

POSTGRADUATE DEGREE PROGRAMS 17-18

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DEGREE PROGRAMS **17-18**



FORMAN  
CHRISTIAN  
COLLEGE  
LA CHARTERED UNIVERSITY

  
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MESSAGE FROM  
THE RECTOR

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Forman Christian College (A Chartered University) was founded in 1864 by Presbyterian missionaries. By the turn of the 20th century it had become recognized as a leading institution in the Indian subcontinent. Since August 1947 the University has served Pakistan with distinction. The number and quality of distinguished alumni of FCCU is rivaled by few universities in the world. Our graduates have leadership positions in government, business, education, various professions, religion and arts. FC College was established as a Chartered University by the Punjab Provincial Assembly in 2004.

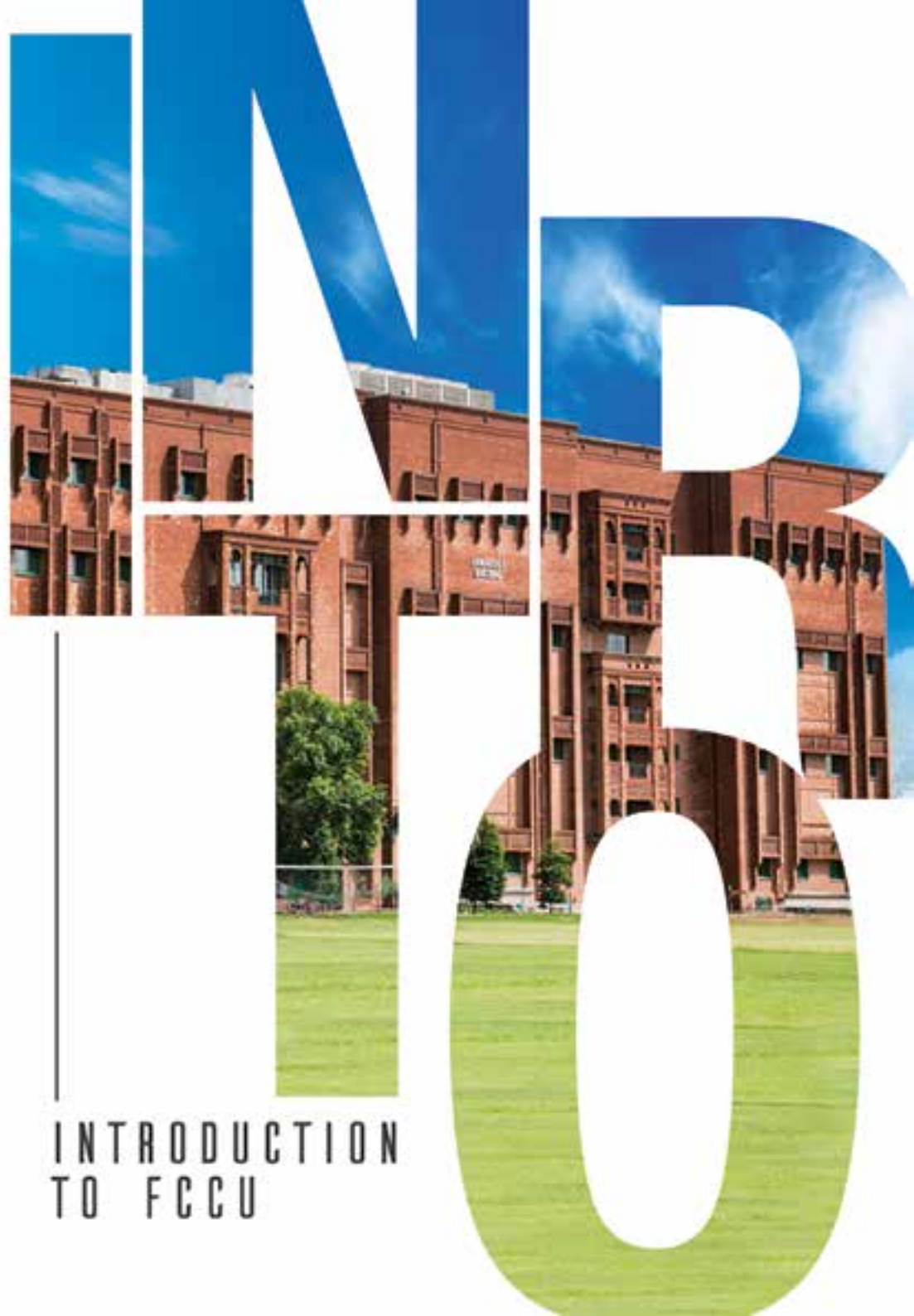
In 2005, FCCU introduced the four-year BA/BSc Honors degree. In 2007, the first postgraduate degrees were offered. Now it offers 14 MPhil and other postgraduate degrees as well as 3 PhD programs. Five Teaching Assistantships will be awarded on the basis of merit in each of our postgraduate programs.

FCCU is a private and not-for-profit institution. The standards and traditions that have made the University in history are being upheld and even enhanced today. We strive to provide a truly outstanding educational program taught by well-qualified faculty who care about students and can lead them in research. The University also provides strong co-curricular programs in order to enable students to not only enjoy themselves but be able to learn outside the classroom. Often students find that the values and habits that they learned while participating in such activities were important developmental steps for them for success later in life.

Forman Christian College (A Chartered University) is situated on 108 beautiful acres on Canal Bank Road in Lahore. Its facilities and labs are up to the latest standard. There is secure, high quality housing available on campus for female postgraduate students.

We eagerly look forward to welcoming new postgraduate students who will enroll in FCCU and become leaders and academics of Pakistan in the years to come.

**Dr James A Tebbe**  
Rector



INTRODUCTION  
TO FCCU

Forman Christian College (A Chartered University) was founded in 1864 by Dr Charles W Forman, a Presbyterian missionary from the USA. The college was initially known as the Lahore Mission College, but in 1894 the name was officially changed to Forman Christian College in honor of the founder. In the early years, degrees were awarded through the Calcutta University. College level instruction was interrupted in 1869 due to the illness of key faculty members. College classes resumed in 1886, with degrees being awarded through the University of the Punjab. In 2004, FCCU became a chartered university and from 2009 onwards has awarded its own degrees.

The early years of the college were marked by rapid growth in enrollment, and a constant struggle to find enough space to house the growing college. Enrollment grew from 18 students in 1886 to 130 in 1890, 311 in 1900, 426 in 1910 and 600 in 1915. Enrollment had reached 1,500 students by the time the college was nationalized in 1972. Enrollment in the university section alone stands at 3,200 students today.

The campus was located in the Anarkali (Nila Gumbad) area of Lahore for many years. Four major buildings were constructed by the college on that campus by 1916, and Ewing Hall, built in 1916, is still used as a hostel by the college. In 1940 the college moved to its present spacious campus of over 100 acres on the scenic banks of Lahore Canal.

FCCU has been served by a large number of distinguished educational leaders and teachers throughout its history. Dr CW Forman, Dr Sir JCR Ewing, Dr CH Rice, Dr ED Lucas, Dr SK Dutta, Dr HC Velte, Dr JH Orbison, Nobel Laureate Dr Arthur Compton, Maulvi Muhammad Bakar, Dr HD Griswold, Prof JM Benade, Shamsul Ulema Maulavi Muhammad Hussain, Dr KC Chatterji, Dr P Carter Speers, Dr SL Sheets, Prof MS Bhatti, Maulana Farzand Ali, Dr RH Ewing, Dr EJ Sinclair, Dr Robert F Tebbe and Dr Carl Wheelless are among many who have impacted the lives of students and shaped the future of the college through the years. Under their leadership, the college became widely regarded as one of the very best in the entire subcontinent.

For many decades, FCCU has been widely recognized for its meritorious work of nurturing and consolidating the social and intellectual capital of Pakistan. The University motto, "By love serve one another," has been a guiding principle for Formanites throughout the history of the college. Among the graduates of the college are two Presidents of Pakistan, a Prime Minister of India, the first Chief Justice of Pakistan, a number of Governors and Chief Ministers of the Punjab and other provinces, an Attorney General of Pakistan, two Foreign Ministers of Pakistan, a President of the Security Council of the United Nations, numerous Ambassadors to other nations, a Chairman of the Atomic Energy Commission, a Chairman of the Senate, several Speakers of the National Assembly, numerous Generals and Admirals and an equally impressive list of leaders in the fields of education, law, medicine, arts and entertainment.

FCCU has been a leader in the development of curriculum among the universities of Pakistan. Through the years the college introduced into the curriculum such subjects as the Sciences, Economics, Psychology, Geography, Technical Chemistry and Sociology. FCCU is the first college in the subcontinent in whose laboratories research work of Nobel Prize caliber was conducted and Dr Arthur Compton received the Nobel Prize in 1932 for research conducted, in a large part, at FCCU. In 1902, the college was the first in Punjab to admit women.

FCCU also has a distinguished record of performing service for the nation. At the time of Independence, the college converted two hostels into a hospital for refugees seeking medical assistance and thus began United Christian Hospital. During the Kangra Valley earthquake disaster in 1905, Dr JCR Ewing organized and led the relief effort. Similarly, at the time of the Quetta earthquake in 1935, the college did devoted relief work, this time under the leadership of Prof Jagun Nath. Social service by students was made popular by Prof DJ Fleming many years ago.

In 1972, the college was nationalized by the government. It was returned to the present owners of the college on 19 March 2003. In March 2004, the government granted university status to FCCU. The University embarked upon an exciting new stage in its history in September 2005 when it began a four-year Baccalaureate (Honors) program designed in accordance with world-class standards for accreditation.

## Mission

The mission of Forman Christian College (A Chartered University) is to impart, create and disseminate knowledge and to develop informed, ethical and responsible citizens who are prepared and committed to learn, lead and serve; persons who exemplify the FCCU motto, "By love serve one another".

## Vision

The vision of FCCU is to be recognized as one of the very best educational institutions in the entire subcontinent. This is in keeping with the distinguished reputation established during the first century in its life.

## Goals

The educational programs and the faculty approach to teaching are designed to graduate:

**Empowered learners** with strong written, oral and quantitative skills that they can use to evaluate a constant flood of information. The idea is to create in them the ability to think independently and critically, solve problems and continue a lifetime of self-directed learning.

**Informed learners** who understand global and cross-cultural relationships, value the philosophy and history underlying the nation of Pakistan, and are fluent in both their native language and English.

**Responsible learners** who understand the ethical consequences of actions and are well-groomed to be active citizens who accept their public duty and participate in the decision-making process of a democracy.

## Our Commitments

### Commitment to Excellence

Forman Christian College (A Chartered University) operates all of its programs in accordance with the highest standards of excellence in education. The educational programs are designed and implemented in accordance with world-class standards of accreditation. The University has begun the process of seeking accreditation with one of the six regional accrediting associations in the USA.

### Commitment to Individual Development

FCCU is concerned with the development of the whole person, and therefore encourages the intellectual, spiritual, cultural, social, emotional and physical growth of each student. We seek to prepare students for the basic responsibilities of life, and especially for competent and humane leadership and service. The FCCU experience is designed to help students go beyond the limitations caused by ignorance, narrowness, conformity, self-centeredness and irresponsibility. Our goal is to help individuals achieve excellence in thought and conduct.

### Commitment to Core Values

The faculty and staff of FCCU seek to live by, and to teach students, its core values. In a variety of different settings, students are asked to learn and live by the following values beginning with signing a 'Shared Commitment' document that highlights the practice of the core values on a regular basis.

- **Integrity**

I will speak the truth and keep my commitments. I will take my responsibilities seriously and fulfill them to the best of my ability

- **Excellence**

I will be steadfast in my pursuit of excellence. I will set high standards in my intellectual life, personal behavior and interpersonal relationships. I will honor the traditions of the University and preserve the beauty of the campus

- **Respect for the Dignity of Each Human Being**

I will treat others with respect, kindness, generosity of heart and compassion. I will accept and tolerate differences. I will handle disagreements with candor and civility



- **Discipline and Accountability for My Actions**

I will uphold the policies of the University and follow the rules and regulations. I understand that behavior has consequences. This understanding is an essential component in the development of my self-discipline

- **Fairness and Justice**

I will be fair in all of my decisions and work towards justice for others

- **Service**

I will live by the motto “By love serve one another,” knowing that serving others is a way of life that will enrich the community and the nation in which I live

- **Community**

I will take the concerns of others in the University community to heart. Because we are bound together by common purpose, objectives and values, the welfare of all will be my concern

### **Commitment of Faculty to Students**

The faculty of FCCU is committed to student learning and to helping students succeed in their studies and be well-prepared for a meaningful and productive life after University. Students will form a close personal relationship with one or more members of the faculty, and this close student-faculty contact has been one of the strengths of FCCU throughout its history. Faculty members provide assistance to students, as needed, outside of the classroom, and they do not charge tuition for this help. Indeed, their contract with the University prohibits faculty members from charging tuition for extra assistance.

### **Commitment to Career Preparation**

Enriched with the enduring qualities of a liberal arts education, FCCU seeks to graduate students who are well-prepared for success in their careers. Through the major field of study selected by the student, he or she will receive a basic knowledge of a particular field in enough depth to be successful in entry level positions in a career and to advance successfully to increased levels of responsibility on the job. However, it is impossible to predict what a person will need to know for success on the job twenty years from now, but we do know that in most jobs new knowledge will have to be mastered that does not even exist today. Therefore, it is more important to learn how to learn, how to think, how to solve problems, and how to communicate effectively rather than just to focus narrowly on the content of an academic discipline. The educational program is designed to help students develop these skills.

### **Commitment to Coeducation**

All programs of FCCU are co-educational. FCCU first admitted women in 1902, and it seeks to provide a learning environment in which both men and women can learn effectively and develop the character traits and personality that will enable them to succeed in later life. The core value of respect for the dignity of each human being is also an important consideration for creating a wholesome and positive atmosphere for learning for both men and women.

### **Commitment to Lifelong Learning**

FCCU seeks to prepare students for a lifetime of self-directed learning. This will be essential for success in a rapidly changing and increasingly complex world. The faculty models this commitment by constantly learning about new knowledge in their academic discipline, and by participation in a variety of professional development programs presented to them by the University management to help them learn new approaches to teaching and learning.

### **Commitment to Equality of Opportunity**

At FCCU, students, faculty and staff are free within the University from all forms of discrimination based upon gender, race, age, ethnicity, nationality, religion or physical disability. Decisions regarding employment and admission to the University are based upon merit. Grades in courses and graduation from the University are based upon the performance of the student in meeting course and graduation requirements.

### **Financial Integrity**

FCCU is a private, not-for-profit education institution. All tuition and other fee income goes directly to the support of the educational program. Indeed, tuition and fees pay only a portion (approximately 69%) of the educational costs per student. Thanks to the support of donors, the balance of costs is paid from endowment and gift income from individuals, churches, corporations and foundations.



CAMPUS

Forman Christian College (A Chartered University) has an impressive and well-maintained campus with all the facilities needed to create an environment that is truly academic and conducive to purposeful learning. Centrally located in a beautiful residential area of Lahore, the campus sprawls over 108 acres along the left bank of the canal.

There are two new purpose-built buildings for University students. Inaugurated in 2007, the Business and Social Sciences Building houses the Social Science disciplines including the Departments of Business Management and Economics. The Armacost Science Building is a modern state-of-the-art science building for the Departments of Biological Sciences, Chemistry, Physics and Computer Studies/Information Technology. It was inaugurated in February 2010.

The Ewing Memorial Library has been functioning since 1943 and now contains over 100,000 volumes. It has an automated Library Management System and state-of-the-art online and electronic reference services. Students can use the web-based Information Portal to search the library catalog and log in to their accounts to view their activity information. The Information Commons in the Armacost Science Building has computer and multimedia workstations, printers, study booths, an information literacy classroom and a research help desk. The Ahmad Saeed Administration Building (former N Block) houses administrative offices.

The Canteen offers a setting for students to relax between classes. Basketball courts, a gymnasium, badminton and table tennis facilities are also located in Lucas Center as are the offices of the Health and Physical Education Department.

Sinclair Hall houses the largest auditorium – seating 740 people – of the University. This is where major events including the annual play and Christmas pageant, etc. are held.

FCCU has a large sports ground in the center of campus that includes facilities for cricket, football and hockey, plus a 400-meter oval-shaped running track. A modern 25-meter swimming pool and six tennis courts are also located on campus.

Hope Tower provides accommodation for approximately 366 women on campus.

Learning is not restricted to the classrooms and many of the most important lessons learned during the University years are learned through participation in co-curricular and sports programs. FCCU offers a great variety of programs that provide opportunities for students to participate in activities that contribute to their learning and enjoyment.



STUDENT  
LIFE

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## Co-Curricular

Forman Christian College (A Chartered University) is committed to providing a holistic education. Classroom learning is supplemented by opportunities for students' intellectual and moral growth through carefully planned literary, academic, cultural and recreational activities and programs. The Office of Student Affairs coordinates and promotes activities of all the student societies; almost every academic department has a student society. Each society plans and conducts programs during the year that enrich the learning experiences of students and provide opportunities for student leadership. Student societies have their own website: [www.fccsocieties.org](http://www.fccsocieties.org). To ensure that society news is uploaded in a timely manner, society presidents must send news write ups and photographs to the Communications Office as soon as possible after the event has taken place. The following societies are currently functioning:

Art Junction	Forman Political Science Society
Bazm-e-Fikr-o-Nazar	Armacost Psychological Society
Benade Physics Society	Forman Sociological Association
Christian Life Program	Forman Statistics Society
Dean Geography Club and Adventure Society	Griswold History Society
Earth Watch Club	Islamic Society
Ewing English Club	International Affairs Society
Formanites Computing Society	Leadership Forum
Formanites Debating Society	Lucas Economics Society
Forman Dramatics Club	Mathematics Society
Formanites Education Society	Philosophy Society
Formanites Journalism Society	Red Crescent Youth Group
Forman Model United Nations Society	Rotaract Club
Forman Music Society	Senior Biological Society
Forman Photographic Society	Speers Chemical Society

## Religious Life

As a University, we are concerned with teaching values and building strong positive character traits and discipline in our students. For Muslim students, there are two mosques on campus. Juma prayers are offered at the main mosque. We also convene Dars-e-Quran classes together with symposiums and discussions to which eminent Muslim scholars are invited to deliver talks and/or to engage students in discussions on important religious, social and moral issues. For Christian students a weekly chapel service is offered on Friday. In addition to regular Chapel programs, we offer regular Bible study groups and opportunities for volunteer service. No classes are scheduled on Friday during Juma or Chapel time.

## Sports

FCCU has a College Sports Board that organizes, promotes and conducts games. The Sports Board features a very active intramural sports program with competition in athletics, basketball, cricket, football, hockey, table tennis, wrestling, lawn tennis and swimming. Participation in intervarsity competitions in many of these sports is part of the sports program.

## Canteens

Student-faculty-staff social interaction in a more relaxed setting takes place at the Canteen. The faculty is available to assist students outside the class, and the Canteen is occasionally an appropriate setting for this interaction. More typically, it is simply a place for students to go for lunch or snacks between classes.

## On-Campus Health Services

The University offers emergency first response services through the Mercy Health Center, an on-campus facility equipped for the routine medical needs of the on-campus residents, day scholars, faculty and staff and has an on-going relationship with the nearby United Christian Hospital for cases that require specialized attention.

## Counseling

The University Counseling Center, located in the Mercy Health Center, is a facility to help students deal with problems which they may not want to discuss with family, friends or their teachers. The Center provides individual and confidential counseling and may refer students to other professionals, if needed. The Center does not deal with issues related to academic advising, but with personal and emotional issues that students face in their lives.

## Discipline

All students are expected to act with dignity and self-respect, to be honest, considerate, well-behaved and courteous. Moreover, students must observe strict disciplinary standards. The decision of the Rector in all disciplinary matters shall be final and legally binding on all students. Proctors maintain discipline, enforce rules of good conduct and take disciplinary action against students wherever required.

- Students are required to observe the rules and regulations governing their studies (both theory and practical) as may be made from time to time

- Students are expected to attend every lecture and laboratory session and academic activity of the classes in which they are enrolled
- Acts of dishonesty and cheating, especially during examinations, are strictly prohibited, and subject to punitive action, if proven
- Students are required to abstain from undesirable behavior that poses a threat to any fellow student, faculty or staff member or any other person working as an employee of the University
- Behavior that disrupts the normal flow of academic work or co-curricular activities is prohibited
- Destruction, defacement or damage caused to University property shall be severely dealt with

The following are strictly forbidden on the University campus:

- Possession or use of alcoholic beverages or drugs
- Weapons of any kind
- Cigarette smoking within the University premises

## Dress Code

The purpose of the FCCU dress code is to ensure that our students are dressed in a dignified manner. This means that the clothing worn should be clean, neat, modest and reflective of the culture in which we are operating. The FCCU ID card must be visibly displayed at all times on campus.

## Sexual Harassment Policy

Sexual harassment is unacceptable behavior at Forman Christian College (A Chartered University) and such behavior will be subject to disciplinary action.

Harassment refers to behaviors that are intended to be offensive, threatening or disturbing to the recipient. To harass is to persistently annoy, attack, or bother someone.

Sexual harassment is defined as any unwelcome sexual advance, request for sexual favors, or other verbal or physical conduct of a sexual nature that is offensive, embarrassing, intimidating or humiliating.

This includes:

- Instances when the harassment has the purpose or effect of unreasonably interfering with an individual's work performance or creating an intimidating, hostile or offensive environment
- Instances when submission to the harassment is made either explicitly or implicitly a term or condition of fair treatment



Specific examples include, but are not limited to:

- Touching in an inappropriate way
- Staring or leering
- Requests for sex
- Subtle pressure for sexual activity or sexual innuendoes
- Display of sexually explicit pictures
- Repeated references to various parts of the body at inappropriate times
- Requests for dates when the other person has made it clear that she or he is not interested
- “Hooting”, whistles, or other suggestive noises or gestures
- Suggestive comments or jokes
- Insults, name-calling or taunts based on a person’s gender
- Derogatory graffiti referring to a person’s character or making sexual implications
- Sexually explicit emails, text messages, etc
- Spreading rumors about another person’s sexual behavior
- Intrusive questions about a person’s private life or body
- Any romantic or sexual behavior that you would consider to be inappropriate if directed at a member of your family

Sexual harassment does not refer to compliments or other behaviors that are considered to be socially appropriate.

There should be no relationships of a romantic or sexual nature between any faculty or staff member and a student. There is no exception to this. A student should not attempt to initiate such a relationship for any reason. There should be no attempt by a student to gain better grades or access to exams or assignments by encouraging or offering such relationships. Any pursuit of such relationships by a faculty or staff member should be immediately reported to the counselor or the Chief Student Affairs Officer.

All faculty and staff members are required to report instances of harassment if they are aware of any. Any faculty or staff member encouraging a student not to report such instances will be subject to disciplinary action.



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MERIT  
SCHOLARSHIPS  
AND TEACHING  
ASSISTANTSHIPS

Merit scholarships and limited teaching assistantship opportunities are awarded to students entering the Postgraduate programs based on the merit determined by the concerned department. Students qualifying for merit scholarship or teaching assistantship are required to submit an application form in Financial Aid Office along with required documents.

## Other Scholarships

There are also some other scholarship opportunities which Postgraduate students can avail if they meet the eligibility criteria of the concerned organizations/donor agencies. Following are the details of scholarship opportunities:

The Punjab Educational Endowment Fund (PEEF) offers full-fee scholarships along with stipend to Postgraduate students who fulfill the prescribed criteria. For more details, you can visit: <http://www.peef.org.pk/MasterLevelScholarship.asp>.

Application forms for PEEF scholarship are submitted in the Financial Aid Office, Room 015, Ahmad Saeed Administration Building.

**Important Note:** All scholarship opportunities are advertised on Financial Aid page of FCCU's website.



AHMAO SAEED  
ADMINISTRATION BUILDING

ACADEMIC  
POLICIES

FCCU is continuously expanding its Postgraduate programs based on the availability of required infrastructure, expertise and demand. Keeping this in view, MPhils and PhDs in various disciplines of Natural and Social Sciences and Humanities have been recently launched. The purpose of Postgraduate Policy is to make uniform rules and regulations governing these programs.

## **MPhil Programs**

The MPhil will generally consist of 2 semesters of coursework during the first year, and 2 semesters of thesis in the second year. However, some departments may have more than 2 semesters of coursework. The maximum registration in MPhil programs is for four years.

### **Admission**

Postgraduate admissions lie with departments. Students may be admitted in the first or second semester. Transfer students can be admitted any time provided they meet the eligibility requirements. Criteria established for admission is GPA 2.75 or 60% for admission to MPhil. Students will take either the GAT or an internal test devised by the department.

### **Course Credit**

The MPhil will have a minimum of one year of coursework. The coursework is expected to take one year, but students may repeat a course, if they wish, in order to get a better grade. In the Natural Sciences, Journal Club is for 2 credits, whereas in Humanities and Social Science it can be up to 3 credits. Students must have a CGPA of 2.75 before proceeding to the thesis research. A student has the right to retake a course on payment to meet the benchmark of research. If a course is not being offered in a particular semester, the student may take an alternative course with the permission of the Chairperson of Department. A student may take a retake with any grade, B to F. A student with CGPA of less than 2.75 at the end of the second semester may start research if allowed by the Departmental Committee if the student is registered to retake a course in the following semester to meet the benchmark. However, the student will not be allowed to appear for the thesis viva until the CGPA requirement is met. Billing for tuition will be done per annum, paid per semester. Any other arrangement will have to be done with the agreement of Accounts Office.

Billing per credit will only be done for courses that are retaken. The charge for tuition is the same whether the year is for coursework or thesis. If a student goes beyond the second year, he/she must register and pay full tuition for every subsequent semester taken. Same deadlines for payment as undergraduates as stated on the Academic Calendar will apply. The maximum registration in the MPhil program is for four years. The thesis synopsis or proposal will be developed after the coursework is complete. The

formal MPhil thesis synopsis must be approved by the Board of Study of the Department. This may either be a synopsis or a proposal, depending on the department. Departments are encouraged to be flexible. Once the synopsis or proposal is approved, the title is sacrosanct. If the title changes, it must go back to the Board of Study of the Department for approval. An MPhil thesis may be supervised by an MPhil or PhD, although the PhD is preferred. The time limit on the MPhil thesis is 3 years. No faculty may supervise more than 5 MPhil theses at a time.

### **Guidelines for Thesis**

The lower word limit for the thesis can be set by the Board of Studies of the Department. Before the submission of the thesis, the advisor will ensure that the thesis has undergone a Turn it in check and report is attached. If the thesis passes the review, the committee will send it to external examiners. A list of external examiners who are experts in a variety of fields is prepared by the Department and approved by the Board of Studies. When the thesis is submitted, it will be sent to one external examiner from the pre-approved list by the Controller of Examinations. If an external examiner declines to review a thesis, another person on the list will be selected. Also, if the external reviewer does not make a decision on the thesis in the time allotted, another examiner from the list will be identified. If the external examiners do not pass the thesis, the student may rewrite it to address deficiencies identified. It must then be resubmitted to the external examiners if required. Once the thesis is reviewed by the external examiner, a mutually agreed date will be set for the oral examination during which the candidate presents the finding of the research. A grade would be awarded based on the evaluation of the external examiner and notified through the Controller's Office.

## **PhD Programs**

### **Admission**

At FCCU, admission to PhD program is made in the research areas which are preferably supported through research projects, and in which faculty research groups are currently engaged. Admission will be made by the Department. Students must have a GPA of 3.0 or 70% marks in MPhil or equivalent and they must show evidence of research aptitude. Departments may also impose extra admission requirements in order to admit strong candidates who are likely to complete the program. Admissions in PhD programs continue throughout the year.

### **Coursework**

There will be a minimum of 18 credit hours of coursework preferably during the first year. Students must maintain a GPA of 2.75 in coursework. There will also be a departmental Comprehensive Exam at the end of the coursework.

## **PhD Thesis**

The synopsis or proposal for the PhD thesis must be approved by the Board of Study of the Department and by the Board of Advanced Study of the University. After the PhD proposal is approved, the time limit for completion is 4 years in Natural Sciences, and 7 years in the Social Sciences and Humanities. Approval from the Rector must be sought to exceed this limit. Minimum duration of PhD program is 3 years.

There must be a Departmental PhD Committee which approves topic and synopsis or proposal. There will also be a supervisory committee comprising of a supervisor and two other faculty members not necessarily from the same department, who will advise and monitor the progress of the research. The function of the supervisory committee is essentially to keep the process moving.

The Department will draw up a list of external examiners from industrially advanced countries who are experts in a variety of fields. Submission of thesis follows the same rules as for MPhil. After receiving positive evaluation from both external examiners, a local external examiner is appointed from the approved list. A date is mutually set for an oral defense of the thesis.

The candidate will give a presentation. Anyone on the University faculty can attend and ask questions. Based on an evaluation by the viva voce committee constituted for the purpose that includes the Chairperson of the Department, Supervisor and the external examiner, the student passes or otherwise. If a student does not pass, he/she can repeat. The student may have unlimited chances of a repeat oral defense, but each chance will be charged.

## **General Policies**

### **Leave and Readmission**

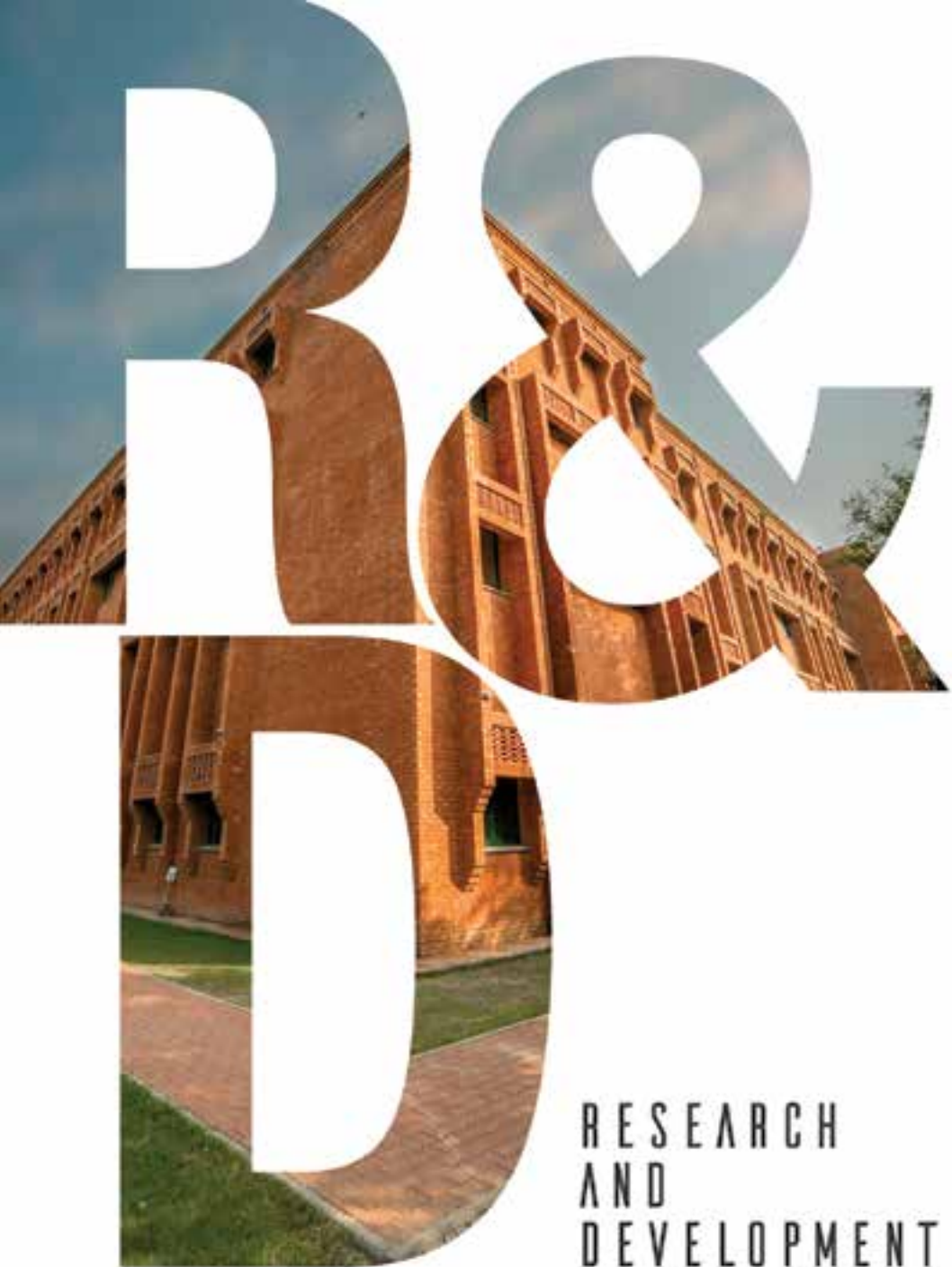
If a student drops out on informed leave for one semester, they may return with no extra procedure. After one year of uninformed leave, the student must go through readmission. Women students may live in the hostel, but are bound by hostel policy. They may remain in the hostel during vacations and summer holidays provided the Department allows them to continue work during these times.

Time limits on labs is determined by the respective departments. If a student wants to stay later, he or she must have special permission from the Chairperson of the Department, and one faculty member must be present. In the Social Sciences or Humanities, the student must leave within one and a half hour of the end of the last class unless he or she has permission to stay. A faculty member must be present.

**Advisors**

Advisors are selected/assigned during coursework. Advisors will be allotted one or two students each by the Chairperson of the Department after submission of recommendation. The Departmental Committee must first approve the title and synopsis or proposal, and then it is sent to Board of Studies. Any research proposal involving human and animal subjects needs to be reviewed by the Institutional Review Board. The University will maintain a record of all theses in the University library in both hard copy and soft copy form, and a soft copy is to be provided to HEC for uploading on its website. Access to a thesis may be restricted if a patent is involved. This includes sponsored research in which the sponsor owns the patent. Plagiarism or falsification of data in any way will be dealt under HEC guidelines and FCCU policies.





RESEARCH  
AND  
DEVELOPMENT

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The Office of Research, Innovation and Commercialization (ORIC) was established in July 2011 to encourage meaningful research by faculty and students and to forge linkages between industry, civil society and academia. ORIC's responsibilities are to:

- Identify research grant opportunities for faculty to apply for funding
- Facilitate faculty to apply for research and amp, and travel grants
- Provide legal, administrative and financial management support for research grants
- Support commercialization, licensing, etc. of the University research products

ORIC also holds lectures and seminars with guest speakers to create awareness about various opportunities and themes for research in both social and natural sciences. This initiative increases the quality of undergraduate and graduate teaching at FCCU.

### **Objective**

ORIC seeks to facilitate the growth of FCCU's research and economic development efforts and output so as to improve the University's industry competitiveness using innovation and becoming the driving force behind research and the economic development of Pakistan.

ORIC facilitates the University's research and external linkages through MoUs signed with the following organizations:

- Plan9
- LUMS
- PCSIR
- WWF
- LCCI (Lahore Chamber of Commerce and Industry)
- BF Biosciences Ltd
- Pioneer Pakistan Seeds Ltd
- Waste Busters, Lahore
- Chughtai Lahore Labs
- International Center for Theoretical Physics
- HBL Foundation
- Allama Iqbal Medical College (AIMC)/Jinnah Hospital
- FB Genetics

### **ORIC Management Includes**

- Dr Kauser Abdulla Malik, Director
- Haroon Samson, Senior Manager

## MoUs

### **Biological Sciences:**

The Department of Biological Sciences has signed a number of MoUs to facilitate research:

- In order for Biotechnology faculty to provide advice on career planning leading to job placement of students, FCCU signed a Memorandum of Understanding (MoU) with BF Biosciences Ltd to explore novel areas in health biotechnology. Researchers from the Department have teamed up with the technical team at BF Biosciences to establish new research projects. A pilot project is the establishment of a bioassay to determine the biological activity of recombinant erythropoietin (rhEPO), a compound manufactured by BF Biosciences and used to stimulate red blood cell production in anemic patients
- Another MoU was signed with Chughtai Lahore Labs to initiate MPhil Molecular Pathology, an industry and academia training program
- The Department also signed an MoU with PCSIR to offer MPhil in Food Safety and Quality Management for professionals. This is a cross-disciplinary program between the departments of Biological Sciences, Business and Chemistry at FCCU and Food Sciences PCSIR

### **Department of Chemistry:**

- The Department of Chemistry has signed MoUs with institutions like HEJ Research Institute of Chemistry, PCSIR Laboratories, B&F Pharmaceutical Company, and NovaMed Pharmaceutical Ltd

## Conferences

- The Centre for Public Policy and Governance co-hosted the 9th Annual Population Association of Pakistan conference on 'Population Dynamics and Security: Public Policy Challenges' in December 2008
- CPPG organized a two-day International Conference on 'Social Change and Security Imperatives: Challenges for Leadership and Democratic Governance in Pakistan' in December 2013
- On 2 December 2016, the Centre for Public Policy and Governance (CPPG) in collaboration with the Wilson Chair in Pakistan Studies at the University of Texas at Austin hosted a workshop on Pakistan: The Long View, 2047. The one-day event brought together academicians, researchers, development practitioners and policy-makers to reflect on Pakistan's multi-faceted development challenges and future policy choices. As Pakistan approaches its 100th year of Independence in the year 2047, the workshop gave participants the opportunity to discuss the intersections of governance and public policy; social, economic and environmental well-being; and human and state security

## Research Seminars

CPPG's seminars bring together academics, policy makers, students and civil society members for two-hour discourses on issues relevant to the Centre's thematic interests. A variety of themes are addressed ranging from public service delivery, effective and participatory governance, internal and regional conflict to environmental wellbeing and sustainable development. Eminent scholars from Pakistan and abroad have participated in these seminars at CPPG to date. The interactive question-and-answer sessions are particularly popular and offer an opportunity for interesting dialogue on relevant public policy issues.

Some of the seminars held at the CPPG in 2016-17 are as follows:

- “Bringing Science to Policy: Sustainable Water Reforms for addressing Water Scarcity and Environmental Challenges” by Dr Akhtar Abbas
- “Liaqat Ali Khan: Jinnah’s Right-Hand Man” by Dr Roder D Long
- “Turkish Nationalism and Islam” by Dr Raja M Ali Saleem
- “From Millennium Development Goals (MDGs) to Sustainable Development Goals (SDGs): Change in Development Paradigm” by Suljuk Muntansar Tarar
- “The Image of ‘Muslim’ in Europe: A Century of Positive and Negative Stereotypes” by Slimane Zeghidour
- “Regional Organizations: The Good, The Troubled and the Irrelevant - Why Association of South East Asian Nations (ASEAN) thrives while South Asian Association of Regional Cooperation (SAARC) and African Union (AU) struggle” by Adnan Rasool
- Seminar on Civil Resistance hosted by CPPG in collaboration with the International Center on Non-Violent Conflict
- “Interpreting Tradition in Modern Islamic Thought: Comparing Turkey and Pakistan” by Dr Daniel Brown
- “Changing Dynamics of US-China Relations and its Impact on Pakistan” by Dr Miles Toder
- “Democratic Cultures: Insights from South Asia” by Dr Lucia Michelutti, Dr Paul Rollier, Dr Ashraf Hoque, Dr David Pucherit and Dr Arild Ruud
- “Climate Change, Nuclear Disarmament and Humane Global Governance” by Richard A Falk
- “Emerging Trends in US-Pakistan Relations” by Rizwan Saeed Sheikh
- “Confronting Religious Extremism in China’s New Silk Web” by Dr Charles Ramsey
- “China’s Rise: How is it Impacting the Gulf, Iran, Pakistan and Beyond?” by Dr Saeed Shafqat
- “Shari’atization of Islam in the Post-Secular World” by Dr Azmi Mohammad
- “Terrorism, Education and Development” by Dr Ummad Mazhar
- “Pakistan and Afghanistan under the Gaze of Incoming US President” by Dr Marvin Weinbaum

## Workshops and Interactive Policy Dialogs

In January 2017, CPPG in association with the NGO The Grief Directory conducted a workshop/short-course titled “Deliberate and Devise a Response for the Sufferers and Survivors of Political Violence in Pakistan.” The workshop was conducted by Professor Marie Breen-Smyth, a native of Northern Ireland and currently a Distinguished Visiting Professor in the Department of Conflict Resolution, Human Security and Global Governance in the McCormack Graduate School of the University of Massachusetts in Boston.

In October 2016, the CPPG held a policy dialogue/workshop on “Rationalizing Discourse on Pak-Afghan Relations: Is a Reset from Acrimony to Amity Possible?” a program conducted in collaboration with The Center for Research & Security Studies (CRSS). The aim was to inculcate a culture of communication and understanding between representatives of both countries by providing them a platform to initiate conversation. Shazia Marri, former Provincial Minister of Sindh for Information, Tourism and Electric Power and Sayed Ishaq Gailani, leader of Hezb-e-Nuhzat Hambastagi Milli participated from Pakistan and Afghanistan respectively.

In September 2016, CPPG held a 2-day interactive seminar on Civil Resistance in collaboration with the International Center on Non-Violent Conflict (ICNC).

In September 2015, CPPG, in collaboration with the United States Institute of Peace, conducted a two-day workshop on Peace-Building and Conflict Management.

## Report Launches

In 2016, CPPG in collaboration with UNFPA & Migration Research Group launched the report “Internal Migration Study Report on Pakistan: The Case of Punjab.”

The Centre for Public Policy and Governance launched the report “Improving Governance: Reforming Provincial Services in Punjab, an Action Research Report on Education, Health, Police and Revenue Departments” in April 2015 at the Planning and Development Department, Punjab.

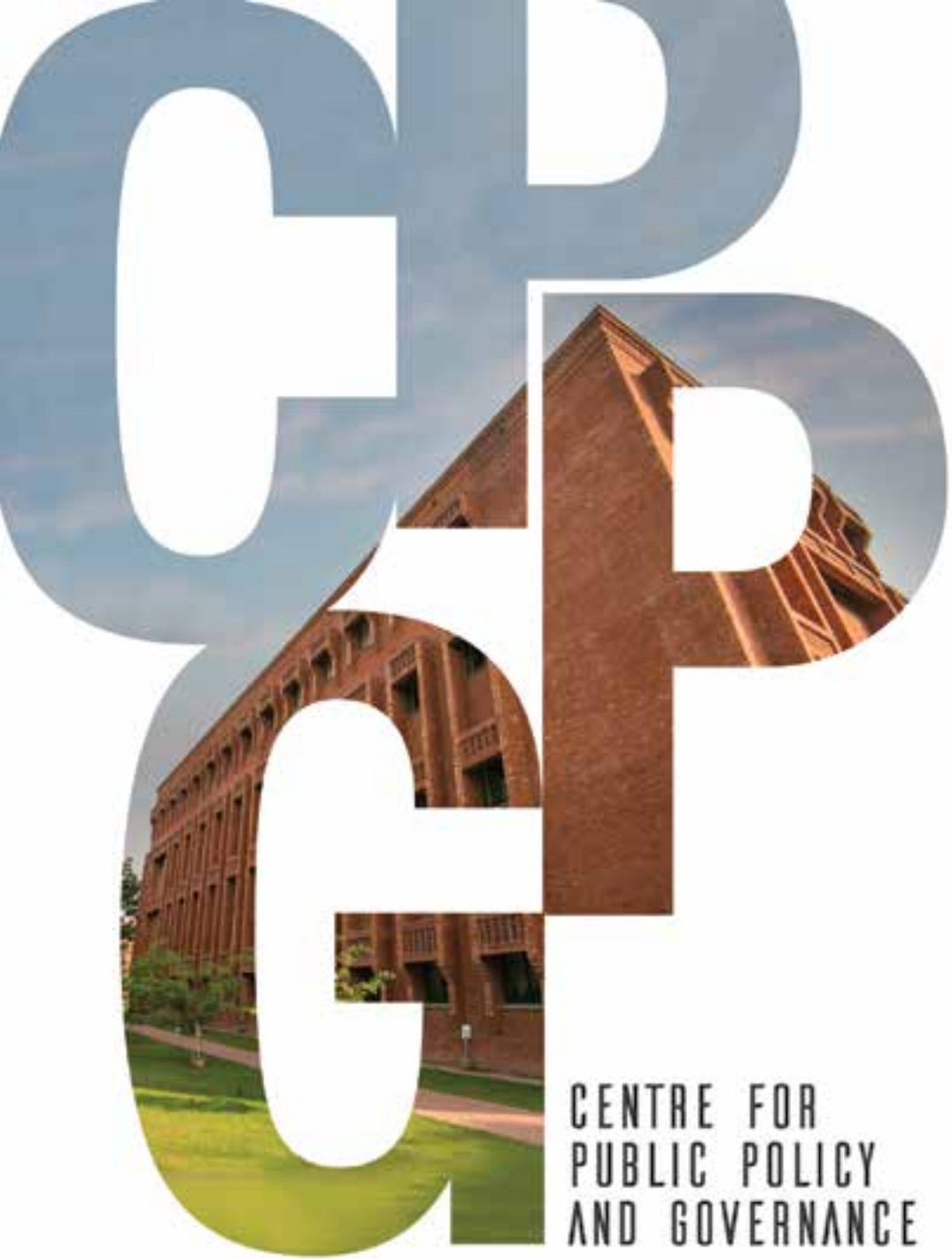
## Projects

The CPPG has been engaged in a range of funded development-related projects. Some of these that are ongoing and that have successfully been completed are listed below:

- A program to Assist and Manage MPhil Research Grants for Peace and Conflict Studies funded by United States Institute of Peace (USIP) - Ongoing 2016-2018
- A project to review, assess and improve the Social Welfare Department Punjab

in context of the 18th Amendment by conducting an Institutional Assessment of the department and undertaking comprehensive capacity-building exercises of the Department's officials. Funded by the USAID Small Grants Program - Ongoing 2016-17

- In 2015-16 the CPPG worked on a USAID Citizen's Voice Project, which was a research grant for Improving Governance: Reforming Provincial Civil Services in Punjab



CENTRE FOR  
PUBLIC POLICY  
AND GOVERNANCE

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The Centre for Public Policy and Governance (CPPG) was established in 2007 as an academic, research and training institute. Its first activities were the launch of its Faculty Seminar Series and the Research and News Quarterly publication, while designing a degree program in Public Policy. In 2009 it introduced the Executive MA in Public Policy, which is geared towards public, private and non-profit sector managers. In 2014 it launched its MPhil in Public Policy program. This first batch of Public Policy graduates qualified in 2016. In both the above programs, students go through a rigorous regimen of theory and practice which leads to skill development in public policy. A final thesis is a requirement which is based on a research proposal, faculty presentations and public defense. CPPG will soon be initiating its PhD in Public Policy. The Centre for Public Policy and Governance is committed to promoting and disseminating teaching and research in public policy that focuses on citizen welfare, distributive justice, participatory development, humane governance and consultative and transparent policy processes.

The CPPG degree programs are offered in Business and Social Sciences Block. In 2013, with support from USAID Small Grants Project, we established the FCCU Public Policy Research and Resource Center (PPRRC), designed to serve as a resource hub for the public policy research community. The Resource Center provides library services, a digital archive of public policy literature and statistical data sources. There is a functional library here where students, faculty and externals can become members as well as lifelong members. Research area and digitized data is available with printing and photocopy facility. CPPG research programs with external donors and entities are executed here.

In 2011, CPPG also launched the Monograph series and published two studies titled 'Pakistan, Afghanistan and US Relations: Implications and Future Directions' and 'Industrial Policy in Punjab: A Case Study of Sunder'.

## Executive Masters Public Policy

The Centre for Public Policy and Governance offers a 1-year inter-disciplinary and analytical degree program in Public Policy. It is designed to cater to professional needs of mid-career leaders. The program integrates domestic requirements, philosophical dimensions and futuristic vision to help students formulate citizen-friendly policies and provide transparent governance to public policy beneficiaries. The program consists of three semesters requiring the completion of 32 credit hours. All classes are scheduled in the afternoon to facilitate working professionals.

Classes are held four days a week, while at least one academic seminar is organized every month. Students go through a rigorous program which includes theoretical frameworks and skills development as they finalize their research proposals after having gone through a series of discussions with their supervisor and presentations to the faculty. CPPG also organizes policy dialogues and short-term training.



## **Degree Requirements**

A total of 32 credits over 1 year distributed as follows:

- Four Core Courses (12 credits): CPPG 601, CPPG 602, CPPG 603, CPPG 604
- One Research Course (6 credits): CPPG 698
- Two Skills courses (5 credits): CPPG 605, CPPG 606, CPPG 610, CPPG 611, CPPG 612
- Any 3 courses out of 1 concentrations (9 credits):
  - o Governance, Democracy and Institution Building: CPPG 650, CPPG 651, CPPG 652, CPPG 653, CPPG 654, CPPG 655
  - o Environment, Demography and Urban Change: EDUC: CPPG 675, CPPG 676, CPPG 677, CPPG 678, CPPG 679

## **Course Descriptions**

### **Core Courses**

#### **CPPG 601: Introduction to Public Policy (3 credits)**

Provides an overview of key components of the policy analysis process: defining problems, selecting criteria to evaluate alternatives, developing policy design; construction of policy design; components of the policy analysis framework; participants would be expected to write a position paper at the end of the course.

#### **CPPG 602: Introduction to Statistics, Economics and Accounting Concepts (3 credits)**

Provides basic statistical, economic and accounting knowledge; descriptive and inferential statistics; GDP, growth rate, and capital accumulation; analysis of financial statements; training for statistical and analytical calculations through computing software.

#### **CPPG 603: ICT Concepts and Tools for Policy Makers (3 credits)**

Trains students in various information and communication technologies (ICT) (word processing, document packaging, spreadsheets, presentation, correspondence and research); explores Management Information Systems and their evolution from standalone to enterprise systems.

#### **CPPG 604: Research Methods (3 credits)**

Familiarizes participants with research tools; qualitative aspects of research and report writing; research variables; designing a research proposals and questionnaires; research methods including, case study, participant observation, content analysis, and comparative studies.

#### **CPPG 698: Research Thesis (6 credits)**

Students regularly work with their supervisors/faculty members on their research projects approved by the faculty. The professors emphasize that students working under their supervision learn to work on research projects independently. Students are required to meet twice a month to their supervisors to discuss progress on their projects.

## **Skills Development Courses**

### **CPPG 605: Writing and Communicating Public Policy (2 credits)**

Develops writing skills and familiarizes students with major written formats; communication through short paper exercises in writing, speaking and debating; examines real world cases on successful policies.

### **CPPG 606: Policy Analysis: Policy Design (3 credits)**

Advanced level course, a follow-up of Introduction to Public Policy that discusses the required public policy framework; ongoing debates about motivational and institutional foundations of public policy; defining policy problems and setting up policy agendas; issues around delivery, implementation and evaluation of public policies.

### **CPPG 610: Cost-Benefit Analysis (3 credits)**

Students will learn to differentiate between economic and financial evaluation; challenges involved in accurately measuring them. The first part of the course will concentrate on theory and concepts, while the second part will evaluate existing public projects.

### **CPPG 611: E-Governance and Technology Policy (3 credits)**

Follow up on 'ICT Concepts and Tools for Policy Makers' course. Discusses how technology's use can be used to improve departmental productivity; examines automation, process re-engineering and their organizational implication; reassesses organizational processes in view of available technologies using case studies of government departments.

### **CPPG 612: Quantitative Techniques for Policy Making and Administration (3 credits)**

*Prerequisite: introduction to Statistics, Economics and Accounting Concepts*

Covers basic regression models, research design, data collection, data processing and presentation of research findings; explores research papers to discuss public policy design, evaluation, monitoring and administration.

## **Concentration Area Courses**

### **Governance, Democracy and Institution Building**

#### **CPPG 650: Federalism and Decentralization (3 credits)**

Examines the theories of federalism and relates these to Pakistan's constitutional development; cuts across the disciplines of political science and economics while theorizing the issues of power-sharing and autonomy.

#### **CPPG 651: Political Institutions and Policy Process (3 credits)**

Examines the relationship between political institutions and policy process; analyzes the political economy surrounding economic and social development in developing, newly industrialized, and transitional countries with a special emphasis on Pakistan.

**CPPG 652: Governance and Management in a Multicultural Society (3 credits)**

Discusses the conceptual framework for inter-cultural communications; exploring traditions of other regions; best practices, theories, techniques and policies relevant for governance and management.

**CPPG 653: Leadership Theories, Governance and Management Change (3 credits)**

Conducted like a seminar where participants will be encouraged to situate and test their leadership and policy skills needed for public service; uses readings, discussions, case studies, simulations, and self-assessment exercises for skill development.

**CPPG 654: Organization Theory and Human Resource Management (3 credits)**

Explores theories and strategies of human resource management; organizational culture and structure, improvement and compensation; competency-based organizational skill set and career planning.

**CPPG 655: Political Economy of Public Policy (3 credits)**

Applies political economy framework to encourage participants to understand and analyze processes of public policy formulation and reform; relies on Game Theory to formulate and promote interactive decision making among the participants.

**Environment, Demography and Urban Change**

**CPPG 675: Environmental Issues and Public Policy (3 credits)**

Builds on the theoretical and empirical concepts of environmental science and policy; evaluates national and international environmental laws and policies; societies and states' responses to concerns on environmental issues and what can be done to educate citizens.

**CPPG 676: The Informal Sector (3 credits)**

Explores the informality debate to include socio-cultural domains of informality; looks at the continuum between the formal and informal variety, their linkages and relationships in light of their impact on the poor.

**CPPG 677: Demography and Security (3 credits)**

Makes a comparative analysis of countries where demographic transition, has either led to reduced or intensified conflict; explores successfully managed public policies used to reduce conflict, improve quality of manpower and security, and increase life expectancy.

**CPPG 678: Urban growth, Environment and Security in South Asia (3 credits)**

Seeks to understand the linkages between accelerated urbanization in South Asia and its impact on environment and human security, makes a comparative analysis of urban and environmental policies of South Asian states; discusses the relationship between economic, social and political factors.

### **CPPG 679: Gender and Population (3 credits)**

Explores concepts, theories, policies and laws on gender and how gender, culture and religion reinforce gender identities; examines changing organization of gender relations in regard to education, marriage, family, reproductive health, migration and human trafficking.

## **MPhil Public Policy**

The MPhil in Public Policy is a 2-year program that aims to contribute to the education of a new generation of public policy-makers and policy analysts. The program equips students with the skills necessary for an in-depth understanding of policy-making in emerging democracies.

### **Degree Requirements**

The coursework must be completed in one year. Students will be required to take 4 core courses, two in each of the semesters. The second year of the program is dedicated to the MPhil thesis entailing original research on a topic of the participants' choice. The MPhil program shall not extend beyond three years.

A total of 8 courses plus Research Thesis (6 credits) totaling 30 credit hours studied as follows:

- Four core courses from: CPPG 615, CPPG 616, CPPG 617, CPPG 618, CPPG 619, CPPG 620, CPPG 621, CPPG 622
- One research course: CPPG 699
- Three from any of the listed concentrations as well as one additional course from a different group
- Governance, Democracy and Institution Building: CPPG 625, CPPG 626, CPPG 627, CPPG 628, CPPG 629, CPPG 630, CPPG 631, CPPG 632, CPPG 633, CPPG 634
- Environment, Demography and Urban Change: CPPG 640, CPPG 641, CPPG 642, CPPG 643, CPPG 644, CPPG 645, CPPG 646, CPPG 647, CPPG 648, CPPG 649, CPPG 656, CPPG 657
- Peace Building and Conflict Management: CPPG 660, CPPG 661, CPPG 662, CPPG 663, CPPG 664, CPPG 665, CPPG 666, CPPG 667, CPPG 668, CPPG 669, CPPG 670

## **Course Descriptions**

### **CPPG 615: Public Policy: Theories and Analysis (3 credits)**

This course covers the formulation of public policies; its stages; theory and practice of policy analysis, issues surrounding the delivery, implementation and evaluation of public policies; and current debates and perspectives in public policy.

**CPPG 616: Research Methodology (3 credits)**

Familiarizes students with research methods in social sciences in general and public policy in particular; the epistemological and methodological concerns, both qualitative and quantitative, as they determine the nature and scope of research.

**CPPG 617: Economics and Public Policy (3 credits)**

Examines the economic aspects of government intervention in the economy; explores market failure, property rights, mixed goods; the nature of government as a producer and the political system as a mechanism for revealing consumer preferences; studies the economic literature on topics such as taxation, and the evaluation of public spending.

**CPPG 618: Strategic Leadership and Governance (3 credits)**

The course will analyze strategic leadership and governance to achieve efficient and effective outputs; will help to develop a critical understanding of the theory and practice of strategic leadership, governance and conflict management.

**CPPG 619: Human Development (3 credits)**

Looks at human development beyond the life-span development approach; the human behavior acquired, maintained and modified in a social environment and with economic, socio-cultural and political constructs; Development Theory, theories of social, human and institutional capital; methodologies and strategies for human development within the context of state policy.

**CPPG 620: Independent Study Research Report Writing (3 credits)**

The course will help participants refine their thesis topic, develop their research design and complete a working outline for their project report. Emphasis will be placed on completing the literature review and methodology sections of the thesis. Students will be required to write a research report on the selected topics at the end of the semester.

**CPPG 621: Technology and Public Policy (3 credits)**

Explores the theoretical relationship of science, technology and society; policies regarding science and technology and information and communication technologies to assess contemporary issues of governance and development will be studied.

**CPPG 622: Institutionalism and Public Policy (3 credits)**

Offers theory and practice on global institutions and policy issues: institutional causes and consequences of public policies: formulation of alternative and workable solutions to build sustainable institutions.

**CPPG 699: Research (6 credits)**

The research projects in MPhil are designed to make an original contribution to knowledge in public policy, governance, and politics. The faculty members help students learn

theories, use them, theorize public policy issues, and conceive solutions to the problems of their choice.

## **Specializations and Elective Courses**

### **Governance, Democracy and Institution Building**

#### **CPPG 625: Leadership Theories and Governance (3 credits)**

The seminar-based course that explores skills needed for leadership and policy-making at the senior management level. Instruction will be done through readings, discussions, case studies, simulations, and self-assessment exercises.

#### **CPPG 626: Analyzing and Communicating Public Policy (3 credits)**

Focuses on the application of the tools of policy analysis to inform and educate the public and to induce social change; the examination of why policies succeed or fail. Participants will be given exercises in writing and speaking, conducting meetings, making presentations and working with the media.

#### **CPPG 627: Public Economics (3 credits)**

Looks at the role of government and the ways in which its policies affect the economy; will study efficiency and equity; the public sector and its decision-making; review of the sources of market failure: public goods, club goods, imperfect competition, externalities and information; and taxation.

#### **CPPG 628: International Trade Policy and Globalization (3 credits)**

Provides an understanding of the intellectual and practical problems those arise from the economic interaction between countries; existing patterns of international trade and assessment of the potential for answers; the global financial crisis, its causes and timing and consequent concerns for policy makers globally.

#### **CPPG 629: Political Leadership and Policy Making in Pakistan (3 credits)**

Studies how different political regimes and political leadership have affected policy making in Pakistan. It will study Pakistan's political history with a focus on policy priorities for specific political regimes.

#### **CPPG 630: Federalism, Provincial Autonomy and the Impact of 18th Amendment (3 credits)**

Studies the theory and practice of federalism; power sharing and autonomy; the 18th Amendment and its implications for governance in Pakistan; the issues of federation-province relations; the degree of differentiation and autonomy at all levels of the government.

#### **CPPG 631: Local Governance and Community Development (3 credits)**

Explores the theoretical and institutional framework for citizens' participation in

governance; skills needed to devise a community inclusive in the decision-making process; understanding of citizenship, the civil society, the commons and participatory democracy; will explore case studies on organizing communities for efficient decision-making and provision of social services and budgeting.

**CPPG 632: Democracy and Institution Building in Pakistan (3 credits)**

Provides students with insight into the structure of key institutions in a functioning democracy; their consequent role in democratic consolidation; and the development of Pakistan's key institutions.

**CPPG 633: Political Economy of Public Policy (3 credits)**

Applies a political economy framework to analyze processes of public policy formulation and reform; use of Game Theory to formulate interactive decision-making among the participants; policy reforms such as democratic economies, autocratic economies, transition economies; reforms in health, environment and transportation, trade and agriculture sectors will be studied.

**CPPG 634: Marketing, Strategic Planning and Communication in Public and Non-Profit Sectors (3 credits)**

Explores how public and nonprofit organizations/sectors interact with their external environment; their sources of revenue generation; development of their brand name/identity; application of private sector marketing techniques, methodologies and strategic plans.

**Environment, Demography and Urban Change**

**CPPG 640: Climate Change Policy and Governance in Asia (3 credits)**

Critiques traditional governance paradigms; will discover better governance solutions to the climate change problem; the role of traditional governance in compounding the problem of exploitation of natural resources.

**CPPG 641: Urban Change in South Asia and South East Asia (3 credits)**

Explores the forces behind urban change; the factors which changes cities; the effects of this change on consumerism, democracy, economic growth and human wellbeing as well as on new social movements, fashions and fads, political struggle and identity politics; and the effect of these factors on the nation's stability.

**CPPG 642: Water Policy and Governance in South Asia (3 credits)**

Analyzes water policies of Asian countries; developing critical insights to make and remake water policies; the effect of developmental activities on reservoir pollution; water management; policies and governance responses to the water crisis.

**CPPG 643: Migration, Human Trafficking in South Asia (3 credits)**

Examines linkages between migration, human trafficking and violence in South Asian states; the impact of internal and international migration on human trafficking and violence; its causes; and the response of different countries.

**CPPG 644: Urban Governance and Security in South Asia (3 credits)**

Studies the link between urban governance and security and the evolving nature of these challenges; the role of policing and civilian law enforcement in the South Asian context, and in Pakistan in particular; the increased rural-urban migration and the resulting urban violence.

**CPPG 645: Environmental Issues and Public Policy (3 credits)**

Explores the nature and causes of existing environmental issues, with a particular focus on their impact for the developing world; existing environmental policies – both global and local – and the drivers behind policy development.

**CPPG 646: Comparative Urban Policy (3 credits)**

Studies contemporary debates in urban policy and planning at the local and international level, with a specific focus on South Asia; the evolution of public spaces; service delivery; and the capacity of the government to meet the needs of rapidly expanding urban centers.

**CPPG 647: Migration and Urbanization (3 credits)**

Studies the drivers behind migration to urban centers; how urban centers can be planned to successfully accommodate their ever-growing populations.

**CPPG 648: Demography, Governance and Security (3 credits)**

Studies the linkages between demographic changes in states and societies and how that helps in promoting security and in reducing conflict; a comparative analysis of countries where demographic transition has either led to reducing or intensifying conflict; and the lessons learnt from successful public policies.

**CPPG 649: Gender and Population (3 credits)**

Explores theories, policies and laws regarding gender; the changing dynamics of gender relations with regards to education, marriage, family and fertility; how culture and religion reinforce gender identities; reproductive health, migration and trafficking of women and children.

**CPPG 656: Informal Economy and Urban Development (3 credits)**

Explores the state's lack of policy regulation or its implementation and how that leads to an existing policy framework which facilitates or creates hurdles for the informal economy; and its impact on urban development issues.



**CPPG 657: Social Entrepreneurship (3 credits)**

Introduces concepts, practices and challenges of social entrepreneurship; analytical frameworks, approaches and tools to achieve social and financial goals and to become effective social entrepreneurs.

**Peace Building and Conflict Management****CPPG 660: Theories of Peace Building and Conflict Management (3 credits)**

Explores conflict management and peacekeeping; methodologies, strategies and processes of conflict management and resolution based on the formulation of conflict due to differences in perspectives, human relationships, and communication problems.

**CPPG 661: Conflict Analysis and Resolution Strategies (3 credits)**

Analyzes the context, actors and dynamics of underlying conflict; the necessary peace-building strategies; tools and methodologies used for conflict analysis; issues such as stakeholder participation, ethics, gender and choice of qualitative versus quantitative research methodologies.

**CPPG 662: Dialogue, Negotiation, Mediation and Facilitation Practicum (3 credits)**

Builds upon the theoretical frameworks learnt in conflict management by applying conflict resolution strategies through practical exercises based on scenarios and role playing. Participants will explore the stages of negotiations and mediations, and apply techniques through a practicum involving case studies and simulation exercises.

**CPPG 663: Minorities and Public Policy in Pakistan (3 credits)**

Studies the consequences of diversity for nation building, policy-making and administrative governance; legal framework of the state, minority representation in political parties, administrative institutions and civil society advocacy groups' highlighting of minority rights; policy responses to the existing challenges; the relationship of an Islamic state with minorities, and human rights and insecurity among minorities.

**CPPG 664: Globalization and Transformation of Religion and Politics in South Asia (3 credits)**

Analyzes the contradictory processes that globalization unleashes such as conflict, giving new sensibility to ethnicity, extremism, nationalism, cultural wars; the impact of globalization on politics; usage of religion in South Asia; and the effect of globalization on the styles and modes of governance.

**CPPG 665: Diplomacy and International Relations in Peace Building (3 credits)**

Explores conflict; tools and perspectives in diplomacy and international relations including multilateral and bilateral processes, Track I and II diplomacy; role of international institutions in conflict resolution and peace building; the history and politics of UN bodies; linkages between diplomatic history, institutional structure and international politics.

**CPPG 666: Terrorism and Counter-Terrorism Policies and Strategies (3 credits)**

Explores the history of terrorism, the goals and structure of terrorist groups, their means of resource acquisition; their use of ideologies for recruitment and creating support; the role of states, its use of non-state actors for various policy objectives and political opposition; counter-terrorism methods.

**CPPG 667: Radicalism and De-radicalization in Pakistan (3 credits)**

Investigates perspectives and frameworks of radicalization; identify factors fueling extremism; discuss, formulate and analyze de-radicalization methodologies and strategies within the framework of socio-cultural, legal and the political economy of policy reforms in Pakistan.

**CPPG 668: Disaster Management, Reconstruction and Rehabilitation (3 credits)**

Looks at the theory and practice of disaster management by exploring its phases; politics of disaster management, leadership, and the role of agency coordination; tools for vulnerability mapping, early warning, infrastructure protection, emergency management and assessment of reconstruction and healthcare.

**CPPG 669: Discourse, Media and Violent Extremism (3 credits)**

Explores the relationship between media and violent extremism on the basis of discourse presented in the media; role of media; discourse of terrorist organizations and their use of media; comparison of mainstream media and terrorist narratives; reasons for their convergence or divergences.

**CPPG 670: Security and Peace Building (3 credits)**

Discusses the theory and practice of peace building; security dynamics of Pakistan and South Asia; Pakistan's current security concerns and issues; peace building exercises from different parts of the world; polices and interventions that can be applied to Pakistan's security environment.

**Collaborative Workshops**

CPPG has conducted policy workshops in collaboration with UNCTAD, Fulbright-USEFP, UNDP, DFID, CWS and many others. The workshops encourage in-depth discussion with and among stakeholders to brainstorm policy issues or to develop a consensus on specific policy options.

**CPPG's Publications**

The CPPG has published the following works through its Monograph Series:

- Rickshaw and Environmental Pollution: Assessing Punjab Government Rickshaw Policy, Raheem ul Haque (2009)
- Pakistan, Afghanistan and US Relations: Implications and Future Directions, Saeed Shafqat and Raheem ul Haque (2011)
- Industrial Policy: A Case Study of Sundar Industrial Estate, Hajra Zafar (2012)
- Policing, Torture and Human Rights: Designing a Policy Framework for Pakistan, Rabia Chaudhry (2013)

## Reports

- A Study of Khai Mohallah: Towards a Social Protection Policy Framework for the Informal Sector, Khalida Ahson and Mughees Tahir Bhalli (2014)
- Reforming Pakistan's Energy Sector: Energy Market, Institutional Framework and Governance, Muhammad Imran and Shahram Rana (2014)
- The Criminal Justice System as a Tool of Anti-Terrorist Efforts in Punjab, Rabia Chaudhry (2014)
- Pattern of Electoral Violence in Punjab, Maheen Saleem Khosa (2014)

## Position Papers

- Lahore Vision 2035:
  - o Governance and Management in Lahore, Khalida Ahson
  - o Transport Planning in Lahore, AR. Sarah Mushir Naqvi
  - o Water, Sewerage and Solid Waste Management in Lahore, Atif Hassan
  - o Real Estate Markets in Lahore, Dr Sania Nazir Chaudhry
  - o Improving Trade in Lahore Region, Dr Imdad Hussain



DEPARTMENT OF BIOLOGICAL  
SCIENCES

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The Biological Sciences Department at Forman Christian College (A Chartered University) was founded in 1870. Distinguished professors, including Dr Saithi, Dr Purio, Dr HK Bhatti and Dr KK Bell, have made significant contributions to the Department and the field of Biological Sciences. In recent years the Department has taken great strides forward.

At the undergraduate level, 4-year degree programs in Biology, Biotechnology and Environmental Sciences are being offered. In 2009, the MPhil Biotechnology program was launched. Following the success of the 4-year BS (Hons) Biotechnology program and the 2-year MPhil in Biotechnology, an important step forward was taken by launching MPhil programs in Food Safety and Quality Management and Molecular Pathology and Genomics as well as PhD in Biotechnology. This has been possible due to the highly qualified faculty, recognized by the HEC. The Department has several ongoing research programs and the faculty has been able to win competitive research grants worth more than Rs 120 million for conducting goal-oriented research. Based on the availability of project funds, many MPhil students are offered Research Assistantships during the second year of MPhil.

## MPhil Biotechnology

MPhil Biotechnology is a two-year program consisting of 2 semesters of coursework followed by 2 semesters of research.

### Requirements for the Program

A total of 42 credit hours. 30 credit hours consist of mandatory coursework in the first 2 semesters. Students must maintain a minimum of 2.75 CGPA in coursework. The last 2 semesters will be dedicated to research of 12 credit hours on a theme chosen by or in consultation with the research supervisor.

## Course Descriptions

### BIOT 502: Advanced Microbial Biotechnology (4 credits)

Development, maintenance and improvement of pure and mixed cultures; role of microbes in controlling environment; use of genetic engineering techniques for cloning and expression for metabolite overproduction; biotechnology in food, chemical and enzyme industry; modern vaccines, antibodies, antimicrobial resistance and antimicrobial agents.

### BIOT 503: Recombinant DNA Technology (4 credits)

History and structure of DNA; packaging of DNA, gene expression in prokaryotes and eukaryotes; introduction to recombinant DNA technology; use of restriction endonucleases and other DNA modification enzymes; different vector systems, construction and screening of genomic and DNA libraries; DNA sequence determination and analysis; site-directed and deletion mutagenesis.

### **BIOT 504: Techniques in Biotechnology (4 credits)**

DNA and protein isolation, purification and analysis techniques; electrophoretic, chromatographic and hybridization technologies; microarray, real time PCR, mass spectrometry, NMR, protein crystallization, molecular imaging, bioinformatics, transmission electron microscopy, latest innovations in bacterial strain identification and transformation methods in bacterial, animal and plant systems.

### **BIOT 505: Protein Design and Engineering (3 credits)**

This course will deal with protein structure, synthesis and posttranslational modifications; structure-function relationship, protein folding and chaperons; protein structural families; protein-protein interactions: molecular immunological, biochemical and physical techniques for studying protein-protein interaction; modeling and prediction of protein structure; protein design strategies: mutagenesis (site directed, random, error prone PCR); computational protein design, directed evolution, gene shuffling, incorporation of unnatural amino acids into proteins; methods of selection and screening for modified proteins; commercial applications antibody engineering.

### **BIOT 506: Biostatistics (3 credits)**

An introduction to Applied Biostatistics; provides an introduction to selected topics in biostatistics. This course covers the tools for the collection, analysis and presentation in biological sciences. Central to these skills is assessing the impact of chance and variability on the interpretation of research findings. Topics covered includes Sampling Techniques; tools for describing central tendency and variability in data; methods for performing inference on population means and proportions via sample data; statistical hypothesis testing and its application to group comparisons; design of experiments and concepts of statistical quality control; finding and interpreting relationship with Binary outcomes, continuous outcomes using simple methods and regression methods. While there are some formulae and computational elements to the course, the emphasis is on interpretation and concepts.

### **BIOT 511: Journal Club (1 credit)**

The course will comprise of at least one presentation by each student on critical analysis of recently published research article in international journals; besides that every student will be required to attend all presentations and actively participate in the weekly Journal Club.

### **BIOT 601: Bioinformatics (3 credits)**

Nucleotide analysis, alignments, phylogenetic trees, search for open reading frames, translation, database search (NCBI, UniPort), dot plots, RNA analysis, structure prediction, graphical representation of structures, prediction of protein secondary structure, signal peptides and trans-membrane helixes, 3D molecule analysis, Pfam domain search, antigenicity and hydrophobicity, proteolytic cleavage, motif search and pattern discovery and finally, primer designing and evaluation.

**BIOT 605: Business Entrepreneurship (1 credit)**

Introduction, global biotechnology industry, business development, how to pick winning technology, the art of the deal and legal perspective, biosafety, biobusiness, raising a company, marketing a product/service, financing new ventures, career development overview.

**BIOT 608: Advances in Agriculture Biotechnology (4 credits)**

Problems of agriculture in Pakistan, microbial biotechnology in agriculture, biotechnology of soil enzymes, plant tissue culture and its application in agriculture, techniques for plant transformation; vectors for plant transformation, promoters and terminators, selectable markers; case studies, herbicide tolerance, pest resistance, plant disease resistance, reducing the effects of viral disease, strategies for engineering stress tolerance, biofortification; science and society: public acceptance of genetically modified crops.

**BIOT 609: Advances in Health Biotechnology (3 credits)**

Problems of healthcare industry in Pakistan; introduction to signal transduction, cancer biology: neoplasia, immunology, monoclonal and polyclonal antibodies, infectious diseases and molecular diagnostics, stem cells and their application, knockout mice, therapeutic proteins, modern vaccines, gene therapy, drug discovery, forensic sciences, nanobiotechnology and its applications in healthcare.

**BIOT 611: Omics (3 credits)**

The genomics section would cover the functional and expression genomics with an insight into reverse genetics. The proteomics would include the massive scale technologies for the protein identification, assay development and a key application in health. Transcriptomics, metagenomics and epigenomic technologies and their application. The neutraceuticals would cover the utilization of biological compounds in biomedicine.

**BIOT 699: Research (12 credits)**

Research project will be allotted to those students who have a minimum of 2.75 CGPA in coursework. They are supposed to get registered for two semesters to complete their research project.

**BIOT 703: Non-Coding Genome (3 credits)**

This course will deal with Introduction to RNA mediated Silencing Pathways and RNA biology, RNA mediated Silencing in different compartments of the cell, role of Arganoue proteins in compartmental and tissue specific vs systemic RNA mediated Silencing, non-coding RNAs as a part of antiviral and anti-genome defense mechanisms: RNA directed methylation and demethylation, epigenetics and non-coding RNAs, non-coding RNAs in genome stability: regulation of transposable elements, maintenance of heterochromatin and centromere formation, meiotic silencing of unpaired chromatin, paramutation and DNA elimination in ciliates, role of non-coding RNAs in cancer: human cancer-associated lncRNAs.

## MPhil Food Safety and Quality Management

Access to safe, wholesome and nutritious food is a fundamental human right. Nevertheless, food systems in developing countries continue to be stressed due to lack of capacity to deal with pre- and post-harvest losses. This, combined with increase in population, migration, urbanization, lack of resources and problems of environmental and food hygiene, adversely affect quality and safety of food supplies in most parts of Pakistan.

In view of the above, the Government of Punjab has recently enacted food laws to take into account food safety concerns of consumers. The rapidly expanding food industry is also aware of these laws. FCCU's resources and expertise in the fields of Biotechnology, Chemistry and Business make it an ideal institution to initiate an MPhil in Food Safety and Quality Management (FSQM) to cater to the needs of the food industry and other sectors.

As an evening program MPhil FSQM allows in-service professionals to benefit from this cross-disciplinary degree. FCCU's MoU with PCSIR Laboratories, Lahore, means that PCSIR expertise can also be used by students to help with research and internships.

### Requirements for the Program

A total of 42 credit hours comprising:

- 30 credit hours of coursework in semesters I and II
- 12 credit hours of research work in the last two semesters

## Course Descriptions

### Semester I

#### **FSQM 501: Food Safety and Quality Management (3 credits)**

Nature of food hazards, physical, microbial and chemicals hazards; toxicity by extraneous chemicals: agricultural chemicals, food processing, packaging, additives, adulterants; toxicity from water; microbial toxins: mycotoxins – moulds, mushrooms; bacterial food intoxication; bacterial food infections; food allergy and intolerance; systems for food safety surveillance – GMP, TQM, HACCP and FSMS-ISO22000:2005; understanding the importance, impact, issues, management skills and role of food safety and quality on local and world trade.

#### **FSQM 502: Food Microbiology and Toxicology (3 credits)**

Different microbial threats related to food safety; epidemiology of different food-borne illnesses; understanding international microbial limits for safe foods; toxicological aspect of foods and their impact; food allergies, microbiological examination of foods, air and biofilms etc.



**FSQM 503: Food Laws, Regulations and Auditing (3 credits)**

Punjab Food Safety and Standards 2017 and current regulations; PSQCA food rules, Codex Alimentarius Food Standards; their role in ensuing safety and wholesomeness of food for consumer and export purposes; understanding importance of auditing with special reference to food safety.

**FSQM 504: Public Health and Nutrition (3 credits)**

Role of public health in overall healthcare system; understanding importance of nutrition in relation to a healthy population in order to promote a healthier population; focus on prevention rather than treatment of diseases.

**FSQM 505: Safe Food Supply Chain Management (3 credits)**

Concept, principles, scope, applications and future of food supply chain management.

**FSQM 506: Research Methodology and Biostatistics (3 credits)**

This course provides an introduction to selected topics in research methodology and biostatistics. It represents an introduction to the field and provides a survey of data and data types. Specific topics include tools for describing central tendency and variability in data; methods for performing inference on population means and proportions via sample data; statistical hypothesis testing and its application to group comparisons; issues of power and sample size in study designs; and random sample and other study types. While there are some formulae and computational elements to the course, the emphasis is on interpretation and concepts.

**Semester II****FSQM 601: Food Labeling, Authenticity and Traceability (3 credits)**

Key issues and requirements of food labeling; understanding systems, laws, standards and guidelines to ensure food traceability and authenticity.

**FSQM 602: Food Technology and Packaging (3 credits)**

Technical and processing aspect of food technology; importance of food packaging; resultant safety concerns and their remedial strategies; interaction of food packaging with food and its health implications.

**FSQM 603: Consumer Behavior and Preferences (3 credits)**

This course will deal with the consumer behavior with special reference to food choices in addition to consumer psychology and microeconomics of consumer behavior in respect to food choices; role of consumer behavior and its business effect; consumer perception of quality, safe and healthy food; importance of consumer behavior for new product development.

### **FSQM 605: Global Issues in Food Security and Safety (3 credits)**

To understand the global food security and safety situation, challenges and possible outcomes.

### **FSQM 606: Advanced Analytical Techniques for Food Safety and Quality (3 credits)**

To understand key issues relating to food sampling and importance of sampling to ensure food safety; use of modern food analysis techniques for food safety, authenticity, quality and traceability.

### **FSQM 699: Research Thesis (12 credits)**

The thesis project provides students detailed exposure to a practical problem in food safety and quality management. Students can join an ongoing project or work on an independent problem in close cooperation with a faculty member (Research Supervisor). In all research projects an active participation of food industry will be ensured.

## **MPhil Molecular Pathology and Genomics**

Molecular Pathology is a rapidly expanding discipline that connects pathology and molecular biology. The future of medicine and clinical diagnostics is molecular based. Therefore, theoretical and practical applications of molecular diagnostics must be the kind of knowledge that is available to aspirants. This program provides training in the application and interpretation of advanced molecular technologies and their use in pathology and clinical diagnostics. This specialist training enables physicians, scientists and technologists to validate, use and develop molecular assays for improved management of patients.

As an evening program, MPhil Molecular Pathology and Genomics allows in-service professionals to benefit from this cross-disciplinary degree. Our partner organization, Chughtai Lahore Labs, is one of the largest private clinical diagnostic laboratories in Pakistan and provides clinical and practical expertise.

### **Requirements for the Program**

A total of 42 credit hours over 2 years distributed as: 14 credit hours (4 courses) in 1st semester; 16 credit hours in second semester; followed by 2 semesters of research of 12 credits.

## **Course Descriptions**

### **Semester I**

#### **MPGN 501: Basic Molecular Biology (4 credits)**

Molecular biology emphasizes the study of molecules that make up an organism and the forces operating among these molecules. Increasingly, molecular biologists can explore

the genetic control of these molecules and thus define the developmental, cellular, and sub-cellular changes that occur during the dynamic processes of life. Virtually every question, whether in biochemistry, cell biology, developmental biology, or some other biological discipline, applies molecular biology, often as the prime approach, in its solution. Biochemical and molecular developments have revolutionized biological research, fuelling the explosive growth in the biotechnology industry and rapid increase of molecular medicine. Students will cover the structure and biochemistry of nucleic acids, DNA and RNA structure, the physical chemistry of nucleic acids, DNA and RNA hybridization, DNA replication and repair, gene organization and expression, gene structure, transcription, RNA processing, translation, post-translational modification, regulation of gene expression including epigenetics.

### **MPGN 502: Research Methodologies (3 credits)**

This module focuses on the development of essential research skills and methodology required to understand, interpret and develop new molecular assays. It includes studies in research methods and scientific communication, together with the practical application of experimental design and evaluation, evidence based medicine, alongside opportunity to discuss why academic integrity is a keystone in science methodology. It will also enable preparation of the research dissertation for the final project.

### **MPGN 503: Basic Pathology (4 credits)**

Pathology is the study of disease. It deals with the etiology, pathogenesis, physiology, and structural and functional alterations that result from disease. The course will cover the study of basic pathologic processes that underlie all diseases, such as cellular pathology, inflammation and repair, fluid and hemodynamic derangements, and neoplasias. In addition, basic information will be provided regarding diseases affecting specific organs and their systems such as cardiovascular, blood, hematopoietic and lymphoreticular, respiratory, gastrointestinal, hepatobiliary, genitourinary, pancreas, male reproductive, breast and female reproductive, endocrine, musculoskeletal, neural and specialized neural, and skin.

### **MPGN 504: Professional Standards – Biosafety, Bioethics and Quality Assurance (3 credits)**

Professionalism embraces rules of conduct, standards of practice, and support for professional associations. Required competencies necessary to be professional in the field of health care, and the lab in particular, will be identified. Among others, this course will cover the following topics: professional practice, project management, regulations, laboratory and clinical research, professional ethics, standards and good laboratory practices (GLP), sample management and data handling, information management systems, and quality assurance systems and processes.

### **MPGN 505: Cellular Signal Transduction and Disease (3 credits)**

For the past half century, our understanding of metabolic and signaling pathways has been built from in vitro measurements of the activities of individual components isolated from homogenized cells, the behavior of the entire pathway being inferred mathematically by summation. Recently, however, modern techniques increasingly allow whole pathways to be monitored in single living cells. The 21st century is likely to be dominated by the study of the cell physiological functions of protein-to-protein interactions as they occur in whole cells. Both metabolic and signal transduction research are in a sense coming full circle to the realization that one only really gets a true picture of how pathways work by looking at them in their entirety and in their natural environment: the complex, crowded and elastic milieu of the living cell.

### **MPGN 506: Research Methodology and Biostatistics (3 credits)**

This course provides an introduction to selected topics in research methodology and biostatistics. This course represents an introduction to the field and provides a survey of data and data types. Specific topics include tools for describing central tendency and variability in data; methods for performing inference on population means and proportions via sample data; statistical hypothesis testing and its application to group comparisons; issues of power and sample size in study designs; and random sample and other study types. While there are some formulae and computational elements to the course, the emphasis is on interpretation and concepts.

## **Semester II**

### **MPGN 601: Molecular Diagnostics – Technologies and Instrumentation (4 credits)**

This course is a comprehensive introduction to the basic principles of the rapidly growing field of molecular diagnostics and therapeutics. Beginning with an overview of essentials and unique terminology, the course addresses many direct and amplified nucleic acid test methods; specimen handling, and the clinical applications, advantages, and disadvantages of molecular diagnostics are also covered. Most importantly, the principles behind molecular diagnostics are presented in detail, giving you a strong foundation for future exploration and study in molecular diagnostics. Introduction, the use of ELISA, DNA hybridization, PCR, RAPD and DNA fingerprinting, bacterial biosensors, PCR/OLA, and restriction digest, in molecular diagnostics; infectious agents and point mutations with prognostic significance will be used when discussing specific applications.

### **MPGN 602: Molecular Pathology and Oncology (4 credits)**

Advances in knowledge of the biology of leukemias and lymphomas; genetic alterations contributing to development of these neoplasms; hematopathology; understanding molecular genetics of solid tumors; inherited alterations in tumor suppressor genes and genes encoding proteins responsible for DNA repair and their association with neoplasms such as breast and colon adenocarcinomas have opened a new and controversial arena of clinical assays for cancer predisposition assessment and response to treatment.

The clonal origin of neoplasms and the phenomenon of clonal evolution, the multistep pathogenesis of neoplasia involving, inherited predisposition, activation of oncogenes, inactivation of tumor suppressor genes, alterations of genes regulating apoptosis, mutations of DNA repair genes.

**MPGN 603: Genetic Basis of Human Diseases (4 credits)**

Human genome and genomic organization; chromatin and chromosome structure; human genetic variation, polymorphisms; molecular basis of inherited disease; deletion, duplication, and insertion mutations; missense, nonsense, null, and frameshift mutations; mutations affecting RNA splicing and stability; mutations altering transcription; patterns of inheritance; autosomal dominant and recessive disorders; de novo mutations; consanguinity; sex-linked disorders; X inactivation; multifactorial inheritance; mitochondrial inheritance; nonclassical patterns of single gene inheritance; mosaicism; imprinting; uniparental disomy; trinucleotide repeat disorders; expression of phenotypes; penetrance and variable expressivity; anticipation; genetic, allelic, and locus heterogeneity; quantitative genetics; population genetics; Hardy-Weinberg equilibrium; laws of probability; Bayesian analysis; linkage analysis.

**MPGN 604: Introduction to Bioinformatics (4 credits)**

In recent years advances in molecular biology together with reference data from the human genome project have made it possible to record the full expression profile of cells (i.e. all genes), high density maps of chromosome gain and loss (using SNP), and now even the full sequence of all transcribed genes (with next-generation sequencing). Such methods are referred to as genomics as they give a full genome level view of cancer cell activity, whilst the process whereby we analyse and interpret these vast and complex datasets has come to be known as Bioinformatics. During this module students will learn about and analyse gene expression microarrays-GEM datasets and several other types of cancer genomic data (SNP microarray, RNA-seq).

**MPGN 605: Molecular Pathology (3 credits)**

Molecular Pathology is an emerging discipline within pathology which is focused in the study and diagnosis of disease through the examination of molecules within organs, tissues or bodily fluids. Molecular Pathology shares some aspects of practice with both anatomic pathology and clinical pathology, molecular biology, biochemistry, proteomics and genetics, and is sometimes considered a “crossover” discipline. It encompasses the development of molecular and genetic approaches to the diagnosis and classification of human diseases, the design and validation of predictive biomarkers for treatment response and disease progression, the susceptibility of individuals of different genetic constitution to develop disorders.

**MPGN 699: Research (12 credits)**

Students can join an ongoing project or work on an independent problem in close cooperation with a faculty member (Research Supervisor).

## PhD Biotechnology

After the success of the 4-year BS (Hons) Biotechnology program, followed by MPhil in Biotechnology, the Department of Biological Sciences has taken an important step forward by launching a PhD Biotechnology program. This has been made possible due to the highly qualified faculty which is also recognized by the HEC as PhD research supervisors. The Department has been able to win competitive research grants worth more than Rs 50 million for conducting goal-oriented research.

### **Degree Requirements**

#### **Total Credit Hours**

The student is required to successfully complete a minimum of 30 credit hours for the degree. The details are as follows:

#### **Coursework**

Coursework of 18 credit hours preferably in the first year is required to be completed and followed by a Comprehensive Examination for granting candidacy as a PhD researcher. A minimum of 70% score is required to pass the Comprehensive Exam.

#### **Research**

After the successful completion of coursework students are required to register for 12 credits of research work.

#### **Foreign Expert Evaluation**

The PhD dissertation must be approved by at least two PhD experts from technologically/academically advanced foreign countries in addition to the local Committee comprised of internal and external examiners.

#### **Plagiarism Test**

The plagiarism test must be conducted on the dissertation before its submission to the two foreign experts, as described below.

#### **Open Defense**

An open defense of dissertation is an essential part of PhD program after positive evaluation.

#### **Research Paper**

Acceptance/publication of at least one research paper in an HEC-approved “X” category journal is a requirement for the award of PhD degree (“Y” in case of Social Sciences only). Or at least one publication in an ISI-indexed impact factor carrying journal.

#### **Copy of PhD Dissertation to HEC**

A copy of PhD dissertation (both hard and soft) must be submitted to the HEC for record in the PhD Country Directory.

## Conduct of PhD Program

According to the HEC, initially there should be at least 3 relevant full-time PhD faculty members in a department to launch a PhD program. The Biological Sciences Department currently has 19 PhDs out of which 12 are HEC-approved PhD supervisors.

The maximum number of PhD students under the supervision of a full time faculty member is three.

Program of Studies:

- Minimum period of completion: three years
- Maximum period of completion: five years
- Students must register for courses during the first year
- The Comprehensive Exam will be conducted after completion of coursework. A maximum of three attempts can be made to pass the exam

Admission to PhD program will only be made in the research areas which are supported through research projects. In case of non-availability of research funding/grant, student may be registered with the approval of Rector.

## Course Descriptions

### **BIOT 701: Gene Structure and Regulation (3 credits)**

Prokaryotic and eukaryotic gene structures, genome organization, gene families, gene regulation in prokaryotes and eukaryotes; transposons, mutagens, mutations and DNA repair, molecular basis of mutations, transposable elements, and mechanisms of DNA repair; basic concepts about epigenetic inheritance patterns; how various genetic and molecular tools are used to perform mutant screening to study biological function; epigenetic, gene regulation mediated by chromatin modifications, non-coding RNAs and their involvement in various cellular processes.

### **BIOT 702: Advances in Cell Biology and Signaling (3 credits)**

Cellular organization and specialization, membrane transport, biomembranes and subcellular organization of eukaryotes, regulation of the eukaryotic cell cycle/apoptosis, protein sorting, protein secretion, muscle contraction, cell surface and communication extra cellular matrix, cell-to-cell signaling, hormones and receptors, primary and secondary messengers, ion, steroid, G-protein, enzyme-linked, nuclear and cytoplasmic interactions, growth factors cancer.

### **BIOT 703: Forensic DNA Typing (3 credits)**

Introduction and history of forensic science, principles of forensic sciences, crime scene investigation, fire and explosive examination, death investigation, collection, storage and analysis of biological evidence and strains, trace biological evidence, forensic DNA analysis, DNA isolation and amplification, paternity identification, DNA profiling, data collection and interpretation.

**BIOT 704: Advances in Virology (3 credits)**

Viral classification and structure, bacteriophages, animal and plant viruses, viral genome replication, regulation and virus assembly; virus-host interactions and epidemiology, host defense mechanisms, vaccines and antiviral drugs, diagnosis and pathology, resistance to infection treatment and prevention, prion diseases, retroviruses and aids, orthomyxoviruses and influenza, control of viral disease by immunization, the herpes viruses.

**BIOT 705: Advances in Immunology (3 credits)**

Cells and organs of immune system; generation of B cells and T cells, organization and expression of immunoglobulin genes; antigen-antibody interaction; major histocompatibility complexes, T cell receptors, T cell maturation, activation and differentiation; B cell generation, activation, and differentiation; the immune system in health and diseases.

**BIOT 706: Practical Approaches to Recombinant DNA Technology (3 credits)**

This course consists of problem-solving exercises. Every student will be given individualized problem to work in a specified time period, at the end of which a solution in the form of a written document is submitted. The evaluation is based upon this document as well as on oral presentation. Students will be required to develop cloning strategy of an individualized gene with the help of a given vector.

**BIOT 707: Journal Club (3 credits)**

The course will comprise of at least one presentation by each student on critical analysis of recently published research article in international journals. The research article will be assigned to each student in the beginning of the semester. Besides that every student will be required to attend all presentations and actively participate in the weekly Journal Club.

**BIOT 799: Research (12 credits)**

After the successful completion of coursework students are required to register for research work. A CGPA of 2.75 is required to be eligible for research. Students will join the ongoing projects or work on an independent problem (depending on availability of facilities and funds) under the supervision of faculty members (Research Supervisors).

**BIOT 703: Non-Coding Genome (3 credits)**

This course will deal with introduction to RNA-mediated silencing pathways and RNA biology, RNA-mediated silencing in different compartments of the cell, role of Argonaute proteins in compartmental and tissue specific vs systemic RNA-mediated silencing, non-coding RNAs as a part of antiviral and anti-genome defense mechanisms: RNA-directed methylation and demethylation, epigenetics and non-coding RNAs, non-coding RNAs in genome stability: regulation of transposable elements, maintenance of heterochromatin and centromere formation, meiotic silencing of unpaired chromatin, paramutation and DNA elimination in ciliates, role of non-coding RNAs in cancer: human cancer associated lncRNAs.



## Linkages

The Department has developed linkages with the following institutions which allow FCCU students to get internships and develop research collaborations:

- Center of Excellence in Molecular Biology, Punjab University (CEMB)
- National Institute for Agriculture and Biology, Faisalabad (NIAB)
- National Institute for Biotechnology and Genetic Engineering, Faisalabad (NIBGE)
- Pakistan Council of Scientific & Industrial Research, Lahore
- School of Biological Sciences, University of Punjab (SBS)
- Shaukat Khanum Memorial Cancer Hospital & Research Center, Lahore (SKMCH&RC)
- University of Health Sciences, Lahore (UHS)
- University of Veterinary and Animal Sciences, Lahore (UVAS)
- Lahore University of Management Sciences, School of Science and Engineering, Lahore (SSE, LUMS)

## Ongoing Research Projects

The faculty and Postgraduate students are currently involved in the following research projects:

Sr#	Titles of Ongoing Research Projects	Principle Investigator	Funded by	Duration
3	Enhancing Fertilizer Use Efficiency in Wheat by using Transgenic Approach (Alp-Fue)	Dr Kauser A Malik	PARC/ALP	2014-2017
6	Development of Homozygous Lines of Transgenic Wheat and Screening for Phosphorus Use Efficiency (PSF-PUE)	Dr Asma Maqbool	Pakistan Science Foundation	2014-2016
8	Incidence of Leptin and Melanocortin 4 Receptor Gene Mutations and Metabolic Profile in Subjects with Early Onset Severe Obesity	Dr M Arslan	Pakistan Academy of Sciences	2015-2017
11	Isolation and Characterization of Secondary Metabolites Produced by Rhizobacteria and their Potential as Biocontrol Agents (HEC Secondary Metabolites)	Dr Samina Mehnaz	Higher Education Commission	2015-2017

Sr#	Research Projects under Review	Principle Investigator	Funded by	Duration
1	Improvement in Cotton Staple Length Integrating Classical and Molecular Genetic Approaches	Dr Aftab Bashir	PARB	2015-2018

2	Overcoming the Wheat Yield Gap in Pakistan: Development of Drought and Salinity Tolerant Wheat	Dr Kauser A Malik	HEC/US-Pak S&T Cooperation	2015-2018
3	Development of Dipstick for Detection of Bt (Cry1ac & Cry2ab) Proteins in Cotton	Dr Aftab Bashir	PSF	2015-2017
4	Development of a New Herbicide Trait and its Transformation into Chloroplasts	Dr M Imran	PARB	2015-2018

## **Seminars and Workshops**

### ***Seminar on Genetic Spectrum of Severely Obese Children from Pakistan***

A seminar was conducted on genetic spectrum of severely obese children in Pakistan. A visiting scholar from Imperial College, UK, discussed the genetics basis of severe obesity in Pakistan, particularly in children. She also talked about the collaborative project with Biological Sciences Department on severe obesity in children.

### ***Seminar on Fluorescent Cell Imager, ChemiDoc Touch imaging system and V3 Western Workflow***

A seminar was organized on Fluorescent Cell Imager, ChemiDoc Touch Imaging System and V3 Western Workflow. The seminar was conducted by BioRad expert about the qualities and principle involved in the above-mentioned high-tech instruments. Faculty and students attended the seminar and took interest in the discussion. The seminar was followed by a demonstration of instruments by the Bio-Rad team.



# CHEM

DEPARTMENT OF  
CHEMISTRY

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The Department of Chemistry is one of the oldest at Forman Christian College (A Chartered University). It enjoys a rich heritage of eminent scholars, three especially being worthy of mention. Dr Carter Speers was Head of the Chemistry Department and Professor of Technical Chemistry, University of the Punjab. Dr Robert F Tebbe, a prominent Organic Chemist and teacher, spent 12 years at FCCU as Professor of Chemistry and also served as the Principal of the College. Dr Khairat M Ibne-Rasa, a scientist of international repute, served as Professor of Organic Chemistry and Head of the Department.

At present, the faculty is committed to continuing these rich traditions. Most of the faculty members are Higher Education Commission (HEC)-approved PhD supervisors for varied HEC-funded schemes. They are meticulous teachers and active researchers. Two of them have recently received the Research Productivity Award for the year 2012 by Pakistan Council for Science and Technology.

The Department has state-of-the-art facilities available for research in several significant areas, including natural products, organic synthesis, organometallics, nano and composite materials, and pharmaceutical chemistry. It also provides opportunities for students to work on projects funded by organizations like the Pakistan Science Foundation (PSF), and the HEC.

The Department of Chemistry makes efforts to prepare its students to play a productive role in different capacities, such as educators, researchers and chemists. It also lays a strong foundation for students who plan further education in Pakistan or abroad.

The Department has four dedicated teaching laboratories and six postgraduate research laboratories. The research and teaching instruments available include: Atomic Absorption Spectrophotometer (AAS), TGA-DSC Analyzer, CHNS/O Analyzer, Gas Chromatography-Mass Spectrometer (GC-MS), HPLC Equipment, Gas Chromatograph, FT-IR Spectrophotometer, UV-VIS Spectrophotometers, Digital Polarimeter, and Rotavapors.

## **MPhil Chemistry**

The MPhil Chemistry program is a two-year, four-semester degree program. The first year, which comprises two semesters, is dedicated to coursework, at the end of which, each student must pass a Comprehensive Examination. In the second year, the students conduct research under the supervision of a faculty member of the Department. A full year of research activities plays a crucial role in training and preparing the students for further learning, or to pursue a career. Fields of specialization available include inorganic-analytical, organic-bio, physical and applied chemistry. A faculty member acts as a program coordinator and assists students in all matters related to learning and research.

## Individual Educational Development Plan

After declaring their major area of interest, the students prepare personal statements of learning goals and expected accomplishments during the MPhil program. Students are encouraged to interact with all faculty members before making the final selection.

### Requirements for the program:

#### Year 1: Coursework

**Semester I:** 4 courses of 3 credits each (total 12 credits) from the following: CHEM 525, CHEM 526, CHEM 542, CHEM 549, CHEM 566.

**Semester II:** 4 courses of 3 credits each (total 12 credits) from the following: CHEM 506, CHEM 520, CHEM 524, CHEM 529, CHEM 541, CHEM 563.

#### Year 2: Research Work

##### Semesters III & IV

2 Seminars relating to the research project.

Research thesis (14 credit hours).

**Total:** 40 credits.

## Course Descriptions

### **CHEM 501: Advanced Electrochemistry (3 credits)**

Industrial electrolytic chemistry, electrokinetic processes, interfaces between two immiscible electrolyte solutions, electrochemical interactions, electrochemical reactors, conductive polymers, electrocatalysis, bio-electrochemistry, photoelectrochemistry, electrochemistry and environment.

### **CHEM 506: Advanced Polymer Chemistry (3 credits)**

Nature, types and structures of polymers; synthesis and characterization techniques; properties, applications and processing; advances in polymer chemistry; glass and conducting polymers, degradable polymers and recycling strategies.

### **CHEM 508: Chemistry of Nanomaterials (3 credits)**

Synthesis, properties, characterization and application of composite and nanomaterials; nanoscale properties including electronic, optical and magnetic properties; surface modification and assembling of nanoparticles; different techniques used for characterization of nanomaterials such as scanning electron diffraction (SEM), dynamic light scattering (DLS) and UV-visible spectroscopy.

### **CHEM 520: Thermal Methods of Analysis (3 credits)**

Thermoanalytical techniques; theory, instrumentation and applications of

thermogravimetric analysis, differential thermal analysis and differential scanning calorimetry; determination of thermodynamic and kinetic parameters by model-based and model-independent methods; residue and evolved gas analysis.

#### **CHEM 524: Inorganic Electronic Spectroscopy (3 credits)**

Brief introduction of Group Theory; term symbols; Russel Saunders coupling scheme; development of correlation and Tanabe-Sugano diagrams; Crystal field and Ligand field diagrams; energy level calculations; selection rules; band intensities and band assignments; interpretation of Crystal Field and Charge Transfer spectra; spectra of low symmetry complexes; application of group theory to vibrational spectra of simple and coordination compounds.

#### **CHEM 525: Bioinorganic Chemistry (3 credits)**

Basics of bioinorganic chemistry; essential and non-essential elements and their roles; extra- and intra-cellular electrolytes; sodium-potassium pump; biochemistry of selenium; biological role of Zn and Fe, Co, Ni, Cu and Mn, structural and active role of transition elements in metallo-proteins and metallo-enzymes; inorganic ions as enzyme inhibitors; chelates in medicine; metal-based drugs.

#### **CHEM 526: Analytical Techniques (3 credits)**

Sampling, sample handling and preparation; quality control of analytical data; analytical spectroscopy, atomic spectroscopy, spectrophotometry, spectrofluorimetry, mass spectrometry and  $\gamma$ -spectrometry; chromatography; electrophoresis and electroanalytical techniques.

#### **CHEM 529: Organometallic Chemistry (3 credits)**

Introduction to organometallic compounds; Grignard reagents; metal-olefin, -polyene and allyl compounds; metal-sandwich compounds; bonding and reactivity of organometallic compounds; synthetic applications and catalytic role of organometallic compounds.

#### **CHEM 541: Chemistry of Isoprenoids and Polyphenols (3 credits)**

Natural products and their importance; distribution and synthesis of terpenoids, steroids and polyphenols in living organisms; isolation, structure, reactivity and medicinal activities of terpenoids; total synthesis of some representative terpenoids; structure and reactivity of flavonoids and isoflavonoids, coumarins, saponins and glycosides; isolation techniques; medicinal applications of polyphenols and flavonoids.

#### **CHEM 542: Advanced Spectroscopy of Organic Compounds (3 credits)**

1D proton and C-13 NMR; chemical shifts, spin-spin couplings, NOE, DEPT and structure elucidation; basic concepts of 2D NMR, homo- and hetero-nuclear correlation spectroscopic techniques; electron impact and chemical ionization, field ionization, field desorption, HRMS; fast atom bombardment (FAB), plasma desorption, thermospray,

electrospray mass spectra; fragmentation pattern of common functional groups; structure elucidation using mass spectrometry and other spectroscopic techniques.

**CHEM 549: Biomolecules: Structure and Function (3 credits)**

Forces determining structure and function of different types of proteins; thermodynamics of globular protein denaturation and re-naturation; chemistry of specific amino acids and co-factors in enzymatic catalysis; hemoglobin and myoglobin as examples of enzyme structure and biological function; role of inorganic ions in structure and function; multi-protein complexes; structure-function of lipids and membranes.

**CHEM 560: Surface Chemistry (3 credits)**

Physical and chemical properties of solid surfaces; thermodynamics and kinetics of gas chemisorption; chemical bonding at surfaces; applications to catalysis and electronic materials, differentiation between physical absorption and chemisorptions; adsorption of gases on solids and influence of temperature and pressure on gaseous adsorption; types of van der Waals adsorption, BET adsorption isotherm and its interpretation. Other industrial applications of adsorption of gases and solutions on solids (such as gas masks and silica gel as drying agents etc.); adsorption isotherm of dilute solution of solids; Gibbs equation, its verification, Gibbs isotherm and the interpretation of adsorption data; ionic and non-ionic surfactants, flotation reagents, and their mechanism for the removal of dirt particles from fabrics; surfactants, flocculating and dispersing agents.

**CHEM 563: Mathematics for Chemists (3 credits)**

Basic algebra, trigonometry and graphic methods, logarithms and exponentials, combinatorial functions, complex numbers and complex functions, vectors, differentiation, concepts of maxima and minima, method of undetermined multipliers, integration, definite and indefinite integrals, Cartesian and polar coordinates and their transformations, power series and Taylor expansion, convergence tests and radius of convergence, matrices and matrix arithmetic, solution of simultaneous linear equations, including determinants, introduction to basic statistical techniques and measures for describing quantitative data, measures of central tendency and measures of dispersion, linear regression, line- and curve-fitting, correlation and tests of significance.

**CHEM 566: Advanced Topics in Physical Chemistry (3 credits)**

Special topics covered in detail according to the recent innovations in field of physical chemistry.

**CHEM 696: Research Seminars (2 credits)**

This comprises two research seminars during the research period.

**CHEM 699: Research Thesis (14 credits)**

Research is a full one-year project with the thesis evaluated by external examiners upon

completion.

- Research projects are assigned and approved by the Department in consultation with the students and their supervisor
- Before starting the research, students must prepare outlines/synopses of their proposed research projects
- The research project has to be completed within the specified period of time, after which the research theses duly signed by the students and their supervisors are submitted to the Department for evaluation
- At the end of the research work, students are required to write comprehensive theses explaining their research findings
- Research theses, which must represent original discovery fulfilling the University's integrity criteria, are accepted only when they meet all the formatting and writing standards of the Department
- Research theses are evaluated by external examiners appointed by the University, after which viva voce is arranged
- Students are expected to work in the laboratory/library for at least 35 hours a week during the research year. Group discussions among students are also encouraged
- Seminars are held during which students present their work before a committee of faculty members for evaluation

## PhD Chemistry

The Department of Chemistry is determined to demonstrate the distinguished features of this great institution including excellence in learning and research. The Department has excellent faculty, most of them being PhD and HEC-approved PhD supervisors. Equipment like GC-MS, AAS, CHNSO analyzer, FTIR, UV-Visible Spectrophotometer Cyclic Voltammetry, 60 MHz Benchtop NMR (1H, 13C), Magnetic Susceptibility Balance, Digital Polarimeter, Freeze Drier and HPLC, etc. are available. The Department of Chemistry follows, in general, the admission and qualification criteria as recommended by Higher Education of Commission of Pakistan subject to the approval by the relevant bodies of the University.

PhD in Chemistry is a 3-year program focusing on independent research and learning. The scholars are encouraged to do research in areas like natural products, organic synthesis, medicinal chemistry, colloidal chemistry, organometallics, modern materials and bioactivities among others.

### **Degree Requirements**

#### **Total Credit Hours**

The student is required to successfully complete a minimum of 30 credit hours for the degree. The details are as follows:



**Coursework**

Coursework of 18 credit hours preferably in the first year is required to be completed and followed by a Comprehensive Examination for granting candidacy as a PhD researcher. A minimum of 70% score is required to pass the Comprehensive Exam.

**Research**

After the successful completion of coursework, students are required to register for 12 credits of research work.

**Foreign Expert Evaluation**

The PhD dissertation must be approved by at least two PhD experts from technologically/academically advanced foreign countries in addition to the local Committee comprised of internal and external examiners.

**Plagiarism Test**

The Plagiarism Test must be conducted on the Dissertation before its submission.

**Open Defense**

An open defense of dissertation is an essential part of PhD program after positive evaluation.

**Research Paper**

Publication of at least one research paper, based on the research project, in an HEC-approved “X” category journal (or in an ISI-indexed impact factor carrying journal) is a requirement for the award of PhD degree.

**Copy of PhD Dissertation to HEC**

A copy of PhD dissertation (both hard and soft) must be submitted to the HEC for record in the PhD Country Directory.

**Program of Studies**

- Minimum period of completion: three years
- Maximum period of completion: five years
- Students must register for courses in each semester as per the University policy
- The Comprehensive Examination will be conducted after completion of coursework. A maximum of three attempts can be made to pass the examination
- At the end of the second semester, a student must obtain a minimum CGPA of 2.5 and must also pass all the courses in order to be promoted to the next semester for research
- A student who has earned “F” or “D” grade in a course may be allowed to repeat the same course when offered, or take one additional course, as offered by the Department, to fulfill the minimum criteria of coursework prior to the formal beginning of his/her research work

## Course Descriptions

### **CHEM 703: Quality Assurance in Research (3 credits)**

Definitions and terminology, accreditation, scope, and specification of analytical requirements; analytical strategy; non-routine analysis; sample handling and preparation; quality assurance and quality control in chemistry research, issues related to environment, equipment, reagents, traceability, measurement uncertainty, methods/procedures for calibrations, method validation, and reference materials.

### **CHEM 705: Characterization of Coordination Complexes (3 credits)**

Elemental analysis, use of ChemSketc and ChemDraw software; structural elucidation, vibrational/rotational spectroscopy, electronic spectroscopy, circular dichroism, nuclear magnetic resonance, determination of magnetic susceptibility, electron spin resonance; determination of ionic charge on metal ions; crystallography.

### **CHEM 745: Medicinal Chemistry (3 credits)**

Principles of drug design, nature and types of drug molecules, drug-receptors interactions, biochemical aspects of drug designing, new approaches to drug designing and drug delivery, categories of different drugs and mechanism of their action.

### **CHEM 746: Advances in Natural Products (3 credits)**

Recent advances in chemistry of natural products, alkaloids, terpenoids and flavonoids, and their application in various fields such as medicine, food and agriculture; antioxidant, anti-enzymatic and antimicrobial properties; advances in isolation techniques, structural elucidation, structure-activity relationship (SAR) and derivatization.

### **CHEM 762: Computational Chemistry (3 credits)**

Background, concepts and applications; different computational programs and their application to predict molecular structures, mechanisms, and structure to activity relationship; role of computational chemistry in drug discovery and other fields.

### **CHEM 763: Electroanalytical Techniques (3 credits)**

Controlled potential techniques, chronoamperometry, polarography, pulse voltammetry, AC voltammetry, stripping analysis, flow analysis, electrochemical sensors.

### **Research Work**

#### **CHEM 799: Research Thesis (12 credits)**

After the successful completion of the coursework and other requirements, a PhD scholar will conduct research under the supervision of a faculty member, and thereafter write, based on his/her research, a research thesis and submit it to the Department for evaluation. At least one research paper based on the research work has to be published in an HEC-approved journal.

## Research Projects

The Pakistan Science Foundation, Islamabad, has provided funds for a research project aimed at the isolation of natural products from a medicinal plant of Pakistan and their chemical and biotechnological studies. The principal investigator of the project is Dr Dildar Ahmed, while Dr Kauser A Malik, distinguished Professor of Biotechnology, is the co-investigator. Two groups of students under their supervision are working on this project. This has been successfully completed.

HEC Pakistan has funded a project entitled “Activity-guided isolation of bioactive chemical constituents from the medicinal plant *Carissa opaca*”. Dr Dildar Ahmed is the principal investigator of the project. A number of our MPhil/PhD students are working on various aspects of these projects.

HEC (NRPU) Project “Synthesis of novel sulfonamide derivatives as inhibitors of ecto-nucleotidases” has recently been awarded to Dr Mariya al-Rashida (Principal Investigator) and Dr Jamshed Iqbal (Co-Principal Investigator, COMSATS, Abbottabad).

## Collaboration with Other Institutions

In order for our students to avail facilities available at other institutions, collaboration has been established with institutions like HEJ Research Institute of Chemistry, PCSIR Laboratories, B&F Pharmaceutical Company, NovaMed Pharmaceuticals and Pharmagen Ltd., Lahore.



DEPARTMENT OF  
COMPUTER SCIENCE

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The Department of Computer Science currently offers one of the best BS (Hons) programs in the region. The program is accredited by NCEAC (National Computing Education Accreditation Council) of HEC. The Department is housed in the Armacost Building, and has five computing labs equipped with modern facilities of desktop computers, printers, multimedia, LAN and Wi-Fi Internet access. It has an active Computing Society and ACM Chapter.

## MS in Computer Science

The MS in Computer Science is an evening program and is in compliance with HEC guidelines. It is a 2-year program of 4 semesters comprising 30 credit hours (24 credits of coursework and 6 credits of thesis). It is aimed at preparing students not only for jobs in the industry through its state-of-the-art courses but also for academia and the pursuit of a doctoral degree through its research orientation. Specializations offered in this program are Software Engineering, Data Science, Intelligent Systems, Computational Imaging and Vision, and Information Sciences and Technology.

### Admission Criteria

Students who wish to study at the graduate level will have two options available to them: 2-year degree program or a non-degree enrollment. Criteria for these two options are as under:

#### 2-year Degree Program

In order to qualify for admissions application process, a candidate must fulfill at least one of the following four criteria:

- BS (CS/SE/IT) 4 years degree (min. 130 credit hours)
- Computer Science Conversion Course, 2-year degree referred to as MCS or MSc (CS/SE/IT)
- Science and engineering graduates with 16 years of education are eligible but have to make up deficiencies in prerequisite undergraduate coursework

All degrees must have been obtained from HEC-recognized local/foreign institutions. Final decision for admission will be based on the following criteria:

- Academic record. As a minimum academic performance, all applicants must have maintained a CGPA of at least 2.4 (on a scale of 4) or at least 60% marks in all university-level degrees
- Performance in admission test conducted by the Department
- Performance in interview. Shortlisted students may be required to appear for interview

#### Non-Degree Option

- Students not admitted to the 2-year degree program can still register for graduate courses as non-degree-seeking students

- Non-degree students must meet course and/or program prerequisites to enroll in graduate courses
- Enrollment as a non-degree student does not constitute admission to a degree program. Students can however transfer credit hours earned while on non-degree status to a degree program. The policy limits the number of hours that can be petitioned into a graduate program to 12 credit hours
- A certificate of achievement (with the grade achieved in the course) will be issued to a student after successful completion of a graduate level course
- Undergraduate students of FCCU can also enroll for the graduate courses, provided they meet the prerequisites and get permission from Graduate Studies Committee of the Department. Credits earned in graduate courses will be counted towards their bachelor's degree requirements

### Program Structure

**Duration:** Minimum 2 years (4 semesters); maximum 5 years (with permission from the Chair and Dean)

**Timing:** Evening

**Type:** Full time

### Specialization Tracks:

- Software Engineering
- Intelligent Systems
- Computational Imaging and Vision
- Information Sciences and Technology
- Data Science

### Distribution of Courses

A student will need to complete 30 credit hours of studies. These will be distributed as follows:

- 3 CS core courses of 3 credit hours each (Table 1)
- 5 CS elective courses (of 3 credit hours each), out of which at least 3 will be selected from the student's selected specialization track (Table 2). The student must declare a specialization while registering for Semester II. Any courses not related to opted specialization will count towards CS electives
- Research Thesis or Project (6 credit hours), taken in the last 2 semesters

**Table 1: CS Core Courses**

#	Code	Course Title	Credit Hours
1	COMP 501	Mathematical Methods for Computer Science	3
2	COMP 502	Advanced Algorithm Analysis	3
3	COMP 503	Advanced Theory of Computation	3

The list of electives is given below, but it is open to expansion/change. Offering (or not) of any specialization is at the Department's discretion.

**Table 2: CS Elective Courses**

<b>Specialization Track</b>	<b>Code</b>	<b>Course Title</b>	<b>Credit Hours</b>
Software Engineering	COMP 513	Advanced Software Engineering	3
	COMP 514	Software Quality Engineering	3
	COMP 515	Software Requirements Engineering	3
	COMP 516	Software Architecture	3
	COMP 518	Software Project Management	3
	COMP 519	Formal Method in Software Engineering	3
	COMP 522	Component-Based Software Engineering	3
	COMP 523	Model-Driven Software Development	3
	COMP 611	Software Evolution and Reengineering	3
	COMP 612	Software Engineering for Safety-Critical Systems	3
	COMP 617	Agent Oriented Software Engineering	3
	COMP 620	Empirical Software Engineering	3
	COMP 621	Software Process Improvement	3
Computational Imaging and Vision	COMP 531	Digital Image Processing	3
	COMP 532	Advanced Computer Vision	3
	COMP 533	Advanced Topics in Computer Vision	3
	COMP 634	3D Computer Vision	3

	COMP 635	Computational Photography	3
	COMP 636	Biomedical Image Processing	3
Intelligent Systems	COMP 532	Advanced Computer Vision (cross-listed with Computational Vision and Imaging)	3
	COMP 551	Advanced Artificial Intelligence	3
	COMP 552	Advanced Machine Learning	3
	COMP 553	Soft Computing	3
	COMP 554	Natural Language Processing	3
	COMP 555	Fuzzy Systems	3
Data Science	COMP 561	Data Mining	3
	COMP 562	Data Warehousing	3
	COMP 566	Advanced Big Data Analytics	3
	COMP 663	Information Integration on the Web	3
	COMP 664	Information Retrieval and Web Search	3
	COMP 665	Data Visualization	3
Information Sciences and Technology	COMP 571	Semantic Web	3
	COMP 572	Human and Information Interaction	3
	COMP 573	Web Services	3
	COMP 574	e-Government	3
	COMP 575	Social Network Analysis	3
	COMP 576	Ubiquitous Information Interaction	3
Free CS Electives*	COMP 581/681	Selected Topics in Computer Science	3
	COMP 582	Network Performance Modeling and Evaluation	3
	COMP 583	Parallel and Distributed Computing	3
	COMP 584	Topics in Computer Networks	3



	COMP 585	Network Security	3
	COMP 586	Operations Research	3
	COMP 587	Research Methods in Computer Science	3
	COMP 588	Advanced Operating Systems	3
	COMP 589	Advanced Optimization Methods	3
	COMP 590	Advanced Database Systems	3
	COMP 591	Advanced Topics in Mobile and Wireless Networks	3

\* In addition to courses noted here, a student can also take courses outside his/her specialization track to count towards Free CS Electives.

### Distribution of Credit Hours

**Table 3: Distribution of Credits**

Course Category	Credit Hours
Core	9
Electives	15
Thesis/Project	6
Total Credit Hours	30

### Semester-wise Plan

#### Semester 1

Sr No	Courses	Credit Hours
1	Core Course 1	3
2	Core Course 2	3
3	Core Course 3/Elective 1	3
		Total: 9

#### Semester 2

Sr No	Courses	Credit Hours
1	Elective 1/Core Course 3	3
2	Elective 2	3

3	Elective 3	3
		Total: 9

### Semester 3

Sr No	Courses	Credit Hours
1	Thesis (partial registration)	3
2	Elective 4	3
3	Elective 5	3
		Total: 9

### Semester 4

Sr No	Courses	Credit Hours
1	Thesis (full registration)	3
2		Total: 3
		Total (all semesters) = 30

### Award of Degree

For the award of MS degree, a student must have:

- Passed at least 30 credit hours of coursework, including 3 core courses and 5 electives courses
- Obtained a CGPA of at least 2.5

## Course Descriptions

### COMP 501: Mathematical Methods for Computer Science (3 credits)

*Prerequisites: Discrete Mathematics (undergraduate level; must cover the deficiency by studying with undergraduate class if not taken previously)*

Logic; sets; functions; sums; algorithms; proofs; induction; Number Theory; counting; probability; expectation; matrices; vectors; factorization; singular value decomposition; systems of linear equations; eigenvalues; polynomials; Graph Theory; Boolean algebra; optimization; basic signal processing; basic differential equations.

### COMP 502: Advanced Algorithm Analysis (3 credits)

*Prerequisites: Design and Analysis of Algorithms (undergraduate level; must cover the deficiency by studying with undergraduate class if not taken previously)*

NP completeness; search techniques; graph and tree algorithms; asymptotic analysis of complexity bounds; randomized algorithms; heuristic and approximation algorithms;

brute-force, greedy, divide-and-conquer, backtracking, branch-and-bound, pattern matching, numerical approximation algorithms.

**COMP 503: Advanced Theory of Computation (3 credits)**

*Prerequisites: Theory of Automata (undergraduate level; must cover the deficiency by studying with undergraduate class if not taken previously)*

Automata theory; formal languages; Turing machines; computability theory; reducibility, computational complexity, determinism, NP completeness, selected advanced topics.

**COMP 513: Advanced Software Engineering (3 credits)**

*Prerequisite: Software Engineering (undergraduate level; must cover the deficiency by studying with undergraduate class if not taken previously)*

Design patterns, object-oriented software engineering, aspect oriented programming, search-based software engineering, software product lines, system re-engineering, domain-specific languages, generative development, service oriented architecture.

**COMP 514: Software Quality Engineering (3 credits)**

*Prerequisites: Software Engineering (undergraduate level; must cover the deficiency by studying with undergraduate class if not taken previously)*

Testing: coverage and usage testing based on checklists and partitions, input domain partitioning and boundary testing, coverage and usage testing based on finite-state machines and Markov Chains, control flow, data dependency, and interaction testing, defect prevention and process improvement, software inspection, formal verification, fault tolerance and failure containment.

**COMP 515: Software Requirements Engineering (3 credits)**

*Prerequisites: Software Engineering (undergraduate level; must cover the deficiency by studying with undergraduate class if not taken previously)*

Elicitation techniques, goal-oriented requirements engineering, requirements specification, requirements verification and validation, management of inconsistency and conflict, requirement change control, prioritization; requirements management; requirements traceability and impact analysis.

**COMP 516: Software Architecture (3 credits)**

*Prerequisites: Software Engineering (undergraduate level; must cover the deficiency by studying with undergraduate class if not taken previously)*

Attribute-driven architectural design, architecture reuse; QAW, evaluating a software architecture (ATAM, CBAM, ARID), views and styles; refinement, software interfaces; architecture description languages, AADL: testing architectures.

**COMP 518: Software Project Management (3 credits)**

*Prerequisites: Software Engineering (undergraduate level; must cover the deficiency by*

*studying with undergraduate class if not taken previously)*

Project plans, work breakdown structures (WBS), software measurement, estimation, scheduling, resource management, team management, project monitoring and control: requirements management, verification and validation, software configuration management, risk management, change control, documentation, cutover/migration, software process improvement.

### **COMP 519: Formal Methods in Software Engineering (3 credits)**

*Prerequisites: Software Engineering (undergraduate level; must cover the deficiency by studying with undergraduate class if not taken previously)*

*Discrete Mathematics (undergraduate level; must cover the deficiency by studying with undergraduate class if not taken previously)*

Logic; theorem proving; modelling software systems, sequential, concurrent and reactive systems; state-based representations, formal specifications, completeness of specification; automatic verification, Z-Specification, structure and schema; object modeling, automatic analysis of object models.

### **COMP 522: Component-Based Software Engineering (3 credits)**

*Prerequisites: Software Engineering (undergraduate level; must cover the deficiency by studying with undergraduate class if not taken previously)*

Modeling components with UML, open component models and technology, component contracts; component specification techniques, component integration and predictable composition, service-oriented computing.

### **COMP 523: Model-Driven Software Development (3 credits)**

*Prerequisites: Software Engineering (undergraduate level; must cover the deficiency by studying with undergraduate class if not taken previously)*

Meta-modeling, object constraint language (OCL), meta-data interchange and serialization (XML), Model-Driven Architecture (MDA), software factories, model transformations, aspect-oriented model transformations, model-to-text transformations, model-to-model transformations, domain-specific languages.

### **COMP 611: Software Evolution and Reengineering (3 credits)**

*Prerequisites: Software Engineering (undergraduate level; must cover the deficiency by studying with undergraduate class if not taken previously)*

Legacy systems; architecture recovery and reconstruction, software aging, code decay, software change; software maintenance.

### **COMP 612: Software Engineering for Safety Critical Systems (3 credits)**

*Prerequisites: Software Engineering (undergraduate level; must cover the deficiency by studying with undergraduate class if not taken previously)*

System safety: risk assessment in system safety; hazard analysis techniques: Fault-Tree

Analysis, HAZOP, FME Analysis, STPA analysis; formal methods for ensuring safety; requirements analysis for safety assurance.

**COMP 617: Agent-Oriented Software Engineering (3 credits)**

*Prerequisites: Artificial Intelligence (undergraduate level; must cover the deficiency by studying with undergraduate class if not taken previously)*

*Software Engineering (undergraduate level; must cover the deficiency by studying with undergraduate class if not taken previously)*

Software agents, agent-oriented Unified Modeling Language (AUML), agent-based analysis and design, agent communication and knowledge sharing, KQML, KIF, ontology engineering, agent-based system architecture and organization.

**COMP 620: Empirical Software Engineering (3 credits)**

*Prerequisites: Software Engineering (undergraduate level; must cover the deficiency by studying with undergraduate class if not taken previously), Probability and Statistics (undergraduate level; must cover the deficiency by studying with undergraduate class if not taken previously)*

Qualitative methods, statistical methods, simulations, empirical strategies: experiments, case studies, surveys, focus groups, systematic literature reviews; missing data handling, data analysis; reporting; building theories; ethics.

**COMP 621: Software Process Improvement (3 credits)**

*Prerequisites: Software Engineering (undergraduate level; must cover the deficiency by studying with undergraduate class if not taken previously)*

Process modeling techniques, UML, CMM, CMMI, PSP and TSP, process changes using PDCA and IDEAL models, process assessments, base-lining, and benchmarking, quality metrics.

**COMP 531: Digital Image Processing (3 credits)**

*Prerequisites: COMP 501 Mathematical Methods in Computer Science*

2D signal processing techniques (2D convolution and filtering), image enhancement (noise removal, edge sharpening, etc.), image filtering, image compression, segmentation, visual feature extraction, object detection and classification, motion estimation.

**COMP 532: Advanced Computer Vision (3 credits)**

*Prerequisites: COMP 501 Mathematical Methods in Computer Science*

Early, intermediate and high level vision, region splitting and merging; quadtree; mean and variance pyramids; computing the first and second derivatives of images using the isotropic, Sobel and Laplacian operators; Hough transform; perceptual grouping; perceptual criteria; relaxation labeling of images: detection of image features; grouping of contours and straight lines into higher order features.

**COMP 533: Advanced Topics in Computer Vision (3 credits)**

*Prerequisites: COMP 532 Advanced Computer Vision*

Low-level vision, geometrical and 3D vision, stereo, 3D scene reconstruction, motion analysis, visual tracking, object recognition; human motion analysis, video processing, vision-based interaction.

**COMP 634: 3D Computer Vision (3 credits)**

*Prerequisites: COMP 532 Advanced Computer Vision*

2D projective geometry. 2D homography; camera models and calibration; epipolar geometry; 3D reconstruction; triview tensor; self-calibration; multiview geometry, correspondence estimation, multiview stereo, optical flow, semantic reconstruction, style and content separation.

**COMP 635: Computational Photography (3 credits)**

*Prerequisites: COMP 531 Digital Image Processing*

Cameras, image formation, visual perception, image and video processing image manipulation (warping, morphing, mosaicing, matting, compositing), high dynamic range imaging, image-based lighting, image-based rendering, non-photorealistic rendering.

**COMP 636: Biomedical Image Processing (3 credits)**

*Prerequisites: COMP 531 Digital Image Processing, COMP532 Advanced Computer Vision*

Study techniques to enhance and analyze 2D and 3D data generated from various medical imaging methods. e.g., X-ray, magnetic resonance imaging (MRI), electroencephalography (EEG), magnetoencephalography (MEG). Topics include acquisition, filtering, de-noising, coding, feature extraction and modeling of medical imaging data as well as machine learning on medical images.

**COMP 551: Advanced Artificial Intelligence (3 credits)**

*Prerequisites: Artificial Intelligence (undergraduate level; must cover the deficiency by studying with undergraduate class if not taken previously)*

Search, machine learning, reasoning, planning, probabilistic reasoning, reinforcement learning, evolutionary computation, advanced neural networks, natural language processing, constraint satisfaction, knowledge-based learning, robotics, emergent behavior, multi-agent systems.

**COMP 552: Advanced Machine Learning (3 credits)**

*Prerequisites: COMP 501 Mathematical Methods for Computer Science*

Supervised learning; logistic regression; perceptron; generative learning algorithms; Gaussian discriminant analysis; support vector machines; model selection and feature selection; evaluating learning algorithms; bias/variance tradeoff; K-means clustering; EM algorithm; factor analysis; PCA (principal components analysis); ICA (independent components analysis); reinforcement learning and control.

**COMP 553: Soft Computing (3 credits)**

*Prerequisites: Artificial Intelligence (undergraduate level; must cover the deficiency by studying with undergraduate class if not taken previously)*

Fuzzy Set Theory: fuzzy logic, fuzzy rules/relations, decision making with fuzzy information, single-layer networks, multi-layer perceptron, radial basis functions, parameter optimization algorithms, Bayesian Nets: neuro-fuzzy systems; evolutionary computation; genetic fuzzy systems: decision tree learning, evaluating hypotheses, instance-based learning.

**COMP 554: Advanced Natural Language Processing (3 credits)**

*Prerequisites: Discrete Mathematics (undergraduate level; must cover the deficiency by studying with undergraduate class if not taken previously)*

Study different approaches to build systems for semantic understanding natural language. Understanding of natural language-processing tools like POS-tagger, sentence parser, named-entity recognizer, etc; design of automatic systems for tasks like machine translation, question-answering, dialogue, summarization, sentiment analysis, opinion mining etc.

**COMP 555: Fuzzy Systems (3 credits)**

*Prerequisites: Discrete Mathematics (undergraduate level; must cover the deficiency by studying with undergraduate class if not taken previously)*

Fuzzy sets; operations on fuzzy sets; fuzzy relations and the Extension Principle; fuzzy logic and approximate reasoning; fuzzy rule base and fuzzy inference engine; fuzzy systems as nonlinear mappings; approximation accuracy of the fuzzy system; design of fuzzy systems from input-output data; fuzzy linear programming.

**COMP 561: Data Mining (3 credits)**

*Prerequisites: COMP 501 Mathematical Methods for Computer Science*

Data pre-processing (noisy and missing data, data normalization and discretization), outlier detection, association rule mining, clustering, classification, fuzzy logic, genetic algorithm, Bayesian networks, and neural network, decision trees, rules, patterns and trends.

**COMP 562: Data Warehousing (3 credits)**

*Prerequisites: Database Systems (undergraduate level; must cover the deficiency by studying with undergraduate class if not taken previously)*

Designing multi-dimensional data model, cleansing and loading of data, determining refresh cycles and methods, efficient data retrieval using bitmap and join indexes, reporting, ad hoc querying, slicing, dicing, pivoting, drill-down, and roll-up operations; association rules, and visualization.

**COMP 566: Advanced Big Data Analytics (3 credits)**

*Prerequisites: Probability and Statistics (undergraduate level; must cover the deficiency by studying with undergraduate class if not taken previously)*

Topic modeling, structure learning, time-series analysis, learning with less supervision, and massive-scale data analytics.

**COMP 663: Information Integration on the Web (3 credits)**

*Prerequisites: COMP 554 Advanced Natural Language Processing, Artificial Intelligence (undergraduate level; must cover the deficiency by studying with undergraduate class if not taken previously)*

Semantic web (RDF, OWL, SPARQL), linked data and services, mash-ups, theory of data integration, schema mappings, record/entity linkage, data cleaning, source modeling, and information extraction.

**COMP 664: Information Retrieval and Web Search (3 credits)**

*Prerequisites: COMP 502 Advanced Algorithm Analysis*

Search engine evaluation, crawling, identifying duplicates, information retrieval, processing text, lexicon construction, normalization, inverted index, YouTube search engine, Google query, page rank, search engine advertising, map/reduce, spelling correction.

**COMP 665: Data Visualization (3 credits)**

*Prerequisites: COMP 502 Advanced Algorithm Analysis*

Pattern discovery; pattern-based classification; scalable pattern discovery methods, pattern evaluation measures, sequential patterns, sub-graph patterns.

**COMP 571: Semantic Web (3 credits)**

*Prerequisites: Nil*

Data modeling techniques, relational models, semi-structured data, XML, XPath, XQuery, RDF, RDFS, formal ontologies, web ontology language OWL, SPARQL, embedded semantics, micro format, linked open data, cloud and semantic data integration.

**COMP 572: Human and Information Interaction (3 credits)**

*Prerequisites: Nil*

Information resources; vocabularies; information interaction in search engines, digital libraries; search techniques; web search; information seeking behavior; user modelling; evaluation of search sources and results; result presentation to users.

**COMP 573: Web Services (3 credits)**

*Prerequisites: Nil*

Mark-up languages; APIs for developing web services; web service standards; service description languages; service publishing; service discovery; services composition; web services management.



**COMP 574: E-Government (3 credits)**

*Prerequisites: Nil*

Overview of trends driving the development of government/non-profit web site and analysis; citizen centric web design; overview of key of e-government practices and applications: citizen to government, business to government, government to government; policy issues in e-government: public access and government transparency, privacy and security issues; IT management for governments and non-profits.

**COMP 575: Social Network Analysis (3 credits)**

*Prerequisites: Nil*

Introduction to social networks; random network models; identifying connected components; giant component; average shortest path; diameter; preferential attachment; network centrality; betweenness; closeness; clustering; community structure; modularity; overlapping communities; small world network models; contagion; opinion formation; applications of social network analysis; social media networks.

**COMP 576: Ubiquitous Information Interaction (3 credits)**

*Prerequisites: Nil*

Information interaction; seminal ideas of ubiquitous computing; tangibility and embodiment; social computing; privacy; critical and cultural perspectives; mobility and spatiality; mobile technology in the messy now; infrastructure; seams, seamlessness, seamfulness; evaluating interaction of ubicomp systems.

**COMP 581/681: Selected Topics in Computer Science (3 credits)**

*Prerequisites: will be stated when the course is offered*

This course covers topics of current interest in Computer Science which are not being covered in other courses.

**COMP 582: Network Performance Modeling and Evaluation (3 credits)**

*Prerequisites: Computer Networks (undergraduate level; must cover the deficiency by studying with undergraduate class if not taken previously)*

*Probability and Statistics (undergraduate level; must cover the deficiency by studying with undergraduate class if not taken previously)*

Probability; random variables; Markov Chains; the Poisson Process; Markov Processes; Queuing Theory; modeling complex communication networks; congestion control analysis, end-to-end analysis, multiple access control, wireless networks, ad-hoc networks, discrete event simulation, performance analysis tools.

**COMP 583: Parallel and Distributed Computing (3 credits)**

*Prerequisites: Computer Networks (undergraduate level; must cover the deficiency by studying with undergraduate class if not taken previously)*

Amdahl's Law, multiprocessors (shared memory), networks of workstations (distributed memory), clusters; threads and shared memory, processes and message passing,

distributed shared memory (DSM), distributed shared data (DSD); parallel algorithms, concurrency and synchronization, data and work partitioning, load balancing.

### **COMP 584: Topics in Computer Networks (3 credits)**

*Prerequisites: Computer Networks (undergraduate level; must cover the deficiency by studying with undergraduate class if not taken previously)*

QoS; scheduling for best-effort and guaranteed services, web protocols, network interface design, optical networking, route lookup algorithms; router architecture; Internet routing protocols, integrated and differentiated network service models; traffic engineering (TE), constraint-based routing algorithms; multi-protocol label switching; quality of service mechanisms for multimedia and real-time communications.

### **COMP 585: Network Security (3 credits)**

*Prerequisites: Computer Networks (undergraduate level; must cover the deficiency by studying with undergraduate class if not taken previously)*

Cryptosystems; encryption techniques; stream and block ciphers; DES; the advanced encryption standard; confidentiality; message authentication: hash functions; public key encryption; RSA; digital signatures; key management schemes; dial-up security; e-mail security, PGP, S-MIME; Kerberos and directory authentication; emerging internet security standards; SET; SSL and IPsec; VPNs; firewalls; viruses; miscellaneous topics.

### **COMP 586: Operations Research (3 credits)**

*Prerequisites: Probability and Statistics (undergraduate level; must cover the deficiency by studying with undergraduate class if not taken previously)*

Mathematical modeling; linear program models, simplex method, sensitivity analysis, specialized LP models; network-based models, shortest path, min weight spanning tree, max flow, PERT/CPM; decision models, dynamic programming, games theory; probabilistic models, expected return models, Markov chains, stochastic processes.

### **COMP 587: Research Methods in Computer Science (3 credits)**

*Prerequisites: Probability and Statistics (undergraduate level; must cover the deficiency by studying with undergraduate class if not taken previously)*

Experiment design, writing short and long papers, thesis writing, grant writing, reading papers, paper review, case studies, data processing, statistics, multidisciplinary research, graphs and visualization; modeling; abstraction; feature selection; logic; axioms; complexity; experimentation; simulation; testing.

### **COMP 588: Advanced Operating Systems (3 credits)**

*Prerequisites: Operating Systems (undergraduate level; must cover the deficiency by studying with undergraduate class if not taken previously)*

Characterization of modern operating systems; file systems, memory management techniques, process scheduling and resource management, architectural models,

inter-process communication, distributed systems, concurrency control coordination, replication, fault-tolerance, mobile and ubiquitous systems.

**COMP 589: Advanced Optimization Methods (3 credits)**

*Prerequisites: Discrete Mathematics (undergraduate level; must cover the deficiency by studying with undergraduate class if not taken previously)*

Convex sets, convex functions and convex optimization; quadratic optimization, combinatorial optimization; geometric and semi definite optimization; duality; computational complexity and NP completeness; unconstrained optimization; constrained optimization; discrete optimization, multi objective optimization.

**COMP 590: Advanced Database Systems (3 credits)**

*Prerequisites: Database Systems (undergraduate level; must cover the deficiency by studying with undergraduate class if not taken previously)*

Modern database management system architectures; high-performance transaction processing systems (OLTP); large-scale analytical systems (OLAP); Advanced SQL; object-oriented and relational databases; XML; Query optimization; concurrency; recovery; efficiency and correctness of implementation.

**COMP 591: Advanced Topics in Mobile and Wireless Networks (3 credits)**

*Prerequisites: Computer Networks (undergraduate level; must cover the deficiency by studying with undergraduate class if not taken previously)*

Cellular systems, medium access control, radio propagation models, error control techniques, handoff, power control, common air protocols, radio resource and network management.



DEPARTMENT OF  
ECONOMICS

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Established in 1915, the Department of Economics at Forman Christian College (A Chartered University) has long offered undergraduate and Postgraduate degree programs. In 2004, the Department started a 4-year BSc (Hons) degree in Economics which is now one of the most popular degree programs at the University. Currently, more than 400 Baccalaureate students are majoring in Economics and around 3,200 students attend Economics courses each year.

The Department of Economics is well-equipped with major academic needs such as lecture halls, seminar rooms, classrooms, meeting rooms, workshop rooms, a computer lab and faculty offices. It continues to meet challenges by updating and revising its curricula, introducing new programs and adding new scholars to teach contemporary courses.

## **MPhil Applied Economics**

This is a 2-year program following the completion of 16 years of education i.e. BSc (Hons) or conventional MA/MSc Economics. After completion of MPhil, a student will have exposure to those courses and skills which are helpful to pursue a doctoral program or enter the teaching/research professions.

The MPhil Applied Economics consists of two semesters (27 credit hours) of coursework. In the summer term, MPhil Applied Economics students choose their advisors and prepare a research proposal. In the second year, students focus their efforts on the MPhil research thesis (12 credit hours) under the supervision of a PhD faculty member.

### **Degree Requirements**

Following requirements must be fulfilled by the students in order to qualify for recommendation by the faculty for the award of MPhil Applied Economics degree:

- Satisfactory completion of 39 credit hours with CGPA of 2.5 or better. 18 are earned through core courses and 9 through electives offered by the Department
- During the third semester of the program, students are required to carry out research on a topic of their choice under the guidance of a supervisor. The research thesis will be of 12 credits hours
- The student must be a full-time student during the coursework
- The thesis will be evaluated by an external expert and will be defended before a committee
- The thesis must be of publication-acceptable standards
- The University grading system will apply to this degree
- All other rules and regulations will apply as per Department and University policy

### **Areas of Specialization**

The Department focuses on limited but in-demand areas to ensure quality education and research training. More areas may be added as the need arises. The following areas of

specialization are currently offered:

- Applied Econometrics
- Environmental and Resource Economics
- Development Economics

## Course Descriptions

### Core Courses

#### **ECON 501: Advanced Microeconomics (4 credits)**

Based on the model-building approach. Students learn rigorous theoretical modeling and decision-making behavior of consumers and firms under certainty and uncertainty.

#### **ECON 502: Advanced Macroeconomics (4 credits)**

Focuses on the economic behavior of different economic aggregates in an economy and its interaction with world economy. Evaluates different stabilization policies to dampen the fluctuations in economic activity.

#### **ECON 505: Applied Econometrics (4 credits)**

Trains students in theoretical and practical discourse of econometrics and provides them knowledge of issues regarding application of various estimation techniques under different sets of information and assumptions.

#### **ECON 625: Advanced Econometric Techniques and Forecasting (3 credits)**

Focuses on advanced topics of econometrics that are useful to understand current published research literature and to develop research ability among students at graduate level. Students learn theoretical as well as application of advanced econometric techniques

#### **ECON 655: Applied Economics (3 credits)**

Designed to teach model building based upon economics and econometrics. Build up quantitative research skills in students about computer softwares on spreadsheet analysis and econometrics.

### Elective Course:

**Note:** Optional courses are decided by the Department of Economics each year. Students are required to take 3 electives for a total of 9 credit hours. Please check with the Department for available courses.

### Areas of Specialization

The Department focuses on limited but in-demand areas to ensure quality education and research training. More areas may be added as the need arises. The following areas of specialization are currently offered:

- Applied Econometrics
- Environmental and Resource Economics
- Development Economics
- Monetary Economics
- International Economics

**ECON 699: Research Thesis (12 credits)**

Each MPhil student will carry out research on a topic of their choice under the guidance of a supervisor. Guidelines about the research will be provided by the supervisor. The student has to submit the approved thesis to the supervisor for internal and external evaluation within the time period as prescribed in the University Calendar.



DEPARTMENT OF  
ENGLISH

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The connection between Forman Christian College (A Chartered University) and the teaching of English has a very long history. FCCU evolved from the Mission School which was established in 1849 as the first English-medium school in Lahore. By 1901, FCC had started English MA classes. The English Department has benefitted from the teaching of great scholars such as Dr HC Velte, Dr FM Velte, Rev HD Griswold, Dr EJ Sinclair and Dr SL Sheets. The graduates of the English Department have distinguished themselves as writers, poets, civil servants, judges, lawyers, diplomats, politicians, and entrepreneurs.

Having offered a 4-year BS Honors degree in English for the last 10 years, this is an appropriate time to offer a higher degree. The MPhil English program will allow graduates and in-service professionals to upgrade their qualifications in English. As an evening program, many current teachers will be able to benefit from it. MPhil graduates will be equipped with analytical and critical research approaches to face the challenges of today's world. The program will carry on FCCU's rich legacy of research and quality teaching.

## MPhil English

The MPhil English program is an evening program and is aimed both at students continuing their education as well as in-service practitioners who want to upgrade their qualifications. The program has a number of objectives. It will advance the levels of English communication and fluency skills within Pakistan and develop well-groomed leadership for research and publication in English. It will improve philological and pedagogical practices in English in the country and enhance ethical values by ensuring original work in the field. It will emphasize the importance of English language and literature through both local and global interactions.

### Program Structure

- Successful completion of coursework, seminars and thesis (30+6=36 credit hours). MPhil students complete 6x3=18 credit hours of core courses and 12 credit hours of electives + 6 credit hours of research (36 credit hours)
- Successful defense of thesis before an external examiner and departmental committee
- Qualifying grade=3 out of 4, equivalent to “B” (acceptable internationally and nationally by HEC)
- Comprehensive Examination to be passed before the thesis is submitted in the 4th semester

**Note:** A student will not be awarded a degree or transcript if he/she decides to drop out of the program at any time or for any reason during the two years or fails to submit his/her thesis.

## Degree Requirements

MPhil English is a 2-year program consisting of four semesters – three semesters of coursework followed by one semester of thesis writing. Coursework includes core and elective courses.

### Core Courses:

ENGL 501: Research Methods and Publishing (3 credits)

ENGL 510: Transcultural Literary Texts and Contexts (3 credits)

ENGL 511: Translation Studies: Theory and Practice (3 credits)

ENGL 520: Critical Theory and Praxis I: Society and Culture (3 credits)

ENGL 521: Critical Theory and Praxis II: Text and Language (3 credits)

ENGL 690: Special Research Seminar (3 credits)

**Semester 1:** 3 core courses of 3 credit hours each – total 9 credit hours

ENGL 501, ENGL 511, ENGL 520

**Semester 2:** 3 core courses of 3 credit hours each – total 9 credit hours

ENGL 510, ENGL 521, ENGL 690

**Semester 3:** 4 elective courses of 3 credit hours each – total 12 credit hours

ENGL 515, ENGL 516, ENGL 525, ENGL 610, ENGL 615, ENGL 616, ENGL 617, ENGL 618

**Semester 4:** Compulsory thesis (ENGL 699) and viva of 6 credit hours

**Total:** 36 credit hours

## Course Descriptions

### ENGL 501: Research Methods and Publishing (3 credits)

Preparing and designing research projects, writing research papers and preparing for publishing; basic understanding of conducting research in literature; understanding and critiquing various research methodologies; identifying and selecting a methodology; skills for presenting research at academic and literary forums; formatting and documenting research through citations, bibliographies (MLA); attending workshops, seminars and discussions; preparing for thesis supervision on one-to-one basis at the end of degree.

### ENGL 510: Transcultural Literary Texts and Contexts (3 credits)

Exploring interconnectedness through globalized mobility; transcultural and transnational perspectives of literary and nonliterary writings in English by diverse socio-cultural groups; reading a range of voices across continents to reflect outside own cultural bearing to imagine the belonging of others; includes some Anglo-American classics along with selections from the Caribbean, China, Africa, Canada, Australia and other hinterlands, offering a good comparative study on colonial/postcolonial dynamic to train thinking

beyond rigid ideologies; enabling readers critique independently texts and contexts that involve representative transcultural exchanges by deconstructing binary or oppositional paradigms in terms of race, class, ethnicity, gender or nationality.

### **ENGL 511: Translation Studies: Theory and Practice (3 credits)**

Introducing major concepts in translation theory; focusing on their application to translation practice; cognitive and critical parameters allow readers to study a wide range of literature across cultures and engage with practicing translation skills; comprehensive overview of discipline of translation studies to create awareness of diversity of possible approaches to translation and relationships between these approaches.

### **ENGL 515: South Asian Literary Genres (3 credits)**

#### *Elective*

Understanding diversity of South Asian culture and history by studying various genres from its literature, including drama, short story, film, autobiography and folk genres; identifying particulars of one or more literary genres by specific characteristics of cultural and social context of time of writing; writing research paper on one particular genre and/or preparing a comparative analysis of various genres; sources include texts from various South Asian vernaculars in English translation.

### **ENGL 516: Minority Literature(s) in English (3 credits)**

#### *Elective*

Issues and paradigms related to literature representing minorities across the world; understanding the term 'minority' and how it is used in tagging certain classes, ethnicity, religious factions and instigating discriminatory and paradoxical notions of 'inclusive' vs 'exclusive' through identity politics; sources include representation of minorities in selected contemporary American, South Asian, British and diasporic literature and film; selection of texts and/or choice of focusing on a specific country/region based on discretion of instructor and interests of students.

### **ENGL 520: Critical Theory and Praxis: Society and Culture – Part 1 (3 credits)**

**(Note:** The course is divided into two major groups of theories due to the complex nature of the texts and availability of the time. The groups are not chronologically or historically formed but are based on the correlation and association of the critical theories investigated.)

Introducing a wide range of canonical 20th century critical theories and methodologies/frameworks; inculcating essential critical and analytical thinking for research thorough discursive approach; part I covers psychoanalysis, Marxism, feminism, gender studies, race studies, Queer Theory, The New Historicism, and Postcolonial Theory via exposure to original texts as well as materials from literature, film and pop culture to comprehend process of hermeneutics and praxis; theorizing, criticizing, and interpreting theoretical/critical paradigms from diverse standpoints.

### **ENGL 521: Critical Theory and Praxis: Text and Language – Part 2 (3 credits)**

Reading a particular text; language construction and use to create ideologies within societies; theories including The New Criticism, Russian Formalism, Semiotics and Structuralism, Post-Structuralism, Frankfurt Critical School, Deconstruction, and Reader-Response Theory; ability to develop critical and analytical sensitivity towards language and its manifestations within society; investigation of transfiguration and development of language across diverse historical and spatio-temporal frameworks.

### **ENGL 525: Literary Stylistics (3 credits)**

*Elective*

Stylistic analysis of literature; focus on all three main genres (poetry, prose fiction and drama); examining poetry and patterns of lexis, phonetic and metrical organization and relationship to meaning; examining fiction through narratology, style variation and speech and thought representation; examining drama through pragmatics, considering topics such as patterns in turn-taking and their relationship to roles and functions of characters, speech act analysis and styles of politeness behavior; social and cultural context of all genres.

### **ENGL 610: Digital Approaches to Literature (3 credits)**

*Elective*

Investigating theoretical and practical role of digital approaches to literary works and their forms; looking into future possibility of digital literariness by exploring new literary and linguistic dimensions, their changing borders and broadening domains along with their innovative production that affects the experience of reading; tracing the role and engagement of electronic devices in English literary studies by asking questions like how digital and electronic methods shape the scope of English literary expression differently.

### **ENGL 615: British Women Writers (3 credits)**

*Elective*

Introduction to British women writers in multiple genres; analysis of relationship between women's practice of literary genres and socio-cultural milieu; emphasis on women writers' particular experimental narrative strategies and manipulation of the dominant language that created an alternative and distinct women's literary tradition; socio-economic factors that influenced production and reception of women writers in the market.

### **ENGL 616: American Literature (3 credits)**

*Elective*

Detailed study and analysis of development of different literary forms, themes, and evolution of American English in the United States; in-depth survey and exploration of leading developments in different genres in American literature (poetry, novel, short story, drama, and non-fictional prose) in the United States in different ages; possible selections (based on instructor's choice) can be: 1) American literature from 1820-1865, intensive examination of the formative period (often called the American Renaissance) of American

literature as well as life and culture; 2) American literature from 1865-1918, representing the transition from Anglo-European literary traditions to Americanized language and literary forms; 3) American literature from 1918 onwards, covering modernism, postmodernism and anti-postmodernism.

### **ENGL 617: Modern to Contemporary Continental Drama (3 credits)**

#### *Elective*

Exploring experiments in modern to contemporary continental drama; avant garde effects of 20th century and changing types; investigating dominant dramaturgical traditions in history of Western drama, theater and performance; improvisation challenging plot, characterization, language, setting, movement; Ibsen as pioneer of modern drama and his genius to substantiate human experience; various dramatists and their disapproval of conventional morality, religion or other accepted mores of their times; their radicalism in form and philosophy of art, concerns about families in crises, inspiration for human sentiment, devotion to Marxist or other ideas and ideologies; conflicts of diverse cultural backgrounds.

### **ENGL 618: Aesthetics and Poetry (3 credits)**

#### *Elective*

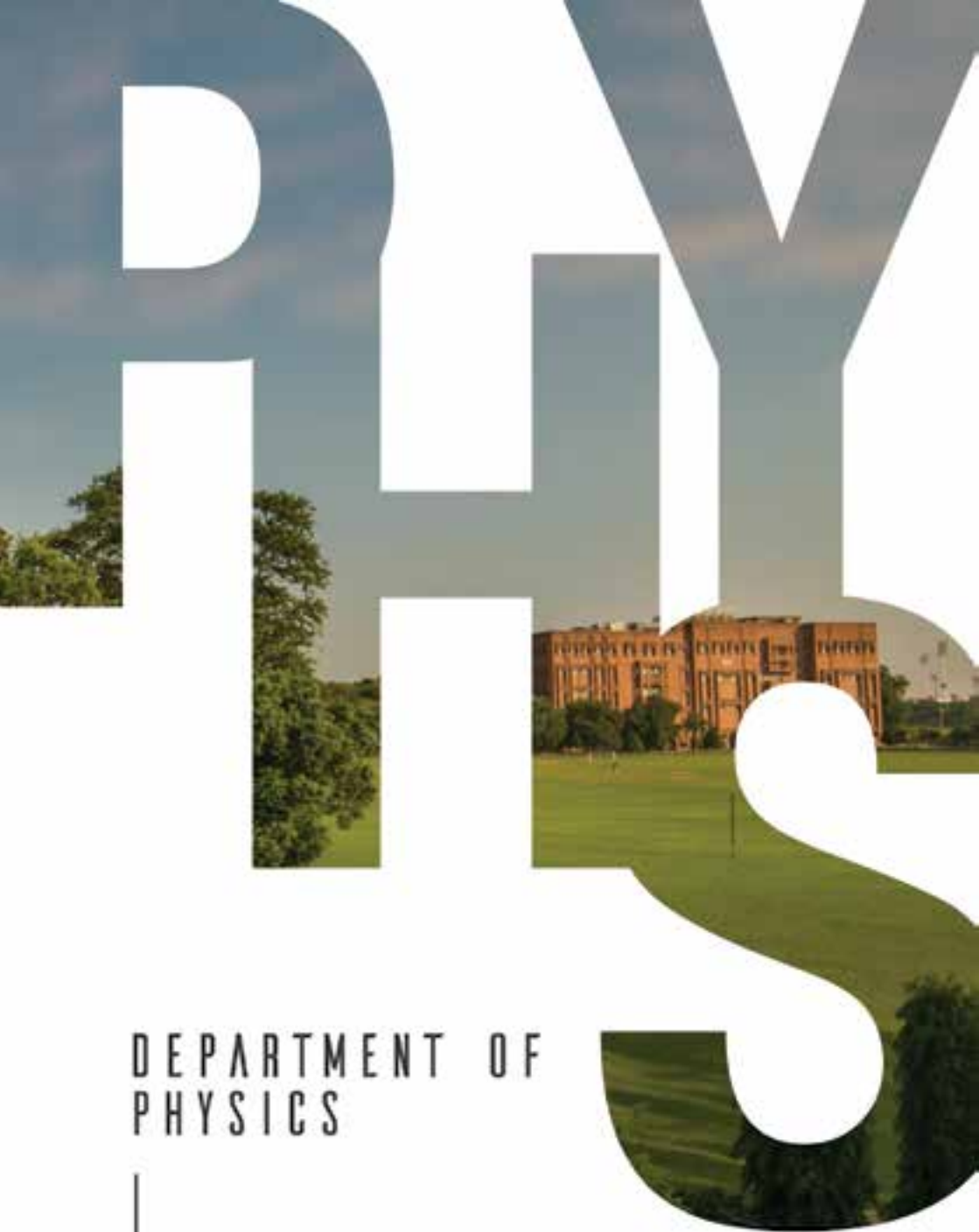
Changing concepts of aesthetic values in poetry in different ages; critical discussion of Modernism; modernist aesthetic characterized by dislocation or abstraction of elements from nature into invented and autotelic artifact; dramatic shift from temporal aesthetic of Romantics to poetics of space in; relationship of an aesthetics of release and enduring forces of restraint.

### **ENGL 690: Special Research Seminar (3 credits)**

Preparing to conduct research independently and learning from and engaging in critical academic discussions; weekly seminars with regular attendance and interaction with academics and experts invited as guest speakers specializing in a specific area of literary studies, Critical Theory or any interdisciplinary area; preparing and presenting two major research papers (6,000 words each) focusing on two different topics covered during these interactions.

### **ENGL 699: Thesis and Viva (6 credits)**

One-to-one supervision through guided academic writing practice and weekly tutorials given by an assigned thesis supervisor. Students are encouraged to prepare drafts of continuous writing (thesis chapters), on which the supervisor will give detailed feedback along with guidance on further readings. Students are expected to learn critical thinking and argumentation skills, apply research skills, develop a theoretical framework, and learn the significance of the theory and its application. There will be a Comprehensive Exam before thesis submission. Finally, students are expected to prepare a thesis of at least 30,000 words following MLA style to be submitted at the end of the final semester. The thesis will be evaluated by the external examiner and students will present a public defense to complete the requirements for thesis assessment.



DEPARTMENT OF  
PHYSICS

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Physics has been taught at Forman Christian College (A Chartered University) since it was established in 1864. The Physics Department was instituted in 1907 with Prof DJ Fleming, who was its first Head. A long line of distinguished professors and prominent scientists have served at this Department, including Nobel Laureate Dr Arthur Compton, Prof JM Benade and Dr Piara Singh Gill. Dr Compton conducted most of his research on cosmic rays while a faculty member at FCC, which led to his receiving the Nobel Prize for Physics in 1927. Prof JM Benade was one of the longest serving professors in the Department, eventually retiring as its Head in 1970. He was an active researcher and the Asian representative in Dr Compton's international research team. Dr Compton's student Dr Piara Singh Gill was a faculty member at FCC from 1940 to 1947 and active in research. He was associated with the University of Chicago and the Georgia Institute of Technology. All these scientists and professors have made significant contributions to the field of Physics.

Today, the well-qualified and experienced faculty is involved in various research programs. The last few years have been busy and productive for the Department. At the undergraduate level, we have established 4-year degrees in Physics and Environmental Sciences. The Department has now launched an MPhil Physics program, keeping in view the needs of Pakistan to upgrade the state of its industries, educational institutions and other services sectors, to compete in the modern world and meet new challenges.

The students of Physics Department, besides continuing with PhD studies, can find employment prospects in the Atomic Energy Commission, defense production units and laboratories, PCSIR, PIA, telecom, power industries, and educational institutions in the private and public sectors. Important employment fields are nuclear medicine, diagnostics, radiotherapy and imaging, energy, environment and climate change.

The Physics Department is located in the Armacost Science Building, having four undergraduate teaching labs, three research labs, a darkroom, a workshop, a research library, and experimental equipment. This includes 4K cryogenic vacuum chamber with temperature monitors and controllers, ellipsometer, digital optical microscope for surface morphology studies, lock-in amplifiers, Tesla meters, laser interferometer with optoelectronic coupling, high temperature three-stage programmable furnace, UV visible spectrophotometer and centrifuge, etc.

## MPhil Physics

The MPhil Physics is a two-year program consisting of two semesters of coursework followed by two semesters of research. Coursework includes core courses and electives. Research is conducted in experimental material science, nanophysics and nanotechnology and theoretical physics. The program consists of four regular semesters of 40 credit hours in total. 24 credit hours of coursework must be completed in the first two semesters while

the 3rd and 4th semesters will be dedicated to research. Limited teaching assistantships are available.

### Degree Requirements

The MPhil Physics is a two-year program consisting of 2 semesters of coursework followed by 2 semesters of research. Coursework includes core courses and electives. Research will be conducted in the following fields:

- Experimental Material Science, Nanophysics and Nanotechnology
- Theoretical Physics

A total of 40 credit hours: 24 credit hours of coursework in first two semesters. Students must maintain a minimum of 3.0 CGPA in coursework. The last two semesters will be dedicated to research on a theme chosen in consultation with the research supervisor.

#### Semester 1 (12 credits)

PHYS 501: Methods of Mathematical Physics	3 credits
PHYS 504: Advanced Condensed Matter Physics	3 credits
PHYS 505: Advanced Electrodynamics	3 credits
Elective 1	3 credits

#### Semester 2 (12 credits)

Elective - 2	3 credits
Elective - 3	3 credits
Elective - 4	3 credits
PHYS 510: Experimental Techniques	3 credits

At the end of the second semester there will be a Comprehensive Examination based on the core courses studied in the two semesters. Two additional elective courses will be included in consultation with the supervisor from the research interest area and the Department Chair. Every student enrolled in MPhil Physics must pass this examination for continuing in the second year. A maximum of 2 attempts are allowed to pass the Comprehensive Examination.

#### Semesters 3 and 4 (16 credits)

PHYS 696: Seminar (2)	2 credits
PHYS 699: Research Thesis	14 credits

**Note:** Candidates may be required to take a number of non-credit undergraduate courses if the research supervisor so desires, in consultation with the faculty advisor and chair of the concerned department.



## Course Descriptions

### Core Courses

#### **PHYS 501: Methods of Mathematical Physics (3 credits)**

Linear differential equations and special functions; separation of coordinates; series solution; Wronskian; two regular singular points; three regular singular points; hypergeometric series; asymptotic series; one regular and one irregular singular point; integral representations; Green's functions; types of boundary conditions; differential equations and Green's functions; source points and boundary points; Green's functions for steady waves; wave equation; diffusion equation.

#### **PHYS 504: Advanced Condensed Matter Physics (3 credits)**

Symmetry and physical properties of crystals; point groups; band theory of solids; hartree approximation; nearly free electron model; tight binding methods; cellular methods; augmented plane waves; orthogonalised plane wave; pseudo-potential technique and model potentials; Fermi surface studies; superconductors; BCS theory; quantum hall effect; high magnetic fields; cyclotron resonance; high-field magneto-resistance; open orbits; magneto-acoustic oscillations; De-Haas Van Alphen effect.

#### **PHYS 505: Advanced Electrodynamics (3 credits)**

Maxwell's equations; gauge transformation; Poynting vector; conservation laws; plane electromagnetic waves in a nonconducting and conducting medium; polarization; propagation in a dispersive medium; reflection and refraction; total internal reflection; radiation by moving charges; Lienard-Wiechert potentials and fields; general angular and frequency distributions of radiation from accelerated charges; Thompson scattering; Cherenkov radiation; fields and radiation of localized oscillating sources; electric dipole fields and radiation; magnetic dipole and electric quadrupole fields; multi-pole fields; multi-pole expansion of the electromagnetic fields; angular distributions; sources of multi-pole radiation; spherical wave expansion of a vector plane wave; scattering of electromagnetic wave by a conducting sphere.

### Compulsory Courses

All students must take the following courses but they are not included in the Comprehensive Examination.

#### **PHYS 510: Experimental Techniques (3 credits)**

High vacuum techniques; physical principles of diffusion and rotary pumps; ultra high vacuum by ionization; sorption and cryogenics; measurement of pressure; leak detection; X-ray; electron and neutron diffraction techniques; methods of recording diffraction patterns; examples of structure determination; analysis of results' characterization techniques.

**PHYS 696: Seminar (2 credits)**

2 seminars related to the research project.

**PHYS 699: Research Project (14 credits)**

MPhil research thesis based on research to be submitted to the university and evaluated by the Departmental Committee and an external examiner

**Elective Courses**

**Note:** Elective courses depend on availability and workload of faculty.

**PHYS 502: Advanced Quantum Physics (3 credits)**

Approximate methods: time independent perturbation theory for non-degenerate and degenerate levels; variational method; WKB approximation; time dependent perturbation theory; identical particles and second quantization: indistinguishability of identical particles; systems of identical particles; quantum dynamics of identical particle systems; statistics; symmetry of states; fermions; bosons; Theory of Scattering: scattering experiments and cross sections; potential scattering; method of partial waves; Born's approximation; the interaction of quantum systems with radiation: electromagnetic field and its interaction with one electron system; transition rates; spontaneous emission; selection rules for electric dipole transitions; spin of photon and its helicity; relativistic quantum mechanics: Schrödinger relativistic equation; probability and current densities; Klein-Gordon equation and hydrogen atom; Dirac relativistic equation.

**PHYS 507: Nanophysics and Nanotechnology I (3 credits)**

Introduction to nanoscale science and technology; quantum nature of nanoworld; solid states with nanocrystalline structures; properties of individual nanoparticles; nanofabrication and nanoanalysis; self-assembly and catalysis; nanowires, fabrication and electrical conduction of nanowires; nanotubes and the crystalline forms of carbon; crystal and electronic structure of nanotubes; growth mechanism of carbon nanotubes and their applications; structure and production of fullerenes.

**PHYS 508: Nanophysics and Nanotechnology II (3 credits)**

Applications of nanomaterials; nanoelectronics; quantum nanodevices; nanoplasmonics; nanomagnetism; magnetic ordering on nanoscale; dynamics of magnetic domain walls in nanomagnetic systems; spintronics; spin dependent transport in ferromagnetic metals; magnetoresistance (MR); ordinary MR; anisotropic MR; giant magnetoresistance (GMR); tunnel magnetoresistance (TMR); magnetic characterization techniques; applications of magnetic materials.

**PHYS 511: Plasma Physics I (3 credits)**

Introduction; occurrence of plasma; concept of temperature; Debye shielding; plasma parameter; criteria for plasma; applications of plasma physics; single-particle motion in electromagnetic field; uniform and non-uniform E and B fields; time-variant E and B fields;

fluid description of plasma; wave propagation in plasma; derivation of dispersion relations for simple electrostatic and electromagnetic modes; introduction to controlled fusion; basic nuclear fusion reactions; reaction rates and power density; radiation losses from plasma; operational conditions.

### **PHYS 512: Plasma Physics II (3 credits)**

Introduction to Inertial Confinement Fusion (ICF): basic requirements of ICF; laser plasma interaction; ablation physics; hydrodynamic compression; energy transport; Nonlinear Plasma Theory: introduction; Quasilinear Theory; conservation of particles, momentum and energy; coherent three waves interaction; three waves interaction with random phase; nonlinear Landau damping; fluctuation, correlations and radiations: shielding of a moving test charge; electric field fluctuations in Maxwellian and non-Maxwellian plasmas; emission of electrostatic waves; electromagnetic fluctuations and radiations; scattering of incoherent radiation from plasma density fluctuations; emission of radiation from a plasma; blackbody radiation; cyclotron radiation; source theory of radiation from a plasma.

### **PHYS 514: Laser Physics (3 credits)**

Review of quantum mechanics; interaction of radiation and atomic systems; density matrix; homogeneous and inhomogeneous broadening of atomic transitions; gain and saturation effects; hole burning; optical resonators; Gaussian beams; laser oscillation; rate equations for a laser oscillator; amplitude fluctuations and spiking; some specific laser system; Q-switching and mode locking; focusing of laser beams.

### **PHYS 515: Materials Science I (3 credits)**

Crystallography; translational periodicity; crystal classes; crystal forms; point and space groups; crystal growth; methods of purification; zone refining; zone leveling; impurity control; methods of perturbing the concentration of impurities in semiconductors; formation of n-p and p-n junctions; different techniques of growing single crystals; structure of materials; ionic bond; covalent bond; metallic bond; Van der Waals' bond; polymer chains; polymerization; polymer processing; ceramics; oxide and silicate; structures; phase transformations; fabrication technology of semiconductor electronic devices.

### **PHYS 516: Materials Science II (3 credits)**

Imperfections in crystals; impurities; vacancies; grain boundaries; dislocations; stacking fault; Frenkel and Schottky disorder; electrons and holes; colour centers; mechanical properties of metals; polymers and ceramics; elastic and plastic deformation; fracture, creep and fatigue phenomena; strengthening mechanisms; annealing; effect of imperfections on the mechanical properties of materials; modulation spectroscopy for optical properties in solids; modulation techniques; wavelength modulation; temperature modulation; stress modulation; piezo absorption and piezo-reflectance; electric field modulation.

### **PHYS 517: Applied Nuclear Physics (3 credits)**

Neutron Physics: Interaction of neutrons with matter in bulk; thermal neutrons; cross-section (measurement of total cross-section); diffusion theory; Fermi age equation; nuclear energy sources: nuclear fission as a source of energy; four factor formula; chain reacting system; neutron cycle; critical dimensions of a thermal nuclear reactor; calculation of multiplication constant for a homogeneous thermal reactor; heterogeneous thermal reactor; energy production in stars; thermonuclear reactions; CNO and P-P cycle in detailed, controlled thermonuclear reactions and fusion reactor; age of galaxy; radioactive measurement and tracer techniques: energy measurement; coincidence measurements; time resolution; measurement of nuclear lifetimes; trace element analysis; mass spectrometry with accelerators.

### **PHYS 518: Quantum Electrodynamics (3 credits)**

Collisions between charged particles; energy loss and scattering; Bremsstrahlung method of virtual quanta; radiative beta process; radiation damping; self fields of a particle; scattering and absorption of radiation by a bound system; wave guides, guided waves, resonant cavities impediment and admittance; scattering.

### **PHYS 519: Atomic and Molecular Physics (3 credits)**

Introduction of structure of atom; Stern Gerach experiment; Schrödinger equation; approximate methods; solution of Schrödinger equation for the hydrogen spectrum; Einstein's coefficients; transition probabilities; hydrogen fine structure; two-electron system; ground and excited states of helium; rotational spectrum of diatomic molecule; rotational and vibrational spectra of diatomic molecule; Franck-Condon principle; Born Oppenheimer approximation; resume of concepts of collision phenomena in ionized gases and surfaces; total collision cross-section, its analysis and measurement; momentum transfer cross-section; diffusion swarm of electrons; mean energy and drift velocity; theory and experimental methods for measurements; elastic scattering in a central force field; ionization and excitation of atoms and molecules by electron impact; inelastic collisions between heavy particles at low energies and at high energies; theory and experimental description.

### **PHYS 524: Non-Linear Physics (3 credits)**

Approximate solutions to nonlinear differential equations; resonance producing secular terms; Van der Pol oscillator; Duffing oscillator; driven damped oscillators; introduction to Chaos - one dimensional model, dynamical systems in two dimensions, dynamical system; Jacobian Matrix; characteristic equation; stability criteria; dissipative and conservative systems; attractors and phase space volume contraction; non-intersection of trajectories and determinism; Sensitivity to Initial Conditions (SIC); Brusselator Model; introduction to Lorentz equations; Strange attractor Solitons Dispersion and non-linearity; KdV equation, solitary limit; relation between amplitude, speed and width; Sagdiyev Potential; conservation laws; non-linear Schrodinger equation; evolution equation for envelope function.

## MPhil leading to PhD in Physics

Physics is a priority area in Pakistan's science and technology policy. It provides the foundation for other disciplines and plays a central role in many different sectors of industry. It includes both curiosity-driven fundamental research as well as applied research linked to emerging technologies. PhDs in Physics and employment in academia, research and development organizations, the energy sector, telecommunications industry and other fields in the private and public sector.

### MPhil/PhD Courses

#### **PHYS 701: Advanced Nonlinear Physics (3 credits)**

*Prerequisites: Nonlinear Physics –I; Plasma Physics*

Chaos in Three Dimensions; Lorentz model and Galerkin Truncation; three dimensional dynamical systems; fixed points; Nonlinear Schrodinger Equation; Pondermotive force; derivation of the nonlinear Schrodinger equation; solution of nonlinear Schrodinger equation; modulational instability; multidimensional solitons; Kadomsteev-Petviashvilli equation; solution and behavior; drift waves; vortices and piece wise linear solutions.

#### **PHYS 702: Instabilities and Quasilinear Theory in Plasmas (3 credits)**

*Prerequisites: Plasma Physics 1 and Plasma Physics 2*

Introduction; classification of turbulence states; methods of approach; weak particle turbulence; Quasilinear Theory; Quasilinear Equation for changes in a plasma distribution; conservation of particles; momentum, and energy in Quasilinear Theory; Landau Damping in Quasilinear Theory; the Gentle-Bump Instability in Quasilinear Theory; plasma wave echoes; initial value problem and perturbed distribution function; Coherent Wave Theory; Nonlinear Landau Damping; literature.

#### **PHYS 703: Optics and Photonics (3 credits)**

*Prerequisites: undergraduate Electricity and Magnetism; Quantum Mechanics*

Postulates of waves optics, Gaussian beam and its properties, interferences and diffraction of light, Bragg gratings, Optical Fourier transform, polarization of light, optics of liquid crystal, fiber optics, Maxwell wave equation in material with instantaneous and impulse response, polarization response of a material, Kramers-Kronig relations, Classical Lorentz oscillator and dispersion, Drude model for the free electron gas, Drude conductivity and skin depth, Microscopic Theory of Refractive Index, Zeeman Splitting, Faraday Rotation, stimulated absorption and emission, rate equations, laser oscillation, CW laser and optimum output coupling, nonlinear optical materials, second harmonic generation, laser cooling, photonics switches and optical computing nonlinear refraction and observation.

#### **PHYS 704: Plasmonics: Theory and its Applications (3 credits)**

*Prerequisites: PHYS 705 or Electrodynamics*

Electromagnetics of metals, introduction to plasmonics; Surface Plasmon Polariton (SPP)

waves; localized surface plasmons; techniques for exciting surface plasmons using Kretschmann and Otto configuration; Wood's Anomalies; Nanoplasmonics; quasi-state approximation; Mie Theory; long wave plasmonics on novel materials such as heavily doped semiconductors, semi-metals and conducting polymers; fluorescence and near field microscopy for imaging of SPP waves; nanofabrication and characterization techniques utilized in plasmonics applications in biosensors; plasmonics metamaterials.

### **PHYS 705: Advanced Microscopy and Image Analysis (3 credit)**

*Prerequisites: Quantum Mechanics, Solid State Physics/Condensed Matter Physics/ Materials Science*

Develop an understanding of advanced microscopy, electron microscopies; scanning probe microscopy. This course has been designed to develop an interest and improve understanding in nano-science and nanotechnology. Students will learn broad applications of advanced microscopy in several research fields including nanomaterials, nanotechnology and nano-devices. To develop creative and critical thinking skills of the use of advanced microscopy in solving real world problems in research and material engineering.

### **PHYS 706: Band Structure Theory in Solids (3 credits)**

An introduction to semiconductors and insulators, Drude and Sommerfeld models for metals, quantum mechanics of particles in a periodic potential, Bloch's theorem, nearly free electron and tight binding models, measurement of band structure, Lorentz force and orbits, Landau levels, application of Bohr's correspondence principle, Quantum Oscillatory Phenomena, the de Haas-van Alphen effect, interband magneto-optics in semiconductors; magneto-resistance in three- and two-dimensional systems and quantum hall effect.

### **PHYS 707: Optical Properties of Solids (3 credits)**

Maxwell's Equations and dielectric function, analysis of charge and current densities, properties of medium, interaction of light with medium, absorption and dispersion, the Lorentz Oscillator, The Drude Model for metals, Quantum Theory of Absorption and Dispersion, direct and indirect inter band transitions, joint density of states and critical points, excitons, quantum confined structures, quantum well absorption and exciton.

### **PHYS 709: Magnetism and Magnetic Materials (3 credits)**

*Prerequisites: Undergrad level Electricity and Magnetism, Quantum Mechanics*

Topics include classical versus quantum mechanical phenomenon of magnetism, diamagnetism, paramagnetism, superparamagnetism, crystal field environments, dipolar and exchange interactions, ferromagnetism, antiferromagnetism, exchange bias, magnetic domains, single-domain structures, magnetic anisotropy and magnetostriction; magnetic materials covered include transition metals, their alloys and oxides, rare earths and their oxides, organic and molecular magnets etc; throughout the course, experimental techniques in magnetic characterization will be discussed. The second part of the course will focus on particular magnetic materials and devices that are of technological

significance (e.g., magnetoresistive, multiferroic and spintronic devices). Additional topics include biomagnetism and biomedical applications of nanomagnetism.

## PhD Physics

The PhD Physics program offers students with opportunities to perform independent research in both theoretical and experimental disciplines. The Department has excellent PhD faculty who are HEC approved supervisors as well. The Department of Physics follows, in general, the admission and qualification criteria as recommended by Higher Education Commission (HEC) of Pakistan.

### Admission Criteria

- MPhil/MS (with research) from a recognized university in any area related to Physical Sciences or Mathematics with a CGPA equivalent to 70% aggregate as prescribed by HEC criteria or First Division (in the annual system) in the MPhil/MS
- Passing a subject test conducted by NTS or ETS (USA) in the area of specialization chosen at the PhD level, or the test conducted by Department of Physics with 60% score
- In the case of GAT subject test a minimum of 60% marks are required
- In the case of GRE subject test, 60th percentile score is required

### Degree Requirements

#### Total Credit Hours

The student is required to successfully complete a minimum of 30 credit hours for the degree. The details are as follows:

#### Coursework

Coursework of 18 credit hours preferably in the first year is required to be completed and followed by a Comprehensive Examination for granting candidacy as a PhD researcher. A minimum of 70% score is required to pass the Comprehensive Exam.

#### Research

After the successful completion of coursework students are required to register for 12 credits of research work.

#### Foreign Expert Evaluation

The PhD Dissertation must be approved by at least two PhD experts from technologically/academically advanced foreign countries in addition to the local Committee comprised of internal and external examiners.

#### Plagiarism Test

The Plagiarism Test must be conducted on the dissertation before its submission to the two foreign experts, as described below.

## Open Defense

An open defense of the dissertation is an essential part of PhD program after positive evaluation.

## Research Paper

Acceptance/publication of at least one research paper in an HEC-approved “X” category journal is a requirement for the award of PhD degree (“Y” in case of Social Sciences only). Or at least one publication in an ISI indexed impact factor carrying journal.

## Copy of PhD Dissertation to HEC

A copy of PhD dissertation (both hard and soft) must be submitted to the HEC for record in the PhD Country Directory.

## Conduct of PhD Program

According to the HEC, initially there should be at least 3 relevant full time PhD faculty members in a department to launch the PhD. The Department of Physics currently has 9 PhDs out of which 8 are HEC-approved PhD supervisors. The maximum number of PhD students under the supervision of a full time faculty member is three.

## Program of Studies:

- Minimum period of completion: three years
- Maximum period of completion: five years
- Students must register for courses during the first year
- The Comprehensive Exam will be conducted after completion of coursework. A maximum of three attempts can be made to pass the exam

Admission to PhD program will only be made in the research areas which are supported through research projects. In case of non-availability of research funding/grant, student may be registered with the approval of Rector.

## Course Descriptions

### PHYS 701: Advanced Nonlinear Physics (3 credits)

MPhil/PhD

*Prerequisites: Nonlinear Physics –I; Plasma Physics*

Chaos in Three Dimensions; Lorentz model and Galerkin Truncation; Three Dimensional dynamical systems; fixed points; Nonlinear Schrodinger Equation; Pondermotive force; derivation of the nonlinear Schrodinger equation; Solution of nonlinear Schrodinger equation; modulational instability; multidimensional solitons; Kadomsteev-Petviashvili equation; Solution and behavior; drift waves; vortices and piece wise linear solutions.

### PHYS 702: Instabilities and Quasilinear Theory in Plasmas (3 credits)

MPhil/PhD

*Prerequisites: Plasma Physics 1 and Plasma Physics2*

Introduction; classification of turbulence states; methods of approach; weak particle



turbulence; Quasilinear Theory; Quasilinear Equation for changes in a plasma distribution; conservation of particles; momentum, and energy in Quasilinear Theory; Landau Damping in Quasilinear Theory; the Gentle-Bump Instability in Quasilinear Theory; plasma wave echoes; initial value problem and perturbed distribution function; Coherent Wave Theory; Nonlinear Landau Damping; literature.

### **PHYS 703: Optics and Photonics (3 credits)**

*MPhil/PhD*

*Prerequisites: undergraduate Electricity and Magnetism; Quantum Mechanics*

Postulates of waves optics, Gaussian beam and its properties, interferences and diffraction of light, Bragg gratings, Optical Fourier transform, polarization of light, optics of liquid crystal, fiber optics, Maxwell wave equation in material with instantaneous and impulse response, polarization response of a material, Kramers-Kronig relations, Classical Lorentz oscillator and dispersion, Drude model for the free electron gas, Drude conductivity and skin depth, Microscopic Theory of Refractive Index, Zeeman Splitting, Faraday rotation, stimulated absorption and emission, rate equations, laser oscillation, CW Laser and optimum output coupling, nonlinear optical materials, second harmonic generation, laser cooling, photonics switches and optical computing nonlinear refraction and observation.

### **PHYS 704: Plasmonics: Theory and its Applications (3 credits)**

*MPhil/PhD*

*Prerequisites: PHYS 705 or Electrodynamics*

Electromagnetics of metals, introduction to plasmonics; Surface Plasmon Polariton (SPP) waves; localized surface plasmons; techniques for exciting surface plasmons using Kretschmann and Otto configuration; Wood's Anomalies; nanoplasmonics; quasi-state approximation; Mie Theory; long wave plasmonics on novel materials such as heavily doped semiconductors, semi-metals and conducting polymers; fluorescence and near field microscopy for imaging of SPP waves; nanofabrication and characterization techniques utilized in plasmonics applications in biosensors; plasmonics metamaterials.

### **PHYS 705: Advanced Microscopy and Image Analysis (3 credit)**

*MPhil/PhD*

*Prerequisites: Quantum Mechanics, Solid State Physics/Condensed Matter Physics/ Materials Science*

Develop an understanding of advanced microscopy, electron microscopies; scanning probe microscopy. This course has been designed to develop an interest and improve understanding in nano-science and nanotechnology. Students will learn broad applications of advanced microscopy in several research fields including nanomaterials, nanotechnology and nano-devices. To develop creative and critical thinking skills of the use of advanced microscopy in solving real world problems in research and material engineering.

### **PHYS 706: Band Structure Theory in Solids (3 credits)**

*MPhil/PhD*

An introduction to semiconductors and insulators, Drude and Sommerfeld models for metals, quantum mechanics of particles in a periodic potential, Bloch's theorem, nearly free electron and tight binding models, measurement of band structure, Lorentz force and orbits, Landau levels, application of Bohr's correspondence principle, quantum oscillatory phenomena, the de Haas-van Alphen effect, interband magneto-optics in semiconductors; magneto-resistance in three- and two-dimensional systems and quantum hall effect.

### **PHYS 707: Optical Properties of Solids (3 credits)**

*MPhil/PhD*

Maxwell's Equations and dielectric function, analysis of charge and current densities, properties of medium, interaction of light with medium, absorption and dispersion, the Lorentz Oscillator, the Drude Model for metals, Quantum Theory of absorption and dispersion, direct and indirect inter band transitions, joint density of states and critical points, excitons, quantum confined structures, quantum well absorption and exciton.

### **PHYS 708: Journal Club (2 credits)**

The course will be comprised of at least one presentation by each student on critical analysis of a recently published research article in international journals. The research article will be assigned to each student in the beginning of the semester. In addition student will be required to attend all presentations and actively participate in the weekly Journal Club.

### **PHYS 799: Research (12 credits)**

After the successful completion of coursework students are required to register for research work. A CGPA of 2.75 is required to be eligible for research. Students have the option of choosing from three specializations: Theoretical Plasma Physics, Condensed Matter Physics, and Optical Physics under the supervision of faculty member.

### **Collaborations**

- Pakistan Council of Scientific and Industrial Research (PCSIR), Lahore
- Pakistan Institute of Nuclear Science and Technology (PINSTECH), Islamabad
- Pakistan Institute of Engineering and Applied Sciences (PIEAS), Islamabad
- Center for Advanced Studies in Physics (CASP), Government College University (GCU), Lahore
- Physics Department, Government College University, Lahore
- Center for Solid State Physics (CSSP), Punjab University (PU), Lahore
- Physics Department, Punjab University, Lahore
- Physics Department, University of Engineering and Technology (UET), Lahore
- Shaukat Khanum Memorial Hospital and Research Center, Lahore



DEPARTMENT OF  
POLITICAL SCIENCE

The Department of Political Science at Forman Christian College (A Chartered University) is one of the largest departments in Social Sciences. The Department's teaching faculty had the distinction of having scholars of national and international prominence like Dr Carl W Wheelless, Prof Mary Wheelless, Dr Kitchen, Dr Anwar M Barkat, Dr Arshad Karim Syed, Dr Shokat Ali, Dr Hamid Kizilbash, Prof Naseem Zakariya, Dr Parveen Shaukat and Dr Shafiqat Hussain Chaudhary.

The quality of instructional work in the Department has been of a high standard. Research work is encouraged. There is a dedicated faculty available to teach various papers and supervise research. The Department arranges extensive lectures, seminars and study tours to facilitate academic excellence in students. Alumni of this Department have contributed positively to national uplift and have excelled in numerous professions.

The Advisory Committee for the Department provides valuable links with foreign scholars who help to establish connections with foreign universities.

## MPhil Political Science

FCCU's MPhil Political Science program is designed to expose graduate students to concrete and theoretical knowledge and scholarly research and to empower them with critical thinking, analytical, research, and writing skills. This program in Political Science builds on training received at the Baccalaureate level. It has a strong emphasis on research skills that will be beneficial for those pursuing careers in the government or private sectors, civil society, or teaching, among others.

MPhil Political Science is a 2-year program comprising of 30 credit hours of mandatory coursework and a written thesis for 12 credits. Coursework will involve eight core courses and two optional courses offered by the Department. Teaching will be mostly in the form of lectures, seminars and colloquium. The program is designed to lead to PhD for those desiring to pursue a terminal degree in the field.

### Degree Requirements

#### Candidates must:

- Complete 30 credit hours of coursework including six core courses and any four electives
- Must complete an MPhil thesis proposal before the start of the second year
- They must complete thesis worth 12 credit hours (six each in the third and four semester)

## Course Descriptions

### Core Courses

#### PLSC 502: Theories of Comparative Politics

The course is designed to introduce students to many (but not all) of the major topics of

study, theories and debates in comparative politics, one of the four major fields in political science. To a certain extent, it will entail a historiography of how the field has developed intellectually over the last few decades. However, primary emphasis is on the current state of debates. Most of the assigned readings have a strong theoretical focus and draw on case evidence to support theory-derived arguments. This is not a course for learning about the politics of particular countries: the empirics of a particular country case are less important for our purposes than developing the skills required to evaluate theoretical propositions using the comparative method, and acquiring a grasp of the state of a variety of literatures in the field of comparative politics.

#### **PLSC 504: Political Thought**

Review of fundamental concepts of ruling parties, justice and resistance and its methods; equality and liberty in the society; examination of traditions to explain their possible normative implication for the present.

#### **PLSC 506: Theories of International Relations**

Theories of international relations; the world order; conflicting situations; imperialism; the balance of power and integration as important modes adopted to avoid disorder; basic theoretical and analytical tools developed by political scientists to understand the complexities of international politics; features of the contemporary global system.

#### **PLSC 507: Constitutional and Political Processes in Pakistan**

Analysis of the political and constitutional developments in Pakistan since its creation; issues in constitution making; study of the constitutions of 1956, 1962 and 1973 and the amendments made; impact of constitution making on Pakistani politics.

#### **PLSC 519: Local Government System in Pakistan**

Understanding the political discourse in Pakistan is imperative if one aspires to further decode the political fabric governing both administrative and social contours of Pakistan. Pakistan, in its federalist construct, has an intricate political and administrative system divided under political leadership, legislative authorities, bureaucratic functionaries, provincial layout and local governance mechanism. This graduate level course will be an overview of the evolution of local governance system in Pakistan, its different manifestations and also a means to examine its pros and cons and forecast efficacy.

#### **PLSC 523: Research Techniques in Political Science**

This course is designed to help students formulate their research proposals, eventually leading to their thesis proposal and MPhil thesis. First we will discuss what political science is and how it has developed over time. We will discuss the philosophical as well as methodological differences underlying quantitative, qualitative, and interpretive research methods. We will engage in practical application of various methods. And most importantly, we will engage in a detailed discussion of how to design research projects. At the end of the course, students should have constructed a blue-print for their proposals.

**PLSC 699: Research Thesis (12 credits)**

Students will undertake research on a topic approved by the Departmental Committee and produce a thesis of at least 25,000 words. The research proposal must have appropriate design and relate to the substantive and methodological understanding developed in the first year of the program through course work. Students will conduct research under the guidance of a faculty member of the Department of Political Science with expertise in the relevant field.

**Elective Courses****PLSC 508: Foreign Policy Analysis**

This course is designed to give students an overview of different explanations for states' foreign policy behavior. Theories of international relations, whether realist or neo-liberal, often assume that states act rationally in their self-interest. However, we know from experience that actors in the international arena often behave in self-destructive ways, especially the decision to go to war. Readings, lectures, and discussions will focus on the pressures of the international system, on the nature of national political regimes, societal forces such as the media and lobbyists, as well as institutional structures and processes. We will also turn our attention to the role of perceptions and misperceptions of individual leaders, their ideologies and beliefs, as well as the problem of images and biases in decision-making particularly during crises.

**PLSC 509: Political Sociology**

Vision of a society as outlined by Karl Marx, Max Weber, and Talcott Parsons; nature and distribution of power; political socialization; socio-political development and change encompassing nation-building/modernization, social and political movements – political parties/culture; social change focusing on social behavior and social order.

**PLSC 513: Advanced Studies in International Relations**

In-depth study of a particular subject matter discussed in PLSC 505, with particular emphasis on the current salience of the topic to contemporary issues and events. Topic subject to faculty interest and departmental approval.

**PLSC 514: International Organizations**

Emergence of international organizations; their concepts and debates; specific focus on the emergence of United Nations and its roles; regional organizations; new economic grouping; challenges of international organizations.

**PLSC 515: Politico-Strategic Dynamics of the Middle East**

Historic antecedents and contemporary issues that have shaped the Middle East; politico-strategic issues affecting the region; politics of the Arab-Israeli conflict; the rise of Arab nationalism; Iranian revolution and its impact on the region; American intervention in Iraq; the emergence of the 'Arab Spring'.

**PLSC 517: Politico-Strategic Dynamics of South Asia**

Drive behind Muslim struggle for establishment of an independent state; dynamics of South Asian politics; terrorism, conflicts about Kashmir, Siachin and water; mutual mistrust, the arms race, nuclear weapons; politico-strategic dynamics of South Asia which damage relations between India and Pakistan. Reference also to the politics of other SAARC members, including Bangladesh, Sri Lanka, Bhutan and the Maldives.

**PLSC 518: Civil Society: Local and Global Dynamics**

This course will explore the origins of the concept of civil society, modern theoretical conceptualization of civil society, civil society and social capital, composition of civil society, civil society and the state, citizenship and civil society, movements and civil society. Emphasis will be placed on the development of civil society in Pakistan within local, regional and global dynamics.

**PLSC 520: Advanced Studies in Political Philosophy**

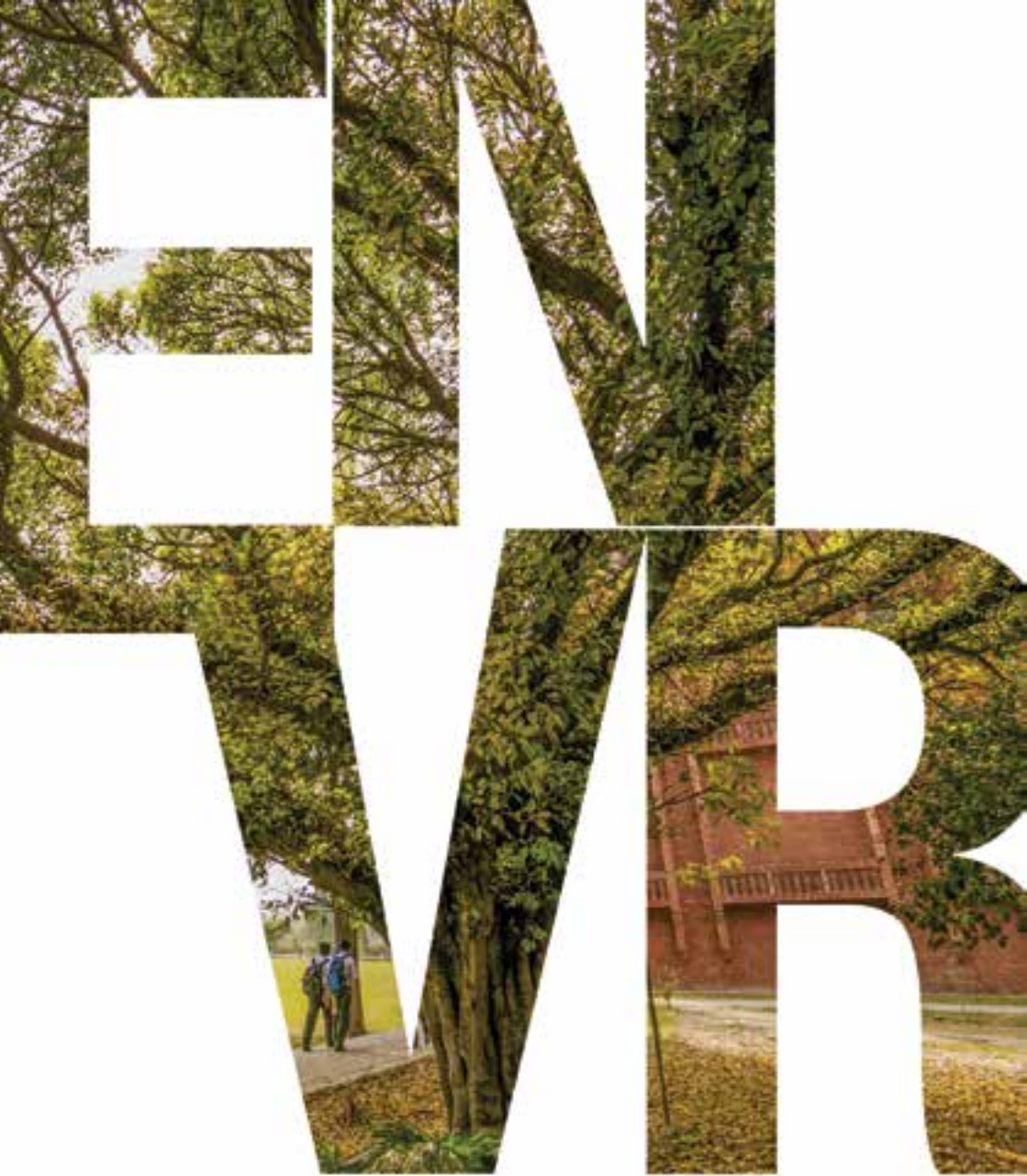
In-depth study of one particular topic within political philosophy introduced in PLSC 504. Could include, but not limited to, ancient, medieval or modern Western political thought, Islamic political philosophy, critical theory and subaltern studies.

**PLSC 521: Women and Politics in Pakistan**

This course aims to develop a comprehensive understanding among students about the dynamics of women political participation in Pakistan-rural and urban, keeping in view the deeply entrenched patriarchy and religiosity in society. The course attempts to understand the cultural/religious perspective, constitutional guarantees as well as legislative enactments regarding women political participation. Further, another important component of this course will be a comparative analysis of Pakistani women with those in near similar environments like South Asia and Middle East. The students will also be exposed to various dimensions of feminist theory and its possible application in Pakistani context.

**PLSC 522: Advanced Studies in Comparative Politics and Area Studies**

This course will focus on the politics of one particular region or neighborhood of the globe not covered in other course offerings. Dependent on faculty availability and research interests.



ENVIRONMENTAL  
SCIENCES PROGRAM

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Environmental Science is an interdisciplinary subject that draws upon the knowledge from the Biological, Physical, Earth and Social Sciences. Study of the subject gives one the opportunity to find out as to how, we as people, through our use of water, land and energy resources, are affecting our surroundings and the globe at large. Information is also gained about the actions that could be taken to reduce, control and, in some case, reverse the damage caused by us to the environment. An MPhil degree in Environmental Sciences from FCCU would not only make the graduate very well-informed about some of the greatest challenges faced by humanity today, but also point to a number of avenues for doctoral studies or gainful employment, both locally and overseas, as world-wide demand for such professionals is growing, at an ever increasing rate.

The Department of Environmental Sciences has a well-qualified and highly experienced, local and foreign faculty to impart high quality education in the subject and, more importantly, to effectively guide the students during their thesis research.

## MPhil Environmental Sciences

The MPhil Environmental Sciences is a two-year program consisting of 2 semesters of coursework followed by 2 semesters of research.

### Degree Requirements

A total of 42 credit hours; 30 credit hours consist of mandatory coursework in the first 2 semesters. Students must maintain a minimum of 2.75 CGPA in coursework.

## Course Descriptions

### **ENVR 501: Wildlife, Forestry and Wetland Conservation and Management (3 credits)**

Philosophy and conservation of wildlife; wildlife of Pakistan: types, distribution, status; threatened animals and plants: laws and regulations for wildlife protection in Pakistan; protected areas in Pakistan: kinds, distribution and management; wetlands: their importance, threats and conservation; forests: their ecological and economic importance, ecological factors affecting forest growth and management; status of forests in Pakistan: types, distribution, management, deforestation and its control; rangeland management; sustainable forest management.

### **ENVR 502: Water and Wastewater Management (3 credits)**

Introduction to water treatment; coagulation; filtration, disinfection; constituents in wastewater and treatment selection: quality parameters and characteristics of influent, effluent, and wastewater; sources and impact of polluted water from the domestic and industrial sources; analysis and design of wastewater treatment systems, conventional treatment methods, preliminary treatment, primary treatment, secondary treatment, trickling filters, activated sludge tanks, constructed wetlands; disinfection processes,

treatment plant performance. wastewater flow rates and constituent loadings, removal of nutrients and toxic materials; re-use and recycling: wastewater reuse guidelines, technologies, practices and examples feasibility in Pakistan, case studies of wastewater recycling; grey water reuse; industrial usage; cost and economics analysis.

### **ENVR 503: Advanced Environmental Analytical Techniques (3 credits)**

Introduction; principles of physical, chemical and microbiological analysis of environmental pollutants; sampling procedure for the examination of water, wastewater, air and solid waste; sampling rules, sample collection and preservation; laboratory techniques and field monitoring for parameters of importance causing environmental pollution; environmental chemical analysis; instrumental techniques like UV-Vis spectrophotometry, IR spectrometry, atomic absorption, and emission analysis gas chromatography, GC-MS, high pressure liquid chromatography; assessment and interpretation of results using statistical tools.

### **ENVR 504: Remote Sensing and GIS Applications (3 credits)**

Image processing for GIS: change detection, classification, and feature extraction; pushing remote sensing derived vector/raster results into GIS workflow; use of model builder to call ENVI processes; web GIS/map server, relational databases; geospatial statistics; monitoring air pollution; case studies: modeling surface water using ArcHydro and GPS; monitoring the human impact of sea level changes; optical, thermal data fusion; global atmospheric circulation analysis using TRMM; interpretation of DEM, geo-referencing, digitizing, mapping, contouring, spatial analyst; satellites, image processing, ERDAS imagine; land use classifications.

### **ENVR 505: Environmental and Health Risk Assessment (3 credits)**

Risks, nature and causes; risk reduction and management, risk management process, role of risk assessment; quantitative risk assessment (QRA); costs and benefits analysis, make non-actuarial predictions; exposure assessment, dose-response assessment; worker health and safety: basic facts (injury and illness statistics), OSHA budget and inspection info; decision-making: distinction between good decision and good outcome, brief discussion of priority-setting and “worst things first” thinking, decision-driven analysis versus analysis-driven decisions; theories of risk perception, risk communication strategies, perception and communication of solutions as supplement/ alternative to risk, communication, acceptability of risk – laws, policies, controversies, types of control; the science-policy landscape of risk assessment.

### **ENVR 601: Alternative Energy Sources (3 credits)**

Energy and its forms, energy resources, types, uses; merits and demerits of development and use of energy resources (coal, gas, petroleum, nuclear) local, regional and global impacts of the use of different energy resources, energy resources of Pakistan, non-renewable and renewable, patterns of energy consumption in Pakistan, future energy

scenario of world and Pakistan, sustainable energy management for agriculture, transport, industry and domestic sectors, alternate energy resources, merits and demerits of wind, solar, hydropower, bio-energy resources.

### **ENVR 602: Cleaner Production and Pollution Control Technologies (4 credits)**

Strategies for a better environment: process internal solutions (process changes, raw materials changes etc.), process external solutions, product changes and other; basic concepts of cleaner production; process management, product design and material selection as components of cleaner production development; air pollution control and gas cleaning technology. waste water treatment; process internal solutions and external solutions in order to minimize water pollutions; introduction to environmental engineering and cover common forms of environmental pollution impacts on the environment; emphasis will be placed on the causes, effects, and control of air, water, and land pollution; scientific and engineering aspects of environmental pollution and control will be covered.

### **ENVR 603: Integrated Management Systems (3 credits)**

Industry and environment, legislation and environment since industrial revolution, general and environmental risk management, WTO and environmental management, safety audits, total quality environmental management, organizational drivers and interventions, management commitment and environmental audit, aspects, impacts analysis, country legislation and EMS, organizational responsibility, EOP and EMP, monitoring and measuring, EMS audit, the corporate environmental plan and its implementation, integrated approach and conceptual models, Devoid EMS model, Isolated EMS model, devolved EMS model and integrated EMS model and their analysis and applications; ISO 9001, ISO 18001, and ISO 14001, theory and practice of integrated environmental management system in Pakistan and at international level; auditing practices of integrated management system; corporate social responsibility (CSR).

### **ENVR 604: Eco-Entrepreneurship (1 credit)**

Strategic planning, survey research design and evaluation, financial management and environmental accounting, environmental markets, business strategy and leadership, managing for innovation, entrepreneurial marketing, patents and intellectual property, new product development.

### **ENVR 605: Research Methods and Scientific Writing (3 credits)**

Introduction and basic research concepts: steps in the process of research; identifying a hypothesis and/or research problem, specifying a purpose, creating research questions; reviewing literature; ethics of research and informed consent; qualitative research methods; quantitative research methods and statistics, quantitative data collection instruments; reporting results of data analysis; introduction to applied statistics, descriptive statistics, inferential statistics; mixed methods research; data mining – finding

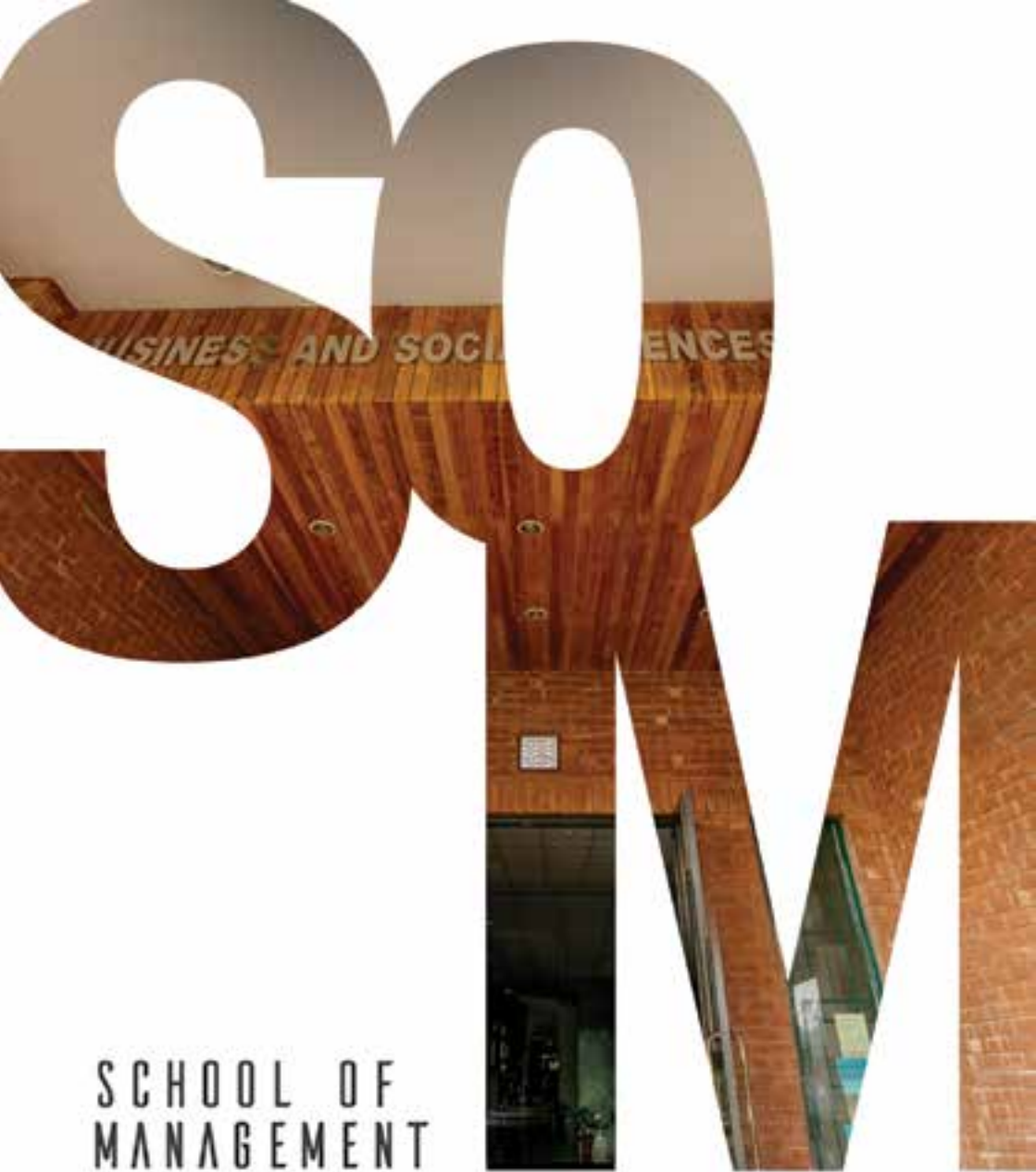
the patterns and problems in the world of data, completing the research project.

**ENVR 606: Seminar (1 credit)**

1 Seminar related to the research project.

**ENVR 699: Research (12 credits)**

MPhil research thesis based on research to be submitted to the University and evaluated by the Departmental Committee and an external examiner.



SCHOOL OF  
MANAGEMENT



The School of Management was established in 2005 and has gained a reputation for the quality and diversity of its programs. At SoM we offer a full-time 2-year MBA, a modular 2-year Executive MBA, a 4-year BS (Hons) Business with specializations in Accounting and Finance, Marketing and Sales, Operations Management, and Human Resources as well as short duration executive education courses.

The MBA in particular aims to develop the functional competence any contemporary manager is expected to have in today's increasingly global business environment. The program has a general management orientation without compromising any essentials of the core functional areas. The Executive MBA has been designed for optimal flexibility while retaining the rigor of comparable international programs.

Three factors give SoM its distinctive edge. First, our faculty specializes in consulting and case writing and has close linkages with the corporate sector. Many of our faculty members are members of various boards as well as providing policy advice to the public sector. Second, we offer specializations in our Baccalaureate program. Third, the triangulation of our pedagogical method combines cases with conceptual understanding of specific subjects, including experiential exercises.

Our mission is to provide a fresh approach to business education through a highly motivated faculty in a young and challenging program resulting in graduates who are bold, can think on their feet, and can adapt themselves to any environment or set of circumstances while adhering to strong values.

## **Masters in Business Administration**

This is a two-year program with a general management focus. The program aims to develop high quality professionals who will be agents of change through a combination of their creativity, initiative, competence and adaptability. The learning experience is highly interactive and offers the best mix of cases, simulations, and lectures to ensure that students gain both from theory and best practice of business. There is a strong emphasis on understanding and managing modern enterprise in the Pakistani environment. The key to this is the experience of the faculty.

We want our students to have a strong entrepreneurial spirit and be able to adapt to challenging situations in diverse environments. Over the last two years our graduates have gone into a variety of professions, including the corporate sector, financial sector, charitable organizations, family businesses, academia, government service, and further education.

The program is designed to build upon skills and techniques developed in the first year and their application to more complex and integrated business issues in the second year.

## Degree Requirements

Students must maintain a CGPA of 2.50/4.00 to graduate from the MBA program. Students take a total of 72 credit hours (24 courses) as well as undertaking a mandatory Internship between the first and second year of the program. Each course is worth 3 credit hours.

## Courses Descriptions

### Year 1

#### **BUSN 501: Financial Accounting (3 credits)**

Focuses on construction and composition of financial statements, consolidation and group accounts, treatment of leasing, etc.

#### **BUSN 506: Management Accounting (3 credits)**

Focuses on critical concepts and tools of cost accounting, including CVP, planning and control, allocation, revenues, cost information, etc.

#### **BUSN 510: Applied Quantitative Techniques (3 credits)**

Introduces fundamental mathematical and statistical tools for decision making including data collection for surveys, modelling, evaluating quantitative data, etc.

#### **BUSN 521: Managerial Economics (3 credits)**

Applies microeconomic analysis to specific business decisions, including production analysis, pricing, capital budgeting and risk assessment.

#### **BUSN 522: Macroeconomics (3 credits)**

Examines determinants of aggregate trends in the economy, including national income, unemployment, inflation, investment, and international trade, etc.

#### **BUSN 531: Principles of Finance (3 credits)**

Focuses on critical concepts, tools and techniques, including time value of money, valuation, short-term financing, cost of capital, and risk-return analysis.

#### **BUSN 550: Organizational Behavior (3 credits)**

Investigates the impact of individuals, groups, and structures on behavior within organizations, including leadership skills, team structures, and conflicts, etc.

#### **BUSN 560: Operations Management (3 credits)**

Equips students with understanding of efficient management, focusing on interfunctional coordination to meet output targets, etc.

#### **BUSN 570: Logic and Critical Thinking I (3 credits)**

Makes students more effective professionals by enhancing critical analytical and

communicative skills which impact on managerial performance.

**BUSN 571: Logic and Critical Thinking II (3 credits)**

This is a follow on course from BUSN 570.

**BUSN 580: Marketing and Sales Management (3 credits)**

Takes students across the spectrum of marketing concepts and application, and introduce critical issues faced by the salesforce in operations.

**BUSN 585: Marketing Research and Analysis (3 credits)**

Covers concepts, tools, and techniques used in marketing research, including consumer behavior, research methodolgies, and statistical applications.

**Year 2**

**BUSN 601: Reporting and Governance (3 credits)**

Introduces students to the critical issue of corporate governance and the specific role of reporting standards in achieving the aims of governance.

**BUSN 605: Management Control Systems (3 credits)**

Focuses on imporatnce of implementation of control systems in organizations and develops understanding of differences in selection of control systems.

**BUSN 622: Topics in Investment and Finance (3 credits)**

Focuses on more complex issues such as portfolio management, dividend policy, interantional finance, financial engineering and corporate finance.

**BUSN 625: Business Ethics (3 credits)**

Focuses on the importance of adhering to values and ethical behavior in the practical business environment.

**BUSN 630: Management Information Systems (3 credits)**

Focuses on the importance of implemenation of efficient data collection and processing systems for operational efficiencies.

**BUSN 640: Entrepreneurship (3 credits)**

Challenges the young minds to generate innovative business ideas and to go through the idea implementation phase in detail.

**BUSN 650: Human Resource Management (3 credits)**

Focuses on importance of HR, its evolution as an organizational function, and the challenges of finding the right HR on national and international levels.



**BUSN 660: Business Law (3 credits)**

Focuses on critical components of law which impact on business practice in Pakistan. These include corporate law, company registration, and labor laws.

**BUSN 670: New Product Development (3 credits)**

Focuses on business innovation, new products and technologies for customer satisfaction, while maintaining quality and competitive advantage.

**BUSN 690: Business Strategy 1 (3 credits)**

Focuses on developing an understanding of the conceptual frameworks in the field of business strategy.

**BUSN 692: Business Strategy 2 (3 credits)**

This is a follow on course from BUSN 690 and focuses more on analytical thinking and contemporary and relevant reference to local environment.

**BUSN 695: Managerial Negotiations (3 credits)**

Prepares the students for carrying out effective negotiations in the practical business world.

**BUSN 698: Internship (3 credits)**

An internship is undertaken between the first and second year of the program.

## Executive Masters in Business Administration

**Degree Requirements**

The Executive MBA has a unique structure. A total of 66 credit hours are earned through 14 modules and one project. Each module is ten days of instruction (3 hours a day) in the evening, with one full day (Saturday) for a total of 40 hours of classroom contact hours per module. With on-line assignments, there are 48 contact hours per module (as per international standards). Thus, each module, with the exception of the last, is 4 credit hours.

The 14th and final module includes a Business Simulation game which will enable the students to apply all the concepts learnt during the entire program. Therefore, this module is 6 credit hours. Students will also be required to undertake a project under the supervision of a faculty advisor. This project will be spread out over a period of almost one year and is 8 credit hours.

## Program Modules

The modules are taught in the following order:

**BUSN 675: Management Communications (4 credits)**

Critical analyses of communication processes with practical applications of skills learnt.

**BUSN 624: Managerial Economics (4 credits)**

Key economic principles and their applications in business and economy.

**BUSN 610: Quantitative Methods for Business (4 credits)**

Basic statistical tools used by businesses for interpreting data.

**BUSN 654: Organizational Behavior (4 credits)**

Human behavior and its impact on teams; work-groups and organizations.

**BUSN 604: Financial Accounting (4 credits)**

Basic accounting principles; preparation and analyses of key financial statements.

**BUSN 684: Marketing and Sales Management (4 credits)**

Critical marketing concepts, their applications and innovation; sales force and channel management.

**BUSN 609: Cost Accounting and Control Systems (4 credits)**

Cost accounting, budgeting and management of control systems.

**BUSN 665: Law, Ethics and Governance (4 credits)**

Impact of key laws and regulations on corporate practices; significance of corporate governance.

**BUSN 628: Financial Management (4 credits)**

Basic tools of financial and investment management; corporate value addition through informed financial decision-making.

**BUSN 664: Operations Management (4 credits)**

Dynamics of the product; design, development and production processes.

**BUSN 655: Human Resource Management (4 credits)**

Managing human capital in an organization.

**BUSN 694: Business Strategy (4 credits)**

Holistic perspective on decision-making in organizations.

**BUSN 634: Entrepreneurship (4 credits)**

Business start-ups, resources required, risk analysis.

**BUSN 674A: Management Information Systems (MIS) (4 credits)**

Integration of all the modules; design and development of information systems; business process re-engineering; technological applications to businesses.

**BUSN 674B: Business Simulation (2 credits)**

Exposure to actual market conditions through computer-simulated environment; decision-making and analysis of impacts on business management.

**BUSN 699: Business Project (8 credits)**

Overall application of knowledge, skills and tools to current business perspective under the supervision of a faculty adviser.



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