a student society (Women Engineering Society) has been established, which is wholly managed by female students. It has successfully arranged two national symposiums to discuss the problems faced by women in this field and also the problems faced by the industry in hiring and retaining of women engineers. The feedback has been enormously encouraging and WES plans to keep working at raising awareness about the viability of engineering profession for women.

6. Literary and Debating Society (LDS)

The society holds debates, declamation contests and literary evenings, and sessions of poetry recitation. It also arranges participation of the GIKI teams in debates and declamation contests held by other universities. LDS is the oldest society of the institute. A special feature of its agenda is the student teacher discussion usually held in the auditorium. These collective sessions prove invaluable for a critical evalu-ation of the diverse aspects of the campus life, and go a long way in promoting rapport between the students and the faculty. The LDS also organizes and participates in international events.

7. Cultural, Dramatic, & Entertainment Society (CDES)

This is one of the most active and widely applauded societies which add colors to the campus life. It creates entertaining and healthy diversion throughout the year by organizing musical concerts, drama festivals, skit competitions, picnics, and bonfires. The activities of the society help in identifying artistic talent among students and nourish students to participate in art competitions. The society also celebrates the much popular "Basant Festival" every spring.

8. SOPHEP- (Society for the Promotion of Higher Education in Pakistan)

In this modern day and age, engineers and scientists are not isolated from the management of the firms they work in. As a matter of fact, they themselves can become senior managers later on. Due to this, companies are perpetually on the look-out for people with solid communication skills. The implication for students is that besides studying hard, they must strive to develop solid presentation and communication skills as well. One of the major problems facing today's Pakistani students is the lack of interaction between the Pakistan's academic and professional communities. As a result of this, young undergraduates lack sufficient knowledge of

the professional world and companies remain unaware of the great potential of these future workers.
In this regard, SOPHEP bridges the gap among these two vital communities. SOPHEP holds workshops that are conducted by successful GIKI alumni that help students to refine their people-skills and professional grooming.

9. Project Topi
Project Topi is a student based society which works for the social uplift of the people living in and around the GIK Institute. This society began back in 2000 with the aim of academic uplift of the people of Topi and other parts of Swabi. Over the Years the domain stretched to areas like medical initiatives, blood camps, and woman/men empowerment, micro financing and continual support of some very poor families as well.

10. NAQSH
Naqsh Art Society is another emerging and popular student society. It organizes the much awaited 'All Pakistan Art Gala' every year, featuring various artistic competitions on a national scale. The society promotes aesthetic sense and faster artistic touch among the prospective engineers.

11. Media Club
To promote creative expression amongst the students, the GIKI Media Club caters for the taste of all. It comprises of Photography Club, Desktop Publishing and vision Club. Emphasis is laid both on still photography and video. The members are supposed to compile and compose the newsletters/magazines. The media club is responsible for the coverage of various events within the Institute and also organizes the very popular annual movie competition at the campus.

12. Sports Society
Sports Society comprises of the coordinators of various sports clubs of the Institute. It promotes and regulates sports and games on the campus. The existing facilities include a sports complex, which houses Swimming Pool, Squash, Basketball, Volleyball & Badminton Court and a Gymnasium. Outdoor facilities include cricket, hockey, football fields, tennis courts, beach soccer, and beach volleyball. Students' hostels have ample provision for the indoor games, such as table tennis, carom and chess. The Society organizes friendly matches throughout the year culminating in annual interfaculty tournaments and competitions. The sports society also organizes fixture Education in Pakistan tournaments with other educational institutions and provides the forum for sportsmen to take part in various national sports events. Following students societies are functional in the Institute:-

1. ACM GIK Chapter: Association of Computing Machinery
2. ASME GIK Chapter: American Society of Mechanical Engineers
3. ASM/TMS GIK Chapter: American Society of Materials/the Materials, Mineral and Metal Society
4. ASHRAE GIK Chapter: American Society of Heating, Refrigerating and Air Conditioning Engineers
5. CDES: Cultural, Dramatic and Entertainment Society
6. GMS:GIKI Mathematic Society 7.GSS: Graduate Student Society
7. IET GIK Chapter: Institute of Engineering and Technology

8. IEEE GIK Chapter: Institute of Electrical and Engineers Electronic Engineering
9. LDS: Literary and Debating Society
10. Media Club: Includes GIKI Vision, Photography and Desktop Publishing
11. Naqsh Art Society: NAQSH promotes and propagates art in GIK Institute.
12. Netronix: NETRONiX is the sole caretaker of GIKI's hostel network, one of the largest in Pakistan & perhaps the only one run by Undergraduate students. Over the past years, NETRONiX has not only maintained its core objective of handling the whole LAN of GIKI but also provided the students a platform to learn and implement their skills. In addition to this, NETRONiX also provides various other services to the students e.g p2p sharing, IPTV, PLEX, gaming servers etc & is the only dedicated gaming community in GIKI which hosts intra-GIKI and All Pakistan gaming events annually.
13. Project Topi: Project Topi is a student run volunteer society which runs many projects for the welfare of Topi community.
14. Science Society: Science society deals in contemporary developments in scientific field.
15. SOPHEP: Society for the Promotion of Higher 1
16. Sports Society: Sports society maintains the sports facilities and organizes events with wide participation.
17. SPIE GIK Chapter: Society for Photo-Optical Instrumentation Engineer
18. SMEP GIK Chapter: Society of Mechanical Engineers of Pakistan
19. WES: Women Engineers Society
20. AIAA GIK Chapter: American Institute of Aeronautic & Astronomic.
21. AIESEC: Its agenda primarily includes sending youth for exchange programs, belonging to different cultures to other countries. It is an attempt to develop and consolidate friendly ties between countries.
22. AICheE GIK Chapter: American Institute of Chemical Engineers, GIKI Chapter.
23. CBS: Character Building Society
24. ImechE: institute of Mechanical Engineering.
25. LES: Leadership and Entrepreneurial Society.
26. ICE:Institution of Civil
27. GIKI Adventure Club
28. GIKI NEXUS: Cyber Security
29. Graduate Student Society (GSS)

M. Wisal Khalil
Director QEC
Ph: 0938 281026 ext. 2261
Email: wisal@giki.edu.pk

Ms. Gul Afroze
Assistant Director QEC
Ph:0938 281026 ext. 2411
Email: gulafroze@giki.edu.pk

Mr. Afsar Zaman
Data Analyst QEC
Ph:0938 281026 ext. 2711
Email: afsar@giki.edu.pk

The GIK Institute Quality Enhancement Cell (QEC) has consistently been ranked as the best Quality Enhancement Cell in Pakistan. The QEC is responsible for managing accreditation for faculty and departments, conducting graduate program self-assessments, preparing yearly progress reports, conducting institutional performance evaluations, and submitting data for international and continental rankings to regulators and to the Pakistan Engineering Council (PEC) and the Higher Education Commission (HEC) in Pakistan.

International Rankings

QS World University Ranking by Subject 2024

The Ghulam Ishaq Khan Institute (GIK) Institute has been ranked for its Mechanical and Electrical Engineering disciplines in the QS World University Rankings by Subject 2024.

- Currently Mechanical Engineering stands among the **451-500** universities of the world as **per QS World University Rankings by Subject 2024.**
- Electrical Engineering stands among the **451-500** universities of the world as **per QS World University Rankings by Subject 2024.**

Times Higher Education (THE) Impact Rankings 2024

This year GIK institute secured an overall position of **13th globally and 3rd in Pakistan** in Times Higher Education (THE) University Impact Rankings 2024 in the category of Sustainable Development Goal **(SDG-4) "Quality Education".**

In SDG 1: No Poverty, GIK Institute achieved an overall position of **201-300 globally and stood 3rd amongst all National Universities.**

The GIK Institute Ranked **800-1000 globally in the overall THE University Impact Rankings 2024;** while maintaining a prominent position among Pakistani universities.

QEC

UI Green Metric World University Ranking.

This year, the GIK Institute participated in the international GreenMetric and was ranked **1st in the KPK region, 11th nationally, and 394 globally.** Participating in the UI GreenMetric ranking aims to increase the university's international recognition and presence by showcasing its sustainability efforts. The GIK Institute shares the same mission and goal of achieving sustainable targets and continuing to progress in this area, and its achievement in the GreenMetric Rankings reaffirms its commitment to implementing environmentally friendly policies and "greening" the campus to support sustainability.

Accreditation of Programs

GIK Institute offered programs are accredited by the concerned accreditation bodies as well as in line with the Washington Accord standards. Our curricula are designed to meet international standards, with a focus on student-centered education and an emphasis on lifelong learning.

All our engineering programs proudly hold accreditation under OBE Level II standards, ensuring a rigorous and comprehensive educational experience that meets international benchmarks for quality. Additionally, our commitment to excellence extends to all other programs, each accredited by their respective accreditation bodies such as NBEAC and NCEAC, ensuring that every student receives a world-class education tailored to their field of study.

Yearly Progress Report (YPR)/ QEC Assessment Score

GIK Institute QEC has been rated SATISFACTORY with a score of **"91.15%"** in its YPR quantitative assessment for the period of July 2021-June 2022. As per the assessment of YPR 2021-22 the overall performance of QEC is rated as MEETING ADEQUATE PARAMETERS SATISFACTORALIY (MAPS) while obtaining 91.15 marks.

Current Membership of International Quality Assurance Networks

INQAAHE
INTERNATIONAL NETWORK FOR QUALITY ASSURANCE AGENCIES IN HIGHER EDUCATION

Association of Quality Assurance Agencies of the Islamic World

The Talloires Network

Amar Ali Khan
Director ORIC

Shehroze Saleem Qureshi
Assistant Director ORIC

Office of Research, Innovation, and Commercialization (ORIC) supports and organizes research and commercialization activities at GIKI. ORIC GIKI aspires to be a facilitator for cutting-edge research, technological advancements, and interdisciplinary collaborations for translating knowledge into innovative solutions that contributes to the socio-economic development of the country.

The ORIC at GIKI was established as per the guidelines of Higher Education Commission of Pakistan (HEC) and was formally recognized by the HEC in 2023.

ORIC has two wings namely, Research Excellence & Innovation and Commercialization.

Key Services Provided by ORIC:

Academia- Industry Linkages

- Linkages/MoUs with Industry
- Visits by Industry Experts
- Compiling & Maintaining R&D Database
- Facilitating the faculty members in reach out to Industry Experts

The GIKI ,through ORIC, has established strong linkages with national and international organizations such as OGDCL, PEL, Dawlance, HBL , WWF and numerous other organizations.

SoPs/Policy Making

- Research Policy
- IP Policy
- Consultancy Policy
- R&D Related Forms

Funding/Grants/Projects/Patents

- Identification of Funding Opportunities for Researchers
- Facilitation and guidance to Faculty for Internal/ External Research Grants
- Facilitation in Patent Filing and Commercialization of Projects

ORIC has played a significant role in facilitating the faculty members in securing funding for projects from different sources such as NESCOM, HEC, PSF, Erasmus Plus, DoST and other national/international bodies.

Enhancement/Promotion of Research Culture

- Capacity Building to Improve Research Skills

Students Placements

- Organizing Career Fair, Industrial Open house.
- Organizing Recruitment drives
- Internship Facilitation

Career Fairs

Each year, the industry is invited from all over the country to GIK Institute on the Career Fair to interact with the third and final-year students to hold interviews for Jobs & internships, conduct presentations, and interact one-on-one with the student body.

The Careers Fair is annually held to provide:

- A meeting place for the Institute's senior students and their prospective employers
- An effective platform for industry-university interaction
- An opportunity for the industry representatives to acquaint themselves with the academic environment provided to the students


Leading national and international companies attended the GIKI Career Fair for the recruitment of GIKI Students
@officialGIKI


Some companies conducted on-the-spot interviews, while others shortlisted students for the internships and jobs
@officialGIKI


CAREER FAIR 2024


GIKI Annual Career Fair provides networking and employment opportunities to students and valuable insights about career paths and industry expectations.
@officialGIKI

Industrial Open House

Each year, the industry is invited from all over the country to view our graduating students' Final Year Projects, hold interviews for Jobs & internships, conduct presentations, and interact one-on-one with the student body. To establish liaison between the Institute and industry and to find appropriate places for its future graduates in the competitive market, a tradition has been set in the Institute to hold an annual event, Industrial Open House, by the Office of Research, Innovation, and Commercialization – ORIC at the campus before graduation ceremony every year.

Alumni Relations

Alumni Relations

GIK Institute is committed to building and nurturing lifelong relationship with its alumni and is looking forward to strengthen it further through ORIC. The office is aiming to form a mutually beneficial relationship between the Institute and alumni, wherever they are located; also by providing alumni with opportunities to ensure that they feel a part of GIK Institute for good. Working close with GIK Institute Alumni Association – GIKIAA, ORIC is offering a range of services and invitations to events organized by GIK Institute.

Alumni Success Stories

Aatif Awan
Founder & Managing Partner
at Indus Valley Capital
x VP, **LinkedIn**
x SPM **Microsoft**

Warda Inam
CEO & Co-Founder, Overjet
Forbes Top 50 Ai Companies
shaping the future
MIT Graduate Women of Excellence

Zia Syed
Founder & Head Decision AI
Google

Aisha Khurshid
Head of Solution Architecture Amazon
Web Services Director Product
Development **General Electric**

Asad Yaqoob
Engineering Leader, Snowflake
Engineering Leadership, **Meta**
Partner Group Engineering
Manager, Microsoft

Durdana Achakzai
Founder & CEO, Pivotal
Head of Digital Portfolio
HSBC
Chief Digital Officer,
Telenor, Pakistan

Asad Awan
Vice President
Meta

Amna Shahid
Director, Product Solutions
Visa Direct
Senior Product Manager
Easypaisa

M. Bilal Jamil
Founder & CEO
Startup Pakistan
Founder & CEO
Shoppingum

Amir Rao
Global Director of Product Management at
Amazon Web Services (AWS)

Dr. Yarjan Abdul Samad
Senior Research Associate & Senior Teaching Fellow at University of Cambridge
Assistant Professor, Aerospace Engineering, Khalifa University

Dr. Yaser Sheikh
Vice President of Research
Meta

Incubation

Muhammad Amin Qureshi
Director Incubation

To create an atmosphere for nurturing ideas into commercialized products, GIK Institute in partnership with the Directorate General of Science and Technology (DoST) Government of Khyber Pakhtunkhwa, has set up a state-of-the-art Incubation facility called the Catalyst. The facility allows budding entrepreneurs access to the latest technology equipment, machinery and research know-how necessary to facilitate product design and commercialization. Top teams are selected from business plan competitions held regularly throughout the year.
The Catalyst GIK Incubator is a technology incubator and the only residential Incubator in Pakistan, where start-ups live on the campus free of cost and spend most of their time building the next big thing. Funded and supported by Directorate of Science and Technology, Government of Khyber Pakhtunkhwa.

Directorate of Science & Technology
Khyber Pakhtunkhwa

DEPARTMENT OF
SCIENCE & TECHNOLOGY
AND INFORMATION TECHNOLOGY
GOVERNMENT OF KHYBER PAKHTUNKHWA

THE CATALYST

OBJECTIVES

- Platform for entrepreneurs to develop technology businesses
- Resources given to produce a near-commercial ready prototype
- Focus on physical products and algorithmically intensive ideas

HOW WE HELP

Resources

- Rs 25,000 stipend for each Co-Founder depending on budget
- Upto 3 Co-Founders allowed in each team
- State of art Office Space / Conference Rooms
- Computers/ High Speed Internet / All Utilities paid
- Free Accommodation and access to University facilities.

Prototype Development

- World class faculty / Pool of Students for Research help
- Use of Labs for all production and testing needs

Professional Guidance and Investment Centre

- Seasoned entrepreneurs and executives
- Trainings
- Investor / GIK Alumni Contacts

In return

- Company favored agreement:
- 10% equity – You make all the decisions!
- Minor stake in profit sharing (time limited for your benefit)
- Minor share in IP and copyrights to align University involvement with Co-Founders

ENTRANCE TO THE GIK INCUBATOR-APPLICATION PROCESS EXPLAINED

We've listed our process below. This will help you prepare for the process in advance.

INSTRUCTIONS

INDUCTION TO THE CATALYST GIK INCUBATOR -APPLICATION PROCESS EXPLAINED

We've listed our process below. This will help you prepare for the process in advance.

INSTRUCTIONS

Stage 1: On-Line Application

When enrollment is open, an online application portal is made available for applicants. For your convenience all the questions asked in the application are listed below. Your application is screened by a panel of GIK Faculty. Start-Ups are shortlisted by end of this stage.

Stage 2: On-Line Pitching

Awesome – you passed the first phase. In this stage, shortlisted Start-Ups from stage -1 are invited for a zoom meeting / pitching session with the panel of judges. This panel of Judges will be reviewing your final presentation and make the decision on your application. So, prepare, prepare, and prepare.

The questions which you need to answer need to be put in a presentation. Presentation Template can be found here.

An on-site visit also gives you a chance to view our facilities, meet with faculty and get any of your questions answered with the staff of The Catalyst.

Stage 3: Start-Up Induction

Upon Selection, The Catalyst team will contact you to set up your final move-in date. All Founders are required to be residents on-campus for the duration of their Incubation period. We'll contact you with all the details.

Gold Medalist 2023

The Institute has established Faculty Gold Medals for best academic performance in each faculty. Two Institute Gold Medals have also been established for students with outstanding performance in the BS Degree. The Ghulam Ishaq Khan Gold Medal is awarded for the best academic performance among all the graduates of the Institute. The Quaid e Azam Gold Medal is awarded for the best overall performance among all the graduates of the Institute.

Quaid-e-Azam Medal

Muhammad Musa Hayat

GIK & Faculty Medal ME

Ahmed Hassan

Faculty Medal CE

Atif Ullah

Faculty Medal CSC

Muhammad Arsalan

Faculty Medal EEE

Muhammad Omar

Faculty Medal EEP

Maaz Bin Khalid

Faculty Medal ES

Sardar Saad Abdullah

Faculty Medal CME

Ali Nawed Abbasi

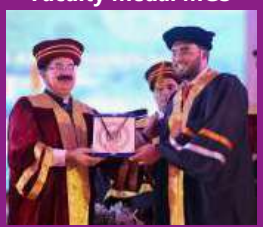
Faculty Medal MSC

Basil Masood

Faculty Medal CVE

Taimoor Shafique

Faculty Medal MGS



Shahzaib Khan

SOPREST OFFICE

Engr. Salim Saifullah Khan	Shakil Durrani	Irfan Ahmad
President SOPREST	Executive Director SOPREST	Secretary SOPREST and BoG

Society for Promotion of Engineering Sciences & Technology Pakistan
Office No. 305-306, Stock Exchange Tower, Blue Area, Islamabad.

Phone No.
051-8778429
051-8779429

Rector
Prof. Dr. Fazal Ahmad Khalid, SI
rector@giki.edu.pk

Pro-Rector (Academic)
Prof. Dr. Syed Mohammad Hassan Zaidi
prorector_acad@giki.edu.pk

Pro-Rector (A&F)
Sardar Aminullah Khan
prorector_af@giki.edu.pk

Dean, Faculty of Computer Sciences and Engineering
Prof. Dr. Qadeer Ul Hasan
qadeer.hasan@giki.edu.pk

Dean, Faculty of Electrical Engineering
Dr. Arbab Abdur Rahim
arbab@giki.edu.pk

Dean, Faculty of Engineering Sciences
Dr. Naveed R. Butt
naveed.butt@giki.edu.pk

Dean, Faculty of Materials and Chemical Engineering
Dr. Fahd Nawaz Khan
fahd@giki.edu.pk

Dean, Faculty of Mechanical Engineering
Dr. Taqi Ahmad Cheema
tacheema@giki.edu.pk

Dean, School of Management Sciences
Dr. Sami Farooq
sami.farooq@giki.edu.pk

HoD, Chemical Engineering
Prof. Dr. Javaid Rabbani
drjrabbani@giki.edu.pk

HoD, Civil Engineering
Dr. M. Ashraf Tanoli
matanoli@giki.edu.pk

Dean Student Affairs
Dr. Muhammad Imran Khan
dsa@giki.edu.pk

Director (Admissions & Examinations)
Mr. Muhammad Faheem Akhtar
coe@giki.edu.pk

Director Admissions
Mr. Muhammad Waqas Malik
waqas@giki.edu.pk

Director (Incubation)
Mr. Muhammad Amin Qureshi
amin.qureshi@giki.edu.pk

Director QEC
Mr. Muhammad Wisal Khalil
wisal@giki.edu.pk

Director ORIC
Mr. Ammar Ali Khan
diroric@giki.edu.pk &
amar.ali@giki.edu.pk

Director IT Department
Mr. Abdul Salam
abdulsalam@giki.edu.pk

Manager Marketing
Mr. Ali Shaukat
alishaukat@giki.edu.pk

Secretary to Rector
Mr. Kifayat Ullah
kifayatullah@giki.edu.pk

Director (Projects/Maintenance)
Col.(R) Muhammad Saleem Khan
director.engineeringprojects@giki.edu.pk

Director Finance
Mr. Tahir Mehmood Mir
tahir.mir@giki.edu.pk

Director Facilitation
Mr. Farrukh Majeed
farrukh.majeed@giki.edu.pk

Deputy Director (HR)
Mr. Khushal Sardar
khushal.sardar@giki.edu.pk

Deputy Director Procurement
Mr. Farid Wahid Siddiqui
farid.wahid@giki.edu.pk

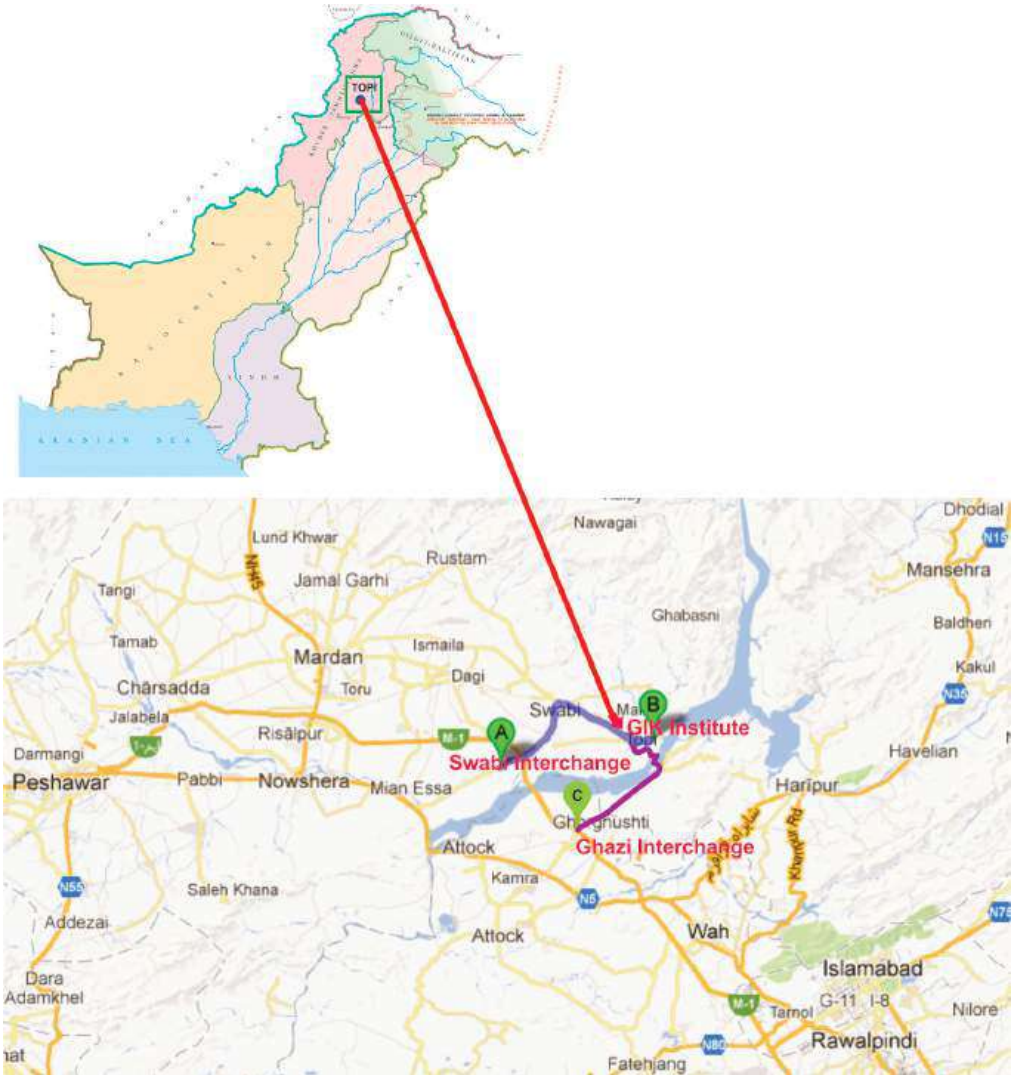
Deputy Director (Security & Protocol)
Maj. (R) Muhammad Irfan

In-charge Medical Center
Dr. Asma Rafique
drasma@giki.edu.pk

Principal GIK College
Ms. Shama Nauman
principal@giki.edu.pk

HOW TO GET TO GIK INSTITUTE

- The Institute is less than one and half hour drive from Islamabad and Peshawar.
- Starting from Islamabad, exiting Islamabad-Peshawar Motorway M1(Point C) at Ghazi Interchange, follow road towords Tarbela and reach Campus after passing through Ghazi Barrage.
- Starting from Peshawar, you should follow the Motorway M1 (Point A) till you reach Swabi Interchange. From there come to Topi and the campus via Swabi.



DISCLAIMER

While every effort has been made to ensure the accuracy of the information in this Prospectus, the Institute can accept no responsibility for any errors or omissions. The Institute reserves the right to amend, offer delete or discontinue course(s) or amend admission requirement whenever it sees fit and prospective and registered students should enquire as to the up to date position should they need to know. The Institute takes all reasonable steps to provide educational ser vices in the manner set out in the Prospectus and in other documents that will be issued to you if you are accepted as a student of the Institute. Should certain circumstances beyond the control of the Institute interfere with its ability to provide educational services, the Institute will take all reasonable steps to minimise the resultant disruption to educational services.

Should you become a student of the Institute, this notice shall be incorporated as a term of any contract between you and the Institute. Any offer of a place at the Institute is made on the basis that in accepting such an offer, you signify your consent to compliance with registration proce dures, to observance of the Act, Guidelines, Rules and Regulations of the Institute.

Undergraduate Admission Committee

Prof. Dr. Syed Mohammad Hasan Zaidi (Convener)
Mr. Muhammad Faheem Akhtar
Dr. Muhammad Imran Khan
Dr. Ghulam Abbass
Dr. Sajjad Hussain
Dr. Memoon Sajid
Dr. Raja Hashim
Dr. S. Zameer Abbas
Dr. Asad Mahmood
Dr. Massab Junaid
Dr. Shiraz Ahmad
Mr. Tahir Mehmood Mir
Mr. Hassaan Tariq
Mr. Muhammad Waqas Malik
Mr. Ali Shaukat
Mr. Taufeeq Ahmad

For further information & updates, please contact or visit website:

The Admission Office, Ghulam Ishaq Khan Institute of Engineering Sciences and Technology
Topi-23640, Khyber Pakhtunkhwa, Pakistan
Tel: (0938) 281026 Fax: (0938) 281052, E-mail: ugadmissions@giki.edu.pk

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THE IMPACT RANKINGS 2024

SDG4 QUALITY EDUCATION

3rd in Pakistan, 13th GLOBALLY

Province Rank: 1st

Ghulam Ishaq Khan Institute of Engineering Sciences and Technology

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