AIR UNIVERSITY

2024

www.au.edu.pk

Air University

Prospectus
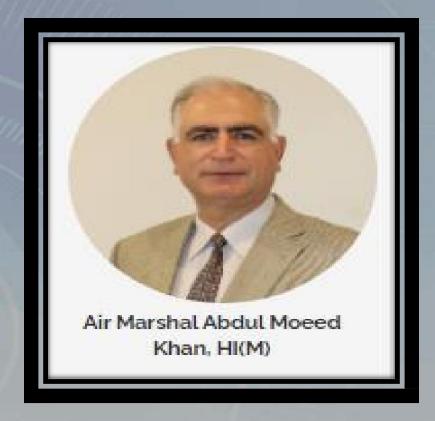
FACULTY OF ENGINEERING

Islamabad, the capital of Pakistan, is located in the Potohar Plateau in the north west of the country. This city was built during the sixties to replace Karachi as Pakistan's capital. Rawalpindi is considered its sister city because of the proximity of the two cities. Islamabad is a well-organized, modern city built round a master plan of self-contained sectors, each with its own shopping areas and parks. It is home to the Federal Parliament, Supreme Court, President's Secretariat, Prime Minister's Secretariat, Federal Ministries and corporates offices of all major public, private, national and multinational organizations.

The young city of Islamabad is preceded by thousands of years of history. This is the site of one of the earliest human settlements in Asia, and is at one end of the ancient Indus Valley civilization. Stone implements made near Islamabad on a mass scale were once sent down to the lower reaches of the River Indus. This is probably where the early migrations from Central Asia of Indo-European tribes made their first settlements. The large number of languages still spoken in the Northern Areas is evidence of the different races that have left their marks on this region, races as disparate as Alexander's Macedonians and Tamurlane's Central Asians. The banks of the River Soan in Islamabad were hosts to stone-age man over seven thousand years ago, and human skulls dating back to 5,000 years B.C. have been found in and around this city.

Admission schedule	Fall-24
Application Deadline (All Programs)	4th August ,2024
CBT Schedule Islamabad Multan A&AC kamra Lahore MS/PhD CBT	4 stations 22nd -30th August ,2024 5th -8th August,2024 6th -8th August,2024 10th -11th August,2024
Announcement of merit score	13th August 2024
Portal open for candidate to change the program	14th -16th August, 2024
Declaration of final merit list(U/G program)	17th August,2024
MS/Phd interviews	18th -19th August,2024
Fee deadline first merit list	22st August,2024
Announcement of 2nd merit list(U/G program)	23rd August,2024
MS/Phd admission announcement	22nd August,2024
Fee deadline 2nd merit list	26th August ,2024
MS/Phd 1st payment deadline	26th August ,2024
Declaration of follow-up merit list as per vacant slots(U/G and P/G program)	27th August – 4th Sep,2024
Orientation Day	14th Sep,2024
1st Day of Classes	15th Sep,2024

Vice Chancellor's Message

Air Marshal Abdul Moeed Khan, HI(M)

It is indeed a privilege to lead Air University, a vibrant hub of academic distinction, with a strong notion of concept based learning and a culture of research and innovation. Cognizant of the dynamics of higher education, the highly qualified and dedicated faculty and staff of Air University help nurture a knowledge driven atmosphere.

In a transforming globalized environment, it will be my endeavor to foster creativity and expression to enable our graduates to contribute at the national and global level. My keen focus would remain on synergizing multidisciplinary research to accrue benefits of upcoming creative technologies. You will find the Air University campus brimming with life, offering modern facilities and opportunities to engage academically, socially and culturally. The expansion of Air University horizons to three new state of the art campuses, reflects the reputation and acclaim of the programs offered. On behalf of the Air University team, I welcome you to a challenging, inspiring and rewarding experience.

1. Welcome to Air University

Air University is a federally chartered Public Sector University established in 2002. The campus is located near the Margalla foothills in the south east corner of sector E-9 (PAF Complex) of Islamabad. The main entrance is adjacent to the intersection of Agha Shahi Avenue (9th Avenue) and Khayaban-e-Iqbal (Margalla Road).

The University is a degree awarding autonomous institution and its graduates are offered good placement opportunities in the job market.

The University promotes research in all disciplines. Faculty members are encouraged to help develop the education system and curricula of the university using their experience and research. Faculty development and updating of courses are given high priority and are undertaken as a regular academic requirement.

1.1. VISION

Air University aspires to be among the leading national universities, excelling in teaching, learning, research, innovation and public service.

1.2. MISSION

The mission of Air University is to achieve excellence in teaching and research for producing graduates with sound professional knowledge, integrity of character, a keen sense of social responsibility and a passion for lifelong learning. The University shall stand committed to creating an environment conducive for attracting the best students, faculty and supporting staff for contributing to the development of a prosperous, peaceful and enlightened society.

1.3. CORE VALUES
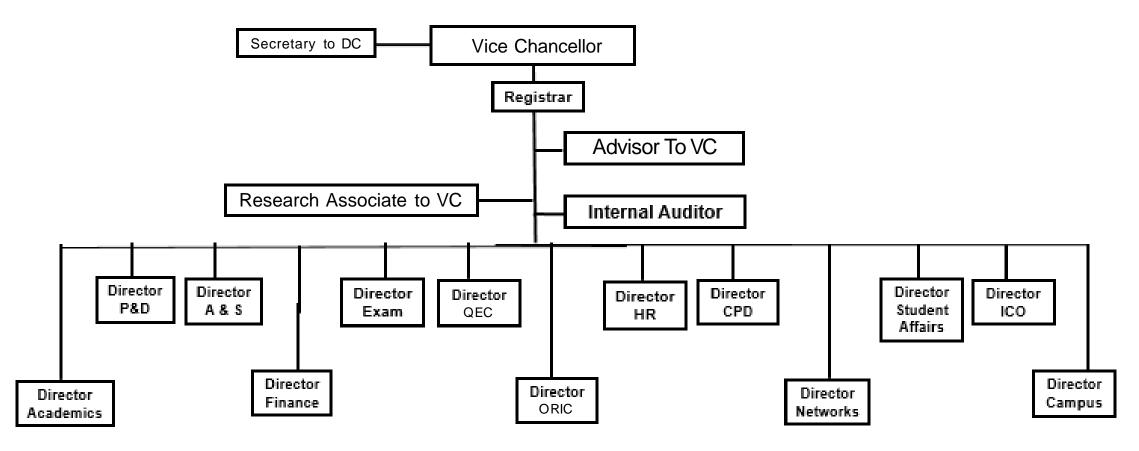
- Integrity
- Professionalism
- Respect
- Meritocracy
- Academic Freedom
- Teamwork
- Open-Mindedness
- Creativity
- Accountability
- Social Responsibility
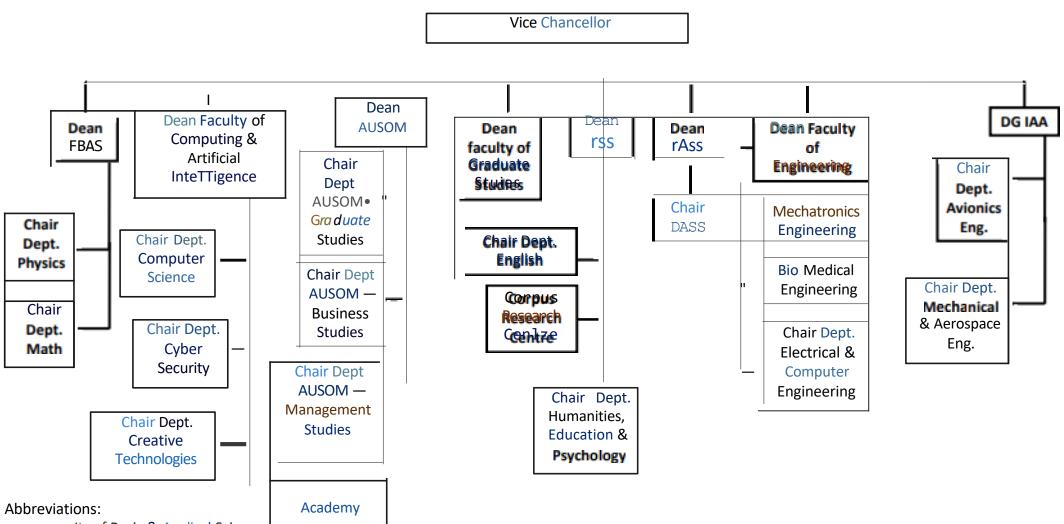
Air University Management Organogram

Secretary to DC	—	Vice Chancellor	

Registrar

Advisor To VC

Research Associate to VC — **Internal Auditor**

- Director P&D
- Director A & S
- Director Exam
- Director QEC
- Director HR
- Director CPD
- Director Student Affairs
- Director ICO
- Director Academics
- Director Finance
- Director ORIC
- Director Networks
- Director Campus

Air University Academic Organogram Main Campus

Vice Chancellor

Dean FBAS

Dean Faculty of Computing & Artificial InteTTigence

Dean AUSOM

Dean faculty of Graduate Studies

Dean rss

Dean rAss

Dean Faculty of Engineering

DG IAA

Chair Dept. Physics

Chair Dept. Math

Chair Dept. Computer Science

Chair Dept. Cyber Security

Chair Dept. Creative Technologies

Chair Dept AUSOM• " *Graduate* Studies

Chair Dept AUSOM — Business Studies

Chair Dept AUSOM — Management Studies

Academy

Chair Dept. English

Corpus Research Cenlze

Chair Dept. Humanities, Education & **Psychology**

Chair DASS

Mechatronics Engineering

Bio Medical Engineering

Chair Dept. Electrical & Computer Engineering

Chair **Dept. Avionics Eng.**

Chair Dept. **Mechanical** & Aerospace Eng.

Abbreviations:
revs: rar «Ity of Basic & Applied Sciences
OSS: F-aculty of Social Sciences
PASS: Faculty of Aerospace & Strategic Studies

2. Faculty of Engineering

Faculty of engineering comprises of two departments, namely:

1. Department of Electrical and Computer Engineering (DECE) Established in 2002.
2. Department of Mechatronics and Biomedical Engineering Established in 2003.

The DECE offers both undergraduate and postgraduate programs. At undergraduate level, the dept. offers two programs, Electrical Engineering Program and Computer Engineering Program. Further, three specialization streams exists in EE program which are Power, Electronics and Telecommunications. The dept. has graduated 14 batches of Electrical Engineers. The Computer Engineering (CE) Program was launched in 2017, therefore its first batch of students is yet to be graduated. At postgraduate level, the dept. offers MSEE and PhD EE programs. Our graduates from Electrical department have found their places in society as professionals serving the industry or as academics, training future graduates in institutions both at home and abroad. Faculty development and academic enrichment for forming constructive learning environments remains an ongoing activity.

The faculty at DECE is qualified, experienced and fully in tune with the directions of the university. The hardware in laboratories is also adequate to support a skill level to complement knowledge from the classroom lectures. We thus have a fully operational engineering program at undergraduate and graduate levels. The bachelor s degree is accredited by the Pakistan Engineering Council (Level-II) for batches 2015 and 2016, and by the acceptance our engineering students have found in the industries where they are employed.

The computer engineering program of the ECE department is a fully operational engineering program at the undergraduate level, with a qualified and experienced team of faculty fully in tune with university standards. Laboratories are equipped with state-of-the-art facilities, both hardware and software to complement the theoretical knowledge gained from classroom lectures. The zero visit of the CE program has been successfully conducted by the PEC and now interim and accreditation visits are scheduled.

3. Message from the Dean, Faculty of Engineering

Air University is in its seventeenth year since being established as a federally chartered public sector university in October 2002. With thirteen batches graduated in Electrical Engineering and twelve in Mechatronics Engineering, the products of the Faculty have found their place in society as professionals serving the industry or as the budding academics of tomorrow being trained in institutions at home and abroad. Yet, the Faculty of Engineering is in its infancy undergoing the usual problems, crises, and challenges that have shaped educational institutions in this stage. Faculty development and academic enrichment remain an ongoing activity. In engineering, the focus is on electronics, telecommunications, power, and mechatronics, while an undergraduate program in mechanical engineering is in place in the university under the supervision of the Institute of Avionics and Aeronautics also located in the same premises.

Our faculty is qualified, experienced and fully in tune with the directions of the university. The hardware in laboratories is also adequate to support a skill level to complement knowledge from the classroom lectures. We thus have a fully operational engineering program at undergraduate and graduate levels. These are accredited by the Pakistan Engineering Council and by the acceptance our graduate students have found in the industry where they are employed.

Our undergraduate students have produced several engineering proof-of-concept products and have participated in national and international competitions. Many projects are placed on social media including YouTube for the widest dissemination possible.

Many of our graduates have proceeded for higher education abroad as well as within Pakistan. They are performing well as the university has done it is all to provide a solid foundation, and they have utilized their time to their own advantage.

I welcome the new students to the Faculty of Engineering assuring them of quality education and full experimental support for their studies. The environment at Air University is conducive for a student to utilize time properly for a promising future in a professional career. With a focused and dedicated approach, and consistent hard work, a student is bound to find time spent here well rewarded.

4. Faculty of Engineering Management Team

Engr. Prof. Dr. Rana Iqtidar Shakoor
Dean Engineering

Engr. prof. Noman Naseer
(Chair Mechatronics and Biomedical Engineering)

Engr. Prof. Dr. Zia Mohy Ud Din
(HoD Biomedical Engineering)

Dr Hafiz Ashiq Hussain
(Chair Electrical and Computer Engineering)

5. Admission Eligibility

Bachelor Programs

Bachelor of Mechatronics Engineering

Applicants must have passed: Intermediate (Part I and II) examination with Physics, Chemistry and Mathematics from any Board of Intermediate and Secondary Education in Pakistan. Applicant must have scored 60% or more marks.

OR

An examination equivalent to Intermediate. Such candidates are required to submit an Equivalence Certificate issued by the Inter Board Chairman Committee, Islamabad before the semester starts. This certificate must indicate the marks equivalent to marks in Intermediate.

OR

GCE 'A' level examination with three subjects (Physics, Chemistry, and Math.). The candidates are required to submit an Equivalence Certificate issued by the Inter Board Chairman Committee, Islamabad before the semester starts. This certificate must indicate the marks equivalent to marks in Intermediate.

Applicants awaiting results shall be given provisional admission until declaration of their respective results. Applicants scoring 60%. or more marks shall only be granted admission. Those scoring less than 60% marks shall have their provisional admission cancelled and they shall be withdrawn from their respective program. Upon announcement of results, only those applicants shall be granted admission, who pass ALL the subjects and score at least 60% marks. Applicants getting partial pass result, due to any reason, or required to appear in compartment / supplementary paper(s) shall not be eligible for admission, even if their aggregate marks are 60% or more.

The absolute value of percentage is considered as final; it is not rounded off to the next whole number, e.g., 59.9% is considered 59.9% and NOT 60%.

The candidates who qualify the Admission Test will only be offered admission as per position in merit list.

Bachelor of Biomedical Engineering

Applicants must have passed: Intermediate (Part I and II) examination with Physics, Chemistry and Mathematics/Biology from any Board of Intermediate and Secondary Education in Pakistan. Applicant must have scored 60% or more marks.

OR

An examination equivalent to Intermediate. Such candidates are required to submit an Equivalence Certificate issued by the Inter Board Chairman Committee, Islamabad before the semester starts. This certificate must indicate the marks equivalent to marks in Intermediate.

OR

GCE 'A' level examination with three subjects (Physics, Chemistry, and Math/Biology.). The candidates are required to submit an Equivalence Certificate issued by the Inter Board Chairman Committee, Islamabad before the semester starts. This certificate must indicate the marks equivalent to marks in Intermediate.

Applicants awaiting results shall be given provisional admission until declaration of their respective results. Applicants scoring 60%. or more marks shall only be granted admission. Those scoring less than 60% marks shall have

their provisional admission cancelled and they shall be withdrawn from their respective program. Upon announcement of results, only those applicants shall be granted admission, who pass ALL the subjects and score at least 60% marks. Applicants getting partial pass result, due to any reason, or required to appear in compartment / supplementary paper(s) shall not be eligible for admission, even if their aggregate marks are 60% or more. The absolute value of percentage is considered as final; it is not rounded off to the next whole number, e.g., 59.9% is considered 59.9% and NOT 60%.

The candidates who qualify the Admission Test will only be offered admission as per position in merit list.

Graduate Programs

Master of Science in Mechatronics Engineering

BE/B.Sc. Engineering or similar qualification in a relevant discipline. Fresh graduates are eligible but some relevant industrial experience will help a student gain more from the program.

Minimum CGPA 2.00/4.00 or equivalent. Students from other disciplines may be required to take prerequisite courses determined by the Department.

AU-GAT (Gen) at least 60% score OR NTS-GAT (Gen) at least 50% score. This must be passed before the date of admission in MS Program.

Candidates will appear in the interview for final selection.

Master of Science in Biomedical Engineering

BE / B.Sc. Engineering (Bio-Medical/ Mechanical/ Electrical, Electronics, Avionics, Aerospace and Mechatronics) with minimum CGPA 2.00/4.00 or equivalent.

AU-GAT (Gen) at least 60% score OR NTS-GAT (Gen) at least 50% score. This must be passed before the date of admission in MS Program

Candidates will appear for an interview for the purpose of final selection.

PhD Engineering

Masters degree (18years education) in engineering (with at least 24 credit-hours course work plus 6 credit hours thesis) with a CGPA of at least 3.00/4.00 or equivalent.

AU-GAT (Sub) at least 70% score or NTS-GAT (Sub) at least 60% score or a GRE Subject Test (at least 60th percentile). This must be passed before the date of admission in PhD Program.

Candidates will appear for an interview for final selection.

6. Application Procedure

Candidates can apply online for admission by visiting the university's website (http://www.au.edu.pk).

Please note that submitting incomplete, false, or misleading information is considered sufficient ground for denial of admission and dismissal at any time.

Required Documents:

The following documents are to be submitted.

Undergraduate Programs

The following documents are to be submitted at the time of interview:

- Attested copy of SSC Mark Sheet or its equivalent.
- Attested copy of HSSC Mark Sheet or its equivalent.
- Equivalence certificate from Inter Board Chairman Committee for A level or equivalent qualification from other systems.
- Three fresh passport size photographs with name and admit card number on the back.
- Attested copy of CNIC or Form 'B'.
- Attested copy of domicile certificate.

Master's Programs

The following documents are to be submitted at the time of interview:

- Attested copy of SSC Certificate/ Marks Sheet or its equivalent.
- Attested copy of HSSC Certificate/ Marks Sheet or its equivalent
- Attested copy of Marks Sheet of Bachelor's degree programme.
- Attested copy of Marks Sheet of Master's degree programme, if applicable.
- Three fresh passport size photographs with name and admit card number on back.
- In case of in-service students, No Objection Certificate (NOC) from the Employer is required to be attached with Application form and routed through Proper Channel or they can submit the same at the time of interview, failing which their admission shall be cancelled.
- Attested copy of NIC.
- PEC Registration Certificate is to be submitted along with the application form for MS Engineering programs.
- Attested copy of domicile certificate.

PhD Programs

The following documents are to be submitted at the time of interview:

- Attested copy of SSC Certificate/ Marks Sheet or its equivalent.
- Attested copy of HSSC Certificate/ Marks Sheet or its equivalent.
- Attested copy of Marks Sheet of Bachelor's degree programme.
- Attested copy of Marks Sheet of Master's degree programme, if applicable.
- Equivalence Certificate from HEC in case of foreign degree.
- Three fresh passport size photographs with name and admit card number on back.
- GAT Subject Test (at least 60% score cumulative) or GRE Subject Test(atleast 60th Percentile) Certificate required.
- Attested copy of NIC.
- Attested copy of domicile certificate.
- Candidates are required to provide a copy of synopsis/research proposal. Admission is subject to the availability of the Supervisor in the field of research and fulfillment of HEC s criteria.
- In case of in-service students, No Objection Certificate (NOC) from the Employer is required to be attached with Application form and routed through Proper Channel or they can submit the same at the time of interview, failing which their admission shall be cancelled.
- Every student at the time of admission to this University shall give an undertaking to the effect that he/she is not pursuing degree program in any other institution.
- Please note that submitting incomplete, false, or misleading information is considered sufficent ground for denial of admission and dismissal at any time.

ADMISSION TEST

Admission test is mandatory for candidates of all programs. Candidates who have cleared SAT/NAT (within the last one year fro m the date of AU Entrance Test) and GAT - General / Subject are exempted from Air University Test, provided their scores in those tests are as follows:

BE Engg Candidates:
- At least 1100 in SAT I or
- At least 50 in NAT

Note: Qualified within last one year from the date of AU Entrance Test.

MBA/MS Candidates:
- GAT-General Test (at least 50% score).

PhD Candidates:
- GAT-Subject Test (at least 60% score).

Instructions for Entrance Test:
- Applicants must bring the following material for the entrance test
- Test admit card
- CNIC
- Eraser, Sharpener and Pencil.
- Applicants are NOT permitted to bring calculators, cellular phones, or other electronic devices to the examination hall. Such a device if found in possession of a candidate during examination shall be confiscated and the candidate shall not be allowed to sit for the exam.

Interviews:

Candidates on the merit list will have to appear for the selection interview as per schedule, along with their original testimonials.

Announcement of Results

The results will be posted on the Air University website (www.au.edu.pk). Merit for admission will be prepared according to the following criteria:

Examination	Undergraduate Programs (BE Engg)
SSC/Equivalent	15%
HSSC/Equivalent	35%
Admission Test	50%
Total	100%

The University Functional Committee (UFC) shall determine the number of candidates to be offered admission on the basis of available seats and the minimum acceptable score. Candidates selected by the UFC shall be notified by mail and AU website. Results will NOT be given on telephone.

LATE ADMISSION

As a matter of policy, no deviation is made from the published schedule and late admissions are not entertained. The University reserves the right to reject the application for admission of a student without assigning a reason.

TRANSFER STUDENTS

The Vice Chancellor after consultation with relevant faculty may allow transfer of students from recognized institutions and reputed universities under specific conditions. A student expelled from another institution on disciplinary grounds cannot transfer to AU.

Applications for transfer are submitted to the Director of Academics using a form available on the website.

The transfer student must complete at least 50 percent of the required credit hours at AU to earn the degree. Courses with grade less than "B minus" cannot be transferred and will need to be retaken at AU. If admitted, the student will be informed clearly what courses may be transferred and what additional courses may be needed. The student must have at least CGPA of 2.5 to be considered for transfer. The final decisio n is taken by the Vice Chancellor.

Transfer of Program within AU

Transfer to another program is generally discouraged but under special circumstances an enrolled student may apply for transfer from one program to another, in the first two semesters of the program. The application is to be submitted to the respective Chair Department at least two weeks before the start of the semester in which the student is seeking a program transfer. Only students with CGPA of at least 3.0 may apply.

7.   FEE & FINANCIAL AID

Fees

AU reviews fee & other dues every year and in case of change (if any) after approval of the competent authority, revised fee would be charged to all new and existing students.

Existing and New Students

Fee for each semester must be paid in advance and within the stipulated period. First semester's Fee is charged as per actual credit hours, for the semester. Tuition fee is to be paid only upon receipt of the online bill available at AU website. All registered students can obtain fee bill from Air University website for current semester after they have formally registered for the courses. The Fee must be settled within the deadline as mentioned in the bill.

Students who fail to pay fee within given deadline, will be charged fine within same semester @ Rs 200/day. In case of non-payment of fee till the mid-semester, student name will be struck off from the University roll. A student whose name has been thus struck off but who is otherwise eligible to continue his/her studies will be reinstated only after he/she has settled all outstanding Fee / fines.

Note:

Please note that Admission Fee, endowment fund, Sports Charges and Student Events charges are not refunded in any case. However, Tuition Fee once deposited, will only be refunded as per the following deadline:

  i.   100% Tuition Fee Refund Up to 7th day of convene of classes
  ii. 50% Tuition Fee Refund From 8th -15th day of convene of classes
  iii. 0% Tuition Fee Refund From 16th day of convene of classes

Admission of candidates who are waiting for results will be cancelled if they fail to meet the minimum eligibility criteria after declaration of the awaited result. Tuition Fee, if submitted, will be refunded as per the timeline mentioned above. Students are not allowed to drop courses during their first two semesters. Refunds for dropped courses from third semester onwards are issued as per policy outlined in AU Academic Regulation.

8. Legal Issues

For Islamabad Campus:

Only the Courts at Islamabad shall have the jurisdiction to adjudicate any legal matters/ issues pertaining to University versus student(s).

9. Fee & Financial Aid

Tuition Fee @ AU

Bachelor of Engineering (BE)

S.No	Program	Total Credit Hours	Tution Fee Rate (Per Cr. Hr.) RS	Estimated Total Cost of Degree Program (RS)	Credit Hours 1st Semester*	Tution Fee as Per Cr. Hr. for 1st Semester (RS)
1	BE Mechatronic Engineering	138	6225	846600	17	112,050
2	BE in Biomedical Engineering	138	6225	846600	18	112,050

MS Engineering Programmes

S.No	Program	Total Credit Hours	Tution Fee Rate (Per Cr. Hr.) RS	Estimated Total Cost of Degree Program (RS)	Credit Hours 1st Semester*	Tution Fee as Per Cr. Hr. for 1st Semester (RS)
1	MS Mechatronics Engineering	24+6	5610	121980	9	50,490
2	MS Biomedical Engineering	31	7700	217000	9	69300

PhD Engineering Programmes

S.No	Program	Total Credit Hours	Tution Fee Rate (Per Cr. Hr.) RS	Estimated Total Cost of Degree Program (RS)	Credit Hours 1st Semester*	Tution Fee as Per Cr. Hr. for 1st Semester (RS)
1	PhD Mechatronics Engineering	18+30	3696	177408	9	33264

	Allied Charges	Amount	Payable
	Admission Fee	20,000	At the time of Admission (Once)
2	Security Refundable	10,000	At the time of Admission (Once)
	Endowment Fund	5,000	At the time of Admission (Once)
4	Convocation Charges	5,000	In last semester of Program
5	Thesis Evaluation Fee	20,000	In last semester of Program
6	Students' Event	1,000	Per Semester
	Sports Fee	1,000	Per Semester
8	Library Fee	500	Per Semester
9	Exam Fee	2,000	Per Semester (Not applicable to PG student's when only registered in Thesis during semester studies)
	Re-Joining Fee	3,000	After Semester leave

The university reserves the right to review tuition fee or any of the above charges at any time, if deemed necessary.

Payment of Fee

The fee is to be paid before the start of the semester. Fee bills are enclosed in the admission letters sent to successful candidates. Candidates failing to submit the fee by the due date shall lose their seats, which will be offered to the next candidate on the merit list.

Financial Aid

Scholarships

Air University provide number of scholarships to support the student in pursuit of their studies. These scholarships are available from undergraduate level to post graduate level.

Types of Scholarships

1.   Air University Need Based Financial Grant (AUNBFG)

Need Based Financial Grants (NBFG) are offered to Undergraduate students of fresh entry on annual basis after assessment of their financial need through a Grant Award System (GAS). NBFG for continuing students are awarded on the basis of their financial need and their educational performance in the previous semester. Fresh entrants may submit their request for scholarship when they deposit their fee after becoming bonafide students of University. However, already enrolled students are also eligible to apply.

Eligibility Criteria

(a)

(b)   Continuation of NBFG is subject to good conduct of the student and educational performance (minimum CGPA of 2.0) in the preceding semester. Financial Grant of the student having less than CGPA of 2.0 will be frozen and would be resumed only when CGPA 2.0.

(c)   Only one NBFG to a student is permissible i.e. student availing any other need based grant or departmental grant or employee concession will not be eligible for second NBFG award.

In a repeat case of penalty due to use of Unfair Mean Case or act of indiscipline, a student would be ineligible for any Need Base Financial Grant/Scholarship in next semesters.

2.   Air University Incentive Scholarship (AUIS)

Air University Incentive Scholarship (AUIS) intends to encourage students with outstanding performance in F.Sc to join all programmes of AU. Under AUIS twenty students in each programme with F.Sc marks greater than 85% will be offered Full Tuiti on Fee waiver in first Semester. The continuation of scholarship is subject to good performance in the next semesters.

3.   HEC Need Based Scholarship

Air University in collaboration of Higher Education Commission aims to provide an opportunity for talented students who are financially disadvantaged and are incapable of meeting higher education costs at partner institutions /universities in all disciplines.

In this regard, funding opportunities are provided for academically qualified, yet financially needy, Pakistani students to continue university studies in selected partner universities of Pakistan, especially from remote and rural areas of Pakistan (FATA, Khyber Pakhtunkhwa, S outhern Punjab, Balochistan, and Northern Sindh). So far, 400 students have availed HEC Need Based Scholarship with total amount disbursed to them is 94 Million approximately.

The scholarship covers full tuition fee along with monthly stipend.

Eligibility Criteria

(a)   Students securing admission on open merit only are eligible for the NBFG award.

(b)   Continuation of NBFG is subject to good conduct of the student and educational performance (minimum CGPA of 2.0) in the preceding semester. Financial Grant of the student having less than CGPA of 2.0 will be frozen and would be resumed only when CGPA 2.0.

(c)   Only one NBFG to a student is permissible i.e. student availing any other need based grant or departmental grant or employee concession will not be eligible for second NBFG award.

(d)   In a repeat case of penalty due to use of Unfair Mean Case or act of indiscipline, a student would be ineligible for any Need Base Financial Grant/Scholarship in next semesters.

4. **Punjab Education Endowment Fund Scholarship**

Punjab Education Endowment Fund has signed an MOU with Air University in 2014 to provide scholarships opportunities in Undergraduate programs to talented and needy students of Punjab Province for pursuing quality education.

ELIGIBILITY CRITERIA

In order to qualify to apply for the scholarship, the student must have:

- Punjab domicile
- Secured at least 60% marks in last degree final exams
- Passed the examination as a regular student from:
- Government Institution, or Continuing scholar of the respective institution
- As a Private Candidate or
- Private Institution (low fee private institutions)
- Monthly household income of families of the selected student is not more thanRs.30,000.
- Not availing any other educational scholarship during the respective academic year.

5. **Merit Based Scholarship**

Air University awards Merit Scholarship to Students who demonstrate academic excellence by achieving outstanding positions at the end of a semester. These scholarships are awarded to TOP THREE position holders of each class (section) in the shape of fee waiver as given below:

Undergraduate Programs

- o 1st Position Holder   50% Tuition Fee wavier
- o 2nd Position Holder   40% Tuition Fee wavier
- o 3rd Position Holder   30% Tuition Fee wavier
- o Student attaining SGPA of 4.0 will get 100% Tuition Fee waiver, however they would be included in first three position holders of the class

Postgraduate Programs

- 1st Position Holder   35% Tuition Fee wavier
- 2nd Position Holder   30% Tuition Fee wavier
- 3rd Position Holder   25% Tuition Fee wavier

Students attaining SGPA of 4.0 will get 50% Tuition Fee Waiver, however they would be included in first three positions of the class

6.   Prime Minister Tuition Fee Reimbursement Scheme for Less Developed Areas

Students with valid domicile/local certificates of Less Developed areas of South Punjab, FATA, Khyber Pakhtunkhwa, Interior Sindh and Baluchistan enrolled in PhD program in Air University are eligible under the scheme. The scheme covers Full Tuition Fee along with other mandatory charges. For details click the following link:

(http://www.hec.gov.pk/INSIDEHEC/DIVISIONS/HRD/TFP/Pages/Introduction.aspx)

How to Apply

For Fall Session, students can apply through online scholarship portal on University website while entering their information regarding family Financial Resources and Expenses along with other important information. New students securing admission after depositing the Tuition Fee would be eligible to apply. After online application, the students will submit the required documents to the AU Financial Aid Office, within ten days after the final date of online submission.

Grant Award System

(a)   Applications for all Need Base Grants are submitted online at the moment of admission and required documents are submitted within Ten (10) days of final admission date at AU Financial Aid Office (FAO).

(b)   AU Financial Aid Office will scrutinize student s documents and prepare a composite list of all the students whose documents are verified.

(c)   Departmental Award Committee (DAC) constituted in each academic department will allocate need assessment points to individual candidates on the basis of the eligibility criteria given at para 8 below in an interview of each student.

(d)   Central Award Committee (CAC) will, based on inputs available from FAO and DAC, interview applicants and finalize the composite order of financial need.

Student Services

Air University Central Library (AUCL)

The library aims to enrich learning, teaching and research programs of the University by providing timely access to high quality scholarly information and learning material in a variety of formats.

Computing Facilities at Air University

Air University provides high-quality IT services to University students, faculty and staff members.

University has a high-speed network of more than 1200 nodes. All university blocks are interconnected with high speed optical fiber network.

University has nine (09) computer labs and one (1) language lab. These Labs are equipped with more than 425 high specs desktop computers. University upgrades these computers frequently to meet the latest I.T and engineering software requirements. All computers are centrally connected with domain based network. These labs provide the facilities of high-speed internet, intranet, individuals email address, individual secure profiles and separate storage areas for students.

Students have access to computer labs from 8:00am till 9:00pm six days a week (Monday   Saturday). Our highly qualified lab staff is always available there to assist students in their daily work.

Campus Medical Officer

   An on-campus medical officer is available for students, faculty and staff from 8:30am till 4:30pm from Monday to Friday. The doctor provides medical consulting, emergency clinical treatment, referral service and first aid. The doctor is also responsible for providing health and hygiene related information to students, faculty and staff. This office also organizes blood donation drives in coordination with various public and private sector organizations.

Hostels

Air University offer hostel facility to female students only. This is available at first come first serve basis.

Advisors

Each student is assigned an advisor from the faculty. The advisor helps the student to identify and achieve high academic goals and take advantage of learning opportunities. The advisors also guide students at the time of course registration every semester.

Transport Facility

Air University transport is available on payment for most students. This facility is available on designated routes between Rawalpindi and Islamabad.

Engineering Laboratories

Students are provided an opportunity to augment their learning through practical work in the modern laboratories of all engineering departments. These labs are adaptable, reconfigurable and modular, making them ideally suited for undergraduate teaching in a wide range of fields. Lab experiments are designed in coherence with theory. Students get confirmation of theoretical concepts by performing experimental work in the laboratories.

Mechtronics Labs

1. Mechanical Vibrations Lab:

The aim of this lab is to provide experimental insight regarding mechanical vibration systems. The apparatus includes Single degree of freedom, multi degree of freedom systems, plate vibration system, whirling of shafts, bifilar pendulum, Kater s Pendulum, torsional vibration apparatus, linear vibration test stands and universal vibration system.

2. Heat & Mass Transfer Lab:

The purpose of this lab is to introduce the undergraduate students with the advanced equipments in the industry and provide a hands-on training of the proper operation of units i.e., linear and radial conduction apparatus, free and forced convection and radiation apparatus. It also

includes condensation and vaporization units. This helps in not only understanding the theoretical fundamentals of the subject but also helps to visualize its real-world applications in the industry.

3. Fluid Mechanics Lab:

Fluid Mechanics laboratory provides a hands on environment that is crucial for developing student s understanding of theoretical concepts of fluid mechanics. The lab is equipped with different flow measuring set-ups such as Venturi meter, orifice-plate, pitot tube, rotameter etc. Osborne Reynolds s setup provides visualization of laminar and turbulent flows. Subsonic wind tunnel provides research opportunities to investigate flow and resulting lift and drag forces on scaled models of various geometries. Losses in bends and valves can also be measured using respective apparatus. Furthermore, the lab has demonstration units of pelton turbine, experimental reaction turbine module, series/parallel pumps, pipe surge and water hammer apparatus, centrifugal pump, compressible flow & pipe friction module, free-forced vortices setup, flow over open channel and impact of jet set-up.

4. Instrumentation and Control Lab:

In this lab, a number of test benches are available. It is used to teach the students how to check the serviceability of various instruments for measurements of pressure and temperature. In addition to this equipment, it also includes process trainer for controlling temperature, pressure, flow, level, speed and motion.

5. Engineering Drawing Lab:

State of the art drawing laboratory. Activities include Use of drawing instruments, Standard Drawing office practice, Principles of orthographic projection in relation to simple solids. Students also study Descriptive Geometry, Plane curves and Machine drawing in this lab.

6. CNC Lab:

Students gain knowledge and experience in CNC programming, understand basic machining processes, learn to set up and adjust the tools and fixtures and follow safety procedures. The hands-on machining experiences in this mechanical lab benefit our engineering students in their current academic course learning as well as future career plan/job searching. CNC milling and CNC turning machine is currently being used to support academic and engineering education.

7. Embedded Systems Lab:

Embedded systems Lab is newly established in Department of Mechatronics Engineering. Undergraduate students are used to perform their hardware-based experiments on latest equipment i.e Oscilloscopes, Function Generators, Power Supplies, FPGA Kits (Field Programmable Gate Array), Programmers, Digital Multimeters.

This Lab is also equipped with Multimedia and updated computer systems with latest software s for students to perform their software-based experiments/tasks.

8. Control & Instrumentation Engineering Laboratory

The Control Engineering Laboratory is equipped with the latest training modules. Concepts in control engineering are experimentally verified on computer-based training systems. The trainers assist in enhancing the concepts starting from simulating a simple transfer function, sensing and measuring various quantities, and PID control to complex coupled multivariable nonlinear systems, and such as this Magnetic Levitation System, the Twin-Rotor MIMO System, the Gyro-stable platform and the 3-degree-of-freedom Helicopter Model. The trainers offer maneuverings to both analog and digital systems. Moreover, industrial control is introduced using the Siemens Programmable Logic Controllers. Recently, the laboratory is equipped with K&H ACS 1000 Analog Control System Trainers.

9. Industrial Automation Laboratory

The lab is equipped with Programmable Logic Controllers PLC and all the requisite equipment. This enables students to perform various experiments concerning Industrial automation processes and methods. We have Allen-Bradley and FATEK PLCs and trainer s to demonstrate the sensors feedback and actuator working.

10. Power Electronics and Electrical Machines Laboratory

The Electrical Machines and Power Electronics laboratory is used to carry out practical work for Electrical Machines, Power Electronics and Electromagnetic Waves. It is equipped with software controlled LabVolt (Canada) equipment, which is useful to perform experim ents related to Single Phase/Three Phase Transformers, A/C Generators/Motors, and D/C Generators/Motors, etc.

In order to perform Power Electronics related experiments it has Software Controlled Lab-Volt (Canada), Terco (Sweden), and K&H (Taiwan) equipment to perform experiments related to Power Thyristors, MOSFET, A/C Motor Drives, D/C Motor Drives, and Speed Regulation etc. This Laboratory is also equipped with Oscilloscopes, Function Generators, Multimeters, and D/C Power Supplies.

Biomedical Labs

1. Basic and Biomedical Electronics lab

Basic and Biomedical Electronics lab facilitates the undergraduate students are used to perform their hardware-based experiments on latest equipment i.e Oscilloscopes, Function Generators, Power Supplies, FPGA Kits (Field Programmable Gate Array), Programmers, Digital Multimeters.

This Lab is also equipped with Multimedia and updated computer systems with latest software s for students to perform their software-based experiments/tasks. Electronics Lab is equipped with components such as diodes, transistors, operational amplifiers, Laboratories 36 oscilloscope, power supplies and function generators; required to practically implement the theoretical concepts of electronic systems.

2. Biomedical Instrumentation lab

This lab covers the instrumentation s courses outline. Fully equipped Work Benches along with instrumentation trainer, Bio-PAC System, qube Servo trainer are also available in the lab. Other biomedical eqipments includes centrifuge, spectrometer and different types of sensors are also available for developing concepts of the students.

3. Biomaterials lab

Biomaterials lab is equipped with biomaterials like PLA, PEUU, PGA, PLGA, PCL used in bomedical applications like formation of dental stature, heart valves, bones etc. The lab also contains rods and joints which are used as bone support.

4. Biomechanics lab

This lab is dedicated for biomedical engineering for various experiments related to biomechanical concepts. This includes experiments of force-motion, torque , normal and abnormal gait analysis. Pasco model of human is available in the lab for performing these experiments.

5. Computing lab

It is a dedicated lab for computer programmingoriented subjects like structured C, object oriented programming, java, computer-aided engineering drawing etc. High speed computers are installed to provide efficient computing facility for the respective courses.

6. Modeling and Simulation lab

This laboratory is equipped with computers installed with softwares like ANSYS etc to study the application of general and specific methods to analyze and model biological systems like blood flow and blood pressure simulation, airflow simulation, 3D simulation with FEM technology of heat transfer in human tissues.

7. Biomedical Signal Processing lab

Biomedical Signal Processing laboratory contains computers installed with latest version of softwares like MATLAB, PROTEUS, MULTISIM and other NI softwares for simulation purposes.

8. Digital Signal Processing lab

Digital signal laboratory contains latest DSP kits such as TMS320C6713, TMS320C6424 and TMS320C6714. Matlab® is used to simulate the experiments as well as projects. Code Composer Studio is used to code the Digital Signal Processors. These DSP kits are used for a wide range of IMAGE and SIGNAL processing applications. The general-purpose digital signal processor is dominated by applications in communications (cellular). Embedded digital signal processors are dominated by consumer products. They are found in cellular phones, fax/modems, disk drives, radio, printers, hearing aids, MP3 players, high-definition television (HDTV), and digital cameras and so on. These processors have become the products of choice for a number of consumer applications, since they are very cost-effective.

9. Project lab

The Projects laboratory includes equipment of multidimensional nature. The purpose of this laboratory is to facilitate students in their respective semester projects as well as in final year design projects. General project-related design and testing equipment including personal computers, oscilloscopes, function generators and high wattage power supplies have been made available in ample quantity. It also has two latest ALL-11 Universal Programmers, which are capable of Programming any chip from any vendor be it microcontroller, AVR, PIC, EEPROM, UVR OM etc. makes it the best Programming option in the world available as yet..

10. Human Anatomy lab

Human Anatomy lab includes bones of human body. The basic purpose of this lab is to provide insight on musculoskeletal functions by demonstrating artificial bones and muscles.

11. Physiology lab

In this lab the students conduct practicals related to the physiology and. Training modules of Biopac and power lab are available in the lab for specific experiments like data acquisition and analysis of EMG, ECG and EOG etc.

12. Biochemistry lab

Biochemistry lab contains equipment like spectrophotometer, water bath, chemistry analyzer, incubators and various chemicals used for basic biochemical analysis by the students. Furthermore, laborartory techniques like electrophoresis and chromatography for mixture separation are also available.

13. Physics lab

Physics laboratory is used to perform practicals of applied physics where theroretical concepts of pressure, force and measurements of physical quantities are implemented using different instruments like screw gauge, vernier calipers, air track, sextant, inclined plane, current balance etc.

Societies & Clubs

At Air University we do not believe in producing single dimensional personalities we rather believe that curricular and co-curricular activities complement each other to develop well-rounded, socially skilled, healthier individuals. Air University promotes variety of activities under different clubs/societies from which a student can choose that which appeals to him/her personally. These activities range from athletics, debates, music, Qirat, dramas, poetry to cultural activities. Out of these some students choose more than one. Each society has a faculty member incharge to facilitate while the entire management of these activities is done by the students themselves. The University encourages students to self-manage these societies and clubs and provides the required resources while the guidance is given by Patron-in-chief of the societies.

We are very pleased to report that students who have been involved in co-curricular activities tend to do well in academic areas as well. This may be due to increased self esteem, motivation, team spirit and better time management that they learn while organizing such events. Many can get

"athletics" or "sports" scholarship abroad as modern universities everywhere are more interested in recruiting students who have something more to offer besides academic qualification.

1) AU Adventure Club
2) Shaoor Society
3) Air University Alumni Association
4) AU Cultural Society
5) AU Literary Society
6) AU Music Society
7) Air University Sports Club
8) Air Media Club
9) Air University Society of Mechanical Engineering (AUSME)

10) Air University Medical Engineering Design Club (AUMEDC Society)

Department of Mechatronics and Biomedical Engineering

Mechatronics Engineering

Mechatronics is the synergistic integration of sensors, actuators, signal conditioning, Power electronics, decision and control algorithms and computer hardware and software to manage complexity, uncertainty, and communication in engineered systems. In Pakistan, Mechatronics is well-suited to the industry as it provides the right mix of mechanical engineering, electronics, and computer science to enable an engineer to grapple with the essentials of industry. At a graduate level, the department aims to concentrate on instrumentation, sensors and control systems.

Mission of Mechatronics Engineering

The mission of the Department of Mechatronics and Biomedical Engineering is to provide students with the advanced knowledge and nurture them with the positive relationship towards their fellow and in particular towards society. The department aspires to produce graduates who can communicate effectively, seek lifelong learning and become a helping hand in developing a prosperous and enlightened society.

Program Educational Objectives (PEOs)

Within a few years of graduation, the students with Bachelors in Mechatronics Engineering are expected to attain the following objectives:

PEO 1: The graduates are analyzing and solving complex engineering problems and proposing solutions to design requirements of the industry.

PEO 2: The graduates are pursuing higher education and are involved in society-oriented research.

PEO 3: The graduates are managing projects or working as a team member as a useful member of the society and are demonstrating high professional and morals ethics.

Program Learning Outcomes (PLOs)

Graduates of the Mechatronics Engineering program will be able to:

(1) Engineering Knowledge

An ability to apply knowledge of mathematics, science, engineering fundamentals and an engineering specialization to the solution of complex engineering problems

(2) Problem Analysis

An 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

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.

(4) Investigation

An ability to investigate complex engineering problems in a methodical way including literature survey, design and conduct of experiments, analysis and 19 interpretation of experimental data, and synthesis of information to derive valid conclusions.

(5) Modern Tool Usage

An 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

(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.

(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.

(8) Ethics

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

(9) Individual and Teamwork

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

(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 reports and design documentation, make effective presentations, and give and receive clear instructions.

(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.

(12) Lifelong Learning

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

Sr. No.	Name	Details of Qualifications		Specialization
		Degree	Institution	
	Dr. Rana Iqtidar Shakoor	PhD	PIEAS, Islamabad	MEMS, Vibrations
		M.S	PIEAS, Islamabad	MEMS, Vibrations
		BSc	UET, Lahore	
	Dr. Zareena Kausar	PhD	University of Auckland, New Zealand	Mechancial Enginering
		MS	UET, Lahore	Mechatronics Engineering
		BB	UET, Lahore	Mechanical Engineering
	Dr. Shakil Rehman Shiekh	PhD	BUAA, China	Unsteady Fluid Dynamics (CFD)
		MS	University of Texas, Austin Texas	Flight dynamics and Controls
		RM	CAE, NED University, Karachi	Aerospace Engineering
	Dr. Noman Naseer	PhD	Pusan National University, Busan, Korea	Brain Computer Interface
		MS	Air University, Islamabad	Mechatronics Engineering
		BS	E&ME NUST, Rawalpindi	Mechatronics Engineering
	Dr. Hafiz Zia Ur Rehman	PhD	Hanyang University, South Korea	Mechatronics
		M.S	ET,	Mechatronics & Control Engineering
		BS	UET, Lahore	Mechatronics & Control Engineering

	Dr. Tallal Saeed	PhD	Beihang University (Beijing University of Aeronautics and Astronautics BUAA), Beijing, China	Control Theory and Control Engineering
		MS	UET, Taxila, Pakistan	Electrical Engineering (Control Systems)
		BSc	UET, Taxila, Pakistan	Electrical Engineering (specialization Computer Engineering)
	Engr. Zahid Husaain	MS	UET, Taxila/ Air University	Thermal Systems
		BS	NUST E&ME, Rawalpindi	Mechanical Engineering
	Engr. Akhtar Khursheed	MS	NUST, Rawalpindi	Manufacturing
		BS	UET, Lahore	Mechanical Engineering
	Engr. Neelum Yousuf	M.S	Air University, Islamabad	Mechatronics Engineering
		B.DE	Air University, Islamabad	Mechatronics Engineering
	Engr. Umer Farooq	MSc	LUMS, Lahore	Embedded systems
		BSc	Federal Urdu University, Islamabad	Electronics
	Dr. Hammad Nazir	PhD	Air University	Brain Computer Interfaces
		MS	NUST, Rawalpindi	Mechatronics Engineering,
		BE	NUST, Rawalpindi	Mechatronics Engineering
	Engr. Atiq ur Rehman	MS	SZABIST, Islamabad	Project Management
		MSc	PIEAS, Islamabad	Process Engineering
		BS	NED University, Karachi	Mechanical Engineering
	Engr. Imran Shabkhez Sarwar	MS	E&ME NUST, Rawalpindi	Mechatronics Engineering
		BS	E&ME NUST, Rawalpindi	Mechatronics Engineering

	Name	Designation	Degree	Year	University	Field
	Engr Muzzamil Gaffar	Research Assistant	Ph.D. MS BE	In Progress 2017	Air University Air University Federal Urdu University	Mechatronics Mechatronics Electrical
	Engr Nauman Ghafoor	Research Assistant	Ph.D. MS BE	In Progress 2018	Air University Air University Air University	Mechatronics Mechatronics Mechatronics
	Engr Umar Jamil	Research Assistant	Ph.D. MS BE	In Progress 2018	Air University Air University Mirpur University of Science and Technology	Mechatronics Mechatronics Electrical
	Engr. Anam Maqbool	Lab Engineer	MS BS	In Progress 2017	Air University COMSATS University	Electrical Electrical
	Engr. Bilal Awais	Lab Engineer	BE	2016	Air University	Mechanical
	Engr. Zargham Raza	Research Assistant	MS BE	In Progress 2017	Air University Air University	Mechatronics Mechatronics
	Engr. Syed Ali Usama	Lab Engineer	MS BE	2020 2018	Air University Air University	Mechatronics Mechatr
	Engr. Ammar Arshad	Lab Engineer	MS BE	In Progress 2020	SMME, NUST Air University	Mechanical Mechanical

Curriculum Design

MTS program s curriculum breakdown according to HEC curriculum layout.

6em-ester	ę No.	Course Code	Course Title	Credit Hours	Knowledge Area	Pre-requisite Courses (if any)
	2	ELT-iłs	Islørnic S łnd lG$	3-0-3	Hum s itice	
	3	Pž-Ł-102	Applied Physics	3-1-4	MoniœüScionccs	
	5	MT-102	Workshop Practice	0-i-2	Engineering Foundation	
	6	MT-142	Electric Circuits Analysis	3-0-3	Engineering Foundation	
	7	MT-142L	Electric Circuits Analysis Lab	0-1-1	Engineering Foundation	
			Total Semester Credit Hours	1		
2	1	MA-217	Linear Algebra and Differential Equations	4-0-4	Mathematics	MA-101
	2	HU-xxx	Social Sciences Electives-I	2-0.-2	Humanities	
	3	HU-121	Communication Skills	2-0-2	Humanities	
	4	CE-112	Computer Programming	2-0-2	Computing	
	5	CE-112L	Computer Programming Lab	0-1-1	Computing	
	ô	MT-240	Electronic Devices and Circuits	3-0-3	Engineering Foundation	IT-142
	'7	MT-240L	Electronic Devices and Circuits Lab	0-1-1	Engineering Foundation	MT-142
	8	MT-111	Engineering Statics	3-Ò-3		
	1	MA-105	Multivariable Calculus	3-0-3	Macbem* és	MA-101
	₄	CE-114	Data Structures and Object Oriented Programming	2-0-2	Computing	CE-112
	3	CL-114L	Data Structures and Object-Oriented Programming Lab	u-i-i	Computing	CL-112
	4	MT-247	Electronic Circuits Design	3-0-?	Engineering Foundation	MT-240
	5	MT-247L	Electronic Circuits Design Lab	0-I-1	Engineering Foundation	MW-fl4O
	6	MT-212	Engineering Dynamics	3-0-3	Engineering Foundation	MT-111
	7	MT-272	Solid Modelling and Manufacturing Processes	0-1-1	Engineering Foundation	MT-170
	8	MT-260	Actuating Systems	3-0-3	Engineering Foundation	

9	MT-260L	Actuating Systems Lab	o-i-i		
		Total Scmcetc C•cdit Hours	J4—*-18		
1	MA-218	Camplex ' zt ad+tee and Tzsusforms	4-O—4	Mathematics	MA-105
2	MT-350	Instrumentation and Measurement Systems	3-0-3	Major Based Core (Breadth)	
3	MT-350L	Instrumentation and Measurement Systems Lab	0-1-1	Major Dazed Core'fDrsodth}	
4	MT-213	Mcchanics ot Matcricls	z—u-z	Lnglnccnng koundoton	MT-111
6	MT-256	Di*itol Logic Design	3-0-3	nginccnne.roundmtion	
7	MT-256L	Digital Logic Design Lab	0-1-1	Engineering Foundation	
8	MT-225	Slater iaIs mid Manufect uriiis Prmcsscs	3-0-3	Engineering Foundation	
1	HU-xxx	Swe‹a.iencesnl‹+‹/'vell	2-0-2	Hum‹innies	
2	MT-252	Sisnolsmids,si‹ms	2-0-2	VWo:0wmdCo +DmmdfhI	
3	MT-359	Microcontroller and Embedded Systems	2-0-2	Major Based Core (Breadth)	MT-256
4	MT-359L	Microcontroller and Embedded Systems Lab	0-2-2	Major Based Core (Breadth)	MT-256
5	MT 317	Theory of Machines	2 0 2	Cttg tneeñng Founda.tion	MT 212
6	MT-317L	Theory of Machines Lab	0-1-1	Engineering Foundation	MT-212
7	MT-xxx	Engincering Elective I	3-0-3	Mayor Boecd .Core f.DnPt1 J'	
8	MT-339	Fundamentals of Thermal Sciences	3-0-3	MQot owed c oe tBmadM	
9	MT-339L	Fundamentals of Thermal Sciences Lab	0-1-1	w Owed Ccr fDrmd &1	
		Total Semester Credit Hours	14-4-18		
1	MA-303	Probability and Random Variables	3-0-3	Mathematics	MA-105
2	MT-S'C8	Mechatronics System Design	2-0-2	Major Based Core (Depth)	MT-256
3	MT-3S8 L	Mechatronics System Design Lab		Major Based Core (Depth)	MT-256
4	MT—4 '2	R++lniti os	3-0-3	Major Based Core (Depth)	
5	MT 46?L	Robot cs Lab	0 1 1	Mojor Bosed Core tOepili}	
6	MA-373	Modelling and Simulation in Mechatronics	3-0-3	MPdnr R bsert U nrP.{flu }	MA-217
7	MT-330	Fluid M cchenics	2-0-2	Meior B-oscd how TBwdth T	
8	MT-330L	Fluid Mcohem s Lab	0-1-1	Major Based Core (Breadth)	

9	MT- 396	Final Year Project I	0-1-1	Senior Design Project	.-
		Total Semester Credit Hours	**1**		
2	J£U-î II	Pakistan Studies	2-0-2	Humanities	
3	HU-3¢i7	Technical Report Writing	1-1-2	Humanities	
4	M î'316	Design of Machine Elements	?02.	Major Based Core (Depth)	MT 2î3
5	MT 452	Control Systems	3 0 3	Major Based Core (Breadth)	MT 373
7	**MT-xxx**	BngUogec4ngEEecMveEl	2-O-Z	Major Based Core (Depth)	
B'	MT-498	Final Year Project II	0-2-2	Senior Design Project	MT-396
9	CSL 407	Community Service Learning (Non Credit)	0 0 0		
		Total Semester Credit Hours	**12-5-17**		
i	**BA/MT xxx**	**Management Sciences Elective**	2 O2	Management Sciences	
4	*fivfiT-45*1L	Manufacturing Automation Lab	0-1-1	Major Based Core (Depth)	
5	**MT-xxx**	Rngfneer4ng Electric CII	3-0-3	Major Based Core (Depth)	
6	MT 499	Pinml veor £mieux I1'î	0 3 3	Senior Design Project	MT 498

Courses Description

MT III kNGINEkRTf"ïG STAT£CH

Forèc und iis rcotangtilor iind obliquc nxis oompniionts (twö und ihrcc ùtîmcnsinnnl systems). Moment nnô roëultnnt *oup1c (iw‹n und three' di'merisiwrial systoms). Equî libri tim Mechanical systeoiä, fiee .troüy ‹liaçmam arif eqiiilibri nm Audit îuris fOr twu ccl three dimensi ûiiaJ systerris,. Slxn ictriree, l•1rine tni.sse.s. c•1iiti‹nn oC p 1ri-ne triissee si t h in eth cit où jet nts mei in efh on cif seciic•ne, f''raine.s. i.:entrr›.ids, cc•inpcis ite oentrcii rle, Diswibuted Rome syéiein. Types Ôf friction, Application ÔPNotion.

'ÎLE' 10Z W O R K H H O P P R A C W U E

Introduction to sensors, different types of sensors and switches. Introduction to electronic devices, Introduction to hydraulic and electric actuators. Introduction to derives and mechanisms used in mechatronic systems, Basic theory and practice on the following shops: Fitting shop, Woodwork shop, Electrical shop, Forging shop, Foundry Shop, Elementary Machine shop (Lathe & Milling), Welding shop, PCB soldering, Introduction to computer hardware.

MT 142 / MT142L ELECTRIC CIRCUITS ANALYSIS

Basic Circuit Elements, Ohm s law, KCL and KVL, Series and Parallel Circuits, Node and Mesh Analysis, Linearity and Superposi tion Principles.

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HU 118 ISLAMIC STUDIES

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MA 217 LINEAR ALGEBRA AND DIFFERENTIAL EQUATIONS

Differential Equations, ODE of First order and first degree, ODEs of second and higher orders. Systems of linenr difToreniinl oquntions. Introduction to. mntrioos: Algebrn. of mnxrioesi Specinl matrices, Detcrminnnts .rind •their Linear independence, bases, Vector space,

MT 170 ENGINEERING DRAWING

Engineering Drawing, Types and usage, Basic geometrical Constructions, First angle end' tliitd an@lú prójeoii'cfiis. D'iiriensipñing .ñiid lütierifig, Tolerances Fits, P.rCijeoii*Óf1*B Of @o'inis, istriiight linds,:planes .a'rLd 'isolids. Seéi.ióñing'.cif ñcilide, li'c:'iuctrac iurJác.Cs,.. ifraw íqg k.Atf. L4ríete-rstnijding und 'óypu:ing siiijplc U D Coordinaie. systems, Modifyiiig.diawing .objeoté. Drawiri@ in layers, creaiirig complex drawingy. Seclioúing, :Hatching Text, -Bloo ks 'Dimensioriirig, Isometric views, Fits and Symbols Surface finish, Threaded parts, and surfaces, Extracting views model space intn paper spaoe, Cheating lay.nuts.'in Paper space, Plotting a:.draw.ing, Plotting from model.space.

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Transmission of Heat, Optics: Lenses, Mirrors, Optical instruments, Fundamentals of electromagnetism, Introduction to Semiconductors.

HU 307 TECHNICAL REPORT WRITING

Technical Writing, Research Writing, Letter Writing, Personal Letters, Business Writing, Practice.

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the Divergence theorem, modeling of heat flow, Stokes s theorem.

MT 240/ MT 240L ELECTRONIC DEVICES AND CIRCUITS

Basic concepts of semiconductor and PN junction physics, Diodes, terminal characteristics of junction diodes, analysis of diode circuits, small signal model and its applications, Zener diodes, Rectifier circuits, Limiting & Clamping circuits. Physical Structure and operating principles of BJTs, basic BJT circuit configurations, DC analysis, Small signal and large signal models of BJT, BJT as a switch. Physical Structure and operating principles of FETs, MOSFETs, Enhancement and Depletion type MOSFETs, basic MOSFET circuit configurations, DC analysis, Small signal and large signal models of MOSFETs.

MT 212 ENGINEERING DYNAMICS

Kinematics of Particles: Rectilinear motion, Plane curvilinear motion, Rectangular coordinates, Normal and tangential coordinates, Polar coordinates, constrained motion. Kinetics of Particles: Force, mass, and acceleration, Newton's second law of motion, equations of motion, Rectilinear and curvilinear motion, Work and energy principle, potential energy, Impulse and momentum, conservation of momentum. Plane Kinematics of Rigid Bodies: Angular motion relations, concept of absolute and relative motion (velocity and acceleration), Instantaneous center of zero velocity. Plane Kinetics of Rigid Bodies: Force, mass, and acceleration, general equation of motion, Translation, fixed axis rotation, Work and energy relationship, Impulse and momentum equation.

MT 272 SOLID MODELING AND MANUFACTURING PROCESSES

Getting acquainted with the Pro/E Interface, Pro/Engineer Wildfire 4 User Interface, Sketcher, Datum features, Extruded Protrusions & cuts, Holes, Rounds and Chamfers, Shells, Ribs, Feature Modification and Manipulation, Patterns and Copies, Revolved Protrusions & cuts, Sweeps and Swept Protrusions & cuts, Blended Protrusion & Swept blends, Assembly Modeling, Sheet Metal Design, Surface Modeling, Style features, Motion, Structure and Thermal Analyses

MT 225 MATERIALS AND MANUFACTURING PROCESSES

Engineering Materials: Engineering Properties of Materials, Concept of Structures, Metals and Alloys, Ceramics, Polymers, Composites, Semiconductors, Materials Characterization, Scanning Probe Microscopy, Non-Destructive Testing, and Material Selection. Manufacturing Processes: Manufacturing Systems, Modern Casting, Conventional machining; turning, milling, tool geometry, chips formation, material removal rate. Non-conventional machining; EDM, ECM, water jet machining, laser, EBW etc. Welding Processes, Heat Treatment, Electronic Fabrication, Rapid Prototyping.

CE 114 / CE 114L DATA STRUCTURES AND OBJECT-ORIENTED PROGRAMMING

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MT 247/ MT 247L ELECTRONIC CIRCUITS DESIGN

Circuit modelling in s-domain, pole and zeros, Bode plots, Frequency response of different single stage amplifier configurations of BJTs and MOSFETs, Miller s theorem, Differential and Multistage Amplifiers, Feedback configurations, Active Filters, Ideal linear op -amp circuits: inverting amplifier, non-inverting amplifier, summing amplifier, instrumentation amplifier, Non- ideal linear op-amp circuits, such as voltage follower, inverting amplifier, non-inverting amplifier, Static limitations of op-amps: bias current, offset current, offset voltage

MT 252 SIGNALS AND SYSTEMS

Continuous-time (CT) and discrete-time (DT) signals; signal energy and power, time shift, reversal, and scaling; periodic signals; even and odd signols, 'CT nnd DT .Complex Exponontiol nnd S›inusoi'dnl iSignnls, Poriodicity Proporti0s, .uniÎ impulsc nnd unit step aignols, Alo mory, lnverlibiÎity, 'Causality Siability, Timi. Inãariancci, Lin0arityi D.T 'and CT. rcjrcsontation: in tci•tna of impulscx* D.T Unit Impuls‹s Răsționsc'‹ .Co ri olution -Suni , mprcScntaticin. of LTJ S ystcmsi CT. Unit:.Impu1sis.Rcspo;nsc', Convoluticin-liitc@ral Rcpmsentation cif.LTI S›ystciiis, Fo'ui icr Serios Repmsciitation -nf

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MA DO.'3 PRODABâI.IT'V ANEn RANDOM MARIABLES

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i IT 359/ MT359L. XVIICROCOHTROLLER AJ•4D RMBEDDED S¥STEMS^

lntroduo1i'Ón to Mioroproçessors und Mioro.oontrollers, nrchiteoturg :óf' :.ri modorn mioroooritroller, Software/firmwnre developmenl lnoÍs, Programming languages; Assembly and C, Simulation tools like Proteus, Digital systems design using internal resources, external peripherals and devices, Implementation of data communication; RS-232, I2C, SPI etc Introduction to embedded systems, Hardware architecture for embedded systems: Microcontrollers, Programmable logic devices like, Programmable array logic (PAL) and its variants, and Field Programmable Gate Arrays (FPGA) and its variants, Programming of embedded systems with Microcontroller and FPGA,

MT 330/ MT 330L FLUID MECHANICS

Introduction to Fluid Mechanics, What is fluid, classification of fluid, and fluid properties. Fluid Statics: Basic equation for pressure field, pressure measuring devices, hydrostatic forces on submerged surface, buoyancy, floatation and stability. Fluid Dynamics: Principles of fluid motion, Definition of path line, streamline, streak line and timeline. Derivation of Bernoulli s and Euler s equation. Flow measurements. Velocity and acceleration field. Derivation of Reynolds transport theorem. Rayleigh s method and Buckingham s Pi theorem. Boundary layer theory.

MT 350/ MT 350L INSTRUMENTATION AND MEASUREMENT SYSTEM

Measurements terminologies including resolution, sensitivity, accuracy, and uncertainty, engineering units and standards. Principles of different measurement techniques. Sensors for measurement of temperature; Thermocouples, RTDs, Thermisters. Sensors for displacement and position; digital encoders, shaft encoders, absolute and relative encoders, linear encoders. Sensors for force, pressure, strain, vibration, velocity, flow rates etc. Signal conditioning and filter design. Types of bridge circuits for measurement of resistance, inductance, and capacitance. Analog to digital conversion. Systems for signal processing and signal transmission. Data recording and data acquisition systems. Microprocessor based instrumentation circuits. Techniques to select different sensors, sensor calibration.

MT 317/ MT 317L THEORY OF MACHINE

Kinematics Fundamentals, Degrees of Freedom, Different types of mechanisms, their characteristics and applications, Position, Velocity and Acceleration analysis, Dynamic force analysis, Static and dynamic balancing, Cam and gear (gear trains) design.

MA 200 NUMERICAL ANALYSIS AND COMPUTATION

Floating Point number system, Stability of Algorithm and Error analysis, Iterative Methods for the Solutions of Non-Linear Equations, Fixed point Method, Newton-Raphson Method, Secant Method, Bisection Method, Regula-Falsi Method; Convergence, Interpolation: Lagrange Interpolation, Newton s Divided Difference, Forward Difference and Backward Difference Interpolations, Numerical Differentiation, Cubic Spline Interpolation, Numerical Integration: Rectangular, Trapezoidal and Simpson s Rules, Determination of Required Accuracy. Numerical Methods in Linear Algebra. Systems of linear Equations, Gauss Elimination Method, LU Factorization: Doolittle s, Crouts s and Cholesky s Methods, Iterative Methods for Systems of Equations: Gauss-Seidel Method, Jacobi s Method, Method of least squares, Evaluation of Eigen values by Iteration: Power Method, Eigenvectors. Solution of 1st and 2nd Order Ordinary Differential Equations: Euler Method, Heun s Method, Runge-Kutta, Method, Runge-Kutta-Nystrom Method, Solution of Elliptic Partial Differential Equations, Laplace and Poisson Equations, Dirichlet Problem, Neumann and Mixed Problem, Irregular Boundary, Solution of Parabolic PDEs: Crank-Nicolson Method, Solution of Hyperbolic PDEs.

MT 368/ MT 368L MECHATRONICS SYSTEM DESIGN

Optimum design process. What steps design engineers follow to design a system? Requirements analysis. Meeting standards. International standards for industrial equipment, embedded systems, standards for safety critical systems like robots and AGVs etc. Format and layout of Design Document. Mechanical Design: Mathematical Model. General equation of motion for a mechatronic system. Estimating Motor torques based on inertia of the system and the desired maximum velocity and acceleration. Estimating frictional forces due to dry friction and misalignment. Designing for low friction and high-rigidity systems. Design of mechanical drive system. Ball screw design. Design of Linear Motion guides. Preparing workshop drawings of various mechanical components using CAD. Preparing part program files for CNC machining of components using G-Simple or any other CAD/CAM package. These drawings and CNC codes will later become part of the final design document.

MT 316 DESIGN OF MACHINE ELEMENT

Introduction to Static loading, Factors of safety, Failure Theories, Failure of Ductile/Brittle Materials, Stress concentration factor, Introduction to fatigue loading, S-N Diagram and loading, Stress concentration effect on fatigue failure, Fluctuating loading, Combined loading, Shafts loading and design considerations, Design of Screw, Fasteners Connections, Welded joints, Mechanical springs, Design and Stress Analysis of helical extension and Compression Spring, Bearing design covering, Gear fundamentals and Miscellaneous Topics such as Mechanical Elements

MT 373 MODELLING AND SIMULATION IN MECHATRONIC

Modeling of mechanical systems (springs, dampers, mass, translational and rotational systems, geared systems), Modeling of electrical systems (capacitor, inductor, resistors, and analog electronic devices), Modeling of hydraulic and pneumatic systems, Mechatronics systems (Electro-mechanical, fluid mechanical and Electro-hydraulic systems), System dynamic response analysis (frequency response),State space analysis, Numerical techniques, time response and digital simulation, stochastic simulation, Monte Carlo methods.

MT 339/ MT 339L FUNDAMENTALS OF THERMAL SCIENCES

Basic Concept of Thermodynamics, Properties of Pure Substance, The First Law of Thermodynamics, The Second Law of Thermodynamics, Power and Refrigeration Cycle, Introduction to Heat Transfer, Conduction Heat Transfer, Convection Heat Transfer, Radiation Heat Transfer, Heat Exchangers and Cooling of Electronic Equipment.

MT 462/ MT 462L ROBOTICS

Types of robots, Types of joints used in robots, Degree of freedom and constraints, Types of planar and spatial mechanisms, Transformations from one system to the other, Forward and Inverse kinematics, Jacobian, Velocity and Force Analysis, Dynamics of robots, Path plan ning and trajectory analysis, Mechanism design (serial and parallel) used in robots, Linear control of manipulators, Sensors and actuators used in robotics, current trends in robotics.

MT 452/ MT 452L CONTROL SYSTEMS

Basic Concepts of control systems, a quick review of mathematical modeling, Transfer functions, Block Diagrams and Signal Flow Graphs. Response of First and Second Order Systems, Asymptotic/BIBO Stability and Routh-Hurwitz Stability Criterion. Performance Specifications of Linear Time-Invariant Control Systems, PID controller design, Root Locus Analysis, Root Locus Design, Frequency Response Analysis, Frequency Response Design, Bode plots, and Nyquist criterion. State space analysis and design.

MT 483 ENGINEERING ECONOMICS

Introduction: Definition, decision-making process, relationship between engineering and management, and principles of engineering economy. Cost concepts and analysis: terminology, application of cost concepts, and accounting and engineering economy studies. Money-time relationship: Time value of money, simple and compound interest, cash flow, single sums of money, uniform series of cash flows and equivalence. Basic methods: present worth, annual worth, future worth, internal rate of return, and external rate of return methods. Comparing alternative proposals: Present worth, Annual payments, future worth, and rate of return methods. Break-even analysis: break-even point, break-even involving income and cost analysis. Benefit-cost analysis: Comparing benefits of costs, B/C ratios, and methods for calculating B/C ratios. Depreciation: measuring depreciation, depreciation accounting and standard methods for calculating depreciation.

MT 362 BIOMECHATRONICS

Theory and design of Mechatronics/Robotic devices related to biomedical engineering including manipulation and mobility devices.

MT 396 Final Year Project I MT 498 Final Year Project II MT 499 Final Year Project III

Independent, or group work, as prescribed by supervisor and projects committee of concerned department

MT 445 SIGNALS & SYSTEMS

Memory, causality, stability, invertibility, linearity and time -invariance linear time invariant systems: impulse response, convolution. Functions of a complex variable, complex series and integrals. Transform methods: Continuous time Fourier series and transform, discrete- time Fourier series and transform, Frequency response. Sampling theory. Laplace and z-transforms, system functions.

MT 446 DIGITAL SIGNAL PROCESSING

Discrete-time signals, sampling theory, interpolation and decimation, causality, stability, convolution of discrete signals, DT Fourier transforms, z-transforms, DFT, FFT algorithms, digital filter design techniques, IIR and FIR Filters, finite word length effects, spectrum analysis, VLSI processors.

MT 454 ADVANCED CONTROLS AND SIMULATION TECHNIQUES

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Telegraph, scanner, laser printer, advanced hardware, Programmable logic devices like, Programmable array logic (PAL) Program mable logic array (PLA),complex Programming logic device (CPLD), Application Specific Integrated Circuits (ASIC) and Field Programmable Gate Arrays (FPGA),introduction to Verilog/VHDL its applications to different components like Mux Demux, counters, registers etc. Introdu ction to simple as Programmable computer (SAP-1 and SAP-2).

MT 474 Computer Aided Engineering

Overview to applied problems in fluid flow, thermal and electrical analyses. Introduction to computational techniques (Finite Element method, Variational principles, Galerkin method, computational fluid dynamics) to solve engineering problems. Codes used in industrial applications. Applications to laminar fluid flow, flow in pipes through bends, pressure drop computations, thermal problems in mixed mode heat transfer.

MT 483 Engineering Economics

The theory of microeconomics makes use engineering economics for the tools of marginal cost-benefit analysis to provide a framework for the qcurıurrııc **azıal**ysfn. or düü ısun-makanç. Murray **-'itme Kalaııcınohlp:** .hmm **yalın .or. rn‹ırıoy,**s ırrıple• **arıd** en **rnpuuiıd** .mıfcûüst, **cash** flcıw, **sınç1t• surns. uf** rriono'y,.uii iform Scrioa of énñh flows'.ond ectuivnlonoc.. Bnsio methods: tirosont worth, umum worth, fiiture Worth, intimigl rnxc oUronirn,.ond :p•! • rate of return methods. Comparing alternative proposalsbreak-even analysis: break-even point, break-even involving income and cost analysis. Benefit-cost analysis: comparing benefits of costs, B/C ratios, and methods for calculating B/C ratios. Depreciation: measuring depreciation, depreoinlıon no.oounting reid stnndnrd rriethöds.tur on1c;alnting doprcointipn.

Basics of computer aided design tools, machine shop equipment and processes, factors of safety and allowances for stress concentration, design of clutches, brakes, belts, joints, cam design.

MT 501 Applied Mechatronics and Robotics

Introduction to Mechatronics systems, Ac circuits introduction, Diodes , transistors , their types and properties, Introduction to digital circuits, combinational logic and logic classes, Introduction to Boolean algebra, Introduction to sequential logic circuits and flip flops, characteristics of real Op Amps, data acquisition, D/A and A/D conversion, temperature measurement, transformers. Types uses and working of Electric Motors (stepper

motors and servo motors). Overview of robots. Robot kinematics and dynamics. Control and sensing systems, robot vision Programming and interfacing. Basics of robot design and robot testing, applications of robots. Forward and Backward kinematics.

MT 502 Applied Mechanical Systems

Modeling of thermal and fluid systems. Kinematics and Dynamics of machinery. CAD tools for mechanical systems.

MT 504 Applied Electrical and Electronics Systems

Electric circuits, amplifiers and their applications, power amplifiers and switches, DC and AC motors, digital systems. Electronic design tools.

MT 506 Microprocessors and Applications

Microprocessor hardware and software modules. Microcontrollers hardware and software architectures, Microcontrollers Programming and interface with real-time mechatronics systems. Data acquisition units, Designing stand-alone embedded systems for mechatronics products. Individual projects.

MT 508 Control Systems

Laplace transformation, block diagrams and signal flow graphs system modeling and reconstruction. Modeling of electrical, mechanical and electromechanical systems, feedback, characteristics of DC generators and servo motors, Masson's gain formula. State space equation, Routh Hurwitz's stability criteria, root locus analysis and design, Bode plots, Magnitude and Phase angle plots. Digital control.

MT 600 Advanced Modeling and Simulation in Mechatronics

Modeling of mechanical systems (springs, dampers, mass, translatory and rotational systems, geared systems). Modeling of electrical systems (capacitor, inductor, resistors, analog electronic devices). Modeling of hydraulic and pneumatic systems. Mechatronics systems (Electro-mechanical, fluid¿mechanical and Electro-hydraulic systems), System dynamic response analysis (frequency response), Numerical techniques, time response and digital simulation, stochastic simulation, Monte Carlo methods. Lagrangian optimization and optimal control strategies in mechatronics.

MT 602 Digital Signal Processing

Signal estimation. Time frequency analysis. DTFT, CTFT, FFT. The z - transform and state-variable methods. Discrete system modeling. Classical compensator design. Pole placement, state estimation, and optimal linear quadratic regulation.

MT 620 Numerical Computing in Engineering

Analysis of linear and nonlinear physical systems equations of motion (ODEs and PDEs). PDEs in Engineering: wave, diffusion, Laplace, Poisson equations. Transform and integral methods for solving boundary and initial value problems. Numerical methods for ordinary and partial differential equations.

MT 622 Embedded Systems for Mechatronics

Examples of embedded systems: Telegraph, scanner, laser printer, advanced hardware, Programmable array logic, Application Specific Integrated Circuits (ASIC) and Field Programmable Gate Arrays (FPGA), architecture, real-time operating systems, embedded software development tools and debugging

MT 634 Control Engineering I

Dynamic analysis of systems involving automatic control of position, speed, power, flow, pressure, temperature, and other physical quantities. Analysis and design of control systems with digital controllers, including PID, finite settling time, state feedback, and minimum variance algorithms. s- transform, z-transform, mathematical modelling   dynamical systems, transfer functions,   plot, Nyquist   Nichols chart Computer simulation and analysis using Matlab; laboratory study of feedback systems.

MT 704 Mechatronic Systems Design

Introduoïïön to multi-domnîi .systcrriö... E?osi@n .méihoùtntngicö for intogrninñ mcühon îènm thürinol, ftiiid, .ctc•é1rîonl mind...cléUtronio scnsorsi-. noïuninrà ond systoms uèod. in;: mtohntronios. Oplimnlity modoling for zrïnss -sprint- darnper   botte or-m motion .oontrol. Vorinlinnnl tngrnn@inn rcprcsiaitnlicin Ïbr. oplimality. Modeling of' moiion sensors for norrlinosr ihermal censors by inlorgral formulation sud Montn 'Car.to simulation. Hmphesiê on mödoling' dnd sirnulatiön o'f hybrid systeme usiiïg niodérñ üörn'pittor-aidöd tnôls.

Mr 7os Appti»a o g t i » i c»n r u i

Paraiiie-ter   Péi1orixini*c.c iiicasiiém: Vsriaficinäl .ap'p*rmàùl*   npiiiiial cn'iiticil; 'Rniitïyapiii!s iiiiiiinmin primeip'le. feedback   dynamical   linear systems with quadratic performance indices, matrix Riccati equation. Numerical techniques of optimal control problems. Lab study to apply optimal control techniques to example dynamical systems.

Un0 rtnin'1y' modèle und .informntion repreisentötiön: 'types of uncertöinilies und unéerföïnty meosuroë... lnléllïgeni oöntröl riiethodologies, ïearqing' control; fiazzy oontrol, neuro-control. neuro-fiizzy oontrol.

MT 712 Smart Structures

Basic material properties, models, and active and sensory material systems. Health monitoring approaches to detect damage in a structure. Applications of smart materials, primarily for vibration and pointing control. Finite element models with piezoelectric elements used in sensor gülC GöM ,Q   Thc' HC lin   CCHb,ck ali :HdH#G C   ac i nK .and

MT 716 Advanced Industrial Instrumentation and Control

Field instrumentation. Cabling and grounding. Data acquisition, signal processing and transmission. Smart sensors and sensor difusion. systems. Computer based control. Direct digital control. Supervisory control. Programmable logic controllers and industrial controllers. Introduction to distributed control systems.

MT 718 Real–Time Robotic Systems

Computational methods and techniques used in vision-based robotics. Real- time embedded control, Design of modern robotic and industrial control systems, optimization techniques, matrix analysis, and analytic 2D / 3D geometry.

'flT 724 Auiumateö Munu'fuct urlriğ Systems

Descrifit•. n iuid' dciżioriüfraLtO.n u£ itpf0rri aL.?d rìxachir ę•. 'tuü.tii ari‹d m'aüh iminł,ţ oo.IIs... Mar'liiri iɪɪɡ.: .c.o'ntÿi   n¡Ti;quraf iJan. arid u crptiun; rri   hint .tial cŁlr2lrUllI r.   rn<Ich• n•cn•• Ct3dt• @t•riHwaÎłUn. £n-prŁlc4rs •• 5Drix Inc   <łIll cUr2ŁrDl   cc:11 c:c Il lrU IÎt•Tsø And sys łc:rT2 s£iTiul:£i£Ł1r2.

MT 726 Machinery Dynamics and Vibration

Machinery vibration analysis: dimensional analysis, signature analysis in time and frequency domains, spectral analysis, fault detection, diagnosis, and correction; instrumentation; case studies; machine monitoring programmes.

MT 730 Distributed Control Systems

Distributed computer systems architecture. System elements. Data communications links. Software algorithms. Reliability. Applications

MT 732 Artificial Intelligent Systems

Biological and Cognitive Paradigms, Concepts of Machine Intelligence, Intelligent Agents, Vision and Image Analysis, Principl es of Making, Fuzzy Logic, Decision Trees, Case-based Reasoning, Genetic Algorithms, Neural Networks, Expert systems.

MT 738 PC–Based Control

Interfacing of electro-mechanical systems to microcomputers for data acquisition, data analysis and digital control. Using of PC ports and Internet for data acquisition and control purposes. PC architecture. Serial port, parallel port, USB. Programming techniques for serial and parallel communication. ISA and PCI bus specifications. ISA bus interfacing and Programming. Simple ISA card desi gn for data acquisition.

MT 740 Power Electronics and Electrical Drives

Energy conversion and electric power conditioning. DC-DC and DC-AC converters for electrical drives, Analysis of electrical drives. Dynamic módeìs øf DC azid AC mäohines, Cözttroì prinoi p1os 'oJ° UsriBbìe. spqod.end servo driyčs: S,č-äìąr oonirs1 öf DC-îsei-vo mótsrs: Sč-alat and vector còntró! examples.

Biomedical Engineering is a broad field with different areas of focus, and the exact nature of the work you can find yourself doing will vary depending on the specifics of your role. A few examples of some of the subdivisions of Biomedical Engineering include; Biomechanics, Biomedical Electronics, Biomaterials, Computational Biology, Medical Imaging, Orthopedic Bioengineering, Bio Nanotechnology, Cellular, Tissue and Genetic Engineering. Biomedical Engineering has brought together the knowledge of diverse fields with a focus of applications in medical sciences. It assisted the healthcare professionals from looking inside the patient s body to rehabilitate the paralyzed ones.

Mission of Biomedical Engineering

To provide students with advanced engineering knowledge and nurture them with the positive relationship their and in particular towards society. The Department aspires to produce graduates who can communicate effectively, seek lifelong learning and contribute developing a prosperous and enlightened society.

Program Educational Objectives (PEOs)

The program of Biomedical Engineering will achieve the following PEOs:

PEO-1: The graduates are applying Biomedical engineering knowledge to identify and address the technical and societal problems.

PEO-2: The graduates are demonstrating intellectual and analytical abilities in taking initiative and/or developing innovative ideas for technological and professional growth in the field of Biomedical Engineering.

The graduates are working and communicating effectively as a team member or lead multidisciplinary teams while demonstrating t interpersonal and management skills and ethical responsibilities.

Prögraiti Lenetting .oiniefiitnes .(PLOa).

Program Learning ou tc:›mas are the narrowar ststements that öosoribe w.hm sludents ate exp eoled io know.and ba sbÏe to do' €•y int time ôL graduation. Thesie,ref aïe io .the knowle'd ci .Lkït Ié :arid sltitutiq\that :tfie étudênts e'cquire. Whit'e progrëseing .through'.tfia pio'gram.

The program must demonstrate that by the time of graduation the students have attained a certain set of knowledge, skills and behavioral traits, at least to some acceptable minimum level. Specifically, it is to be demonstrated that the students have acquired the following graduate attributes (PLO

PLO-01: Engineering Knowledge: Ability to apply knowledge mathematics, science and engineering fundamentals and an engineering specialization to the solution of complex engineering problems.

PLO-02: 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' Sioluttons: Ability. to :doñign soIutioqs fot complex enginoering problems on'n .ciesign sys1am'ai, components.. or processes that meet specified needs with appropriate consideration for public health and safety, cultural, societal, and environmental considerations.

PLO-04: 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.

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PLO-06: 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.

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PLfimB: Et4nlcs: Appl;'. oihioot .principles Panel **oommll** .to:protàssinnal **.elhios end rosponsibslilias:. and** norms.:.rif' **engineering proolico.**

PLO-09: Individual and Team Work: 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 documentations, 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 tcvclnpmcnio:

No	Name	Designation
1	Dr Rana Iqtidar Shakor	Dean of Engineering
2	Dr Zia Mohy Ud Din	Head of Department
3	Dr. Hafiz Zia Ur Rehman	Assistant Professor
4	Dr Menaa Nawaz	Assistant Professor
5	Dr Neelum Yousuf	Assistant Professor
6	Engr Inam Ur Rehman	Lecturer
7	Engr Jamila Akhtar	Lecturer
8	Engr Nabeeha Ehsan	Lecturer
9	Engr Anum Rashid	Lecturer
10	Engr.Maria Tahir	Lecturer
11	Engr Hajira Ahmed	Lecturer
12	Engr Batool Zehra	Lecturer
13	Engr Noor Fatima	Lab Engineer
14	Engr Omar Cheema	Lab Engineer
15	Engr Fahad Shakeel	Lab Engineer
16	Engr Anusha Ishtiaq	Lab Engineer

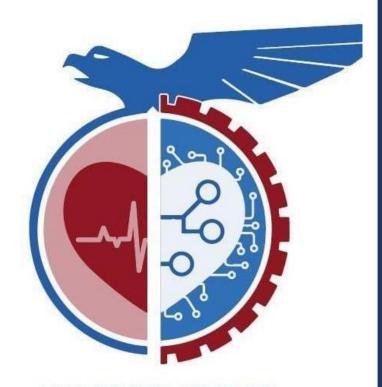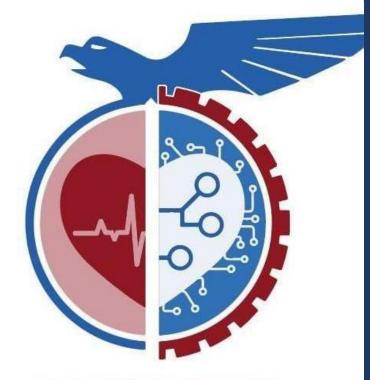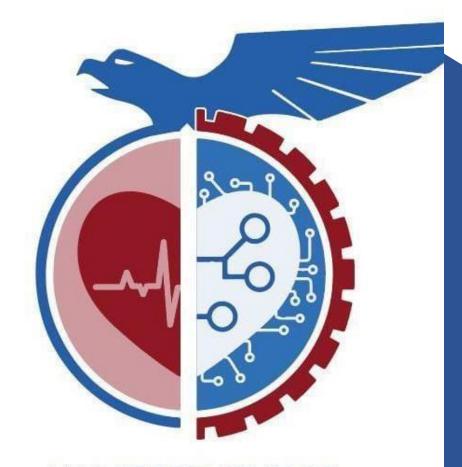AU DEPARTMENT OF
BIOMEDICAL ENGINEERING

Curriculum Design

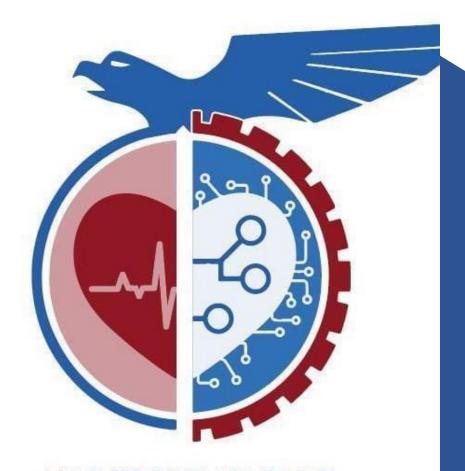E program s curriculum breakdown according to HEC curriculum layout.

Semester No.	Sr. No.	Code	Course Title	Prerequisite	Credit Hours		
I	1	PH-102	Applied Physics	-	3	1	4
	2	CE-112	Computer Programming	-	2	0	2
		CE-112L	Computer Programming Lab		0	1	1
	3	BM-120	Basic Electrical Engineering	-	3	0	3
		BM-120L	Basic Electrical Engineering Lab	-	0	1	1
	4	MA-100	Foundational Mathematics	-	4	0	4
		BM-110	Basic Biology	-	4	0	4
	5	BM-130	Introduction to Biomedical Engineering	-	1	0	1
	6	HU-121	Communication Skills	-	2	0	2
Total Semester Credit Hours:					**15**	**3**	**18**
II	7	MA-111	Calculus & Analytical Geometry	-	4	0	4
	8	BM-111	Physiology I	-	2	0	2
		BM-111L	Physiology I Lab	-	0	1	1
	9	BM-121	Circuit Analysis	BM-120	3	0	3
		BM-121L	Circuit Analysis Lab	BM-120	0	1	1
	10	CE-115	Object Oriented Programming	CE-112	2	0	2
		CE-115L	Object Oriented Programming Lab	CE-112L	0	1	1
	11	BM-112	Human Anatomy	-	2	0	2
		BM-112L	Human Anatomy Lab	-	0	1	1
	12	BM-100L	Computer Aided Engineering Drawing	-	0	1	1
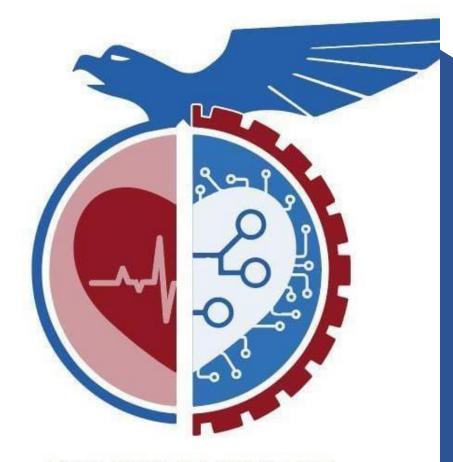
		Total Semester Credit Hours:			**13**	**5**	**18**
III	13	MA-218	Complex Variables &Transforms	MA-111	4	0	4
	14	BM-213	Physiology II	BM-111	2	0	2
		BM-213L	Physiology II Lab	BM-111	0	1	1
	15	BM-222	Digital Logic Design	-	3	0	3
		BM-222L	Digital Logic Design Lab	-	0	1	1
	16	BM-223	Basic Electronics	BM-121	3	0	3
		BM-223L	Basic Electronics Lab	BM-121	0	1	1
	17	HU-114	Technical English	-	2	0	2
		Total Semester Credit Hours:			**14**	**3**	**17**
IV	18	BM-224	Biomedical Electronics	BM-220	3	0	3
		BM-224L	Biomedical Electronics Lab	BM-220	0	1	1
	19	BM-240	Biochemistry	-	2	0	2
		BM-240L	Biochemistry Lab	-	0	1	1
	20	MA-108	Ordinary Differential Equations & Linear Algebra	MA-111	3	0	3
	21	BM-231	Biomedical Instrumentation I	-	3	0	3
		BM-231L	Biomedical Instrumentation I Lab	-	0	1	1
	22	BM-201	Signals & Systems	-	3	0	3
		BM-201L	Signals & Systems Lab	-	0	1	1

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		Total Semester Credit Hours:			14	4	18
V	23	BM-332	Biomechanics	-	3	0	3
		BM-332L	Biomechanics Lab	-	0	1	1
	24	BM-302	Modeling & Simulation	MA-108	2	0	2
		BM-302L	Modeling & Simulation Lab	MA-108	0	1	1
	25	MA-208	Engineering Probability & Statistics	-	3	0	3
	26	BM-341	Biomaterials	BM-212	3	0	3
		BM-341L	Biomaterials Lab	BM-212	0	1	1
	27	BM-303	Biomedical Signal Processing	BM-202	3	0	3
		BM-303L	Biomedical Signal Processing Lab	BM-202	0	1	1
		Total Semester Credit Hours:			14	4	18
VI	28	BM-333	Biomedical Instrumentation II	BM-231	3	0	3
		BM-333L	Biomedical Instrumentation II Lab	BM-231	0	1	1
	29	BM-3XX	Elective I	-	3	0	3
	30	BM-334	Biomedical Control Systems	MA-108	3	0	3
		BM-334L	Biomedical Control Systems Lab	MA-108	0	1	1
	31	MA-200	Numerical Methods	-	2	0	2
	32	BM-305	Microprocessor & Interfacing	BM-226	2	0	2
		BM-305L	Microprocessor & Interfacing Lab	BM-226	0	1	1
	33	BM-496	Final Year Project I	-	0	1	1

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			Total Semester Credit Hours:		13	4	17
VII	34	HU-115	Pakistan Studies	-	2	0	2
	35	BM-436	Medical Imaging	PH-102	2	0	2
		BM-436L	Medical Imaging Lab	PH-102	0	1	1
	36	BM-4XX	Elective II	-	3	0	3
	37	BM-4XX	Elective III	-	3	0	3
	38	HU-307	Technical Report Writing	-	1	1	2
	39	MT-303	Engineering Procurement and Contract Management	-	2	0	2
	40	BM-497	Final Year Project - II	-	0	2	2
			Total Semester Credit Hours:		13	4	17
VIII	41	HU-118	Islamic Studies	-	2	0	2
	42	BM-4XX	Elective IV	-	3	0	3
	43	HU-215	Ethics	-	2	0	2
	44	BM-4XX	Elective V	-	3	0	3
	45	BM-498	Final Year Project - III	-	0	3	3
	46	MT-304	Engineering Management and Entrepreneurship	-	2	0	2
Internship				-	0	0	0
Total Semester Credit Hours:					12	3	15
Total Credit Hours:					108	30	138

AU DEPARTMENT OF BIOMEDICAL ENGINEERING

List of Elective Courses according to Streams

Stream No.	Stream Name	Course Code	Course Name
0	Biomedical Computing	BM-407	DNA Computing
		BM-408	Computational Fluid Dynamics
		BM-404	Bioinformatics
		BM-409	Medical Image Processing
		BM-406	Hospital Information Management System
2	Electronics	BM-325	Power Electronics
		BM-326	Bioelectricity
3 & 6	Biomedical Instrumentation	BM-335	Biomedical Engineering Systems
		BM-460	Medical Device Quality System and Standards
		BM-461	Medical Device Regulatory Affairs
		BM-462	Medical Robotics
		BM-463	Rehabilitation Engineering
		BM-437	Telemedicine Systems
		BM-438	Medical Data System
		BM-439	Artificial Intelligence
4	Biomaterials	BM-342	Biophysics
		BM-343	Biofluid Mechanics & Bioheat Transfer
		BM-444	Tissue Engineering
		BM-445	Genetic Engineering
		BM-446	Nano Biotechnology
		BM-447	Regenerative Medicine
		BM-448	Drug Delivery Systems

Course Description

PH-102 Applied Physics

Applied Physics is a science course designed for the students to have a broad understanding of physics and the ability to apply those principles in the work force. This course includes Motion, Oscillations, waves and propagation, Electric Charge and Coulomb Law, Electric Field, Electric Potential, Capacitors and Dielectric, Current and Resistance, AC and DC, Magnetic fields, Ampere Law and Faraday law, Maxwell equations and Traveling waves.

Computer programming course focuses on helping students develop an understanding of computer networks, operating systems, algorithms, database systems and web design. Students in computer programming course will become familiar with different programming languages.

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The purpose of this course is to provide an elementary understanding of biological mechanisms of living organisms from engineering perspective. Students must be capable of understanding the basic unit of life, the functions of biomolecules and the role of genes expression in human body.

MA-100 Foundational Mathematics

The student must be capable of solving the basic mathematical equations like quadratic equation, matrices and trigonometric functions. Along with these he should be able of solve engineering problems using various techniques like integration and differentiation.

The Student must have the understanding of biomedical devices, its function and their applications in different fields of life.

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MA-111 Calculus & Analytical Geometry

It begins with a review of algebra and trigonometry; then the idea of limits and continuity is introduced. With the knowledge of limits and continuity the student develops the concept of the derivative and its applications. At the end, the student studies the antiderivative of elementary functions and the applications of the definite integral in geometry, science, and engineering.

Student will learn the fundamental concepts of life. Be able to recognize the physiological principle of cells and tissue, skeletal, muscular, and immune and nervous systems.

cuit Analysis

This course will focus on applying basic voltage and current laws in identification, and finding solution of basic problem of circuit analysis. It also involves the physical analysis of circuits through the use of network laws and theorems. Be able to describe the behavior of energy storing elements and their transient response analysis.

CE-115 Object Oriented Programming

This course introduces the concepts of object-oriented programming to students with a background in the procedural paradigm. The course begins with a brief review of control structures and data types with emphasis on structured data types and array processing. It then moves on to introduce the object-oriented programming paradigm, focusing on the definition and use of classes along with the fundamentals of object-oriented design.

BM-112 Human Anatomy

This course will focus on the understanding of the anatomical planes and positions, the principle structures of major human organs and systems and will describe and classify the basic anatomical structures associated with the circulatory/ cardiovascular, respiratory, urinary, endocrine, digestive and lymphatic systems.

BM-100L Computer Aided Engineering Drawing

Emphasis in this course is on the basic knowledge of drawing skills and CAD designs by understanding the concept of basic drawing techniques.

MA-218 Complex Variables and Transforms

The course gives the students a sound knowledge of Fourier transforms along with Fourier integrals, partial differential equations, advanced vector analysis, complex variables and complex integrals.

ogy

Student will acquire the knowledge about basic physiological principles of nervous, endocrine, reproductive and lymphatic systems.

This course covers the design and application of digital logic circuits, including combinational and sequential logic circuits. Different representations including truth table, logic gate, timing diagram, switch representation, and state diagram will be discussed.

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HU-114 Technical English

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BM-224 Biomedical Electronics

This course covers the design of electronic circuits for biomedical applications. It also covers basic operational amplifier circuits as well as the operation of semiconductor diodes, transistors, signal conditioning circuits and filters.

BM-240 Biochemistry

The main aim of this course is to ensure that the students acquire knowledge of biochemical and biophysical processes at molecular level. It also involves the description of the structure, classification and functions of protein and enzymes.

MA-108 Ordinary Differential Equations & Linear Algebra

This course includes, but is not limited to, the study of systems of linear equations, matrices, determinants, vectors and vector spaces, linear transformations, eigenvalues and eigenvectors, and their applications.

The main objective of this course is to develop an understanding of the measurement principles of medical instrumentation, including biomedical sensors, bio-potential amplifiers, bioelectrical signals (ECG, EEG), measurement of respiratory function, cardiac variables, blood pressure, blood flow as well as medical devices.

BM-201 Signals & Systems

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'J'his cozzzec is dcsigncd to provide students n•ith azz undcrstazzding of th'c basyc know1cdgc of moving systcm oacchnuics with un a vczwrcw of anatomical terminology. Students must be able to describe and imitate gross human movements using various biomechanical tools.

BM-302 Modeling & Simulation

The course will introduce the basic concepts of Mathematical, Electrical and Fluidic Models. Students will use MATLAB to explore a range of programming and modeling concepts in order to analyze the research problems by simulating the physiological models.

MA-208 Engineering Probability & Statistics

This course covers quantitative analysis of uncertainty and risk for engineering applications. Fundamentals of probability, random processes, statistics, and decision analysis are covered, along with random variables and vectors, uncertainty propagation, conditional distributions, and second-moment analysis.

BM-341 Biomaterials

The primary objective of this course is to teach the chemistry and engineering skills needed to solve challenges in the biomaterials and its sub engineering crow. Students will be able to identify the classes of biomaterials and discuss the progenies of biomaterials for various Biomedical..

applications.

BM-303 Biomedical Signal Processing

This course presents the relationships among different theoretical measures of biomedical signals and an understanding of the information these measures provide regarding the sources of signals and the behaviors of their sources in response to natural or imposed perturbations.

in zfiis course stud   11   the princi   ng of biomedical i   logy analyzer and electrophoresis machine. And will learn its maintenance and usage in the industry.

BM-334 Biomedical Control Systems

The purpose of this course is to provide an understanding of the basic principles of control engineering. Furthermore, students will learn the various techniques to find the control system stability to analyze the performance of control systems.

MA-200 Numerical Methods

ft de:its cvith the theory and application of numerical approximation techniques as well as their computer implementation. It covers computer arithmetic, Volution of nonlinear equations, interpolation etid approximation, numerical integration and differentiation, solution of differential equations, and matrix computation.

BM-305 Microprocessor & Interfacing

The purpose of this course is to provide an understanding of the features and operation of contemporary microcontroller and microprocessor. Students must be capable of developing an assembly program and show agility of the microprocessor/ microcontroller using interfacing.

HU-115 Pakistan Studies

TO is course aims en introctuce crude iris to tthe hiniory of iTae rec;i‹T» com pricin p Pak ician, provide an overview o I conton d ink hers pecii ver cn i£ie orig ins of' rTze country. and examine irs potitics, soc iety ztnd culture. Tile course. lust ftemzo\e, looks at some contemporo   deveTopmental issues f%ingChecounly.

BM-401 Medical Imaging

The main purpose of this course is to understand the basic physical principles involved in all imaging techniques. Students should be able to understand the operation, construction and function of each imaging equipment.

HU-307 Technical Report Writing

Technical writing prepares students to design effective technical documents for both written and digital media, with particular emphasis upon technical memos, problem-solving and decision-making reports.

MT-303 Engineering Procurement and Contract Management

Aim of this course is to develop leadership skills in the engineering fied and to learn how to plan and deliver complex engineering projects.

HU-118 Islamic Studies

This course has been compiled to meet the needs of students studying Islamic studies as a compulsory subject. The purpose of this course is to build up the information about fundamentals of Islam and to understand its implementation.

HU-215 Ethics

This course is an introduction to the philosophical study of morality, including the theory of right and wrong behavior, the theory of value (goodness and badness), and the theory of virtue and vice.

MT-304 Engineering Management and Entrepreneurship

The course is aimed primarily at science and technology graduates who want to develop advanced skills and pursue a management career in engineering, manufacturing or commercial enterprise.

BM-496 Final Year Project   I

BM-497 Final Year Project   II

BM-498 Final Year Project - III

AIR UNIVERSITY

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