PhD

DOCTOR OF PHILOSOPHY

CHANDIGARH UNIVERSITY
CU
CHANDIGARH UNIVERSITY
Discover. Learn. Empower.

IMPORTANT DATES

JANUARY, 2024 Intake

Last date for submission of online application forms

November 15, 2023
(Wednesday)
(till 4:30pm)

Conduct of Ph. D Entrance Examination

Dec. 10, 2023
(Sunday)

Result of Ph. D Entrance Examination

Dec. 23, 2023
(Saturday)

Interview Schedule

Jan. 04-05, 2024
(Thursday-Friday)

Admission notification and deposit of admission fee

Jan. 17, 2024
(Wednesday)

INFORMATION BROCHURE
CUM ENTRANCE TEST FORM FEE:
Rs. 1100/-

CONTENTS

Doctor of Philosophy

Accredited by NAAC with the prestigious A+ Grade in the first cycle itself, Chandigarh University (CU) is an institution committed to excellence in research, innovation, and interdisciplinary education.

Chandigarh University (CU) located at Gharuan, Mohali has been established through The Chandigarh University Act. 2012 passed by State Legislative assembly, and recognized under section 2(f) of UGC Act. 1956. The University has been conceived as a temple of learning for intellectual, cultural, asesthetic and skil development of the brilliant youth of the country. CU offers in an ideal Academic environment and industry integration. Being a University, the CU campus allows a large number of students different parts of the world to study and mingle together. This unique mix of the cultures and backgorund, helps our students learn the finer aspects of loife, above the regular academics.

The academic program of CU leading to the Ph. D degree is broad-based abd involves a minimum cource credit requirement and\ research thesis. Interdiscripilnary work through a joint system of supervision is also encouraged alonghwith interdepartmental group activities. The presence of a strong research oriented faculty provides opportunity for excellent research training. The University aims to undertake sponsored from industrial and other organizations in public as well as private sector. The required research laboratories are also being set up in each academic department In addition, there are a number of central facilities, which include Computer Center, Central Libary, Workshops, Xerox and Photography Sections. The Central Library has a very large collection of books, back volumes of periodicals, standard specification and other literature. The Library subscribe to over 6400 current E-journals in Science, Engineering. Humanities an Social Science.

Chandigarh University follows UGC regulation on minimum standards and procedure for the award of M.Phil/Ph.D Degree, regulation 2009

Application are invited from eligible candidates for admission to its Full-time/Part-time Ph. D. programs for the year **January,** 202**4** intake. The Ph. D. Programme can be pursued in thefollowing disciplines.

ENGINEERING
(Computer Science, Artifical Intelligence, Electronis & Communication, Mechanical, Electrical, Civil Engineering)

BUSINESS MANAGEMENT
(Commerce, Economics)

APPLIED SCIENCES
(Mathematics, Physics, Chemistry)

COMPUTER APPLICATIONS

BIO-TECHNOLOGY

PHARMACEUTICAL SCIENCES

PSYCHOLOGY

EDUCATION

ENGLISH

FORENSIC SCIENCE

LAW

TOURISM & HOSPITALITY MANAGEMENT

ARCHITECTURE

Admission to Ph. D programme will be made purely on the basis of merit following the prescribe criteria of the University based on UGC regulations.

*Other disciplines may be added depending upon the viability & fulfilment of the Conditions

*Candidates are advised to contact Dean Research, Chandigarh University through Email : dean.research@cumail.in for updated information about any further availability of seats.

Computer Science & Engineering	30
*Artificial Intelligence	20
Electronics & Communication Engineering	20
Electrical Engineering	20
Civil Engineering	20
Mechanical Engineering	20
Business Management	20
Mathematics	20
Physics	20
Chemistry	20
Computer Applications	20
Bio-Technology	20
Pharmaceutical Sciences	20
Forensic Science	20
Law	20
Tourism & Hospitality Management	20
Mass Communication	20
Education	20
Psychology	20
English	20
Commerce	20
Economics	20
Architecture	10

*University promotes the areas of AI for applied research. Candidates from Engineering/Health Sciences/Agriculture can appear for the interview in second round. (First round is entrance test in respective domains/UGC-NET/CSIR-NET/GATE/GPAT.

For Interdisciplinary research, Candidate can approach CU- University Centre for Research & Development (UCRD)

CATEGORIES OF ADMISSION

Candidates will be admitted to the Ph. D programme of the Chandigarh University under one of the following categories:

REGULAR FULL-TIME SCHOLARS

For admissions in Ph. D programme under regular category a common merit list will be prepared based on the marks in the entrance test and interview.

RESEARCH SCHOLARS WORKING ON PART-TIME BASIS

Part-time studies leading to PhD degree are permitted for local professionally employed personal such as working engineers, scientists and teacher from R & D establishments, corporate sector and UGC/ AICTE recognized educational Institutions. Candidates working withing a radius of 250 kms will be treated as locals. However, such a candidates must be in regular employment work in the area to which admission is sought. A research scholar working on part time basis shall normally carry out the research work at Chandigarh University under the supervision of guide at Chandigarh University, The feasibility of doing this with sufficient the scholar in this category.

RESEARCH SCHOLARS UNDER THE EXTERNAL REGISTRATION

Research scholars under the external registration programme sponsored by and employed in industry/organization having R & D facilities and recognized by DST or Chandigarh University, national laboratories, reputed universities/colleges or employed in research/analysis jobs in public sector/private sector/ government organizations.
A research scholar under the external registration programme will normally carry out part or all of his / her research work in the industry/ organization/national laboratories/universities employing the scholar under the supervision of a co-guide also employed in the same organization, but the main guide should be at Chandigarh University.

Note:

Part-time candidates are required to submit the "No Objection Certificate" from their parent organization/ department/ employer stating that the candidate is permitted to pursue studies on a part-time basis and that the candidate's official duties permit her/him to devote sufficient time for research.

Ph.D in Engineering

Candidates with a Master's degree in Engineering/ Technology with a good academic record (minimum CGPA of 5.5 on a 10 point scale of 55% Marks in aggregate where marks are awarded) Admission of PhD candidate in a department/school other than his/her basic background. Suitability of a candidate is the purview of admission committee, if a candidate qualifies the test and interview then he/she should be allowed to pursue PhD programme. However, the admission committee may recommend additional courses for the candidate to clear. Relaxation for appearing the Entrance Test may be given by the University to those candidates who have qualified GATE/UGC/CSIR(JRF)

Eligibility

Minimum Educational Qualification*

The minimum educational qualifications for admission to the Ph.D programme of the Institute are as follows:

Note:
Candidates shall be admitted on the basis of merit of Entrance Test and interview to be conducted by the University. During interview, a candidate is required to given a presentation to the selection committe in the indicated area of research

Ph.D in Law

An applicant holding LL.M. Degree from a recognised university with minimum 55% marks or its equivalent grade 'B' in the UGC 7-point scale (or an equivalent grade in a point scale wherever grading system is followed) or an equivalent degree from a foreign educational Institution accredited by an Assessment and Accreditation Agency which is approved, recognised or authorized by an authority, established or incorporated under a law in its home country or any other statutory authority in that country for the purpose of assessing, accrediting or assuring quality and standards of educational institutions.

Ph.D in Tourism & Hospitality Management

Ph.D. in Tourism & Hospitality Management Candidates with 55 % marks in Post-Graduation in relevant field. The candidates having 3 years executive experience in Tourism & Hospitality industry may register for the Ph.D. program if otherwise eligible as per the University/UGC norms. As per the U.G.O Guidelines applicants for the Ph.D. program who have qualified NET/SET along with the award of Junior Research fellowship (JRF) shall be admitted to the program directly without having to undergo an Entrance test.

Ph.D. in Forensic Science

Candidates with a Masters degree in Forensic Sciences and related fields i.e M.A Criminology, Digital Forensic (MCA) LLM, M.Sc. in Life Sciences i.e. Physics, Chemistry, Botany, Zoology, Postgraduate in Social Science, Psychology, Computers, Engineering, Physical Science, Engineering, Ballistics, Arms and Ammunition with good academic record (minimum CGPA of 5.5 on a 10 points scale or 55% marks in aggregate where marks are awarded) and having a valid score in GPAT /UGC /CSIR / NET / CU-PhDs entrance test or equivalent qualification tenable for the current year in relevant area.

Ph.D. in Computer Applications

Masters degree in Computer Applications/ Computer Science / Information Technology or equipment with a good academic record (minimum CGPA of 5.5 on a 10 point scale or 55% marks in aggregate where marks are awarded) and having a valid score in GATE/UGC/CSIR-NET/CU-Ph.D Entrance Test.

Ph.D. in Sciences

Master degree in Sciences with a good academic record (minimum CGPA of 5.5 on a 10 point scale or 55% marks in aggregate where marks are awarded) and having a valid score in GATE UGO/CSIR-NET/NBHM/CU-Ph.D. Entrance Test or equivalent qualification tenable for the current year in the relevant area.

Ph.D. in Bio-Technology

Candidate with a Master's degree in Bio-Technology /Sciences / Pharmacy or relevant stream with a good academic record (minimum CGPA of 5.5 on a 10 point scale or 55% marks in aggregate where marks are awarded) and having a valid score in UGC/CSIR-NET/ CU-Ph.D. Entrance Test or equivalent qualification tenable for the current year in the relevant area.

Ph.D in Management

MBA/ M.Com degree or equivalent PG Diploma or Associateship in a relevant discipline, and a Bachelors degree with a good academic record OR Five year integrated masters degree / dual degree or equivalent in a relevant discipline with a good academic record (minimum CGPA of 5.5 on a 10 point scale or 55% marks in aggregate Where marks EH8 awarded). and having a valid Score in GO/CSIRNET/CU Ph.D Entrance Test.

Ph.D in Pharmaceutical Sciences

Candidate with a Master's degree in Pharmacy/ Biologw Bio-Technology or relevant stream with a good academic record (minimum CGPA of 5.5 on a 10 point scale or 55% marks in aggregate where marks are awarded) and having a valid score in GPAT/UGC/CSIR-NET/CU-Ph.D. Entrance Test or equivalent qualification tenable for the current year in the relevant area.

Ph.D in Education

Candidate with a Master's degree / M.Ed in Education with a good academic record (minimum CGPA of 5.5 on a 10 point scale or 55% marks in aggregate where marks are awarded) and having a valid score in UGC/CSIR-NET/CU-Ph.D. Entrance Test or equivalent qualification tenable for the current year in the relevant area.

Ph.D in Psychology

Candidate with a Master's degree in Psychology with a good academic record (minimum CGPA of 5.5 on a 10 point scale or 55% marks in aggregate where marks are awarded) and having a valid score in UGC/CSIR-NET/CU-Ph.D. Entrance Test or equivalent qualification tenable for the current year in the relevant area.

Ph.D in English

Candidate with a Master's degree in English with a good academic record (minimum CGPA of 5.5 on a 10 point scale or 55% marks in aggregate where marks are awarded) and having a valid score in UGC/CSIR-NET/CU-Ph.D. Entrance Test or equivalent qualification tenable for the current year in the relevant area.

Ph.D in Mass Communication

Candidate with a Master's degree in Mass Comm./ Film / Animation with a good academic record (minimum CGPA of 5.5 on a 10 point scale or 55% marks in aggregate where marks are awarded) and having a valid score in UGC/CSIR-NET/CU-Ph.D. Entrance Test or equivalent qualification tenable for the current year in the relevant area.

Ph.D in Commerce

Candidate with a Master's degree in commerce with a good academic record (minimum CGPA of 5.5 on a 10 point scale or 55% marks in aggregate where marks are awarded) and having a valid score in UGC/CSIR-NET/CU-Ph.D. Entrance test or equivalent qualification tenable for the current year in the relevant area.

Ph.D in Economics

Candidate with a Master's degree in Economics with a good academic record (minimum CGPA of 5.5 on a 10 point scale or 55% marks in aggregate where marks are awarded) and having a valid score in UGC/CSIR-NET/CU-Ph.D. Entrance test or equivalent qualification tenable for the current year in the relevant area.

Ph.D. in Architecture

Candidates with Bachelor and Masters Degree in architecture/allied specialization or equivalent from a recognized academic institution (with not less than 55% of marks, or a CGPA of 5.5 and above in the 10-point scale) and having a Valid Score in UGC/CSIR/NET/CU-Ph.D. Entrance examination or equivalent qualification tenable for the current year in relevant year.

International Students

Foreign nationals can only register as regular full-times scholars. Foreign nationals with degree from Indian Universities will be treated on par with Indian nationals for admission purposes. Foreign nationals with foreign degrees must meet the minimum educational requirements as given above and equivalent to a Indian Master's degree in the relevant disciplines, In addition, they should have a valid GRE/ GMAT / GATE/JMET/CAT/XAT/MAT/ATMA/ UGC or CSIR / NET / JRF or CU Ph.D Entrance test and should have cleared TOEFL score in the relevant discipline. International students are expected to have a working knowledge of English.

Selection Procedure

Eligible candidates possessing the minimum educational qualifications and satisfying additional criteria as set above, will be called for an Interview by the Ph.D Admission Committee.

Based on the academic record and the performance of the candidates in the interview and/or test, the Admission Committee will recommend to the Vice-Chancellor the names of candidates found suitable for admission to the Ph.D Programme,

Admission

(a) Candidates whose selection is approved by the Vice-Chancellor will be admitted to the Ph.D programme after payment of prescribed fees.

(b) Ordinarily, a candidate is not eligible for re-registration for Ph.D after cancellation of his/her earlier registration for any reason, Based on the merits of the individual case and taking into consideration of any special circumstances, a candidate may be considered for re-registration.

CHOICE OF GUIDE

(a)   Recommendation about the allotment of research scholars to guides will be made by the Head of the Department taking into consideration the research profile of the department and the preferences of the research scholars and guides, which shall be approved by the University Research Committee.

(b)   There shall be not more than two guides from the Institute for a research scholar

(c)   Additional Guide from outside the Institute can be allowed with the approval of Vice-Chancellor on case to case to case basic only for research based on Biomedical Devices and Technology areas.

(d)   The recommendation for the co-guide shall be made with valid reasons and justifications by the Doctoral Committee (DC) of the research scholar

ELIGIBILITY FOR BEING SUPERVISOR/GUIDE

Only such faculty/staff members of the University will be proposed as supervisors who hold a Ph.D or its equivalent degree. If any faculty member supervises a Ph.D student of another University then that will also be counted towards the total number of students being guided by the faculty. Only regular faculty members and Adjunct/Visiting faculty of the University can act as supervisors. A supervisor can at a time supervise maximum 8 research scholars. Other important points are.

If the faculty member, guiding you for at least years retires, will continue to be your guide and a co-guide will be appointed. The guide will be invited for Doctoral Committee meetings, synopsis meeting and viva voce.

A faculty member who is to retire in 3 years can become a guide to a new scholar with another faculty member who is not likely to retire in the next 5 years as a co-guide. The guide will be invited for Doctoral Committee meetings, synopsis meeting and viva voce.

CSIR, Emeritus fellows and professors who have held office at CU for 2 years can become co-guides for scholars along with a guide from CU left with 5 years of service at the time of registration

If the guide goes on 1+ year leave, another faculty member will be identified as co-guide

The induction of new guides after 3 years of registration of a research scholar will be onsidered only after the recommendation by the University Research Committee.

CHANGE/ADDITION OF GUIDE

The Doctoral Committee of a research scholar may recommend change of guide or appointment of a co-guide for valid reasons.

Ph.D ADMISSION COMMITTEE

The Vice-Chancellor Chandigarh University will appoint Ph.D Admission Committee.

The following is the composition of the Ph.D Admission Committee

Dean of Academic Affairs	Chairman
Dean of Research & Development	Member
Senior most Professor (Engineering)	Member(s)
Senior most Professor (Management)	Member
Senior most Professor (Sciences/Humanities)	Member

Research Degree Board (RDB)

The Research proposal will be considered by the Research Degree Board (RDB)

Dean of Academic Affairs	Chairman Member (s)
All Deans of Faculties	Member(s)
All Professors of Department	Member
All Head of Departments	Member(s)
Two Associates Professors & two Senior most assistant professors of the University by rotation according to security provided that they hold a Ph.D degree	Member
Three outside experts (One each from Engineering Management & applied Sciences) holding Ph.D degree to be nominated by the Vice. Chancellor	Member

RIGOROUS SCHEDULE INSURES SUCCESS

The supervisor of the candidate shall propose names of three experts from the approved panel of outside experts.

In case of non-availability of experts in the relevant area of specialization in the approved University Research Board panel of outside experts, the supervisor may submit an additional list of five experts of relevant area through Head of the Department/School to Dean Academic Affairs/Dean of Research.

The candidate shall be required to make a presentation in the topic of her/his proposed research. The research proposal shall include survey of literature, board objective, scope and approach of the proposed investigation, facilities required for successful implementation and the significant contribution / advancement likely to be made. The University Research Board will consider the proposal and decide the viability of the proposal. The exact title, objectives and scope of the research work shall be finalized by the doctoral committee at the time of Pre-Ph.D. presentation and before submission of the synopsis. The synopsis shall thereafter be got approved from the University Research Board.

RESEARCH DEGREE BOARD (RDC)

The Head of the Department will intimate to the Dean, Research & Development, for each scholar the area of research, the name(s) of the guide(s) and a panel of names, indicating the area of specialization of faculty members for the purpose of finalization of Research topic & objective, the candidate shall be required to summit 15 copies of the tentative design for the research project along with the registrations form to the RDC, The Head of the Department have the option for presentation of the symposis by the candidate before the joint meeting of the administrative & Academic committee in the presence of local member of the Research Degree Committee, other faculty members, students & proposed supervisor(s).

Constitution of the Research Degree committee shall be as follows

|	
Dean of faculty concerned	Chairperson
Head of Department	Member
All Professors & Associate Professors of the Department who holds Ph.D degree	Member(s)
Max 03-experts from the same or allied disciplines from the University as recommended by Dean Academic Affairs	Member(s)
Two Assistant Professors by rotation in order of seniority provided they hold Ph.D degree	Member(s)
Supervisor(s) or Guide (s)	Member(s)

Scientific/Design / Administrative staff and others who are eligible to guide Ph.D. scholars may be nominated as members of the Research Doctoral Committee.

If the Chairman, Board of Studies happens to be the Guide of a scholar, the senior most Professor/ previous HoD will be nominated by Vice-Chancellor.

Ph.D research scholar may within one year of her/his registration modify the proposal of her/his subject with approval of Dean Academic Affairs/ Dean of Research on the recommendations of Doctoral Committee. Provided that Vice-Chancellor, on the recommendation of Dean Academic Affairs / Dean of Research may allow modification to be made in the proposal even after one year if the proposed modification does not involve any major changes.

A Candidate can change the status of his registration from full time to part time on approval of Dean Academic Affairs/ Dean of Research on the recommendation of Doctoral Committee. The student shall be required to submit a half—yearly progress report to the Registrar through Doctoral Committee about his research work on the prescribed Per forma in cases of non-recei[t of two consecutive progress reports or two consecutive unsatisfactory reports or unethical practices in research committed by the student or misconduct of the student.

Committee under the Chairperson ship of Dean Academic Affairs / Dean of Research can recommend any action including cancellation of registration.
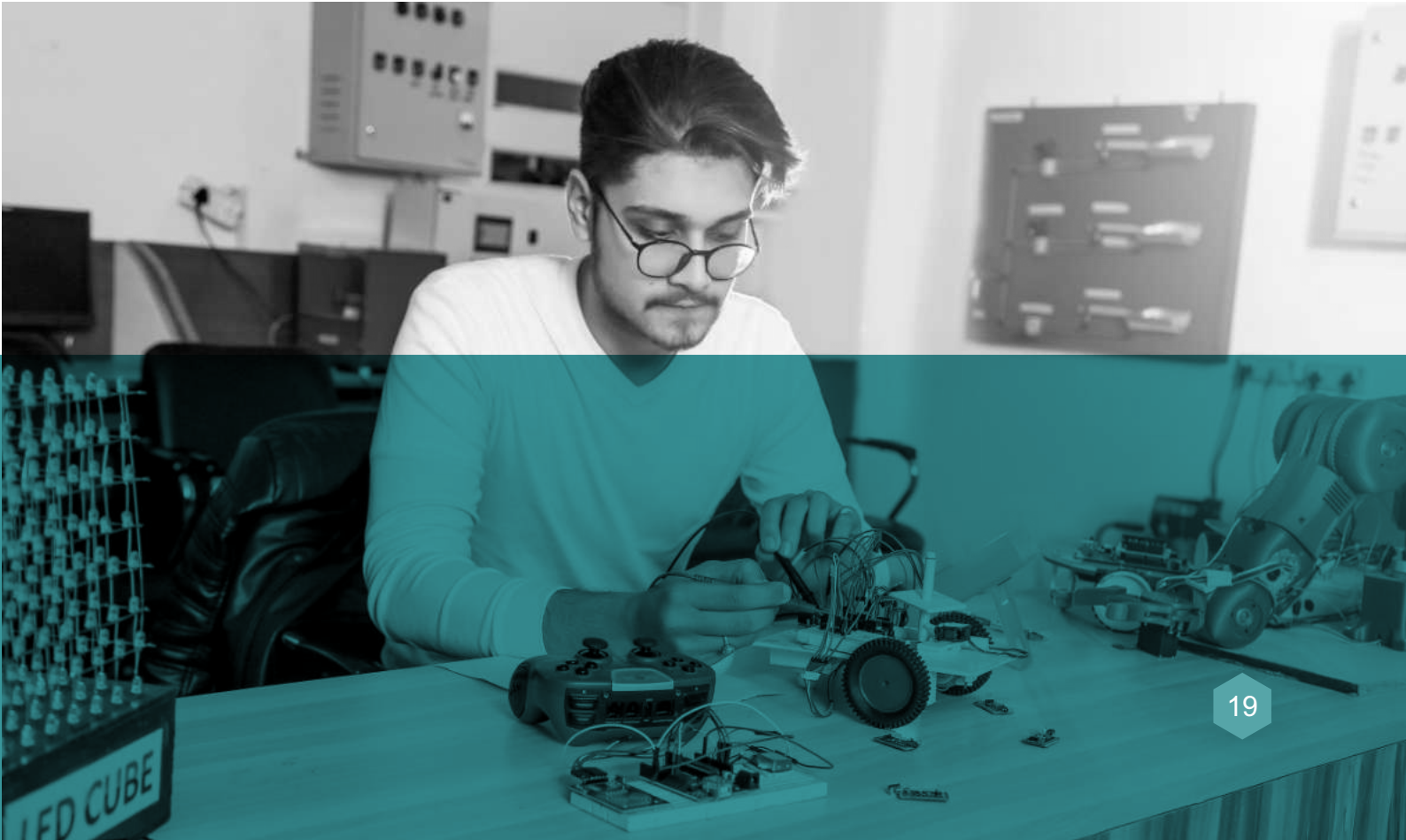
ENROLLMENT

All research scholars are required to enroll in person each semester on the stipulated date till their submission of thesis after payment of the requisite fees. The enrolment will be completed only after successful completion of progress during the semester. The enrolment will be cancelled of the progress is not satisfactory.

COURSE WORK

Every admitted candidate shall have to do course work for a minimum of one semester. The course work shall include at least three courses, namely, a course on research methodology (may include quantitative methods and computer applications) or a course proposed by the Admission Committee (for those who have studied a similar course on Research Methodology at PG level), professional course (syllabus to be proposed by the allocated) supervisor and approved by Chairman, Admission Committee) and a seminar (Relevant in the area of research). Minimum credits for the course work shall be 12 including a seminar of 4 credits. The process of registration in the course work, examination, evaluation and grading shall be same as followed for UG/PG programmes. Only those candidates who successfully complete the course work within one year of admission and with minimum Cumulative Grate Point Average (CGPA) of 6.00 on 10.00 point scale shall be registered in the Ph.D programme.

Every candidate will be required to submit a research proposal within 6 months, duly recommended by the Supervisor(s) after the successful completion of course work. Research proposals will be submitted to the concerned Head of the Department/School. In case of non-submission of proposal with the prescribed period, concerned Dean Academic Affairs/ Dean of Research on the recommendations of the Supervisors and Head of the Department / School may grant an extension for a maximum period of six months, on valid reasons. If the candidate fails to submit the proposal even during the extended period her/his provisional registration will be cancelled. In case candidate's proposal in rejected by the University Research Board she/he may submit it within next six months starting the date of dispatch of information about rejection, failing which her/his provisional registration will be cancelled.

REGISTRATION

It is mandatory for all the Ph.D students to register in the concerned Department / School

Candidates who pass the examination for the prescribed courses and whose research proposals are accepted will be allowed to register for the Ph.D program after due approval from Doctoral Committee and University Research Board. The date of registration will be from the date of approval of research proposal by URB

Candidates will be permitted to commence research thereafter

PROGRESS REPORT

- A registered research scholar shall submit a written report in the required format, after every six months from the date of registration.

- The report should be routed through the guide to the Head of the Department for consideration by the Doctoral Committee.The report should be routed through the guide to the Head of the Department for consideration by the Doctoral Committee.

- Continuance of registration and award/continuance of Scholarship/Research Assistantship will be based on the recommendation of the Doctoral Committee.

- In the case of research scholars under external registration or working on a part time basis, the Doctoral Committee will pay particular attention to the quantum of effort put in by the scholar towards doctoral studies and progress. Inadequacy of effort progress can be a reason for cancellation of registration.

RELIEF FROM Ph.D PROGRAMME TO TAKE UP JOB

Ph.D Scholars who got a job offer can get relief from the programme, while keeping their registration alive on payment of the requisite fees every semester on the following condition.

Scholars who take up jobs will be relieved on their request, based on the recommendations of Doctoral Committee, if they have completed their.

Substantial research work
Course work

The renewal of their registration for every year / semester however, will be considered only if the Doctoral Committee finds his/her progress to be satisfactory and recommends continuance of registrations.

MAXIMUM DURATION OF PROGRAMME

The Student shall submit her/his thesis to the Registrar within five years but not earlier than 3.0 years from the date of her/his admission. The student would be expected to work for her/his thesis at the university except for visits to other Labs/Organizations wit the approval of the Supervisor(s) and concerned Head of the Department / School.

Every student shall ordinarily complete her/his research work within the normal period as provided in the ordinance, but in genuine cases of hardship, Dean Academic Affairs / Dean of Research on the recommendations of the doctoral Committee may allow extension up to one year.

Provided further that if at the end of six year period, the student is found to have completed a substantial part of his thesis or has published research papers in some refereed journals the Vice Chancellor on the recommendation of Dean Academic Affairs / Dean of Research may allow further extension of one year recording detailed and specific reasons as to why this special extension is being allowed.

Registration of students who fails to submit their thesis with the stipulated periods as above or who fail to apply for grant of extension would automatically stand cancelled. No extension beyond the total period of seven years shall be granted in any case.

CANCELLATION OF REGISTRATION

- The registration of a research scholar whose progress is not found to be satisfactory by the Doctoral Committee or who has not enrolled is liable to be cancelled.

- The registration of a research scholar who has not submitted his/her thesis before the end of the maximum permissible period will be

WITHDRAWAL FROM THE PROGRAMME

A scholar may be permitted by the Dean Academic Affairs / Dean of Research to withdraw from the programme for a semester or longer for reasons of ill health or other valid grounds duly recommended by the Doctoral Committee. Normally a scholar will be permitted to discontinue from the programme only for a maximum continuous period of two semesters.

SYNOPSIS

On satisfactory completion of the prescribed courses, and the research work, the scholar shall submit the requisite copies of the synopsis of his/her research work in the required format through the guide(s) and Head of the Department to the Academic Section for consideration of the Doctoral Committee (DC)

Prior to submission of the synopsis, the scholar is required to give at least one seminar talk on the topic of his/her research.
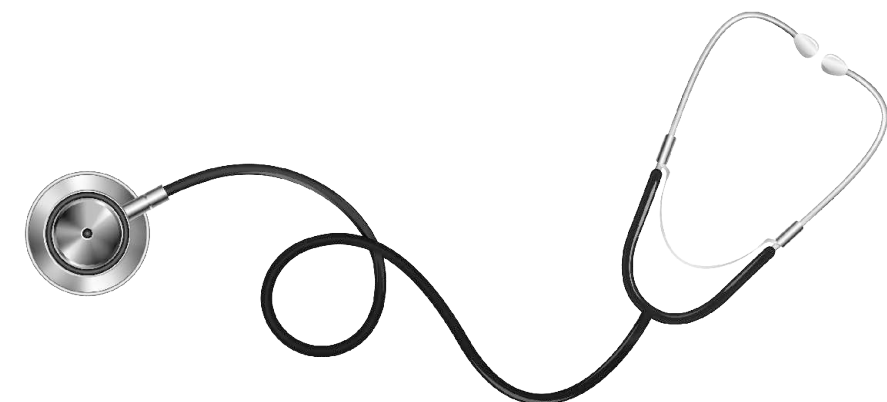
SUBMISSION OF THESIS

The Scholar should have atleast three research papers published and indexed in Scopus /WOS Journal.

The research scholar is required to give presentation of the research work before submission of the long abstract in the presence of the Doctoral Committee. The gist of the abstract should match with approved research proposal by the University Research board. After the presentation, the student shall submit four copies of the long abstract of thesis along with list of relevant references so that these could be sent to the proposed examiners while obtaining their acceptance to act as examiners.

The research scholar shall, within three months of acceptance of the long abstract, submit four copies of the thesis, spiral bound and printed on both sides, along with a soft copy and abstract of the thesis accompanied with a fee, as prescribed by the University, The Doctoral Committee may grant additional time beyond three months on request from the scholar for valid reasons. Students required resubmitting their theses after revision will be charged full fee as prescribed for submitting the original thesis. Prior to submission of the synopsis, the scholar is required to give at least one seminar talk on the topic of his/her research.

Dean Academic Affairs / Dean of Research, on receipt of the intimation from the student, shall take the necessary steps for the appointment of examiners.

THESIS REPORT

Each Examiner shall state in her/his report the following:

- The relevance and depth of the research work
- Whether the degree be awarded to the student
- Whether the thesis bye rejected.
- In case an examiner recommends revision of the thesis he shall also indicate whether the revision suggested by her/him requires:

    1. **Substantial changes in the thesis before it can be accepted for Ph.D degree.**
    2. **Minor additions or alterations in the thesis before its acceptance, wherever necessary.**
    3. **The examiner may indicate whether he would like to re Examine the thesis after the revision**

- Questions if any, which she/he may like the student to, answer in the viva-voce in a separate cover.

In the event of an examiner making recommendation for the revision / modification of the thesis, the student shall be free to defend her / his point of view through Dean Academic Affairs / Dean of defense, the student shall be required to carry out necessary revision / modification as finally suggested by the examiner before her / his case is proceeded with.

The student, who is required to re-submit the thesis, must do so within one year from the date of receipt of the examiners comments by the University, unless an extension is specially given by Dean Academic Affairs / Dean of Research. A re-submitted thesis will be examined by the same examiner who had recommended re-submission unless she/he herself/himself is unable to do so or declines to do so.

In the event of one of the examiners recommending the award of the degree and the second examiner recommending rejection of the thesis, the thesis shall be referred to a third examiner to be appointed by the Vice Chancellor from out of the original panel of examiners. The recommendations of the third examiner shall be final.

The procedure shall also be followed if the examiner who has suggested revision / modification rejects the revised thesis.

In case reports of both examiners are positive, the Doctoral Committee shall prepare a gist of the reports of the examiners for the consideration of the Vice Chancellor in order to take further, decision regarding the conduct of Viva-voce.

VIVA VOCE EXAMINATION

The viva-voce examination shall be compulsory for all the students and shall be conducted jointly by the Supervisor(s) and one of the external examiners. In case an external examiner is unable to conduct the viva-voce, a set of questions would be obtained from her/him by Dean Academic Affairs/Dean of Research, and viva-voce will be conducted by an examiner to be appointed by the Vice Chancellor.

The Dean of Academics, Dean of Research, Doctoral Committee members of the research scholar; faculty members and PG students of the concerned department will be invitees to the viva voce.

AWARD OF Ph.D DEGREE

The Doctoral Committee under the Chairperson ship of Dean of Research shall give final recommendations for the award of Ph.D degree on the basis of examiners reports along with the gist of reports prepared by the Doctoral Committee. The decision will be reported to the Board of Management. The registrar shall publish the result in accordance with the decision as conveyed by the Vice Chancellor.

LEAVE RULES

The Ph.D student getting Research/Teaching Assistantship through the University shall abide by the following leave rules:
Male : 10 days of leave per annum
Female : 20 days of leave per annum.
There will be no summer/winter vacations for such students.

POWER TO MODIFY

Not with standing all that has been started above, the Vice Chancellor has the right to modify any of the above regulations from time to time.

REGISTRATION

Every scholar is required to observe disciplined and decorous behavior both inside and outside the campus and should not indulge in any activity, which will tend to bring down the prestige of the Institute. The research scholar should avoid plagiarism at any stage of his/her research. Any act of indiscipline of a scholar reported to the Dean of Research or Dean of Academics will be referred to Discipline Committee nominated of the University.

The committee will investigate the charges and will recommend suitable punishment if it finds the charges substantiated. The recommendation of the Committee will be considered by the URC, which will authorize the Dean of Academic Research to take the action taken by to the Vice-Chancellor.

APPEAL

The Scholar may go in for appeal to the Vice-Chancellor whose decision will be final.

IMPORTANT NOTE

Ragging is not allowed at Chandigarh University, and is strictly prohibited. As per the directives received from the Honorable Supreme Court of India, the student (s) involved in ragging shall be given liberty to explain, and if his/her explanation is not found satisfactory, the University would expel him/her from the Institute.

FELLOWSHIP

ELIGIBILITY

Fellowship / teaching assistantship may be granted to candidates out of those admitted to the Ph.D (Regular) programme. Only those candidates will be considered who have obtained minimum first division or equivalent in their qualifying examination.

NUMBER AND VALUES OF THE ASSISTANTSHIP

Teaching assistantship are allocated to each Department / School depending upon their requirement. The numbers of teaching assistantship vary from time to time.
Emoluments for the teaching assistantship will be **Rs.21600/- (including contingency)** per month or as approved from time to time by the University. Suitable accommodation may be provided, if available in the University on rentals basis.

DURATION

The assistantship will be tenable for one semester at the first instance from the date of selection, to be renewed after every semester as per requirement of the Deptt. School

GENERAL CONDITIONS

A scholar who has been selected for the award will be given 8-12 hours of teaching load per week.

A scholar who has been selected for assistantship shall not be eligible for any other fellowship from the University or from any other source. A scholar who has been selected for assistantship shall be liable to pay tuition fee and other dues as prescribed by the University from time to time.

SCHEME OF PH.D ENTRANCE TEST

The medium of Test shall be English only. The Question Paper shall comprise of objective / descriptive type questions.

Section | carrying 50 marks will consists of 50 objective type question of 1 mark each designed to test the general & research aptitude and English language proficiency as per the following components :

Logical Reasoning

Research Aptitude

Functional Knowledge of Computer

English Language Proficiency

Section I| carrying 50 marks will consists of descriptive question based on the area of specialization. The candidates will be required to attempt any 5 questions out of 6 questions.

All questions shall carry equal marks. The syllabus for this section will be prescribed by the University.

DURATION OF TEST

The duration of the Test shall be three hours. Candidates qualifying the written test will be subjected to personal interviews to assess their motivation & potential in proposed research area. Admission will be taken as per UGC - 2016 Ph.D. guidelines.
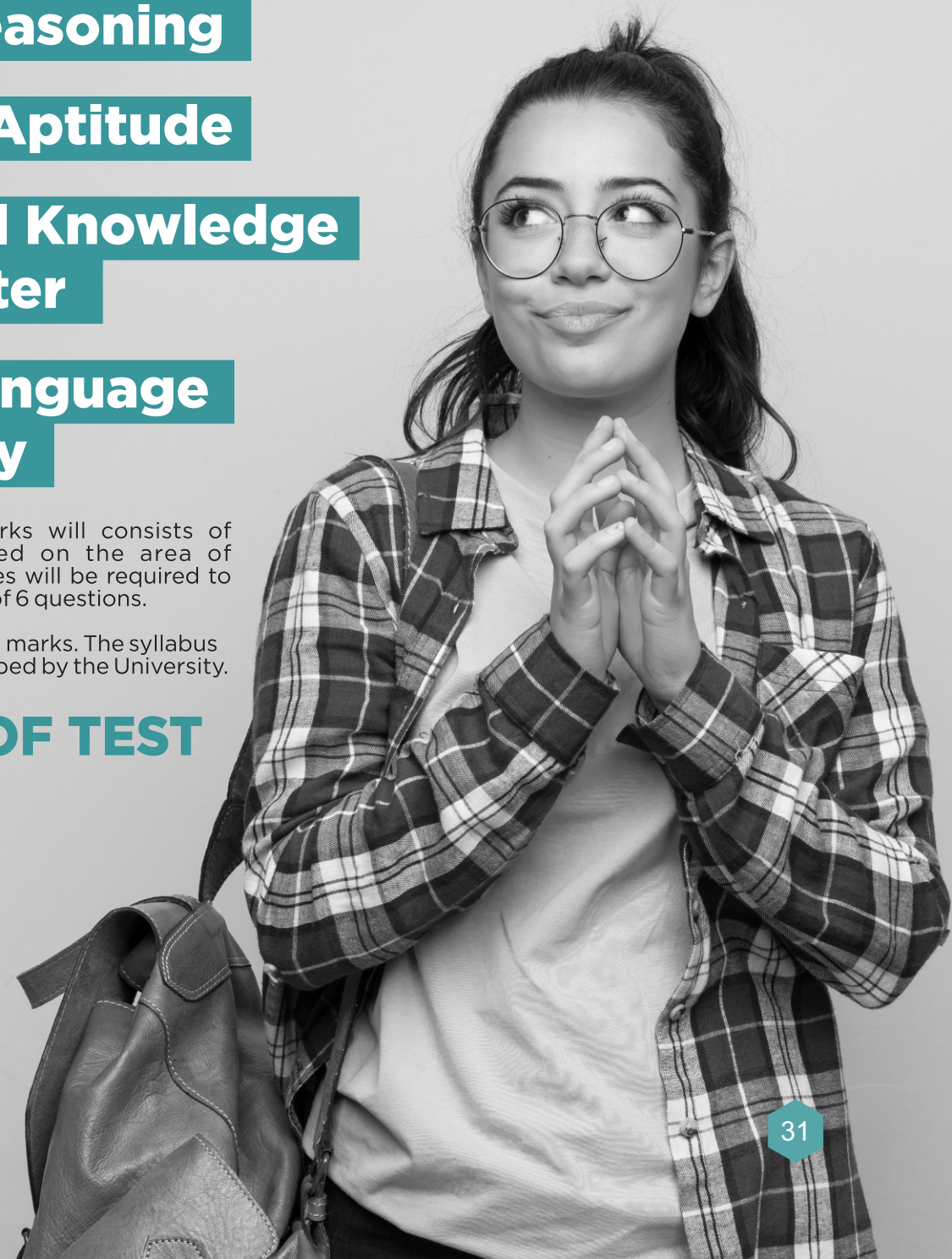
SYLLABUS FOR THE ENTRANCE TEST

Mathematical: Discrete Structures: Sets, Relations, Functions, Combinatorics, Graphs and Trees, Recurrence relations, Algebraic structures.

Statistics: Probability, Conditional Probability; Bayes' theorem, Bernoulli trials, Random variables, discrete and continuous distributions.
Programming in C: Basic concepts, Data types, control structures, structured data types, recursion

Data structures: Arrays, Stacks, Queues, Linked lists, Graphs and Trees.

Object oriented programming: Abstraction, Encapsulation and information hiding, Classes and Objects, inheritance, polymorphism, Function overloading, Operator overloading, constructors and destructors, friend functions, virtual functions, exception handling.

Algorithm Design: Analysis and Design of Algorithms, Growth of functions and asymptotic notations, Algorithm Design strategies: Divide and Conquer, Greedy Method, Dynamic programming, Backtracking, Branch and Bound, Graph based Algorithm design techniques. Problems based on different algorithms design techniques. Flow networks and sorting networks. NP Hard and NP complete problems.

Theory of Computation: Formal Languages, Regular languages and finite automata, Regular Expressions, Kleen's theorem, Context free languages and Push-down automata, Context free grammars, Simplification of context free grammars and normal forms, Recursively enumerable sets and Turing machines, Undecidability, Chomsky Hierarchy of languages.
Compiler Design: Phase structure of a Compiler, Lexical analysis, Syntax analysis, Parsers, Syntax directed translation, intermediate code generation, code optimization, code generation, symbol tables, error handling.

Software Engineering: Software life cycle models, Information gathering, Feasibility Study, Requirement Gathering, analysis and SRS Specification, Data flow diagrams, Function oriented and object oriented design, coding and testing, Software Maintenance, Software Project Management, Software quality and Reliability.

Database Concepts : Database concepts, data models : ER-model, Relational model, Network model, Hierarchical model, Relational algebra, Tuple calculus, Database design, integrity constraints, Normal forms, Query languages (SQL), Transactions and Concurrency control
Computer Networks: OSI and TCP/IP Reference Model, LAN Technologies (Ethernet, Token ring), Flow and error control techniques, Routing algorithms, Congestion control, TCP/UDP and sockets, Application layer Protocols (IC\VIR DNS, SMTP,FTP, HTTP), Basic concepts of Hubs, Switches, Gateways, and Routers. Network Security — Basic concept of Public Key and Private Key Cryptography, Digital Signature, Firewalls.

Digital Logic: Logic functions, Minimization, Design and Synthesis of Combinational and Sequential Circuits, Number Systems: Binary, Octal, Decimal, Hexadecimal, 1's Complement and 2's Complement. Computer Organization and Architecture: Register Transfer Logic, Machine instructions and Addressing Modes, ALU and Data-Path, CPU Control Design, Memory interface, I/O interface (interrupt and DMA mode), Parallel Processing, Pipelining.
Operating System: Functions of Operating System, Multiprogramming, Multiprocessing, Multitasking, Processes, Threads, Inter-Process Communication, Concurrency, Synchronization, Deadlock, CPU scheduling, Memory management and Virtual Memory, File systems, I/O systems, Protection and Security.

ELECTRONICS & COMMUNICATION ENGINEERING

Networks : Network graphs: matrices associated with graphs; incidence, fundamental cut set and fundamental circuit matrices. Solution methods: nodal and mesh analysis, Network theorems: superposition, Thevenin and Norton's maximum power transfer, Wye-Delta transformation. Steady state sinusoidal analysis using phasors. Linear constant coefficient differential equations; time domain analysis of simple RLC circuits, Solution of network equations using Laplace transform: frequency domain analysis of RLC circuits. 2-port network parameters: driving point and transfer functions. State equations for networks.

Electronics Devices : Energy bands in silicon, intrinsic and extrinsic silicon, Carrier transport in silicon: diffusion current, drift current, mobility and resistivity. Generation and recombination carriers. p-n junction diode, Zener diode, tunnel diode, BJT, JFET MOS capacitor, MOSFET, LED, pln and avalanche photo diode, Basics of LASERs. Device technology: integrated circuits fabrication process, oxidation, diffusion, ion implantation, photolithography, n-tub, and twin-tub CMOS process.

Analog Circuits : Small Signal Equivalent circuits of diodes, BJTs, MOSFETs and analog CMOS. Simple diode circuits, clipping, clamping, rectifies. Biasing and bias stability of transistor and FET amplifiers, Amplifiers: single-and multi-stage, differential and operational, feedback, and power. Frequency response of amplifiers. Simple op-amp circuits. Filters. Sinusoidal oscillators; criterion for oscillation; singe-transistor and op-amp configurations. Function generators and wave-shapping circuits, 555 Timers. Power supplies.

Digital Circuits : Boolean algebra, minimization of Boolean functions; logic gates; digital IC families (DTL, TTL, ECL, MOS, CMOS). Combinatorial circuits: arithmetic circuits, code converters, multiplexers, decoders, PROMs and PLAs. Sequential circuits: latches and flip-flops, counters and shift-registers. Sample and hold circuits, ADCs, DACs. Semiconductor memories. Microprocessor (8085): architecture, programming memory and I/O interfacing,

Signals and Systems: Definitions and properties of Laplace transform, continuos-time and discrete-time Fourier series, continuous-time and discrete-time Fourier Transform DFT and FFT. ztranform. Sampling theorem. Linear Time-Invariant (LTI) Systems: definitions and properties: causality stability impulse response, convolution, poles and zeros, parallel and cascade structure, frequency response, group delay phase delay. Signal transmission through LTI systems.

Signals and Systems: Definitions and properties of Laplace transform, continuous-time and discrete-time Fourier series, continuous-time and discrete-time fourier transform, DFT and FFT, ztransform. Sampling theorem. Linear Time-Invariant (LTI) Systems: definitions and properties; causality, stability, impulse response, convolution, poles and zeros, parallel and cascade structure, frequency response, group delay, phase delay, Signal transmission through LTI systems.

Control Systems: Basic control system components; block diagrammatic description, reduction of block diagrams. Open loop and closed loop (feedback) systems and stability analysis of these systems. Signal flow graphs and their use in determining transfer functions of systems: transient and steady state analysis of LTI control systems and frequency response. Tools and techniques for LTI control system analysis: root loci, Routh-Hurwitz criterion, Bode and Nyquist plots. Control system compensators: elements of lead and lag compensation, elements of Proportional-Integral-Derivative (PID) control. State variable representation and solution of state equation of LTI control systems.

Communications: Random signals and noise: probability, random variables, probability density function, autocorrelation, power spectral density. Analog communication systems: amplitude and angle modulation and demodulation systems, spectral analysis of these operations, superheterodyne receivers: elements of hardware, realizations of analog communication system: signal-to-noise ration (SNR) calculations for amplitude modulation (AM) and frequency modulation (FM) for low noise conditions. Fundamentals of information theory and channel capacity theorem. Digital communication systems: pulse code modulation (PCM), differential pulse code modulation (DPCM), digital modulation schemes: amplitude phase and frequency shiff keying schemes (ASK PSK FSK) matched filter receivers brandwidth consideration and probability of error calculations for these schemes. Basics of TDMA, FDMA and CDMA and GSM.

Electromagnetics: Elements of vector calculus divergence and curl; Gauss and Stokes theorems, Maxwell's equations: differential and integral forms. Wave equation Poynting vector Plane waves: propagation through various media reflection and refraction: phase and group vellocity: skin depth. Transmission lines: characteristic impedance: impedance transmission: Smith chart; impedance matching: S parameters, pulse excitation.

Waveguides: Modes in rectangular waveguides; boundary conditions; cut-off frequencies; dispersion relations Basics of propagation in dielectric waveguide and optical fibers. Basics of Antennas: Dipole antennas; radiations pattern; antenna gain

CIVIL ENGINEERING

For Section - A (Objective): Refer : Information Broucher
For Section - B (Subjective)

STRUCTURAL ENGINEERING

Mechanics: Bending moment and shear force in statically determinate beams, Simple stress and strain relationship: Stress and strain in two dimensions, principal stresses, stress transformation, Mohr's circle. Simple bending theory, Flexural and shear stresses.
Unsymmetrical bending, shear centre. Thin walled pressure vessels, Uniform torsion, Buckling of column, combined and direct bending stresses.
Structural Analysis: Analysis of statically determinate trusses, arches, beams, cables and frames, displacements in statically determinate structures and analysis of statically indeterminate structures by force/energy methods, analysis by displacement methods (slope deflection and moment distribution methods), influence lines for determinate and indeterminate structures. Basic concepts of matrix methods of structural analysis.
Concrete Structures: Concrete Technology-properties of concrete, basics of mix design, Concrete design-basic working stress and limit state design concepts, analysis of ultimate load capacity and design of members subjected to flexure, shear, compression and torsion by limit state methods. Basic elements of prestressed concrete analysis of beam sections at transfer and service loads.
Steel Structures: Analysis and design of tension and compression members, beams and beam-columns, column bases. Connections-simple and eccentric, beam-columnconnections. plate girders and trusses. Plastic analysis of beams and frames.

GEOTECHNICAL ENGINEERING

Soil Mechanics: Origin of soils, soil classification, three-phase system, fundamental definitions, relationship and interrelationships, permeability & seepage, effective stress principle consolidation, compaction, shear strength.
Foundation Engineering: Sub-surface investigations-scope, drilling bore holes, sampling, penetration tests, plate load test, Earth pressure theories effect of water table, layered soils. Stability of slopes-infinite slopes, finite slopes. Foundation types-foundation design requirements. Shallow foundations-bearing capacity, effect of shape, water table and other factory, stress distribution settlement analysis in sands & clays. Deep foundations-pile types, dynamic and static formulae, load capacity of piles in sands and clays negative skin friction.

WATER RESOURCES ENGINEERING

Soil Fluid Mechanics and Hydraulics: Properties of fluids, principle of conservation of mass, momentum, energy and corresponding equations, potential flow applications of momentum and Bernoulli's equation, laminar and turbulent flow, flow in pipes, pipe networks. Concept of boundary layer and its growth. Uniform flow, critical flow and gradually varied flow in channels, specific energy concept, hydraulic jump. Forces on immersed bodies, flow measurements in channels tanks and pipes. Dimensional analysis and hydraulic modeling. Kinematics of flow, velocity triangles and specific speed of pumps and turbines.
Hydrology: Hydrologic cycle, rainfall, evaporation, infiltration, stage discharge relationships, unit hydrographs, flood estimation reservoir capacity, reservoir and channel routing. Well hydraulics.
Irrigation: Duty, delta, estimation of evapo-transpiration. Crop water requirements. Design of: lined and unlined canals, waterways, head works, gravity dams and spillways. Design of weirs on permeable foundation. Types of irrigation system, irrigation methods. Water logging and drainage, sodic soils.

ENVIRONMENTAL ENGINEERING

Water requirements: Quality standards, basic unit processes and operations for water treatment. Drinking water standards, water requirements, basic unit operations and unit processes for surface water treatment, distribution of water. Sewage and sewerage treatment, quantity and characteristics of wastewater. Primary, secondary and tertiary treatment of wastewater, sludge disposal, effluent discharge standards. Domestic water treatment, quantity of characteristics of domestic wastewater, primary and secondary treatment Unit operations and unit processes of domestic wastewater, sludge disposal.
Air Pollution: Types of pollutants, their sources and impacts, air pollution meteorology, air pollution control, air quality standards and limits.
Municipal Solid Wastes: Characteristics, generation, collection and transportation of soild wastes, engineered systems for solid waste management (reuse/recycle, energy recovery, treatment and disposal).
Noise Pollution: Impacts of noise, permissible limits of noise pollution, measurement of noise and control of noise pollution.

TRANSPORTATION ENGINEERING

Highway Planning: Geometric design of highways, testing and specifications of paving materials, design of flexible and rigid pavements.
Traffic Engineering: Traffic characteristics, theory of traffic flow, intersection design, traffic signs and signal design, highway capacity.

SURVEYING

Importance of surveying, principles and classifications, mapping concepts, coordinate system, map projections, measurements of distance and directions, leveling, theodolite traversing, plane table surveying, errors and adjustments, curves.

Doctor of Philosophy

MECHANICAL ENGINEERING

Engineering Mechanics: Free body diagrams and equilibrium; trusses and frames virtual work; kinematics and dynamics of particles and of rigid bodies in plane motion, including impulse and momentum (linear and angular) and energy formulations; impact.

Strength of Materials: Stress and strain, stress-relationship and elastic constants, Mohr's circle for plane stress and plane strain, thin cylinders; shear force and bending moment diagrams; bending ans shear stresses; deflection of beams; torsion of circular shafts; Euler's theory if columns; strain energy methods; thermal stresses.

Theory of Machines: Displacement, velocity and acceleration analysis of plane mechanisms; dynamic analysis of slider-crank mechanism; gear trains; flywheels.

Vibrations: Free and forced vibration of single degree of freedom systems; effect of damping; vibration isolation; resonance, critical speeds of shafts.

Deisgn: Design for static and dynamic loading; failure theories; fatigue strength and the S-N diagram; principles of the design of machine elements such as bolted, riveted and welded joints, shafts, spur gears, rolling and sliding contact bearings, brakes and clutches.

Fluid Mechanics: Fluid properties; fluid statics, manometry, buoyancy; control-volume analysis of mass, momentum and energy; fluid acceleration; differential equations of continuity and momentum; Bernoullis equation; viscous flow of incompressible fluids; boundary layer; elementary turbulent flow; flow through pipes, head losses in pipes, bends etc.

Heat-Transfer: Modes of heat transfer; one dimensional heat conduction, resistance concept, electrical analogy, unsteady heat conduction, fins; dimension less parameters in free and forced convective heat transfer, various correlations for heat transfer, various correlations for theat transfer in flow over flat plates and through pipes; thermal boundary layer; effect of turbulence, radiative heat transfer, black and grey surfaces, shape factors, network analysis; heat exchanger performance, LMTD and NTU methods.

Thermodynamics: Zeroth, First and Second laws of thermodynamics; thermodynamic system and processes; Carnot cycle. Irreversibility and availability; behaviors of ideal and real gases, properties of pure substances, calculation of work and heat in ideal processes; analysis of thermodynamic cycles related to energy conversion. Power Engineering: Steam Tables, Rankine, Brayton cycles with regeneration and reheat. I.C. Engines: air-standard Otto, Diesel cycles.

Refrigeration and Air-conditioning: Vapour refrigeration cycle, heat pumps, gas refrigeration, Reverse Brayton cycle; moist air: psychrometric chart, basic psychrometric.

Turbomachinery: Peltonwheel Francis and Kaplan turbines-impulse and reaction principles, velocity diagrams.

Engineering Materials: Structure and properties of engineering materials, heat treatment, stress-strain diagrams for engineering materials.

Metal Casting: Design of patterns, moulds and cores; solidification and cooling; riser and gating design, design considerations.

Forming: Plastic deformation and yield criteria; fundamentals of hot and cold working processes; load estimation for bulk (forging, rolling, extrusion, drawing) and sheet (shearing deep drawing, bending) metal forming processes; principles of powder metallurgy.

Joining: Physics of welding, brazing and soldering; adhesive bonding; design considerations in welding. Machine and Machine.

Tool Operations: Mechanics of machining, single and multi-point cutting tools, tool geometry and materials, tool life and wear; economics of machining; principles of non-traditional machining processes; principles of work holding, principles of design of jigs and fixtures.

Metrology and Inspection: Limits fits and tolerances; linear and angular measurements; comparators; gauge design, interferometry; form and finish measurement' alignment and testing methods; tolerance analysis in manufacturing and assembly.

Computer Integrated Manufacturing: Basic concepts of CAD/CAM and their integration tools.

Production Planning and Control: Forecasting models, aggregate production planning scheduling materials requirement planning.

MATHEMATICS

Linear Algebra: Finite dimensional vector spaces; Linear transformations and their matrix representations, rank; systems of linear equations, eigen values and eigen vectors, minimal polynomial, Cayley-Hamilton Theorem, duagonalisation Hermitian, Skew-Hermitian and unitary matrices; Finite dimensional inner product spaces, Gram-Schmidt orthonormalization process, self-adjoint operators.

Complex Analysis: Analytic functions conformal mappings bilinear transformations; complex integration; Caychy's integral theorem and formula; Liouville's theorem, maximum modulus principle, taylor and Laurent's series; residue theorem and applications for evaluating real integrals.

Analysis: Sequences and series of functions, uniform convergence, power series, Fourier series, functions of several variables, maxima, minima, Riemann integration multiple integrals, line, surface and volume integrals, theorems of Green Stokes and Gauss; metric spaces, completeness, Weierstrass approximation theorem, compactness, Banach spaces, Hilbert spaces. Basic concepts of topology, product topology, connectedness, compactness, countability and separation axioms, Urysohn's Lemma.

Ordinary Differential's Equations: First order ordinary differential equations, existence and uniqueness theorems, systems of linear first order ordinary differential equations, linear ordinary differential equations of higher order with constant coefficients; linear second order ordinary differential equations with variable coefficients; method of Laplace transforms for solving ordinary differential equations, series solutions; Legendre and Bessel functions and their orthogonality.

Algebra: Normal subgroups and homomorphism theorems, automorphisms; Group actions, Sylow's theorems and their applications; Euclidean domains, Principle ideal domains and unique factorization domains. Prime ideals and maximal ideals in commutative rings; Fields, finite fields.

Numerical Analysis: Numerical solution of algebraic and transcendental equations: bisection, secant method Newton-Raphson method, fixed point iteration; interpolation: error of polynomial interpolation, Lagrange, Newton interpolations; numerical differentiation; numerical integration. Trapezoidal and Simpson rules, Gauss Legendre quadrature, method of undetermined parameters; least square polynomial approximation; numerical solution of systems of linear equations: direct methods (Gauss elimination, LU decomposition); iterative methods (Jocobi and Gauss-Seidel), matrix eigenvalue problems: power method, numerical solution of ordinary differential equations: initial value problems: Taylor series methods. Euler's method, Runge-Kutta methods.

Partial Differential Equations: Linear first order partial differential equations, method of characteristics; second order linear equations in two variables and their classification; Cauchy, Dirichlet and Neumann problems: solutions of Laplace and wave equations in two variables; Fourier series and fourier transform.

Mechanics: Virtual work Lagrange's equations for holonomic systems, Hamiltonian equations.

Probability and Statistics: Probability space, conditional probability, Bayes theorem, independence, Random variables, joint and conditional distributions standard probability distributions, standard probability distributions and their properties, expectation, moments weak and strong law of large numbers, central limit theorem, Sampling distributions UMVU estimators maximum likelihood estimators, Testing of hypotheses, standard parametric tests based on normal, $X2$, t, F-distributions; Linear regression: Interval estimation.

Linear Programming: Linear programming problem and its formulation, convex sets and their properties, graphical method, basic feasible solution, simplex method, infeasible and unbounded LPP's alternate optima; Dual problem and duality theorems, dual simplex method, Big-M and Two phase method; infeasible and unbounded LLP's alternate optima; Dual problem and duality theorems, dual simplex method and its application in post optimality analysis; Balanced and unbalanced transportation problems, u-v method for solving transportation problems Hungarian method for solving assignment problems.

ELECTRICAL ENGINEERING

Networks: Network graphs: matrices associated with graphs; incidence, fundamental cut set and fundamental circuit matrices. Solution methods: nodal and mesh analysis. Network theorems: superposition, Thevenin and Norton's maximum power transfer, Wye-Delta transformation. Steady state sinusoidal analysis using phasors. Linear constant coefficient differential equations; time domain analysis of simple RLC circuits, Solution of network equations using Laplace transform: frequency domain analysis of RLC circuits. 2-port network parameters: driving point and transfer functions. State z equations for networks.

Transform: Frequency domain analysis of RLC circuits. 2-port network parameters: driving point and transfer functions. State z equations for networks.

Analog Circuits: Small Signal Equivalent circuits of diodes, BJTs, MOSFETs and analog CMOS. Simple diode circuits, clipping, clamping rectifier.
Biasing and bias stability of transistor and FET amplifier. Amplifiers: single-and multi-stage, differential and operational feedback, and power. Frequency response of amplifiers. Simple op-amp circuits. Fliters. Sinusoidal oscillators; criterion for oscillation; single-transistor and op-amp configurations. Function generators and wave-shaping circuits, 555 Timers. Power supplies.

Electrical Machines: Transformers: Theory - ideal transformer, Construction of transformers, Equivalent circuit, Phasor diagram, Regulation Losses, Efficiency, Parallel operation, Three winding transformer, Polyphase connections, Scott connected transformer, Auto transformer, Transformer windings, Tap-changing and voltage control. DC Machines: Construction of DC machines, lap and wave windings, EMF equation, Torque equation, Excitation, Commutation, Armature reaction, Equivalent circuit, Self excitation of generators, Characteristics of DC generators Paralled operation of generators: DC motor operation and characteristics. Parallel operation of motors: Losses in DC machines, Efficiency, Starting, speed control & braking of DC motors.

Induction Machines: Construction of induction machinesm Armature windings emf equation, MMF of polu phase windings, rotating magnetic field. IM action, Generalized transformer Equivalent circuit, Performance calculation. Testing lossesm efficiency Torque, Power, and Power factor, Starting, speed control and braking, Single phase induction motor, Armature reaction in induction motors, Equivalent cage rotor, Induction generators, line excited, self excited, Cascade connection, Induction frequency converter, Harmonics and their effects, High torque cage machines.

Synchronous Machines: Equivalent circuit, Generator load characteristic, Regulation by emf method. Regulation

alternators by MMF and Potier methods, Parallel operation of alternators. Generators on infinite bus bars, Capability chart of alternators. Electrical load diagram.
Determination of xd, xq of salient pole machines, Starting of synchronous motors. Synchronous condensers.

Power Electronics: Semiconductor Devices in switched mode, Diode, SCR, BJT, IGBT, MOSFET - drivers, protection, thermal aspects, ratings, Figures of merit, ripple factor, average value, Harmonic factor, Distortion factor, THD, Power factor, Crest factor Power in switching circuits, 2-pulse Midpoint converter, analysis for R load, infinite inductive load, R-L load, implications of commutation overlap, use in DC drives.
3-Pulse converter: analysis for R load, infinite inductive load, R-L load, implications of commutation overlap, use in DC drives. Bridge converters: three phase and single phase, analysis for R load, implications of commutation overlap, use in DC drives. Buck Boost, Buck-Boost and Cuk Converters: circuit steady state analysis, current and voltage ripple estimation, discontinuous and continuous modes of operation. Use of SCR in buck converters, commutation circuit.

inverters: 120 deg, and 180deg, conduction operation, selective harmonic elimination, McMurray inverter SPWM, Unipolar and bipolar switching, Single phase AC Voltage Controller, analysis and operation Snubbers, turn on turn off, snubbers.

Power Systems: Modeling of transmission lines, Performance analysis of distribution lines with inductance and capacitance calculations, voltage regulation, efficiency, ABCD parameters, Insulators and string efficiency, cables, series and shunt compensation, surge impedance loading, power factor correction and devices, synchronous machines and transformers, one-line diagram, per unit (p.u) computation, Symmetrical and Unsymmetrical fault analysis, Power System Protection, Design of relays, Zomne of protection, primary and backup protection protection of transmission lines and transformers. Bus admittance and impedance matrices; node elimination by matrix methods. Load flow Solution - Gauss - Siedel Method, Newton Raphson method, decoupled and fast decoupled methods. Economic Load Disptach (without line losses take into consideration), Basic power generation concepts, Power System Stability - Swing equation, Single generator infinite bus model, and equal area criterion.

HVDC transmission and FACTS concepts, power quality, Harmonics in pwer systems, Renewable energy systems.

Instrumentation and Measurements: Analog indicating instruments; Q-meter, Hall effect instruments, rms, average and peak reading electronic instruments, Galvanometers, CRO and its applications, Errors in measurement, Systematic and Ranodm errors, error analysis DC and AC potentiometers, DC and AC bridges, Interference and noise, Screening and earthing, Instrument transformers, Digital

instruments, Counters, A/D and D/A converters, Active and passive transduces, Instrumentation system for non electrical quantities, Thermo couples, Piezo electric type transducers.

Measurement Systems: Generalized performance characteristics, Amplitude modulation and demodulator circuits. Passive transducers: Resistance Transducers - Resistance potentiometer, Strain gauges, Resistance thermometers, Hotwire anemometers Inductance Transducers and associated bridge circuits, LVDT Capacitance Transducers and associated signal conditioning circuits, Seismic Pickups, Force-Balance Transducers Active transducers: General type pickups, thermocouples, Piezoelectric sensors.

Instrumentation Systems: Measurement of non-electrical quantities like displacement and locity, sound flow, temperature, etc.

Signals and Systems: Definitions and properties of Laplace transform, continuous-time and discrete-time fourier series, continuous-time and discrete-time Fourier Transform, DFT and FFT, ztransform. Sampling theorem. Linear Time-Invariant (LTI) Systems: definitions and properties; causality, stability, impulse response, convolution, poles and zeros, parallel and cascade structure, frequency response, group delay, phase delay Signal transmission through LTI systems.

Control Systems: Basic control system components, block diagrammatic description, reduction of block diagrams, Open loop and closed loop (feedback) systems and stablity analysis of these systems. Signal flow graphs and their use in determining transfer functions of systems; transient and steady state analysis of LTI control system and frequency response. Tools and techniques for LTI control system analysis: root loci, Routh-Hurwitz criterion, Bode and Nyquist plots. Control system compensators" elements of lead and lag compensation, elements of Proportional-Integral-Derivative (PID) control. State variable representation and solution of state equation of LTI control systems.

Digital Signal Processing Discrete Time Signals and Systems: Linear time invariant systems, stability, causality; Convolution; Discrete time Fourier Transform and properties Z-Transform; Properties and ROC, inverse transform Sampling; band limited continuous time signals, frequency doman respresentation of sampling.reconstruction, interpolation and decimation Transform Analysis of LTI systems; Frequency response, Magnittude and phase responses, All-pass minimum phase, generalized linear phase systems. Structures for LTI systems; signal flow graph representation. IIR and FIR structures and different forms. DFT: Properties Fourier Transform of Periodic Sequences, Finite Duration Sequences, Circular and linear Convolution, FFT.

Optics: interference and Diffraction of Light, Interaction of Light with Atoms-Absorption/Emission Lasers and amplifiers, including modelocking/Q switching, Semiconductor light sources and detectors -pn junctions Fiber optics - modes, attenuation/ dispersion, Electro - optics/Acousto-optics

Engineering Mathematics: Linear Algebra, Calculus Differential equations, Complex variables, Probability and Statistics Numerical Methods, Transform Theory.
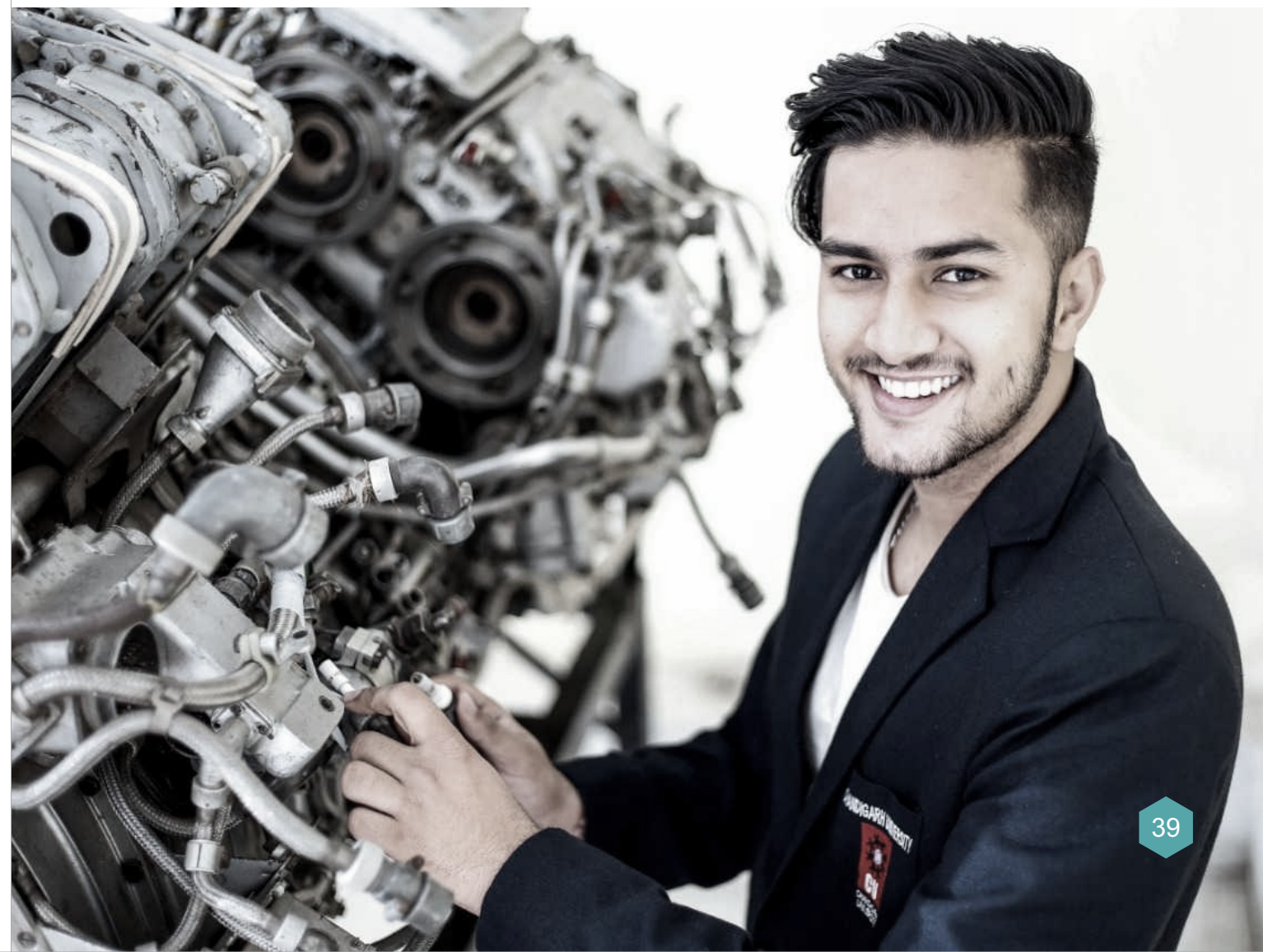
LEARN IN CONTEMPORARY FACILITIES & REAL LIFE, WORKPLACE SCENARIOS

PHYSICS

Mathematical Physics: Linear vector space, matrices; vector calculus. linear differential equations; elements of complex analysis, Laplace transforms, Fourier analysis, elementary ideas about tensors.

Classical Mechanics: Conservation laws, central forces, Kepler problem and planetary motion, collisions and scattering in laboratory and centre of mass frames mechanics of system of particles, rigid body dynamics, moment of inertia tensor, nominertial frames and pseudo forces, variational principle, Lagrange's and Hamilton's formalisms, equation of motion, small oscillations, normal modes; special theory of relativity - Lorentz transformations, relativistic kinematics, mass-energy equivalence.

Electromagnetic Theory: Solution of electrostatic and magnetostatic problems including boundary value problems; dietectrics and conductors, Biot-Savart's and Ampere;s laws; Faraday's law; Maxwell's equations; scalar and vector potentials; Coulomb and Lorentz guages; Electromagnetic waves and their reflection, refraction interference, diffraction and polarization, Poynting vector, Poynting theorem, energy and momentum of electromagnetic waves, radiation from a moving charge,

Quantum Mechanics: Physical basis of quantum mechation; one, two and three dimensional potential problems, particle in a box harmonic oscillator, hydrogen atom, linear vectors and operators in Hilbert space, angular momentum and spin, addition of angular momenta, time independent perturbation theory, elementary scattering theory.

Thermodynamics and Statistival Physics: Laws of thermodynamics, macrostates and microstates phase space probability ensembles, partition function free engery calculation of thermodynamic quantities, classical and quantum statistics, degenerate Fermi gas, black body radiation and planck's distribution law, Bose-Einstein condensation, first and second order phase trasitions critical point.

Atomic and Modecular Physics: Spectra of one-and many electron atoms, LS and JJ ocupling, hyperfine structurem Zeeman and Stark effects, electric dispole

transitions and selection rules, X-ray spectra, ratational and vibrational spectra of diatomic modecules, electronic transition in diatomic modecules, Franck-Condon principle, Raman effect, NMR and ESR, lasers. Solid State Physics, Elements of crystallography diffraction methods for structure determination bonding in solids, elastic properties of solids defects in crystals, lattice vibrations and therman properties of solids, free electron theory, band theory of solidsm netals semiconductors and insulators transport properties optical dielectric and of solids, elements of superconductivity.

Nuclear and Particle Physics: Nuclear radii and charge distributions, nuclear binding energy, Electric and magnetic moments, nuclear models, liquid drop model-semi-empirical mass formula, Fermi gas model nuclear force and two nucleon problem Alpha decay Beta-decay electromagnetic transitions in nucle Rutherford scattering, nuclear reactions conservation laws fission and fusion particle accelerators and detectors elementary particles, photons, baryons, mesons and leptons, quark model.

Electronics: Network analysis, semiconductor devices, Bipolar Junction Transistors, Field Effect Transistors, amplifier and oscillator circuits, operational amplifier, negative feedback circuits, active filters and oscillators, rectifier circuits, regulated power supplies, basic digital logic circuits. sequential circuits, flip-flops, counters registers, A/D and D/A conversion.

Fiber Optics: Nintroduction to optical fibre, Refractive index, Propagation of light through optical fibre, Acceptance Angle Numerical Aperture, Types of optical fibre, Normalized Frequency, Optical - Couplers Connectors, Splicers, Fibre losses, Applications of optical fibre.

CHEMISTRY

Structure and bonding : Lonic and covalent bonding, M.O. and V.B. approaches for diatomic molecules, VSEPR theory and shape of molecules, hybridisation, resonance, dipole moment, structure parameters such as bond length, bond angle and bond energy, hydrogen bonding, vander Waals interactions, Ionic solidsm ionic, radil, lattice energy (Born-Haber Cycle.)

S.P. and D Block Elements : Oxides halides and hydrides of alkali and alkaline earth metals, B. AI, Si, N, P, and S, general characteristics of 3D elements, coordination complexes: valence bond and crystal field theory, color, geometry and magnetic properties.

Chemical Equilibria : Colligative properties of solutions, ionic equilibria in solution, solubility product, common ion effectm hyrolysis of salts, pH, buffer and their applications in chemical analysis equilibrium constants (Kc, Kp and Kx) for homogeneous reactions.

Electrochemistry : Conductance, Kohlrausch law, Half Cell potentials, emf, Nernst equation, galvanic cells, thermodynamic aspects and their applications.

Reaction Kinetics : Rate constant, order of reaction molecularity, activation energy zero, first and second order kinetics, catalysis and elementary enzyme reactions.

Thermodynamics : First law, reversible and irreversible processes, internal energy enthalpy, Kirchoff's equation, heat of reaction, Hess law, heat of formation, Second law, entropy, free energy, and work function. Gibbs-Helmholtz equation, Clausius-Clapeyron equation, free energy change and equilibrium constant, Troutons rule, Third law of thermodynamics.

Instrumrntation and analytical chemistry: (UV-Vis, NMR, IR, Mass, Raman spectroscopy), Amperometry, TGA, DTA/DSC, XRD, BET.

Organometallics: Catalysis and Green Chemistry.

Bioorganic Chemistry: Carbohydrates, Amino acids and proteins, Nucleic acids, Lipids.

Bio Organic Chemistry: Electron Transfer reactions Metal Complexes in medicine.

Pericyclic Reactions: Electrocyclisation, Cyc;paddotopm amd sog,atropic rearrangements Synthesis and reactivity of common heterocyclic compounds.

BUSINESS MANAGE-MENT & COMMERCE

Business Environment : The concept of business environment Its significance and nature, The process of environmental scanning, Basic philosophies of capitalism and socialism with their variants, rise of consumerism in India, Economic environment, Socio-cultural environment, Politico-legal environment, Technological environment, Technological environment, Technological environment Indian financial markets and their regulating body - SEBI, Institutional financing bodies and role of RBI in regulating money and economy, Indian planning and sectoral development, National Income-Concepts & Measurement, Industrial policy, Fiscal & monetary Policy, Economic Reforms since 1991, EXIM Policy-EPZ, export houses and trading houses, etc. Inflationary trends impacts and analysis concept od WPI, CPI, Global Economy : Size Growth, Inflation, Developed, NISs and underdeveloped countries and their growth Prospects, International Trade: World Trade, Pattern,

Composition, Significant shifts, Volume, Trade in services. India's Position in world trade.

Organisational behaviour: The concept and significance of organisational behaviour - skills and roles in an organisation classical, Neo-Classical and Modern Theories of Organisational Structure Organisational design Understanding and Managing individual behaviour personality - Perception - Values - Attitudes - Learning - Motivation. Understanding and Managing Group Behaviour, Processes Inter personal and group dynamics - Communication - Leadership - Managing change-Managing conflicts, Organisational Development.

Human Resource Management Concepts and perspectives: HRM in changing environment, Human Resource Planning - Objectives, Process and Techniques, Job analysis - Job Description, Selecting Human Resources. Induction, Training and Development. Exit policy and Implications. Performance Appraisal and Evaluation, Potential Assessment, Job Evaluation, Wage Determination, Industrial Relations and Trade Unions, Dispute Resolution and Grievance Management, Labour Welfare and Social Security Measures.

Financial Management: Nature and Scope, Valuation Concepts and Valuation of Securities, Capital Budgeting Decisions - Risk Analysis, Capital Structure and Cost of Capital, Dividend Policy - Determinants, Long - Term and Short - Term Financing Instruments Mergers and Acquisitions.

Financial Management: Marketing Environment and Environment Scanning, Marketing Information Systems and Marketing Research understanding Consumer and Industrial Markets Demand Measurement and Forecasting; Market Segmentation - Targeting and Positioning, Product Decisions, Product mix, Product Life Cycle, New Product Development, Branding and Packaging Pricing Methods and Strategies. Promotion Decisions Promotion mix Advertising, Personal Selling; Channel Management; Vertical Marketing Systems; Evaluation and Control of Marketing Effort, Marketing of Services Customer Relation Management uses of Internet as a Marketing Medium - Other related issues like branding market development, Advertising and retailing on the net New issues in Marketing.

Production Management: Role and Scope of production Management, faculty Location Layout Planning and Analysis Production Planning and Control-Production Process Analysis, Demand Forecasting for Operations; Determinants of Product mix, Production Scheduling, Work measurement Time and Motion Study, Statistical Quality Control. Role and Scope of Operations Research, Linear Programming, Sensitivity Analysis Duality Transportation Model Inventory Control, Queuing Theory, Decision, Theory, Markov Analysis, PERT / CPM, Basic Concept of Total Quality management Principles of total quality management, Objectives Models and Process. Quality management Philosophies, Tools for Management Process, Strategic planning and sustaining total quality. Benchmarking. Six Sigma and business Process Re-engineering.

Quantitative methods & Techniques: Overview of Statistics, Classifying Data to convey meaning, Measures of Central Tendency - Mean, Median & Mode, Measures of Variation - Range, Average Deviation, Standard Deviation, Probability Theory Probability distributions-Binomial, Poission, Normal and Exponential, Correlation and Regression analysis, Sampling theory, Sampling distributions, Test of Hypothesis, Large and small samples, tz, F, Chi-Square tests. Use of Computers in Managerial applications. Technology issue and Data processing in organization, Information systems, MIS and

Decision making, system analysis and design, Trends in Information Technology Internet and Internet- based applications.

Strategic Management : Concept of Corporate Strategy, Components of Strategy Formulation, Ansoffs Growth Vector, BCG Model, Porter's Generic Strategies, Competitor Analysis, Strategic Dimensions and Group Mapping, Industry Analysis, Strategies in Industry Evolution, Fragmentation, Maturity and decline. Competitive strategy and Corporate Strategy trans nationalization of World Economy, Managing Cultural Diversity, Global Entry Strategies. Globalisation of Financial system and services, Managing International business, Competitive Advantage of nations, RTP and WTO corporate governance, theories of corporate governance, composition of board procedures and principles of good governance, governance referms in India.

Entrepreneurship : Importance of Entrepreneur Qualities of Entrepreneur Entrepreneurial Decision Process, Types of start up, Definition of Micro, Small and Medium Enterprises, Institutional Support and Legality - Directorate of Industries, District Industries Centre Agro Power, Scientific Institutions and software Technology, Formulating a business plan, Marketing plan financial plan, managing innovation and change, Preparation of Project Report Women Entrepreneurs labour legislation for SSI. Detailed business plan preparation Managing small enterprises, Planning for growth, Sickness in Small Enterprises, Rehabilitation of Sick Enterprises, Entrepreneurship (Organisational Entrepreneurship).

Ethical Perspective : Ethics and Management System Ethical issues and Analysis in Management Value based organisations personal framework for ethical choices Ethical pressure on individual in organisations Gender issues, Ecological consciousness, Environmental ethics Social responsibilities of buesiness Corporate governance and ethics.

COMPUTER APPLICATIONS

Programming in C and C++: Programming in C, Elements of C-Tokens, Identigiers, Data types in Cm Control structure in C, Sequence selection and iteration, Structured data types in C-arrays, structure union, string an pointers O-O Programming concepts; Classes, Object, installation, Inheritance, Polymorphism and overloading C++ Programming: Element of C++ Tokens, identifiers, Variable and constants, Data types, Operator Control Statement, Function parameter passing, Class and object, Constructor and destructor, overloading inheritance temples, exception handling.

Relational database design and SQL: E-R Diagram and their transformation to relation design, normalization-INF, 2NF and BCNF SQL: Data definition language (DDL) Data manipulation language (DCL) commands database objects like. Views indexes sequences synonyms, data dictionary, Database concepts, ER diagrams, Data model, Design of Relational Database, Normalization, SQL and QBE, Query Processing and Optimization, Centralized and Distributed Database, Security, Concurrency and recovery in centrailzed and Distributed Database, Security, Concurrency and recovery in centralized and Distributed Database System, Object oriented Database Management System (Concept, composite object, Integration with RDBMSapplication), ORACLE.

Data and file Structure: Data information definition of data structure, arrays, stacks, queues, liked lists, tree graphs. priority queues and heaps. File Structure: Fields records and files sequential direct, index Sequential and elative files hashing, inverted lists multi list. B trees and B+trees.

Computer Network: Network Fundaments: Local area Network (LAN), metropolitan Area Network (MKAN), wide area Network (WAN)m, Wireless Network, Inter Network Reference Model: The OSI model, TCP/IP model Data communication cannel capacity Transmission media. Twisted pasi Coaxial cables, Fiber optic cables, Wireless transmission - radio, microwave infrared and millimeter waves Light wave trasmission, telephones-local loop, trunks, multiplexing switching, narrowband ISDNm broadband ISDNm, ATM, high speed LANS, Cellular radio Communication satelite - Geosynchronous and low orbit Internetworking: Switch/Hub Bridge router gateways Concatchesd virtual circuits, Tunneling, Fragmentation Firewalls Routing, Virtual ciruits and datagrams, Routing algorithms, congestion control Network Security Cryptography-Publich key, Secret Key, domain Name System (DNS), electronics mall and worldwide web (www), the Dns Resource Records name Services, Email Architecture and Servers.

Systems Software: Assemble language fundamental (8085) based assembly language programming (Assember-2) pass and single pass, Macros and Microprocessor Loading, linking, program recordable, linkage editing text editor programming environments debugger and program generator Compilation and interpretation, Bootstrap compiler. Phase of Compilation process, Lexical analysis, Lex package on UNIX system context free grammar parsing and parse tree representation pf parse (derivation) tree as nightmare and leftmost derivation, Bottom up parsers -= Shift reduce, operator precedence, and LR YACC package an on UNIX system Top down parses-left recursion and its removal, recursive descend pares. Predictive parses, Intermediate codesm Quadruples, Triplesm Intermediate code generation, Code generation, Code optimization.

Operating System: Main function of operating system, Multiprogramming multiprocessing and multitasking Memory management: Virtual memory, Paging, fragmentation Concurrent processing: mutual exclusion, critical regions, locks ad unlock Scheduling, CPU scheduling I/o Scheduling, resource sheduling, Banker's Algorithm fir deadlock handling, Unix system, File system process management bourne shell shell variables, command line programming fiters and commands: Pr Head tail, cut paste siort, uniq TR, Join etc. Grep egrep, fgrep etc sed, awk etc, System call (like) Create open close read write seem link unlink stat fstat, unmask chmos exec fork.

Software Engineering: System development cycle (SDCL) : Steps, water fall model, Prototypes, Spiral model Software Metrics : Software Project Management Software Design : System Design, Detailed design., function oriented design, Object oriented design, user interface design, Desin level metrics Coding and testing Testing level metrics, Software quality ad reliability, clean room approach, Software engineering.

Data Ware housing and Mining: Data Ware housing environments, Architecture of a data warehouses methodolgy, Analysis design, Construction and administration Extraction models and pattern form large database data mining techniques, classification regression, clustering summarization, dependency modeling, link analysis, sequencing analysis, mining scientific and business data.

Computer Graphics: Display system, input devise 2D, geometry, Graphics operation. 3D Graphics, Animation Graphic Standard, Application Concepts, Storage Devices, Input Tools, Authoring Tools Application files.

Principles of Programming: Programming language, concepts, Paradigm and models Data, Data types, Operators, Expressions, Assignments, Flow of control-Control structure, I/O Statement, User Defined and Built in Function parameter passing Principles, Classes, inheritance, Class hierachies, Polymorphism, Dynamic binding, reference semantics and their implementation Principles, functions, lists, types and polymorphism, higher order functions laxy evaluation equations and pattern matching Principlex horn clauses and their execution logical variables relations,data structure, Controlling the search order, programme development in prolog, example programme in prolog Principle of parallelism co-routines, Communication execution Parallel virtual Machine (Pl/M) and message passing interface (MPI), routine an call Parallel progra,,es om PVM paradigm a swell as MPI, paradigm for simple problems like matrix multiplication Precoditions post conditions, axiomatic approaches for semantic corrections axiomatic approaches for semantic, correction's denotation semantics Complier structure, Compiler construction fools, coalition phases Finite Automata Pushdown Automata, Non-Determinations, and NFA, DPDA and PDAs and language accepted by these structure, Grammars, language-Types of grammar-type 0, type 1, tope3 type3. The relationship between types of grammars, and finite machine, Pushdown automata and contex free Framers, Lexical Analysis-regular express and regular languages LEX pacemaker on UNIX, Conversion of NFA to DFA minimizing the number of states in a DFA, Compilation an interpretation Bootstrap Compilers Context free grammars, Parsing and parse trees, representation of parse trees as right most ma leftmost derivation. Bottom up parsers-shift reduce, operator precedence an LR, YACC package on UNIX system, Top down parsers Left recursion and its removal recursive descent Parsers, Predictive parser intermediate codes-Quadruples, triples Intermediate code generation Code generation, Code optimization.

BIO-TECHNOLOGY

Biochemistry and Biophysics:
Structure of atoms, molecules and chemical bonds. Composition, structure and function of Carbohydrates, Proteins, Lipids and Nucleic acids. Principles of Biophysical chemistry: Van der Waals, electrostatic, hydrogen bonding, hydrophobic interaction, etc. Bioenergetics, glycolysis, oxidative phosphorylation, coupled reaction, group transfer, biological energy transducers. Principles of catalysis, enzymes and enzyme kinetics, enzyme regulation, mechanism of enzyme catalysis, isozymes, Conformation of proteins (Ramachandran plot, secondary structure, domains, motif and folds. Conformation of nucleic acids (helix (A, B, Z), t-RNA, microRNA).Analytical **Techniques:**
Spectroscopy, Chromatography, X-ray diffraction etc.

Methods in Biotechnology Molecular Biology and Recombinant DNA methods:
Isolation of Nucleic acids (RNA, Genomic and Plasmid DNA) and proteins, different separation methods. Analysis of Nucleic acids and proteins through different electrophoretic techniques.
Principles of recombinant DNA technology (Expression of recombinant proteins using bacterial, animal and plant vectors. Isolation of specific nucleic acid sequences, Generation of genomic and cDNA libraries in plasmid, phage, cosmid, BAC and YAC vectors. In vitro mutagenesis and deletion techniques, gene knock out in bacterial and eukaryotic organisms.)Protein and DNA sequencing methods. Isolation, separation and analysis of carbohydrate and lipid molecules RFLP, RAPD and AFLP techniques. Immunochemical and histochemical techniques. Microarray technology.

Taxonomy and Biodiversity Principles & methods of taxonomy: Concepts of species and hierarchical taxa, biological nomenclature, classical & quantititative methods of taxonomy of plants, animals and microorganisms. Levels of structural organization: Unicellular, colonial and multicellular forms. Levels of organization of tissues, organs & systems. Comparative anatomy, adaptive radiation, adaptive modifications. Outline classification of plants, animals & microorganisms: Important criteria used for classification in each taxon. Classification of plants, animals and microorganisms. Evolutionary relationships among taxa.

Cell Biology Membrane structure and function:
Structure of fluid mosaic model of membrane, lipid bilayer, transport across membrane, mechanism of sorting and regulation of intracellular transport. Structural organization and function of intracellular organelles. Host parasite interaction Recognition and entry processes of different pathogens like bacteria, viruses into animal and plant host cells, alteration of host cell behavior by pathogens, virus-induced cell transformation, pathogen-induced diseases in animals and plants, cell-cell fusion in both normal and abnormal cells. Cell signaling Hormones and their receptors, cell surface receptor, signaling through Gprotein coupled receptors, signal transduction pathways, light signaling in plants, bacterial chemotaxis and quorum sensing. Cellular communication Regulation of hematopoiesis, general principles of cell communication, cell adhesion and roles of different adhesion molecules, gap junctions, extracellular matrix, integrins, neuro transmission and its regulation. Cancer: Genetic rearrangements in progenitor cells, oncogenes, tumor suppressor genes, cancer and the cell cycle, virus-induced cancer, metastasis, interaction of cancer cells with normal cells, apoptosis, therapeutic interventions of uncontrolled cell growth.

Immunology & Microbiology:
Innate and adaptive immune system Cells and molecules involved in innate and adaptive immunity, antigens, antigenicity and immunogenicity. B and T cell epitopes, structure and function of antibody molecules. generation of antibody diversity, monoclonal antibodies, antibody engineering, antigen-antibody interactions, MHC molecules, antigen processing and presentation, activation and differentiation of B and T cells, B and T cell receptors, humoral and cell-mediated immune responses,primary and secondary immune modulation, the complement system, Toll-like receptors, cell-mediated effector functions, inflammation, hypersensitivity and autoimmunity, immune response during bacterial (tuberculosis), parasitic (malaria) and viral (HIV) infections, congenital and acquired immunodeficiencies, vaccines.
Microbial Nutrition: Nutritional types (definition and example) - Photoautotrophs, Photoorganotrophs, Chemolithotrophs (ammonia, nitrite, sulfur, hydrogen, iron oxidizing bacteria); Chemoorganotrophs,
Effect of oxygen on growth - classification on the basis of oxygen requirement and tolerance. Bacterial Growth: Growth phases - Generation time. Kinetics of growth, Batch culture. Continuous culture. Synchronous culture (definition and brief description). Physical factors influencing growth - Temperature. pH, osmotic pressure, salt concentration. Control of growth of Microbes: Sterilization, disinfection, antiseptic, sanitizer, germicide, antimicrobial agent (definition, application & examples); physical method of disinfection and sterilization - dry heat, moist heat, filtration, radiation (mode of action, applications); Chemical control – dye solutions, alcohol, acid, alkali, halogen, heavy metal, phenol, phenol derivatives, formaldehyde, ethylene oxide, detergents (mode of action, applications). Assessment of chemical disinfectant; phenol coefficient-definition and method of determination. Chemotherapeutic agents - sulphonamides, antibiotics, (definition types); mechanism of action and antimicrobial spectrum of penicillin, streptomycin, tetracycline, chloramphenicol, Nalidixic acid and metronidazole; drug resistance - phenomena and mechanism., staining (Definition of auxochrome; Chromophores; Acidic and Basic dyes; Classification of stains; Simple and differential staining: theories of staining, mordant and its function; Gram staining; acid fast staining; endospore staining; negative staining ; capsule staining; flagella staining; mechanism of gram staining.), microscopy (different components of light wave (UV, IR, visible); principles and applications of Compound Microscope; Light Microscope; Dark field Mircroscope; Bright field Microscope; Phase Contrast Microscope; Fluorescent Microscope; Electron Microscope; Resolving power; Numerical aperture:Chromatic Aberration)

Dominance, segregation, independent assortment. Concept of gene: Allele,multiple alleles, pseudoallele, complementation tests. Extensions of Mendelian principles: Codominance, incomplete dominance, gene interactions, pleiotropy, genomic imprinting, penetrance and expressivity, phenocopy, linkage and crossing over, sex linkage, sex limited and sex influenced characters.Gene mapping methods : Linkage maps, tetrad analysis, mapping with molecular markers, mapping by using somatic cell hybrids, development of mapping population in plants. Extra chromosomal inheritance: Inheritance of Mitochondrial and chloroplast genes, maternal inheritance. Microbial genetics: Methods of genetic transfers – transformation, conjugation, transduction and sex-duction, mapping genes by interrupted mating, fine structure analysis of genes. Human genetics: Pedigree analysis, lod score for linkage testing, karyotypes, genetic disorders. Quantitative genetics: Polygenic inheritance, heritability and its measurements, QTL mapping. Mutation : Types, causes and detection, mutant types – lethal, conditional, biochemical, loss of function, gain of function, germinal verses somatic mutants, insertional mutagenesis. Structural and numerical alterations of chromosomes : Deletion, duplication, inversion, translocation, ploidy and their genetic implications. Recombination: Homologous and non-homologous recombination including transposition.

Applications of Biotechnology:
Screening Selection and Improvement of Industrially important microorganisms.
Design of a fermentor. Microbial fermentation and production of small and macro molecules. Application of immunological principles, vaccines, diagnostics. Tissue and cell culture methods for plants and animals. Transgenic animals and plants, molecular approaches to diagnosis and strain identification. Genomics and its application to health and agriculture, including gene therapy.Bioresource and uses of biodiversity. Breeding in plants and animals, including marker – assisted selection. Bioremediation and phytoremediation.Biosensors. Seed development and structure, Hybrid seed production technology: Genetic determinants of flowering, seed development and germination, male sterility and apomixes.

Transgenics:
Plant transformation techniques: Methods of gene transfer in plants, Agrobacterium-mediated gene transfer, direct gene transfer methods- electroporation, microinjection, particle bombardment, selection of transformants.Transgenic plants: Herbicide resistance, resistance against biotic stress- bacterial, viral, fungal and insect resistance, abiotic stress, improved crop productivity, improved nutritional quality. Molecular pharming.

Intellectual Property Rights (IPR):
IPRs and agricultural technology-implications for India, WTO, WIPO, GATT, TRIPS. Plant Breeder's Rights, legal implications. Ethical issues associated with onsumption of GM food, labelling of GM crops and foods.

Cloning of Animals:
Methods and uses. Introduction, nuclear transfer for cloning, cloning fromembryonic cells, adult and fetal cells. Cloning from short-term and long-term cultured cells:
cloning of sheep, cloning of cows from aged animals. Human cloning: ethical issues.

PHARMACEUTICAL SCIENCES

PHARMACEUTICS
Liquid Dosages Forms, Semisolid Dosage Forms, Sterilization, Blood Products and Plasma Substitutes, Cosmeticology and Cosmetic Preparations, Capsules, Micro-encapsulation, Tablets Pharmacokinetics, Clinical Pharmacokinetics, Bioavailability and bioequivalence, Micromeritics, Rheology and interfacial Phenomenon.

PHARMACEUTICAL CHEMISTRY AND RELATED TOPICS Properties and QSAR of the Following Classes of Drugs:

Drugs acting on the central nervous system, Hypnotics and Sedatives, Anticonvulsants, Anti-Parkinsonian drugs, Psychopharmacological agents (Neuroleptics, Anti-depressants, Anxiolytics), CNS stimulants, Anti-neoplastic agents; Anti-viral agents (including anti–HIV) Fundamentals of volumetric analysis, Chromatography, Ultraviolet and visible spectrophotometry, Fluorimetry, Infrared spectrophotometry, Nuclear Magnetic Resonance spectroscopy [proton technique only], Mass Spectrometry (EI & CI only), X-ray Diffraction Analysis.

PHARMACOLOGY

Pharmacology of Central Nervous System:

Neurohumoral transmission in the C.N.S., General Anesthetics, Alcohols and disulfiram, Sedatives, Hypnotics, Anti-anxiety agents and Centrally acting muscle relaxants, Psychopharmacological agents (anti-psychotics), anti-maniacs, and hallucinogens, Antidepressants, Anti-epileptics drugs, Anti-Parkinsonian drugs, Analgesics, Antipyretics, Narcotic analgesics and antagonists, C.N.S. stimulants, Drug Addiction and Drug Abuse.

Pharmacology of Cardiovascular System:

Drugs used in the management of congestive cardiac failure, Antihypertensive drugs, Anti-anginal and Vasodilator drugs, including calcium channel blockers and beta adrenergic antagonists.

Drugs Acting on the Respiratory System:

Anti-asthmatic drugs including bronchodilators, Anti-tussives and expectorants, Respiratory stimulants.

PHARMACOGNOSY

Sources of Drugs, Biological, marine, mineral and plant tissue cultures as sources of drugs; Fibers, Study of fibers used in pharmacy such as cotton, silk, wool, nylon, glass-wool, polyester and asbestos.

Studies of Traditional Drugs:

Common vernacular names, botanical sources, morphology, chemical nature of chief constituents, pharmacology, categories and common uses and marketed formulations of following indigenous drugs: Amla, Kantkari, Satavari, Tylophora, Bhilawa, Kalijiri, Bach, Rasna, Punarnava, Chitrack, Apamarg, Gokhru, Shankhapushpi, Brahmi, Adusa, Arjuna, Ashoka, Methi, Lahsun, Palash, Guggal, Gymnema, Shilajit, Nagarmotha and Neem. The holistic concept of drug administration in traditional systems of medicine.Introduction to ayurvedic preparations like Arishtas, Asvas, Gutikas, Tailas, Chrnas, Lehyas and Bhasmas

FORENSIC SCIENCE

For Section – A (Objective):
Refer: Information Brochure
For Section – B (Subjective)

Basics of Forensic Science & Crime Scene Management: Need, Scope and principles of Forensic Science, organization of a Crime Laboratory, Services of the Crime Laboratory, Functions of the Forensic Scientist, Secure and preserve crime scene, Documentation of a Crime Scene, Photographic Evidence and Log Recording, Search Patterns of a crime scene, Physical evidences & types, Trace evidences & Tool marks, Documentation, Collection, Packaging, Labelling & Forwarding of exhibits to forensic laboratories. Crime & Criminal behaviour, cause and theories, criminal justice system-its structure & functioning, Role of Police officers, prosecution & judicial officers. Role of Forensic scientists, medico-legal doctors, Expert Testimony Forensic

Science, History & Development of Forensic Science Organizational structure of Forensic Science labs in Central & State. Dauber's law and Fries law, Presentation of expert evidence. Data depiction. Report writing. Forensic photography. Basic principles and applications of photography in forensic science. Photographic evidence. Infrared and ultraviolet photography.

FORENSIC BIOLOGY AND SEROLOGY

Body fluids: their location, Importance, nature, collection and identification by tests. Blood grouping from stains of blood, semen, saliva and other body fluids by Absorption-inhibition, Absorption-elution and mixed agglutination techniques, determination of secretor/non-secretor status. Hair and Fibres: Importance, nature, location, collection, evaluation and tests for their identification. Blood group determination from fresh blood, titer, Roulex formation and Bombay blood group. Forensic entomology-General introduction Insects of forensic importance, Collection of entomological evidence during death investigations. Sexual offences Sexual Offences - Rape, DFSA (Drug Facilitated Sexual Assault) Examination of the victim & the accused Collection of evidence, Infanticide, Abortion, Artificial Insemination Medical Termination of Pregnancy Act 1971 Prenatal Diagnostic Technique Act 1984. Forensic DNA Finger Printing: DNA-Introduction, source of DNA in Forensic case work, Extraction of DNA, Techniques of DNA fingerprinting-RFLP, STR, PCR. DNA fingerprinting in paternity disputes, mass disaster and other forensic case work, legal issues in DNA fingerprinting, Medico legal aspect of Death Concept of Human Anatomy & Physiology Time of Death Causes of Death Injuries: classification, forms and medico legal aspects Medico Legal Aspects. Identification of bones. Comparison of skeletal remains. Determination of age, sex, stature and race from skeletal material. Introduction to Dermatoglyphics-Fingerprints, lip prints and ear prints.

Drugs of abuse-Introduction, Drug addiction, Classification of drugs of abuse, Introduction to Depressants, Stimulants, Hallucinogens, Drugs in sexual assault, Screening tests (color/spot) and Microcrystalline testing for these drugs. Analysis of NDPS evidence by Presumptive tests, Colour tests, Microcrystal tests, UV-Vis spectrophotometry, Thin layer chromatography (TLC), Gas chromatography (GC-FID/MS), High performance liquid chromatography (HPLC), IR spectroscopy. Introduction, Principles, Applications, Nature of cases, Role of the Forensic Toxicologist, Information required by the toxicologist, Samples, Interpretations of results and report Writing. & Handling Fire Scene Investigation Analysis & Interpretation of fire scenes Fire Dynamics, Forensic Speaker identification, polygraph test.

FORENSIC TOXICOLOGY

Poisons-Introduction, Signs and symptoms, common antidotes, Emergency Hospital toxicology, Collection and preservation of viscera for various types of poisons: Choice of preservatives, containers and storage conditions. Analysis of Exhumed and decomposed bodies. Alcohol Intoxication, Absorption & elimination mechanism in the body, effects, fatal dose, Chemical tests for alcohol in blood and urine including Breath Screening devices, Gaseous Poisoning: CO and Phosphine gases, significance, signs and symptoms, methods of diagnosis, tests for identification. Pesticide Poisoning: Organochloro/Organophosphate and Carbamate poisoning, significance, signs and symptoms, methods of diagnosis, tests for identification.

QUESTIONED DOCUMENT EXAMINATION

General and individual characteristics of handwriting, Development of individuality in handwriting, Examination and comparison of handwritings, Natural variations and fundamental divergences in handwritings, Forgeries and types, Indented and invisible writings, .Alterations in documents-

erasures, additions, overwriting and obliterations, Absolute and relative age of documents, Working of typewriter & Printers, Comparison of type written matter, Comparison of printed matter, Built-up Documents: nature and their examination. Determination of sequence of strokes of ballpoint pens, gel pens, printed matter vii a vis different pens. Counterfeit currency examination and important documents, Advanced methods of document examination by Projectina/video-spectral comparator (VSC) their working principles and applications.

FORENSIC BALLISTICS

History and development of firearms. Classification of firearms. Firing mechanisms of different firearms. Principle of firearms identification. Types of ammunition, Introduction to internal, external and terminal ballistics. Matching of bullets and cartridge cases in regular firearms. Identification of bullets, pellets and wads fired from improvised, country made firearms. Automated method of bullet and cartridge case comparison. Determination of range of fire and time of fire. Mechanisms of formation of gunshot residues. Methods of analysis of gunshot residues from shooting hands and targets, with special reference to clothings. Explosives, Types of Explosives, Composition and characteristics of explosives, Pyrotechnics, IEDs. Explosion process and affects, Types of hazards, Effect of blast wave on structures, human etc, Specific approach to scene of explosion, Reconstruction of sequence of events, Evaluation and assessment of scene of explosion, Post blast residue collection, Systematic examination of explosives and explosion residues in the laboratory using chemical and instrumental techniques and interpretation of results.

LAW

For Section – A (Objective):
Refer: Information Brochure
For Section – B (Subjective)

(i) Research Methodology: Concept and Meaning of Research;

Reflective thinking; Nature & Objectives of Legal Research; Types and Methods of Research; Formulation of Research Problem; Hypothesis; Observation; Questionnaire; Review of Related Literature; Data Collection (Sampling) Sampling and Population Techniques of Sampling, Research Report; Law Reform and Legal Research; Tools of Data Collection; Statistics

(ii) Constitutional Law: Preamble; Fundamental Rights and Duties; Directive Principles of State Policy; Judiciary; Executive; Union state legislative relation; Emergency Provision; Amendment of the Constitution; Writ Jurisdiction

(iii) Jurisprudence: Definition, nature and scope of jurisprudence, Schools of Law; Concepts of Person, Rights and Duties, Possession and Ownership, Property; Sources of Law; Relation between Law and Morals; Concept of Administration of Justice, Difference between Civil and Criminal Administration Justice, Theories of Punishment.

(iv) Business and Commercial Law: Companies Act, 2013; Indian Contract Act, 1872; Sales of Goods Act, 1930; Partnership Act, 1932; Competition Act, 2002.

(v) Criminal Law: IPC, Prevention of Corruption Act, 1988, Juvenile Justice (Care and Protection of Children Act), 2000, Code of Criminal Procedure, 1973, Indian Evidence Act 1872.

(vi) Family Law: Evolution of Hindu Law; Hindu Marriage Act, 1955; Hindu Adoptions and Maintenance Act, 1956; Hindu Minority and Guardianship Act. 1956; Hindu Succession Act, 1956; Muslim Law: sources, schools, Shariat Act 1937, Marriage, Dower, Divorce, Maintenance, Legitimacy and Parentage, Guardianship.

TOURISM & HOSPITALITY MANAGEMENT

For Section — A (Objective):
Refer: Information Brochure
For Section - B (Subjective)

Tourist I Visitor I Traveler Excursionist — definition and differentiation. Tourism recreation and leisure inter-relationship (s). Tourism components, Elements and infrastructure. Types and typologies of Tourism. Emerging concepts: Eco / rural / agri. / frame / green / wilderness /country side / special interest tourism.

Tourism Trends: Growth and development over the years and factors responsible therein. Changing market-destination patterns, Traffic flows / receipt trends. Travel motivator and deterrents. Pull and Push forces in tourism.

Linkages and channels of distribution in Tourism: Tourism Organisation / Institutions: Origin, organisation and functions of WTO, PATA, IATA, ICAO, FHRAI, TAAI, IATO and UFTAA. Concept of resource, Attraction and product in tourism. Tourism products: typology and unique features.

Natural Tourism Resources in India: Existing use patterns vis — a — vis potential with relation to varied landforms (mountains, deserts, beaches, coastal areas and Islands), Water bodies and biotic wealth (flora — fauna). Popular tourist destination for land based (soft I hard trekking, ice skiing, mountaineering, desert safaris, car rallies, etc.), water based (rafting, kayaking, canoeing, surfing, water skiing, scuba / snuba diving) and air based (para — sailing, para — gliding, ballooning, hand — gliding and microlighting, etc) tourist activities. Wildlife — Tourism and conservation related issues — Occurrence

distribution of popular wildlife species in India. Tourism in National parks, Wildlife sanctuaries and biosphere reserves (case of Dachigham Corbett I Dudhwa / Kaziranga / Kanha / Girl Ranthambor /

Mudumalai / Sunderbans / Shivpuri / Manas / Nanda Devi / Valley of flowers reserves). Tourism and nature conservation-Conflicts, Symbiosis and Synergy.

Cultural Tourism Resources in India: Indian Culture and society. Indian History -Ancient, Medieval and Modern

Accommodation: Concept, Types and Typologies, Linkages and Significance with relation to tourism. Emerging dimensions of accommodation industry — Heritage hotels, Motels and resort properties. Time share establishments.

Hotel and Hoteliering: Origin, Growth and diversification. Classification, registration and gradation of hotels. Organizational structure, Functions and responsibilities of the various departments of a standard hotel / other catering outlets, viz., bars, restaurants, fast food centres. In flight catering.

Transportation: Dynamically Changing needs and means. Landmarks in the development of transport sector and the consequent socio — economic, Cultural and environmental implications. Tourism transport system.

Airlines Transportation: The Airlines Industry-Origin and Growth. Organisation of Air Transport Industry in International context. Scheduled and non — scheduled Airlines services; Air taxis. Multinational Air Transport Regulations-Nature, Significance and Limitations. Role of LATA, ICAO and other agencies. Bermuda Convention. Air Transport Industry in India – DGCA and other key players; Regulatory Framework; Air Corporation Act, Indian carriers-Operations, management and performance. Marketing strategies of Air India.

Travel Agency and Tour Operations Business: Origin, Growth and development; Definition, Differentiation and linkages; Organisation and functions-Travel information counselling, Itinerary preparation, Reservation, Tour costing / pricing. Marketing of tour packages. Income sources. Marketing: Core concepts in marketing; Needs, Wants, Demands, Products, markets. Marketing management philosophies-Production, Product, Selling, Marketing and societal perspectives. Economic importance of marketing.

Tourism marketing: Service characteristics of tourism. Unique features of tourist demand and tourism product I Tourism marketing mix.

Analysis and selection of market: Measuring and forecasting tourism demand; Forecasting methods, Managing capacity and demand. Market segmentation and positioning. Tourism Planning: Origin, Concept and approaches. Levels and types of tourism planning-Sectoral, Spatial, Integrated, Complex, Centralized and Decentralized. Product life cycle theories and their applicability in tourism planning, Urban and rural tourism planning. Tourism planning and policy perspectives; planning at national, state and regional levels. India's tourism policies.

Tourism Planning Process: Objective setting, Background analysis, Detailed research and analysis, Synthesis, Goal setting and Plan formulation, Evaluation of tourism project-Project feasibility study; Plan implementation, Development and monitoring. Tourism master plan.

Tourist safety and security, reservation and conservation of heritage environment, Archaeological sites and wildlife.

The nature of field techniques; Field techniques and tourism and hotel business; Importance; and Limitations.

MASS COMMUNICATION

For Section - A (Objective):
Refer: Information Brochure
For Section — B (Subjective)
Syllabus For Section-A (Objective):
Refer:- Information Brochure
For Section-B (Subjective)

I. Communication and Journalism -Basic terms, Concept and definition, types and process Types of Communication. Mass Communication -nature of media and content. Mass communication in India-Reach, access and nature of audience, Role of media in society Impact of media on specific audience-Women, children etc. Mass campaigns for specific issues-Social concerns environment, human rights, gender equality the press, radio, television, cinemas, and traditional form of communication. Journalism as a profession, Journalists -their role and responsibilities, Indian constitution and freedom of speech. Freedom of Press.

II. Ethics and Journalism, media laws in India. History of Print and Broadcast media in general with particular reference to India. Post- independent development in print, news paper-English and Indian Languages press-major landmarks. Magazines-their role book phase and contemporary situation. Various National and International News Agencies. History and growth of Print and electronic media. MacBride Commission-recommendation and policy options.

III. Introduction of research methods and process. Mass Communication and research-Historical overviews. Administrative and critical traditions. Effects research-Strengths and limitations. Communication research in India- Landmark studies related to SITE Content analysis-Quantitative and qualitative approaches. Market research and its relationship to communication particularly advertising Sampling techniques-Strengths and limitations Statistical method of analysis basics.

IV. Radio & TV and Video and media of Communication. Grammar of TV and Radio and Video. The production team. Role of Producer. Different types of programmes. Writing for Radio. Writing for TV- researching for Script. The Visual language Camera Movement. Basic theories of composition-Cause and commands. Format for Radio Television-News Sitcoms, Features, Commercial, Operas, Documentation, Cinema, Theater, Drama. Editing, theory and Practices. Satellite, Cable television, Computers , Microchips.

V. Advertising, Fundamentals, AIDA Model, Types of Advertising. Social Advertising. Classification of Advertising. Ad Copy. Public Relations. PR Tools. PR Campaign. Publicity. Propaganda. Celebrity Management. Crisis Management. Public Opinion. Syndicates and Freelancing. Printing Technology and Production methods. Different Forms of Writing. Digital Media. Social Media. Fake News. Paid News.

ARCHITECTURE

For Section – A (Objective)
Refer: Information Brochure
For Section – B (Subjective)
General Architecture (50 Marks)

Sustainable Architecture (Inclusive of Building Science and Climate Responsive Architecture) Solar architecture; Thermal, visual and acoustic comfort in built environments; Natural ventilation in buildings; Sustainable building strategies;Climate responsive design; Energy-Efficient architecture. Building Performance Simulation and Evaluation; Intelligent Buildings, Green Building Rating Systems, Healthy Building, Energy-Audit, Energy-Audit.

Landscape Architecture
Man and Nature; Landscape traditions; historical public spaces and gardens;Elements and principles of landscape design; Aspects of outdoor design and site planning in enhancing and improving the quality of building environs, functionally and aesthetically; Site structure relationship; Analytic, artistic and technical aspects of designing open spaces at different scales; Role of Landscape design in sustainability; Overview of ecological balance; Impacts of human activities and the need for environmental protection and landscape conservation.

Urban Design and Heritage Conservation
Historical and modern examples of urban design; Elements of urban built environment, Concepts and theories of urban design; Principles, tools and techniques of urban design; Public spaces, character, spatial qualities and Sense of Place; Urban design interventions for sustainable development and transportation; Development controls, densities and building bye-laws. ; Urban renewal and conservation; heritage conservation; historical public spaces.

History and Contemporary Architecture
Principles of Art and Architecture; World History of Architecture: Egyptian, Greco-Roman classical period, Byzantine, Gothic, Renaissance, Baroque- Rococo, etc.; Recent trends in Contemporary Architecture: Art Nouveau, Art Deco, Eclecticism, International styles, Postmodernism, Deconstruction in architecture, Mughal Architecture etc.; Influence of Modern art and Design in Architecture; Indian vernacular and traditional Architecture: Islamic, Buddhist and Hindu Periods, Oriental Architecture ; Works of renowned national and international architects.

Building Services

Mechanical ventilation in buildings; Air-Conditioning systems; Water supply; Sewerage and drainage systems; Sanitary fittings and fixtures; Plumbing systems; Principles of internal and external drainage system; Principles of electrification of buildings; Firefighting Systems; Building Safety and Security systems; Building Management Systems, Elevators and Escalators, solid waste management, Recycling and Reuse of solid waste.

Building Materials, Building Construction and Structural Systems

Primary and Secondary Building Materials, Building construction techniques, methods and details; Building systems and prefabrication of building elements; Principles of Modular Coordination; Construction planning and equipment; Building material characteristics and applications; Alternative building materials; Foundations; Design of structural elements with different materials;Structural systems; Principles of Pre-stressing / Post-Tensioning,etc;

High Rise and Long Span structures; Estimation-Costing; Professional Practice; Project management techniques, Estimation and Specification; Professional practice and ethics; Form and Structure; Principles and design of disaster resistant structures; Temporary structures for rehabilitation.

Housing and Town Planning Basics

Housing typologies; Concepts, principles and examples of neighbourhood; Affordable Housing; Real estate valuation, Concepts of Land-Use, Ancient Indian Town Planning Concepts, Ekistics, Garden-City Concept. Architecture, Graphics and Design Architectural Graphics; Visual composition in 2D and 3D; Computer application in Architecture and Planning; Anthropometrics; Organization of space; Circulation- horizontal and vertical; Transportation, Space Standards; Universal design; Building bye-laws; Codes and standards.

EDUCATION

Eligibility Conditions
For Section —A (Objective)
Refer: Information Brochure
For Section — B (Subjective)

Syllabus For Section-A (Objective):
Refer:- Information Brochure
For Section-B (Subjective)

Unit I: Philosophical and Sociological Foundations of Education Concept of Philosophy and its contribution to curriculum and pedagogy. Schools of philosophy: Idealism, Pragmatism, Naturalism, their educational and implications. Education as related to social equity and equality of educational opportunities with special reference to socio-economically disadvantaged sections of society based on caste, gender, place, income disparity and different disabilities. Social Stratification and Social Mobility; Concepts, Factors affecting; Education in relation to Social stratification and Social Mobility with special reference to Indian Society.

Unit II: Educational Psychology Concept of Educational Psychology. Growth and Development: Concept, differences, principles of development, Principles and factors affecting human development, Hazards during various developmental, Cognitive development by Piaget, Moral development by Kohlberg, Psychosocial

Development by Ericson. Social Learning: Concept and importance, Factors affecting Social Learning, Social Competence, Classroom Dynamics: Concept, Need and its Relevance, Strategies for promoting healthy, psycho-social environment in class.

Unit III: Educational Research Educational Research: Meaning, Need and Importance, Classification: Fundamental, Applied and Action Research, Qualitative Research: Meaning, Characteristics, Merits and limitations, Selection of research problem, areas of research, identification and statement of research problem. Hypothesis: definition, importance, types and formulation of hypothesis. Testing of hypothesis, Type-I and Type —II Errors. Sampling: meaning and steps. Methods of sampling: Non Probability and Probability. Sampling Error

Unit IV: Teacher EducationImportance of Teacher Education, Teacher Educators, their roles and responsibilities. Scope of Teacher Education - Preparing teachers for Secondary and Higher Education. New courses in Teacher Education. Agencies regulation Teacher Education in India (NCERT, NCTE: roles and responsibilities. Strategies of Professional Development: workshops, seminars, symposium, panel discussions, conferences self-study, extension lectures, refresher courses, research colloquium. Agencies for in-service education (Institutional Programmes, DIET, NOTE,

NCERT, SCERT, Academic Staff College, (HRD Department) Extension Department).

Unit V: Educational Technology and ICT Educational Technology: Concept, Nature and scope of educational technology in India. Historical perspective of Educational Technology. Types of Educational Technology. Models of Teaching: Basic teaching model, Concept Attainment model and Advance Organizer

Model. Communication: Concept of communication, process, principles and barriers of communication. Information and Communication Technology (ICT): concept, need, advantages and barriers to expansion of Information and Communication Technology. Computer assisted instruction, e-learning, online learning.

ENGLISH

Eligibility Conditions
For Section —A (Objective)
Refer: Information Brochure
For Section — B (Subjective)

SYLLABUS

Unit I: British Literature from 14th century to 20th century Chaucerian Age —Elizabethan Age — Puritan Era —Metaphysical Poets — Restoration Age —Augustan Age — Pre Romantic & Romantic Ages —Victorian Age — Twentieth century —1950s onwards.

Unit II: Indian & Non-British Literature Introduction — New Poetry —American Literature — Indian Writings in English (Pre-Independence Era) — Indian Writings in English (Modern Writings, Partition Literature, Dalit Literature, Feminist Writings, Diasporic Writings, North East Indian

Literature, Literatures in Translation) — Commonwealth Literature/Post Colonial Literature.

Unit III: Contemporary Literature Familiarity with contemporary writers, their works, literary award winners, new movements in literature.

Unit IV: Literary Theory and Criticism Classical Age — Renaissance, 17th & 18th Centuries — Romantic Age —British Liberal Humanists & New Criticism — Structuralism, Post Structuralism & Deconstruction —Postmodernism — Feminism —Marxism - Postcolonial Theories - Gender/Queer/LGBT Theories —Film Theories/Film Criticism.

Unit V: Linguistics History of English Language, Renaissance and the English Language, The growth of Modern Linguistics, Phonology of English, Transcription of English words, Levels of Linguistic Analysis.

PSYCHOLOGY

For Section – A (Objective):
Refer: Information Brochure
For Section – B (Subjective)

UNIT 1:
GENERAL PSYCHOLOGY, SYSTEMS THEORIES & EXPERIMENTAL PSYCHOLOGY, SOCIAL PSYCHOLOGY

Psychology concept and scope, Theoretical perspectives: Psychodynamic, Behavioral, Cognitive and Humanistic. Nature & History of Experimental Psychology, Contribution of Weber & Wundt, Perception, Classical & Operant Conditioning.
Social Psychology: Socialization, Aggression, Attitude Formation, Attribution, Pro-social Behaviour & Altruism, Social Learning Theories, Impression formation, Interpersonal Relationships.

UNIT II:
ADVANCE COUNSELLING SKILLS

Counseling Process, Ethics and Qualities of Counselor, Educational Counseling, Counseling Techniques, Counselee
Appraisal: Case Study, Interview and Observation.

UNIT III:
CHILD PSYCHOPATHOLOGY

Nature of Child Psychopathology, Causes: Biological, Psychological & Social.
Childhood Disorders: Autistic, Mental Retardation, ADHD, Conduct Disorder.

UNIT IV:
CLINICAL PSYCHOLOGY

Diagnostic Classification systems: DSM-V and ICD-10; Clinical Examination of Psychological Disorders; Common Psychological disorders; Symptoms, Etiology, Diagnostic Criteria and Treatment: Generalized Anxiety, ObsessiveCompulsive, Bipolar Disorder, Post-Traumatic Stress Disorder, Dissociative Disorders, Personality Disorders, Schizophrenia, Substance Abuse.

UNIT V:
ORGANIZATIONAL PSYCHOLOGY

Organizational Behaviour and Its Model, Bureaucratic model, Theory X and Y, Organizational Culture, Leadership, Decision Making, Human Resource Development: Job Analysis and Talent Acquisition; Interviewing Procedure.

ECONOMICS

For Section – A (Objective): Refer:
Information Brochure
For Section – B (Subjective)

1. Micro-economic Analysis Demand analysis – Marshallian, Hicksian and Revealed preference approaches, Theory of Production and Costs, Pricing and output under different forms of market structure and Factor Pricing analysis.

2. Macro-economic Analysis Determination of output and employment – Classical approach, Keynesian approach, Consumption hypotheses. Demand for Money – Fisher and Cambridge versions, Approaches of Keynesian and Bauman Determinants of money supply, High-powered money, Money multiplier.

3. Development and Planning Economic Growth, Economic Development and sustainable Development. Measurement of development conventional, HDI and quality of life indices. Economic Growth – HarrodDomar model, Solow's model, big push, unlimited supply of labour, unbalanced growth, low income equilibrium trap. Indicators and measurement of poverty. Eleventh Five Year Plan, planning in a market oriented economy.

4. Public Finance The Public Budgets – Kinds of Budgets, Zero-base budgeting, different concepts of budget deficits; Budgets of the Union Government in India Public Expenditure – Hypotheses; effects and evaluation Public Revenue – Incidence and effects of taxation; elasticity and buoyancy; taxable capacity Public Debt – Sources, effects, burden and its management.

5. International Economics Theories of International Trade: International Trade under Imperfect competition Terms of Trade and Economic Growth – Secular Deterioration of Terms of Trade Hypothesis. Disequilibrium in Balance of Payment – Traditional, Absorption and Monetary approaches for adjustment in the Balance of Payments, Foreign Trade multiplier Trade Policy and Reforms in India

6. Indian Economy Basic Economic indicators – National income, performance of different sectors Trends in prices and money supply Agriculture –New agricultural policy Industry – New industrial policy and liberalization Money and banking – Concepts of money supply, inflation, monetary policy and financial sector reforms Public finance – Trends in revenue and expenditures of the Central and State Governments, Public debt; analysis of the Union Budget Foreign trade – Trends, Balance of payments and trade reforms Poverty, unemployment, and environment.

Submission of Application Form

Application for admission must be submitted on the prescribed form; the application form can be downloaded from the University website www.chandigarhuniversity.ac.in. or collected personally from the university admission office

Completed Application form along with enclosures and Demand Draft of Rs 1100/– in favour of Chandigarh University payable at Gharuan, Mohali should reach in the office the Dean Research by **November 15, 2023**

Enclosures:

- ✓ Details of publications
- ✓ Copies of certificates and mark sheets of examinations passed.
- ✓ Copy of NET/JRF/GATE, if applicable
- ✓ Copy of date of birth certificate/ document
- ✓ Copy ST/SC/OBC status certificates, if applicable
- ✓ NOC from the employer, if applicable

Note : Original Certificates will be required for verification on at the time of admission by the University.

Fee Structure

Admission Fee	Rs. 10,000/-
Examination Fee	Rs. 2,000
Tuition Fee (per semester)	Rs. 70,000
Refundable Security (one time)	Rs. 5,000/-
Thesis Submission Fee	Rs. 25,000/-

CHANDIGARH UNIVERSITY
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APPLICATION FORM
FOR Ph.D. Admissions January, 2024

APPLICATION FORM FOR Ph.D. Admissions

1. Name in Full (as In Qualifying Degree Certificate)

PHOTO

2. Father's Name (in Full)

3. Mother's Name (in Full)

4. a) GATE records: If any (Attach copy of GATE score card)

Reg. No. _____ Year _____ Gate Score _____ Air _____

(b) Other Competitive (All India) Exams Score, if any like CAT/MAT/NET/AIIMS

Name of Competitive Exam _____ Year _____ Score _____

5. (a) Address of the candidate for communication

City _____ State _____ Pincode _____

(b) Name & Address of Parent/ Guardian (i.e. Permanent Address)

City _____ State _____ Pincode _____

6. Telephone with STD Code _____

E-mail: _____

7. Date of Birth D D M M Y Y Y Y   8. Sex ___   9. GN/SC/ST/PD ___   10. Marital Status ___
(Write 'M' for Married/ 'S' for Single)

11. Qualifying Degree _____ (Write 'M.E/M.Tech/MSc/MPhil/MBA/MCom')

12. Qualifying Discipline _____

13. Status of Examination _____ (Write 'Cleared/Appeared')

14. No. of years of Experience: a) Teaching _____ b) Industry _____ (attach experience certificate)

15. Details of Academic Record (Starting from 10th class onwards):

Institute/University	Examination Passed	Year of Passing	Class/Division	Average % of Marks/ Grade

16. Departments/Interdisciplinary Groups/Centre and Schools applied for (kindly tick):

CSE ____   ECE ____   MECH ____   Mathematics ____   Physics ____

Chemistry ____   Business Management ____   Computer Applications ____   Others ____

17. *Categories under which you want to apply: (write in order of preference)

Part Time ____   Full Time ____

18. Papers published, if any: (Please attach extract)

No. of Papers: Published in Journals ____   Accepted for publication ____

No. of Papers: Published/Presented in Conferences ____

19. Declaration:

I certify that the information given above is correct and I am aware that providing incorrect information in the application form will result in cancellation of the admission.

Place: Date: Signature of the Applicant

* Employed candidates should attach No-Objection Certificate.

Details of Demand Draft

Demand Draft No.: ....   Demand Draft Date: ....

Amount: ....   Banker's Name: ....

CHANDIGARH UNIVERSITY
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ADMIT CARD
FOR Ph.D. Admissions January, 2024

DEPARTMENTS/INTERDISCIPLINARY GROUPS/CENTRE AND SCHOOLS APPLIED FOR (KINDLY TICK)

CSE ____   Civil Engg. ____   AI ____   ECE ____   EE ____   Physics ____

Chemistry ____   Mech. Engg. ____   Mass Comm. ____   Mathematics ____

Bus. Mgt. ____   Commerce ____   Computer Appl. ____   Eco. ____   Edu. ____

Psycho. ____   Biotech ____   Pharma Sciences ____   Forensic Science ____

Law ____   Tourism & Hospitality Management ____   Architecture ____

Roll No. (Kindly Leave it Blank) ☐☐☐☐☐☐☐☐

Name in Full (as In Qualifying Degree Certificate)
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Father's Name (in Full)
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PHOTO

_____   _____
Signature of Candidate   Coordinator Entrance Examination

NO OBJECTION cum SPONSORSHIP CERTIFICATE
(Required from Full Time / Part Time / Sponsored candidates only)

The undersigned is pleased to sponsor Mr./ Ms. .... who is working in this organisation for the last .... years and is presently holding the rank/ position of .... for pursuing Ph.D. programme in the .... (Engineering/ Sciences/ Business Management/ Computer Applications)

His/ Her conduct and character is good.

The Institution/ Organisation would allow/relieve him/her immediately for joining the above course, if selected for admission.

The Institution/ Organisation also agrees to PAY/ NOT PAY the contingent/ all expenses stipulated by the Institute. This is further certified that the sponsorship for admission will not be withdrawn midway till completion of the Ph.D. programme.

Signature of the Head of the Institution/ Organisation with seal

Name _____
Designation _____
Place : _____
Date : _____