Ghulam Ishaq Khan Institute
of Engineering Sciences and Technology

Undergraduate Prospectus 2021

VISION

The Institute aspires for the leadership role in pursuit of excellence in engineering, sciences and technology.

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 Gulam Ishaq Khan (GIK) Institute of Engineering Sciences and Technology has earned a reputation as an institution of the excellence in the country for imparting quality education in engineering sciences and technology. Not many institutions have earned so much recognition and respect, both within the country and abroad, in such a short time as has the GIK Institute. This distinction would not have been possible without the commitment and dedication of its teachers, staff and students. Thus, all of their efforts deserve to be complimented.

Engineering sciences and Technology hold the key to the development and security of the country. Advanced technology, however, is not easily available in the international market nor can it be borrowed. We, therefore, must make a concerted effort to develop our own indigenous technologies that suit our peculiar environment and also caters to our particular needs in the industrial, economic and other sectors.

It is gratifying to note that the private sector is increasingly participating in the effort to broaden the base of scientific and engineering education in the country. I would like to commend the GIK Institute for playing a leading role in this endeavour by introducing new and emerging technologies and producing highly trained manpower capable of meeting the challenges of the modern day, complemented by a robust research program.

Institutes like GIK must play the role of a catalyst in bringing about a techno-industrial transformation. We need men and women of vision, knowledge, courage and integrity. We expect from our institutions to produce such professionals. I urge the GIK Institute to continue its quest for excellence and hope that its alumni serve the nation and contribute towards making Pakistan a highly developed and prosperous country.

May Allah Almighty be our protector and guide! Ameen

Dr. Arif Alvi
President of the Islamic Republic of Pakistan

From the President

It is a matter of great satisfaction for me to see the Ghulam Ishaq Khan (GIK) Institute of Engineering Sciences and Technology continue to take major strides in its pursuit of excellence in education and research. GIK has not only maintained its leading position in many engineering fields, but has now, further expanded its activities to provide quality education in new and innovative areas at the cutting edge of technological research, innovation and development, worldwide.

In today's digital world where information and knowledge are fast becoming the basis of human economic and social interaction and progress, GIK is determined to be in the forefront of these developments. Plans for setting up a Center for work on Artificial Intelligence (AI) and its applications to National Development are under active consideration. In this regard, GIK has forged important partnership for faculty and student exchange with a number of well-known foreign Universities and a well-known International Corporation. Our Business and Management programme also offers opportunities to students to couple their technical knowledge and skills with the practical know how of entrepreneurship and enterprise development.

GIK has always striven to select the best and the most motivated students. Selection on Merit has always been our only criteria for enrollment. Once enrolled, students can rest assured that they will be provided with all available benefits and support to facilitate them in the successful pursuit of their studies. We are very encouraged to see a quantum leap in the number of female students who are excelling in every field and hope to see larger female enrollment in the future.

We are very proud of our capable management, under the able leadership of the Rector and supported by the distinguished members of the faculty. They are, indeed, a body of competent and dedicated supervisors, teachers and support staff and an asset 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 sympathetic guidance and support.

Finally, I would like to add that the expanding GIK facilities with spacious ground, elegant class rooms and hostels and state of the art equipment and laboratories, offer a fully supportive environment for study, research, creative activities and sports, and its tranquil and peaceful location a grand opportunity for serious scholarship

I wish you all great success.

Farid Rahman
President SOPREST

From the Rector

The past year has been quite difficult for everyone because of the corona virus. Nevertheless, I must applaud the students, faculty and all other employees of GIK for their outstanding contributions to the effort to keep the Institute functioning. To ensure that students did not lose precious academic time, the faculty managed to swiftly move back and forth between online and on-campus teaching and assessment, as demanded by the Government, and without compromising on quality. The students' cooperation, and the full support of the Administration, was commendable.

Over the years the reputation of the GIK Institute has been built on the quality of its faculty, students and the facilities, particularly the laboratories. This was on display during the COVID-19 crisis. Faculty members, who have outstanding academic credentials, have been publishing their research in journals of high repute, often with the collaboration of universities abroad.

The GIK Team Invictus secured second position in the Proposal stage of the American Institute of Aeronautics and Astronautics Design, Build, Fly Competition, beating many of the top universities from around the world. We wish the team the very best as they endeavor to reach the final stage.

A new discipline at the undergraduate level – BS in Artificial Intelligence – was started in Fall 2020, with the support of Huawe**i** – one of the world's leading and most reputable multinational companies. This, "BS in AI – Partnered by Huawei" program, is one of a kind outside of China, and is a reflection of the stature of the GIK Institute. We expect it will lead to further collaboration between GIK and Huawei, which had earlier established a Network Training Academy on campus, and which has recently been upgraded. Another modern program, **Data Science, is being launched this year.**

According to a recent announcement by **Times Higher Education, one of the most prestigious publishers of university rankings, GIK was ranked No. 1 in Pakistan in its World University Impact Rankings 2021 in the category of Quality Education (SDG4)**. Worldwide, the Institute was ranked No: 30 out of 966 universities.

GIK is a PCP and FBR certified not-for-profit institution where all students, boys and girls, and faculty, live on a self-contained and environment friendly campus. Admission is entirely on merit and thus, quite competitive. While the academics are rather rigorous, there is also a large variety of activities and facilities outside the classroom that will help you develop a range of skills, including self-confidence, that you will find very useful later in life.

The Institute feels that talented individuals of limited means must also be given the opportunity of benefitting from what is on offer here. Thus, GIK provides a substantial number of scholarships and long term interest free loans to such students from its own resources. This year, it also has arrangements for additional financial assistance facilities and scholarships by SOPREST and with a number of its partners.

We are grateful to our alumni, the members of the Board of Governors and our many other friends and well-wishers, whose support and advice has been invaluable.

Thank you for considering the possibility of becoming a part of the GIK family. I look forward to welcoming you on campus with the hope that COVID-19 will be history by then.

Sardar Aminullah Khan
Acting Rector

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Campus Life

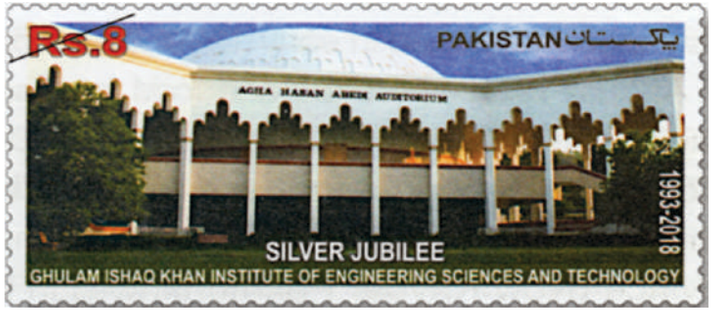
The Genesis of the Institute goes back to the early 50's when Mr. Ghulam Ishaq Khan, during his close association with the Water and Power Development Authority and the Pakistan Industrial Development Corporation, became acutely aware of Pakistan's dependence on foreign expertise and imported technology. His frequent interaction with foreign and local experts led to the idea of a center of excellence in engineering sciences and production technology whose standards of education would be comparable to those of its counterparts in the 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 Pakhtun Khwa 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 started in early 1990. An interim office of the Institute was set

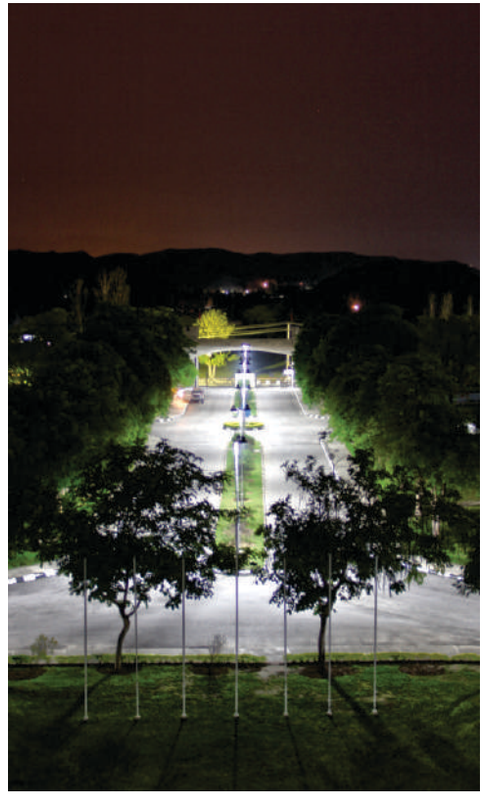
up in August 1992 where experienced professionals worked on the educational aims and philosophy of the Institute, its curricula and details of equipment for its laboratories and workshops. The ordinance for the establishment of the Institute was promulgated by the Frontier Government in March 1993 and 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 bring our engineering education at par with that of advanced countries.

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



COMMEMORATIVE POSTAGE STAMP

The aim of the Institute is to pursue excellence in education and research by developing appropriate curricula and teaching practices, acquiring talented faculty 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 of facts; 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 educates 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 the 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
Mr. Farid Rahman

Members
Engr. Salim Saifullah Khan
Mr. M. Adil Khattak
Khwaja Zaheer Ahmad
Mr. Atif Rais Khan
Mr. Osman Saifullah Khan
Mr. Iftikhar H. Shirazi
Dr. Nilofar Shaikh

Other Members
Mr. Abdul Razzaq Dawood
Mr. Shah Faisal Afridi

Ex-Officio Members
Chairman, WAPDA
Executive Director SOPREST
Secretary, Finance Division, Govt. of Pakistan
Chief Secretary, Khyber Pakhtunkhawa
Chairman, HEC
Secretary Law, Khyber Pakhtunkhawa

Secretary SOPREST and BOG
Mr. Mushtaq Ahmad Khan

Enviroment

Spread over an area of more than 400 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, vast grassy fields with the mighty Indus meandering across a lush green belt.

Bordering on its campus is the traditional village of Topi, the birth place 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 Ghandara, 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 Ghandara 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 and in 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 northern areas of Pakistan which attract expeditions from all over the world are easily accessible from here. Perhaps the most important advantage is the invaluable opportunities it offers for establishing interaction between industry and the university. 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 Foundry and Forge Engineering, 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.

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 centre, and offices for the faculty and staff, a well-furnished conference hall, a discussion room, three class-rooms, 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 equipments where high quality research is possible.

The Administration block Of the Institute includes the Offices Of the Rector, Pro-Rectors, Dean (Student Affairs). Director (A&E), Director (Admin), Director (Finance), Director (Procurement) and Other allied Offices.

Students Accommodation: The accommodation facilities for students are entirely on-campus. There are eleven (II) hostels for boys and one separate hostel-wing for girl 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.

Guest House & Auditorium: The first building which was constructed right at the inception of the Institute stay at the Campus. It is situated close to the rnain entrance of the Institute and is centrally air-conditioned. Fully furnished, it has ten bedrooms and a big lounge for indoor functions. A spectacular auditorium occupies the central place in the campus and its dome meshes With the surrounding hills to present a breath-taking skyscape. It has a seating capacity of 535 and is a venue Of conferences, seminars, debates. declamation contests, concerts, and Other such functions. A lavishly furnished conference room, a seminar/workshop and a service centre are also parts Of this block

Faculty Club: Faculty Club has tken constructed on the top of a hill and presents a picturesque view of Tarbela Dam and its environs. Its building is air-conditioned and is fully furnished. The accommodation comprises four bedrooms, a spacious sitting hall and a dining room where over 100 persons can be entertained.

Business Incubator: Extending its services as a catalyst to the regional and national economic development the Institute has recently set up a business incubator. It provides managerial trainings, business guidance and logistic supFH)rt to start-ups. A state of the art building is under construction, which will shortly be shinning along the hills standing out in silhouette

Since Topi has cold winters (with temperatures reaching -1C, the rooms are centrally heated and running hot water is available during winter.

Each hostel has an air-conditioned common room that can seat up to 80 students. It has a television with a satellite receiver. The mess is run on a no-profit no-loss basis and a student mess committee regulates the weekly menu and the quality of the food.

Incubation Center-The Catalyst: To create impact in entrepreneurial ecosystem of the region, the Institute launched an incubation Program called The Catalyst back in 2014. It is the only residential incubator in Pakistan which offers a wide range of services to build the future large enterprise. The companies are provided various facilities including free accommodation on campus, office space, Stipend for each founder, access to all the labs, workshops and resources of the Institute. It is a very specialized program focused on bringing the technology-intensive start-up ideas to life. The Science and Technology Department of KP have extended valuable financial and technical support for the Incubation Center. One of our start-up from recent batch Greenovation had created a device to convert Plastic waste to LPG gas, another start-up from the first batch Micro power Labs created world's fastest charging power bank that secured multiple international grants and funding."

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 stay, 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 first-come-first-serve basis on reasonable charges for short visits. Efforts are made to make their Stay as comfortable as possible.

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 of hematology, bio-chemistry and endocrinology tests.

Cafeteria: The Institute's cafeteria has been named as GIKafe. It offers regular rneals and snacks at modest prices. It caters for both the faculty and the students. Students who normally have their regular rneals 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

Service, Barber Shop, Dairy Shop, Juice Bar.

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

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, checkroom, administrative offices and refreshment rooms have been provided. A separate ladies gym is also operative in the sports complex. 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: 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.

GIK College: Affiliated with the FBISE, the GIK College provides quality education to the employees' wards, both living at the campus and outside. Originally meant for the employees' children it now also offers admissions to the local private students. Being the most aspired for educational institution in the area, its student enrollment has risen to 740, in a very short period of time. It has a highly qualified and experienced staff possessing compulsory Masters, B.Ed and M. Ed degrees. Besides providing quality education, it lays great stress on the development of the students' personality, civic and hygiene sense. In this regard students are actively engaged in co-curricular activities, sports events, educational trips and campaigns. The Annual Art and Science Exhibitions showcase students' creative skills in art, craft and science. The College football and cricket teams have several inter- collegiate sports titles to their names. The students living at the campus also have an access to the central library, medical center,

sports complex with a swimming pool and gym, and cafe.

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.

Library and Information Services: A stately three-storey building, set against the background of brooding and austere hills of Tarbela, houses the Central Library of the Institute. Its interior design, decor, and furniture create an atmosphere of an intellectual sanctuary wherein the students and faculty can concentrate on their studies. It operates in two shifts and remains open till late in night seven days a week. It has textbooks, reference works, printed as well as online journals to meet the needs of students and faculties. To share resources through inter-library loan and exchange of databases, it is electronically linked to all prominent libraries of the country. It also provides re-prographic services.

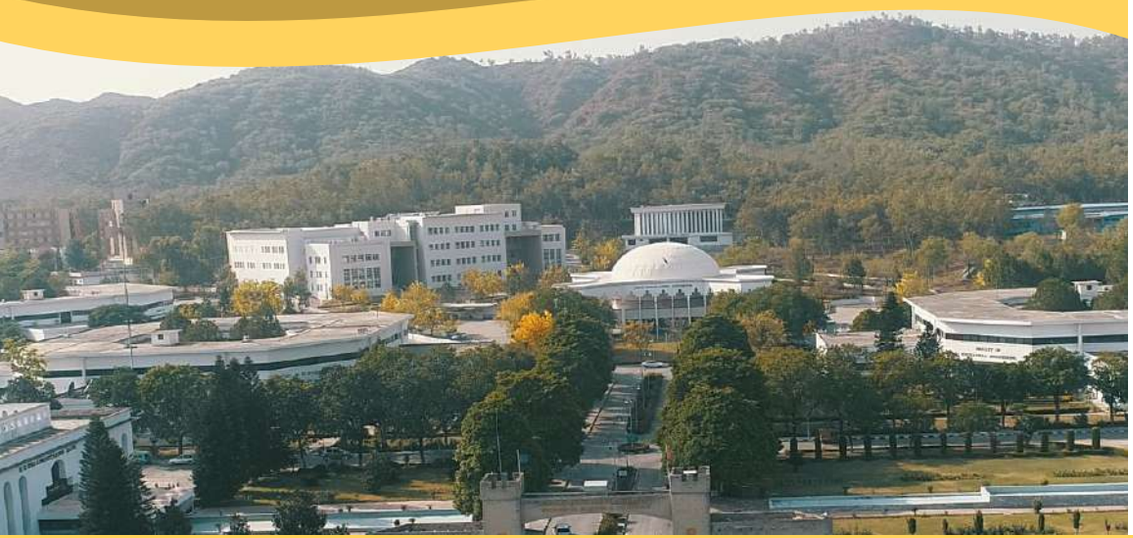
The GIK Institute's digital library provides access to resources of HEC that include databases of journals and books to support the faculty and students community of the Institute. The digital resources include about 15000 electronic journals, 80,000 ebooks, audio/video materials, IEEE databases on DVDs and other reference databases. The students and faculty members at the Institute can easily access all the resources on their desks through http://www.digitallibrary.edu.pk/giki.html, which provides online access to IEEE, Science-Direct (partial), and other valuable resources.

Wireless network is available in the library and open for all users. Student society Meeting/Discussion Room available in library on request.

Turritis software for plagiarism detection service is also available to facilitate the students to improve the writing skills.

GIKafe: We take great pride in serving the GIK community. The Gikafe is tailored to the specific tastes and needs of the individuals who live and work there. In the GIKafe you'll find a range of tasty and diverse choices and environments, meeting your needs if you're on the go, if you need a quiet space to dine, or if you want to convene a group of friends or colleagues for a meal. There's something for everyone and we invite you to explore campus and the variety of foods available in the GIKafe. It caters for the requirement of the Societies as well. GIKafe is open to all members of the GIK community and their accompanied guests.

ACADEMICS



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 maintain the Institute's standards of education and research. One such device is the International Advisory Board consisting of leading 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, the caliber of faculty, revision and review of the curricula, and the adequacy of the laboratory and library facilities. It also reviews

Faculty of Computer Science and Engineering (FCSE)

Prof. Dr. Ashfaq A. Khokhar
Departments of Electrical and Computer Engineering
University of Illinois, Chicago, IL, USA

Prof. Dr. Eric Gaussier
University of Grenoble, France

Professor Marcel Waldvogel
Department of Computer and Information Science
University of Konstanz, Germany

Faculty of Electrical Engineering (FEE)

Dr. Kamran Iqbal
Department of Systems Engineering
University of Arkansas at Little Rock , S. University Ave,
Little Rock, AR, USA

Dr. Costas Constantinou
Reader in Communications Engineering
School of Electronic Electrical an
d Computer Engineering, University of Birmingham, Edgbaston. UK

Dr. Muhammad Suhail Zubairy
Department of Physics, Texas A&M University
College Station, TX, USA

Faculty of Engineering Sciences (FES)

Prof. Dr. Talat S. Rahman
Department of Physics, College of Sciences,
University of Central Floreda Orlando, USA

Prof. Dr. Sabin Stoica
Horia Hulubei National Institute of Physics and Nuclear Engineering (IFIN-HH)
Bucharest-Magurele, Romania

Prof. Dr. Joseph D. Smith
Wayne and Gayle Laufer Endowed Energy Chair
Missouri University of Science and Technology
Rolla, MO, USA

Faculty of Materials and Chemical Engineering (FMCE)

Prof. Dr. John H. Weaver
Donald B. Willett Professor
Department of Materials Science & Engineering and Department of Physics
University of Illinois at Urbana-Champaign, USA

Dr. Manfred Roth
Head Joining and Interface Technology
Swiss Institute of Technology (EMPA),
Dubendorf, Switzerland

Prof. Dr. Shuichi Miyazaki
Institute of Materials Science, University of Tsukuba,
Ibaraki, Japan

Department of Chemical Engineering

Prof. Dr. Jean-Francis Bloch
LGP2/ Grenoble INP-Pagora/CNRS
Physique des structures fibreuses, rue de la Papeterie
Saint-Martin d'Hères Cedex, France

Faculty of Mechanical Engineering (FME)

Prof. Dr. David H Nash,
FIMechE FIES ASME Fellow Ceng
Reader & Vice Dean (Knowledge Exchange)
Faculty of Engineering, Department of Mechanical and Aerospace Engineering
(Institution of Mechanical Engineers Scottish Regional Chairman 2008-2010)
University of Strathclyde, UK

Dr. Zahid Ayub
President Isotherm, Inc (a Manufacture of Heat Transfer Equipment)
East Arlington, Texas, USA

Dr. Ahmed F. Ghoniem
Ronald C. Crane (1972) Professor of Mechanical Engineering
Massachusetts Institute of Technology, USA

School of Management Sciences

Dr. John Gowdy
Rittenhouse Teaching Professor of Humanities and Social Sciences
Department of Economics, Rensselaer Polytechnic Institute
New York, USA

Professor Kaifeng Yang
Administration and Policy College of Social Sciences and Public Policy Florida State University Tallahassee,
Florida, USA

Admissions

Director (Admissions & Examinations)
Muhammad Faheem Akhtar
M.Sc. (Rensselaer)

Deputy Director
Muhammad Waqas Malik

Assistant Director
Zil-e-Huma

Examination Officer
Wah eed-Ur-Rahman

Database Supervisor
Riaz Ahmed

Office Assistant
Noor Ul Saeed Almaarij

Office Assistant
Muhammad Israr

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 simultaneously at Islamabad, Karachi, Lahore, Multan, Peshawar, Quetta and Rawalpindi. The venue and general instructions for the test are intimated along with the downloadable Admit Cards. Applicants can choose the test center according to their convenience. 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 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 may not be given any credits for the courses passed earlier.

Applications: The admission processing fee is Rs.5,500 (US$ 100 for oversees applicants applying on SAT basis). Rs.6,500 in case of appearing in both admission tests. 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. The original receipt of payment should be brought to Test Center. Prospectus will be dispatched at the postal address of applicants. Those applying for Financial Assistant must pay Rs.500 extra with processing fee.

Advance Standing: A person who has been enrolled for a relevant Bachelors degree program in engineering at some PEC accredited and HEC recognized Institution 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 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 or SAT-II (Overseas Applicants), respectively, 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 information, please contact the Admission Office.

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 (Pre-Medical) with Additional Mathematics and 60% or above marks each in Mathematics, Physics & Overall.
3. A-Level in three subjects Mathematics, Physics and Chemistry with D or above grade each in Mathematics & Physics and O-Level 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.
4. American or Canadian High School Diploma or International Baccalaureate Diploma with Mathematics (Calculus), Physics and Chemistry with 60% or above marks, as per IBCC equivalence formula, each in Mathematics, Physics & Overall.
5. 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: Applicant with Mathematics, Physics and Chemistry background can apply for all Programs including Computer Engineering.

Basic Eligibility Criteria for Artificial Intelligence, Computer Science and Data Science:

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-Level in three subjects Mathematics, Physics and any other third subject, with D or above grade each in Mathematics & Physics and O-Level 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-Level in three subjects with D's or above grades in two principal subjects and O-Level 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.

Comparative Assessment Criteria (Merit List)

Score in Admission Test OR SAT-II (in Mathematics and Physics for Engineering and Computer Science Programs and in any two subjects for Management Sciences Program) for those applying from outside Pakistan	85%
SSC/O-level (for Those with A-level and O-level background) / Equivalent	15%
Last completed qualification for High School diploma, IB diploma or B.Sc. or DAE.	15%

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.

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-level and A-level background to submit equivalence certifies form IBCC.

HOW TO APPLY

Only Online Applications will be accepted. Complete instructions will be available on the link http://admissions.giki.edu.pk by July 04, 2021. 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 and Scholarship, must fill 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 admission test at designated Test Center. Bring along Admit Card, Paid Bank Challan (GIK Institute Copy) and SSC or O-Level certificate/CNIC etc.
7. Check your result and proceed as per online instructions.

The Institute is a not-for-profit organization and provides subsidized 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.	2021-22	367,500	330,000
2.	2022-23	387,500	345,000
3.	2023-24	407,500	360,000
4.	2024-25	427,500	375,000

The annual tuition fee for foreign students is US$ 7,500/- 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. 63,000/-for Pakistani or US $ 680/- for foreign applicants is also required to be deposited at the time of admission. Rs. 25,000 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. 17,000/-. An advance of Rs. 8,000 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.

Timelines	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 commencement of classes	No refund

Withholding Tax

Withholding Tax under section 236I of Income Tax Ordinance 2001 is applicable @ 5% on Semester Fee, Admission Fee and Administrative Charges. However, this tax is not applicable in case:

- Fee is paid by a person appearing on the active tax payer list.
- Fee is paid by a non-resident subject to provision of the following:
  - Copy of passport as evidence that during previous tax year, his stay in Pakistan was less than one hundred eighty-three days;
  - Furnishes a certificate that he has no Pakistan-source income; and
  - The fee is remitted directly from abroad through normal banking channels to the bank account of the educational institution.

Note: Tax collected under this section shall be adjustable against the tax liability of either of the parents or guardian making payment of the fee.

Free Electricity Unit

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

	Male	Female
Summer per month	93 units per month	100 units
Winter per month	61 units per month	70 units

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 Institute website along with the admission form (Please add Rs. 500 added as financial assistance processing fee in addition to Rs. 5,500 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 2020-2021:

	Scholarships/Financial Assistance	Qualification/Conditions/Criteria	Scholarships
Scholarships	GIKI Merit Scholarship	Engineering: Top 14 position in Admission Test Management Sciences: Top 6 position in Admission Test	20
	Squeaks Foundation	Female student from Khyber Pakhtunkhwa	01
	HBL Platinum Scholarship	Need-Cum-Merit Basis	01
	Chief Minister Khyber Pakhtunkhwa	KP domiciled with annual Family income less than Rs. 600,000/-	20
	Chief Minister Education Endowment Fund (CMEEF) Scholarship	KP domiciled with annual income less than Rs. 1,200,000/- (Faculty of Engineering Sciences with specialization in Photonics)	02
	Frontier Education Foundation (FEF)	KP domiciled with annual family income less than Rs. 300,000/-	06
	Punjab Educational Endowment Fund	Punjab domiciled with annual family income less than Rs. 360,000	10
	Sindh Education Endowment Fund	Sindh domiciled with annual family income less than Rs. 1,200,000/-	05
	ICI Scholarship	Top female	01
	Bestway Educational Foundation Scholarship	Merit-cum-Need basis	01
	Fast Scholarship	Electrical Engineering student with GPA 3.0	01
	Govt. of Balochistan	Balochistan domiciled	02
	Lucky Cement (Pvt) Ltd.	Pakistani National, preference will be given to those with KP domicile, on Need cum Merit basis	01
	GIK Alumni Association	Needy students (2nd year onwards)	20
Financial Assistance (Loan)	Financial Assistance by GIK Institute	Need-cum-Merit Basis	40
	Financial Assistance For Top Female	Engineering: Top 7, Management: Top 3 Females	10
	Ihsan Trust Qarze Hasna interest free Loan	Need Basis	20
	(Meezan Bank) Habbah Educational Trust	Need Basis	04

For further details: Please Contact Admission Office GIK Institute at Telephone:+92-938-281026, Ext: 2301, 2342, 2354, 2595

Campus Jobs: A number of on-campus jobs are available for students with remuneration adjusted against fee and mess bills, However, qualification conditions and hours per week limitation apply.

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 afresh with no credit transfer if two consecutive probations are experienced in first two semesters.

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. 850 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, 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.

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.

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 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 ears 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 of 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 and Engineering
CV	Civil Engineering
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

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-, C+, C, C-, D+, D, F, I, E and W for 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 (GPC). The following Table indicates the gradation from excellent to failure.

FACULTY OF COMPUTER SCIENCE AND ENGINEERING

Thrust Areas

- Artificial Intelligence and Robotics
- Algorithms and Computational Theory
- High Performance Computing
- Machine Learning & Data Mining
- Network Communications and Distributed Systems
- Signal and Image Processing
- Software and Systems Engineering
- Data Science & Data Mining
- Data Warehousing
- Data Visualization

Academics

B.S. Artificial Intelligence
Taj Muhammad Khan, PhD (University of Grenoble, France)
Farhan Khan, PhD (Bilkent Univeristy, Turkey)
Hina Ayaz (GA-4), MS (NUCES, Pak)

B.S. Computer Engineering
Muhammad Hanif, PhD (Australian National University, Australia)
Raja Hashim Ali, PhD (Kungliga Tekniska Högskolan, Sweden)
Shahabuddin Ansari, PhD (GIK Institute, Pakistan)
Muhammad Waqas, PhD (Tsinghua University, China)
Kamran Javaid, PhD (Seoul National University, South Korea)
Badre Munir, MS (GIK Institute, Pakistan)
Ali Shaukat, MS (GIK Institute, Pak)
Jalees-ur-Rehman (GA-4), MS (GIK Institute, Pak)
Usman Haider (GA-4), MS (GIK Institute, Pak)

B.S. Computer Science
Khalid J. Siddiqui, PhD (Concordia University, Montreal, Canada)
Zahid Halim, PhD (NUCES, Pakistan)
Syed Fawad Hussain, PhD (University of Grenoble, France)
Ghulam Abbas, PhD (University of Liverpool, UK)
Rashad Jillani, PhD (Florida Atlantic University, USA)
Ahsan Shah, MS (GIK Institute, Pakistan)
Hammad Mehmood, MS (LUMS, Pakistan)
Ehtisham Hassan (GA-4), MS (NUST, Pakistan)
Atta ur Rahman (GA-4), MS (UET, Pakistan)

B.S. Data Science
Masroor Hussain, PhD (GIK Institute, Pakistan)
Abinta Mehmood Mir, MS (UET Taxilla, Pakistan)

Faculty on Leave for PhD
Zawar Hussain (Macquarie University, Australia)
Usman Raza (Purdue University, USA)

Lab Engineers
Mumtaz Ali Shah, MS Computer Science (VU)
Aqsa Khan, MS Computer System Engineering (GIK Institute)
Amna Arooj, BS Computer Engineering (Islamia University)
Syed Arsalan, BS Computer Engineering (GIK Institute)
Maryam Hassan, BS Electrical Engineering (IIIU)
Kiran Shah, BS Computer Engineering (CIIT)
Muhammad Abu Bakr, BS Computer Engineering (UET Taxila)
Hayat Ullah, BS Electrical Engineering (UET Peshawar)

Graduate Assistants
Abdur Razaq (GA-F) MS Computer Science (CIIT)
Akhtar Badshah (GA-F) MS Software Engineering (UET)
Ehsan Elahi (GA-F) MS Software Engineering (CIIT)

Secretary
Hamid ur Rehman MA (Public Administration) and MA (Islamic Studies) (UoP)

Dean

Ahmar Rashid
Dean, PhD
Jeju National University, South Korea

Introduction

The Faculty of Computer Science and Engineering (FCSE) is one of the five faculties at GIK Institute. FCSE offers four programs (1) Artificial Intelligence, (2) Computer Engineering, (3) Computer Science and (4) Data Science leading to Bachelor (BS), Master (MS) and Doctor of Philosophy (Ph.D.) degrees in Computer Engineering and in Computer Science, and Bachelors (BS) degrees in Artificial Intelligence and in Data Science.

FCSE employs competent faculty members qualified to accomplish the mission and goals of the Institute. When determining acceptable qualifications of its faculty, FCSE asserts primary consideration to the terminal degree in the discipline. FCSE also considers competence, effectiveness and capacity, including, as appropriate, undergraduate and graduate degrees, related work experiences in the field, professional licensure and certifications, honors and awards, continuous documented excellence in teaching, or other demonstrated competencies and achievements that contribute to effective teaching, research and student learning outcomes.

FACULTY MISSION

The faculty strives to produce competent professionals who have sound knowledge in the field of computing and information technology. The faculty is to produce graduates having enhanced creative thinking, problem solving skills and ability for lifelong learning in their professional careers and to develop research programs to address the evolving needs of industry, academia and society.

The graduates of the Faculty of Computer Science and Engineering shall play a productive role, both in the practical and research areas of computing. The faculty uses modern technologies to enhance the learning capabilities of students and to provide them with a stimulating and challenging environment. Emphasis is placed on the practical applications of computer systems to the software and hardware needs of the global industry in general and the Pakistani industry in particular.

UNDERGRADUATE PROGRAMS (OBJECTIVES)

The undergraduate programs combine the strength of Mathematics, Statistics, and Computer Science. The courses develop a professional approach to design computer-based systems, looking at both widely applicable principles of software engineering and the evolving computing technologies in the thrust areas of the faculty. Students are admitted to a four-year BS degree in the Faculty of Computer Science & Engineering, opting for one of the following four specialized degree programs:

- Artificial Intelligence, partnered by Huawei (accredited by NCEAC)
- Computer Engineering (accredited by PEC under Washington Accord level–II, i.e., OBE)
- Computer Science (accredited by NCEAC)
- Data Science (accredited by NCEAC)

The Artificial Intelligence program, partnered by Huawei, aims to give in-depth knowledge required to transform data (including Big Data) into intelligent decisions. The theme of the program and its curriculum is primarily based on inferring the machine-based decisions from the complex inputs, such as image, text, and databases. Upon completion of the coursework students will be able to select data driven technologies to mimic or enhance human capabilities. GIK Institute joins hands with Huawei (ranked 61st on Fortune Global 500 companies), to bring the cutting-edge technology along with the latest curriculum updates and equipment for the students in Artificial Intelligence program. Huawei Pakistan supports the program by providing student internships, certification opportunities in AI, faculty training and latest AI equipment for the students, which will enhance the skillset of the students and help secure better jobs in the market in future.

The Computer Engineering 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 of computer programming, algorithms, data structures, microprocessor systems, and electronics with an understanding of the applications of computer engineering principles.

The Computer Science program offers a broad understanding of the field through introducing concepts, theory, and techniques with intensive education in core areas of Computer Science, e.g., databases, graphics, software engineering, computer systems development, etc. This program encourages students to develop and use abstract models as well as apply respective technologies in practical settings.

The Data Science program introduces its students to exploring the statistics hidden behind Data, through various techniques like data analytics, data visualization, and data ware housing. The program is especially meant for students, who are interested in exploring the patterns hidden in the data as well as making predictions for the future of any data-intensive industry.

All four streams focus on establishing a strong mathematical foundation, basic hardware aspects of computing, and advanced technical electives spanning areas such as computer communications, neural networks, reinforcement learning, expert systems, databases, biologically inspired computing, data and network security, signal processing and computer vision. Abundant opportunities exist for students to develop expertise in their areas of interest through enrolment in an assortment of elective courses offered by FCSE and other faculties.

Students are also accepted into various programs under the scholarship schemes offered by federal and provincial governments of Pakistan, National ICT R&D Funds and other organizations (See the Scholarship section of Prospectus).

GRADUATES POTENTIAL

The graduates of FCSE faculty should be able to meet the highest standards of knowledge and training for leadership in evolving fields of artificial intelligence, computer engineering, computer science and data science profession, including teaching, research, development and higher education at the national and international levels. This fact is evident from the positions and respect our graduates are enjoying at national and international universities as well as at multi-national software/IT enterprises.

PROGRAM EDUCATIONAL OBJECTIVES (PEOs)

a. Artificial Intelligence

The Program Educational Objectives (PEOs) of BS (AI), partnered by Huawei, are:

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

b. Computer Engineering

The Program Educational Objectives (PEOs) of BS (CE) are:

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

c. Computer Science

Following are the Program Educational Objectives (PEOs) of BS (CS).

- PEO-1: Practice professional careers while maintaining environmental, ethical and social values.
- PEO-2: Apply and effectively communicate knowledge both individually and in

a team through state-of-the-art tools and technologies.

PEO-3: Stay current with technological innovations through trainings, higher education, and lifelong learning.

d. Data Science

The Program Educational Objectives (PEOs) of BS (DS) are:

- PEO-1: Graduates utilizing their skills and knowledge to solve complex problems in real-world settings.
- PEO-2: Graduates practicing in the area of Data Science in a socially and ethically responsible way.

PEO-3: Graduates demonstrating lifelong learning skills in Data Science and allied disciplines.

PROGRAM LEARNING OUTCOMES (PLOs)

a. BS (AI), BS (CS) and BS (DS)

The Program Learning Outcomes (PLOs) of BS (AI) partnered by Huawei, those of BS (CS) and those of BS (DS) are:

1. Knowledge of Computing – Ability to apply knowledge of mathematics, science, computing fundamentals and any of it's specializations to solve complex problems.
2. Problem Analysis – Ability to identify, formulate, research literature, and analyze complex problems reaching substantiated conclusions using basic principles of mathematics, natural sciences and computer science.
3. Design/Development of Solutions – Ability to design solutions for complex problems and design software systems, components or processes that meet specified needs with appropriate consideration for public health and safety, cultural, societal, and environmental considerations.
4. Investigation – Ability to investigate methodically complex problems including literature survey, design and conduct of experiments, analysis and interpretation of experimental data, and synthesis of information to derive valid conclusions.
5. Modern Tool Usage – Ability to create, select and apply appropriate techniques, resources, and modern IT tools, including prediction and modeling, to complex activities, with an understanding of the limitations.
6. Society Impact – Ability to apply reasoning informed by contextual knowledge to assess societal, health, safety, legal and cultural issues.
7. Environment and Sustainability – Ability to understand the impact of professional solutions in societal and environmental contexts and demonstrate knowledge of and need for sustainable development.
8. Ethics – Ability to apply ethical principles and commit to professional ethics and responsibilities and norms of society and professional practice.
9. Individual and Team Work – Ability to work effectively, as an individual or in a team, on multifaceted and/or multidisciplinary settings.
10. Communication – Ability to communicate effectively, orally as well as in writing, on complex activities with the community and with the society at large, such as being able to write effective reports and design documentation, make effective presentations, and give and receive clear instructions.
11. Project Management – Ability to demonstrate management skills and apply systems development principles to one's own

work, as a member and/or leader in a team, to manage projects in a multidisciplinary environment.

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

Upon completion of BS (AI) partnered by Huawei / BS (CS) / BS(DS) degree, all the students should have attained the aforementioned twelve PLOs.

b. BS (CE)

The Program Learning Outcomes (PLOs) of BS (CE) are:

1. Engineering Knowledge – Ability to apply knowledge of mathematics, science, engineering fundamentals and an engineering specialization to the solution of complex engineering problems.
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.
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.
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.
5. 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.
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.

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.
8. Ethics – Ability to apply ethical principles and commit to professional ethics and responsibilities and norms of engineering practice.
9. Individual and Team Work – Ability to work effectively, as an individual or in a team, on multifaceted and/or multidisciplinary settings.
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.
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.
12. 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.

COMMON IT FACILITIES

a. Internet/LAN

The Institute provides 400 Mbps Internet access to all faculties and student hostels through Pakistan Education and Research Network (PERN-II) and PTCL. All rooms in student hostels are connected through Fiber Optics LAN that also provides peer-to-peer file sharing for student collaboration.

b. Video Conferencing Room

The video conferencing facility is located at the Workshop Room adjacent to the Agha Hasan Abedi auditorium. The room is equipped with LifeSize® Room 220™ system for high-definition H.323 multipoint videoconferencing and a high-resolution interactive smartboard digital projector. The room provides seating for 65 participants, and is equipped with conference sound/microphone system

LABORATORIES AND RESEARCH FACILITIES

The Faculty of Computer Science and Engineering is well equipped with state-of-the-art computer systems running a wide range of applications and specialized software supporting the courses. In addition, well-equipped research laboratories are available for the use of faculty, graduate students, and senior undergraduate students. The following is a brief description of various laboratories and their functions.

a. Personal Computing (PC) Lab

The Personal Computing (PC) laboratory is the central computing laboratory of the Institute, providing general purpose computing facilities to all students, as well as internet and printing facilities. It is open seven days a week from early morning till late at night. It houses 104 Core-i3/i5/i7 networked machines running Windows as well as Linux operating systems. DSL - WiFi facilities are also available. Introduction to Computing and Intensive Programming lab modules are conducted in this lab. Student workshops and software competitions are also held in this laboratory.

b. Software Engineering (SE) Lab

The Software Engineering (SE) laboratory focuses on providing facilities for courses such as Software Engineering, Language and Compilation Techniques, and Databases. It houses 50 networked Core-i7 machines. They are connected to database and other servers of the Institute, including the printing facilities. In addition, DSL-WiFi facilities and various software tools (e.g., Eclipse, Visual Studio, Flex, Bison, Oracle/Developer and Rational Rose) are also available in this lab. This laboratory also hosts student workshops and software competitions.

c. Operating Systems and Programming (OSP) Lab

The Operating Systems and Programming (OSP) laboratory is used mainly for lab modules for Operating Systems, Computer Communications and Networking and Systems Programming courses. This lab is equipped with 100 machines running various operating systems and network simulation software tools, e.g., DEVC++, MATLAB, Prolog, Oracle 11G + Wamp Server, Cisco Packet Tracer and other software tools.

d. Project and Software Development (PSD) Lab

The Project and Software Development (PSD) laboratory is used for coding and simulating problems related to both academia and industry. This lab is primarily used for lab sessions for students of Data Structures and Signals as well as for conducting workshops and events organized by faculty members and different societies at GIK Institute. It is equipped with 48 Core-i5 workstation running window 7 professional, Visual Studio 2012, MATLAB, Packet Tracer and other software tools.

e. Final Year Project (FYP) Lab

The Final Year Projects (FYP) laboratory is used mainly by seniors of Computer Engineering (CE) and Computer Science (CS) programs for developing their final year projects. This lab is equipped with 15 Core-i7 workstations running various operating systems, network simulation software tools, Visual Studio 2020, and other simulation and development software. Students are allowed to add hardware and accessories according to their project requirements.

f. High-Performance Computing (HPC) Facility

High-Performance Computing (HPC) facility was established in Faculty of Computer Science and Engineering in 2006, using an AMD Opteron-based computing cluster. This facility has been upgraded using 10 million rupees funds from Directorate of Science and Technology (DoST), Government of Khyber Pakhtunkhwa. The facility consists of 160 CPU cores, 1024 GPU cores, 640 GB main memory and 10 GB Ethernet switch interconnection.

g. Artificial Intelligence Computing (AIC) Lab

The Artificial Intelligence Computing (AIC) laboratory is the main computing facility for AI-specific lab and research tasks. It houses 55 state-of-the-art Core-i7 networked thin-client machines connected to a Dell Opteron server with capacity to serve 100 clients. In addition, this lab contains 10 high speed computing servers with additional memory and GPU support. Deep Neural Networks, Computer Vision, Machine Learning, and Natural Language Processing lab modules are conducted in this lab.

h. Artificial Intelligence & Data Science Project (AIDSP) Lab

The Artificial Intelligence and Data Science Project (AIDSP) laboratory is the project facility for AI-specific and Data-Science project tasks. It houses 25 state-of-the-art Core-i7 networked machines running Windows as well as Linux operating systems. In addition, this lab contains 15 high speed computing servers with additional memory and GPU support for projects of various courses and Senior Year Design Projects for AI and DS students. The lab will also be used for conducting industrial training labs and Problem Based Learning for AI (PBL for AI) and Problem Based Learning for DS (PBL for DS) labs.

i. Data Science Computing (DSC) Lab

The Data Science Computing (DSC) laboratory is the main computing facility for DS-specific lab and research tasks. It houses 55 state-of-the-art Core-i7 networked machines running Windows as well as Linux operating systems. In addition, this lab contains 10 high speed computing servers with additional memory and GPU support. Big Data Analytics, Data Mining, Data Visualization, and Data Warehousing and Business Intelligence lab modules are conducted in this lab.

j. Hardware Project (HP) Lab

The Hardware Project (HP) laboratory is the main hardware facility for CE-specific lab, project and research tasks. It has 20 work stations (hardware boards and tables) with seating ability for 40 students. It contains 10 state-of-the-art Core-i7 networked machines running Windows that can be used for designing hardware. In addition, the lab contains complete hardware kits for the lab modules of various Computer Engineering courses, e.g., Logic Design, Computer Organization and Assembly Language, Microprocessor Interfacing, Signal Processing, Digital System Design, and ASIC Design. In addition, it is also used for designing and manufacturing hardware components of Final Year Projects hosted at Faculty of Computer Science and Engineering.

k. Digital Logic Design for Computing (DLDC) Lab

The Data Science Computing (DSC) laboratory is the main logic design facility for all computing programs and research tasks. It has 23 work stations (hardware boards and tables) with seating ability for 56 students. It contains 12 state-of-the-art Core-i7 networked machines running Windows that can be used for designing hardware. In addition, the lab contains complete hardware kits for the lab modules of all Computing courses, e.g., Logic Design, and Computer Organization and Assembly Language.

ACCREDITATION

The BS program in Computer Engineering is accredited by Pakistan Engineering Council (PEC) under Washington Accord level-II, i.e., Outcome-Based Education (OBE), whereas the BS programs in Artificial Intelligence partnered by Huawei (AI), Computer Science (CS) and Data Science (DS) are accredited by the National Computing Education Accreditation Council (NCEAC).

DEGREE REQUIREMENTS FOR FACULTY OF COMPUTER SCIENCE AND ENGINEERING

a. Degree Requirements for BS in Artificial Intelligence (135 Credit Hours)

For obtaining Bachelor of Science degree in Artificial Intelligence partnered by Huawei, a student must complete 135 credit hours with a CGPA of 2.0 or above.

In addition, every BS (AI) partnered by Huawei student is required to participate in a summer training program and submit a formal written report during the summer of Junior Year.

Moreover, every BS (AI) student will undertake a 15-hour community service activity as a degree requirement using the summers or fall semester of their Sophomore Year.

Course requirements for obtaining BS (AI) degree offered by FCS&E are given below.

Course Group (HEC Category)		Course Code	Course Title	Credit Hours	Total Credits
General Education Requirements	*Computing*	CS103, CS103L	Computer Programming + Lab	3+1	7
		CS121	Fundamentals of Computer Science	3	
	English Language	HM101	English Language & Communication Skills	3	6
		HM102	Technical Writing	3	
	Humanities	HM211	Pakistan & Islamic Studies	3	9
		HM321	Sociology & Human Behavior	3	
		HM322	Corporate Law & Professional Ethics	3	
	Mathematics	ES111	Introduction to Statistical Theory	3	18
		DS221	Inferential Statistics and Applied Probability	3	
		MT101	Calculus I	3	
		MT102	Calculus II	3	
		MT201	Differential Equations & Linear Algebra I	3	
		ES304	Linear Algebra II	3	
	Management	MS291	Engineering Economics	3	3
Core Requirements	*Computing*	CS112, CS112L	Object-Oriented Programming + Lab	3+1	49
		CE121, CE121L	Fundamentals of Logic Design + Lab	3+1	
		CS131	Discrete Structures	3	
		CS221, CS221L	Data Structure & Algorithms + Lab	3+1	
		CE222, CE222L	Computer Organization & Assembly Language + Lab	3+1	
		CS232, CS232L	Introduction to Databases + Lab	3+1	

		CS311, CS311L	Operating System + Lab	3+1	
		CS325	Software Engineering	3	
		CE413	Computer Networks	3	
		CS417, CS417L	Parallel Processing + Lab	3+1	
		CS464	Data & Networks Security	3	
		CS478	Design & Analysis of Algorithms	3	
		CS481	Senior Year Design Project (Part-I)	0+3	
		CS482	Senior Year Design Project (Part-II)	0+3	
Core Requirements (CTD)	*AI Domain-Specific*	AI201, AI201L	Programming for Artificial Intelligence + Lab	2+1	28
		AI221, AI221L	Introduction to Artificial Intelligence + Lab	2+1	
		AI231	Knowledge Representation & Problem Solving	3	
		AI319, AI319L	Computer Vision + Lab	3+1	
		AI341, AI341L	Deep Neural Networks + Lab	3+1	
		AI351, AI351L	Introduction to Machine Learning + Lab	3+1	
		AI361, AI361L	Natural Language Processing + Lab	3+1	
		AI305L	Associate in Artificial Intelligence Lab	0+1	
		AI406L	Professional in Artificial Intelligence Lab	0+1	
		AI407L	Problem Based Learning for Artificial Intelligence Lab	0+1	
Electives	*Management Science Courses (Choose ONE course)*	MS426	Technology Management	3	3
		CS436	Operation Research	3	
		CS491	Entrepreneurship & Technology Commercialization	3	
		CS492	Network Security & Cyber Ethics	3	
		MS492	Operations Management	3	
		MS493	Industrial Safety	3	
		MS494	Total Quality Management	3	
		MS496	Project Management	3	
		MS497	Procurement Management	3	

Electives	*AI Domain Breadth Courses (Choose ONE course)*	AI309	Deep Reinforcement Learning & Control	3	3
		CS324	Computer Architecture	3	
		CS328	Introduction to Development Operations	3	
		AI372	Nature inspired Computing	3	
	AI Domain Specialization Courses	AI408	Cloud Computing	3	9
		AI410	Data Mining	3	
		CS411	Block Chain	3	
	(Choose THREE courses)	CS412	Information Retrieval	3	
		CS413	Internet of Things	3	
		CS414	Geographic Information Systems	3	
		AI420	Medical Image Processing	3	
		CS420	Cyber Security	3	
		CE421	Advanced Computer Architecture	3	
		AI423	Advances in Object Oriented Analysis & Design	3	
		CE423	General Purpose Computing with GPU	3	
		AI425	Fundamentals of Microprocessor Interfacing	3	
		AI426	Introduction to Mobile Computing	3	
		CS432	Advanced Databases	3	
		CS433	Computer Graphics	3	
		EE436	VLSI Design	3	
		CS437	Data Warehousing & Data Mining	3	
		CS438	Web Mining and Social Media Analysis	3	
		CS439	Data Science	3	
		AI452	Techniques of Soft Computing	3	
		CE453	Robotic Vision	3	
		CS458	Distributed Systems	3	
		CS463	Web Engineering	3	
		AI473	Computational Neuroscience	3	
		CS474	Bio-Informatics	3	
		CS476	Computational Biology	3	
Degree total		40 courses – 112 theory credits – 23 lab credits – 135 credits			

(b) Degree Requirements for BS in Computer Engineering (136 Credit Hours)

For obtaining Bachelor of Science degree in Computer Engineering, a student has to complete 136 credit hours with a CGPA of 2.0 or above.

In addition, every BS (CE) student is required to participate in a summer training program and submit a formal written report during the summer of Junior Year.

Course requirements for obtaining BS (CE) degree offered by FCS&E are given below.

Course Group (HEC Category)		Course Code	Course Title	Credit Hours	Total Credits
General Education Requirements	*Basic Engineering Courses*	MS291	Engineering Economics	3	3
	Computing	CS103, L	Computer Programming + Lab	3+1	7
		CS121	Fundamentals of Computer Science	3	
	English Language	HM101	English Language & Communication Skills	3	6
		HM102	Technical Writing	3	
	Humanities	HM211	Pakistan & Islamic Studies	3	9
		HM321	Sociology & Human Behavior	3	
		HM322	Corporate Law & Professional Ethics	3	
	Mathematics	MT103	Analytical Geometry & Calculus	3	15
		MT201	Differential Equations & Linear Algebra I	3	
		ES111	Introduction to Statistical Theory	3	
		ES204	Complex Variables & Transforms	3	
		ES304	Linear Algebra II	3	
	Sciences	CH161	Occupational Health & Safety	1	3
		PH104	Fundamentals of Electricity and Magnetism	2	
Core Requirements	*Computer Engineering*	CE102L	Computer Engineering Workshop	0+1	45
		CE121, L	Digital Logic Design + Lab	3+1	
		CE211, L	Circuit Analysis + Lab	3+1	
		CE222, L	Computer Assembly & Organization Language + Lab	3+1	
		CE231, L	Electronics-I + Lab	3+1	

Course Group (HEC Category)		Course Code	Course Title	Credit Hours	Total Credits
		CE313, L	Computer Communication and Networks + Lab	3+1	
		CE324, L	Microprocessor Interfacing + Lab	3+1	
		CE341, L	Signals and Systems + Lab	3+1	
		CE362, L	Signal Processing + Lab	3+1	
		CE408, L	Cloud and Distributed Computing + Lab	3+1	
		CE436, L	Digital System Design + Lab	3+1	
		CE442, L	Computational Methods and Techniques + Lab	3+1	
	Computer Science	CS112, L	Object-Oriented Programming + Lab	3+1	28
		CS131	Discrete Structures	3	
		CS221, L	Data Structure and Algorithms + Lab	3+1	
		CS232, L	Introduction to Databases + Lab	3+1	
		CS211, L	Fundamentals of Operating Systems + Lab	3+1	
		CS425	Software Architecture and Engineering	3	
		CS481	Senior Year Design Project (Part-I)	0+3	
		CS482	Senior Year Design Project (Part-II)	0+3	
Electives	*Management Science Courses (Choose any ONE course)*	MS426	Technology Management	3	3
		CS436	Operation Research	3	
		CS491	Entrepreneurship & Technology Commercialization	3	
		CS492	Network Security & Cyber Ethics	3	
		MS492	Operations Management	3	
		MS493	Industrial Safety	3	
		MS494	Total Quality Management	3	
		MS496	Project Management	3	
		MS497	Procurement Management	3	
	CE Domain Specialization Breadth Courses	CS312	System Programming	3+1	8
		CS318	Introduction to Digital Image Processing	3+1	
		CE339	Introduction to Data Science	3+1	

Course Group (HEC Category)		Course Code	Course Title	Credit Hours	Total Credits
	(Choose any TWO courses)	CE351	Linear Control Systems	3+1	
		CS351	Artificial Intelligence	3+1	
		CE361	Communication Theory	3+1	
	CE Domain Specialization Depth Courses (Choose any ONE course)	CE421	Advanced Computer Architecture	3	3
		CE423	General Processing with GPU	3	
		CE432	Digital Communication	3	
		CE453	Robotic Vision	3	
		CE465	Introduction to ASIC Design	3	
		CE475	Real Time Embedded Systems	3	
	Inter-Disciplinary Engineering Courses (Choose any TWO courses)	CS323	Object-oriented Analysis and Design	3	6
		CS326	Mobile Computing	3	
		CS352	Introduction to Soft Computing	3	
		CS411	Block Chain	3	
		CS413	Internet of Things	3	
		CS414	Geographic Information Systems	3	
		CS416	Introduction to Deep Learning	3	
		CS417	Parallel Processing	3	
		CS419	Applied Image Processing	3	
		CS420	Cyber Security	3	
		CS423	Development Operations	3	
		CS425	Design Patterns	3	
		CS432	Advanced Databases	3	
		CS437	Data Warehousing and Data Mining	3	
		CS438	Web Mining and Social Media Analysis	3	
		CS439	Data Science	3	
		CS463	Web Engineering	3	
		CS472	Bio-inspired Computing	3	
		CS474	Bioinformatics	3	
		CS476	Computational Biology	3	
Degree total		42 courses – 114 theory credits – 25 lab credits – 136 credits			

(c) Degree Requirements for BS in Computer Science (132 Credit Hours)

For obtaining Bachelor of Science degree in Computer Science, a student has to complete 132 credit hours with a CGPA of 2.0 or above.

In addition, every BS (CS) student is required to participate in a summer training program and submit a formal written report during the summer of Junior Year.

Moreover, every BS (CS) student will undertake a 15-hour community service activity as a degree requirement using the summers or fall semester of their Sophomore Year.

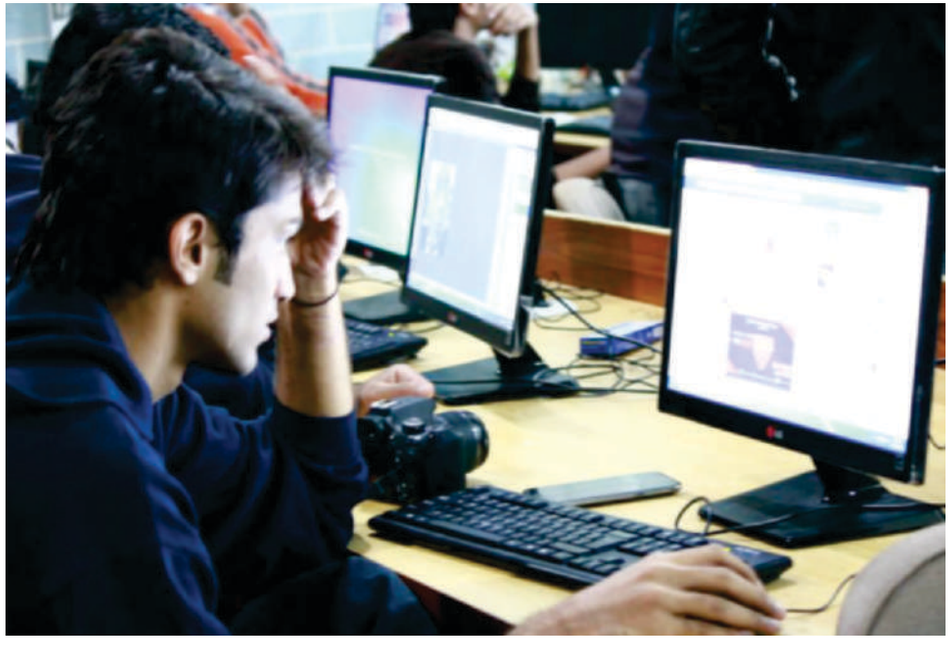
Course requirements for obtaining BS (CS) degree offered by FCS&E are given below.

Course Group (HEC Category)		Course Code	Course Title	Credit Hours	Total Credits
General Education Requirements	*Basic Engineering Courses*	ME102	Engineering Graphics	1+1	5
		MS291	Engineering Economics	3	
	Computing	CS103, CS103L	Computer Programming + Lab	3+1	7
		CS121	Fundamentals of Computer Science	3	
	English Language	HM101	English Language & Communication Skills	3	6
		HM102	Technical Writing	3	
	Humanities	HM211	Pakistan & Islamic Studies	3	9
		HM321	Sociology & Human Behavior	3	
		HM322	Corporate Law & Professional Ethics	3	
	Mathematics	ES202	Engineering Statistics	3	15
		MT101	Calculus I	3	
		MT102	Calculus II	3	
		MT201	Differential Equations & Linear Algebra I	3	
		ES304	Linear Algebra II	3	
	Sciences	PH103	Fundamentals of Mechanics	2	4
		PH104	Fundamentals of Electricity and Magnetism	2	
Core Requirements	*Computing*	CS131	Discrete Structures	3	35
		CS221, L	Data Structure and Algorithms + Lab	3+1	
		CE221, L	Logic Design + Lab	3+1	
		CS225	Introduction to Software Engineering	3	

Course Group (HEC Category)		Course Code	Course Title	Credit Hours	Total Credits
		CS232, L	Introduction to Databases + Lab	3+1	
		CS311, L	Operating System + Lab	3+1	
		CS313, L	Computer Communications & Networks + Lab	3+1	
		CS464	Data & Network Security	3	
		CS481	Senior Year Design Project (Part-I)	0+3	
		CS482	Senior Year Design Project (Part-II)	0+3	
	Computer Science Domain Specific	CS112, L	Object-Oriented Programming + Lab	3+1	21
		CE222, L	Computer Organization & Assembly Language + Lab	3+1	
		CS224	Formal Languages & Automata Theory	3	
		CS342	Numerical Analysis & Computational Methods	3	
		CS424, L	Compiler Construction + Lab	3+1	
		CS478	Design & Analysis of Algorithms	3	
	Computer Science Breadth	CS312, L	Systems Programming + Lab	3+1	15
		CS324	Computer Architecture	3	
		CS351, L	Artificial Intelligence + Lab	3+1	
		CS417, L	Parallel Processing + Lab	3+1	
Electives	*Management Science Courses (Choose any ONE course)*	MS426	Technology Management	3	3
		CS436	Operation Research	3	
		CS491	Entrepreneurship & Technology Commercialization	3	
		CS492	Network Security & Cyber Ethics	3	
		MS492	Operations Management	3	
		MS493	Industrial Safety	3	
		MS494	Total Quality Management	3	
		MS496	Project Management	3	
		MS497	Procurement Management	3	
	CS Domain Breadth Courses	CS323	Object-Oriented Analysis & Design	3	3
		CS326	Mobile Computing	3	

Course Group (HEC Category)		Course Code	Course Title	Credit Hours	Total Credits
	(Choose any ONE course)	CS327	Software Engineering II	3	
		CS329	Fundamentals of Cyber security	3	
		CS352	Introduction to Soft Computing	3	
	CS Domain Specialization Courses (Choose any THREE courses)	CS411	Block chain	3	9
		CS412	Information Retrieval	3	
		CS413	Internet of Things	3	
		CS414	Geographic Information Systems	3	
		CS416	Introduction to Deep Learning	3	
		CS418	Digital Image Processing	3	
		CS419	Applied Image Processing	3	
		AI420	Medical Image Processing	3	
		CE421	Advanced Computer Architecture	3	
		CS421	Human Computer Interaction	3	
		CS422	Professional Issues in IT	3	
		CE423	General Purpose Computing with GPU	3	
		CS423	Development Operations	3	
		CS425	Design Patterns	3	
		CS426	Software Testing and Quality Engineering	3	
		CS427	Software Design and Architecture	3	
		CS428	Design of Programming Language	3	
		CS429	Software Project Management	3	
		CS432	Advanced Databases	3	
		CS433	Computer Graphics	3	
		CS435	MIS & DSS	3	
		CS437	Data Warehousing and Data Mining	3	
		CS438	Web Mining and Social Media Analysis	3	
		CS439	Data Science	3	
		CS452	Artificial Neural Networks	3	
		CE453	Robotic Vision	3	

Course Group (HEC Category)		Course Code	Course Title	Credit Hours	Total Credits
		CS454	Real-Time Programming	3	
		CS458	Distributed Systems	3	
		CS463	Web Engineering	3	
		CS472	Bio-Inspired Computing	3	
		CS474	Bio-Informatics	3	
		CS476	Computational Biology	3	
Degree total		41 courses – 113 theory credits – 19 lab credits – 132 credits			



(d) Degree Requirements for BS in Data Science (135 Credit Hours)

For obtaining Bachelor of Science degree in Data Science, a student has to complete 135 credit hours with a CGPA of 2.0 or above.

In addition, every BS (DS) student is required to participate in a summer training program and submit a formal written report during the summer of Junior Year.

Moreover, every BS (DS) student will undertake a 15-hour community service activity as a degree requirement using the summers or fall semester of their Sophomore Year.

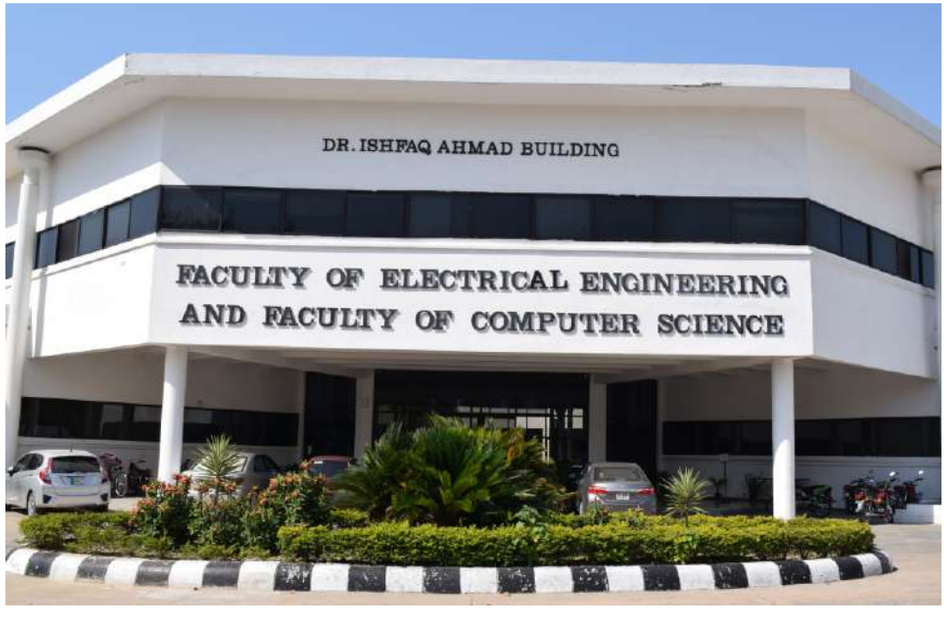
Course requirements for obtaining BS (DS) degree offered by FCS&E are given below.

Course Group (HEC Category)		Course Code	Course Title	Credit Hours	Total Credits
General Education Requirements	*Basic Engineering*	MS490	Engineering Economics and Management	3	3
	Computing	CS103, CS103L	Computer Programming + Lab	3+1	7
		CS121	Fundamentals of Computer Science	3	
	English Language	HM101	English Language & Communication Skills	3	9
		HM102	Technical Writing	3	
		HM203	Business Communication & Presentation Skills	3	
	Humanities	HM211	Pakistan & Islamic Studies	3	9
		HM321	Sociology & Human Behavior	3	
		HM322	Corporate Law & Professional Ethics	3	
	Mathematics	ES111	Introduction to Statistical Theory	3	15
		ES304	Linear Algebra II	3	
		MT101	Calculus I	3	
		MT102	Calculus II	3	
		MT201	Differential Equations & Linear Algebra I	3	
Core Requirements	*Computing*	CE213, CE213L	Computer Communications + Lab	3+1	35
		CE221, CE221L	Logic Design + Lab	3+1	
		CS131	Discrete Structures	3	
		CS221, CS221L	Data Structure and Algorithms + Lab	3+1	

Course Group (HEC Category)		Course Code	Course Title	Credit Hours	Total Credits
		CS232, CS232L	Introduction to Databases + Lab	3+1	
		CS311, CS311L	Operating System + Lab	3+1	
		CS325	Software Engineering	3	
		CS464	Data & Network Security	3	
		CS481	Senior Year Design Project (Part-I)	0+3	
		CS482	Senior Year Design Project (Part-II)	0+3	
	Computer Science Domain Specific	CS112, CS112L	Object-Oriented Programming + Lab	3+1	18
		CE222, CE222L	Computer Organization & Assembly Language + Lab	3+1	
		CS251, CS251L	Introduction to Artificial Intelligence	3+1	
		CS378	Design & Analysis of Algorithms	3	
		CS417	Parallel Processing	3	
	Data Science Domain Specific	DS211	Theory of Data Science	3	24
		DS221	Inferential Statistics & Applied Probability	3	
		DS331, DS331L	Data ware Housing & Business Intelligence	3+1	
		DS341, DS341L	Data Mining	3+1	
		DS351, DS351L	Data Visualization	2+1	
		DS461, DS461L	Big Data Analytics	3+1	
		DS301L	Problem Based Learning for Data Science Lab	0+1	
		DS302L	Industrial Data Science Training Lab I	0+1	
		DS403L	Industrial Data Science Training Lab II	0+1	
Electives	*Management Science Courses (Choose any ONE course)*	MS426	Technology Management	3	3
		CS436	Operation Research	3	
		CS491	Entrepreneurship & Technology Commercialization	3	
		CS492	Network Security & Cyber Ethics	3	
		MS492	Operations Management	3	

Course Group (HEC Category)		Course Code	Course Title	Credit Hours	Total Credits
		MS493	Industrial Safety	3	
		MS494	Total Quality Management	3	
		MS496	Project Management	3	
		MS497	Procurement Management	3	
	DS Domain Breadth Courses (Choose any ONE course)	CS328	Introduction to Development Operations	3	3
		CS326	Mobile Computing	3	
		CE318	Introduction to Digital Image Processing	3	
		CS329	Fundamentals of Cyber security	3	
		CS352	Introduction to Soft Computing	3	
	DS Domain Specialization Courses (Choose any THREE courses)	CS411	Block chain	3	9
		CS412	Information Retrieval	3	
		CS413	Internet of Things	3	
		CS414	Geographic Information Systems	3	
		CS416	Introduction to Deep Learning	3	
		CS419	Applied Image Processing	3	
		AI420	Medical Image Processing	3	
		CE421	Advanced Computer Architecture	3	
		CS421	Human Computer Interaction	3	
		CS422	Professional Issues in IT	3	
		CE423	General Purpose Computing with GPU	3	
		CS425	Design Patterns	3	
		CS426	Software Testing and Quality Engineering	3	
		CS427	Software Design and Architecture	3	
		CS428	Design of Programming Language	3	
		CS429	Software Project Management	3	
		CS432	Advanced Databases	3	
		CS433	Computer Graphics	3	
		CS435	MIS & DSS	3	
		CS438	Web Mining and Social Media Analysis	3	

Course Group (HEC Category)		Course Code	Course Title	Credit Hours	Total Credits
		CS452	Artificial Neural Networks	3	
		CE453	Robotic Vision	3	
		CS454	Real-Time Programming	3	
		CS458	Distributed Systems	3	
		CS463	Web Engineering	3	
		CS472	Bio-Inspired Computing	3	
		CS474	Bio-Informatics	3	
		CS476	Computational Biology	3	
Degree total		41 courses – 113 theory credits – 22 lab credits – 135 credits			



a.BS in Artificial Intelligence, Powered by Huawei (135 Credit Hours)

	Course Code	Course Title	Lecture Hours	Lab Hours	Credit Hours	Pre Req	Co Req
1st Semester	CS103	Computer Programming	3	0	3	-	-
	CS131	Discrete Structures	3	0	3	-	-
	HM101	English Language and Communication Skills	3	0	3	-	-
	MT101	Calculus I	3	0	3	-	-
	CS121	Fundamentals of Computer Science	3	0	3	-	-
	CS103L	Computer Programming Lab	0	3	1	-	CS103
2nd Semester	CE121	Fundamentals of Logic Design	3	0	3	-	-
	CS112	Object-oriented Programming	3	0	3	CS103	-
	HM102	Technical Writing	3	0	3	-	-
	ES111	Introduction to Statistical Theory	3	0	3	MT101	-
	MT102	Calculus II	3	0	3	MT101	-
	CE121L	Fundamentals of Logic Design Lab	0	3	1	-	CE121
	CS112L	Object Oriented Programming Lab	0	3	1	-	CS112
3rd Semester	AI201	Programming for AI	2	0	2	CS112	-
	AI211	Introduction to AI	2	0	2	CS112	-
	CS221	Data Structures and Algorithms	3	0	3	CS103	-
	MS291	Engineering Economics	3	0	3	-	-
	MT201	Differential Equations & Linear Algebra I	3	0	3	MT102	-
	AI201L	Programming for AI Lab	0	3	1	-	AI201
	AI211L	Introduction to AI Lab	0	3	1	-	AI211
	CS221L	Data Structures and Algorithms Lab	0	3	1	-	CS221

	Course Code	Course Title	Lecture Hours	Lab Hours	Credit Hours	Pre Req	Co Req
4th Semester	AI231	Knowledge Representation and Problem Solving	3	0	3	CS221	-
	CE222	Computer Organization and Assembly Language	3	0	3	CE121	-
	CS232	Introduction to Databases	3	0	3	CS112	-
	DS221	Inferential Statistics and Applied Probability	3	0	3	ES111	-
	HM211	Islamic and Pakistan Studies	3	0	3	-	-
	CE222L	Computer Organization and Assembly Language Lab	0	3	1	-	CE222
	CS231L	Introduction to Databases Lab	0	3	1	-	CS231
5th Semester	AI341	Deep Neural Networks	3	0	3	AI231	-
	AI351	Introduction to Machine Learning	3	0	3	MT201	-
	CS311	Operating Systems	3	0	3	CS221	-
	ES304	Linear Algebra II	3	0	3	MT201	-
	HM321	Sociology and Human Behavior	3	0	3	-	-
	AI341L	Deep Neural Networks Lab	0	3	1	-	AI341
	AI351L	Introduction to Machine Learning Lab	0	3	1	-	AI351
	CS311L	Operating Systems Lab	0	3	1	-	CS311
6th Semester	AI361	Natural Language Processing	3	0	3	AI341	-
	AI319	Computer Vision	3	0	3	AI341	-
	AI3xx †	AI Specialization Elective (Breadth)	3	0	3	**	**
	HM322	Corporate Law and Professional Ethics	3	0	3	-	-
	CS325	Software Engineering	3	0	3	CS221	-
	AI361L	Natural Language Processing Lab	0	3	1	-	AI302
	AI305L	Associate in AI Training Lab	0	3	1	AI341	-
	AI319L	Computer Vision Lab	0	3	1	-	AI319

	Course Code	Course Title	Lecture Hours	Lab Hours	Credit Hours	Pre Req	Co Req
7th Semester	AI4xx	AI Specialization Elective (Depth) I	3	0	3	**	**
	AI4xx	AI Specialization Elective (Depth) II	3	0	3	**	**
	CS417	Parallel Processing	3	0	3	CS311	-
	CS478	Design and Analysis of Algorithms	3	0	3	CS221	-
	CS481	Senior Design Project (Part I)	0	9	3	-	-
	AI406L	Professional in AI Training Lab	0	3	1	AI305L	-
	CS417L	Parallel Processing Lab	0	3	1	-	CS417

8th Semester	AI4xx	AI Specialization Elective (Depth) III	3	0	3	**	**
	CS464	Data and Network Security	3	0	3	CS221	-
	CS482	Senior Design Project (Part II)	0	9	3	-	-
	CE413	Computer Networks	3	0	3	-	-
	MSxxx	Management Elective	3	0	3	**	**
	AI407L	PBL for AI Lab	0	3	1	AI319	-

One course from the pool of following courses

- Computer Architecture,
- Deep Reinforcement Learning & Control,
- Introduction to Development Operations,
- Nature-inspired Computing.

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

B. BS in Computer Engineering (136 Credit Hours)

	Course Code	Course Title	Lecture Hours	Lab Hours	Credit Hours	Pre Req	Co Req
1st Semester	CS103	Computer Programming	3	0	3	-	-
	CS121	Fundamentals of Computer Science	3	0	3	-	-
	CH161	Occupational Health and Safety	1	0	1	-	-
	HM101	English Language & Communication Skills	3	0	3	-	-
	MT103	Calculus and Analytical Geometry	3	0	3	-	-
	PH104	Essentials of Electricity & Magnetism	2	0	2	-	-
	CE102L	Computer Engineering Workshop	0	3	1	-	-
	CS103L	Computer Programming Lab	0	3	1	-	CS103

2nd Semester	CE121	Fundamentals of Logic Design	3	0	3	-	-
	CS112	Object-oriented Programming	3	0	3	CS103	-
	CS131	Discrete Structures	3	0	3	-	-
	ES111	Introduction to Statistical Theory	3	0	3	MT103	-
	HM102	Technical Writing	3	0	3	-	-
	CE121L	Fundamentals of Logic Design Lab	0	3	1	-	CE121
	CS112L	Object-oriented Programming Lab	0	3	1	-	CS112

3rd Semester	CE211	Circuit Analysis	3	0	3	MT101	-
	CS221	Data Structures and Algorithms	3	0	3	CS103	-
	CE222	Computer Organization and Assembly Language	3	0	3	CE121	-
	MS291	Engineering Economics	3	0	3	-	-
	MT201	Differential Equation & Linear Algebra I	3	0	3	MT102	-
	CE211L	Circuit Analysis Lab	0	3	1	-	CE211
	CS221L	Data Structures and Algorithms Lab	0	3	1	-	CS221
	CE222L	Computer Organization & Assembly Language Lab	0	3	1	-	CE222

	Course Code	Course Title	Lecture Hours	Lab Hours	Credit Hours	Pre Req	Co Req
4th Semester	CE231	Electronics I	3	0	3	CE211	-
	CS211	Fundamentals of Operating Systems	3	0	3	CS221	-
	CS232	Introduction to Databases	3	0	3	CS112	-
	HM211	Pakistan and Islamic Studies	3	0	3	-	-
	MT203	Complex Variables and Transforms	3	0	3	MT201	-
	CE231L	Electronics I Lab	0	3	1	-	CE231
	CS211L	Fundamentals of Operating Systems	0	3	1	-	CS211
	CS232L	Introduction to Databases Lab	0	3	1	-	CS232
5th Semester	CE313	Computer Communication & Networks	3	0	3	-	-
	CE324	Microprocessor Interfacing	3	0	3	CE222	-
	CE341	Signals & Systems	3	0	3	MT201	-
	ES304	Linear Algebra II	3	0	3	MT201	-
	HM321	Sociology and Human Behavior	3	0	3	-	-
	CE313L	Computer Communication & Networks Lab	0	3	1	-	CE313
	CE324L	Microprocessor Interfacing Lab	0	3	1	-	CE324
	CE341L	Signals & Systems Lab	0	3	1	-	CE341
6th Semester	CE362	Signal Processing	3	0	3	CS341	-
	CE3xx†	CE Specialization Elective I (Breadth)	3	0	3	**	**
	CE3xx†	CE Specialization Elective II (Breadth)	3	0	3	**	**
	HM322	Corporate Law and Professional Ethics	3	0	3	-	-
	XX3xx*	IDE Elective I	3	0	3	**	**
	CE3xxL	CE Specialization Elective (Breadth) I Lab	0	3	1	-	CE3xx
	CE3xxL	CE Specialization Elective (Breadth) II Lab	0	3	1	-	CE3xx
	CE362L	Signal Processing Lab	0	3	1	-	CE362

	Course Code	Course Title	Lecture Hours	Lab Hours	Credit Hours	Pre Req	Co Req
7th Semester	CE408	Cloud and Distributed Computing	3	0	3	CE313	-
	CE425	Software Architecture and Engineering	3	0	3	CS221	-
	CE442	Computational Methods and Techniques	3	0	3	CS221	-
	CS481	Senior Design Project (Part-I)	0	9	3	-	-
	MS4xx	Management Elective	3	0	3	**	**
	CE408L	Cloud and Distributed Computing Lab	0	3	1	-	CE408
	CE442L	Computational Methods and Techniques Lab	0	3	1	-	CE442
8th Semester	CE436	Digital System Design	3	0	3	CE324	-
	CE4xx#	CE Specialization Elective (Depth)	3	0	3	**	**
	XX4xx*	IDE Elective II	3	0	3	**	**
	CS482	Senior Design Project (Part-II)	0	9	3	-	-
	CE436L	Digital System Design Lab	0	3	1	-	CE436

Two courses and their labs from the pool of following courses

- CS312 – System Programming
- CS318 – Introduction to Digital Image Processing
- CE339 – Introduction to Data Science
- CS351 – Artificial Intelligence
- CE361 – Communication Theory
- EE351 – Linear Control Systems
- EE361 – Communication Systems

* Two courses from the pool of listed courses in Inter-Disciplinary Engineering Electives.
# One course from the pool of listed courses in CE Domain Specialization Depth Courses.
** means that the pre-requisites or the co-requisites may vary depending on the electives.

C. BS in Computer Science (132 Credit Hours)

	Course Code	Course Title	Lecture Hours	Lab Hours	Credit Hours	Pre Req	Co Req
1st Semester	CS103	Computer Programming	3	0	3	-	-
	CS121	Fundamentals of CS	3	0	3	-	-
	HM101	English and Study Skills	3	0	3	-	-
	MT101	Calculus I	3	0	3	-	-
	PH103	Fundamentals of Mechanics	2	0	2	-	-
	CS103L	Computer Programming Lab	0	3	1	-	CS103
2nd Semester	CS112	Object-oriented Programming	3	0	3	CS103	-
	CS131	Discrete Structures	3	0	3	-	-
	HM102	Technical Writing	3	0	3	-	-
	ME102	Engineering Graphics	1	3	2	-	-
	MT102	Calculus II	3	0	3	MT101	-
	PH104	Fundamentals of Electricity & Magnetism	2	0	2	-	-
	CS112L	Object-oriented Programming Lab	0	3	1	-	CS112
3rd Semester	CE221	Logic Design	3	0	3	-	-
	CS221	Data Structure and Algorithms	3	0	3	CS112	-
	CS224	Formal Languages and Automata Theory	3	0	3	CS131	-
	MS291	Engineering Economics	3	0	3	-	-
	MT201	Differential Equations & Linear Algebra I	3	0	3	MT102	-
	CE221L	Logic Design Lab	0	3	1	-	CE221
	CS221L	Data Structure and Algorithms Lab	0	3	1	-	CS221

	Course Code	Course Title	Lecture Hours	Lab Hours	Credit Hours	Pre Req	Co Req
4th Semester	CE222	Computer Organization and Assembly Language	3	0	3	CE221	-
	CS225	Introduction to Software Engineering	3	0	3	CS221	-
	CS232	Introduction to Databases	3	0	3	CS112	-
	ES202	Engineering Statistics	3	0	3	MT101	-
	HM211	Pakistan and Islamic Studies	3	0	3	-	-
	CE222L	Computer Organization and Assembly Language Lab	0	3	1	-	CE222
	CS232L	Introduction to Databases Lab	0	3	1	-	CS232
5th Semester	CS311	Operating Systems	3	0	3	CS221	-
	CS324	Computer Architecture	3	0	3	CS222	-
	CS342	Numerical Analysis & Computational Methods	3	0	3	MT201	-
	ES304	Linear Algebra II	3	0	3	MT201	-
	HM321	Sociology and Human Behavior	3	0	3	-	-
	CS311L	Operating Systems Lab	0	3	1	CS221	CS311
6th Semester	CE313	Computer Communication and Networking	3	0	3	CS311	-
	CS312	Systems Programming	3	0	3	CS311	-
	CS351	Artificial Intelligence	3	0	3	CS221	-
	CS3xx †	CS Specialization Elective (Breadth)	3	0	3	**	**
	HM322	Corporate Law & Professional Ethics	3	0	3	-	-
	CE313L	Computer Communication and Networking Lab	0	3	1	-	CE313
	CS312L	Systems Programming Lab	0	3	1	-	CS312
	CS351L	Artificial Intelligence Lab	0	3	1	-	CS351

	Course Code	Course Title	Lecture Hours	Lab Hours	Credit Hours	Pre Req	Co Req
7th Semester	CS417	Parallel Processing	3	0	3	CS311	-
	CS478	Design & Analysis of Algorithm	3	0	3	CS221	-
	CS481	Senior Design Project (Part-I)	0	9	3	-	-
	CS4xx	CS Specialization Elective (Depth) I	3	0	3	**	**
	CS4xx	CS Specialization Elective (Depth) II	3	0	3	**	**
	CS417L	Parallel Processing Lab	0	3	1	-	CS417

8th Semester	CS424	Compiler Construction	3	0	3	CS224	-
	CS464	Data and Network Security	3	0	3	CS311	-
	CS482	Senior Design Project (Part-II)	0	9	3	-	-
	CS4xx	CS Specialization Elective (Depth) III	3	0	3	**	**
	MSxxx	Management Elective	3	0	3	**	**
	CS424L	Compiler Construction Lab	0	3	1	-	CS424

† One course from the pool of following courses
Introduction to Soft Computing, Mobile Computing,
Object-oriented Analysis and Design, Software Engineering II,
Fundamentals of Cyber Security

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

D. BS in Data Science (135 Credit Hours)

	Course Code	Course Title	Lecture Hours	Lab Hours	Credit Hours	Pre Req	Co Req
1st Semester	CS103	Computer Programming	3	0	3	-	-
	CS121	Fundamentals of Computer Science	3	0	3	-	-
	CS131	Discrete Structures	3	0	3	-	-
	HM101	English Language and Communication Skills	3	0	3	-	-
	MT101	Calculus I	3	0	3	-	-
	CS103L	Computer Programming Lab	0	3	1	-	CS103

2nd Semester	CE121	Fundamentals of Logic Design	3	0	3	-	-
	CS112	Object-oriented Programming	3	0	3	CS103	-
	ES111	Introduction to Statistical Theory	3	0	3	MT101	-
	HM102	Technical Writing	3	0	3	-	-
	MT102	Calculus II	3	0	3	MT101	-
	CE121L	Fundamentals of Logic Design Lab	0	3	1	-	CE121
	CS112L	Object-oriented Programming Lab	0	3	1	-	CS112

3rd Semester	CE222	Computer Organization & Assembly Language	3	0	3	CE121	-
	CS221	Data Structure and Algorithms	3	0	3	CS103	-
	CS232	Introduction to Databases	3	0	3	CS112	-
	HM203	Business Communications & Presentation Skills	3	0	3	HM101	-
	MT201	Differential Equations & Linear Algebra I	3	0	3	MT102	-
	CE222L	Computer Organization & Assembly Language Lab	0	3	1	-	CE222
	CS221L	Data Structure and Algorithms Lab	0	3	1	-	CS221
	CS232L	Introduction to Databases Lab	0	3	1	-	CS232

	Course Code	Course Title	Lecture Hours	Lab Hours	Credit Hours	Pre Req	Co Req
4th Semester	CE213	Computer Communications	3	0	3	-	-
	CS251	Introduction to Artificial Intelligence	3	0	3	CS221	-
	DS211	Theory of Data Science	3	0	3	CS112	-
	DS221	Inferential Statistics & Applied Probability	3	0	3	ES111	-
	HM211	Pakistan & Islamic Studies	3	0	3	-	-
	CE213L	Computer Communications Lab	0	3	1	-	CE213
	CS251L	Introduction to Artificial Intelligence Lab	0	3	1	-	CS251
5th Semester	CS311	Operating Systems	3	0	3	CS221	-
	DS331	Data Warehousing & Business Intelligence	3	0	3	DS211	-
	DS341	Data Mining	3	0	3	DS221	-
	ES304	Linear Algebra II	3	0	3	MT201	-
	HM321	Sociology and Human Behavior	3	0	3	-	-
	CS311L	Operating Systems Lab	0	3	1	-	CS311
	DS331L	Data Warehousing & Business Intelligence Lab	0	3	1	-	DS331
	DS341L	Data Mining Lab	0	3	1	-	DS341
6th Semester	CS325	Software Engineering	3	0	3	CS221	-
	CS378	Design & Analysis of Algorithms	3	0	3	CS221	-
	DS351	Data Visualization	2	0	2	DS341	-
	DS3xx[†]	DS Elective (Breadth)	3	0	3	**	**
	HM322	Corporate Law & Professional Ethics	3	0	3	-	-
	DS301L	Problem Based Learning for DS Lab	0	3	1	-	-
	DS302L	Industrial DS Training Lab I	0	3	1	-	-
	DS351L	Data Visualization Lab	0	3	1	-	DS351

	Course Code	Course Title	Lecture Hours	Lab Hours	Credit Hours	Pre Req	Co Req
7th Semester	CS417	Parallel Processing	3	0	3	CS311	-
	CS481	Senior Design Project (Part-I)	0	9	3	-	-
	DS461	Big Data Analytics	3	0	3	DS221	-
	DS4xx	DS Specialization Elective I	3	0	3	**	**
	MS490	Engineering Economics and Management	3	0	3	-	-
	DS403L	Industrial DS Training Lab II	0	3	1	-	-
	DS461L	Big Data Analytics Lab	0	3	1	-	DS461
8th Semester	CS464	Data & Network Security	3	0	3	CS311	-
	CS482	Senior Design Project (Part-II)	0	9	3	-	-
	DS4xx	DS Specialization Elective – II	3	0	3	**	**
	DS4xx	DS Specialization Elective – III	3	0	3	**	**
	MS4xx	Management Elective	3	0	3	**	**

One course from the pool of following courses

- Introduction to Soft Computing,
- Mobile Computing,
- Introduction to Development Operations,
- Introduction to Digital Image Processing,
- Fundamentals of Cyber Security.

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

CORE COURSES

CS101 Introduction to Computing (2 3 3):

History and basic components of a computer system, approaches to solving problems using computers, problem solving in C++, control structures, functions, structures, arrays and strings, pointers and advanced topics in arrays, file handling, graphics, etc.

Prerequisite(s): None Core for: Other faculties

CS103 Computer Programming (3 3 4):

Computers and their applications, types of computers, history of computers, hardware and software, peripheral devices, data representation and conversion – Binary and Decimal number systems, ASCII/Unicode representation, microprocessors, primary and secondary memory, storage devices, networks, types of networks, algorithms, flowcharts, pseudocode, components of algorithms, formal specification of pseudocode, 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: AI, CE, CS, DS

CS112 Object-Oriented Programming (3 3 4):

User defined data types, structures, unions and enumerations, recursion, preprocessing in C++, bit manipulation, strings, pointers, reference and dynamic memory allocation, function pointers, ADTs and C++ classes, constructor, destructors, static data members and functions, 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, graphic mode programming, GUI programming, introduction to standard template library.

Prerequisite(s): CS103

Core for: AI, CE, CS, DS

CS121 Fundamentals of Computer Science (3 0 3):

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: AI, CE, CS, DS

CE121 Fundamentals of Logic Design (3 3 4):

Deals with the 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), introduction to hardware description language (HDL) and their use to design the basic digital hardware.

Prerequisite(s): None

Core for: AI, CE, DS

CS131 Discrete Structures (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 group theory and algorithms.

Prerequisite(s): None

Core for: AI, CE, CS, DS

AI201 Programming for AI (2 3 3):

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

CS201 Introduction to Computer (3 0 3):

Technical introduction to computer and information sciences to undergraduate business students with focus on developing an elementary knowledge of computing; basic and applied knowledge of computer operating systems and computer applications; Microsoft Office Applications (Microsoft Word, Microsoft Excel, Microsoft PowerPoint Microsoft Access and Visio); computer hardware, software, operating systems, data communication through internet and Microsoft applications; database management through Microsoft Access.

Prerequisite(s): None Core for: MgS

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): MT103 Core for: CE

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

CE213 Computer Communications (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): None Core for: DS

AI221 Introduction to AI (3 3 4):

Introduction to Artificial Intelligence and its applications towards Knowledge Based Systems; Introduction to Reasoning and Knowledge Representation, Problem Solving by Searching – Informed searching, Uninformed searching, Heuristics, Local searching, Adversarial Search, Min-max algorithm, Alpha beta pruning, Game-playing; Case Studies: General Problem Solver, Eliza, Student, Macsyma; Learning from examples; Natural Language Processing; Recent trends in AI and applications, Prolog programming language to explore and illustrate various issues and techniques in Artificial Intelligence.

Prerequisite(s): None Core for: AI

CE221 Logic Design (3 3 4):

Deals with the 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), introduction to hardware description language (HDL) and their use to design the basic digital hardware.

Prerequisite(s): None Core for: CS

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: AI, CE, CS, DS

DS221 Inferential Statistics and Applied Probability (3 0 3):

Introduction to Statistics, Use of Statistics in Data Science, Experimental Design, Statistical Techniques for Forecasting, Interpolation/ Extrapolation, Introduction to Probability, Conditional Probability, Prior and Posterior Probability, Random number generation (RNG), Techniques for RNG, Correlation analysis, Chi Square Dependency tests, Diversity Index, Data Distributions Multivariate Distributions, Error estimation, Confidence Intervals, Linear transformations, Gradient Descent and Coordinate Descent, Likelihood inference, Revision of linear regression and likelihood inference, Fitting algorithms for nonlinear models and related diagnostics, Generalized linear model; 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: DS

CE222 Computer Organization & Assembly Language (3 3 4):

Microprocessor bus structure: addressing, data and control, memory organization and structure (segmented and linear models), introduction to registers and flags, data movement, arithmetic and logic, program control, subroutines, stack and its operation, peripheral control interrupts, interfacing with high level languages, real-time applications.

Objectives and perspectives of Assembly language, addressing modes, introduction to the assembler and debugger, manipulate and translate machine and assembly code, describe actions inside the processing chip, discuss operations performed by an instruction set, write documented programs, using an assembler of choice.

Prerequisite(s): CS112

Core for: AI, CE, CS, DS

CS224 Formal Languages and Automata Theory (3 0 3):

Study of regular languages, regular expressions and finite state machines, deterministic and non-deterministic finite state machines, pushdown automata, context free grammar, Turing machines and applications of various kinds of finite state machines.

Prerequisite(s): CS231 Core for: CS

CS225 Introduction to Software Engineering (3 0 3):

Software development life cycle, software development processes, software requirement identification and specification, system analysis, software architecture, software design approaches: object-oriented and function-oriented, user interface design, program design techniques, software testing and maintenance, software technical metrics, introduction to quality assurance and project management.

Hands-on Practice: using Microsoft Project, introduction to MS .Net framework, introduction to Windows form programming in MS .Net, creating user interfaces in .Net, debugging applications, performance testing of applications.

Prerequisite(s): CS221 Core for: CS

AI231 Knowledge Representation and Problem Solving (3 3 4):

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): CS221 Core for: AI

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

CS232 Introduction to Databases (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: AI, CE, CS, DS

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, introduction to distributed operating systems, scheduling and dispatch, and introduction to concurrency.

Prerequisite(s): CS221 Core for: AI, CE, CS, DS

CS312 Systems Programming (3 3 4):

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 Core for: CS

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): None Core for: CE, CS

AI319 Computer Vision (3 3 4):

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, and image classification and scene understanding.

Prerequisite(s): AI341 Core for: AI

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): CS222 Core for: CE

CS324 Computer Architecture (3 0 3):
Fundamentals of computer design including performance measurements and quantitative principles, principles of Instruction Set Design, operands, addressing modes and encoding, pipelining of processors: issues and bottlenecks, exception handling features, instruction-level parallelism and dynamic handling of exceptions, memory hierarchy design, cache design, performance issues and improvements, main memory performance issues, storage systems, multiprocessors and thread level parallelism, case studies.

Prerequisite(s): CS222 Core for: CS
Specialization(s): AI

CS325 Software Engineering (3 0 3):
Software development life cycle, software development processes, software requirement identification and specification, system analysis, software architecture, software design approaches: object-oriented and function-oriented, user interface design, program design techniques, software testing and maintenance, software technical metrics, introduction to quality assurance and project management. Hands-on Practice: using Microsoft Project, introduction to MS .Net framework, introduction to Windows form programming in MS .Net, creating user interfaces in .Net, debugging applications, performance testing of applications.

Prerequisite(s): CS112 Core for: AI

DS331 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

CS342 Numerical Analysis & Computational Methods (3 0 3): Error and computer arithmetic, root finding for non-linear equation, interpolation and polynomial approximation, solution of system of linear equations, numerical differentiation and integration, numerical solution of ordinary differential equations.

Prerequisite(s): MT201 Core for: CS

AI351 Introduction to Machine Learning (3 3 4):
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; Semi-supervised learning with EM using labeled and unlabeled data; Reinforcement Learning: Hidden Markov models, Monte Carlo some inference Exploration vs. Exploitation trade-offs, Markov Decision Processes, Ensemble Learning, Using committees of multiple hypotheses, Bagging, and Boosting.

Prerequisite(s): CS221 Core for: AI

CS351 Artificial Intelligence (3 3 4): Overview of artificial intelligence, issues and application, knowledge representation, searching techniques, pruning, heuristics, production systems, basic elements of Prolog language, expert systems, neural networks, robotics, etc.

Prerequisite(s): CS221 Core for: CS
Specialization(s): CE

DS351 Data Visualization (2 3 3):
Introduction of Exploratory Data Analysis and Visualization, Building Blocks and Basic Operations; Types of Exploratory Graphs, single and multi-dimensional summaries, five number summary, box plots, histogram, bar plot and others; Distributions, their representation using histograms, outliers, variance; Probability Mass Functions and their visualization; Cumulative distribution functions, percentile-based statistics, random numbers; Modelling distributions, exponential, normal, lognormal, pareto; Probability density functions, kernel density estimation; Relationship between variables, scatter plots, correlation, covariance; Estimation and Hypothesis Testing; Clustering using K-means and Hierarchical; Time series and survival analysis; Implementing concepts with R (or similar language).

Prerequisite(s): DS341 Core for: DS

AI361 Natural Language Processing (3 3 4):
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, and bag of words model.

Prerequisite(s): CS221 Core for: AI

CE362 Signal Processing (3 0 3):
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

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: DS

CE413 Computer 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, networking technologies.

Prerequisite(s): CS311 Core for: AI, CE

CS417 Parallel Processing (3 3 4):
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: CS311 Core for: AI, CS, DS

CS424 Compiler Construction (3 3 4):

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 Specialization(s): CE

CE425 Software Architecture and Engineering (3 0 3):

Software development life cycle, software development processes, software requirement identification and specification, system analysis, software architecture, software design approaches: object-oriented and function-oriented, user interface design, program design techniques, software testing and maintenance, software technical metrics, introduction to quality assurance and project management. Hands-on Practice: using Microsoft Project, introduction to MS .Net framework, introduction to Windows form programming in MS .Net, creating user interfaces in .Net, debugging applications, performance testing of applications.

Prerequisite(s): CS112 Core for: CE

CE436 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 Behavioural, 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

DS461 Big Data Analytics (4 Credits) (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

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, 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: AI, CS, DS

CS478 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): CS221Core for: AI, CS Specialization(s): CE

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: AI, CE, CS, DS

Muhammad Sehel Khan

I can proudly say that in my 2 years in GIKI, I have been fortunate enough to not only learn skills vital toMy professional career but also to groom my personality through the rich and fruitful co-curricular culture that exists here. As a sophomore, I have taken courses that require a lot of time and dedication along with planning and critical thinking. The road to becoming a computer engineer is not an easy one, but the experienced faculty and staff members at GIKI are here to assist in every aspect. GIKI has continuously molded me for success in this fast-paced field. I believe the willingness of the professors to help us, not only in the areas pertinent to their class but also our endeavors outside of the classroom, makes me proud for the choices I've made.

SPECIALIZATION ELECTIVE COURSES

AI304 Advanced Statistics for AI (3 0 3): Review of probability and distributions, tests of hypothesis, types of errors, create and interpret data visualizations using the Python programming language and associated packages & libraries, apply statistical modeling techniques to data (i.e., linear and logistic regression, linear models, multilevel models, Bayesian inference techniques), apply and interpret inferential procedures when analyzing real data, understand importance of connecting research questions to data analysis methods.
Prerequisite(s):ES111
Specialization(s) : AI

AI309 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): AI202
Specialization(s): AI

CE317 Fundamentals of Parallel Processing (3 3 4): 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: CS311
Specialization(s): CE

CE318 Introduction to Digital Image Processing (3 0 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
Specialization(s): CE, DS

AI328 Introduction to Development Operations (3 0 3): Basics of Development Operations (DevOps), commonly used build tools, 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): AI, DS

CS323 Object Oriented Analysis and Design (3 0 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
Specialization(s): CS

CS326 Mobile Computing (3 0 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
Specialization(s): CS, DS

CS327 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: CS325
Specialization(s): CS

CS329 Fundamentals of 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

CE339 Introduction to 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

CS352 Introduction to 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): CS232
Specialization(s): CS, DS

CE361 Communication Theory (3 0 3): Introduction to modern analog and digital communication systems, Fourier analysis of

signals and systems, signal transmission, amplitude and angle modulation techniques, sampling theorem, PCM, DPCM, and delta

modulation, digital communication systems, principal of modern digital communication systems including M-ary communication, digital carrier and multiplexing, and emerging digital communication technologies.
Prerequisite(s):CE341
Specialization(s): CE

AI372 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): CS221
Specialization(s): AI

AI408 Cloud Computing (3 0 3): Introduction to cloud computing, techniques for building, deploying and maintaining images and applications, important APIs used in the Elastic Cloud Amazon and Azure, using cloud as an infrastructure for existing and new services, Opensource implementation, scalable clustering computational environments, building efficient applications, non-trivial issues of cloud, e.g., load balancing, caching, authorization management, distributed transactions etc., enterprise applications, cloud tools, RESTFul Web Services, Amazon Elastic Cloud, Azure, Google App Engine, etc.
Prerequisite(s): CS221
Specialization(s): AI

AI410 Data Mining (3 0 3): Introduction to data mining, related technologies – Machine learning, DBMS, OLAP, stages and techniques of data mining process, methods and applications of knowledge representation, data preprocessing, data cleaning, data transformation, data reduction, discretization, generating concept hierarchies, Weka 3 data mining system, filters, statistics and discretization in Weka, measures of interestingness, visualization techniques and experiments in Weka, 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, basic learning/mining tasks, inferring rudimentary rules: 1R algorithm, decision trees and rules in Weka, statistical (Bayesian) classification, Bayesian networks, instance-based methods (nearest neighbor), linear models, training and testing in Weka, estimating classifier accuracy, combining multiple models (bagging, boosting, stacking), Minimum Description Length Principle (MLD), clustering, partitioning methods: k-means, expectation maximization (EM), hierarchical methods: distance-based agglomerative and divisible clustering, Cobweb, text mining: extracting attributes, structural approaches (parsing, soft parsing), Bayesian approach to classifying text, web mining: classifying web pages, extracting knowledge from the web, and data mining software and applications.
Prerequisite(s): AI231
Specialization(s): AI

CS411 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

CE412 Fundamentals of Systems Programming (3 3 4): 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 and FIFOs, single and multiple reader/writers, semaphores, shared memory and message-queues, sockets, attributes and addressing schemes, multiple client connections, connectionless socket communication.
Prerequisite(s): CS311
Specialization(s): CE

CS412 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

CS413 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

CS414 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

CS416 Introduction to 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

CS418 Digital Image Processing (3 0 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
Specialization(s): CS

CS419 Applied Image Processing (3 0 3): Review digital image processing, advanced image recognition topics like texture analysis and fractal analysis, advanced segmentation techniques using fractal dimension, clustering, watershed transform, medial axis transformation, 2D to 3D rendering, 3D visualization, stereo imaging, medical imaging applications, and signal image processing techniques.
Prerequisite: CE318/CS418
Specialization(s): CE, CS

AI420 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): CS221
Specialization(s): AI, CE, CS

CS420 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): AI, CE

CE421 Advanced Computer Architecture (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, interconnection networks.
Prerequisite(s): CE324/CS324
Specialization(s): AI, CE, CS

CS421 Human Computer Interaction (3 0 3): The human, computer and interaction, usability paradigm and principles, introduction to design basics, HCI in software process, design rules, prototyping, evaluation techniques, task analysis, universal design and user support and computer supported cooperative work, introduction to specialized topics such as groupware, pervasive and ubiquitous applications.
Prerequisite(s): CS325
Specialization(s): CS

CS422 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
Specialization(s): CS

AI423 Advances in Object-Oriented Analysis and Design (3 0 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
Specialization(s): AI, DS

CE423 General Purpose Computing with GPU (3 0 3): Graphics Processing Units (GPU) for computer graphics and gaming, general parallel computation, assessing performance of parallel algorithms on GPUs, measuring the speedup over similar CPU algorithms, applications of signal processing, neural networks, etc., programming techniques for GPUs, NVIDIA's parallel computing language, CUDA programming model and syntax, GPU architecture, high performance computing on GPUs, parallel algorithms, CUDA libraries, applications of GPU computing, performance optimization and specific GPU applications, e.g., Machine Learning computations.
Prerequisite(s): CE324/CS324
Specialization(s): AI, CE, CS

CS423 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

AI425 Fundamentals of Microprocessor Interfacing (3 0 3): Introduction to 16-bit microprocessor, software model, addressing modes, instruction set, assembly language

programming, hardware model, 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): CS324
Specialization(s): AI

CS425 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
Specialization(s): CE, CS, DS

AI426 Introduction to Mobile Computing (3 0 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
Specialization(s): AI, CE

CS426 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 and standards, quality planning and quality 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
Specialization(s): CS

CS427 Software Design and Architecture (3 0 3): Overview of SDLC, engineering design vs. software design, design heuristics and principles, reusability, metrics and quality of design, frameworks, and architectures, framework development approaches, service-oriented architectures, middleware architectures, design patterns, architectural patterns, design issues for distributed and real-time software, re-engineering and reverse engineering.
Pre-requisites: CS325
Specialization(s): CS

CS428 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
Specialization(s): CS

CS429 Software Project Management (3 0 3): Project management processes and phases, resource identification, software size estimation, budgeting and costing, project planning and scheduling, customer relationship management, technical resource management, configuration management, outsourcing, team selection, risk management, software process management, process improvement framework, software release management.
Prerequisite(s): CS325
Specialization(s): CS

CE432 Digital Communication (3 0 3): Sampling and time-division multiplexing, baseband digital signals and systems; coded pulse modulation, error control coding, digital modulation systems, information measure and source encoding, and introduction to spread spectrum communications.
Prerequisite(s): CE341
Specialization(s): CE

CS432 Advanced Databases (3 0 3): Design of data models, recently developed protocols to guarantee consistency of databases, the design of physical models, and performance analysis techniques, algorithms and data structures such a B-trees, transposed files, phantom files, and hybrid structures, distributed databases and database machines, object-oriented databases concepts.
Prerequisite(s): CS232
Specialization(s): AI, CS

CS433 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

CS435 MIS & DSS (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

CS437 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

CS438 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

CS439 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): AI, CS

CE444 Simulation and Modeling (3 0 3): Analysis of physical systems and industrial processes, formulation in the form of mathematical equations or inequalities, mathematical models,

solution of models, use of computers for design, optimization and control of actual systems in engineering.
Prerequisite(s): MT201
Specialization(s): CE

AI452 Techniques of 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): AI231/CS351
Specialization(s): AI, CE

CS452 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

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.
Pre-requisites: CS221
Specialization(s): AI, CE, CS

CS454 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.
Pre-requisites: CS311
Specialization(s): CS

CS458 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.
Pre-requisites: CS311
Specialization(s): AI, CS

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): CS311
Specialization(s): CE

CS463 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.
Pre-requisites: CS311
Specialization(s): AI, CE, CS

CE465/EE424 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, libraries, utilities for high level description, data flow description, timing and delays, modeling techniques.
Prerequisite(s): CS222
Specialization(s): CE

CS465 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

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 Specialization(s): CE

CS472 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

AI473 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
Specialization(s): AI

CS474 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.
Prerequisite(s): CS121
Specialization(s): AI, CE, CS, DS

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
Specialization(s): CE

CS476 Computational Biology (3 0 3): Algorithmic and machine learning foundations of computational biology, combining theory with practice, principles of algorithm design for biological datasets, and analyze influential problems and techniques, analyzing real datasets from large-scale studies in genomics and proteomics, Genomes: biological sequence analysis, hidden Markov models, gene finding, RNA folding, sequence alignment, genome assembly, networks: gene expression analysis, regulatory motifs, graph algorithms, scale-free networks, network motifs, network evolution, evolution: comparative genomics, phylogenetics, genome duplication, genome rearrangements, evolutionary theory, rapid evolution.
Prerequisite(s): CS221
Specialization(s): AI, CE, CS, DS

MANAGEMENT ELECTIVE COURSES

CS436 Operations Research (3 0 3): Optimization and computational efficiency in automated decision systems, art of modeling, mathematical modeling, linear programming and simplex method, duality theory and sensitivity analysis, transportation algorithm and its variants, advanced topics in linear programming, e.g., goal programming, integer programming, probabilistic models, e.g., queuing systems, simulation modeling, etc.
Prerequisite(s): MT201
Specialization(s): AI, CE, CS, DS

CS491 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
Specialization(s): AI, CE, CS, DS

CS492 Network Security & Cyber Ethics (3 0 3): Cybercrime landscape, morality, ethics, technology, value, cyberspace infrastructure, anatomy of the security problem, enterprise security, information security protocols, best practices, security and privacy in online social networks, security in mobile system, security in the cloud, security and compliance.
Prerequisite(s): none
Specialization(s): AI, CE, CS, DS

Wardah Shakeel BS (AI)

The decision of joining GIK has not only been difficult to make but also the one that I have never regretted. GIK Institute had a lot more to offer than only academics. Little did I know, my life had taken a turn for the better.

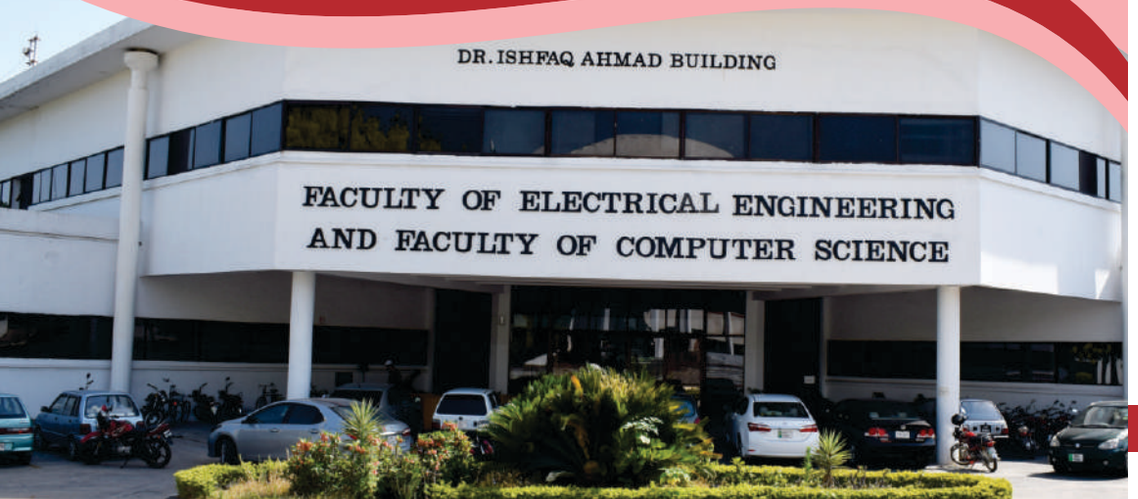
I have found this place to be a perfect amalgamation of academics, a vibrant social culture and co-curriculars nonetheless. When it comes to grooming this place has it all. Whether it is the gruelling academics or the society you are part of, there always is a learning element present. Every day here is a new challenge, one harder than before and sometimes it can be overwhelming. In such a short time, this place has shaped me into a person who is more confident, decisive and independent. I would say that choosing GIK for AI has turned out to be the best decision. From guidance by the finest instructors and mentors to receiving the best facilities for this every course, I have learned so much already and look forward to absorbing meaningful knowledge and skills in coming years.

GIK has given me so much in such a short time. Experience here is one of its kind. I am all set and braced to live and experience more of what this place has in store for me!

FACULTY OF ELECTRICAL ENGINEERING

Thrust Areas

- **Communication Systems and Digital Signal Processing**
- **Microelectronics & ASIC Design**
- **Electric Power**
- **Control Systems**



Faculty

Nisar Ahmed - PhD, ICSTM, London, UK
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Ziaul Haq Abbas - PhD, University of Agder, Norway
Adnan Noor - PhD, University of Manchester, UK
Husnul Maab - PhD, QAU, Islamabad, Pakistan
Arbab Abdur Rahim - PhD, Politecnico di Torino, Italy
Shahid Alam - PhD, Chalmers University of Technology, Sweden
Hadeed Ahmed Sher - PhD, King Saud University, KSA
Ahmad Kamal Hassan - PhD, King Abdulaziz University, KSA
Memoon Sajid - PhD, Jeju University, South Korea
Dur-e-Zehra Baig - PhD, UNSW, Sydney, Australia
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Akrama Khan - PhD, University of Cape Town, South Africa
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Mohsin Hassan - BS, GIK Institute, Pakistan
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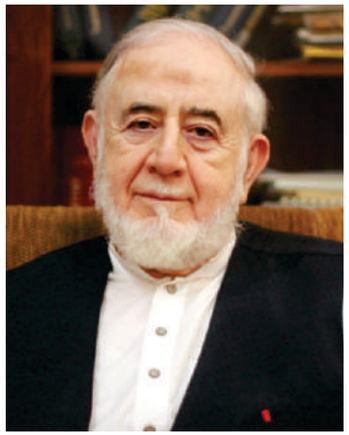
Israr Ullah - MS, UET, Peshawar, Pakistan
Ahsan Nadeem - MS, COMSATS, Pakistan
Rahmat Ullah - MS, COMSATS, Pakistan
Atif Mehmood - MS, IUB, Bahawalpur Pakistan
Mujtaba Ghous - MS, NUST, Pakistan
Irfan Ullah - MS, GIK Institute, Pakistan
Anam Hanif - MS, Mirpur University, AJK, Pakistan
Amna Irshad - BS, UET, Lahore, Pakistan
Muhammad Zakir - BS, UET, Peshawar, Pakistan
Ubaid ur Rehman - BS, UET, Peshawar, Pakistan
Sana Khan - BS, UET, Lahore, Pakistan
Tauqir Ahmad - BS, UET, Peshawar, Pakistan
Hamed Khan - BS, UET, Peshawar, Pakistan
Zarak Jamal Khattak - BS, UET, Peshawar, Pakistan
Jawad Ali - BS, UET, Peshawar, Pakistan
Danyal Afgan Khan - BS, UET, Peshawar, Pakistan
Muhammad Hani Mazaheri - BS, IST, Islamabad, Pakistan.

Personal Secretary to Dean

Ikram Ullah - MA, Gomal University, Pakistan



Dean

Muhammad Akbar
PhD, University of Tokyo, Japan

Electrical Engineering:

Electrical Engineering (EE) is one of the oldest disciplines of engineering. Initially, it was confined to a few areas such as power generation, transmission and distribution; radio communication and wireless telephony. However, in the last few decades, it has seen as tremendous growth and expansion in some new areas. The diversification and expansion in new areas of Electrical Engineering have been of such a large magnitude that each area seems an independent discipline in its own. These include Electronic Engineering, Power Engineering, Telecommunication Engineering, Computer Engineering, Information Technology, and Control Systems. However, in a large part of the world, Electrical Engineering is still considered to be a mother discipline.

Electrical Power Engineering is an important and vital discipline in Pakistan due to present scenario of power sector facing shortfall of required energy needs. The main aim of this discipline is not only to study existing methods of power generation, transmission and distribution but also to study the new ways of power generation involving renewable and sustainable technologies. The Electrical Power Engineering Program covers a broad range of activities and evolving issues that are of great importance in the field of sustainable and smart power systems.

With the turn of the century, we have entered into a new era of micro and nano-fabrication technologies. With the new methods of chip design at nano scale, system-On-Chip has enabled the integration of millions of devices in small sized chips, thus exponentially enhancing capabilities offered by the electronic devices. Other micro-fabrication technologies related to the fields such as Micro-Electro-Mechanical Systems (MEMS), are now reaching a point of being able to contribute in a similar manner.

The immense development in the field of microelectronics has generated an ever-increasing demand of electronic and electrical engineers, modern engineers are expected to cope not only with the development in traditional fields like communications, robotics, digital signal processing, power and control systems but are also required to possess relevant knowledge and theoretical understanding of the emerging areas like biomedical instrumentation, security, surveillance and biometrics.

Keeping in mind the latest requirements of the national and international job markets and research trends, Faculty of Electrical Engineering has designed an updated curriculum offering high-quality courses. The program of study enables electrical engineering (EE) students to lead the teams of future young engineers in diverse working environment and to practically realize their innovative ideas. The faculty also provides students with the opportunity to learn as how research is carried out.

Undergraduate Program

The Faculty offers a four-year degree program through courses that are modular in nature and are evenly distributed across eight regular semesters. The theoretical knowledge obtained in the classroom is reinforced through laboratory work. These laboratories, which support more than 70% of the courses, are equipped with the latest pedagogical tools to illustrate important concepts, and provide their practical demonstration. The students can opt for one of the following streams:

- Electronic Engineering
- Power Engineering

Program Educational Objectives (PEOs)

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

1. Competent Engineer: Capable of demonstrating knowledge by innovating, criticizing, and finding solutions of real-world problems pertinent to the field of electrical engineering.

2. Skillful Manager: Capable of communicating, leading, making judgements, creating a collaborative environment, establishing goals, planning tasks and meeting objectives.

3. Responsible Individual: Appreciative of social needs with considerations of ethical, environmental, and global factors.

Program Learning Outcomes (PLOs)

There is a set of twelve Program Learning Objectives (PLOs) of Electrical Engineering which describe as what students are expected to know/perform/attain by the time they graduate.

These twelve PLOs are set such that delivery of each course encompasses them. These PLOs are described as follows:

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

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

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.

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.

5) Modern Tool Usage:
Ability to create, select and apply appropriate techniques, resources, and modern engineering and IT tools, including prediction and modelling, to complex engineering issues, with an understanding of the limitations.

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 practices and solution to complex engineering problems.

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.

8) Ethics:

Ability to apply ethical principles and commit to professional ethics and responsibilities and norms of engineering practice.

9) Individual and Team Work:

Ability to work effectively, as an individual or in a team, on multifaceted and /or multidisciplinary settings.

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.

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.

12) Lifelong Learning:

Ability to recognize importance of, and pursue lifelong learning in the broader context of innovation and technological developments.

Career in Electrical Engineering

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

- Communication and Digital Signal Processing
- Microelectronics and ASIC Design, and
- Electric Power, and
- Control System

These areas have been selected keeping in mind the current and future requirements of Pakistan. The first, Communication and Digital Signal Processing, is the key to the global information revolution. The second, Microelectronics and ASIC Design, targets the heart of the computer revolution, and encompasses issues related to the theory, fabrication and design of high speed, dense integrated circuits. The third, Power and Control, has special relevance to Pakistan given the level of investment in the power sector, and wide-spread applications of control systems in industry. Choosing this degree course does not restrict choice of careers. In the past, our graduates have been employed in areas as diverse as power, telecommunications, computer networks, industrial control, and VLSI/ASIC design. A significant number of graduates have opted to pursue advanced studies in the US and Europe.

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 up with the 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 to practical use. Major laboratory facilities are summarized below:

Electrical Workshop Practice

In this lab, student get a hands-on experience with the hardware tools and electrical wirings. The lab contains 12 wiring stations, 20 soldering stations for experimentation. Moreover, software experimentation is carried out on 36 computer systems in computer lab. Each student experiences use of drill machine, hack saw, multimeter, hardware tools and PCB fabrication equipment. Since the students work with the electrical wiring, safety measures are strictly followed under the supervision of lab instructor

Wave Propagation and Antennas Lab

This lab contains microwave training systems, antennas, waveguides, and transmission line demonstrators suitable for the study of generation, propagation, and reception of microwave signals. This lab is used for practical experimentation pertaining to wave propagation & antennas and microwave engineering courses.

Electric Machines Lab

In this laboratory, students augment their concepts about the fundamentals behind working of transformers and the rotating machinery. The laboratory is equipped with single and three-phase transformers, induction motors, synchronous generators and motors, DC generators and motors, DC and AC power supplies, electrical and mechanical loads, and a number of test and monitoring equipment such as watt-meters, power-factor meters, voltmeters, ammeters and frequency meters. The students also learn practically the synchronization of two electricity networks and the power flow between them.

Digital Logic Design Lab

This lab is for the understanding of fundamental digital logic related concepts and contains 30 sets of oscilloscopes, digital trainers, digital multi meters (DMMs), function generators and support accessories. Starting with simple universal NAND/NOR gates, the students learn to design and implement different combinational as well as sequential circuits taught in the corresponding theory class. Counter design using state machine and verilog basics are also included towards the end.

Analog Electronics Labs

There are two analog electronics laboratories in the faculty, equipped with over 60 sets of oscilloscopes, trainers, power supplies and functional generators. The labs are used for the

courses of electronics devices and circuits, electronic circuit design and linear circuit analysis. The labs augment the theoretical knowledge, which the students acquire in theory classes. On the basis of experiments in these labs, the students not only verify their theoretical analysis but also learn about the limitations associated with the equipment, which are always there regardless of how sensitive and expensive the equipment is. The labs also help to enhance the students' knowledge in fundamental design concepts.

Communication Systems Lab

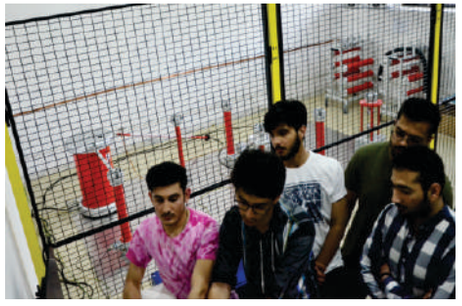
The faculty has a very comprehensive communication systems laboratory, which covers both the analog and digital communication systems. The central equipment of the lab is a set of training panels, which have built-in modules ranging from phase modulation to coding of digital data. The panels are equipped with 200 kHz function generators, noise generators and spectrum analyser modules to help set up various experiments. In addition to this, the lab is also equipped with universal u-controllers and computers. Telephone switching module and optical fibre transmitter and receiver trainers are also available.

Signal Processing Simulation Lab

This lab has 50 networked core i7 PCs with various kinds of software packages installed including Matlab, PSpice, Microsoft Office, ModelSim, Xilinx ISE. Matlab is used for running exercises in the courses of signals and systems, control systems, digital communication systems, digital signal processing and digital image processing. PSpice, a simulation tool for analysing electric and electronic circuit is used in the labs of linear circuit analysis, electrical network analysis and electronics devices and circuits. Matlab and PSpice are also used in the course of power electronics.

Linear Control System Lab

This laboratory offers a unique opportunity to familiarize students with Siemens S-7 1200 PLC programming, and modelling and analysis of LTI systems in MATLAB/Simulink. PLCs are embedded inside dedicated development kits with interconnected touchscreen HMI for real-time



monitoring of different applications. The development kits are interfaced with high-speed computing PCs, each having licensed TIA Portal programming platform for designing different ladder-logics. The kits having the selecting wiring enable students to configure the PLC for any application with ease and convenience. In addition, Linear Control Systems lab PCs are also equipped with MATLAB software with Control Systems Toolbox for analysis, modelling, and design of Linear Time Invariant Systems. Modelling and analyzing real LTI systems help demonstrate and give practical knowledge about different theoretical concepts studied in the control systems course. This helps solidify the background for robust control of available real-time systems in the lab, including DC motor speed control, DC motor torque control, magnetic levitation system, twin rotor MIMO system, inverted pendulum, and robotic arm.

Microprocessor Interfacing Lab

The intent of this laboratory is to provide an insight into a typical microprocessor and microprocessor-based system. The lab is equipped with trainer boards designed to provide comprehensive hands-on training, employing the latest state of-the-art technology. Easy PIC V8 microcontroller trainers with ISP and ICD options are used in this

lab. The lab follows a modular approach to teach microprocessor architecture and interfacing concepts along with its applications. In addition, the laboratory is also equipped with universal programmers for high-end controllers and advanced peripherals that can be interfaced with the controller in different applications.

ASIC Design Lab

This laboratory is equipped with VLSI and electronic design automation (EDA) tools, such as Xilinx, ModelSim, Leonardo spectrums, place and route tools, ISE web pack, Microwind and DCH. Altera and Quartus are available for ASIC design in HDL (Hardware description language), for simulation and synthesis. Moreover, the laboratory is equipped with a number of latest Xilinx/Altera FPGA development boards.

Electrical Measurement and Instrumentation Lab

This lab covers investigation of instruments, error types and characteristics of instruments, determination of dynamic behaviour of typical sensors, signal conditioning circuits such as DC and AC bridges, instrumentation amplifiers and filters, computer-based data and signal processing for different measurement systems.

Electrical Simulation Lab

This lab has 50 networked Core i7 PCs with various kinds of software packages installed; including Matlab, PSpice, Power World Simulator and Calculu. Matlab is used for running exercises in the courses of signals and systems, control systems, digital communication systems, digital signal processing, digital image processing, power system analysis and design and power distribution and utilization. PSpice, a simulation tool for analysing electric and electronic circuits is used in the labs of linear circuit analysis, electrical network analysis, and electronics devices and circuits. Power World Simulator is used for solving problems involving power flows. Calculux is used for luminance calculations in lighting systems.

Power Electronics Lab

Power electronics lab is equipped with the state-of-the-art instrumentation for design, simulation, layout, prototyping, and testing of switching/analog circuits. The experiments in the power electronics laboratory involve modeling, control, topologies, and integration of switching converters, inverters, single-phase and three-phase thyristor, power factor correction methods active power filters and power conversion for alternative energy sources.

Power Transmission and Energy Labs

The main focus of this lab is to introduce students with the state-of the art power transmission practices, connections and equipment. The lab consists of modern transmission and distribution trainers which give students a flavor of the power industry. This lab gives hands-on experience related to energy generation and power transmission.

Power Distribution and Utilization (PDU) Lab

Power distribution and utilization is one of the core courses of electrical engineering. The lab consists of power distribution trainers related to both radial and mesh systems, power factor correction; as well as modern energy metering devices, batteries, illumination and earthing systems.

Power System Protection Lab

This lab has the modern protection trainers to let students perform practical work in power system protection. The equipment includes, instrument transformers (CTs, PTs) of different ratios, microprocessor based relays, and a variety of circuit breakers in modular forms.

High Voltage Engineering Lab

The laboratory is equipped with a single-stage HV kit capable of generating AC, DC and Impulse voltage up to 150 kV. The students are given the opportunity to extend their theoretical knowledge obtained in the lectures by conducting experiments. The experiments can be performed in small groups of 3-5 students under the guidance of an instructor. The idea of conducting experiments independently and in a responsible manner is particularly important with regard to the student adherence to safety measure for protecting personnel and equipment. The first part of experiments is basic in nature dealing with the generation and measurement of high voltage AC, DC and impulse. The second part of experiments relates to insulation breakdown procedure of solid, liquid & gaseous insulation systems simulating practical situations in real life condition (under voltage stress).

Accreditation

The Degree of Bachelor of Science in Electrical Engineering is accredited by the Pakistan Engineering Council (PEC), the regulatory body of engineering education.

Course Work Requirements

A student must complete the following courses as per details given in Table a-g:

(a) General Education Requirements (54 Credit Hours)

Course Titles	Course Code	Credit Hour
Basic Engineering	PH103, PH104, PH103L, CH101, CH161, MM103, MM141L, ME102, ME231/MM211/ES331	16
Computing	CS101, CS101L, CS102L, EE222, EE421	8
English Language	HM101, HM102	6
Humanities	HM211, HM321, HM322	9
Management	MS490	3
Mathematics	MT101, MT102, MT201, MT203	12

(b) Core Requirements (50 Credit Hours)

Course Titles	Course Code	Credit Hour
Electrical Workshop	EE101	1
Digital Logic Design	EE121	3
Linear Circuit Analysis	EE211	3
Electrical Network Analysis	EE212	3
Electrical Instrumentation and Measurements	EE213	2
Microprocessor Systems	EE221	3
Electronic Devices and Circuits	EE231	3
Probability Methods in Engineering	EE241	3
Electric Machines	EE311	3

Power Distribution and Utilization	EE312	3
Signals and Systems	EE341	3
Linear Control Systems	EE351	3
Electromagnetic Field Theory	EE371	3
Senior Design Project (Part-I)	EE491	3
Senior Design Project (Part-II)	EE492	3
Digital Logic Design Lab	EE121L	1
Linear Circuit Analysis Lab	EE211L	1
Electrical Instrumentation and Measurements Lab	EE213L	1
Microprocessor Systems Lab	EE221L	1
Electronic Devices and Circuits Lab	EE231L	1
Electric Machines Lab	EE311L	1
Signals and Systems Lab	EE341L	1
Linear Control Systems Lab	EE351L	1

(c) Specialization Requirement for Electrical Engineering (20*, 23 Credit Hours)**

Course Titles	Course Code	Credit Hour
Power Transmission**	EE313	2
Electronic Circuit Design*	EE331	3
Power Electronics	EE332	3
Communication Systems	EE361	3
Power System Analysis**	EE411	3
Power System Protection**	EE412	3
High Voltage Engineering**	EE413	3

Digital Signal Processing*	EE441	3
Wave Propagation and Antennas*	EE471	3
Power Transmission Lab**	EE313L	1
Electronic Circuit Design Lab*	EE331L	1
Power Electronics Lab	EE332L	1
Communication Systems Lab	EE361L	1
Power System Analysis Lab**	EE411L	1
Power System Protection Lab**	EE412L	1
High Voltage Engineering Lab**	EE413L	1
Digital Signal Processing Lab*	EE441L	1
Wave Propagation and Antennas Lab*	EE471L	1

* Electronic stream; ** Power stream

(d) Technical Elective for Electrical Engineering (09*, 06 Credit Hours)**

Course Titles	Course Code	Credit Hour
Power System Analysis*	EE411	3
Power System Protection*	EE412	3
Renewable Electrical Energy Systems	EE414	3
Electrical Machine Design and Maintenance	EE415	3
Electrical Machine Drives and Control	EE416	3
Special types of Electrical Machines	EE417	3
Introduction to ASIC Design	EE422	3
Digital Integrated Circuit Design	EE423	3
VLSI Design	EE424	3
Solid State Electronics	EE431	3

Industrial Electronics	EE432	3
Digital Image Processing	EE442/CS418	3
Introduction to Wavelets	EE443	3
Introduction to Robotics	EE451	3
Industrial Process Control	EE452	3
Digital Control Systems	EE453	3
Communication System Design and Performance Analysis	EE461	3
Computer Communication Networks	EE462/CE313	3
Cellular Mobile Communication Systems	EE463	3
Satellite Communication Systems	EE464	3
Antenna Theory and Design	EE472	3
Microwave Engineering	EE473	3
Radar Systems	EE474	3
Electrical Estimation Installation and Planning	EE481	3
Power Generation	EE482	3
Power Plant Engineering	EE483	3
Electrical Insulation Materials	EE484	3
Power Economics and Management	EE485	3
Power System Operation and Control	EE486	3
Power System Design	EE487	3

* Electronic stream; ** Power stream

(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 136 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	Chemistry for Engineers	2	0	2	None
	CH161	Occupational Health and Safety	0	3	1	None
	CS101	Introduction to Computing	2	0	2	None
	HM101	English Language and Communication Skills	3	0	3	None
	MT101	Calculus I	3	0	3	None
	PH103	Fundamentals of Mechanics	2	0	2	None
	PH104	Fundamentals of Electricity & Magnetism	2	0	2	None
	PH103L	Fundamentals of Mechanics Lab	0	3	1	None
	EE101	Workshop Practice	0	3	1	None
	CS101L	Computing Lab	0	3	1	None

	Course Code	Course Titles	Lec. Hrs	Lab. Hrs	Credit Hours	Pre-req
2nd Semester	EE121	Digital Logic Design	3	0	3	None
	HM102	Technical Report Writing	3	0	3	HM101
	ME102	Engineering Graphics	1	3	2	None
	MM103	Introduction to structure of Engineering Materials	2	0	2	None
	MT102	Calculus II	3	0	3	MT101
	CS102L	Intensive Programming Lab	0	3	1	None
	EE121L	Digital Logic Design Lab	0	3	1	None
	MM141L	Materials Lab I	0	3	1	None

* Electronic stream; ** Power stream

	Course Code	Course Titles	Lec. Hrs	Lab. Hrs	Credit Hours	Pre-req
3rd Semester	EE211	Linear Circuit Analysis	3	0	3	MT101
	EE231	Electronic Devices and Circuits	3	0	3	None
	HM211	Pak and Islamic Studies	3	0	3	None
	ME231	Thermodynamics I	3	0	3	MT101
	MT201	Differential Equations and Linear Algebra I	3	0	3	MT102
	EE211L	Linear Circuit Analysis Lab	0	3	1	None
	EE231L	Electronic Devices and Circuits Lab	0	3	1	None

	Course Code	Course Titles	Lec. Hrs	Lab. Hrs	Credit Hours	Pre-req
4th Semester	EE212	Electrical Network Analysis	3	0	3	EE211
	EE213	Electrical Instrumentation and Measurements	2	0	2	EE211
	EE221	Microprocessor Systems	3	0	3	EE121
	EE241	Probability Methods in Engineering	3	0	3	MT201
	EE222	Data Structures and Algorithms	2	0	2	CS101
	MT203	Complex Variables and Transforms	3	0	3	MT102
	EE213L	Electrical Instrumentation and Measurements Lab	0	3	1	None
	EE221L	Microprocessor Systems Lab	0	3	1	None

* Electronic stream; ** Power stream

5th Semester	Course Code	Course Titles	Lec. Hrs	Lab. Hrs	Credit Hours	Pre-req
	EE311	Electric Machines	3	0	3	EE212
	EE312	Power Distribution and Utilization	3	0	3	EE212
	EE331	Electronic Circuit Design*	3	0	3	EE231
	EE313	Power Transmission**	2	0	2	EE212
	EE341	Signals and Systems	3	0	3	EE212 MT201
	HM322	Cooperative law and Professional Ethics	3	0	3	None
	EE311L	Electric Machines Lab	0	3	1	None
	EE331L	Electronic Circuit Design Lab*	0	3	1	None
	EE313L	Power Transmission Lab**	0	3	1	None
	EE341L	Signals and Systems Lab	0	3	1	None

6th Semester	Course Code	Course Titles	Lec. Hrs	Lab. Hrs	Credit Hours	Pre-req
	EE332	Power Electronics	3	0	3	EE231 EE311
	EE351	Linear Control Systems	3	0	3	EE341
	EE361	Communication Systems	3	0	3	EE341
	EE371	Electromagnetic Field Theory	3	0	3	PH104, MT201
	HM321	Sociology and Human Behavior	3	0	3	None
	EE332L	Power Electronics Lab	0	3	1	None
	EE351L	Linear Control Systems Lab	0	3	1	None
	EE361L	Communication Systems Lab	0	3	1	None

* Electronic stream; ** Power stream

7th Semester	Course Code	Course Titles	Lec. Hrs	Lab. Hrs	Credit Hours	Pre-req
	EE441	Digital Signal Processing*	3	0	3	EE341
	EE471	Wave Propagation and Antennas*	3	0	3	EE371
	EE411	Power System Analysis**	3	0	3	EE212
	EE412	Power System Protection**	3	0	3	EE311
	EE/CS/ ES4xx	Technical Elective I	3	0	3	None
	EE441L	Digital Signal Processing Lab*	0	3	1	None
	EE471L	Wave Propagation and Antennas Lab*	0	3	1	None
	EE411L	Power System Analysis Lab**	0	3	1	None
	EE412L	Power System Protection Lab**	0	3	1	None
	EE491	Senior Design Project (Part-I)	0	9	3	None
	MS490	Engineering Economics & Management	3	0	3	None

8th Semester	Course Code	Course Titles	Lec. Hrs	Lab. Hrs	Credit Hours	Pre-req
	EE413	High Voltage Engineering**	3	0	3	EE312
	EE421	Programming Tools for Optimization	2	0	2	EE222
	EE413L	High Voltage Engineering Lab**	0	3	1	None
	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

* Electronic stream; ** Power stream

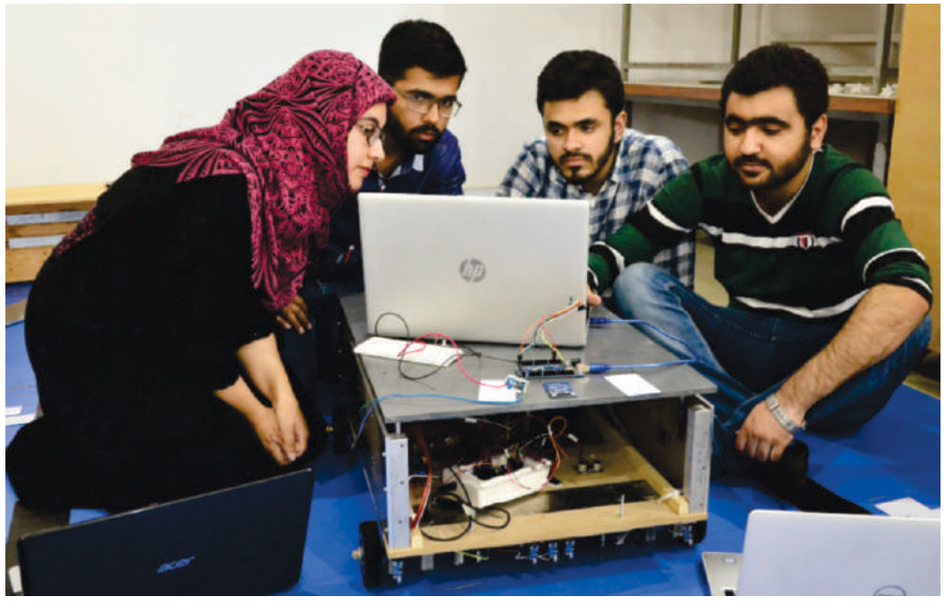
COURSE DESCRIPTION

EE101 Electrical Workshop Practice (031):
Introduction to various technical facilities in the workshop including mechanical and electrical equipment. Mechanical part includes machining of samples using lathe, milling, and filing. Electrical portion includes usage of tools, wiring regulations, types of cables and electric accessories including switches, plugs, circuit breakers, fuses etc.; symbols for electrical wiring schematics, drawing and wiring schemes, testing methods, two-way and three-way circuits and ringing circuits, voltage and current measurements. Soldering and soldering tools, methods and skills; PCB designing, transferring a circuit to PCB, etching, drilling and soldering component on PCB testing.

EE121 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): 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): PH102/PH104

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, Fourier analysis techniques.
Pre-requisite(s): EE211

EE213 Electrical Instrumentation and 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, oscilloscopes, signal generators, transducers, bridges, power and energy meters; temperature and other measurements.
Pre-requisite (s): EE211

EE221 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): EE121

EE222 Data Structures and Algorithms (2 0 2): 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

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 regualtors, 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 Probability Methods in Engineering (3 0 3):
Probability axioms, conditional probability, independence, probability mass function (PMF), cumulative distribution function (CDF), families of discrete random variables, expectations, functions of random variables, expectations of derived random, variance and standard deviation, conditional PMF, joint PMF, marginal PMF, joint expectation, joint conditional PMF, independent discrete random variables, more than two discrete random variables, continuous sample space, CDF of continuous random variable, probability density function (PDF), Gaussian distributions, delta functions and mixed random variables, PDFs of derived random variables, conditioning a continuous random variable, joint CDF, joint PDF,

marginal PDF, conditional PDF, independent continuous random variables, jointly Gaussian distribution, basic concepts of stochastic processes.
Pre-requisite(s): MT102

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 distribution system, characteristics and estimation of load, grounding and earthing, power factor and methods for its improvement, batteries and electrochemical processes, cathodic protection, heating and welding, fundamentals of illumination engineering: laws, units and terms used, types of lamps, their working and relative merit.
Pre-requisite (s): EE212

EE313 Power Transmission (3 0 3):
Percent and per-unit quantities, one-line diagram, HV, EHV and UHV systems, conductor types, resistance, skin effect, line inductance and capacitance, ferranti effect, short, medium and long transmission lines, traveling waves, surge impedance loading (SIL), mechanical design of transmission lines, corona effect, underground cables, modern trends in power transmission.
Pre-requisite (s): EE212

EE331 Electronic Circuit Design (3 0 3):
Multistage gain calculation , impedance matching for amplifiers, hybrid model of BJT, current sources, 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

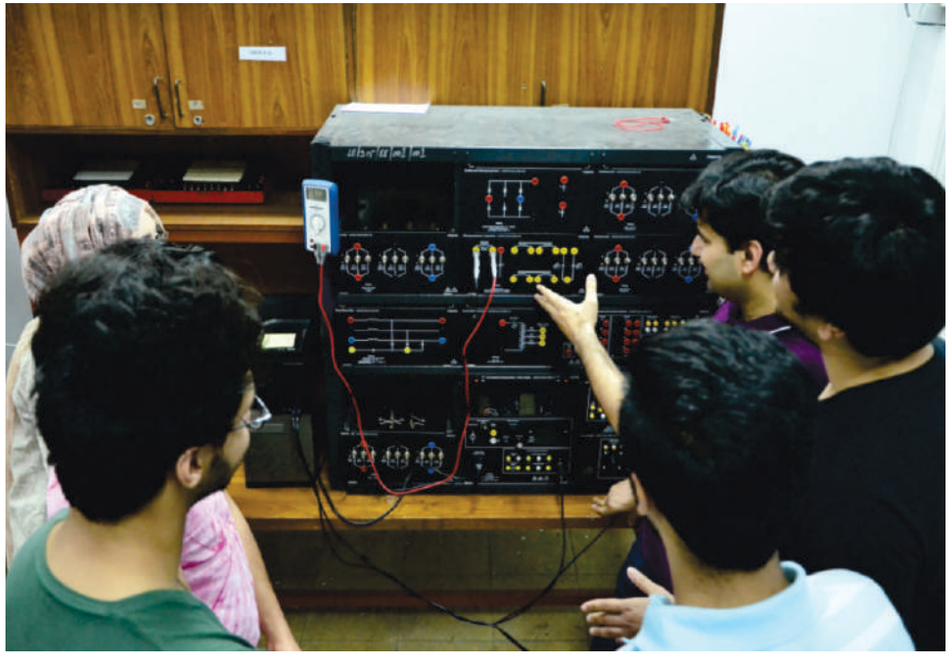
EE332 Power Electronics (3 0 3):
Introduction to power electronics, power electronic devices: diode, BJT, MOSFET, IGBT, SCR, rectifier circuits: single and three phase controlled and uncontrolled rectifiers, DC-DC converters: buck, boost, buck-boost and isolated converters: forward and flyback converters, 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): MT201, 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 side band, 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): PH104, MT201

EE411 Power System Analysis (3 0 3):
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): EE212

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, distance protection, differential protection of transformers, generator protection, bus bar protection, types and operation of relays and circuit-breakers, switch-gears.
Pre-requisite(s): EE311

EE413 High Voltage Engineering (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 standalone 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):

Part-A 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.

Part-B 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 Electrical Machine Drives and Control (Elective) (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

EE417 Special types of Electrical Machines (Elective) (3 0 3):
Construction and principles of special types of electrical machine, reference-frame theory, switched reluctance motors, stepper motors, theory of brushless dc machines, linearized machine equations, symmetrical and unsymmetrical 2-Phase induction machines,
Pre-requisite (s): EE311

EE421 Programming Tools for Optimization (2 0 2):
Linear programming, network programming, integer programming, stochastic programming, concepts of convexity, steepest gradient descend method for solving convex optimization problems.
Pre-requisite(s): EE222

EE422 Introduction to ASIC Design (Elective) (3 0 3):
Introduction to FPGA, ASIC technologies, design methodologies, 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): EE221

EE423 Digital Integrated Circuit Design (Elective) (3 0 3):
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: EE221, EE331

EE424 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 with respect to a number metrics: 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): EE231

EE431 Solid State Electronics (Elective) (3 0 3):
Introduction to semiconductor materials, 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, distributed control system in process industries, basic concepts of SCADA.
Pre-requisite (s): EE331, EE351

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, 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 Introduction to Robotics (Elective) (3 0 3):
Introduction to robotics, sensors, actuators and manipulators, introduction to computer programming for robotics, inverse kinematics, robot dynamics, robot control, trajectory planning, work-space considerations, obstacle avoidance.
Pre-requisite(s): EE351

EE452 Industrial Process Control (Elective) (3 0 3):
Introduction to process control, sensors and measurement systems, signal conditioning and processing, estimation of errors and calibration, analogue 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

EE453 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

EE461 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 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): EE241, EE361

EE462 Computer Communication Networks (Elective) (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 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, convergence of communication networks.
Pre-requisite(s): EE361

Shahzaib Nadeem

A gathering of students from diverse cultural background integrated with an energizing environment is what makes GIKI the finest learning destinations within the country. Living distant from home makes one feel imprisoned but the shoulders of strangers, before long transform into life-long companions, make living in GIKI a very special experience. The Faculty of Electrical Engineering lives up to its standards with immense theoretical and practical engagement providing a platform that keeps the students committed throughout the year. Extra-curricular activities organized by the student body is another exceptional quality of GIKI, which is unparalleled to any other university in Pakistan. GIKI teaches us how to live our lives while surviving at our highest potential. Memories of friends, all-nighters and birthday surprises will all be cherished as I strive on for more.

EE463 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-scale 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, EE471

EE464 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 space craft 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): EE371, EE361

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 striplines/coupled microstriplines, 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): EE471

EE474 Radar Systems (Elective) (3 0 3):

Basic principles, wave propagation near 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 Electrical Estimation Installation and Planning (Elective) (3 0 3):

The estimating process, components of electrical system, installation, protection circuits design and testing, planning:, system protection, low voltage switch boards and distribution system, grounding system, power factor correction and harmonic filtering, power cables, supply systems, electrical installation equipment and system.

Pre-requisite (s): EE312

EE482 Power Generation (Elective) (3 0 3):

Introduction and overview of conventional power generation, review of basic thermodynamics and thermal sciences, thermal and hydroelectric power plants, reservoir based and run of the river hydroelectric projects, introduction to renewable energy systems, solar photovoltaic, wind turbine systems, geothermal energy system, biomass energy harnessing, nuclear power plants,

sociological, political and economic aspects of conventional and non-conventional energy resources and sustainability analysis.
Pre-requisite (s): EE311, EE332

EE483 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 boiler, steam turbines types and efficiency, steam condensers, nuclear power plants, PWR and fast breeder reactors, hydro- electric power plant, reaction and impulse turbines, wind turbines and photo voltaics.
Pre-requisite (s): EE312

EE484 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

EE485 Power Economics and Management (Elective) (3 0 3):
Fundamentals of markets, modeling the consumers & producers, types of markets, spot market, forward contracts & markets, future contracts & markets, open electrical energy market, operation of the managed spot market. retailors of electricity market, unit commitment, brute force technique, priority order scheme, equal incremental cost criteria, power & cash flow, capacity payments, energy payments, consumer end tariff, models of competition. restructuring of power sector, role of power sector entities
Pre-requisite (s): MS291, EE312

Zunaira Faheem

GIKI is not just a mere academic institute. It is a whole world in itself. People ask us don't we get bored in the wilderness but the real question is do we even get time to think about getting bored with all the happenings around us? With a live in campus, GIKI challenges us to our limits with classes till late and then the real fun begins with the extracurricular societies. Ranging from technical to arts to literary it opens all doors to explore ourselves. The various societies channel our personalities in a way that shows us how to take academics side by side with the extracurricular, paving way for a future where we are not just stuck in a tiresome cycle of a 9-5.

EE486 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, hydro thermal coordination, voltage, power and frequency control, evaluation of the effect of speed change on droop characteristics, SCADA system.
Pre-requisite (s): EE311, EE351

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

EE491 and EE492 Senior Design Project (0 18 6):
The aim of the design project is 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 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 term 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.

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

EE/PE 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.

FACULTY OF ENGINEERING SCIENCES

THRUST AREAS

Semiconductor and Microelectronics

Photonics

Modeling and Simulation

Faculty

Muhammad Hassan Sayyad, PhD (Dublin City University, Ireland)
Jameel-Un Nabi, PhD (University of Heidelberg, Germany) (On Leave)
Ghulam Shabbir, PhD (University of Aberdeen, UK)
Habibullah Jamal, PhD (University of Toronto, Canada)
Sirajul Haq, PhD (University of Liverpool, UK)
Irgaziev Bakhdir, PhD (Moscow State University, USSR)
Muhammad Zahir Iqbal, PhD (Universitat Politècnica de Catalunya, Spain)
Muhammad Usman, PhD (Hanyang University, South Korea)
Tahseen Amin Khan Qasuria, PhD (GIK Institute, Pakistan)
Sakander Hayat, PhD (University of Science and Technology, China)
Asad Mahmood, PhD (Telecom Paristech, Paris, France)
Muhammad Tayyab, PhD (University of Turin and Polytechnic University of Turin, Italy)
Shafqat Ali, PhD (International School for Advanced Studies, SISSA, Italy)
Sheharyar Pervez, MS (Indiana University Bloomington, USA)
Shahid Ahmad, MS (University of Illinois, Urbana Champaign, USA)
Fahad Zulfiqar, MS (University of Sheffield, England)
Muhammad Saqib, MS (NUST, Pakistan)
Sibtul Hassan Shirazi MS (GIK Institute, Pakistan)

Faculty (on study leave for PhD)

Rahim Umer (Nanjing University of Aeronautics and Astronautics, China)
Taimoor Ali (University of Oxford, UK)
Naveed Ahmed Azam (Kyoto University, Japan)

Joint Faculty

Khasan Karimov, PhD (Physical Technical Institute S.-Petersburg, Russia)
S. M. Ahmed, PhD (University of Sheffield, UK)
Mohammad Akbar, PhD (Tokyo University, Japan)

Lab Engineers

Zain ul Abidin, BS (GIK Institute, Pakistan)
Muhammad Sadiq, BS (GIK Institute, Pakistan)
Fooqia Khalid Awan, BS (GIK Institute Topi, Pakistan)
Usama Javed, BS (GIK Institute Topi,, Pakistan)

Graduate Assistants

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Ihteram Ali, MS (Applied Mathematics) (GIK Institute, Topi, Pakistan)
Asim Ullah, MS (Applied Physics) (GIK Institute, Topi, Pakistan)
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Shamsul Arifeen, MS (Applied Mathematics) (GIK Institute, Topi, Pakistan)
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Saad Rasheed, BS – Hons (Physics), Abbottabad University of Science and Technology, Abbottabad (AUST)
Shazma Ali BS (Physics), COMSATS Institute of Information Technology

Dean

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

PS to Dean, FES

Muhammad Shafiq, MA English
(University of Peshawar, Pakistan)

Engineering Sciences:

Introduction

Faculty of Engineering Sciences, GIK Institute is a unique multidisciplinary engineering program in Pakistan, duly recognized by the Pakistan Engineering Council. This program offers flexible curricula in several interdisciplinary areas of concentration. It includes emerging fields of engineering and differs from traditional engineering disciplines of Civil, Electrical and Mechanical. All 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.

The vigorous growth of the photonic industries, lasers, semiconductor and microelectronics, instrumentation and simulation of systems has created a demand for engineers who can completely cope with the present and future demands of the modern industry. 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 as also discussed below.

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

Undergraduate Program: Faculty of Engineering Sciences offers specialization in three contemporary fields of engineering. These include Photonics, Semiconductor and Microelectronics and Modeling and Simulation. The Institute is the trend setter in establishing these programs within the country which is duly accredited by the Pakistan Engineering Council. Students are required to opt for the specialization in the third year (5th Semester) of their undergraduate degree plan. To complete the degree requirement, students must complete 17 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. Maximum efforts are made to induct equal number of students into the various streams. Following are the three specialization streams offered by FES:

- Modeling and Simulation
- Photonics
- Semiconductor and Microelectronics

Modeling and Simulation: Modeling and Simulation Engineering 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 when it comes to application or development of modeling and simulation technology. Generally, modeling and simulation engineering is a discipline of designing mathematical model of actual or theoretical physical systems executing the model on a computer and analyzing the execution output. Due to its dynamic nature, the modeling and simulation engineering field has tremendous potential for creating student interest in science, technology, engineering, and mathematics disciplines. Computer simulations are extensively

being used in aerospace industry, automobile systems, financial markets, environment systems and medical sciences. Students graduated in this discipline get attractive jobs opportunities in almost all industries including national and multinational sectors.

Modeling and Simulation is playing a vital role to solve problems from almost all domains. Most of the time an investment in Modeling and Simulation saves more than it costs. Modeling and simulation 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 and Simulation:

- 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).

Photonics: Photonics is located at the crossroads of natural sciences and engineering. Photonics encompasses the use of lasers from probing atomic media to laser treatment of living tissues and from laser cutting to design of laser guided missiles and much more. The Photonics Engineering stream labs are equipped with state-of-the-art facilities ranging from simple diode lasers to high power cutting lasers, optical communication systems to high precision spectrometers. The course contents have been designed to enable the students to gain an insight into the basic working, design, simulation, fabrication and testing of a wide range of photonic devices and systems, such as, optical fiber communication links, laser material processing, laser communication, solar cells, sensors, photodiodes, etc. Also, software tools are employed for the modeling and simulation of numerous photonic systems.

The 21st century will be the century of the photonics, as much as the 20th century was the century of the electronics. Photonics – the science of optical applications – is expected to have an even greater impact on society and industry throughout the world. Applications of photonics are ubiquitous. Included are all areas from everyday life to the most advanced science and engineering, e.g., light detection, telecommunications, information processing, photonic computing, lighting, metrology, spectroscopy, holography, medicine (surgery, vision correction, endoscopy, health monitoring), biophotonics, military technology, laser material processing, art diagnostics (involving InfraRed Reflectography, X-rays, Ultraviolet fluorescence, XRF), agriculture, and robotics.

Just as applications of electronics have expanded dramatically since the first transistor was invented in 1948, the unique applications of photonics continue to emerge. Economically important applications for semiconductor photonic devices

include optical data recording, fiber optic telecommunications, laser printing (based on xerography), displays, and optical pumping of high-power lasers. The potential applications of photonics are virtually unlimited and include chemical synthesis, medical diagnostics, on-chip data communication, laser defense, and fusion energy, to name several interesting additional examples.

• Consumer equipment: barcode scanner, printer, CD/DVD/Blu-ray devices, remote control devices.

• Telecommunications: optical fiber communications, optical down converter to microwave.

• Medicine: correction of poor eyesight, laser surgery, surgical endoscopy, tattoo removal.

• Industrial manufacturing: the use of lasers for welding, drilling, cutting, and various methods of surface modification.

• Construction: laser leveling, laser range finding, smart structures

•Aviation: Photonic gyroscopes lacking mobile parts.

•Military: IR sensors, command and control, navigation, search, and rescue, mine laying and detection.

•Entertainment: laser shows, beam effects, holographic, art.

•Information processing.

•Metrology: time and frequency measurements, range finding.

•Photonic computing: clock distribution and communication between computers, printed circuit boards, or within optoelectronic integrated circuits; in the future: quantum computing.

Career in Photonics: The job opportunities for those engineers who will graduate with expertise in photonics currently and during the coming decades are outstanding both in the national and international levels. B.S. degree in Photonic Engineering will enable students to analyze and design photonic systems for a broad set of innovative applications including:

• Atmospheric sciences
• Biomedical engineering
• Biophotonics
• Defense and Security
• Energy
• Instrumentation and measurements
• Materials and nanotechnology
• Microelectromechanical systems (MEMs)
• Nanophotonics
• Optical computing
• Optical image processing
• Optical networking and communications
• Photonic devices
• Simulation and modeling of photonic systems
• Synthesis of nanomaterials

According to a report by United Nations Industrial Development Organization (UNIDO) and the International Centre for Science and High Technology (ICS), the photonics engineers have great scope in establishing small and medium enterprises (SMEs). They will also be able to continue their education toward an MS or a PhD degree in Photonics and numerous other areas of modern optics, laser manufacturing, optoelectronics, photonics networks, software development, instrumentation & control, nanotechnology, biophotonics, optical image processing, medical photonics, computational photonics, etc.

•**Semiconductor and Microelectronics:**

Semiconductor and Microelectronics lie at core of electronics engineering, finding its application in modern electronics, communication systems, defense industry, automobile, medical diagnostic equipment, biomedical electronic and space industry. Semiconductor and Microelectronics is not only limited to the above-mentioned areas but it opens up interdisciplinary opportunities in the area of photonics, materials, chemicals, nanotechnology and micro-electromechnical systems MEMS. Semiconductor and Microelectronics is also a key to a sound understanding of nanotechnology, a developing technology which has potential to improve our quality of life in diverse ways, such as faster electronics, huge memory/storage devices. Semiconductor technology provides the state of art solutions to the photovoltaic technology for the economical production and storage of electricity. Organic semiconductor is another area which produces OLEDs, flexible displays, and a variety of multifunctional sensors. Semiconductor students can explore new horizons for the betterment of humanity and can upraise the standard of living by providing economical and efficient solutions to the problems.

Career in Semiconductor and Microelectronics:

BS degree in Engineering Sciences with major in semiconductor and microelectronics engineering will enable students to pursue their careers in all kind of electronic equipment manufacturing industry. They can excel in R&D of defense organizations (Space, Missiles and Communication etc.). Semiconductor and Microelectronics students can also pursue their careers in the renewable energy technologies (Solar, Wind, Tidal etc.) and can explore the job market of power electronics. This stream also provides the students with the option of pursuing interdisciplinary careers in the field of:

• Green Energy Technologies
• Biomedical engineering
• Telecom equipment manufacturing industry
• Instrumentation and measurements
• Defense and security
• Nanotechnology
• Environmental monitoring and sensing
• Microelectromechanical systems (MEMs)

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 having 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 apparatus (PASCO) and Variable "g" pendulum (PASCO). 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.

Teaching and Research Labs:

Faculty of Engineering Sciences has many teaching and research laboratories.

Teaching Labs:

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

Mechanics Lab: In this laboratory students perform the experiments related to the measurements, error analysis, vector properties, equilibrium, kinematics, and dynamics of translator motion, two-dimensional motion Work-Energy Theorem, rotational dynamics, and oscillations. The laboratory is equipped with various kits including Mechanics System Kit (PASCO), Air Track Kit (PASCO), Rotational Dynamics Kit (PASCO and PHYWE), Projectile Launcher (PASCO) Gravitational constant apparatus (PASCO), Free Fall apparatus (PASCO) and Variable "g" pendulum (PASCO).

Electricity and Magnetism Lab: This lab is meant for the relevant to professional engineering practice and understanding of the fundamentals and concepts related to Electricity and Magnetism. This Lab includes experiments related to electric charge, electric field, electric potential, DC circuits, magnetic field of current Faraday's law of induction, ferromagnetic materials, capacitance, inductance and alternating current etc. The laboratory is equipped with trainer boards, oscilloscopes, apparatus for magnetic moment (PHYWE), apparatus for magnetic force (PHYWE), apparatus for measuring e/m of electron (PASCO), Coulomb's law apparatus (PASCO), electric field apparatus (PHEWE), Magnetic field of a coil and solenoid apparatus (PHEWE), Faraday's law of induction apparatus and apparatus to study the magnetic properties of materials.

Fundamentals of Mechanics Lab In this lab students perform the experiments related to the fundamentals of mechanics such as kinematics including motion in one, two and three dimensions, rotational dynamics, etc.

Circuit Analysis Lab: This lab will give students the ability to analyze AC circuits and Analyze Variable-Frequency Network Performance, analyze circuits using Laplace Transform technique, analyze circuits using Fourier techniques and two port parameter concepts.

Logic Design Lab: This lab introduces to logic design and basic building blocks used in digital systems. A study of basic and complex digital logic circuit design, and their implementation. Circuit schematic development simulation of digital systems. Experiments explore designs with combinational and sequential logic. Students work through design activities, which include testing, implementing, troubleshooting, and a final lab project.

Computer Architecture Lab: 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.

Electronics I Lab: 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).

Microprocessor Interfacing Lab: 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.

Signals and Systems Lab: 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.

Introduction to Photonics Lab: 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, 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.

Characterization of Materials Lab: Students will perform material characterization using optical and thermal techniques such as Atomic Force Microscopy (AFM), ellipsometer etc. Display measured material characteristics using state-of-the-art modeling software. For optical characterization, students will be introduced to Michelson Interferometer Kit (EDU-MINT1/M), Polarization setup (Heliopan 48 mm), Diffraction Grating Spectrometer UV/VIS/NIR (Spectrometer Lamda-19) and optical devices such as Laser, LED. For thermal characterization, students will be essentially introduced to Differential Thermal Analyzer (Perkin Elmer DTA 7), Differential Scanning Calorimeter (Perkin Elmer DSC 7), Thermal Analysis Controller (Perkin Elmer TAC 7/DX).

Computer Simulation Methods Lab: 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.

Financial Engineering Models Lab: This lab will demonstrate Modeling the Term Structure, Simulating Stock Prices, Simulating Options and Option Strategies, Monte Carlo Methods, Monte Carlo Simulations for Investments, Monte Carlo Methods for Option Pricing

Instrumentation Lab: 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.

Semiconductor Devices Characterization Lab: The laboratory is an integral part of the modern curriculum in Faculty of Engineering Sciences. It allows students to apply what they have studied in Semiconductor Devices course. They learn how to find the properties related to Semiconductor Devices and explore the device fabrication. The experiments like resistivity measurement, conductivity type and carrier concentration are addressed. Students are given demonstrations on the photolithography machine. For characterization of the material, they are given demos on the SEM, EDS, XRD and Optical Microscopy. For the device fabrication they are given demos on Thermal Vacuum Evaporator and Spin Coater. Students are further given demos on probe station and Lock-in Amplifier for device characterization. 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.

Optics Lab: Laboratory experiments introducing

principles of optical waveguiding, fiber optic communications, optical network analysis, principles of lasers, optical modulators, WDM component characterization, modeling and simulation of photonic systems. The optics laboratory is currently engaged in numerous research projects in the fields of laser, photonics and optical technologies. Active research areas include free space laser communication, 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 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.

Research Labs:

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

Magnetism and Magnetic Materials Lab: Magnetism and magnetic materials laboratory is equipped with the High-Power vibrating sample magnetometer of Lakeshore. It can generate the power of 11 Tesla. This lab consists of a high-power magnet, power supply and a low temperature probe for measuring the magnetic behavior of the conducting and superconducting materials.

Thermal Analysis Lab: The thermal analysis laboratory has state-of-the-art equipment purchased from PerkinElmer including Differential Scanning Calorimeter (PerkinElmer DSC-7), Differential Thermal Analyzer (DTA-7), Thermal Gravimetric Analyzer (TGA-7) and Dynamic Mechanical Analyzer (DMA-7). This equipment can be used to investigate the kinetic parameters and change of mass and mechanical properties of various materials with temperature. Moreover, the equipment has direct application for the product development in the paper ceramic, polymer, rubber, glass, and paint industries.

Spectroscopy Lab: Spectroscopy laboratory houses PerkinElmer Fourier Transform Infrared Spectrometer (FTIR System 2000) and UV/VIS/NIR (Spectrometer Lamda-19). Facilities are available for the spectroscopic analysis of liquid, solid and gaseous sample in transmission as well as reflection mode. The equipment has direct application in environmental studies, chemical biochemical and pharmaceutical industries.

Organic Electronics Research Lab: The laboratory has so far produced eight PhDs and several MS students in the investigation of organic semiconductors, conducting polymers and nanoparticles of organic semiconductors for potential applications in organic electronic and photonics devices. The facilities are available for the fabrication and characterization of organic electronic and photonic devices, such as, junction diodes, sensors, etc.

High Power LASER Research Lab: The high-power laser lab at the faculty of engineering sciences is currently engaged in research projects in the fields of laser ablation, laser micromachining and laser materials processing. The laboratory facilities include a Quantel Brilliant B high power Q-switched Nd:YAG Laser of energy of 950 mJ at its fundamental wavelength of 1064 nm.

Advance Photovoltaics Research Labs: The Faculty of Engineering Sciences, GIK Institute is home to the four state-of-the-art Advance Photovoltaics Research Laboratories including:

- Dye-sensitized solar cell fabrication laboratory
- Solar cell I-V and C-V characterization laboratory

- Solar cell transient photo-voltage and photocurrent characterization laboratory
- Laboratory for the design and simulation of molecular systems for efficient solar energy harvesting

The labs were established for the development of next generation solar cell technology and computational design of molecular systems for efficient harvesting of solar energy as part of the collaborative research project entitled "New Approaches for Lower Cost, Longer Stability, and Higher Efficiency of Dye-Sensitized Solar Cells (DSSCs)" between the Faculty of Engineering Sciences, Ghulam Ishaq Khan Institute (GIKI) of Engineering Sciences and Technology and Department of Electrical Engineering, Center for Advanced Photovoltaics, South Dakota State University (SDSU), Brookings, USA under the Pakistan-U.S. Science and Technology Cooperation Program Phase V.

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.

Computational Physics Lab: Study of our universe is by no means an easy task. The complex astrophysical phenomena involved make the problem incredibly challenging and indeed know how of basic sciences, engineering, modeling and simulation is the minimal requirement for a better understanding of our Universe. The nucleosynthesis problem (r, s, p and rp-process), evolution phases of stars and supernova explosions are few astrophysical phenomena that require microscopic calculation of weak interaction rates at high temperatures (of the order of billions of kelvin) and high densities (of the order of 10^{11} g/cm^3). Besides, we also need calculation of other input data before we can run the mega codes on supercomputers to model these phenomena.

The Computational Physics, Modeling and Simulation (CPMS) group is part of a world-wide effort to microscopically calculate the inputs for these simulation and modeling codes. The group is mainly concerned with the calculation of nuclear data. The results are then forwarded to collaborators running the simulation codes. Various nuclear models (e.g., QRPA, shell model, IBM, FRDM) are employed to calculate the inputs. Numerical techniques, computer programming and understanding of various physical phenomena are few keywords of the CPMS Group. More than 25 graduate students have so far done/currently doing their MS/PhD thesis work in CPMS Group. The number of international collaborations (including USA, Europe, and Egypt) is more than 20.

Accreditation: The BS Degree Program in Engineering Sciences is accredited by the Pakistan Engineering Council.

Coursework Requirements

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

(a) General Education Requirements (52 Credit Hours)

Course Titles	Course Codes	CH
Basic Engineering	MM101, MM141, CH161, ME102, ME101, MM102	10
Computing	CS101, CS101L, CS102	04
English Language	HM101, HM102	06
Humanities	HM211, HM321, HM322	09
Mathematics	MT101, MT102, MT201, ES202, ES304	15
Sciences	PH101, PH102, PH101L, PH102L	08

(b) Core Requirements (55 Credit Hours)

Course Titles	Course Codes	CH
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 Interfacing	ES314	3
Microprocessor Interfacing Lab	ES314L	1
Signals and Systems	ES332/CS341	3
Signals and Systems Lab	ES332L/CS341L	1
Fluid Mechanics	ES333/ME321	3
Numerical Analysis	ES341	3
Engineering Electromagnetics	ES371	3
Instrumentation	ES451	3
Instrumentation Lab	ES451L	1
Semiconductor Materials and Devices	ES462	3
Senior Design Project Part-I and II	ES481/ES482	6

(c) Inter-Faculty Electives (At Least 06 Credit Hours)

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

(d) 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.

(e) 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	Introduction to Computing	2	0	2	None	CS101L
	CS101L	Computing Lab	0	3	1	None	None
	HM101	English and Study Skills	3	0	3	None	None
	ME101	Workshop Practice	0	3	1	None	None
	MM101	Chemistry for Engineers	2	0	2	None	None
	MT101	Calculus I	3	0	3	None	None
	PH101	Mechanics	3	0	3	None	PH101L
	PH101L	Mechanics Lab	0	3	1	None	None

	Course Code	Course Titles	Lec. Hrs	Lab. Hrs	CH	Pre-req	Co-req
2nd Semester	CSE102	Intensive Programming Lab	0	3	1	CS101	None
	HM102	Technical Report Writing	3	0	3	HM101	None
	ME102	Engineering Graphics	1	3	2	None	None
	MM102	Introduction to Engineering Materials	3	0	3	None	None
	MM141L	Material Lab I	0	3	1	None	MM101

	Course Code	Course Titles	Lec. Hrs	Lab. Hrs	CH	Pre-req	Co-req
2nd Semester	MT102	Calculus II	3	0	3	MT101	None
	PH102	Electricity and Magnetism	3	0	3	PH101	PH102L
	PH102L	Electricity and Magnetism Lab	0	3	1	PH101L	None

	Course Code	Course Titles	Lec. Hrs	Lab. Hrs	CH	Pre-req	Co-req
3rd Semester	ES211/EE211	Circuit Analysis I	3	0	3	MT101	MT201
	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	MT102	NONE
	HM211	Pakistan and Islamic Studies	3	0	3	NONE	NONE
	MT201	Differential Equations and Linear Algebra I	3	0	3	MT102	NONE

	Course Code	Course Titles	Lec. Hrs	Lab. Hrs	CH	Pre-req	Co-req
4th Semester	ES202	Engineering Statistics	3	0	3	NONE	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
	ES221/CS211	Data Structure and Algorithms	3	0	3	CS112/CS102L	None
	ES231/EE231	Electronics I	3	0	3	ES211/EE211	None
	ES231L/EE231L	Electronics I Lab	0	3	1	None	ES211/EE211

Specializations (Streams):

1. Modeling and Simulation Stream

	Course Code	Course Titles	Lec. Hrs	Lab. Hrs	CH	Pre-req	Co-req
5th Semester	ES304	Linear Algebra II	3	0	3	MT201	None
	ES314/EE323	Microprocessor Interfacing	3	0	3	ES213	None
	ES314L/EE323L	Microprocessor Interfacing Lab	0	3	1	None	ES314/ EE323
	ES332/CS341	Signals and Systems	3	0	3	ES214/ EE212	None
	ES332L/CS341L	Signals and Systems Lab	0	3	1	None	ES332/ CS341
	ES342	Modeling Processes	3	0	3	MT201	None
	HM321	Sociology and Human Behavior	3	0	3	None	None

	Course Code	Course Titles	Lec. Hrs	Lab. Hrs	CH	Pre-req	Co-req
6th Semester	ES333/ME321	Fluid Mechanics	3	0	3	ES232	None
	ES341	Numerical Analysis	3	0	3	MT201	None
	ES344	Optimization Modeling	3	0	3		
	ES371	Engineering Electromagnetics	3	0	3	PH102, MT201	None
	HM322	Corporate Law and Professional Ethics	3	0	3	None	None
	XX3XX	Interfaculty Elective	3	0	3	-	-

	Course Code	Course Titles	Lec. Hrs	Lab. Hrs	CH	Pre-req	Co-req
7th Semester	ES445	Computer Simulation Methods	3	0	3	ES344	None
	ES445L	Computer Simulation Methods Lab	0	3	1	None	ES445
	ES451	Instrumentation	3	0	3	ES211	None
	ES451L	Instrumentation Lab	0	3	1	None	ES451
	ES462	Semiconductor Materials and Devices	3	0	3	PH102	None
	ES481	Senior Design Project Part I	0	9	3	None	None
	MS4XX	General Management Elective	3	0	3	None	None

	Course Code	Course Titles	Lec. Hrs	Lab. Hrs	CH	Pre-req	CO-REQ
8th Semester	ES446	Heat Transfer and Modeling	3	0	3	ES202/ES342	None
	ES447	Financial Engineering Models	3	0	3	ES445	None
	ES447L	Financial Engineering Models Lab	0	3	1	None	ES447
	ES482	Senior Design Project Part II	0	9	0	None	None
	MS4XX	General Management Elective	3	0	3	None	None
	XX4XX	Interfaculty Elective	3	0	3	None	None

2. Photonics Stream

	Course Code	Course Titles	Lec. Hrs	Lab. Hrs	CH	Pre-req	Co-req
5th Semester	ES304	Linear Algebra II	3	0	3	MT201	None
	ES314/EE323	Microprocessor Interfacing	3	0	3	ES213	None
	ES314L/EE323L	Microprocessor Interfacing Lab	0	3	1	None	ES314/EE323
	ES332/CE341	Signals and Systems	3	0	3	ES214/EE212	None
	ES332/CE341L	Signals and Systems Lab	0	3	1	None	ES332/CS341
	ES334	Introduction to Photonics	3	0	3	PH102	None
	ES334L	Introduction to Photonics Lab	0	3	1	None	ES334

	Course Code	Course Titles	Lec. Hrs	Lab. Hrs	CH	Pre-req	Co-req
6th Semester	ES333/ ME321	Fluid Mechanics	3	0	3	ES232	None
	ES341	Numerical Analysis	3	0	3	MT201	None
	ES371	Engineering Electromagnetics	3	0	3	PH102, MT201	None
	ES376	Optical Engineering	3	0	3	ES371	None
	HM322	Corporate Law and Professional Ethics	3	0	3	None	None
	XX3XX	Interfaculty Elective	3	0	3	-	-

	Course Code	Course Titles	Lec. Hrs	Lab. Hrs	CH	Pre-req	Co-req
7th Semester	ES451	Instrumentation	3	0	3	ES211	None
	ES451L	Instrumentation Lab	0	3	1	None	ES451
	ES462	Semiconductor Materials and Devices	3	0	3	PH102	NONE
	ES471L	Optics Lab	0	3	1	ES334L	ES472
	ES472	Lasers Engineering and Applications	3	0	3	ES376	None
	ES481	Senior Design Project Part I	0	9	3	None	None
	MS4XX	General Management Elective	3	0	3	None	None

	Course Code	Course Titles	Lec. Hrs	Lab. Hrs	CH	Pre-req	CO-REQ
8th Semester	ES 474	Optoelectronics	3	0	3	ES376	None
	ES 475	Optical Communication & Computing	3	0	3	ES376	None
	ES482	Senior Design Project Part II	0	9	0	None	None
	MS4XX	General Management Elective	3	0	3	None	None
	XX4XX	Interfaculty Elective	3	0	3	None	None

3. Semiconductors 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	MT201	None
	ES314/EE323	Microprocessor Interfacing	3	0	3	ES213	None
	ES314L/EE323L	Microprocessor Interfacing Lab	0	3	1	None	ES314/EE323
	ES332/CS341	Signals and Systems	3	0	3	ES214/EE212	None
	ES332L/CS341L	Signals and Systems Lab	0	3	1	None	ES332/CS341
	ES361	Solid State Electronics	3	0	3	PH102	None
	HM321	Sociology and Human Behavior	3	0	3	None	None

	Course Code	Course Titles	Lec. Hrs	Lab. Hrs	CH	Pre-req	Co-req
6th Semester	ES333/ME321	Fluid Mechanics	3	0	3	ES232	None
	ES341	Numerical Analysis	3	0	3	MT201	None
	ES362	Characterization of Materials	3	0	3	None	None
	ES362L	Characterization of Materials Lab	0	3	1	None	None
	ES371	Engineering Electromagnetics	3	0	3	None	None
	HM322	Corporate Law and Professional Ethics	3	0	3	None	None
	XX3XX	Interfaculty Elective	3	0	3	None	None

	Course Code	Course Titles	Lec. Hrs	Lab. Hrs	CH	Pre-req	Co-req
7th Semester	ES451	Instrumentation	3	0	3	ES211	None
	ES451L	Instrumentation Lab	0	3	1	None	ES451
	ES462	Semiconductor Materials and Devices	3	0	3	PH102	None
	ES462L	Semiconductor Devices Characterization Lab	0	3	1	None	ES462
	ES463	Electronic and Magnetic Materials	3	0	3	ES361	None
	ES481	Senior Design Project Part I	0	9	3	None	None
	MS4XX	General Management Elective	3	0	3	None	None

	Course Code	Course Titles	Lec. Hrs	Lab. Hrs	CH	Pre-req	CO-REQ
8th Semester	ES465	Semiconductor Devices and Applications	3	0	3	ES462	None
	ES466	Microelectronics Manufacturing Engineering	3	0	3	None	None
	ES482	Senior Design Project Part II	0	9	0	None	None
	MS4XX	General Management Elective	3	0	3	None	None
	XX4XX	Interfaculty Elective	3	0	3	None	None

Course Description

MT101 Calculus I (3-0-3): Functions of one variable, limits and continuity, differentiation of functions of one variable, properties of differentiable functions, differentials and linear approximation, maxima minima and curvature, applied optimization problems of functions of one variable, indefinite integrals and techniques of integration, definite integrals and fundamental theorem of calculus, applications of definite integrals, polar coordinates and polar curves, parametric functions and curves, conic sections and their parametric representations, properties of famous plane curves, algebra of complex numbers and some applications of complex numbers.
Pre-requisite(s): None

Mt102 Calculus II (3-0-3): Infinite sequences and series, convergence of infinite sequences and series, general properties of convergent sequences and series, tests of convergence, power series, Taylor's series, analytical geometry of three dimensions, planes and straight lines in space, quadric surfaces, functions of several variables, continuity of functions of several variables, partial derivatives and partial differentials, chain rule, directional derivatives and gradient, extreme values, Lagrange multipliers, applied optimization problems, double and triple integrals and their evaluation, cylindrical and spherical coordinates, applications of double and triple integrals, vector calculus including line and surface integrals, theorems of Green, Gauss and Stokes.
Pre-requisite(s): MT101

PH101 Mechanics (3-0-3): Motion in one dimension, motion in two dimensions, Newton's Law of motions, Newton's Law of universal gravitation, work and energy, conservation of energy, center of mass, conservation of momentum, collisions, static equilibrium of rigid body, conditions for static equilibrium, translation and rotation of rigid object, rotational kinetic energy, moment of inertia, angular momentum, conservation of angular momentum and oscillations.
Pre-requisite(s): None

PH102 Electricity and Magnetism (3-0-3): Coulomb's Law and electric field, Gauss's Law, electric potential, electrical energy and property of insulator, current and resistance, ohm's Law, conduction in semiconductors, energy and current in DC circuits, magnetic field, force on a current carrying conductor, Biot-Savart Law, Faraday's Law, self-induced emf's and self-inductance, energy transfer in LR circuits, mutual inductance, transformers, and Maxwell equations.
Pre-requisite(s): PH101

PH103 Fundamentals of Mechanics (2-0-2): This course covers the fundamentals of mechanics such as introduction to engineering mechanics problems, motion in one, two and three dimensions, Newton's Laws and its applications, momentum, rotational dynamics and kinematics, energy, and gravitation.
Pre-Requisite: None

PH104 Fundamentals of Electricity and Magnetism (2-0-2): This course covers the fundamentals of electromagnetism such as electrostatics, electric potential, Gauss's law, Ampere's law, Faraday's law, and electric circuits.
Pre-Requisite: Ph103

MT201 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, vector spaces, linear dependent and independent vectors, basis, eigenvalue and eigenvectors, first and second differential equations and their solution techniques, higher order linear differential equations, applications of differential equations, power series solutions and systems of linear differential equations.
Pre-requisite(s): MT102

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

ES202 Engineering Statistics (3-0-3): Review of set algebra and combinatorial analysis, sample space and events, axiomatic definition of probability, rules of calculation of probabilities, conditional probability and probability of the composite random events, independent experiments, discrete and continuous random variables, binomial, Poisson, multinomial, exponential and normal distribution, data analysis and descriptive statistics, introduction to inferential statistics, point estimation, methods of moments and methods of maximum likelihood, confidence intervals, tests of hypothesis, first and second types of errors, tests for mean, proportion and variance, chi-square and student's t-test.
Pre-requisite(s): MT101

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.
Pre-requisite(s): MT101, MT201 (co-requisite)

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

ES213 Computer Architecture (3–0–3): Review of Verilog HDL, registers and register transfers, memory basics, computer design basics, instruction set architecture, central processing units, input—output and communication and memory systems.
Pre-requisite(s): CS101, ES212

ES214 Circuit Analysis II (3–0–3): AC steady-state analysis, 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

ES221/CSE211 Data Structures and Algorithms (3-0-3): Fundamentals data structures: record, stack, list, queue, tree. Algorithms: sorting and searching. Graph theory.
Pre-requisite(s): CS101, ES221

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

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): MT102

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): MT201

ES314 Microprocessor 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

Mahnoor Atif (Batch 29 FES)

Coming to Ghulam Ishaq Khan (GIK) Institute was a dream come true. GIK Institute is one of the most prestigiuos institutes of engineering in Pakistan and I am honored to be part of their Engineering Sciences program. People from all over Pakistan come to GIK and, thus, I got to experience a diverse culture here which has helped me get a whole new perspective of things. GIK has enabled me to meet lots of new people and I've learnt a great deal from them. As they say the best education you get is outside the class and that's truly the case here at GIK. I didn't expect anything when I stepped into this, all I wanted to do was grow and learn day by day and I believe by the grace of Allah and my Mum and Dad's prayer, that is what's happening. The standard of GIK has been set very high due to the incredibly well qualified faculty and in my two years, so far, here I've been privileged to come across many great instructors. Their constant support and friendly nature make learning and asking questions quite easy. All in all, GIK is fun and a great place to study at. From the many events happening all year long to the breathtaking scenary, I can't be more happy of where I'm at right now in life.

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

ES332/EE341 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): ES214/EE212

ES333 Fluid Mechanics (3-0-3): Fluid flow theory, hydrostatics, dimensional analysis and similitude, pipe flows, flow requirement, open channels, fluid machinery and forces.
Pre-requisite(s): ES232

ES334 Introduction to Photonics (3-0-3): Introduction to photonics engineering, nature and properties of light, light sources and laser safety, basic geometrical optics, basic physical optics, lasers and applications, optical modulation and detection, integrated optics, nonlinear optics, optical waveguides and fibers, fiber optic telecommunication, optical sensors, organic/inorganic and hybrid photovoltaics, biophotonics, nanophotonics, and optical micro-electro-mechanical systems (mems).
Pre-requisite(s): PH102

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): MT201

ES342 Modeling Processes (3-0-3): Introduction to modeling, review of mathematics of modeling, continuous models and classic optimization techniques, non-continuous and discrete models, linear models and linear programming, simplex algorithm, modeling of basic engineering systems, translational and rotational systems, analysis of vibrations, basic components of electrical systems, series and parallel LRC circuits, modeling of experimental data, curve fitting to experimental data, interpolation and extrapolation, regression analysis and error analysis.
Pre-requisite(s): MT201

ES344 Optimization Modeling (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): ES202, ES342

ES361/EE333 Solid State Electronics (3-0-3): Introduction to semiconductor materials, basic structure and properties, carrier transport in semiconductor, pn-junction, metal-semiconductor transistors, metal-oxide semiconductor FET and bipolar transistors and

microelectronics.
Pre-requisite(s): PH102

ES362 Characterization of Materials (3-0-3): Electrical characterization techniques such as resistivity measurements, carrier and doping concentration measurements, mobility measurements, optical characterization techniques such as optical microscopy, ellipsometry, photoluminescence, Raman spectroscopy, scanning probe microscopy such as atomic force microscopy (AFM), chemical and physical characterization techniques such as electron beam techniques including scanning electron microscopy (SEM), transmission electron microscopy (TEM) and ion beam techniques such as secondary ion mass spectroscopy (SIMS).

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): PH102, MT201

ES376 Optical Engineering (3-0-3): Optical beams and resonators, laser dynamics and advance topics, principles of operation and applications of lasers, geometrical optics and wave optics, Fermat's principles, Fresnel's formulae for amplitude coefficients, reflected and transmitted energy, normal incidence, polarization by reflection, total internal reflection, principle of interference and diffraction.
Co-requisite(s): ES371

ES445 Computer Simulation Methods (3-0-3): Introduction to simulation, simulation and modeling, types and uses of simulation, continuous system simulation, simulation schemes, simulation of basic mechanical and electrical systems, transfer functions and their simulation, simulation of combination of systems, discrete event simulation, simulation of basic engineering problems of discrete nature, analysis of output data, simulation of stochastic systems, review of standard probability distributions, Monte-Carlo simulation, simulation

of random variates, simulation of deterministic and stochastic inventory problems, simulation and analysis of simple M/M/k queuing systems.
Pre-requisite(s): ES344

ES446 Heat Transfer and Modeling (3-0-3): Standard partial differential equations of heat transfer in two and three dimensions, transformation to cylindrical coordinates, general solution of heat equation under various boundary conditions, steady and transient heat conduction in solids, contact heat transfer in heterogeneous materials, heat transfer at phase transformation, free boundary problems and methods of their solutions, heat and mass transfer in low temperature plasma, applications to plasmotrons and electrical relays.
Pre-requisite(s): ES202, ES342

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): ES445

ES451 Instrumentation (3-0-3): Physical principles governing sensors and actuators,

classification of sensing devices and transducers, data acquisition principles using RS-232 and GPIB interface bases and review of the state-of-the-art transducers.
Pre-requisite(s): ES211

ES462 Semiconductor Materials and Devices (3-0-3):
Semiconductors and their preparation for engineering use, crystal structure, mobility, and electrical conductivity, measuring electrical conductivity, measuring electrical parameters of semiconductors, energy bands in solids, homogeneous semiconductor in thermodynamic equilibrium, amorphous semiconductors, the pn junction, semiconductors in optoelectronics, the photovoltaic effect, semiconductor devices, super conducting devices, power semiconductor devices and devices of the future.
Pre-requisite(s): PH102

ES463 Electronic and Magnetic Materials (3-0-3): Classification of materials according to magnetic properties. Origin of magnetic moments of atoms, theories of all types of magnetism, magnetization curves, hysteresis, magnetic domains, domain walls, methods of observation of domains, soft magnetic materials, hard magnetic materials, powder magnets, historical introduction to superconductivity, superconductors and type of superconductors, the Meissner effect, isotope effect, BCS theory and superconducting devices.
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): ES462

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): None

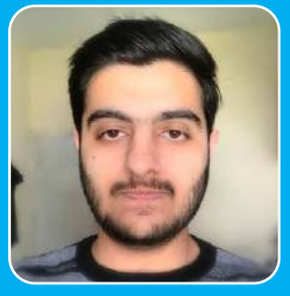
ES472 Lasers Engineering and Applications (3-0-3): Fundamentals of wave properties of light, energy levels, laser system, laser cavity, laser gain curve, laser types, laser properties, controlling laser radiation, industrial applications of laser such as laser cutting, drilling, welding, metrology applications such as, alignment, gauging, range finding, holography, laser beam communications, medical applications such as laser surgery, resurfacing, research applications such as laser plasma spectroscopy, LIBS, laser isotope separation and laser nuclear fusion.
Pre-requisite(s): ES376

ES474 Optoelectronics (3-0-3): Polarization, light propagation in an anisotropic medium, electro optic effects and devices, magnetooptic effect and devices, acousto-optics, integrated optics, optical MEMs, waveguide modulators, display devices, optical amplifiers, optical detection, noise in optical detection, photovoltaic devices, photonic switching, and organic optoelectronics. Pre-requisite(s): ES376

ES475/ EE473 Optical Communication and Computing (3-0-3): An overview of optical communications, principles of fiber optics, signal degradation in optical fibers, optical fibers, principles of fiber optic communication, modulation and multiplexing, fiber optic components, sources, photodetectors, transmitter and receiver design, optical multiplexers and demultiplexer, fiber optic communication system designing, optical networks, fiber optic measurement, optical computing. Pre-requisite(s): ES376

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 electronic engineering 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.

PH101L, PH102L, PH103L, ES211L, ES212L, ES213L, ES22L, ES314L, ES303L, ES441L, ES451L, ES471L (Laboratory courses, 1 Credit Hour each). The relevant course must be a co-requisite.



Talha Ejaz (Batch 29 FES)

I do not want to sound clichéd but my journey with Ghulam Ishaq Institute of Engineering Sciences and Technology has been really great, thus far. During these hard times of online classes, that we experienced firsthand, the faculty and the university staff proved to be helpful and a constant source of guidance. With no hesitation, they gave us all the extra help needed. Adapting to this new mode of learning was made easy for us without a doubt. During the first few months, getting used to semester system was a great challenge along with the hostel life. But soon I realized the foremost part of scoring good grades was consistency along with hard work and determination. Moving on to campus life, I was stretched and challenged. I pushed out of my comfort zone but at the same time it was doable! I found new friends. I joined the GIK Science Society which gave me a good deal of exposure, enhanced my learning curve, and gave me a platform to showcase my extracurricular talent.

FACULTY OF MATERIALS & CHEMICAL ENGINEERING

Thrust Areas

Materials Sciences and Engineering:

Materials Processing, Manufacturing and Characterization, Surface Engineering and Coating Technology, Nanotechnology and Nanomaterials, Advanced Materials, Ceramics, Polymers and Composites, Biomaterials, Corrosion and Degradation

Chemical Engineering

Process and Equipment Design, Fluid Handling and Thermodynamic behavior, Reaction Kinetics and Catalysis, Transport Processes.

Faculty

Fahd Nawaz Khan, PhD (University of Northumbria at Newcastle, UK)
Javaid Rabbani Khan, PhD (University of New Castle Upon Tyne, UK)
Fida Muhammad, PhD (University of California, USA)
Muhammad Imran Khan, PhD (University of Tsukuba, Japan)
Muhammad Shozab Mehdi, PhD (PIEAS, Pakistan)
Khurram Imran Khan, PhD (Politecnico di Torino, Italy)
Ramzan Abdul Karim, PhD (Politecnico di Torino, Italy)
Rashid Ali, PhD (University of Roma Tre, Italy)
Sajjad Hussain, PhD (University of Sao Paulo (USP) Brazil)
Muhammad Usman Farooq, PhD (University of Waterloo, Ontario-Canada)
Syed Zameer Abbas, PhD (GIK Institute, Topi)
Hammad Amjad Khan, PhD (Hanyang University, South Korea)
Shanza Rehan, PhD (University of Science and Technology, South Korea)
Muhammad Shirjeel Khan (University of Queensland, Australia)
Mohsin Ali Marwat (Huazhong University of Science & Technology, China)
Tauheed Shehbaz, MS (NUST, Islamabad)
Hafiz Muzammil Irshad, MS (KFUPM, KSA)
Imran Abbas, MS (University of Science and Technology, South Korea)
Asim Iltaf MS (GIK Institute, Topi)
Engr Ramesha Tariq, (UET Lahore)

Faculty on Study Leave

Engr Tahir Sattar
Engr Faraz Saeed Butt

Adjunct Faculty

Fazal Ahmad Khalid SI, DPhil (Oxford University)
Peter Humphrey Draper, PhD (Imperial, London)
Jawad Dar, PhD (QMUL) – City University London)
Tahir I. Khan, PhD (Cantob) – University of Calgary, Canada

Lab Engineers and Graduate Fellows

Sohail Khan, BS Engr (GIK Institute, Topi)
Waqas Afridi, BS Engr (GIK Institute, Topi)
Muhammar Umar Farooq BS Engr (GIK Institute, Topi)
Jalal Fida, BS Engr (GIK Institute, Topi)
Furqan Yousafzai, BS Engr (GIK Institute, Topi)
Murad Zahoor, BS (UET Lahore)
Hizbullah, (GIK Institute Topi)
Fazal Wahab, (GIK Institute Topi)

Graduate Assistants

Rida Batool Naqvi, MS (GIK Institute)
Waseem Shehzad, MS (UET Lahore)
Iqra Yasmeen, (MS COMSATS)
Muhammad Kamran Alam, (UET Peshawar)
Sundas Khushnood, (UET Peshawar)
Muhmmad Umar, (MS GIK Institute)
Munzar Badshah, (UET Peshawar)
Muhammad Awais (UET Peshawar)
Ateeq uz Zaman (GIK Institute)
Muhammad Usman (NFC Multan)
Talha Faizi (GIK Instititute)
Nishwana Tahir (NFC Multan)
Muhammad Arsalan Akhtar
Amina Bibi
Abdul Rafay

Dean

Fahd Nawaz Khan,
PhD (University of Northumbria at Newcastle, UK)

Personal Assistant to Dean FMCE

Mohajir Shah, MA Peshawar
Asad-ur-Rehman (PS to HOD)

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 graduate and postgraduate levels. FMCE employs highly qualified teaching faculty from the universities of international repute and state-of-the-art laboratories to provide students with a conducive learning experience. The faculty keeps a history of academic achievements, which is manifested by commitment to excellence in teaching and pursuance of high quality research addressing multidisciplinary challenges.

Faculty Mission

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

Department of Materials Science and Engineering

Mission Statement

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 Program

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 and 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.

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.

Undergraduate Program

The department offers a four-year BS in Materials Engineering degree program with specialization in Nanotechnology, or Manufacturing based on theory and laboratory work. The curriculum is specifically designed to commensurate with both the need of local industry and R & D organization

as well as keeping in view the emerging research trends abroad. 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, i.e., metals, ceramics, polymers and composites. Specialization tracks and combination of electives allow a student to develop a concentration in a particular area of materials. A sequence of two design courses in the senior year serves as a capstone design experience for the program.

The BS program in Materials Engineering has a very favourable student/faculty ratio and students have significant personal interaction with the faculty. Talented faculty with international qualifications has been hired and state of the art equipment like Atomic Force Microscope (AFM), Nanoindenter, Thermomechanical Analyzer, Simultaneous Thermal Analyser, Magnetron Sputtering Scanning Electron Microscope (SEM), X-ray Diffractometer (XRD), latest computerised Potentiostat and lab scale Electric Arc Furnace are available to provide practical hands on experience to support teaching and research in specialised areas of Nanotechnology and Manufacturing of materials. The faculty offers conducive environment for students to learn latest theories and develop practical skills in the labs. To sustain the quality of teaching, outcome-based education (OBE) system has been in place since fall 2014 and the engineering program curriculum has been updated to international benchmarks with collaboration of academia and industry representatives.

Program Educational Objectives (PEOs)

Graduates in Materials Science and Engineering will:

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 ethical and professional manner.

Program Learning Outcomes (PLOs)

The Learning Outcomes for the BS in Materials Engineering Program are listed below:

PLO-1: Engineering Knowledge

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

PLO-2: Problem Analysis

Students shall have the ability to identify, formulate, 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

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.

ASM-TMS International Student Chapter

The International Student Chapter of ASM-TMS at GIK Institute helps students in professional development and training. Its activities include organization of seminars, designing and publishing department newsletter, video shows, discussions and industrial visits.

Graduate Program (MS and PhD)

In addition to educating and training undergraduates, the faculty is actively involved in graduate programs leading to MS and PhD degree respectively. The title of graduate program is MS in Materials Engineering and it can be pursued in one of the following areas:

i. Materials Science and Engineering
ii. Nanotechnology and Materials Engineering

The graduate engineers with BS degree are enrolled to study at the MS and PhD levels in following research areas with a prescribed course work: Smart Materials, Advanced Coatings, Corrosion & Protection, Biomaterials, Composite Materials, Super Alloys, Functional Materials, Magnetic Materials, Superconducting Materials, Nanomaterials, Aerospace Materials and Failure Analysis of Materials.

Most of the students enrolled for MS and PhD program are financially supported by various sources including GIKI during their postgraduate studies. These students are required to complete the prescribed course work as well as demonstrate their research capability through independently conducted research.

Department of Materials Science and Engineering Laboratories

The department of Materials Science and Engineering houses following laboratories

1. Mechanical Testing Lab
2. Heat Treatment Lab
3. Melting and Casting Lab
4. Corrosion Lab
5. Non-Destructive Testing Lab
6. Metallography Lab
7. Scanning Electron Microscopy Lab
8. X-Ray Diffraction Lab
10. Thermal Analysis Lab
11. Polymer Lab
12. Thin film and Alloy Making Lab
13. Ceramics Lab
14. Atomic Force Microscopy Lab
15. Nanoindentation Lab
16. Computational Lab
17. Workshop and Welding practices Lab.

Careers in Materials Engineering

Majority 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 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.

Accreditation

The Department of Materials Science and Engineering offers a program leading to the Bachelor of Science in Materials Engineering degree that is accredited by the Pakistan Engineering Council PEC http://www.pec.org.pk

Course Work Requirements

For BS in Materials Engineering degree student must complete the following requirements as detailed in Table a-g.

(a) General Education Requirement (54 Credit Hours)

Course Title	Course Code	CH
Humanities/Social Sciences	HM101, HM102, HM211, HM322, HM321	15
Basic Engineering Courses	ME101, ME102, MS291, EE2 01, CH161	10
Mathematics	MT101, MT102, MT201 , ES202, ES341	15
Sciences	PH103, PH104, PH101L, CH101, MM104	10
Computer Science	CS101, CS101L, CS102L	4

(b) Core Requirement (50 Credit Hours)

Course Title	Course Code	CH
Introduction to Engineering Materials	MM102	3
Thermodynamics of Materials	MM231	3
Materials Evaluation Techniques	MM212	3
Phase Equilibria and Microstructures	MM232	3
Strength of Materials	MM222	3
Alloy Production	MM233	3
Crystallography & X-ray Diffraction	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
Materials Labs I to VII (Interactive sessions)	MM141L, MM242L, MM243L, MM344L, MM345L, MM446L, MM447L	8
Senior Design Project	MM481, MM482	6

(c) Specialization in Manufacturing (18 Credit Hours)

Course Title	Course Code	CH
Joining of Materials	MM351	3
Manufacturing Processes-I	MM352	3
Smart and Functional Materials	MM353	3
Manufacturing Processes-II	MM451	3
CAD/CAM	MM453/ME418	3
Entrepreneurship and Marketing	MS434	3

(d) Specialization in Nanotechnology (18 Credit Hours)

Course Title	Course Code	CH
Nanomaterials and Nanotechnology-I	MM391	3
Nanomaterials and Nanotechnology-II	MM392	3
Electronic and Magnetic Materials	MM393	3
Materials Characterization	MM494	3
Nanosystems and Devices	MM495	3
Nanotechnology for Energy	MM499	3

(e) Technical Electives (06 Credit Hours)

Course Title	Course Code	CH
Casting Design and Foundry Technology	MM416	3
Surface Engineering	MM436	3
CAD/CAM	MM453/ME418	3
Powder Metallurgy	MM454	3
Introduction to 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 Electives (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	MS4xx	3

(g) List of Laboratory Courses in Each Semester (08 Credit Hours)

Lab Code	Associated Course	CH
MM141L Materials Lab-I	MM102	1
MM242L Materials Lab-II	MM212, MM231	1
MM243L Materials Lab-III	MM232, MM233	1
MM344L Materials Lab-IV	MM323, MM324, MM334, MM391	2
MM345L Materials Lab-V	MM352, MM362, MM365, MM392, MM393	1
MM446L Materials Lab-VI	MM435, MM436, MM494	1
MM447L Materials Lab-VII	MM496, MM451, MM495, MM499	1

(h) Summer Internship (Pass/Fail Grade; 0 CH)

Every student is required to participate in 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 (134 CH)

For the award of BS degree in Materials Engineering, a student has to complete 134 credit hours.

BS Program in Materials Engineering: Semester-wise Degree Plan

	Course Code	Course Title	Lec. Hrs	Lab. Hrs	CH	Pre-req	Co-req
1st Semester	MT101	Calculus I	3	0	3	-	-
	PH103	Mechanics	2	0	2	-	-
	CS101	Introduction to Computing	2	0	2	-	-
	HM101	English and Study Skills	3	0	3	-	-
	CH101	Chemistry for Engineers	2	0	2	-	-
	PH103L	Mechanics Lab	0	3	1	-	-
	CS101L	Computing Lab	0	3	1	-	CS101
	ME101	Workshop Practice	0	3	1	-	-
	CH161	Occupational Health and Safety	1	0	1	-	-

	Course Code	Course Title	Lec. Hrs	Lab. Hrs	CH	Pre-req	Co-req
2nd Semester	MT102	Calculus II	3	0	3	MT101	-
	PH104	Electricity and Magnetism	2	0	2	PH103	-
	HM102	Technical Report Writing	3	0	3	HM101	-
	MM102	Introduction to Engineering Materials	3	0	3	-	-
	ME102	Engineering Graphics	1	3	2	-	-
	CS102L	Intensive Programming Lab	0	3	1	CS101	-
	MM104	Materials Chemistry	3	0	3	-	
	MM141L	Materials Lab I	0	3	1	MM102	-

	Course Code	Course Title	Lec. Hrs	Lab. Hrs	CH	Pre-req	Co-req
3rd Semester	MT201	Differential Equations and Linear Algebra I	3	0	3	MT102	-
	MM231	Thermodynamics of Materials	3	0	3	-	-
	MM212	Materials Evaluation Techniques	3	0	3	MM102	-
	EE 201	Applied Electrical Engineering	3	0	3	MT101	-
	MM242L	Materials Lab II	0	3	1	MM102	-
	HM211	Pakistan and Islamic Studies	3	0	3	-	-

	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	3	0	3	MM102	-
	MM243L	Materials Lab III	0	3	1	MM102	-
	ME201/ES202	Engineering Statistics	3	0	3	MT102	-
	MS291	Engineering Economics	3	0	3	-	-

Manufacturing Stream

	Course Code	Course Title	Lec. Hrs	Lab. Hrs	CH	Pre-req	Co-req
5th Semester	MM323	Crystallography and X-ray Diffraction	3	0	3	MM102	-
	MM324	Deformation & Fracture	3	0	3	MM222	-
	MM334	Heat Treatment and Processing	3	0	3	MM232	-
	MM344L	Materials Lab IV	0	6	2	MM102	-
	MM351	Joining of Materials	3	0	3	MM212	-
	HM321	Sociology and Human Behaviour	3	0	3	-	-

	Course Code	Course Title	Lec. Hrs	Lab. Hrs	CH	Pre-req	Co-req
6th Semester	MM352	Manufacturing Processes-I	3	0	3	MM324	-
	MM353	Smart and Functional Materials	3	0	3	-	-
	MM365	Polymers and Composites	3	0	3	MM102 & CH101	-
	MM362	Ceramics and Glasses	3	0	3	MM231	-
	MM345L	Materials Lab V	0	3	1	MM102	-
	ES341/CS342	Numerical analysis	3	0	3	MT201	-
	HM322	Corporate Law and Professional Ethics	3	0	3	-	-

	Course Code	Course Title	Lec. Hrs	Lab. Hrs	CH	Pre-req	Co-req
7th Semester	MM435	Corrosion Degradation and Protection	3	0	3	CH101 & MM231	
	MM453/ME418	CAD/CAM	2	3	3	ME102	
	MM4XX	MM technical elective	3	0	3	-	
	MS4XX	Management Elective	3	0	3	-	
	MM481	Senior Design Project I	3	0	3	-	
	MM446L	Materials Lab VI	0	3	1	MM102	

	Course Code	Course Title	Lec. Hrs	Lab. Hrs	CH	Pre-req	Co-req
8th Semester	MS434	Entrepreneurship and Marketing	3	0	3	-	
	MM451	Manufacturing Process-II	3	0	3	MM352	
	MS4XX	Management Elective	3	0	3	-	
	MM482	Senior Design Project II	3	0	3	-	
	MM4xx	MM Technical Elective	3	0	3	MM102	
	MM447L	Materials Lab VII	0	3	1		

Nanotechnology Stream

	Course Code	Course Titles	Lec. Hrs	Lab. Hrs	CH	Pre-req	Co-req
5th Semester	MM323	Crystallography and X-ray Diffraction	3	0	3	MM102	-
	MM324	Deformation & Fracture	3	0	3	MM222	-
	MM334	Heat Treatment and Processing	3	0	3	MM232	-
	MM391	Nanomaterials and Nanotechnology-I	3	0	3	-	-
	MM344L	Materials Lab IV	0	6	2	MM102	-
	HM321	Sociology and Human Behaviour	3	0	3	-	-

	Course Code	Course Title	Lec. Hrs	Lab. Hrs	CH	Pre-req	Co-req
6th Semester	MM392	Nanomaterials and Nanotechnology-II	3	0	3	MM391	-
	MM393	Electronic and Magnetic Materials	3	0	3	-	-
	MM362	Ceramics and Glasses	3	0	3	MM102	-
	MM365	Polymers and Composites	3	0	3	CH101 & MM102	-
	MM345L	Materials Lab V	0	3	1	MM102	-
	ES341/CS342	Numerical analysis	3	0	3	MT201	-
	HM322	Corporate Law and Professional Ethics	3	0	3	-	-

	Course Code	Course Title	Lec. Hrs	Lab. Hrs	CH	Pre-req	Co-req
7th Semester	MM435	Corrosion Degradation and Protection	3	0	3	CH101 & MM231	-
	MM494	Materials Characterization	3	0	3	MM102	-
	MM4XX	MM technical elective	3	0	3	-	-
	MS4XX	Management Elective	3	0	3	-	-
	MM481	Senior Design Project I	3	0	3	-	-
	MM446L	Materials Lab VI	0	3	1		-

	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 Elective	3	0	3	-	-
	MS4XX	Management Elective	3	0	3	-	-
	MM482	Senior Design Project II	3	0	3	-	-
	MM447L	Materials Lab VII	0	3	1	MM102	-

COURSE DESCRIPTION

CH101 Chemistry for Engineers (2-0-2):
Importance of chemistry for engineers, Mass spectrometry, Determination of atomic masses, Stoichiometry and chemical calculations, Balancing chemical equation using algebraic method, Standardization of solution for quantitative titration, Nano-chemistry, deposition of Thin films, CVD, PVD, Purification of silicon for chip making, Electrochemistry, Galvanic cells, Batteries, Corrosion control, Fossil fuels, Clean combustion of coal, Syngas from coal, Environmental chemistry, Photochemistry, Free radicals, Interaction of solar radiation with molecules in the atmosphere, Acid rain, ozone in the atmosphere, Urban smog, Treatment of Fresh water for domestic use and industrial use, treatment of waste water for conservation for safety of rivers.
Pre Req: Nil

MM102 Introduction to Engineering Materials (3-0-3):
Fundamentals of engineering materials, Crystal structures, imperfection and defects in solids, Diffusion and mass transfer, solutions and phase diagrams, metals and alloys, effects of stress on structure, mechanical properties, Introduction to engineering ceramics properties, processing and applications, polymers, metal/alloy and composites, Introduction to advanced materials and nanotechnology.
Pre Req: Nil

MM103 Introduction to Structure of Engineering Materials (2-0-2):
Introduction to Solids: Crystalline and Amorphous solids, Forces between atoms and Molecules, Fundamentals of crystal structure (FCC, BCC, HCP), Imperfections in crystals, Diffusion in solids (Fick's first law only), Mechanical properties of metals and alloys, Failure of metals: Fracture, fatigue, creep. Types of ceramics, Crystal structure (AX type only), polymers (Monomers, chain and condensation). Introduction to Composites.
Pre Req: Nil

MM104 Materials Chemistry (3-0-3)
Solutions, colloids, emulsions, surfactants, heating curves, lattice energy, intermolecular forces, solvents, ionic liquids, extraction of metals, 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 (3-0-3):
Evaluation and quality assurance, standard specifications of materials, objectives of materials testing and evaluation, Destructive testing of materials, tensile and compression test, bend test, Micro and macro hardness testing, Shear and torsion tests, Sheet metal testing, impact testing and fracture mechanics, fatigue testing, creep testing, Importance of non-destructive evaluation (NDE) of materials, Methods of NDE, visual inspection (VT), liquid penetrant test (LPT), radiographic examinations (RT), magnetic particles inspection (MPI), ultrasonic testing (UT), Advanced NDE techniques, Microscopy (OM, SEM, TEM, AFM).
Pre Req: MM102

MM222 Strength of Materials (3-0-3):
Normal and shear stress and strains in materials, Factor of safety, Stress concentration, Simple loading, tension, Torsion and bending, True stress & true strain, modulus of elasticity, elastic vs plastic behavior of a material, comparison of true strain & conventional strain. Deformation under axial loading, Stresses and deformation in circular shaft, Stresses in elastic range, Angle of twist, Shear force & bending moment diagram, Moment of a force & moment of inertia, Symmetric members in pure bending, Shear force and bending moment diagram, Design of prismatic beam for bending, Transformation of stress and strain, Principal stresses, Mohr's circle for plane stress, Failure theories and their application to failure analysis
Pre Req: Nil

Faculty of Materials and Chemical Engineering

MM231 Thermodynamics of Materials (3-0-3):
First law of thermodynamics, enthalpy, internal energy, Heat capacity, Relationship between heat and work, Reversible and irreversible processes, statistical interpretation of entropy, partition function and its use to derive expression for internal energy and entropy, Second law, entropy, Third law, Enthalpy and Gibb's energy changes, adiabatic flame temperature, Heat engines, refrigerators, heat pumps, Property relations, Maxwell relations, Gibbs and Helmholtz free energies, Vant Hoff's isotherm, Behaviour of gases, partial properties, behaviour of ideal and non-ideal solutions, chemical equilibria, activity/fugacity and chemical potential, Gas-solid equilibria, Ellingham diagrams, Phase equilibria (single and multicomponent systems), Gibbs phase rule.
Pre Req: Nil

MM232 Phase Equilibria and Microstructures (3-0-3): Solid solution, Gibbs phase rule, One-component diagram, Phase diagrams of isomorphous and eutectic systems, Microstructures development while slow and fast cooling, Eutectoid and peritectic reactions. Congruent phase transformations, Phase diagram and free energy, Iron–Iron Carbide phase diagram, Development of microstructures in iron-carbon alloy, Microstructure development during precipitation, Ternary phase diagrams, Kinetics of phase transformation, Homogenous and heterogeneous nucleation, Diffusional transformation and types, Military transformation, Diffusionless transformation characteristics, Military transformation, Diffusionless transformation characteristics
Pre Req: MM231

MM233 Alloy Production (3-0-3):
Casting, Pattern making and materials, types of patterns, Core making and materials, Testing and control of molding sands, Molding processes and materials, casting techniques, gating system design, Melting furnaces, Solidification of pure metal and alloys, Casting defects and inspection, Crushing and grinding, Concentration processes, Blast furnace, Steel and cast iron, Charge calculations and Ellingham diagram, Steel making processes, Non-ferrous metals Al, Ni, Ti, Cu, Mg
Pre Req: MM102

MM323 Crystallography and X-ray Diffraction (3-0-3):
Crystals and crystal systems, Construction of crystals and packing of layers, Introduction to X-rays, Safety precautions, Bragg's analysis of X-ray diffraction, Two-dimensional patterns, lattices and symmetry, Bravais lattices and crystal systems, Plane group symmetry, Point group symmetry, space groups, Quasi-crystals, Zone axis, Reciprocal lattices, Ewald's sphere construction, X-ray diffraction of polycrystalline materials, texture analysis, lattice parameter measurements, Indexing patterns, Identification of unknown

phases, Measurement of crystallite size, Measurement of internal elastic strains, Electron diffraction and its applications, The stereographic projection and its uses
Pre Req: MM102

MM324 Deformation and Fracture (3-0-3):
Types of stress-strain and flow curves, elastic and plastic deformations, Strain and stress tensors, Mohr's circle of stress and strain in 2D and 3D, Principal stresses and strains, Hydrostatic and deviator strain and stress components, Generalized Hooke's law, Anisotropy of elasticity, Crystallographic aspects of plastic deformation, Dislocation and its types, Mechanisms of deformation, Critical resolved shear stress, Strain hardening of single crystal FCC, Barriers to dislocation glide, Strengthening mechanisms, Creep and fatigue, Theories of fracture, Fracture toughness, Failure analysis, Fracture mechanics in stress corrosion. Characteristics of fracture observed in ductile and brittle material. The crack opening displacement approach and empirical methods for assessing crack propagation in thick sections.
Pre Req: MM222

MM334 Heat Treatment and Processing (3-0-3):
Fe-Fe_3C diagram, Transformation temperatures, kinetics of transformation, IT, CCT and TTT diagrams, interphase precipitation, divorced eutectoid structures, Formation mechanisms and morphologies of steel phases, Austenite grain size effect on phase diagram, effect of second phase particles, discontinuous grain growth, Annealing, normalising, quenching, austempering, martempering, HT defects and remedies, effect of quenching rates and quenching media, Hardenability, surface hardening processes and surface modification, HT processing of HSLA, dual phase and microalloyed steels, Stainless steels and tool steels.
Pre Req: MM232

MM351 Joining of Materials (3-0-3):
Joining types and forces involved, Joint stresses and efficiency, design aspects of joints, fastener types and their uses, Adhesive bonding, types, joints and forces, preparation and testing, Principles of soldering and brazing, types, fillers, fluxes, applications, joints and testing, Welding process, fusion and non-fusion welding processes, defects and tests, thermal cycles and effect of filler and environment, microstructure and defects in fusion, partially melted, and heat affected zones, Variant and hybrid joining processes.
Pre Req: MM212

MM352 Manufacturing Processes-I (3-0-3):
Manufacturing principles, Manufacturing and processing operation, Engineering materials: review and classification and properties of engineering materials in manufacturing, Forging, Rod and wiredrawing, tube drawing processes, Rolling, Forming methods, shearing, Extrusion; Drawing of rods, wires and tubes, Sheet metal forming, Machining of metals and alloys: Machining operations and machine tools and fluids,
Machining centers and turning centers, machining operations for special geometries, high-speed machining.
Pre Req: MM324

MM353 Smart and Functional Materials (3-0-3):
Shape memory materials, superelastic materials, magnetic shape memory alloys, photomechanical materials, self-healing materials, ferrofluids, piezoelectric materials, thermo-electric materials, magnetostrictive materials, functionally graded materials, chromogenic systems, electro-active polymers, temperature responsive polymers.
Pre Req: Nil

MM362 Ceramics and Glasses (3-0-3):
Silicates and clay minerals, powder making and characterization of powders, traditional ceramics-triaxial porcelain; raw materials processing, forming/shaping, glazing, sintering, RBS, SPS, HIPING and sintering kilns, refractories and their applications, silicon carbide, silicon nitride, sialon, boron nitride, bioceramics, piezo ceramics and biomimetics, cement, glass-ceramics and glasses, glass fibers and optical fibers, processing of glasses, heat treatment and testing of glasses, Characterization of ceramics.
Pre Req: MM102

MM365 Polymers and Composites (3-0-3):
Polymer types and application, polymerization and kinetics, molecular weight, structure and morphology, crystallization regimes, glass transition and melting point, mechanical properties, processing, Composite classification, applications, matrices and reinforcements, rule of mixtures, testing of composites, production of fibers, Production of MMCs, CMCs, PMCs, effect of structure on physical and mechanical properties, Production, properties and application of carbon-carbon composites, Mechanics of composites.
Pre Req: CH101 & MM102

MM391 Nanomaterials & Nanotechnology-I (3-0-3):
Introduction to Nano science 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 Req: Nil

MM392 Nanomaterials & Nanotechnology-II (3-0-3):
Nanotechnology and prospects for business and industry, Nano Materials Characterization Methods, Nano Fabrication Methods, nanometrologly, Nano electronics, Nano optics, Nano structure and nanofilms, Nanocatalysis, nanobiotechnology, biomimetics, Medical nanotechnology, environmental nanotechnology, societal implications of nanotechnology.
Pre Req: MM391

MM393 Electronic and Magnetic Materials (3-0-3):
Introduction to magnetic materials, Diamagnetism and paramagnetism, Ferromagnetism, Antiferromagnetism, Ferrimagnetism, Domains and the magnetization process, Soft magnetic materials, Hard magnetic materials, Electronic materials, Elementary Quantum physics semiconductors, Semiconductor devices, Packaging of devices/ Dicing/ Wire bonding.
Pre Req: Nil

MM435 Corrosion Degradation and Protection (3-0-3):
Corrosion engineering, corrosion environments and damage, corrosion classification, roles of corrosion engineer, electrochemical theory and thermodynamics of corrosion, Nernst equation,

Pourbaix diagrams, emf and galvanic series. Faraday law and corrosion rate determination. Electrode kinetics, polarization and types, Ohmic drop at electrolyte/metal interface, mixed potential theory, passivity. Corrosion failures, factors and corrosion and their prevention. Corrosion testing: salt spray/fog test, electrochemical corrosion testing, corrosion data analysis, Tafel extrapolation. Corrosion protection measures: cathodic/anodic protection, coatings and inhibitors, synergistic mixtures, design considerations Corrosion of ceramics and degradation of polymers
Pre Req: CH101 & MM231

MM 436 Surface Engineering (3-0-3):
TLK Model Surface Crystallography, Surface Point defects, Adsorption, Physisorption, and Chemisorption, Contact mechanisms (Hertz Theory), wear in tribo-contacts, Residual stresses, Friction surfacing, Cold gas spraying, Electrolytic and electrophoretic deposition, Electroless deposition. Anodizing, Phosphating, Nitrocarburizng, HVOF, Detonation gun, Plasma spraying, , CVD, PECVD, Hard coatings, PVD (Evaporation, Sputtering), (Thermionic ion plating, Arc evaporation, magnetron sputtering). Hard coatings, Hybrid processes, Thickness, Fracture, adhesion & scratch testing, Residual stress measurements, Surface acoustic wave spectroscopy, Impact Excitation.
Pre Req: MM102

MM451 Manufacturing Processes-II (3-0-3):
Component design for manufacturing, Non-traditional and non-conventional machining, Manufacturing operations, Group technology, Abrasive machining, Thread and gear manufacturing, Chemical machining,
Electro-chemical machining, Electric discharge machining, Laser jet machining, Electron beam machining, Hybrid machining operations, Sawing (band, circular, hacksaw), Flexible operations, Sawing (band, circular, hacksaw), Flexible Automation and industrial control technologies, Sensors and other control systems, Materials handling and identification processes, Storage and inventory, Quality control systems, SPC (statistical process control) and charts, Design and process planning, Agile manufacturing, Production volume and assembly techniques, Rapid Prototyping, Additive manufacturing, micro and nano fabrication, Lithography
Pre Req: MM352

MM453/ME418 CAD/CAM (3-0-3):
Introduction and history, Geometric modeling, Feature based design, CAD hardware and software, 2D and 3D graphics and transformations, assembly modeling and analysis, Concurrent engineering, axiomatic design, DFM, DFA, group technology, CE tools, Process Planning, manual, variant, generative and hybrid approaches, tolerance charts, Manufacturing planning and control, Cellular and JIT manufacturing, Numerical control, NC programming, CNC, DNC, Robotics, Computer-integrated manufacturing, Creo based lab sessions related to design, assembly and manufacturing.
Pre Req: ME102

MM454 Powder Metallurgy (3-0-3):
Production of metallic powders, Powder characterization techniques, Microstructure control in powder, Kinetics of solidification in powders, Powder handling and purity modification, Shaping and compaction, Sintering, Characterization of sintered components, finishing operations, structural and porous components, Cermets, Dispersion strengthened materials.
Pre Req: Nil

Momina Azhar (Sophomore)

Getting into GIKI was a dream come true for me. I still remember the excitement I had while packing for this new journey. As I saw the prestigious building, the labs, got to know the dedicated staff and made amazing friends, I knew that this was where I wanted to be, that this was the institute I wanted to graduate from.
The professionalism, the high-tech labs, the comfortable environment and the devoted teachers made me feel at home. I realized that one must work very hard in order to keep up with the fast pace and secure good grades and I felt that I was set on track.
As the days went, GIKI got more and more familiar. I felt myself settling into the routine of waking up early, walking to classes, adjusting to the mess routine, making notes, handing assignments, staying in the library for long hours to study. I got accustomed to the idea of quizzes at night. This was the GIKI life and it was the life for me.
Getting into GIKI was a blessing by Allah Almighty and I thank Allah every day.

MM455 Introduction to Finite Element Methods (3-0-3):
Mathematical modeling and its applications in thermal, structural and coupled analysis, General steps of the Finite Element Method (FEM), Applications and advantages of FEM, Computer programs for FEM analysis, Introduction of stiffness matrix, Boundary conditions, Potential energy approach, Use of ANSYS for problems, Global stiffness matrix, Comparison of finite element solutions to exact solution, Galerkins's residual method and its application, Axisymmetric elements and their use, Practical consideration in modeling, results interpretation, Plane stress and plane strain analysis, Thermal and structural stress analysis using ANSYS Multi-physics, Use of ANSYS optimization for structural optimization under thermal-structural coupled analysis, Introduction to Finite Difference Methods, use of SolidCast for casting simulation and mould design.
Pre Req: Nil

MM469-Automobile Engineering and Materials (3-0-3):
Introduction to Automobile Engineering (layout and components, engine, chassis frame and body, wheel and tyre etc.); Materials for consideration and use in automotive body structures, Historical perspective and evolving materials technology. Advanced materials for lightweight automotive structures (advanced steels, aluminium and magnesium alloys, polymers and composites etc.). Manufacturing and design of lightweight automotive structures (Vehicle architecture design and manufacturing; casting, forming and joining processes for automotive components). 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, Crystallite size by XRD, BET specific surface area, Laser confocal fluorescence microscopy, NSOM and STED, Electron

microscopy, SEM and types, TEM, Sample preparation techs, Ion milling, FIB, AFM and STM, Chemical spectroscopy of materials by XRF, EDX, XPS/AES, FTIR, Raman spectroscopy
Pre Req: MM102

MM495 Nanosystem 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, 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: MM102

MM497 Biomaterials (3-0-3):
Materials for biomedical applications, types of biomaterials, synthesis and fabrication, advanced alloys for production of hip joints, prostheses, and implants, surface properties and cells interaction, Hydroxyapatite (HA) surface coatings, dental materials, biocompatibility, Polymers and biocomposites for tissue engineering, next-generation biomaterials and emerging manufacturing technologies
Pre Req: MM102

MM499 Nanotechnology for Energy (3-0-3):
Nanotechnology in clean and renewable energies: Nanotechnologies in 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

Laboratory Courses:

MM141L Materials Lab-I (0-3-1): The complementary laboratory course to the MM102 lectures. Experiments and demonstrations to give a basic understanding of the structure and properties of materials and an introduction to their fabrication and testing.
Pre Req: MM102

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: MM102

MM243L Materials Lab-III (0-3-1):
Experiments concerning casting of different metallic materials and optical microscopic techniques for the study and evaluation of materials.
Pre Req: MM102

MM344L Materials Lab-IV (0-6-2):
Exercises concerning crystallography, and experiments demonstrating the use of XRD. Experiments designed to examine the effect of processing parameters and phase transformations on the properties of steels, alloys. Also includes experiments related to joining of materials using various techniques. Synthesis and characterization of nanomaterials is also a part of this lab course.
Pre Req: MM102

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: MM102

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: MM102

MM447L Materials Lab-VII (0-3-1): Experiments related to powder metallurgy, advanced materials, semiconductor and energy storage devices.
Pre Req: MM102

Asad Ali (Junior Year)

My passion for engineering and my dream to study in a reputable institute was fulfilled by my admission in GIK. Coming to GIK has been a life changer for me as I belong to Multan and never stepped out of my city before. GIK offers opportunities at every doorstep and an atmosphere that helps you grow. Faculty of materials is well-appointed with the cutting-edge technology and top-notch staff. Here the amount of work is large, but it is just the right amount to exploit our potential. The recent Pandemic has been tough, but it was well managed by the administration, so it did not hinder our studies. GIK has been encouraging students to be a part of societies which help improve management, leadership, and communicational skills. These experiences would be impactful and eternal for me.

Department of Chemical Engineering

Rapid commercialization of conventional and modern, man-made products gave birth to process industry. The dynamics of the industry requires group of highly trained professionals from almost all engineering disciplines. However chemical engineer organizes his/her coordination at the process plant and thus deemed as process brain. Such responsibility demands basic knowledge of all conventional trades of engineering in addition to in-depth knowledge of large-scale industrial dynamics. Continuous & safe process operation is an exclusive responsibility of this trade, in addition to design, problem investigation and troubleshooting. Well-versed chemical engineer, during his/her career, usually encounters a diverse field of application in thermodynamics dictating unit processes.

Department of Chemical Engineering is endeavouring to achieve excellence as per requirements of Outcome Based Education (OBE) system to enhance the capabilities of its graduates. The department offers a 4-years degree program in chemical engineering detailing basic principles & mathematics of process operations in the first two years. Third & final year deal with the advanced level of the trade closely selected to cope the industrial requirements.

The newly established laboratories are the prime feature, providing state of the art equipment. Most of the laboratories are designed having conventional features imitated by the more sophisticated and risk-free digital equipment. Experiments are designed to trigger the thinking of students and not just mere data logging.

Mission

The mission of the department of chemical engineering 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.

Careers in Chemical Engineering

Quality of modern living standards has encouraged the mass production of various utilities, necessities, and amenities. Since the birth of process & processing industry, after 18th century, there is a dramatic increase in its volume. Population trends and chain of never ending new/modern products ensures the growth in this sector. Furthermore, struggling third world countries like Pakistan are now focusing to process their raw materials in their own facilities. When it comes to realization, chemical engineers become an essential part of the team to chart the layout and erection of the new production line. Existing plants also require chemical engineers not only for supervising & ensuring their smooth operation but also for troubleshooting, demanding interaction between the engineers and scientists from various other fields. Resources at the faculty are designed to inculcate the necessary knowledge, practices and behavioural aspects into the graduates, prerequisites for the responsibilities of professional life. Chemical engineers find their utility in various industries including chemical & petrochemical, nuclear, energy, oil & gas, food, pharmaceutical, cosmetics, and in various defence sectors, in addition to emerging research fields. Furthermore, these engineers are equipped to collaborate with different resources at the plant including management, utility engineers and above all with the technicians and plant operators as they will be their observing eyes in the field.

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.

Program Learning Outcomes (PLOs)

There is a set of twelve Program Learning Outcomes (PLOs) of Chemical Engineering program which describe what students are expected to know/perform/attain by the time they graduate from Department of Chemical Engineering. The PLOs are given bellow:

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 analyse 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 tools, including prediction and modelling, to complex engineering activities, with an understanding of the limitations.

PLO-6: 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.

PLO-7: 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.

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.

Laboratories

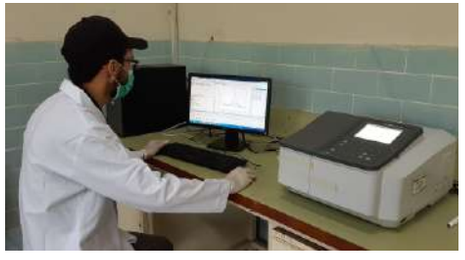
The Department of Chemical Engineering houses state of art labs of core chemical engineering courses, Industrial products quality testing labs, Particle Technology, Thermodynamics, Reaction Engineering, Heat and Mass Transfer Operations, Fluid Mechanics, Environmental Engineering, Instruments and Process Control, Process Simulation & Modelling and Mechanical Workshop.

AIChE-GIKI Student Chapter

The International Student Chapter of AIChE at GIK Institute helps students in professional development and training. Its activities include organization of seminars, video shows, discussions, and industrial visits.

Accreditation

The BS Degree in Chemical Engineering is accredited under level II, substantially equivalent to Washington Accord by the Pakistan Engineering Council (PEC).



Course Work Requirements

For BS in Chemical Engineering degree student must complete the following requirements as per details given in Table a-f.

(a) General Education Requirements (55 Credit Hours)

Course Title	Course Code	CH
Mathematics	MT101, MT102, MT201	9
Sciences	PH103, PH104, PH103L, CH101	8
Comp. System Eng.	CS101, CS101L, CS102L, ES341	7
Basic Engineering Courses	ME101, ME102, MM102, MM141L, ME201, MS291, EE213	16
Humanities/Social Sciences/Management	HM101, HM102, HM211, HM321, HM322	15

(b) Core Requirements (68 Credit Hours)

Course Title	Course Code	CH
Physical and Analytical Chemistry	CH102	3
Occupational Health and Safety	CH161	1
Inorganic and Organic Chemistry	CH201	3
Chemical Process Industries	CH211	2
Energy Engineering	CH212	3
Chemical Engineering Thermodynamics-I	CH214	3
Chemical Engineering Principles	CH231	3
Particle Technology	CH341	3
Heat Transfer	CH311	3
Mass Transfer	CH313	3
Chemical Engineering Thermodynamics-II	CH321	3
Reaction Kinetics and Reactor Design	CH322	3
Fluid Mechanics-I	CH241	3
Fluid Mechanics-II	CH342	2
Environmental Engineering	CH361	2
Simultaneous Heat and Mass Transfer	CH411	3
Transport Phenomenon	CH412	3
Instrumentation and Process Control	CH415	3
Process Modelling & Simulation	CH431	2
Chemical Engineering Plant Design	CH441	3
Chemical Engineering Labs	CH251L, CH252L, CH253L, CH351L, CH352L, CH353L, CH451L, CH452L	8
Chemical Engineering Project Design	CH481, CH482	6

(c) Technical Electives (06 Credit Hours)

Course Title	Course Code	CH
Food Technology	CH413	3
Petroleum Refinery Engineering	CH414	3
Pharmaceutical Engineering	CH417	3
Nuclear Engineering	CH418	3
Water Treatment & Purification	CH419	3
Enzyme Technology	CH420	3
Statistical Thermodynamics	CH421	3
Heterogeneous Catalysis	CH422	3
Piping Design	CH442	3
Environmental Impact Assessment	CH461	3
Fuel & Clean Technology	CH462	3
Industrial Waste Management	CH471	3
Biomaterials	MM497	3
Corrosion Degradation and Protection	MM435	3
Polymers and Composites	MM365	3
Nanomaterials & Nanotechnology	MM391	3

(d) Engineering Management Electives (06 Credit Hours)

Course Title	Course Code	CH
Maintenance Engineering & Industrial Management	CH371	3
Operation Management	MS492	3
Industrial Safety	MS493	3
Total Quality Management	MS494	3
Maintenance Management	MS495	3
Project Management	MS496	3

(e) 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.

(f) Total Requirement (135 Credit Hours)

Degree Plan

	No.	Course Titles	Lec. Hrs	Lab. Hrs	CH	Pre-req	Co-req
1st Semester	MT101	Calculus I	3	0	3	None	None
	PH103	Fundamentals of Mechanics	2	0	2	None	None
	CS101	Introduction to Computing	2	0	2	None	None
	HM101	English and Study Skills-I	3	0	3	None	None
	CH101	Chemistry for Engineers	2	0	2	None	None
	PH103L	Fundamentals of Mechanics Lab	0	3	1	None	PH103
	CS101L	Computing Lab	0	3	1	None	CS101
	ME101	Workshop Practice	0	3	1	None	None
	CH161	Occupational Health & Safety	1	0	1	None	None

	No.	Course Titles	Lec. Hrs	Lab. Hrs	CH	Pre-req	Co-req
2nd Semester	MT102	Calculus-II	3	0	3	MT101	None
	CS102L	Intensive Programming Lab	0	3	1	CS101	None
	PH104	Fundamentals of Elect. & Magnetism	2	0	2	None	None
	HM102	Technical Report Writing	3	0	3	HM101	None
	MM102	Introduction to Engineering Material	3	0	3	None	None
	ME102	Engineering Graphics	1	3	2	None	None
	CH102	Physical and Analytical Chemistry	3	0	3	None	None
	MM141	Materials Lab I	0	3	1	None	MM101

	No.	Course Titles	Lec. Hrs	Lab. Hrs	CH	Pre-req	Co-req
3rd Semester	MT201	Differential Equations & Linear Algebra I	3	0	3	MT102	None
	CH241	Fluid Mechanics-I	3	0	3	None	None
	CH211	Chemical Process Industries	2	0	2	CH101	None
	CH231	Chemical Engineering Principles	3	0	3	None	None
	EE213	Applied Electrical Engineering	3	0	3	MT101	None
	HM211	Pakistan & Islamic Studies	3	0	3	None	None
	CH251L	Chemical Engineering Lab-I	0	3	1	None	CH211, CH241

	No.	Course Titles	Lec. Hrs	Lab. Hrs	CH	Pre-req	Co-req
4th Semester	CH212	Energy Engineering	3	0	3	None	None
	CH214	Chemical Engg. Thermodynamics-I	3	0	3	None	None
	CH201	Inorganic & Organic Chemistry	3	0	3	CH211	None
	ME201	Engineering Statistics	3	0	3	None	None
	MS291	Engineering Economics	3	0	3	None	None
	CH252L	Chemical Engineering Lab-II	0	3	1	None	CH212, CH214
	CH253L	Chemical Engineering Lab-III	0	3	1	None	CH201

	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
	HM321	Sociology and Human Behaviour	3	0	3	None	None
	CH351L	Chemical Engineering Lab IV	0	3	1	None	CH311
	CH352L	Chemical Engineering Lab V	0	3	1	None	CH341

	No.	Course Titles	Lec. Hrs	Lab. Hrs	CH	Pre-req	Co-req
6th Semester	CH361	Environmental Engineering	2	0	2	None	None
	CH322	Reaction Kinetics and Reactor Design	3	0	3	CH321	None
	XXXXX	Management Elective	3	0	3	**	**
	CH342	Fluid Mechanics-II	2	0	2	CH241	None
	ES341/ CS342	Numerical Analysis	3	0	3	MT201	None
	HM322	Corporate Law and Professional Ethics	3	0	3	None	None
	CH353L	Chemical Engineering Lab-VI	0	3	1	None	CH322, CH361

	No.	Course Titles	Lec. Hrs	Lab. Hrs	CH	Pre-req	Co-req
7th Semester	CH411	Simultaneous Heat & Mass Transfer	3	0	3	CH311, CH313	None
	CH415	Instrumentation & Process Control	3	0	3	None	None
	XXXXX	Technical Elective	3	0	3	**	**
	CH431	Process Modelling & Simulation	2	0	2	CH322, CH241	None
	CH451L	Chemical Engineering Lab-VII	0	3	1	None	CH411, CH415
	CH481	Chemical Engg. Project Design-I	0	9	3	None	None

	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
	XXXXX	Technical Elective	3	0	3	**	**
	XXXXX	Management Elective	3	0	3	**	**
	CH452L	Chemical Engineering Lab-VIII	0	3	1	CH431	None
	CH482	Chemical Engg. Project Design-II	0	9	3	None	None

CH101 Chemistry for Engineers (2-0-2): Importance of chemistry for engineers, Photochemistry, free radicals, Energy states of molecules, Intermolecular forces, Interaction of electromagnetic radiation with matter; IR, Vis and UV spectroscopy, Standardization of Solution for quantitative titration & Stoichiometry, Determination of atomic mass and mass spectroscopy, Nano-chemistry, Thin Films, CVD, PVD, and Silicon Purification, Electrochemistry; Galvanic Cells, Batteries, Nernst equation, pH-measurement, Corrosion reactions. Fossil Fuels, Environmental pollution; Acid rain, Urban Smog, Water Treatment (Industrial purposes, Domestic purposes, Wastewater)

CH102 Physical and Analytical Chemistry (3-0-3): Chemical Kinetics: The rates of reactions, order reactions and methods for determination of order of reactions. Solution Chemistry: Ideal and non-ideal solutions, Raoult's law, vapor pressure, boiling point, and freezing point, osmotic pressure, and Henry's law. Dynamic Equilibrium and Thermodynamics: Equilibrium reactions in different phases, extent of reactions and equilibrium constants, Gibbs energies of formation, van't Hoff equation, Le-Chatelier's principle. Colloid and Surface Chemistry: adsorption and adsorption isotherms, Freundlich and Langmuir adsorption isotherms, Colloidal solutions, Polymer Chemistry: Introduction to polymers, step-growth polymerization, polymer chain growth, kinetics of polymer chain growth, co-polymerization, emulsion polymerization, Separation Techniques and spectroscopy Photochemistry and Environmental chemistry.

CH161 Occupational Health & Safety (1-0-1): Introduction to health and safety, workplace hazards, personal protective equipment, fire hazard and control, general chemicals & lab safety, manual and mechanical handling hazards and control, work equipment hazards and control, biological hazard, electrical hazard, construction activities – hazards and control, first aid, accident investigation, promoting a positive health and safety culture, permit to work, risk assessment and control, principles of control, engineering ethics.

CH201 Inorganic & Organic Chemistry (3-0-3) Pre-requisite(s): CH211**:** Inorganic Chemistry: Chemistry for chemical engineering, Atomic, ionic and molecular solids, Atomic structure and Transition elements, Multiple oxidation states and shielding effect, Redox reactions, Coordination compounds, Isomerism, Catalysis, Chemistry in non-aqueous solvents, radioactivity, Organic Chemistry: Shape and structure of organic compounds, Hydrocarbons and their derivatives, Functional groups, Carbonyl compounds, Conformation, Isomerism and chirality, Polarity, Inductive effect and acidity in organic compounds, Reaction mechanism in organic reactions and structure-reactivity relationships, Macromolecules and polymers, Biologically important compounds such as amino acids and polypetides, Bio-chemical processes, Carbohydrates: di and poly-schharides, Nucleic acids and DNA.

CH211 Chemical Process Industries (2-0-2) Pre-requisite(s): CH101**:** Various well established chemical manufacturing processes; Latest trends in process industries, Fertilizer manufacturing, Insecticides production, Soaps & detergents, Sugar industry, Cement industry, chemical manufacturing units; Soda ash, Caustic soda, Chlorine, Sulphuric acid, Water treatment plants, Fermentation & Food processing industry, Tannery processing, Pulp & paper and Basic pharmaceutical industries.

CH212 Energy Engineering (3-0-3): Classification of Conventional energy resources, Origin, characterization and taxonomy of available fuels, Principles of combustion, Combustion of solid, liquid, and gaseous fuels. Fluidized Bed. Combustion calculation; energy requirements and combustion efficiency of Industrial Burners. fuel economy measures, excess air, heat distribution, temperature control, draft control and Flame stability. Fuel quality & combustion efficiency enhancement. Importance of Alternate Energy Resources; Solar, Wind, Wave, Tidal, geothermal, Nuclear and Hydel, Densification & calorific value up-gradation of biomass, Carbonization and Gasification of biomass, Energy generation from municipal waste, Development of fuel cells. Environmental and global impact of energy resources, Industrial fuels & selection criteria, Energy audit, conservation waste heat recovery.

CH214 Chemical Engineering Thermodynamics-I (3-0-3): Thermodynamic systems and processes, Reversible and Irreversible Processes, The first law of thermodynamics, Energy balance for open systems with and without reaction; Ideal/non-ideal gas model, Equation of state and Property relations Second law of thermodynamics, Entropy and Entropy balance for closed and open systems, Isentropic efficiencies of turbines, Nozzles, Applications of thermodynamics to flow processes, Nozzles, Turbines, Compressors, Heat engines, Refrigeration, Air conditioning and Liquefaction of gases.

CH231 Chemical Engineering Principles (3-0-3): Units, dimensions and conversions, Temperature and Pressure scales, Composition of mixtures, Principles of stoichiometric combination, Nature of balances; Concept of a balance, Input-output relationships, Steady-state considerations, Sub-systems and interconnections, Mass balance diagrams and tables, Mass balances for items of plant, Choice of basis/datum for balances, Overall and component balances, Limiting and excess reactants, Balances for systems with recycle, purge and by-pass streams, Mass balances for reactive processes,

Mass balances for unit operations, Tie components, Balances for batch and continuous plant. Concepts of Energy balance, Mass and energy balances for reacting systems, Balances for combustion processes.

CH241 Fluid Mechanics-I (3-0-3): Concept, Properties and types of fluids, Stress analysis of static fluids, Newton's Law of viscosity, Introduction to non-Newtonian fluids. Estimation and measurement of Pressure and Pressure gradient, Manometry, Buoyancy and Stability, Basic physical Laws in Fluid Mechanics, Conservation of Mass, Continuity equation, Linear Momentum, Angular Momentum and Energy, The Bernoulli's Equation and its application, Dimensional Analysis and Similitude, Viscous Flow in internal flows, Concept of Laminar and turbulent flow, Concept of friction and pressure drop in flowing fluids, Friction factor in laminar and turbulent flows in pipes, Concept of equivalent diameter, Pipe sizing problems, Flow measuring devices such as Bernoulli devices, Notches and Weirs. Concept of Boundary layer and its importance in fluid mechanics, brief introduction to external flows.

CH311 Heat Transfer (3-0-3): Basic concepts of thermal energy Modes of heat transfer, steady and unsteady state conduction in different co-ordinates, convective heat transfer with and without phase change. Correlations for forced and natural convection. Analogy between momentum and heat transfer. Radiation heat transfer, Heat transfer in extended surfaces. Industrial applications, categorization, selection criteria and design of numerous heat transfer equipment: Heat exchangers, Waste heat recovery boilers, Evaporators, Condensers, Boilers. Heat transfer augmentation techniques.

CH313 Mass Transfer (3-0-3) Pre-requisite(s): CH214**:** Diffusion in Fluids Molecular and Eddy diffusion in a gas and liquid, Steady state diffusion under stagnant and laminar flow condition, Diffusion measurement and calculations, Ordinary diffusion in multicomponent gaseous mixtures, Diffusion in solids, Interface mass transfer, Theory of mass transfer, Concept of mass transfer coefficient, Overall mass transfer coefficient, Analogies between momentum and mass transfer coefficients, Absorption theories of gas absorption, Design of absorption towers, Absorption with chemical reaction, Concept of NTU and HTU, Adsorption, Ion-Exchange, Extraction Processes, Liquid-Liquid extraction, Leaching; General principles, Factors influencing the rate of extraction, Mass transfer in leaching operations.

CH321 Chemical Engineering Thermodynamics-II (3-0-3) Pre-requisite(s): CH214**:** Advanced principles of thermodynamics focusing on phase equilibria, Maxwell relationships, Gibbs Duheum's theorem, Thermodynamics of separation processes, Two component systems, Liquid-vapor equilibria, Ideal and non-ideal solutions, Composition of vapor in equilibrium with liquid, Fractional distillation, Azeotropes, mixing, Liquid-solid equilibria.

Thermodynamic analysis of power plants, Liquefaction & refrigeration systems, Chemical reaction equilibrium.

CH322 Reaction Kinetics and Reactor Design (3-0-3) Pre-requisite(s): CH321**:** Equilibrium and effect of heat on reactions, Rate of reactions, Molecularity and order of reaction, Reaction mechanism, conversion and reactor sizing, rate laws and stoichiometry for a single and multiple reactions/reactors and its applications to steady-state isothermal & non-isothermal reactors along with pressure drop effect. Collection and analysis of rate data, catalytic reactors and catalysis.

CH341 Particle Technology (3-0-3): Introduction to particle technology, Fundamentals of solid handling, Transportation (conveying) & storage, Size reduction (crushing & grinding) & enlargement crystallization, Pelletization & granulation, Screening, Sieving, Coagulation, Flocculation, Fluidization, Mixing, Filtration, Agitation, Particles settling, Statistics of particle size and their distribution & classification, Various solid handling & Processing equipment, Emulsions, Coagulants and Powder technology. Powder characterisation and handling for Pharmaceutical industries

CH342 Fluid Mechanics-II (2-0-2) Pre-requisite(s): CH241**:** Centrifugal pumps; Concept Characteristics; NPSH and its application in chemical engineering, Concept of specific speed, Similarity laws in centrifugal pumps. Pumps in series and parallel. Positive displacement pumps; classification, characteristics, selection and matching system characteristics with pump characteristics. Turbines; classification and selection. Compressible flow and its application in chemical engineering, Concept of choked flow in CD nozzle, Compressors; classification, characteristics, and selection.

CH361 Environmental Engineering (2-0-2): Introduction to environment and ecology, Pollution concept, types of pollution, Environmental policy and standards, Environmental Monitoring (Air, Water & Soil), Objectives of sampling and monitoring program, Design and types of samples; Pre-sampling

requirements/information, Sampling and design purposes, Air pollution control technologies, Water pollution control technologies, Water treatment technologies, Soil pollution control technologies, Noise pollution control technologies, Biotechnology for environment, Industrial pollution control, Solid Waste management.

CH371 Maintenance Engineering & Industrial Management (3-0-3): Maintenance: Preventive, predictive, Break down and total productive maintenance, Individual versus group replacement, Internal versus external maintenance, Scheduling of maintenance, computerized maintenance, Inspection techniques, Non-destructive testing techniques, Basics of rigging and lifting, Lubrication and lubricants, Industrial management, Process layout analysis and comparison, Material handling considerations in layout, Production planning methods, Capacity planning and control; Production control systems, Job shop scheduling, Quality Control, Production control charts, Scheduling techniques, Software for project management, Purchasing and procurement, Inventory control. Organizational structure, Human resource management, Project management principles, PERT/CPM, Total quality management, Labour and engineering laws, Prevention, and settlement of disputes.

CH411 Simultaneous Heat & Mass Transfer (3-0-3) Pre-requisite(s): CH311, CH313**:** Various industrial distillations: Binary distillation, Extractive

distillation, Molecular distillation, Azeotropic distillation, Steam distillation, Reactive distillation, Multi-component distillation. Key components in multi-component mixtures and recovery fraction. Continuous flash distillation with heat balancing, Column Design, Tray design, hydraulics and performance, Batch distillation, Drying: Diffusion and Capillary theory of drying, Classification, and selection of dryers. Freeze drying, Flash drying, Partial-recycle dryers, The drying of gases, Humidification and Cooling Towers, Crystallization, Operation, and equipment.

CH412 Transport Phenomena (3-0-3) Pre-requisite(s): CH411**:** Transfer processes; A review of the mechanisms of momentum, Energy and mass transport, Momentum transport; Derivation of equations of continuity and motion (Navier-Stoke's equation) at molecular level, Equations of change both for isothermal, Non-isothermal and multi component systems, Velocity distribution, Application in laminar and turbulent flow problems. Energy transport: Derivation of energy equation, Mechanism of energy transport at molecular level, Temperature distributions in flow, Application to heat transfer problems involving conduction, Forced and free convection, Application in laminar and turbulent flow problems. Mass transport: Derivation of species conservation equations for binary and multicomponent mixtures, Application to mass transfer problems with and without chemical reaction, Application in laminar and turbulent flow problems.

CH413 Food Technology (3-0-3) Application of biotechnology in chemical Industry, Biodegradation, Bio mass productivity & activity, Aerobic & anaerobic processes, Bio-chemical processes involved in the production of food products, Beverages, Organic Acids, Industrial solvents, Various pharmaceutical products and antibiotic and commercial enzymes, Fermentation Industries: Industrial alcohol, Biodiesel and industrial solvents, Waste treatment from Food and pharmaceutical Industry, Bioremediation, Food preservation, Health hazards, Hygiene and sanitation, Important food industries in Pakistan and Food legislation.

CH414 Petroleum Refining Engineering (3-0-3) Introduction, Origin, Formation & composition of petroleum, Indigenous and world resources, Refinery products, Properties, Standard tests, Characterization and evaluation of crude oil stocks, Crude pre heating and preliminary treatment, Pipestill heaters, Desalting, atmospheric and vacuum distillation, Steam stripping, Arrangement of towers, Calculation of number of trays, Types of reflux employed, Packie's approach, Processing plans, schemes and product patterns of refineries, Modern separation, Conversion and treatment processes, Thermal & catalytic cracking and reforming, Hydrocracking, Auxiliary processes and operations, refinery corrosion and metals, Blending plants, Product design and marketing, Use of linear programming techniques to solve refinery blending and production problems, Overview of petroleum act.

CH415 Instrumentation & Process Control (3-0-3): Instrumentation: instrument's terminologies and performance, P&I diagram, Instrumentation and sensors, Mathematical modelling of process control. Transfer functions. Dynamic behaviour of chemical processes. Control loops and its components, Feedback control. Dynamic behaviour of closed-loop systems. Stability analysis. Frequency response analysis. Controller design and tuning. Introduction to computer control. Laboratory and simulations applications Cascade Control, Ratio Control, Split Range Control, Feed Forward Control.

CH417 Pharmaceutical Engineering (3-0-3) Engineering principles to pharmaceutical and life sciences related to industries, Process engineering in the drug discovery, High throughput characterization and optimization of new chemical entities, Solid-state engineering and intelligent pharmaceutical manufacturing systems.

CH418 Nuclear Engineering (3-0-3) Role and importance of nuclear energy, Nuclear reactors cross-sections, Reaction rates, Nuclear fission and chain reaction, Critical conditions, Conversion and breading, Reactor components and their characteristics, Classification and design features, Production and power reactors, Fast and fusion reactor systems, Fuel cycles, Uranium enrichment, Fabrication of fuel, Reprocessing of irradiated fuel, Fuel cycle performance, In-core fuel management & fuel management strategies and handling of nuclear waste.

CH419 Water Treatment & Purification (3-0-

3) Primary & secondary treatment of the fresh feed water to the plant, Clarification, Sedimentation, Flocculation & Coagulation, Filtration, ion exchange, Membrane separation & reverse osmosis, Advance technologies, Cooling water treatment, Use of biocides & shock dosage, bacterial count and their importance, Treatment of sea water, Desalination, Treatment of various waste waters and biological waste water treatment.

CH420 Enzyme Technology (3-0-3) Basics of Microbiology, Enzyme classification, Enzyme reaction kinetics (Single- substrate Reactions) and energy patterns in biological system, Enzyme Inhibition, Non-ideal enzyme kinetics, isolation of enzymes and immobilized enzyme technology, Applications of enzyme catalysis (Biocatalysis), Transport phenomenon in microbial system, Design and analysis of biochemical reactors (fermentations), Anaerobic and aerobic metabolism photosynthesis and bio-synthesis, Biochemical and microbiological application to commercial and engineering.

CH421 Statistical Thermodynamics (3-0-3) Boltzmann Hypothesis & distribution, Entropy at statistical level, Partition function, Degeneracy, Maxwell-Boltzmann & Fermi-Dirac distributions, Effusion, Diffusion, Various types of solid defects, Surfaces and interfaces, Transformations, Kinetics and non-equilibrium thermodynamics.

CH422 Heterogeneous Catalysis (3-0-3) Introduction and basic concepts, Adsorption, Rates and kinetic models of catalytic reactions, Catalyst preparation and manufacture, Characterization of physicochemical properties, Surface characterization, Supported metal catalysts, Acid-base catalysts and zeolites, metal oxide catalysts and catalytic oxidation, Examples of important heterogeneous catalytic reactions.

CH431 Process Modelling & Simulation (2-0-2) Pre-requisite(s): CH322, CH241**:** Introduction to MATLAB, Linear algebra applications including Eigen Values, Symbolic and numerical differentiation (ODE solution), Calculation of integrals, , First and second order transfer function, Plots for stability analysis., Mathematical

Huzaifa Kamran, Final Year Student

Situated in a picturesque corner of Pakistan, the GIK Institute introduced me to a totally different world. The tough academic competition combined with the society culture made me stretch my boundaries, step out of my comfort zone and evolve into a more independent person. GIKI has given me more than just a degree but a virtual tour of my life ahead, and now I feel my goals are well versed and enlightened. Living between people who have come from different backgrounds of diverse mindsets has made me adaptable, compromising and most of all a national person. To sum it up, GIKI has given me a head start for my long-awaited professional career.

modelling related to chemical engineering. Solution of mathematical models on MS Excel and MATLAB. Pinch Analysis, Optimization, Development of process flow diagrams for various process industries and de bottlenecking using simulation software such as ASPEN, Economic evaluation of processes.

CH441 Chemical Engineering Plant Design (3-0-3) Pre-requisite(s): CH411, MS291**:** Process design and development. General design considerations, Health and safety, HAZOP study, Contingency plans, Design codes & standards, Economics and optimization, Materials selection for various services, Fabrication of desired component to facilitate processes, Vessel design; Low, medium and high pressure storage and transportation vessels, Cryogenic vessels. Design of mass transfer equipment: Material transport and Material handling. Heat transfer equipment including furnaces and refrigeration units, Piping and pipeline design, Basic Concepts of Optimization, Optimization of Unconstrained Functions, Linear Programming Applications, Non-Linear Programming with Constraints, and Application of computer aided design, Engineering Ethics, Local, and Global Impact Analysis.

CH442 Piping Design (3-0-3) Process plant layout & equipment, Oil & gas pipeline design per ASME B31.4 / B 31.8, Piping stress analysis, Process piping drafting, Liquid pipeline hydraulics, Fire safety piping and use of various design software related to the field e.g. Piping Systems Fluid Flow.

CH461 Environmental Impact Assessment (3-0-3) Principles and purposes of IEE and EIA and its significance for the society, Cost and benefits of EIA, Main stages in EIA process, Public consultation and participation in EIA process, EIA methods and techniques for impact prediction and evaluation.

CH471 Industrial Waste Management (3-0-3) Environmental management ISO 14001, EMAS, Environmental auditing, Environmental Policies & regulations, Different types of eco-labelling, Pollution prevention & potential implementation strategies, Material Recycling, Waste

characterization, Physical, Chemical & Biological methods to treat liquid waste streams, Treatment of solid waste including separation, Incineration & composting and treatment of radioactive waste. Production of biogas, Anaerobic digestion and other stabilization methods, Dewatering, Drying, Air pollution Management.

Final Year Project Design

CH481 Chemical Engineering Project Design-I (0-9-1): Chemical Engineering Project Design is the practical demonstration of student's theoretical knowledge. Groups of students are assigned a project of industrial scope and importance under the supervision of faculty member, which includes literature survey for process selection and feasibility, development of flow sheet, material and energy balances, design and sizing of different units or equipment, instrumentation and control, materials selection and cost estimation, economic analysis of plant, safety aspects/HAZOP study etc. The progress will be monitored through interim presentations and reports.

CH482 Chemical Engineering Project Design-II (0-9-1): Student will continue work on the Chemical Engineering Project Design-I (CH481). Students may require the fabrication of small unit for hands on experience. The progress will be monitored through interim presentations and report. A final report will be due at the end of term.

Laboratory Courses

CH251L Chemical Engineering Lab I (Fluid Mechanics & Process Industries) (0-3-1) Co-requisite(s): CH241, CH211**:** The experiments in this laboratory are designed to demonstrate various phenomena of fluid flow. Quantitative analysis of water, milk and soap samples.

CH252L Chemical Engineering Lab II (0-3-1) (Thermodynamics and Energy) Co-requisite(s): CH212, CH214**:** Experiments related to fuel & its properties and chemical engineering thermodynamics and energy engineering.

Alina Naseem, Sophomore Student

It has not been more than a year since I enrolled to GIK Institute, yet my experience here so far has evolved my personality a great deal. Whether we talk about the beautiful campus, incredible hostel life, vibrant society culture, excellent sports facilities, or the vigorous study environment, everything about the institute is quite extraordinary. As amazing as this place is, surviving here is not easy. GIKI gives you the utmost freedom to spend your time however you wish and yet, without any hesitation, it gives you the bitter taste of every wrong move. My message to all prospective students is that GIKI has the facilities, and the reputation to help you achieve your goals but more importantly, it forces you to become disciplined enough to keep working diligently towards them and to grow as a person in the process. All the while you get to make some of the most cherished memories of your life.

CH253L Chemical Engineering Lab III (Analytical and Physical Chemistry) (0-3-1) Co-requisite(s): CH201**:** Chemistry.

CH351L Chemical Engineering Lab IV (Heat and Mass Transfer) (0-3-1) Co-requisite(s): CH311: The laboratories for this course are equipped with heat & mass transfer experimental benches.

CH352L Chemical Engineering Lab V (Particle Technology& VLE) (0-3-1) Co-requisite(s): CH341**:** Experiments related to the particle technology and vapor liquid equilibrium.

CH353L Chemical Engineering Lab VI (Reaction and Environmental Engineering) (0-3-1) Co-requisite(s): CH322, CH361**:** The laboratories for this course are equipped chemical reactors and environmental engineering.

CH451L Chemical Engineering Lab VII (Instrumentation and SHMT) (0-3-1) Co-requisite(s): CH411, CH415**:** Experiments in this course will demonstrate characteristics of instrumentation and control. Experiments related to simultaneous heat & mass transfer phenomena.

CH452L Chemical Engineering Lab VIII (Process Simulation) (0-3-1) Pre-requisite(s): CH431**:** Introduction of Aspen HYSYS and MATLAB SIMULINK for chemical engineering process simulation.

FACULTY OF MECHANICAL ENGINEERING

Thrust Areas

Design and Manufacturing Engineering
Thermo-Fluid Engineering
System Dynamics and Controls

Faculty

S. M. Ahmad, PhD, University of Sheffield, UK, Chartered Engineer, MIMechE
Wasim Ahmed Khan, PhD, University of Sheffield, UK, Chartered Engineer, FIMechE
Ghulam Hussain, PhD, Nanjing University of Aeronautics & Astronautics, China
Taqi Ahmad Cheema, PhD, Kyungpook National University, South Korea
Sohail Malik, PhD, University, Politecnica' Delle Marchi, Ancona, Italy
Muhammad Asif, PhD, Hanyang University, South Korea
Muhammad Ilyas, PhD, ISAE-SUPAERO, University of Toulouse, France
Ahmad Abbas, PhD, GIK Institute, Pakistan
Massab Junaid, PhD, GIK Institute, Pakistan
Ali Turab Jafry, PhD, Sungkyunkwan University, South Korea
Abid Imran, PhD, Hanyang University, South Korea
Arslan Arif, PhD, Hanyang University, South Korea
Faheem Ahmad, MS, INHA University, South Korea
Malik Hassan, MS, GIK Institute, Pakistan
Sadia Bakhtiar, MS, UET Peshawar, Pakistan

Faculty on study leave for PhD

Shahbaz M. Khan
Yasir Mahmood Khan

Lab Engineers

Samar Abbas, BS, University of Wah
Syed Usman Ali Bukhari, BS, GIK Institute
Ridah Afzal, BS, UET Peshawar
Salman Amin, BS, GIK Institute
Muhammad Aneeq Asif, BS, UET Faisalabad
Zubair Ahmad, BS, UET Peshawar

Graduate Assistant

Asif Ullah (PhD Scholar) (MS NUST)
Salman Ahmad (PhD Scholar) (MS GIK Institute)
Muhammad Hammad (PhD Scholar) (MS UET Lahore)
Muteeb ul Haq (PhD Scholar) (MS NUST)
Babar Ashfaq (PhD Scholar) (MS IIUI Islamabad)
Atif Muzaffar (PhD Scholar) (MS GIK Institute)
Ahsan Tanveer, BS, UET Peshawar
Ali Ul Atas Khan, BS, UET Peshawar
Faiq Ahmad, BS, UET Peshawar
Farooq Khan, BS, UET Peshawar
Muhammad Umair Shafiq, BS, NUST
Saad Ahmad, BS, COMSATS University
Saad Fareed, BS, UET Peshawar
Syed Farhad Shah, BS, GIK Institute
Gohar Hussain, BS, UET Taxila
Muhammad Abdullah Sheeraz, BS, UET Lahore
Syed Imtiaz Ali Shah, BS, GIK Institute
Muhammad Usman, BS, UET Peshawar
Hamza Qayyum, BS, PIEAS, Islamabad
Muhammad Sulaiman, BS, IST Islamabad
Muhammad Usman, BS, IIUI, Islamabad
Shahvaiz Khan, BS, UET Peshawar
Masroor Khan, BS, GIK Institute
Jawad Rabbi, BS, UET Peshawar
Minhaj Ullah, BS, UET Peshawar
Wajeeha Bibi, BS, UET Peshawar
M. Husnain Tariq, BS, UET Rachna Campus
Syed Mir Hamza, BS, UET Peshawar
M. Ahmed Rabbani, BS, UET Lahore

Dean

Khalid Rehman, PhD
JEJU National University, South Korea

Personal Secretary to Dean

Nizakat Ali Khan,
MA, Peshawar University, MBA, Virtual University.
Muhammad Tofiq, Students Section

Introduction

Mechanical engineers confront diverse and challenging engineering problems which requires integration of science, engineering and socio-economic knowledge. They are trained to solve real-world engineering problems arising in energy production, heating, ventilation, air conditioning and manufacturing. They design complex machines, manufacturing processes and translate them into real products that addresses societal issues. However, with recent advances, mechanical systems are increasingly integrated with electronics, sensors, actuators, micro-controllers and computers. Mechanical engineering education thus needs to gear up to keep up with the fast-changing technology development.

The Faculty of Mechanical Engineering (FME) has a modern curriculum designed by experts and practitioner of engineering profession. Drawing on from disciplines such as mechanics and materials, thermal and fluid sciences, design and manufacturing, vibration and control systems, the curriculum also reflects the latest advances in finite element methods, computational fluid dynamics, computer-aided design and additive manufacturing. 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 infuses 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.

Outcome Based Education (OBE)

FME has adopted student centric OBE system that leads to enhanced learning outcomes for students and relies heavily 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

FME offers a well-structured 4-year BS degree program in mechanical engineering. As a cross-disciplinary program, it gives its students a sound foundation of engineering principles and promotes communication and practical skills that

are the need of the present and future knowledge driven industry. Classroom theory is reinforced through extensive laboratory work, problem-based learning, and complex engineering problem. FME is focused on design and manufacturing, thermo-fluids as well as system dynamics and control, thus, enabling students to pursue their final year design projects as per their future career aspirations.

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.

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 Objectives 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.

Careers in Mechanical Engineering

Mechanical Engineering involves application of mechanics and thermal-fluid sciences to design, manufacture, operate, maintain, various processes and plants. Mechanical Engineers are the backbone of many industries and can have a career in a wide spectrum of fields including shipbuilding, aerospace, railroad works, automotive, turbomachinery, pharmaceutical, petroleum, chemical, process and energy industries, just to name a few. FME graduates are well sought after by R&D/defense organization, fertilizers and cement companies, power plants and petrochemical industries, automobile manufacturers as well as by various multi-national companies. Re-accreditation of BS program by Pakistan Engineering Council (PEC) under Level-II category i.e., 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 engineers to gain professional registration in other countries.

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

Course Work Requirements

A student majoring in Mechanical Engineering must complete the following courses

(a) General Education Requirements (52 Credit Hours)

Course Titles	Course Code	Credit Hour
Computer Science & Engineering	CS101, CS101L, CS102L	4
Humanities	HM101, HM102, HM211, HM321, HM322	15
Basic Engineering	CH101, CH161, MM141, MM102, ME101, ME102, MS291	13
Mathematics	MT101, MT102, MT201, ES202, ES341/CS342	15
Sciences	PH103, PH104, PH102L	5

(b) Core Requirements (68 Credit Hours)

Course Titles	Course Code	Credit Hour
Circuits and Electronic Devices Electronics and Instrumentation Lab	ME203 ME243	4
Electrical Machines and Drives Mechatronics Lab	ME403 ME447	4
Measurement and Instrumentation	ME202	2
Engineering Mechanics (Statics, Dynamics)	ME211, ME212	6
Mechanics of Solids	ME213, ME314	6
Thermodynamics	ME231, ME232	6
Fluid Mechanics	ME321, ME322	6
Theory of Machines	ME313	3
Heat Transfer	ME333	3
Design of Machine Elements	ME261, ME364	5
Manufacturing Processes	ME353	3
Mechanical Vibrations	ME315	3
Design Project	ME481, ME482	6
System Dynamics & Control	ME464	3
Finite Element Analysis	ME467	3
Mechanical Eng. Lab. Courses	ME244, ME342, ME346, ME347, ME446	5

(c) Technical Electives (9 Credit Hours)

Design and Manufacturing

Course Titles	Course Code	Credit Hour
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

Thermo Fluids

Course Titles	Course Code	Credit Hour
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

System Dynamics and Control

Course Titles	Course Code	Credit Hour
Robotics	ME452	3
Design of Experiments in Mechanical Engineering	ME469	3
Industrial Automation	ME493	3
Flight Dynamics and Control	ME494	3

(d) Management Elective (At Least 6 Credit Hours)

Course Titles	Course Code	Credit Hour
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

(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 135 credit hours.

Degree Plan

	Course Code	Course Titles	Lec. Hrs	Lab. Hrs	Credit Hours	Pre-req	Co-req
1st Semester	MT101	Calculus I	3	0	3	None	None
	PH103	Fundamentals of Mechanics	2	0	2	None	None
	CS101	Introduction to Computing	2	0	2	None	None
	HM101	English and Study Skills	3	0	3	None	None
	CH101	Chemistry for Engineers	2	0	2	None	None
	ME102	Engineering Graphics	1	3	2	None	None
	CS101L	Computing Lab	0	3	1	None	CS101
	ME101	Workshop Practice	0	3	1	None	None
	CH161	Occupational Health and Safety	1	0	1	None	None
	Total		14	9	17		

	Course Code	Course Titles	Lec. Hrs	Lab. Hrs	Credit Hours	Pre-req	Co-req
2nd Semester	MT102	Calculus II	3	0	3	MT101	None
	CS102L	Intensive Programming Lab	0	3	1	CS101	None
	PH104	Fundamentals of Electricity & Magnetism	2	0	2	PH103	None
	HM102	Technical Report Writing	3	0	3	HM101	None
	MM102	Introduction to Engg. Materials	3	0	3	None	None
	ME111	Statics	3	0	3	PH103	None
	PH102L	Electricity and Magnetism Lab	0	3	1	None	PH104
	MM141	Materials Lab I	0	3	1	None	MM102
	Total		14	9	17		

3rd Semester	Course Code	Course Titles	Lec. Hrs	Lab. Hrs	Credit Hours	Pre-req	Co-req
	MT201	Differential Equations	3	0	3	None	None
	MS291	Engineering Economy	3	0	3	None	None
	ME203	Circuits and Electronic Devices	3	0	3	PH104	None
	ME202	Measurement and Instrumentation	2	0	2	None	None
	ME213	Mechanics of Solids I	3	0	3	ME111	None
	ME231	Thermodynamics I	3	0	3	MT101	None
	ME243	Electronics and Instrumentation Lab	0	3	1	None	ME202, ME203
	Total		17	3	18		

4th Semester	Course Code	Course Titles	Lec. Hrs	Lab. Hrs	Credit Hours	Pre-req	Co-req
	ES202	Engineering Statistics	3	0	3	MT101	None
	ME232	Thermodynamics II	3	0	3	ME231	None
	ME261	Design of Machine Elements I	3	0	3	ME101	None
	ME212	Dynamics	3	0	3	ME111	None
	HM211	Pak. & Islamic Studies	3	0	3	None	None
	ME244	Statics and Dynamics Lab	0	3	1	ME111	ME212
	Total		15	3	16		

5th Semester	Course Code	Course Titles	Lec. Hrs	Lab. Hrs	Credit Hours	Pre-req	Co-req
	ME313	Theory of Machines	3	0	3	ME212	None
	HM322	Corporate Law and Professional Ethics	3	0	3	None	None
	ME321	Fluid Mechanics I	3	0	3	MT101, ME212	None
	ME314	Mechanics of Solids II	3	0	3	ME213	None
	ME364	Design of Machine Elements II	2	0	2	ME261	None
	ES341/ CS342	Numerical Analysis	3	0	3	MT201	None
	ME346	Thermo-Fluid Lab I	0	3	1	ME232	ME321
	Total		17	3	18		

6th Semester	Course Code	Course Titles	Lec. Hrs	Lab. Hrs	Credit Hours	Pre-req	Co-req
	HM321	Sociology and Human Behavior	3	0	3	None	None
	ME333	Heat Transfer	3	0	3	ME231, ME321	None
	ME353	Manufacturing Processes	3	0	3	ME213	None
	ME315	Mechanical Vibration	3	0	3	MT201, ME212	None
	ME322	Fluid Mechanics II	3	0	3	ME321	None
	ME347	Thermo-Fluid Lab II	0	3	1	None	ME333, ME322
	ME342	Mechanics of Solids and Manufacturing Processes Lab	0	3	1	ME213	ME353
	Total		15	6	17		

7th Semester	Course Code	Course Titles	Lec. Hrs	Lab. Hrs	Credit Hours	Pre-req	Co-req
	MS49x	Management Electives I	3	0	3	None	None
	ME4xx	Technical Elective I	3	0	3	None	None
	ME464	System Dynamics and Control	3	0	3	MT201	None
	ME446	Mechanical Vibration and Control Systems Lab	0	3	1	ME315, MT201	ME464
	ME481	Senior Design Project-I	0	9	3	None	None
	ME403	Electrical Machines and Drives	3	0	3	ME203	None
	ME447	Mechatronics Lab	0	3	1	ME203	ME403
	Total		12	15	17		

8th Semester	Course Code	Course Titles	Lec. Hrs	Lab. Hrs	Credit Hours	Pre-req	Co-req
	MS49x	Management Elective II	3	0	3	None	None
	ME467	Finite Element Analysis	2	3	3	None	None
	ME4xx	Technical Elective II	3	0	3	None	None
	ME4xx	Technical Elective III	3	0	3	None	None
	ME482	Senior Design Project-II	0	9	3	ME481	None
	Total		11	12	15		

ME101 WORKSHOP PRACTICE (0-3-1): Principles and practice of machine tools of the mechanical engineering metal shop, measurements, filing and fitting; drilling; welding; bench work, grinding and sheet metal operations, conventional turning and milling operations are included.

ME102 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 MEASUREMENT AND INSTRUMENTATION (2-0-2): Introduction to measurement standards, design of experiment, major blocks of a measurement system, introduction to instruments, statics and dynamic characteristics of instruments, analog and digital signals, active and passive filters, temperature measurement, pressure measurement, position measurement, hall-effect sensing and application, piezoelectric sensors and applications, design of a sensor, data acquisition systems and post-processing/data analysis, test rig development.

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, properties, types and applications, Introduction to MOSFETs, structure, properties, types and applications, Introduction to IGBTs, structure, properties, types and applications.
Pre-requisite(s): PH104.

ME111 STATICS (3-0-3): Basic concepts of scalars and vectors, Newton's laws, units, problem-solving in statics. Force Systems: Force, rectangular components, moment, couple, resultants, force systems in 3-D. 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. Virtual Work: Introduction, work, equilibrium.
Pre-requisite(s): PH103.

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 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.

ME261 DESIGN OF MACHINE ELEMENTS-I (3-0-3): Philosophy and concept of engineering design, engineering creativity, phases and procedures in design. Design codes and standards, Basic criteria of design of machine parts, 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, Fundamentals of CAD.
Pre-requisite (s): ME101

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, Thin and thick curved bars.
Pre-requisite(s): ME111

ME353 MANUFACTURING PROCESSES (3-0-3): Machining operations, cutting tool technology. Non-Traditional Machining Operations: Mechanical processes, electrical processes, chemical processes. Metal Forming Technology: Extrusion, Drawing, Sheet metal forming. Welding Technology: Fusion welding, solid-state welding. Processing of Polymers and Composites. CNC part programming.
Pre-requisite(s): ME213

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

ME314 MECHANICS OF SOLIDS II (3-0-3): Analysis of stress and strain in two and three dimensions, Principal stresses and strains, Mohr's circle for stress and strain, 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

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): ME261

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.

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 Governors. Gyroscopes: Gyroscopic couple, effect of gyroscopic couple on navigation.
Pre-requisite(s): ME212

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.

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, non-isentropic 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, impulse turbines, reactive turbines, compressors, compressible flow turbines, windmills.
Pre-requisite(s): ME 321

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

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

ME467 FINITE ELEMENT ANALYSIS (2-1-3): 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.

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.

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

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.
Pre-requisite(s): ME212, ME313

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, suspension 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.

Syed Muhammad Zoraiz Hussain
Junior Year

A white globe, surrounded by serene mountains in the lap of calm and composed waters of Tarbela, not only offers quality education but also a dense and dispersed extra-curricular environment due to its one-of-a-kind society culture.
Three years at GIK were like a roller coaster ride for me, it has the capability to take you to heights unseen. Taking admission at GIK was probably the best decision I could have taken at that time. One must prove oneself every day, in order to survive. But studies are just a small chunk of the larger picture, the thing that sets GIKI aside from other mainstream universities of Pakistan is its diverse society culture. This culture has the capability to groom you into a fine individual, but it is up to your own capability and capacity on how you can manage and attain a perfect balance between socializing and studies. The environment and competition at GIKI will push you to your limits, harder than you have ever experienced before but at the end it will forge you into a hardened steel, a solid sword that can face each situation that this mortal world has to offer.

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.

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.

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.

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

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.

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

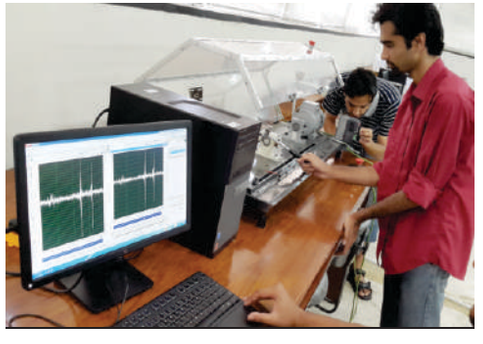
Amina Qaisar
Junior year

I vividly remember the first time I set foot into GIKI as a shy and timid young girl, with mixed feelings of excitement and fear of what the next 4 years over here had in store for me; and since then, honestly, my life has never been the same. I wouldn't say it was easy, but I assure you, joining GIKI was probably the best decision that I've ever made. Bound within these walls is a beautiful campus, within which resides an endless whirlpool of classes, labs, quizzes, society events, and of course, the unceasing fun. Over here, it's not just about doing your best; it's about doing your best under intense pressure. It's about crossing your boundaries, going out of the box, and pushing yourself to achieve whatever you put your mind to. It's about self-motivation, self-belief, self-reliance and a wild dream to be the best you could ever be As an international student, enrolled in the absurdly gender-segregated field of mechanical engineering, I was repeatedly questioned if I could survive. But what the world made me feel like I couldn't do, GIKI made me believe that I could. GIKI has reshaped me, in terms of strength, confidence, determination, and latitude. It has built me into a woman I never thought I could be. And today, I can undoubtedly say, that no matter what the future holds, I will make it through.

Availability Maintainability and Safety (RAMS), Industry 4.0, ERP, e-Commerce

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

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.



Lab Courses

ME243 ELECTRONICS AND INSTRUMENTATION LAB (0-3-1): Laboratory experiments related to circuits, electronic devices and instrumentation.
Co-requisite(s): ME202, ME203

ME244 STATICS AND DYNAMICS LAB (0-3-1): Laboratory experiments related to Statics and Dynamics.
Pre-requisite(s): ME111; 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

ME342 MECHANICS OF SOLIDS AND MANUFACTURING PROCESSES LAB (0-3-1): Experiments related to Mechanics of Solids and manufacturing processes.
Pre-requisite(s): ME213; Co-requisite(s): ME353

ME347 THERMO-FLUID LAB-II (0-3-1): Laboratory experiments related to Heat Transfer and Fluid Mechanics II.
Co-requisite(s): ME333, ME322

ME447 MECHATRONICS LAB (0-3-1): Laboratory experiments related to Mechatronics.
Pre-requisite(s): ME203; Co-requisite(s): ME403

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

DEPARTMENT OF CIVIL ENGINEERING

Thrust Areas

Water Resources Engineering
Geotechnical Engineering
Transportation Engineering
Structural Engineering
Environmental Engineering
Construction Engineering

Faculty

Muhammad Ashraf Tanoli	PhD (Tottori University, Japan)
Khawar Rehman	PhD (Hanyang University, Republic of Korea)
Shamsher Sadiq	PhD (Hanyang University, Republic of Korea)
Shiraz Ahmed	PhD (University of Hasselt, Belgium)
Muhammad Farjad Iqbal	MS (Shanghai Jiao Tong University, China)
Muhammad Naveed	MS (Polimi, Italy)

Lab Engineers

Muhammad Hamza Sabir	BS Eng. (COMSATS, Pakistan)
Muhammad Shahkar	BS Eng. (COMSATS, Pakistan)
Kaleem Afzal	BS Eng. (UET Peshawar, Pakistan)

HOD

M. Ashraf Tanoli

PhD (Tottori University, Japan)

Civil Engineering

The ever green field of Civil Engineering is a necessity for the people dwelling all around the globe. The increase in population calls for more structural construction but lesser vegetative destruction. Be it water sanitation, building construction, travelling through canyons, over, under and around the mountains, Civil Engineering is an integral part of all development.

Being a multi-dimensional field, the Civil Engineering program at GIK Institute offers six major thrust areas to its students. The program trains its graduates to participate effectively in the development challenges by getting involved in multiple projects of national and international scope.

The department aims to train its graduates to gain practical understanding of the theoretical knowledge obtained in class by applying them in the department's immaculate laboratories. The campus of GIK Institute provides necessary field area for understanding the application, and integration of field and laboratory outcomes.

Thrust Areas

- Water Resources Engineering
- Geotechnical Engineering
- Transportation Engineering
- Structural Engineering
- Environmental Engineering
- Construction Engineering

Department Mission

The department's mission is to inspire and produce competitive professionals to address societal changes through innovation in Civil Engineering education and research.

Program Educational Objectives (PEOs) Main emphasis of Civil Engineering Faculty 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 development in the field.

PEO3: Graduates possess 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: An ability to apply knowledge of mathematics, science, engineering fundamentals and an engineering specialization to the solution of complex

engineering problems.

PLO 2: 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.

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: 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.

PLO 5:Modern Tool Usage: An ability to crate, select and apply appropriate techniques, resources and modern engineering and IT tools, including prediction and modeling, to complex engineering activities, with an understanding of limitations.

PLO 6: 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.

PLO 7: 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.

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

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

PLO 10: 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 report and design documentation, make effective presentations and give and receive clear instructions.

PLO 11: 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.

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

LABORATORIES

Theory of Structures Lab

The theory of structures 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 a member can absorb at the ultimate loading.

Transportation Lab & Highway 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

The 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 Atterbergs' limits. The installed equipment can determine permeability of soil, verify of 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.

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

Environmental engineering 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 Lab

The fluid mechanics lab has equipment which includes pressure gauges, venturi flume, Bernoulli's theorem apparatus, turbines and pump. The equipment is digitized to accurately measure the head losses in different cases including various materials and types of bends. The lab also contains an 8m long tilting flume to

approximate the open channel flow conditions in the laboratory.

Hydrology and Water Management 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 Primevera and geotechnical hazard assessment using OpenQuake.

ACCREDITION

The PEC has granted formal approval to initiate BS civil Engineering. It is the one of the first program across Pakistan to have started on OBE guidelines from day one.

A. General Education requirements (57)

Subject Area	Course Code	CH
Computer Sciences	CS101, CS101L, CS102L	4
Humanities	HM101, HM102, HM211, HM322	12
Management Sciences	MS496, CV323, CV323L, CV407	8
Natural Sciences	MT101, MT102, MT201, ES202, ES341, CH101,CH161	18
Basic Engineering	PH101, PH101L, PH102, PH102L	8
Interdisciplinary Engineering	ME101, MM102, MM141L, ME102, ME102L	7

B. Core requirements (74)

Surveying and Geo Informatics	CV201, CV201L, CV202, CV202L, CV305, CV305L	7
Geotechnical Engineering	CV230, CV231, CV231L, CV332, CV332L	10
Structural Engineering	CV211, CV211L, CV212, CV213, CV313, CV412	15
Concrete Engineering	CV215, CV215L, CV314, CV414, CV414L	11
Hydraulic Engineering	CV221, CV221L, CV322, CV322L, CV425	10
Transportation Engineering	CV341, CV442, CV442L	7
Construction Engineering	CV351	2
Environmental Engineering	CV361, CV361L	4
Civil Engineering Drawing	CV301L	1
Quantity Surveying and Cost Estimation	CV403	1
Project	CV481, CV482	6

C. Technical electives (6)

1. Structural Engineering

CV413	Matrix Methods of Structural Analysis	3
CV415	Introduction to Structural Dynamics	3
CV416	Pre-stressed Concrete	3
CV418	Introduction to Earthquake Engineering	3

2. Water Resources Engineering

CV422	Hydraulic Engineering Design	3
CV424	Applied Hydrology	3

3. Geotechnical Engineering

CV432	Foundation Engineering	3
CV433	Slope Stability	3
CV434	Design and Construction of Earthen Dams	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

CV457	Contract Management	3
CV458	Entrepreneurship	3

6. Environmental Engineering

CV464	Environmental Impact Assessment	3
CV465	Environmental Engineering II	3
CV466	Solid Waste Management	3

7. Geo Informatics Engineering

CV472	Remote Sensing	3
CV473	Watershed Modeling Using GIS	3
CV474	Climate Change	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 week internship after 6th semester.

CIVIL ENGINEERING – SEMESTER WISE BREAKDOWN

	Course Code	Course Title	Class Hrs	Lab Hrs	Credit Hrs	Pre-requisite	Co-requisite
Semester 1	MT101	Calculus I	3		3		
	PH101	Mechanics	3		3		
	CS101	Introduction to computing	2		2		
	CH101	Chemistry for Engineers	3		2		
	HM101	English and Study Skills	3		3		
	PH101L	Mechanics Lab		3	1		PH101
	ME101	Workshop Practice		3	1		
	CS101L	Computing Lab		3	1		CS101
	CH161	Occupational Health and Safety		3	1		
Semester 2	MT102	Calculus II	3		3	MT101	
	PH102	Electricity and Magnetism	3		3		
	CV111	Mechanics of Solids I	3		3		
	CV111L	Mechanics of Solids I Lab		3	1		CV111
	HM102	Technical Report Writing	3		3		
	ME102	Engineering Graphics	1		1		
	ME102L	Engineering Graphics Lab		3	1		ME102
	PH102L	Electricity and Magnetism Lab		3	1		PH102
	CS102L	Intensive Programming Lab		3	1		CS101
Semester 3	MT201	Differential Equations and Linear Algebra I	3		3	MT102	
	CV201	Basic Surveying	2		2		
	CV201L	Basic Surveying Lab		3	1		CV201
	CV215	Construction Materials and Concrete Technology	3		3		
	CV215L	Construction Materials and Concrete Technology Lab		3	1		CV215
	CV221	Fluid Mechanics I	2		2		
	CV221L	Fluid Mechanics I Lab		3	1		CV221
	CV230	Engineering Geology	2		2		
	HM211	Pakistan and Islamic Studies	3		3		

Semester 4	ES202	Probability and Statistics	3		3	MT101	
	CV241	Transportation Engineering	3		3		
	CV202	Advanced Surveying	1		1	CV201	
	CV202L	Advanced Surveying Lab		3	1		CV202
	CV212	Mechanics of Solids II	2		2	CV111	
	CV213	Basic Structure Analysis	3		3		
	CV231	Soil Mechanics	3		3		
	CV231L	Soil Mechanics Lab		3	1		
Semester 5	ES341	Numerical Analysis	3		3	MT201	
	CV313	Indeterminate Structural Analysis	3		3	CV213	
	CV322	Fluid Mechanics II	3		3	CV221	
	CV322L	Fluid Mechanics II Lab		3	1		CV322
	CV332	Geotechnical Engineering	3		3	CV231	
	CV332L	Geotechnical Engineering Lab		3	1		CV332
	CV323	Hydrology and Water Management	2		2		
	CV323L	Hydrology and Water Management Lab		3	1		CV323
	CV301L	Civil Engineering Drawing and Graphics		3	1		
Semester 6	CV305	Geo Informatics	1		1		
	CV305L	Geo Informatics Lab		3	1		CV305
	CV314	Reinforced Concrete Design I	3		3	CV215	
	CV324	Engineering Hydraulics	3		3	CV322	
	CV351	Construction Engineering	2		2		
	CV361	Environmental Engineering I	3		3	CV221	
	CV361L	Environmental Engineering I Lab		3	1		CV361
	HM322	Corporate law and Professional Ethics	3		3		

Semester 7	CV403	Quantity Surveying and Cost Estimation	1		1		
	CV403L	Quantity Surveying and Cost Estimation Lab		3	1		
	CV407	Civil Engineering Economics	2		2		
	CV414	Reinforced Concrete Design II	3		3	CV314	
	CV414L	Reinforced Concrete Design II Lab		3	1		CV414
	CV442	Highway Engineering	3		3		
	CV442L	Highway Engineering Lab		3	1		CV442
	CVxxx	Technical Elective I	3		3		
	CV481	Senior Design Project I		9	3		
Semester 8	CV412	Design of Steel Structures	3		3		
	CV425	Irrigation Engineering	3		3		
	MS496	Project Management	3		3		
	CVxxx	Technical Elective II	3		3		
	CV482	Senior Design Project II		9	3	CV481	

CV111 Mechanics of Solids I: (3-0-3) Simple Stress and Strain (Hooke's law, Moduli of elasticity, Lateral strain, Volumetric strain, Poisson's ratio, Temperature stresses). Shear Force and Bending Moment Diagrams. Stresses in beams (Theory of simple bending, Applications of flexure formula, Computation of shear stresses in beams, Shear center and shear flow). Columns and Struts (Axially loaded columns, Euler's formula, Rankine Gordon formula for short and intermediate columns, Slenderness ratio). Circular shafts. Springs (Open coil springs, Closed coil springs, Leaf springs).Strain Energy (Strain energy due to direct loads, shear force, bending moment and torque; Stresses due to impact loads; Application of strain energy, its minimization and equilibrium).

CV111L Mechanics of Solids I Lab: (0-3-1)

To determine young's modulus of elasticity of steel bar. To perform young's modulus of elasticity for concrete. To perform compression test on wood sample of 2"x2"x2" size, with load parallel and perpendicular to grains. To perform impact test on metals. To perform bending test on 1.5"x3"x30" specimen. To investigate the relationship between the deflections and the applied loads and the effect of variations in length and cross sectional dimensions on the beam deflection. To study the effect of combined bending & torsion. To study the effects unsymmetrical bending of beams. To determine and compare the modulus of rigidity for different materials. To determine the crippling load for struts of varying slenderness ratios and end fixing conditions.

CV201 Basic Surveying: (2-0-2)

Calculation of Area and Volumes (earth work calculation, DMD method, Simpson and trapezoidal rule). Traversing (traversing with prismatic compass and plane table, computations and adjustments of traverse). Plane Table Surveying (parts and accessories, methods, two and three-point problems). Leveling (Type of levels, principle of leveling, classification of leveling, errors in leveling). Contouring (characteristics of contour line, locating contours, interpolation of contours). Global Positioning System (types, accuracy of GPS, factors affecting GPS.

CV201L Basic Surveying Lab: (0-3-1)

Drawing of Chain Survey Sketch of a small area. Use of level and drawing a contour plan of an area. Use of plan table and drawing a plan table sketch of an area. Drawing of L section and cross section of road by leveling.

CV202 Advanced Surveying: (1-0-1)

Tacheometry (Principles of tangential and stadia methods. Field observations and Calculations for measurement of horizontal distance and height).Theodolite Traverse (Theodolite. Temporary adjustment of Theodolite) Measurement of angles. Traverse survey with the Theodolite. Checks in traversing. Traverse computations. Adjustment of closed traverse. Computation of area of a closed traverse. Measurement of horizontal and vertical angles. Triangulation Photogrammetry. Hydrographic surveying. Tunnel Surveying. Geographic

Information System. Remote Sensing. Curves (Simple circular curves, compound curves, transition curves, vertical curves, reverse curves). Computations and setting out by different methods.

CV202L Advanced Surveying Lab: (0-3-1)

To determine height of a building when base in accessible. To determine height of a building when base in inaccessible. Theodolite Triangulation, its adjustments and plotting. Theodolite Traversing and Plotting of Traverse. Setting out simple curve by Rankine's Method. Setting out simple curve by offset from long chord. Setting out simple curve by offset from tangent. Setting out compound curve by Rankine's Method. Setting out transition curve. Building Layout. Demonstrate working on Total Station.

CV212 Mechanics of Solids II: (2-0-2)

Stress Analysis (Analysis of stresses and strains due to combined effect of axial force, shear force and bending moment. Mohr's circle for stresses & strains. Strain rosettes).Theories of Failure. Unsymmetrical Bending. Thin and Thick Cylinders (Introduction to cylindrical pressure vessels, Stresses in Thin cylinders, Strains in Thin cylinders, Thick Cylinders, stresses in thick cylinders). Analysis of Curved Beams (Curved Beams and Stresses in Curved Beams, Circumferential Stresses in Curved Beams, Location of Neutral Axis in Curved Beams, Radial Stresses in Curved Beams). Eccentrically Loaded Columns (Deflections and bending moment in eccentrically loaded column, The Secant Formula).

CV213 Basic Structure Analysis: (3-0-3)

Redundancy and stability of structures. Analysis of Determinate pin Jointed Structures. Analysis of Statically Determinate Rigid Jointed Plane Frames. Influence lines for reactions, shear force and bending moment in statically determinate beams and paneled girders, influence lines for member forces in pin jointed frames, Calculation of maximum stress function in these structures. Three Hinged Arches, Cables and Suspension Bridges: Basic considerations in analysis and design. Moving loads on three hinged arches and suspension bridges. Moment area method, conjugate beam method, double integration method, Castigliano's second theorem. Rotation and deflection of plane trusses and frames. Principle of virtual work, unit load method, graphical method.

CV215 Construction Materials and Concrete Technology (3-0-3).

Ceramics and Bricks: History and evolution of ceramics, Manufacture of ceramics, Properties and applications of ceramics in buildings. History and evolution of bricks, Properties and applications of bricks, Brick dimensions, Manufacture and classification of bricks. Plastics: Structure of plastics, Polymer technology, Types, Properties, Use of plastics as construction material Glass: Constituents of glass, Methods of manufacture, Types, Use and significance in civil engineering, Advantages and drawbacks. Wood: Structure of tree, General characteristics, Types, Seasoning of wood, Preservation of wood, Lamination of wood. Paints: Objectives, Composition, Types, Consideration in choosing a particular paint, Introduction, objectives and applications of varnish. Concrete and Concrete Materials. Workability of Concrete, Measurement of workability, slump test, Ve Be test, C.F Test and Segregation and bleeding control of segregation). Admixtures. Mixing, Transporting, Placing & Compaction of Concrete. Curing of Concrete (Curing of concrete, Maturity of concrete. ACI recommendations). 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 of Concrete (Nature of strength of concrete, factors affecting the strength). Durability of Concrete (Definition, Deteriorating influences, Chemical attack on

concrete, Sulphate attack.

CV215LConstruction Materials and Concrete Technology Lab (30-3).

Tests on Cement and Aggregates, Measurement of the fineness of cement, setting time of cement, specific gravities of fine and coarse aggregate, fineness modulus of sand, measurement the moisture content in coarse and fine aggregate, the water absorption in coarse and fine aggregate. soundness of coarse aggregate, organic impurities in sand, Slump Test, CF Test, VeBe Test, Compressive strength and, Measurement of air content in concrete, Effect of curing on the strength of concrete, Compression test on cubes and cylinders, Flexure test, equivalent cube test, Splitting test, Effects of water cement ratio on the strength of concrete, Effect of age on the strength of concrete, Mix design by ACI method, Rebound hammer test on concrete specimens, Ultrasonic pulse velocity test.

CV215L Concrete Technology Lab: (0-3-1)

Tests on Cement and Aggregates, Measurement of the fineness of cement, setting time of cement, specific gravities of fine and coarse aggregates, fineness modulus of sand, measurement of the moisture content in coarse and fine aggregates, the water absorption in coarse and fine aggregates. soundness of coarse aggregates, organic impurities in sand, Slump Test, CF Test, Ve Be Test, Compressive strength and, Measurement of air content in concrete, Effect of curing on the strength of concrete, Compression test on cubes and cylinders, Flexure test, equivalent cube test, Splitting test, Effects of water cement ratio on the strength of concrete, Effect of age on the strength of concrete, Mix design by ACI method, Rebound hammer test on concrete specimens, Ultrasonic pulse velocity test.

CV221 Fluid Mechanics I: (2-0-2)

Properties of Fluids (Shear stresses in moving fluids, specific weight, specific gravity, specific volume. Dynamic and kinematic viscosity; Surface tension; Capillarity; Vapor pressure). Pressure and Head (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 (Uniform and steady flow; Real and ideal fluids; Compressible and incompressible flow; One, two and three-dimensional flow; Streamline; Laminar and turbulent flow; Velocity variation over a section, Mean velocity; Discharge). Fundamental Equations of Fluid Motion. Applications of the Energy equation (Flow through a tapering pipe, Venturimeter, Notches, Orifices, Pitot tube, Sharp-crested weir).

CV221L Fluid Mechanics I Lab: (0-3-1)

Demonstration of various parts of hydraulic bench and measure of discharge. Calibration of pressure gauge using dead weight tester. Determination of the center of pressure of a submerged plane surface. To investigate the stability of a floating body. Demonstration of Bernoulli's theorem. Study of flow through Venturimeter. Determination of the coefficients of contraction, velocity and discharge for an orifice. To study the impact of jet on a flat plate and a hemispherical cup. Demonstration of Reynolds number apparatus. Demonstration of flow visualization on laminar flow table. Determination of the coefficient of discharge for a V-shaped and a rectangular notch

CV230 Engineering Geology: (2-0-2)

Introduction to Geology Rocks and Minerals (main groups, igneous, sedimentary and metamorphic rocks, importance of minerals and ores, rock cycle). Weathering and Erosion (agents of weathering, weathering classification, cycle of erosion, erosion types, land forms, mass wasting, formation of meanders and ox-bow lakes).Structural Features (dip, strike, folds, faults, joints, unconformities, effects of structural features on civil engineering projects).Earthquakes (definition and technical terms, causes, classification, measuring of earthquake intensity), Landslides, Glaciers and Glaciations. Tunneling. Engineering Applications.

CV231 Soil Mechanics: (3-0-3)

Basic Properties of Soil: (Soil formation and nature of soil constituents, Physical properties of soil, Weight volume relationships, Mechanical analysis of soil Hydrometer analysis, Consistency limits of soil). Soil Classification Systems: (AASHTO and Unified soil classification system). Soil Compaction: (Moisture density relationships, Properties and structures of compacted soils, Factors effecting compaction). Permeability and Seepage :(Hydraulic gradients, Darcy's law, Coefficient of permeability, Factors affecting permeability, Field determination 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.

CV231L Soil Mechanics Lab: (0-3-1)

To conduct the Sieve Analysis of Soil, to determine the Moisture Content of Soil by; Oven Drying Method, Speedy Tester Method, to find the Specific Gravity of Soil. Atterberg Limits, Hydrometer Analysis to measure and quantify the size distribution of the clay and silt content in soil, To conduct the Permeability Test of soil using Constant Head Apparatus and Variable Head Apparatus, To find the Optimum Moisture Content (OMC) for compacted soil by, Standard Proctor Test, Modified Proctor Test, To determine the in Situ Density of Soil by Core Cutter Method and by Sand Replacement Method, to conduct the consolidation test to find settlement of soil.

CV273 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.

CV301L Civil Engineering Drawing and Graphics: (0-3-1)

Types of Civil Engineering drawing. Set of the working drawings of a residential building. Preparation of plans, elevations and sections Use of computer graphics software. Introduction of

building information modeling (BIM). Application of architectural planning and rendering in Civil Engineering projects. Basic Concepts of AutoCAD. Building Drawing, Structural Drawing (Elements of structural drawing and detailing: Preparation of foundation plan, structural framing, slab details, staircase details, water tanks, beam and column elevations and sections mostly pertaining to reinforced concrete structures. Details of steel roof truss, connection details and fabrication drawings, Plumbing and electrical detailing pertaining to small residential units).

CV305 Geo Informatics: (2-0-2)

Introduction to Geo informatics; Resources of information; photogrammetric surveying, Satellite System, Aerial and Satellite photogrammetry. Geographic Information System (GIS): Fundamentals of GIS, Spatial Data types and acquiring consideration. Data models and structures. Coordinate System, Datum and map projection and their transformation. Attribute-based operation, Introduction to Spatial Analysis. Remote Sensing (RS): Basic Concepts. Physicals basis of Remote Sensing, Earth Resources Satellites/ Platforms, Sensors, Types of Resolutions, Geo-Referencing, Image Processing Techniques. Classification. Global Positioning System (GPS): Navigational Satellites, Positioning Systems, Fundamentals and Elements of GPS.

CV305L Geo Informatics Lab (0-1-1).

Tutorial on Spatial Data Generation, Modeling, Analysis and Applications. On Satellite Image Dereferencing Enhancement, And Filtration, Transformation, Classification and Accuracy Assessment and Application. Laboratory Session Evolving Use of State of The Art GIS. Use Image Processing

Software. Handling and Analysis Spatial Datasets Including Satellite Images Reading. To Digitize MAPs.

CV313 Indeterminate Structural Analysis: (3-0-3)

Method of Consistent Deformations (Analysis of statically indeterminate beams, frames,

Introduction to Castigliano's second theorem, Analysis of Indeterminate Trusses, Application of virtual work method to deflection of trusses, Analysis of trusses with redundant support viscosity. Determination of the coefficient of drag of a sphere falling through a column of water. Determination of head loss through a straight pipe of uniform cross section. Determination of head loss through different pipe fittings. To study cavitation phenomenon. To study characteristics of a centrifugal pump. To study characteristics of a Francis turbine. To study the characteristics of a reciprocating pump.

CV323 Hydrology and Water Management: (2-0-2)

Surface water hydrology (Hydrological cycle, Hydrologic equation and Importance and practical applications of hydrology). Precipitation, Water Losses, Evaporation, Transpiration, Evapotranspiration. Runoff & Hydrograph (Runoff & Factors Affecting Runoff, Computation of Runoff, Characteristics of hydrograph, Components of a hydrograph, Unit Hydrograph, S-curve and Discharge estimation by probabilistic method). Stream Flow Measurement. Ground water hydrology (Aquiclude, Aquifuge, Aquifer & Types of Aquifer). Well Hydraulics (Steady Radial Flow to Well in Confined & Unconfined Aquifers – Dupuits Theory, Assumptions & Limitations of Dupuits Theory, Well Losses, Capacity of Well, Interference among Wells).

CV323L Hydrology and Water Management Lab: (0-3-1) Measurement of precipitation and Computation of Average Rainfall over a Basin, Stream Flow Measurement, Methods of Stream Gauging and Measurement of Stream Flow by Current Meter,

CV332 Geotechnical Engineering: (3-0-3)

Shear Strength of Soil, Bearing Capacity of Soil (Terzaghi's bearing capacity theory; Meyerhoff's method; Vesic's method Factors affecting bearing capacity; Bearing capacity from field tests; Effect of GWT on bearing capacity Stresses due to Point Load, Strip Load etc., Types of Foundations. Geotechnical design of shallow foundation, Deep Foundations, Lateral Earth Pressure (Active, at rest and Passive earth pressures; Rankine and Coulomb's theories; External stability of gravity and cantilever retaining walls). Stresses in soil, Slope Stability: Types of slopes, Factors affecting stability and remedies, Types of failure Methods of analysis; Swedish circular method, Taylor's slope stability number and Bishop's Methods.

CV332L Geotechnical Engineering Lab: (0-3-1)

To find the geotechnical parameters cohesion (c) and angle of internal friction (ϕ) of soil by Direct Shear Test Apparatus, To find the geo-technical parameter cohesion (c) and angle of internal friction (ϕ) by Unconfined Compression Test Apparatus, To conduct the Consolidated Drained Test of soil by using Tri-axial Compression Test Apparatus, To conduct the Consolidated Undrained Test of soil by using Tri-axial Compression Test Apparatus, To conduct the Unconsolidated Undrained Test of soil by using Tri-axial Compression Test Apparatus, To conduct the Standard Penetration Test (SPT) to find the bearing capacity of Soil, To conduct the Cone Penetration Test (CPT) to find the bearing capacity of Soil, To conduct the plate load test to find out the bearing capacity of Soil .

CV341 Transportation Engineering: (3-0-3)

Introduction to Transportation Systems. Airport Engineering, Aircraft Characteristics and Computation of Runway Length, Airport Configurations, Geometric Standards and Obstruction Clearance Criteria, Railway

Engineering, Track, Rail Gauges, Rails and Rail Fastenings, Sleepers, Ballast and Formation (Function and type of sleepers; Sleeper material, density, spacing and stiffness of tracks; Material for ballast and renewal), Creep and Rail-bed Soil, Station and Yards, Construction and Maintenance. Coastal Engineering, Ports and Harbor, Effects of Tides, Winds and Sea waves, Ports and Harbor Structures, Maintenance and Modernization (Coastal protection; Dredging, sluicing).

CV351 Construction Engineering: (2-0-2)

Construction projects, Project goals and objectives, Project categories, Building permits, codes and construction standards, Sustainability. Construction Equipment, Investment costs, Maintenance and repair costs. Productivity and cost effectiveness. Site selection and orientation of building, Grading considerations, Layout techniques with special reference to buildings. Construction Methodologies, Methodologies for Excavation in different types of soils, In-situ and pre-cast concrete construction of buildings. Design and use of formwork. Methods of concreting. Construction joints, Mass concreting, Process of site reactions). Method of least work (Application to beams and trusses). Slope-Deflection Method. Moment Distribution Method. Rotation Contribution Method (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, Evaluation of stiffness factors and carry-over factors).

CV314 Reinforced Concrete Design I: (3-0-3)

Basic principles of reinforced concrete design and associated assumptions, Behavior of reinforced concrete members in flexure, Design philosophy. Working stress method. Serviceability criteria and checks for deflection, crack width, and crack spacing. Ultimate Strength Design method, Analysis of one-way solid and ribbed slabs with general discussion on other slab systems, Shear stress in reinforced concrete sections, Design for diagonal tension. Design and detailing for bond, anchorage, development length, laps and splices. Short Columns (Axial capacity within elastic range and at ultimate loads bending of short columns about single axis). Design of Isolated footings and structural design of simple rectangular footing.

CV322 Fluid Mechanics II: (3-0-3)

Dimensional Analysis and Similitude (Geometric, kinematic and dynamic similarities; Different dimensionless numbers and their significance). Laminar Flow Through Pipes, Turbulent Flow Through Pipes (Turbulent flow; Darcy Weisbach equation; Velocity distribution in fully turbulent flow; Shear stresses in pipes; Universal velocity distribution; Turbulent fluctuating velocity components; Moody chart and Colebrook-White formula; Separation losses). Steady, Incompressible Flow in Pipelines, Steady, Uniform Open-Channel Flow. Incompressible flow around a body, Fluid Machines (Velocity diagrams for fluid machines; turbines, Centrifugal pump, construction features and applications; Reciprocating pump, construction features and applications; Cavitation in Fluid Machines).

CV361 Environmental Engineering I: (3-0-3).

Sources of Water Supply (Types of well construction, Yield of well, Test for yield of well etc). Water Quantity Population Forecast (Water uses & consumption, Types and variations in

demand), Rural Water Supply & Urban Water Supply. Collection and Conveyance of Water (Intake, Types of intakes, pipes, pipe corrosion). Water Distributions (Layout and design of water transmission works and distribution networks, service reservoirs, Fixtures and their installation, Service Reservoirs, Fixture and their installation, tapping of water mains). Water Quality (Water impurities and their health significance, Water quality standards, Water quality monitoring). Water Supply Sampling and Testing. Diseases (Water borne, and Vector borne diseases). Estimation of Sewage Quantities, Characteristics of Sewage (Sampling techniques and Examination of waste water). 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 and Analysis, diameter and Gradient, Sewer.

CV361L Environmental Engineering I Lab I: (0-3-1).

To find out the Turbidity of a given sample of waste water by Nephelometeric method, To determine the pH value of a given sample of water, To find out the suspended solids (SS), dissolved solids (DS) and total solids (TS) in the given sample of water, To determine the Carbonate, Bicarbonate and Hydroxide Alkalinity in the given sample of water, To find out the concentration of Chlorides and residual chlorine in the given sample of water, To find out the Hardness in the given sample of water by standard EDTA method, To determine the optimum dosage for the turbid water by Jar test, Estimation of Chemical Oxygen Demand (COD) in water To determine the Biochemical Oxygen Demand (BOD) in water, To Determine the Dissolved oxygen in a sample by Azide Modification method, To find out Hydrogen sulfide and E-coli in the given sample of water.

CV403 Quantity Surveying and Cost Estimation: (0-1-1).

Introduction (Cost estimating process, Design process and Types of cost estimates). Budget Estimates (Budget estimates, Design budget estimates and Budget estimate accuracy). Preconstruction Services Estimate (Development of the preconstruction services estimate, Preconstruction services contract and Process interactions). PreEstimate Activities (Estimating process, Invitation for bid, Pre-bid meeting, Bid date and time, Bid document revision, Deciding whether or not to tender a bid, Work breakdown structure, Estimating team, Scheduling the estimating work, Subcontractors and major suppliers, Data resources, estimating forms, files and electronic spreadsheets). Estimating Sub-Contractor Works.

CV407 Civil Engineering Economics (2-0-2).

Fundamentals of Engineering Economics: Basic concepts and principles of Economics, Micro-economics theory. Capital Financing and Allocation: Capital Budgeting, allocation of capital among independent projects, Financing with debt capital, Business Organization and Industrial Relationship: Linear Programming: Mathematical statement of linear programming problems, Graphic solution simplex procedure, Duality problem Depreciation and Taxes: Depreciation concept, Economic life, Methods of depreciation, Profit and returns on capital, productivity of capital, Gain (loss) on the disposal of an asset, Depreciation as a tax shield. Selection between Alternatives: Time value of money and financial rate of return, present value, future value and annuities, Rate of Return Analysis, Incremental analysis, Cost-benefit analysis, Payback period. Cost estimating: Types of Estimates, Approximate estimates – Unit estimate, Factor estimate, Cost indexes, parametric estimate, and Life cycle cost. Financial management: Construction accounting, Chart of Accounts, Financial statements – Profit and loss, Balance sheets, Financial ratios, Working capital management.

CV403 Quantity Surveying and Cost Estimation: (3-0-3)

Introduction (Cost estimating process, Design process and Types of cost estimates). Budget Estimates (Budget estimates, Design budget estimates and Budget estimate accuracy). Preconstruction Services Estimate (Development of the preconstruction services estimate, Preconstruction services contract and Process interactions). PreEstimate Activities (Estimating process, Invitation for bid, Pre-bid meeting, Bid date and time, Bid document revision, Deciding whether or not to tender a bid, Work breakdown structure, Estimating team, Scheduling the estimating work, Subcontractors and major suppliers, Data resources, estimating forms, files and electronic spreadsheets). Estimating Sub-Contractor Works.

CV412 Design of Steel Structures: (3-0-3)

Introduction to Structural Steel Design, Stress-strain Relationship in Structural Steel, Introduction to ASD (Allowable Stress Design) and LRFD (Load and Resistance Factor Design) methods, Fabrication and erection methods of steel structures. Tension Members. Compression Members. Design of Beams. Connection Design (Riveted connections, Types of rivets). Bolted connections. Welded Connections. Plastic Analysis and Design (Theory of Plastic analysis and Introduction to plastic design). Design of Roof Trusses (Roof trusses-introduction, Design loads and load combinations, Roof truss analysis and Design of roof trusses, using AISC specification), and Introduction to Relevant Software Packages.

CV413 Matrix Methods of Structural Analysis: (3-0-3)

Virtual force principle and flexibility method, flexibility of bar, beam and general flexural elements, analysis of 2D framed structures with temperature, support settlement and lack of fit. Virtual displacement principle and displacement method, element stiffness matrix for bar, beam and plane frame element, coordinate transformation. Compatibility and equilibrium. Assembly of structure stiffness matrix. Analysis by stiffness method of 2D trusses, beams and frames.

Reliability of computer results. Computer applications of above using interactive computer programs and Introduction to Finite Element Method.

CV414 Reinforced Concrete Design II: (3-0-3)

Two-way slab systems (Introduction, Design of two way slabs by Co-efficient method). Analysis and design of flat plate, flat slabs and waffle slabs, for flexure and shear under gravity loading. Design of biaxial column. Analysis and design of slender columns subjected to combined flexure and axial loading. Guidelines for design of shear walls-an over view. Design of Different Types of Foundations: Analysis and design of combined footing, strap, strip and mat footings. Stairs, Analysis and Design of Various Types of Stairs and Staircases. Pre-stressing Principles & Design Philosophy. Introduction to earthquake resistant design of structures. Design of cantilever retaining walls.

CV414L Reinforced Concrete Design II Lab: (0-3-1)

Concrete Portion: Design and sketch of residential building. Slab, beam, column, footing and retaining wall (Details). Steel Portion: Analysis of portal frame, Beam design, and beam column design, Foundation design, Joint design (Sketching and detailing). SAP, ETABS Etc.

CV415 Introduction to Structural Dynamics: (3-0-3)

Introduction to structural dynamics (Introduction to equation of motion and solution methods, Degrees of freedom and their inclusion in equation of motion. Introduction to 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, time period, amplitude of motion, natural frequency, Introduction to SDOF system, undamped SDOF system, damped SDOF system.

CV418 Introduction to Earthquake Engineering: (3-0-3)

Introduction to earthquake phenomena. Types of seismic waves and introduction to some major earthquakes in the Pakistan and world. Introduction to parameters of seismic response of structures. Introduction to Seismic hazard assessment. General seismic design considerations: common mistakes in practice, regularity, lateral force resisting mechanisms and ductility). Earthquake excitation, equation of motion of SDOF system for earthquake excitation. Generalized SDOF system, rigid body assemblages, and lumped mass system: shear building. Equation of motion for SDOF Lumped mass system: shear building and solution of various examples. Strong Ground Motion (Equivalent lateral force procedure and Calculation of base shear for given building frame system. Seismic design of reinforced concrete columns, according to provisions of ACI. Seismic design of concrete Structures. Seismic design of steel structures. Detailing of reinforced concrete structures for earthquake resistance as per Code).

CV324 Engineering Hydraulics: (3-0-3)

Non-uniform Flow in Open Channel (Specific energy, E-y curve, Subcritical and supercritical flow, Critical depth, Dynamic equation of gradually varied flow, Surface profiles, Backwater curves, Humps, Constrictions, Hydraulic jump, Broad-crested weirs, Venturi flume and Critical depth meters). Unsteady flow, Dams & Hydropower Engineering, Sediment Transport. Reservoir Sedimentation (Sediment rating curves, Sediment yield of a catchment and Sedimentation in reservoirs). Practicals (To study the subcritical, critical and supercritical flow in a flume. To study the flow over a broad-crested weir. To study the flow through a constricted channel section. To study the hydraulic jump. To study the flow below the sluice gate. To study the sediment transport phenomenon).

MOEZZA TEHSEEN
Junior

If you ask me what GIKI is to me, I'd say it's a second home to me and probably this is the response of most here. The emotion I feel every single day here is a mesmerizing amalgam of euphoria and fear. It's daunting and uplifting at the same time. The institute has the best to offer in every aspect be it academics, co-curricular activities or the beautiful scenery that surrounds the campus. It not only prepares you for the engineering field but also for life itself. I've grown so much as a person in this finite time here and so much is yet to be learnt. The best part about GIKI to me is its variety. It never gets monotonous here, one can always find something happening. My advice to enjoying your time here is to strike the right balance between your social and academic life.

CV422 Hydraulic Engineering Design: (3-0-3)

The Flow Resistance (The resistance equation, The Chezy equation, Behavior of Chezy coefficient C, The Manning's equation, The uniform flow). The 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 (The natural river, The dominant discharge, Braided and meandering channel, Width-discharge-slope variations, River training and control, Scour around bridge piers).

CV425 Irrigation Engineering (3-0-3).

Indus Basin Irrigation System. Canal Irrigation (Elementary concept about canal head works. Weirs and barrages). Components and functions. Measures adopted to control silt entry into canals. Design of weirs on permeable foundations. Sheet piles and cut off walls. Design of irrigation channels. Kennedy's and Lacey's Theories. Rational methods for design of irrigation channels. Comparison of various methods. Dams Engineering (Selection of dams sites, Components of dams, Layout of dams, Types of storage dams, Forces on dams, Design of gravity dams, Reservoir engineering and Operation and regulation of storage reservoirs). Barrages and Headworks (Canal head regulators. Falls. Flumes. Cross drainage works, types and functions. Water Logging and Salinity (Causes and effects of water logging).

CV432 Foundation Engineering: (3-0-3)

Introduction; Investigation of subsurface condition; Principles of foundation engineering; Stress distribution due to eccentric loading; Geotechnical design of shallow foundation; Geotechnical design of Retaining walls and abutments; Settlement analysis of shallow foundations; Geotechnical design of machine foundation; Deep Foundations-Piles and Piled Foundations, Classification of piles,

Load carrying capacity of piles, Pile driving, Settlement of single piles, Settlement of pile groups, Geotechnical design of driven piles under axial loads, Geotechnical design of driven shafts under axial loading, design of piles under lateral loads, Analysis and design of piles using computer; Deep excavation, Stability Of Excavations-Earth pressure on braced excavations, design of anchors and sheet piles.

CV433 Slope Stability: (3-0-3)

Introduction, General Principles of the Behavior of Soft Ground, Field Instrumentation for Soft Ground, Examples of Instrumentation, Applications for Projects in Soft Ground, Behavior of Clay Foundation Soils, Drained and Undrained analysis, Different types of slope failures, their identification, Different method for slope stability analysis, Factor of Safety, Limit Equilibrium Analysis of slopes using software, Methods of Construction, Strategy for Design Studies, Fundamentals of Geosynthetics, Soil-Geosynthetic Interaction, Geosynthetic for Retaining Walls, Geosynthetic for Embankments, Geosynthetic for Shallow Foundations, Geosynthetic for Slopes, Geosynthetic for Earth Dams, Geosynthetic applicationsgeneral aspects and selected case studies.

CV434 Design and Construction of Earthen Dams: (3-0-3)

General Design Criteria, Theoretical Aspects of Seepage (Flow net for earth dam, Use of SEEP/W computer software for generating flownet). Control of Seepage Through Embankments (Adverse effects of seepage, Methods of seepage control, Provision of core, Design of transition filters, Drainage of embankments, Drainage of upstream face and Control of seepage on downstream face). Control of Seepage Through Foundations. Section Detail related special problems (Section details, Cracking and its control, Dams in fault zones, River diversion, Conduits through earth dams and Dispersive and expansive soils). Quality Control of Earthen Dams (Compaction, Placement control, Field tests, Borrow area control, Foundation preparation and treatment and Contact treatment).

CV442 Highway Engineering: (3-0-3)

Pavement Engineering, Pavement Materials(Road bed soils, Stone aggregates, gradation and batch mixing problems, Composition, types and characterization of
bituminous materials, Bituminous binder testing, Marshall mix design). Pavement Structural Design Geometric Design, Highway components, typical cross sections. Elements of Road Cross-section (Pavement characteristics; Drainage channels, curves and traffic barriers; Right of way). Horizontal and Vertical road alignment. Road Construction and Maintenance. 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.

CV442L Highway Engineering Lab: (0-3-1)

Penetration test of bituminous materials. Ductility test of bituminous materials. Softening point test of bituminous materials. Flash and fire point of bituminous materials. Aggregate gradation test. Lab and Field CBR Test. Compaction Test. Blending of aggregates – Mix Design. Marshall Stability and flow test – Mix Design.

CV443 Traffic Engineering: (3-0-3) Traffic Engineering (Elements of traffic engineering, Traffic characteristic, Traffic survey and Mass transit and rapid transit). Traffic Flow Characteristics (Nature of traffic flow, Parameters connected with traffic flow, Categories of traffic flow, Analysis of speed flow and density relationship, Traffic stream characteristics, Interrupted and uninterrupted traffic flow models and Queuing theory and shock wave theory). Traffic Safety (Traffic regulation and control, Traffic signs, Clear roadside recovery areas, Guardrail design, Median barriers, Crash cushions and Highway lighting, Measures of safety and identification of hazardous location and Safety considerations in highway design), Traffic Signals (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 (PCA mix design, Batch mixing, transporting and handling of concrete). Asphalt and Concrete Batching Plants, (Material calculations, Layout and material handling. Practicals (Standard viscosity test for bituminous materials, bituminous materials extraction test, Marshall stability and flow test, Preparation of job mix and PG binder testing). Pavement Systems (Pavement types, Wheel loads, Design factors, Layered system concept). Pavement Design (ASSHTO design methods - Flexible and Rigid).

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). Highway Capacity Manual (Introduction, Usage of manual, Making profiles for draftman/AutoCAD), 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). Practicals (Making horizontal and vertical profiles using CAD, Cross sections of roads on CAD and Introduction to geometric design software).

CV457 Contract Management: (3-0-3)

Principles of administration of construction contracts, Types of Construction Contracts. Option for Project Delivery. Procurement Methods (Bid Method, Negotiated Method). Subcontracting Partnering (Subcontracting, Partnering and Strategic Alliances). Analysis of Contracts (Analysis of Selected Contracts, Contract Clauses and Comparison). Contract Disputes (Reasons of Contract Disputes, Clauses of Contract to Prevent Disputes). Dispute Resolution (Methods of Dispute Resolution; Mediation, Arbitration and DAB). Contract claims. International Contracting (International contracting, Joint Ventures, FIDIC Form of Contract).

CV458 Entrepreneurship: (3-0-3)

: The concept of entrepreneurship, the economist view of entrepreneurship, The sociologist view, Behavioural approach, Entrepreneurship and Management Entrepreneurial Management, The entrepreneurial business, Entrepreneurship in service institutions, The new venture Entrepreneurship and Innovation, Importance of innovation for entrepreneurship, Sources of innovative opportunities, The innovation process, Risks involved in innovation Developing Entrepreneur, Motivation and compensation, Devising entrepreneurial marketing plan, Entrepreneurial marketing strategies, Role of entrepreneur in the economic development generation of services, Employment creation and training, Ideas, knowledge and skill development.

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. Water Quality (Water quality and impact of project on water quality). Future of Environmental Impact Assessment (Future of environmental management, Environmental

issues and Future of environmental impact assessment). Mitigation of environmental impacts. World Bank (WB) and Asian Development Bank (ADB) guidelines.

CV465 Environmental Engineering II (3-0-3). Water Treatment: Treatment of surface and ground water; Screening, Sedimentation, Coagulation; Coagulants and dosages; Filtration, design aspects of slow and rapid filters; Filtration rates, Operation, Head loss, Back wash and filter Efficiency, Pressure Filters; Fluoridation, Hardness removal, Iron and Manganese removal). Water softening Methods. Water Disinfection and Chemicals. Use of Chlorine, quantity, Dosages and efficiency, Treatment methods. Introduction to Relevant Software Packages. Testing of Sewers Municipal and Industrial Wastes, water Pollution, Causes and Control Parameter, Effluent disposal guidelines and Standards, Pakistan National Environmental Quality StandardsNEQS. Primary Treatment System (Plain sedimentation, Rectangular/square tanks as primary clarifiers, Imhoff and septic tanks). Secondary Treatment Systems (Purpose and classification, growth process description intermittent to sand filters; flocculation, sedimentation, and filtration systems. Trickling filter, classification and efficiency of trickling filters; Design of trickling filters, final clarifier design, OP problems of filters; Suspended growth process principle, activated sludge process details, loading criteria, sludge volume index; Aeration processes, mixing techniques, analysis and operational problems; Design of aeration tank, secondary clarifier, Oxidation ponds & aerobic, anaerobic and facultative ponds). Sludge Treatment (Amount and characteristics of sludge, sludge conditioning methods; Anaerobic and aerobic digestion).

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), Sewage Disposal Sludge Treatment (Amount and characteristics of sludge, sludge conditioning methods; Anaerobic and aerobic digestion).

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.

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.

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.

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.

Waqas Khan
Sophomore

GIK Institute is one of the finest and leading university of Pakistan. It is a dream come true and honor to be a part of the institute and to learn from a finest foundations of the country. GIK provides a great environment for learning and grooming simultaneously. The academic schedule is the best part according to me as it has helps me polish myself and pushes me to maximum of my capabilities as it is a rigorous task to do well and ace in the relative semester system. The institute is equipped with the latest equipment which helps the students to learn in a professional up-to date environment. Speaking of the institute, it has an outstanding society culture that inculcates teamwork, leadership and conflict management. This beautiful institute has become my second home. I feel proud to call myself "GIKIAN".

SCHOOL OF MANAGEMENT SCIENCES

Thrust Areas

Accounting and Finance
Entrepreneurship and Marketing
Supply Chain Management

Faculty Members
Sami Farooq, PhD (University of Nottingham, UK)
Maazullah Khan, PhD (Erasmus University Rotterdam)
Yousaf Ali Khan, PhD (University of Macerata, Italy)
Kashif Ullah Khan, PhD (University of Science and Technology of China, Hefei, China)
Umar Farooq, PhD (Dongguk University, South Korea)
Abid Ullah, PhD, (Ural Federal University Russia)
Rahman Khan, PhD, (University of Pau and Pays de l'Adour, France)
Bushra Sarwar, PhD (University of Science and Technology, Beijing)
Waqas Rehman, (MS University of West of Scotland, UK)
Fahmida Rahman, (M.A University of Peshawar, Pakistan)
Hassaan Tariq, (MSc University of Warwick, UK)
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Kinza Rahim, Mphil (Applied Linguistics, Kinnaird College for Women, Lahore, Pakistan)
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Erum Irfan
Feroz Khan
Hina Shabbir
Muhammad Ahmad Cheema
Muhammad Junaid Tayyab
Muhammad Salman Hassan
Muhammad Ahmad Sethi
Muhammad Hamza Farooq
Habib Tariq
Ubaid Ullah Khan

Dean
Sami Farooq

P.S to Dean
Noor-ul-Bashar

Today, the world of business is being transformed by the technological innovations, unique leadership models and the power of analytics, all defining features GIKI Department of Management Sciences. These aspects are drawing attention of the business community and corporate stakeholders towards revolutionizing the conventional academic practices by offering creative and interdisciplinary solutions. With our campus wide strengths, we are positioned to provide practical solutions to the emerging problems in the business world and educate the next generation of business executives to transform the existing structure of the corporate world.

The Bachelor's in Management Sciences, Program will focus on exploring business models from a societal and economic perspective, with particular emphasis on national, regional and international Supply Chain Management systems, and innovative entrepreneurial models in order to enable students to become pioneering icons in the corporate world. With so much attention being given to environmental concerns by world leaders and industry giants, another niche of this program will be enlightening the students with recent developments and discussions about sustainability in a long-term business context with special reference to Pakistan and South Asia.

The unique Program of BS in Management Sciences at Ghulam Ishaq Khan (GIK) Institute of Engineering Sciences and Technology would offer students once in a lifetime experience of interdisciplinary study, experiential learning and extraordinary co-curricular activities. Combining a solid academic foundation in management with multiple courses in the development of leadership and interpersonal skills in cross cultural contexts will ensure that students become successful in adapting personally and professionally to changes in the global economy.

Our Program stands out since it focuses on the integration of courses from the domains of business leadership and sustainability with a technological perspective. The students will excel in making economic, societal, ecological and legal decisions from a managerial perspective once they become a part of local and international markets.
Some noteworthy features of our B.S program are as follows:

- Extensive contact with instructors
- Intellectual environment
- Case Study Methodology
- Individual attention
- Executive grooming

Program's Educational Objectives

The objectives of the Program are as follows:

1) Producing graduates with analytical and critical skills who can research and analyze complex business problems, design feasible alternatives and make efficient and effective decisions by blending theory with practice.
2) Producing professionally competent graduates who can take entrepreneurial initiatives, advance their knowledge and excel in their profession.
3) Producing graduates who understand group dynamics and can play their role as an effective team member.
4) Producing young business experts who understand the importance of ethical and sustainable practices and their responsibility towards corporate social responsibilities in local and global markets.
5) Producing business executives with strong communication and interpersonal skills possessing command on composing and communicating effective business reports and presentations so as to add value to their job performance.

Program Learning Outcomes

Proposed Learning Outcomes for the Program are as follows:

1) Able to utilize analytical and critical skills to research and understand complex business problems and apply data-driven solutions in a highly dynamic business environment.

2) Able to understand the local, regional and international risk factors arising out of cultural values, attitudes and belief systems and integrate them into strategic decision making process for SMEs and large scale organizations.

3) Able to take advantage of problem-solving, negotiation, and team building skills and in turn reflect high degree of productive leadership.

4) Able to identify ethical issues within an organization and recommend solutions in the light of ethical theories.

5) Able to compose and deliver audience-centered presentations and business documents individually and as a team member.

Innovative Features

Our Program stands out, since it effectively blends the academic aspects with experiential learning. Academically, the Program has a business development component and a number of specially designed courses emphasizing the role of technology and environment. The high-level curricular programming and the experiential learning embedded in the Program are particularly strong and also unique in the context of undergraduate management education in Pakistan. No other Program lays such an importance on innovation, sustainability and entrepreneurship, while simultaneously maintaining a quantitative and analytical focus.

Degree Nomenclature

a) The Undergraduate Program in Management Sciences is of 4-years duration, spread over 8 regular semesters, and consisting of 133 credit hours after completing twelve years of higher secondary school certificate or equivalent.

b) The BS (Management Sciences) degree would require successful completion of a minimum of 42 courses (3 or 2 cr. hr. each) picked from different streams. It specifies the minimum and maximum range in each category. The course titles are suggestive and not mandatory.

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.

Mode of Delivery

The courses will be delivered in the format normal to all GIK undergraduate courses. That is, typically, courses will be taught in small lecture sections permitting active involvement of students. Many of the courses will require group assignments and group work. In a number of courses, the cases will be used to complement normal teaching by topics. That is, students will be presented with cases in advance of the classes, and these cases will integrate what they have learned both in the course in question and in other courses. Students will come prepared to the class for the discussion of the cases. Alumni and guest speakers will be invited to deliver lectures in-order to augment the elements of relevance and real-life applications. Some courses will provide students with the experience of actively engaging in situations that are simulated to reflect a variety of different work cultures. The simulations will require the students to incorporate theoretical knowledge gained in their current course and from other courses in the Program.

Compulsory Courses (25 Cr Hr)

Course Title	Course Code	Cr. Hr
English Language & Communication Skills	HM101	3
Technical Writing	HM102	3
Islamic Studies/Ethics	HM111	2
Pakistan Studies	HM112	2
Business Communication	HM203	3
Advance Oral Communication	HM404	3
Business Mathematics	MS101	3
Business Statistics	MS102	3
Introduction to Computer	CS201	3

General Courses (27 Cr Hr)

Course Title	Course Code	Cr. Hr
Sociology	HM121	3
History	HM213	3
International Relations and Currents Affairs	HM222	3
Psychology	HM223	3
Anthropology	HM224	3
Business Ethics	MS311	3
Logic	MS312	3
Pakistan Economy	MS343	3
Environmental Science	MS444	3

Discipline Specific Courses (42-48 Credit Hrs)

Course Title	Course Code	Cr. Hr
Fundamentals of Management	MS121	3
Human Resource Management	MS122	3
Principles of Marketing	MS131	3
Microeconomics	MS141	3
Introduction to Accounting	MS151	3
International Business	MS223	3
Marketing Management	MS232	3
Macroeconomics	MS242	3
Financial Accounting	MS252	3
Business Finance	MS253	3
Cost and Management Accounting	MS254	3
Business Research Methods	MS303	3
Business Policy	MS324	3
Consumer Behavior	MS333	3
Financial Management	MS355	3
Money and Banking	MS356	3

Elective/Specialization Courses (27-39 Cr. Hrs)

Course Title	Course Code	Credit Hours	Pre-requisites
Management Information System (MIS & DSS)	CS302	3	CS201
Business Law	MS313	3	None
Organizational Behaviour	MS325	3	MS121
Financial Econometrics	MS357	3	MS102
Corporate Finance	MS358	3	MS253
Legal & Taxation Issues	MS359	3	None
Operations and Production Management	MS361	3	None
Supply Chain Management	MS362	3	None
Corporate Social Responsibilities	MS414	3	MS311
Project Management	MS426	3	None
Entrepreneurship	MS434	3	MS131

Business Process Design and Analysis	MS435	3	MS131
Industrial Economy	MS445	3	MS141
Business and Economic Forecasting	MS446	3	MS102
Technology Management	MS463	3	None
Senior Year Project I	MS471	3	MS303
Senior Year Project II	MS472	3	MS471

***15 Credit Hours of Elective Courses will be taught**.

Specialization Requirement (12 Credit Hours)

1). Accounting and Finance

Course Title	Course Code	Credit. Hours
Accounting Information Systems	AF451	3
Auditing	AF452	3
Investment and Portfolio Management	AF453	3
Financial Risk Management	AF454	3

2). Entrepreneurship and Marketing

Course Title	Course Code	Credit Hours
Business Plan for New Ventures	EM431	3
Digital Marketing	EM432	3
Corporate Entrepreneurship and Innovation	EM433	3
Services Marketing	EM434	3

3.) Supply Chain Management

Course Title	Course Code	Credit Hours
Planning and Control System	SC461	3
Business logistic Strategy	SC462	3
Sustainability in Supply chain Management	SC463	3
Lean & Six Sigma in Supply Chain Management	SC464	3

Semester Wise Breakdown

Semester 1

Course Title	Course Code	Credit Hours	Pre-requisite
English Language and Communication Skills	HM101	3	None
Islamic Studies/Ethics	HM111	2	None
Sociology	HM121	3	None
Business Mathematics	MS101	3	None
Fundamentals of Management	MS121	3	None
Introduction to Accounting	MS151	3	None

Semester 2

Course Title	Course Code	Credit Hours	Pre-requisite
Technical Writing	HM102	3	HM101
Pakistan Studies	HM112	2	None
Business Statistics	MS102	3	None
Human Resource Management	MS122	3	None
Principles of Marketing	MS131	3	None
Microeconomics	MS141	3	None

Semester 3

Course Title	Course Code	Credit Hours	Pre-requisite
Business Communication	HM203	3	HM 101
History	HM213	3	None
International Relations & Current Affairs	HM222	3	None
Introduction to Computer	CS201	3	None
Macroeconomics	MS242	3	None
Financial Accounting	MS252	3	MS151

Semester 4

Course Title	Course Code	Credit Hours	Pre-requisite
Psychology	HM223	3	None
Anthropology	HM224	3	None
International Business	MS223	3	MS121
Marketing Management	MS232	3	MS131
Business Finance	MS253	3	None
Cost and Management Accounting	MS254	3	MS151

	Course Title	Course Code	Credit Hours	Pre-requisite
Semester 5	Business Ethics	MS311	3	None
	Logic	MS312	3	None
	Pakistan Economy	MS343	3	MS242
	Financial Management	MS355	3	MS253
	Elective I	MS3XX	3	
	Elective II	MS3XX	3	
Semester 6	**Course Title**	**Course Code**	**Credit Hours**	**Pre-requisite**
	Business Research Methods	MS303	3	MS102
	Business Policy	MS324	3	MS121
	Consumer Behaviour	MS333	3	MS131
	Money and Banking	MS356	3	None
	Elective III	MS3XX	3	
	Elective IV	MS3XX	3	
Semester 7	**Course Title**	**Course Code**	**Credit Hours**	**Pre-requisite**
	Environmental Sciences	MS444	3	
	Specialization Course I	AF/EM/SC4XX	3	
	Specialization course II	AF/EM/SC4XX	3	
	Elective V	MS4XX	3	
	Research Project I	MS471	3	MS303
Semester 8	**Course Title**	**Course Code**	**Credit Hours**	**Pre-requisite**
	Advance Oral Communication	HM404	3	HM101
	Specialization Course III	AF/EM/SC4XX	3	
	Specialization Course IV	AF/EM/SC4XX	3	
	Research Project II	MS472	3	MS471

Total Requirements
For the award of BS in Management Sciences along with the options taken from specializations a student must complete 133 credit hours.

HM101 English Language and Communication Skills (3-0-3): 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 in consideration while speaking. The learners are also introduced to the principles of effective writing from the sentence level to full-length texts with special emphasis on logical organization of materials.

HM111 Islamic Studies/Ephics (2-0-2): The course of Islamic Studies presents Islam as a balanced mode of life by incorporating basic aspects of human rights and rule of law, brotherhood. Students are also taught the concepts relative to respect of other religions, equality of mankind and harmony between religion and practical aspects of life.

HM121 Sociology (3-0-3): The purpose of the course is to familiarize the students with the definition of sociology, founders of early sociology, three theories given by early sociologist, definition of culture and its development, elements of culture, cultural integration, and cultural variation. The course also elaborates the components of society, social interaction, groups, social role, role of conflict institutions, verbal and non-verbal communication, social group bureaucracy, deviance, conformity, and national and international social problems.

MS101 Business Mathematics (3-0-3): Business Mathematics presents mathematical 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; basic statistical measures; and stocks and bonds.

MS121 Fundamentals of Management (3-0-3): Fundamentals of Management is an introductory course about the management of organizations. It provides guidelines on the principles of management that are applicable to all types of enterprises; basic management philosophy and decision making; principles involved in planning, organizing, leading, and controlling; global environment; managing change and innovation; human resource management introduction; organizational behavior; power politics., conflict,

and stress; leading with influence; communication and information technology; control systems; and operations management. The contents learned in this course will allow students to work effectively with others in an organization. The course will also encourage students to explore the applicability of western management principles and theories in local settings.

MS151 Introduction to Accounting (3-0-3): This course is designed to provide the introduction to financial accounting and reporting to the students. The course is intended to teach the students to read, understand and analyze financial transactions. Then they will learn how to record these transactions in books of accounts. The desired results from these recordings will be calculated in the form of final accounts.

HM102 Technical Writing (3-0-3): The course aims to develop 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 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.

HM112 Pakistan Studies (2-0-2): This is an introductory course for examining the political behavior, processes, and government institutions. The course aims to give students an awareness of political ideas, theories, national systems, and public policies. The course effectively lays emphasis on critical analysis of the political issues in national and international level.

MS102 Business Statistics: The course is designed to introduce students to the major concepts and tools for collecting, analyzing, and drawing conclusions from the data. Data and information are integral to the operation and planning of all businesses, and as businesses grow and develop there is an increasing need for the use of formalized statistical methodology to answer business related questions. This course will cover topics like; types of variables and data; frequency

distributions; data organization and presentation; numerical measures; measures of dispersion; index numbers, regression and correlation analysis; concepts of probability and sampling methods.

MS122 Human Resource Management (3-0-3): This course is designed to provide the students with understanding of key HRM functions, designed to help them understand if western human resource management theories and practices have any relevance to local settings. The course will also discuss the Islamic perspective of managing human resource. The students will also be encouraged to compare and contrast the human resource practices suggested in their textbooks and the practices critical for achieving success from indigenous perspective. The course contents include human resource planning; strategic human resource management; recruitment and selection; interviewing candidates; training and development; performance appraisal and performance management; career development, retention and voluntary/involuntary turnover; compensation; and global human resource management.

MS131 Principles of Marketing (3-0-3): This course will focus on developing an understanding of key marketing concepts aimed at improving the conceptual knowledge of marketing as applicable to decision making process with a focus on tactical marketing mix decisions. Furthermore, it will provide the students with a comprehensive framework to evaluate marketing decisions and to create successful marketing initiatives. The contents included in the course would be definition, evolution and future of marketing; marketing strategies and elements of marketing mix; elements and analysis of marketing environment; ethics and social marketing; strategic marketing planning; sales forecasting; and designing marketing plan.

MS141 Microeconomics (3-0-3)

The course would provide an understanding of the principles of microeconomic analysis of business decisions in competitive and noncompetitive markets. The main topics in this course include supply and demand analysis; free markets; scarcity; production possibilities; the price system; government policy; labor markets; capital, and natural resource markets, and externalities.

HM203 Business Communication (3-0-3): The main objective of this course is to give students practical awareness of activities such as interacting, informing, instructing and persuading within the business community. It would bring in them the personalities of businesspeople as communicators, who can speak, write and interact with others effectively and professionally. The main topics of the course include introduction to communication, types of internal and external communications, types of formal and informal communication upward, downward and horizontal communication, use of technology in business communication; perception, adaptation and selection of appropriate words; writing emails, memos; and listening and speaking skills in business environments. This course aims at giving students an advanced understanding of the concepts and principles of professional business communication.

HM213 History (3-0-3): The course will help to inculcate historical consciousness about the human past and analytical and interpretative approach towards historical facts amongst the students. It will provide an in-depth, critical introduction to the theoretical, conceptual and epistemological foundations of the academic

discipline. The students will be acquainted with the main political events, cultural and intellectual debates; religious movements and social issues. The students will also delve into the cultural heritage in South Asia and the world at large and develop an awareness of the political, constitutional and historical development in Pakistan before and after 1947. It will train the students to use historical knowledge to resolve the socioeconomic, political and intellectual problems of state and society.

HM222 International Relations and Current Affairs (3-0-3): International relations course is designed to meet the needs of all those students who wish to enhance their understanding of the subject focusing on the changing political, economic and socio-cultural relations within the international system of the modern era. The subject explores the underlying global, regional, and domestic factors that influence relations between actors on the world stage. It seeks to provide students with the knowledge of the global system tools to function effectively in the present, and the ability to respond to future developments. The course concocts the element of current affairs to establish a productive knowledge of the socio-political happenings in Pakistan and abroad. The course also aims to develop a cogent political thought amongst the students by focusing on the strategies that affect the countenance of national and international politics. It also delves into the elements of constitutions, governments, human rights and economic development from a sociopolitical point of view. Diplomatic relations along with the critical analysis of the dynamics of indigenous and international politics are accentuated in the subject.

CS201 Introduction to Computer (3-0-3): This course will provide a technical introduction to computer and information sciences to undergraduate business students. The course will focus on developing an elementary knowledge of computing amongst the students. The goal of this course is to introduce students with the basic and applied knowledge of computer operating systems and computer applications. The core focus of the course will be on Microsoft Office Application (Microsoft Word, Microsoft Excel, Microsoft PowerPoint Microsoft Access and Visio). In the first part, this course will introduce the students to computer hardware, software, operating systems, data communication through internet and Microsoft applications. Then, building upon these foundations the students will be introduced to database management through Microsoft Access. This will help students to exploit opportunities and accept the challenges posed by doing business in an increasingly digital domain.

MS242 Macroeconomics (3-0-3): The main objective of this course is to give students an understanding of the working of socialist,

capitalist and mixed economy at the aggregate level. The basic themes are extended to explore the disciplines of national income, public finance, macroeconomics in closed and open economies, macroeconomic stabilization policies, money and banking link up with conventional macroeconomics.

MS252 Financial Accounting (3-0-3): This course is built upon the basic concepts of Financial Accounting and integrates theoretical and practical aspects of financial accounting and reporting. The course is designed to introduce the students to the regulatory framework governing the preparation and publication of financial statements of a limited company and groups of companies. It mainly focuses upon the company accounts and their understanding in the context of IFRS and companies' ordinance 1984.

HM223 Psychology (3-0-3): This course surveys the major sub disciplines of the field, including such topics as the brain and neuroscience, behavioral genetics, cognitive and social development, perception, learning, memory, decision-making, language, consciousness, emotions, motivation, psychological disorders, social identity, interpersonal interactions and group and cultural processes. The course is designed to provide students with a well-rounded knowledge of the domains of psychology where the theories and practical aspects of the subject are introduced to them. It focuses on enhancing the knowledge human cognition, behavior and development. Furthermore, students will develop an understanding of the impact of cultural, social and environmental factors that affect mental health and well-being of an individual.

HM224 Anthropology (3-0-3): This course is design as an introduction to the discipline of anthropology as a whole. It presents students with a theoretical grounding in the major subfields of Cultural and linguistic anthropology. The main

topics of this course includes the introduction to anthropology, principles of anthropology, the cultural change and development, political anthropology & social problems, and the economic anthropology. In this class the emphasis is on the holistic nature of the discipline.
Students will able to explore the history of the discipline and profession, The course objectives is set to learnt the basic methods and theories, and the political and ethical dimensions of modern practice in the domain of anthropology. Similarly, the students will learn to examine and interpret evidence using specific examples, from artifacts to sites to regions. The course frequency is set for the business students at every year, there is no pre-requisite course required for this course.

MS223 International Business (3-0-3): This course aims to provide the students with an overview of the unique problems faced by firms engaging in international activities; the importance of understanding the foreign economic, social, political, cultural and legal environment; the mechanics of importing and exporting; joint venture, franchising and subsidiaries; international dimensions of management, marketing and accounting, international financial management. The course also delves into the special problems of multi-national corporations; recent problems of the international economic system; country-risk analysis; the increasing use of counter trade.

MS232 Marketing Management (3-0-3): This course is gear towards providing an understanding of the rationale for marketing decisions from a managerial perspective. Emphasis will be on including the knowledge of integrating theory and practice amongst the students. Students will have to apply analytical techniques they have learned in this course, to make strategic marketing decisions. The course contents include introduction to marketing; marketing environment and market analysis, market research; buyer or consumer behavior; consumer decision making; marketing research and analysis; market segmentation, targeting and positioning; product concepts; product management; service and nonprofit marketing; pricing strategy; placing strategies; wholesaling and Industrial distribution; retailing; promotional strategies; and intercultural and international marketing.

MS253 Business Finance (3-0-3): The objective of this course is to introduce concepts and techniques of finance and build the foundations for all subsequent finance courses and provide basic knowledge of the analytical tools required by every student. This course is a rigorous introduction to the basic principles of finance and their applications to usual finance issues and decision making. The course provides an overview of business finance management and lays emphasis on the financial statement analysis, time value of money, and management of cash flow, risk and return and source of financing.

MS254 Cost and Management Accounting (3-0-3): This course focuses on the use of accounting information to report managerial performance and to facilitate business decisions. It covers the preparation and use of cost and management accounting information in planning, budgeting, break-even analysis, income determination, product costing, process control, corporate financing and capital structure decision making.

MS311 Business Ethics (3-0-3): It introduces students to ethical and moral issues, conflicts and decisions confronting citizens, groups and communities of Pakistan. The course aims at highlighting the necessity and importance of good character conduct and moral life as manifested in major world religions. The students are also motivated to appreciate the ethical and moral dimensions of Pakistani culture. The course contents include introducing and defining business ethics; social responsibility and development of ethical issues in business; application of moral philosophies to business ethics; ethical decision-making framework; organizational influences on ethical decision making; influence of significant others in organizations; role of opportunity and conflict; development of effective ethics; and international business ethics.

MS312 Logic (3-0-3): Logic is fundamental to the way humans communicate. Our public debates and private reasoning are shaped by logical principles, even though most of us would struggle to spell them out. Introduction to Logic will teach the basics of formal logic, which provides symbolic methods for assessing and representing the logical form of arguments to the students. The students will develop an understanding of symbolic language and logic, as well as familiarity with precise models of deductive reasoning.

MS313 Business Law (3-0-3): No business enterprise can function without following the country's legal processes as well as its own. If it wishes to expand beyond local borders, then international laws and treaties also come into play. This course will look at company laws, contract laws, buying & selling goods & services, law relating to intellectual property, law of agency, company financial reports, elements of employment law, and management and employment ethics. Prudential Regulations of the State Bank of Pakistan and major regulatory frameworks under the Securities & Exchange Commission of Pakistan will also be discussed.

MS343 Pakistan Economy (3-0-3): This course aims to make students understand the key sectors of economy of Pakistan and contemporary issues in agriculture, industry and financial and social sector. It intends to give students a comprehensive knowledge about the outlook and comparison of developing and developed economies with specific reference to Pakistan. To make students understand current policies in trade, commerce, fiscal/monetary policy, industry and agriculture. It is designed to provide students with critical information and knowledge about Pakistan economic environment. Important Components which contribute to the development and progress of the economy of country are included here.

MS325 Organizational Behavior (3-0-3): The knowledge of individuals' perceptions, motivational attitudes and behavior enable students to not only understand themselves better, but also to adopt appropriate managerial policies and leadership styles to increase their effectiveness. The focus of instruction will move progressively through the individual, group and organizational levels of behavior and will examine the interrelationships of behavioral phenomena among these levels. Specific topics include leadership, motivation, teamwork, career issues,

work roles, job enrichment, employee participation, and work and non-work integration.

MS355 Financial Management (3-0-3): The main objective of this course is to develop a foundation of financial management concepts. This will enable the students to understand how corporations make important investment and financing decisions and establish working capital policies. The course also lays a foundation for more complex financial topics that arise in additional elective courses in finance. This course introduces the students to fundamental principles of finance i.e., time value of money and relations between risk and return, MM theories of irrelevance and efficient markets. Through exposure to these fundamental concepts, it is expected that the students will learn how to apply their knowledge the valuation of stocks and bonds, financial planning, capital budgeting, long-term financing, capital structure, dividend policy, working capital management, and risk management.

MS303 Business Research Methods (3-0-3)

The objective of this course is to expose students to the principles and methods of business research and encourage them to explore application of theories that have been predominantly developed in Western cultures by using different research techniques. An understanding of the relevance of Western research for local practice would help

students to explore various business-related problems and their plausible solutions from an indigenous perspective. Topics would include: introduction to research methods in business and management disciplines; literature searching strategies; literature review; research paradigms and approaches; theory and research; introduction to SPSS; quantitative research design; internal and external validity; survey-based research; case study research; quantitative and qualitative data analysis; and writing research proposals and thesis.

MS324 Business Policy (3-0-3): The course focuses on the formulation and implementation of corporate policies. The knowledge and techniques learned in earlier courses will be applied in an integrated fashion to the process of strategic decision making and organizational change. The topics considered in the course will be relationships of organizations to their environments, the hierarchy of organizational objectives, structured as well as informal approaches to strategic planning, the integration of business functions, organizational structure, and policy implementation and evaluation. A significant aspect of the course is devoted to assessing the competitive dynamics of firms.

MS333 Consumer Behavior (3-0-3): This course is designed to enhance students' understanding of how and why consumers purchase (or do not purchase) goods and services. It will combine both the theoretical concepts of consumer behavior and its application for marketing strategies related to private, public and non-profit sections. At the conceptual level, it will seek to present an integrated framework around which major areas of consumer behavior can be understood and applied. This course will explore and identify market identities and various sources of influence with the way consumers think and learn from market related information. The knowledge and understanding gained from this course can be utilized in the marketplace to make rational decisions to satisfy consumer needs and wants and remain loyal to products. Specific topics to be covered include cognition process, consumer motivation, emotions; consumer cultural theories; consumption, meaning and identities; and role of market and consumer ideologies.

CS302 Management Information Systems (MIS and DSS) (3-0-3): Information systems began as automation of office systems and have grown into systems that assist managers to make decisions, systems that model successful business practices, and systems that transform the modern business into knowledge-based enterprise. New types of infrastructure and applications are developed and utilized such as ERP (enterprise resource planning), IOS (inter-organizational systems), RIFD (radio frequency identification), and CRM (customer relationship management) to name a few. This course helps students see the connection between information systems (IS) and business performance and explores current information systems concepts and technologies. Students will learn how information systems give a business competitive edge by providing technologies that help managers plan, control and make decisions. Included in course are topics such as hardware and software components of Information systems, e-business concepts and implementation and survey of common information systems used today.

MS356 Money and Banking (3-0-3): The course will cover both theory and practice of money and banking. The first part of the course will cover commercial and central banking. Topics on commercial banking will include economics of banking; the role of banks in the presence of asymmetric information; examining bank's balance sheet operations with their need to balance; asset, liability, liquidity, and risk and return. The second part will focus on State Bank of Pakistan's role in monetary policy and supervision of banking sector through prudential regulations.

MS357 Financial Econometrics (3-0-3): This course focuses on techniques for estimating regression models, problems encountered in estimating such models, and interpreting their output. The goal of the course is to teach students the basics of the theory and practice of econometrics and to give them experience in estimating econometric models with actual data. The course covers the topics like single equation regression models, regression analysis, two-variable and multiple regression analysis, econometrics modeling, and time series econometrics.

MS358 Corporate Finance (3-0-3): This important module aims to develop the analytical skills for making corporate investment with regards to financial decisions and risk analysis. This course will examine various theories including the concept of present value, the opportunity cost of capital, discounted cash flow analysis, a consortium of valuation techniques, issues between short & long term financial management, risk and return, capital asset pricing model, capital budgeting, corporate capital structure and financing decisions, dividend policy, investment and financial decisions in the international context, including exchange rate/interest rate risk analysis, and issues of corporate governance and control. This course also explores the very patterns of corporate finance that has shaped the familiar yet complex terrain of today's global economy.

MS359 Legal and Taxation Issues (3-0-3): This course is designed to give students a familiarity of various forms of organizations and the rights and responsibilities of its officers, employees, and shareholders; taxation of the various organizational forms; patents and other forms of intellectual property issues; contract law particularly as it applies to licensing, leases, employees and insurance; and ways to mitigate various forms of risk.

MS361 Operations and Production Management (3-0-3): This course introduces the theory and practice of operations and production management as a functional area in the management of business enterprise. This course will discuss the principles, concepts and basic problems affecting manufacturing and non-manufacturing firms. Topics covered will explore Tangible & intangible functions of production, Discrete & continuous manufacturing processes & systems, Conventional & system approach to Design, Production planning & Control, Process planning, Quality control, Quality assurance, Assembly methods, Packaging, Production work measurements, Production standards, Production philosophies, Operations Strategy, Managing Processes, Process Strategy, Process Analysis, Process Performance & Quality, Constraint Management, Process Layout, managing value chains, Forecasting, Sales & Operations planning, Resource planning, Linear Programming, Scheduling.

MS362 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.

HM404 Advance Oral Communication (3-0-3): The course of Oral Communication has been designed to help students devise oral, interpersonal and physical strategies required to confidently and effectively interact with a variety of audiences. In this module, the students are taught to effectively eclecticize the oral rhetoric with the paralinguistic features and visual aids to deliver successful oral presentations. Apart from other skills students will also achieve excellence in creativity and flair; oral business communication; and problem solving. The major skills targeted in the course are Tutorial Presentations, Poster presentation, Seminar Presentations, Conference Presentations, thesis defense, viva Skills and Negotiation Skills.

MS414 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 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 a general knowhow 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.

MS426 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.

MS434 Entrepreneurship (3-0-3): This course focuses on identifying business opportunities and developing them into a business. The management functions of accounting, finance, and marketing as well as legal and economic considerations are catered in the subject. Students are taught to take business responsibilities and initiatives as business strategies are created. Through the process of developing a business plan, students acquire various necessary skills to operate a successful business. Topics of discussion will include history of entrepreneurship, idea generation, technology and ideas, sources of finance, elevator pitch, patents and formulation of business plan.

MS435 Business Process Design and Analysis (3-0-3): This course includes identification, development, analysis, controlling, enhancement and management of business processes. Examples from different industries and functional areas within firms would be employed in the course to identify similarities and differences of well-run processes.

MS444 Environmental Sciences (3-0-3): The environment impacts our way of life in many aspects (e.g. food and fiber production, resources for building shelter and infrastructure, and water supplies). Adverse impacts to this environment affect the well-being of humans and other living organisms. Therefore, the broad topics covered will include natural environmental systems, physical and social causes of environmental problems, and strategies to mitigate or manage these issues. The course will also address issues like sustainable communities and sustainable development.

MS445 Industrial Economy (3-0-3): Industrial Economy focuses on the study of firms, industries and markets. When analyzing decision making at the levels of individual firm and industry, Industrial Economics helps in understanding issues like; the levels at which capacity, output and prices are set, the extent to which the products are differentiated from each other, how much firms invest in research and development (R&D), how and why firms advertise. Industrial economy will cover the topics of size and structure of firms, separation of ownership and control, short-run price competition, dynamic price competition, entry deterrence and entry accommodation, product differentiation and non-price competition, price discrimination, vertical relations, the determinants of market structure, competition and industrial policy regulations.

MS446 Business and Economic Forecasting (3-0-3): This course will examine a more rigorous approach to various financial, econometric and time series approaches for predicting the effects of future corporate planning decisions and policies. The course would include topics of forecasting methods with single equation models, predicting with quantitative as well as qualitative choice models, and simulation with single and multi-equation models. These techniques are used to predict product sales, economic variables, and financial indicators. The course will be useful for recipients and users of forecasts and the ones involved in conducting business and economic forecasts.

MS 463 Technology Management (3-0-3): This course introduces the students to the concepts of Industrial Networks, Fundamentals of product and process development, Business Community and new generation of managers, Practical Skills, knowledge and experience in commercialization of new technological innovations. The module also delves int the core ideas of use of multi-disciplinary science based knowledge, Problem-solving, Team work, Outreach activity, Major steps in proof of concept to intellectual property protection, Proto-type 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.

EM431 Business Plan for New Ventures (3- 0-3): Developing a business plan for a new venture and the entrepreneurial process of executing the first phases of new venture creation can be daunting. This course will explore areas like idea conception, entrepreneurship, business planning, market

research, entrepreneurial opportunities and strategies, venture analysis and strategy, industry and competitor analysis, marketing plan and risk assessment. Emphasis is placed on high growth business opportunities. The final deliverable will be a complete business plan for a high growth venture and formal presentation of the plan to mock investors. Some individual off campus travel will be required.

EM432 Digital Marketing (3-0-3): The evolution of traditional mass media has highlighted the importance of digital advertising. This course is designed to give students a thorough understanding of assessment and evaluation of the businesses in the new technological era. The course will also delve into the details for preparing a digital marketing plan for entrepreneurial and business expansion opportunities. Furthermore, it will help the students to plan and develop digital platforms for online businesses and e-commerce solutions.

EM433 Corporate Entrepreneurship and Innovation (3-0-3): This course focuses on the processes by which teams within an established company conceive, foster, launch and manage a new business that is distinct from the parent company. Following the market development lifecycle, students will examine the management of eight types of innovation: disruptive, application, product, process, experiential, marketing, business model and structural. The ability to simultaneously integrate and differentiate between a company's existing and new business is crucial to the success of any corporate entrepreneurship effort. As an advanced course, emphasis will be placed on skills needed to promote and manage corporate entrepreneurship including opportunity recognition, selling an idea and conflict management. Furthermore, in this course, we will examine the apparent contradiction in the term "corporate entrepreneurship" and discuss managerial techniques and organizational structures that promote entrepreneurial behavior in a corporate context. Attention will also be given to the difficulties inherent in the process of assessing entrepreneurial performance within a corporation and control mechanisms put in place by corporate managers to restrict the economy of corporate entrepreneurial initiatives.

EM434 Services Marketing (3-0-3): The objective of this course is to give students an understanding of the strategic and managerial issues adherent to marketing services in industries with high service components. It will also provide the learners with an insight to the distinguishing aspects of service marketing thereby advancing their ability to apply marketing strategies to create, communicate and deliver customer value in the service economy.

AF451 Accounting Information System (3-0-3): This course applies the practical application of accrual-basis accounting using accounting software. Students will gain experience in integrated software designed to handle general ledger, accounts payable, accounts receivable, financial statement analysis, fixed assets, sales order processing, inventory, and payroll. Students will explore various topics in AIS to understand and use technologies in making decisions in specialized areas of the accounting profession, such as managerial accounting, financial accounting, auditing, and tax accounting. Topics include types of AIS applications and systems, technologies and database concepts, internal control issues, audit issues, and systems development issues and current trends in AIS.

AF452 Auditing (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): The focus of this course is on financial theory and empirical evidence that are useful for investment decisions and provide a comprehensive, analytical approach to modern theory of investments. Topics covered include mean variance analysis, Markowitz type portfolio analysis, portfolio construction, asset pricing theory, market efficiency and anomalies, hedge funds and investment funds performance evaluation. Topics include modern portfolio theory, fundamental and technical analysis of equities, concentrated equities positions, fixed income analysis, benchmarking, capital markets, the appropriate use of mutual and importance of asset allocation.

AF454 Financial risk management (3-0-3): The course will focus on variety of risks faced by financial managers and tools available for managing these risks. Particularly, it focuses on credit risk, interest rate and liquidity risk, market risk, foreign exchange risk and country risk. The students will learn about the tools and techniques for managing these risks such as future contracts, option contracts, swaps, value at risk, and other standard risk hedging techniques and methods of measuring volatility. Students attending this course are expected to have studied a basic course of investment and portfolio management and have a good understanding of asset pricing models. This course also examines theoretical and practical aspects of risk management with emphasis on the effective use of future options and other financial derivatives to control market risk exposure. Reviews no- arbitrage methods and options, including the Black-Scholes model and binomial tree numerical methods.

SC461 Planning and Control Systems (3-0-3): This course includes the design and management of planning and control systems within the organization and across the supply chain. It covers business planning; master production scheduling; material requirements planning; just-in-time and theory of constraints, Enterprise resource planning (ERP) and business-to-business (B2B) systems; impact of information technologies on planning and control systems.

SC462 Business Logistics Strategy (3-0-3): Logistics and distribution are the core components of supply chain management. Logistics management plans, implementation and controls efficient, effective forward and backward flow, storage of goods and services. It also predicts and circulates timely related information between the point of origin and the points of production, purchase and consumption in order to meet customers' requirements. Logistics decisions are typically classified into 1) strategic: dealing with decisions that have a long-lasting effect on the firm; 2) tactical: including decisions that are updated anywhere between once every quarter and once every year; 3) operational: referring to day-to-day decisions. For this course, the focus will be on strategic and tactical decisions in logistics management.

SC463 Sustainability in Supply Chain Management (3-0-3): Sustainability in Supply chain Management is a modern concept of management practices attempting to integrate environmental concerns to all stages up and down the supply chain. In a globalized market, the environmental performance criteria extend beyond the single firm to its entire supply chain network across national borders. Topics covered

will include closed-loop supply chains; reverse logistics systems; carbon foot printing; water foot printing; life-cycle analysis; and supply chain sustainability strategy.

SC464 Lean and Six Sigma in Supply Chain Management (3-0-3): Today's world-class companies have been successful in eliminating process inefficiencies and streamlining management hierarchies to cut costs, improve quality and become more responsive to customers. It's more important than ever to increase organizational effectiveness through engagement of people, elimination of waste and cultivation of innovative teams who are constantly striving to improve. These are all part of a management concept known as Lean management. The aim of this course is to go through the entire Lean and six sigma Model, to reinforce critical concepts and implementation methods. By the end of course, participants will have a solid base of knowledge of Lean Management and six sigma concepts and how to build the right behavior in their organization to increase business performance.

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 up 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 in effectively managing the 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 brain storming sessions and interact with eminent from 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	CH
English Language and Communication Skills	HM101	3
Technical Report Writing	HM102	3
Pakistan and Islamic Studies / Ethics / Impact of Science and Technology on Society	HM211	3
Engineering Economics	MS291	3
Sociology and Human Behavior	HM321	3
Corporate Law and Professional Ethics	HM322	3
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
Engineering Economics and Management	MS490	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

HM101 English Language and Communication Skills (3-0-3): The course aims at equipping the students with the necessary language and communication skills to cope with their academic and professional needs. The course prepares the students for academic reading and writing, oral presentations, reference skills and grammar. The students are given practice in communication skills and are introduced to the principles of effective writing from the sentence level to full-length texts with emphasis on logical organization of materials. Oral communication is improved through class seminars and group discussions.

HM102 Technical Report Writing (3-0-3): The course aims at imparting to the student's competence in scientific and technical report writing. The mechanics and conventions of writing process are introduced through communicative activities and tasks. The course focuses on technical report writing and correspondence related to the profession of Engineering. The course also deals with the issues and problems of planning and designing technical presentations for varying situations and audiences.

HM211 Pakistan and Islamic Studies (3-0-3): The course introduces students to the origins and development of Muslim nationalism in South Asia and the struggle for freedom in the wider historical perspective. It also examines the political, socio-cultural and economic aspects of the state and society of Pakistan with reference to the ideals and concepts of its founding fathers.
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.

HM211 Ethics (3-0-3): The course is offered to Non-Muslim students in place of Islamic Studies. It introduces students to ethical and moral issues, conflicts and decisions confronting the citizens, groups and communities of Pakistan. The course aims at highlighting the necessity and importance of good character, conduct and moral life as manifested in major world religions. The students are also enlightened to appreciate the ethical and moral dimensions of Pakistani culture.

HM211 Impact of Science and Technology on Society (3-0-3): This course, too, is offered to non-Muslims students in place of Islamic Studies as a second option. They are given sociological perspectives on cultural changes and the role played by scientific and technological innovations affecting such changes. The main topics dwelt upon are the holistic character of cultures, the phenomenon of cultural lag and the resultant socio-cultural dislocations, the social order and technology nexus, and the impact of technological advancements on social institutions.

MS291 Engineering Economics (3-0-3): This course delves into the areas of cost concepts, Money time relationships, Measures of worth, Performance analysis form final accounts, Decision-making, Brief introduction of the quantitative techniques and of the behavioural aspects.

HM321 Sociology and Human Behavior (3-0-3): 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 counter-cultures, cultural relativism, social stratification, and social institutions. Organizational behavior, Management and employment, HRD (Human Resource Development)

HM322 Corporate Law and Professional Ethics (3-0-3): The course introduces student o the ethical and moral issues they are likely to confront as Engineers such as the vital impact their work has on health, safety and welfare of people. Major theories of moral development and code of ethics, prescribed by the professional bodies and case studies illustrating ethical and moral dilemma engineers have to cope with. The legal component deals with the constitutional provision regarding fundamental human rights, principles of natural justice, basic aspects of contract law, arbitration, partnership, evidence law, labour laws, and drafting legal documents used in contractual transactions.

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.

MS490 Engineering Economics and Management (3-0-3):
Engineering Economics decision, Interest Rate and Economic Equivalence, Understanding Money and its Management, Present-Worth Analysis, Annual Equivalent- Worth Analysis, Rate-of-Return Analysis, Cost Concepts relevant to Decision making, Depreciation and Corporate Taxes, Developing Project Cash Flows, Project Risk and Uncertainity, Special Topics in Engineering Economics

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.

Mahnoor Nadeem
Freshman Student

Mahnoor Nadeem – Freshman Student
I still vividly remember the day I discovered GIKI's management science program. It was right at the end of my A Levels, and I was scrolling through university websites to explore my options. I opened GIKI's website and, in the undergraduate programs, found a degree based on management sciences. I was intrigued, to say in the least, and clicked on the details to have a closer look. Needless to say, I was amazed. The program, and all the courses, seemed like the perfect match for me, and any other doubts that I had were squashed after seeing pictures of the campus. The greenery, the buildings, and just the general aura of GIKI conveyed a feeling of exquisite serenity. It was then, that I knew GIKI would be the university for me.
My time here has been remarkable. The campus is wonderful, and the hostels are very well facilitated. I have had the honor of learning from amazing instructors who have motivated and inspired me. The connections that I have made, I feel, will last for years. GIKI truly is a wonderful experience, and I can't wait to see where this journey takes me.

OFFICE OF STUDENT AFFAIRS

Dean Student Affairs

Dr. Muhammad Imran Khan
Ph. D. (University of Tsukuba, Japan)

Sabahat Hussain, Assistant Director Student Affairs
Sumira Siddique, Student Wellness Counselor
Arshia Shehzadi, Warden

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 Assistant 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 a host of 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 activities. 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

It provides opportunities to students to nurture their scientific talents. It arranges video shows on contemporary developments in various scientific fields. It encourages and financially backs scientific projects undertaken by students on their own initiative. It provides a forum where students and teachers can get together to exchange ideas and information on scientific topics beyond the confines of the formal curricula.

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) GIK Chapter

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 evaluation 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 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
8. **IET GIK Chapter:** Institute of Engineering and Technology
9. **IEEE GIK Chapter:** Institute of Electrical and Electronic Engineering
10. **LDS:** Literary and Debating Society
11. **Media Club:** Includes GIKI Vision, Photography and Desktop Publishing
12. **Naqsh Art Society:** NAQSH promotes and propagates art in GIK Institute.
13. **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.
14. **Project Topi**: Project Topi is a student run volunteer society which runs many projects for the welfare of Topi community.
15. Web Team: The GIKI Webteam is an in-house team of students that voluntarily design and manage the GIKI website and its related affairs, with their services being officially recognized by the Institute.
16. **Science Society:** Science society deals in contemporary developments in scientific field.
17. **SOPHEP:** Society for the Promotion of Higher Education in Pakistan
18. **Sports Society:** Sports society maintains the sports facilities and organizes events with wide participation.
19. **SPIE GIK Chapter:** Society for Photo-Optical Instrumentation Engineer
20. **SMEP GIK Chapter:** Society of Mechanical Engineers of Pakistan
21. **WES:** Women Engineers Society
22. **AIAA GIK Chapter:** American Institute of Aeronautic & Astronomic.
23. **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.
24. **AICheE GIK Chapter**: American Institute of Chemical Engineers, GIKI Chapter.
25. **CBS:** Character Building Society
26. **ImechE:** institute of Mechanical Engineering.
27. **LES:** Leadership and Entrepreneurial Society.

Open House & Careers Fair

An Open House & Career Fair is organized at the GIK Institute Campus every year. Its objective is to invite senior representatives from the industry to visit the Institute, have a view of the facilities and first hand information on the Institute's academic and research activities. It also provides a forum for faculty members and senior management from the industry to exchange views and discuss matters of mutual interest, such as, sponsoring research projects and reviewing the academic curricula to meet the needs of industry. Another important aspect of the Open House & Career Fair is the employment for our graduating students. The Open House & Career Fair provides an excellent opportunity for the prospective employers to judge the caliber of the graduating engineers through discussions and interviews. Poster presentations of senior year projects are also held in conjunction with the Open House & Career Fair in which the students have an opportunity to display their projects to the prospective employers.

Office of Research, Innovation and Commercialization - ORIC

Dr. Dawood Mamoon. Director (ORIC)
Muhammad Amin Qureshi, Deputy Director (ORIC)

The Institute has established Office of Research, Innovation and Commercialization (ORIC) to promote research and commercialization and to undertake following assignments and programs:

- Organizing Industrial Open House (IOH)
- Supporting the Institute's strategic research direction and policies
- Increasing and diversifying external research funding
- Improving recruitment and retention of top faculty
- Improving integration of research and education at all level of the Institute
- Improving translation of research into the public benefit
- Strengthening Institute-Industry relations
- Promoting entrepreneurship, technology-transfer and commercialization activities that energize and support the local and national industry
- Promoting and enhancing cross-cutting and multi-disciplinary research initiatives

The office program and activities are supervised by the Pro-Rector (Academic) and officers including Director, Manager University Industrial Linkages and Technology Transfer, Manager Research Operation and Development and Research Associate.

Quality Enhancement Cell (QEC)

The Quality Enhancement Cell (QEC) at GIK Institute is taking necessary steps to achieve the highest level of quality in education and ensure the effective learning experience of students. Under the supervision of Pro Rector (A), GIK has advanced towards the External Quality Assurance. Previously for consecutive 4 years (2014 to 2017) Quality Enhancement Cell (QEC) of GIK has achieved highest "W" category rated in the top ranked of Internal Quality Assurance (IQA). Recently in External Quality Assurance (EQA), QEC for consecutive 2 years (2018 to 2019) has achieved highest category in the quantitative assessment of QAA, HEC.

Moreover, Quality Enhancement Cell (QEC) of GIK Institute successfully completed Self-Assessment exercise for MS and PhD in Mechanical Engineering, MS and PhD Electrical Engineering, MS and PhD Computer Engineering, MS and PhD Computer Science, MS and PhD Chemical Engineering, MS in Nanotechnology and BS in Management Sciences Programs during 2019-20.

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

MARIA GULZAR

GIK & Faculty Medal CS

SYED MUHAMMAD BASHMUND SHAH

Faculty Medal CE

REHAN

Faculty Medal EEE

ZAIGHUM AKHTAR

Faculty Medal EEP

HUMAYYUAN RASHEED

Faculty Medal ES

IBRAHIM ABDURRAB

Faculty Medal CME

SUNDAS

Faculty Medal MSE

ZULQARNAIN HAIDER

Faculty Medal ME

MUHAMMAD IDREES

Faculty Medal MGS

SYED WASIF ALI

GIK Institute commends its alumni who appeared in CSS Competitive Examination 2020 and pass with flying colors. Our alumni have yet again made us all immensely proud.

Among the 221 selected candidates, our stars stand as follows:

The GIK Family is elated at their tremendous achievement, and wishes them the very best for their professional careers ahead.

Out of 18553 candidates who appeared in CSS Exams, 376 cleared the written test and final 221 were selected. The passing percentage of selected candidates this year is 1.96% .

·Mr. Arslan Gul, FME, Batch 24
Allocated Foreign Service of Pakistan
Merit no. 24.

Mr. Shahroz Mukhtar, BCE Batch 22,
Allocated Inland Revenue Service (IRS)
Merit no. 77.

·Mr. Awais Khan, FEE Batch 22,
Allocated Pakistan Audit and Accounts Service (PAAS)
Merit no. 122.

Warda Inam
CEO-Overjet

Overjet, is a startup that was co-founded by Wardah Inam, who also acts as its CEO. Ms. Inam is an alumni of GIK Institute, earning her bachelor's degree from the esteemed university in 2010. She went on to earn her Master's degree and PhD from MIT, and has since been involved with cutting edge research at companies like GE and Apple. She has also been involved in several tech-based startups similar to Overjet such as uLink Technologies and Q bio.

Ahmer Ali Khan
Co-Inventer
Apple Pay

Co-inventor Apple Pay, is the only Pakistani out of seven pioneers of Apple's new technology. Mr. Khan graduated from Ghulam Ishaq Khan Institute of Engineering Sciences and Technology in 2002. Later he moved to Silicon Valley where his career took off. Working in ViVOtech, Khan structured a model for building a smart-phone based payment system. In 2011, Apple selected Khan to apply his theory into practice. In February 2014, Khan along with other six inventors had filed a patent for what the world now known as "Apple Pay". This innovation has revolutionized the lives of global citizens by making all transactions totally private and secure. This has left a permanent mark on the way we buy things. He has attributed his success to thorough grounding in basic principles while a student of GIK Institute.

Farid Rahman	Shakil Durrani	Mushtaq Ahmad Khan
President SOPREST	Executive Director SOPREST	Secretary SOPREST and BoG

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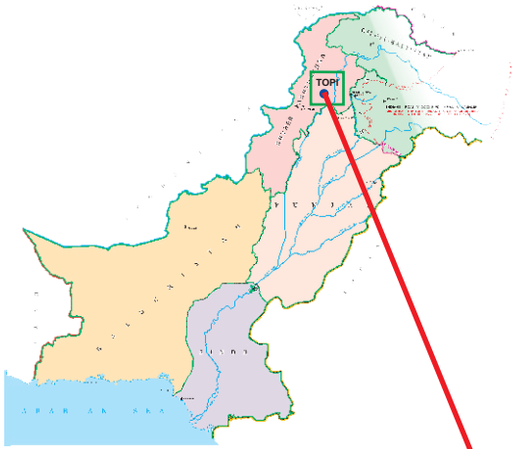
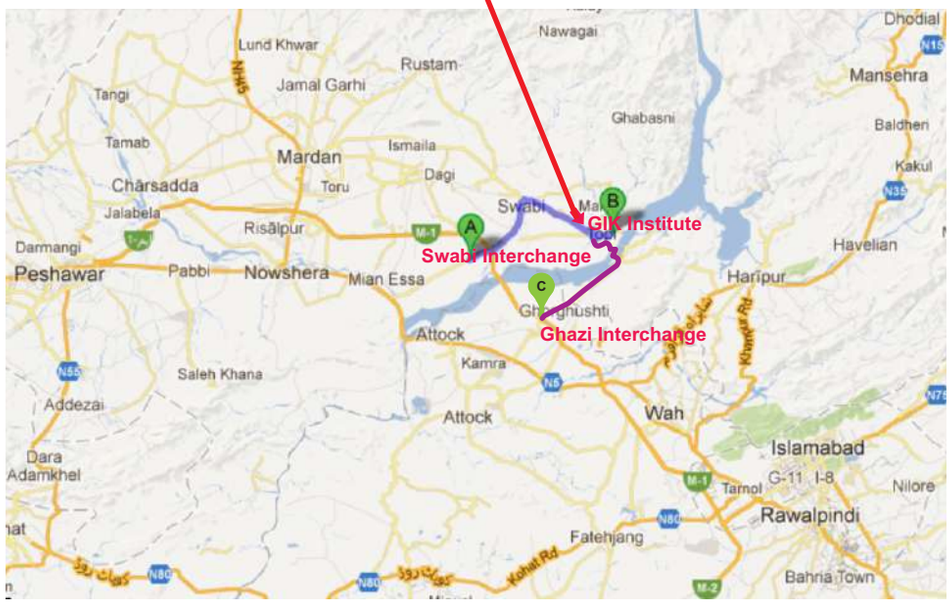
HOW TO GET TO GIK INSTITUTE

- 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 services 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 procedures, to observance of the Act, Guidelines, Rules and Regulations of the Institute.

Undergraduate Prospectus Committee

Prof. Dr. Wasim Ahmad Khan (Convener)
Mr. Muhammad Faheem Akhtar
Dr. Muhammad Imran Khan
Dr. Muhammad Hanif
Dr. Ahmad Kamal Hassan
Dr. Muhammad Usman
Dr. S. Zameer Abbas
Dr. Khurram Imran Khan
Dr. Massab Junaid
Dr. Khawar Rehman
Mr. Hassaan Tariq
Mr. Ateeq ur Rehman
Mr. Tahir Mir
Mr. Muhammad Waqas Malik
Mr. Taufeeq Ahmad

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