# CENTRAL UNIVERSITY OF PUNJAB

Established vide an Act of Parliament of 2009

## ADMISSION NOTIFICATION: 2014-2015

Central University of Punjab is one of the fastest growing central universities of India having state-of-the-art infrastructure, well equipped research laboratories, enriched modern library and computing facilities of global standards. The students are provided a large number of scholarships, benefits of credit transfer mechanism to other universities and campus wide Wi-Fi internet connectivity. In the field of research, university has ranked first among newly established central universities on the basis of citation index, h-index, RG score as available on scopus.com and researchgate.net. The university is offering admission to following programmes through All India Online Entrance Test – 2014:

**PROGRAMMES OFFERED**

**RESEARCH PROGRAMMES:**

| | |
|---|---|
| **M.Phil.** | • Biosciences<br>• Comparative Literature<br>• Development Economics<br>• Environmental Science & Technology<br>• Physics<br>• South and Central Asian Studies |

**POST-GRADUATE PROGRAMMES:**

| | |
|---|---|
| **M.A.** | • Comparative Literature<br>• Development Economics<br>• Education<br>• International Studies |
| **M.A. (Hons.)** | • Punjabi and Comparative Literature |
| **M.Ed.** | • Education |
| **M.Sc.** | • Bioinformatics<br>• Biosciences<br>• Chemical Sciences (Medicinal Chemistry)<br>• Computational Sciences<br>• Environmental Science & Technology<br>• Genetic Diseases and Molecular Medicine<br>• Human Genetics<br>• Molecular Genetics<br>• Physics (Nanophysics) |
| **M.Pharm**. | • Pharmaceutical Sciences (Medicinal Chemistry)<br>• Pharmaceutical Sciences (Pharmacognosy and Phytochemistry) |
| **M.Tech.** | • Computer Science & Technology<br>• Cyber Security |
| **LL.M.** | • Environmental Law |

**POST-GRADUATE DIPLOMA PROGRAMMES:**

| | |
|---|---|
| **PGDTBR** | • Translational Biomedical Research |
| **PGDMAC** | • Museology, Archaeology and Conservation |

**Date of Entrance Test:** **28-29 June, 2014** (Saturday & Sunday)

**Details of Entrance Test:** Available at university websites: **www.cup.ac.in** and **www.centralunipunjab.com**

**Chairman, Admission Committee**
**E-mail: cupb.admissions2014@gmail.com Telefax: 0164-2864109**
**Central University of Punjab, City Campus, Mansa Road, Bathinda-151001**

# ADMISSION NOTIFICATION 2014-15

## 1. List of Programmes for Admission to Academic Session 2014-15

### A. Research Programmes

#### (a) M.Phil. (Duration: 3 Semesters)

| S.No. | Programme# | School | Eligibility | No. of Seats* | Syllabus Sections |
|---|---|---|---|---|---|
| 1. | M.Phil. Biosciences | School of Basic and Applied Sciences | Master's degree in any branch of life sciences with 55% marks from a recognized Indian or foreign university. | 20 | **A** & B |
| 2. | M.Phil. Comparative Literature | School of Languages, Literature and Culture | Master's Degree in Comparative Literature / Linguistics / any Indian Language or allied / relevant field with 55% marks from a recognized Indian or foreign university. | 25 | **A** & C |
| 3. | M.Phil. Development Economics | School of Social Sciences | Master's Degree in Economics or allied / relevant field with 55% marks from a recognized Indian or foreign university. | 25 | **A** & D |
| 4. | M.Phil. Environmental Science and Technology | School of Environment and Earth Sciences | M.Tech./ Master's degree in Environmental Sciences or a relevant branch of Life Sciences / Chemical Sciences or Engineering with 55% marks from a recognized Indian or foreign university. | 20 | **A** & E |
| 5. | M.Phil. Physics | School of Basic and Applied Sciences | Master's degree in Physics with a minimum of 55% marks from a recognized Indian or foreign university | 10 | **A** & F |
| 6. | M.Phil. South and Central Asian Studies | School of Global Relations | Master's Degree in South and Central Asian Studies, Indian History, Political Science, Economics, Sociology, Public Administration, Geography or allied/ relevant field with 55% marks from a recognized Indian or foreign university. | 25 | **A** & G |
| **Total Seats** | | | | **125** | |

## B. Post Graduate Programmes

### (a) M.A. (Duration: 4 Semesters)

| S.No. | Programme# | School | Eligibility | No. of Seats* | Syllabus Sections |
|---|---|---|---|---|---|
| 1. | M.A. in Comparative Literature | School of Languages, Literature and Culture | Bachelor's degree in any stream with 55% marks from a recognized Indian or foreign university. | 25 | **H** & I |
| 2. | M.A. in Development Economics | School of Social Sciences | Bachelor's degree with Economics as a subject of study or its equivalent in any discipline with 55% marks from a recognized Indian or foreign university. | 25 | **H** & J |
| 3. | M.A. in Education | School of Informative and Communicative Sciences | Bachelor's degree in any subject with B.Ed., from a recognized Indian or foreign university with a minimum of 55% marks. | 20 | **H** & K |
| 4. | M.A. in International Studies | School of Global Relations | Bachelor's degree with 55% marks from a recognized Indian or foreign university. | 25 | **H** & L |
| **Total Seats** | | | | **95** | |

### (b) M.A. (Hons.) (Duration: 4 Semesters)

| S.No. | Programme# | School | Eligibility | No. of Seats* | Syllabus Sections |
|---|---|---|---|---|---|
| 1. | M.A. (Hons.) in Punjabi and Comparative Literature | School of Languages, Literature and Culture | Bachelor's degree in any stream with 50% marks from a recognized Indian or foreign university. | 25 | **H** & M |

### (c) M.Ed. (Duration: 2 Semesters)

| S.No. | Programme# | School | Eligibility | No. of Seats* | Syllabus Sections |
|---|---|---|---|---|---|
| 1. | M.Ed. | School of Informative and Communicative Sciences | Bachelor's / Master's degree in any subject with B.Ed., from a recognized Indian or foreign university with a minimum of 55% marks. | 35 | **H** & K |

**(d) M.Sc. (Duration: 4 Semesters)**

| S.No. | Programme# | School | Eligibility | No. of Seats* | Syllabus Sections |
|---|---|---|---|---|---|
| 1. | M.Sc. in Bioinformatics | School of Emerging Life Science Technologies | Bachelor's degree in any branch of Life Sciences/ Pharmaceutical Sciences/ Mathematical Sciences/ Computer Sciences (or applications)/ Physical Sciences/ Chemical Sciences/ Veterinary Sciences/ Agricultural Sciences/ Medical Sciences or an engineering degree in a related stream with 55% marks from a recognized Indian or foreign university. | 10 | **H** & N |
| 2. | M.Sc. in Biosciences | School of Basic and Applied Sciences | Bachelor's degree in any branch of Life Sciences with 55% marks from a recognized Indian or foreign university. | 25 | **H** & O |
| 3. | M.Sc. in Chemical Sciences (Medicinal Chemistry) | School of Basic and Applied Sciences | Bachelor's degree in Science with Chemistry as a subject with 55% marks in aggregate from a recognized Indian or foreign university. | 25 | **H** & P |
| 4. | M.Sc. in Computational Sciences | School of Basic and Applied Sciences | Bachelor's degree in Chemical/ Physical/ Mathematical/ Biological Sciences/ B.Tech. or B.E. in Bioinformatics or Chemical Engineering/ B.Pharm. with a minimum of 55% marks from a recognized Indian or foreign University. | 10 | **H** & Q |
| 5. | M.Sc. in Environmental Science and Technology | School of Environment and Earth Sciences | Bachelor's degree in any branch of biological/chemical/environmental sciences or an engineering degree in a related stream with 55% marks from a recognized Indian or foreign university. | 25 | **H** & O |
| 6. | M.Sc. in Genetic Diseases and Molecular Medicine | School of Emerging Life Science Technologies | Bachelor's degree in life sciences/ animal/ medical sciences or related sciences with 55% marks from a recognized Indian or foreign university. | 10 | **H** & R |
| 7. | M.Sc. in Human Genetics | School of Health Sciences | Bachelor's degree in life sciences/ M.B.B.S. or B.D.S. with 55% marks from a recognized Indian or foreign university. | 10 | **H** & S |
| 8. | M.Sc. in Molecular Genetics | School of Basic and Applied Sciences | Bachelor's degree in any branch of Life Sciences with 55% marks from a recognized Indian or foreign university. | 10 | **H** & O |
| 9. | M.Sc. in Physics (Nanophysics) | School of Basic and Applied Sciences | Bachelor's degree in Science with Physics and Mathematics as subjects with 55% marks from a recognized Indian or foreign university. | 10 | **H** & T |
| **Total Seats** | | | | **135** | |

### (e) M.Pharm. (Duration: 4 Semesters)

| S.No. | Programme# | School | Eligibility | No. of Seats* | Syllabus Sections |
|---|---|---|---|---|---|
| 1. | M.Pharm. in Pharmaceutical Sciences (Medicinal Chemistry) | School of Basic and Applied Sciences | Bachelor's degree in Pharmacy with 55% marks from a recognized Indian or foreign university and also having valid GPAT score. | 18 | **H** & U |
| 2. | M.Pharm. in Pharmaceutical Sciences (Pharmacognosy and Phytochemistry) | School of Basic and Applied Sciences | Bachelor's degree in Pharmacy with 55% marks from a recognized Indian or foreign university and also having valid GPAT score. | 18 | **H** & U |
| **Total Seats** | | | | **36** | |

### (f) M.Tech. (Duration: 4 Semesters)

| S.No. | Programme# | School | Eligibility | No. of Seats* | Syllabus Sections |
|---|---|---|---|---|---|
| 1. | M.Tech. in Computer Science & Technology | School of Engineering and Technology | B.Tech. / B.E. in Computer Science and Engineering / Information Technology / Electronics / Electronics & Communication / Electrical / Instrumentation Engineering from a recognized Indian or foreign university with minimum 55% marks and also having valid GATE score. | 24 | **H** & V |
| 2. | M.Tech. in Cyber Security | School of Engineering and Technology | B.Tech. / B.E. in Computer Science and Engineering / Information Technology / Electronics and Communication Engineering from a recognized Indian or foreign university with minimum 55% marks. | 18 | **H** & V |
| **Total Seats** | | | | **42** | |

### (g) LL.M. (Duration: 2 Semesters)

| S.No. | Programme# | School | Eligibility | No. of Seats* | Syllabus Sections |
|---|---|---|---|---|---|
| 1. | LL.M. in Environmental Law | School of Legal Studies and Governance | Bachelor's Degree in Law with 55% marks from a recognized Indian or foreign university. | 10 | **H** & W |

## C. Post Graduate Diploma Programmes

### (a) PGDTBR and PGDMAC (Duration: 2 Semesters)

| S.No. | Programme[#] | School | Eligibility | No. of Seats* | Syllabus Sections |
|---|---|---|---|---|---|
| 1. | P.G. Diploma in Museology, Archaeology and Conservation (PGDMAC) | School of Languages, Literature and Culture | Bachelor's degree with History / History of Art / Fine Arts / Visual arts / Archaeology / Ancient Indian History Culture and Archaeology as a subject or Bachelor's degree in Science with 55% marks in aggregate from a recognized Indian or foreign university. | 10 | **H** & X |
| 2. | P.G. Diploma in Translational Biomedical Research (PGDTBR) | School of Basic and Applied Sciences | Master's degree in life sciences or Chemistry / B.Pharm. / MBBS / BDS / B.V.Sc. with 55% marks in aggregate from a recognized Indian or foreign university. | 40 | **H** & Y |

**[#] The university reserves the right not to offer the programme in any particular discipline if the response to the course is not adequate. The decision of the university will be final in this regard.**

*** Notes**

- **The university reserves the right to change the number of seats in any programme.**
- **The reservation and eligibility for the candidates belonging to SC/ST/OBC/PWD/Kashmiri Migrants will be as per Government of India rules.**
- **The candidates appearing in the qualifying examination are also eligible to apply and take the entrance test. However, they will have to submit their result on or before the date of interview, failing which their candidature will be cancelled. Self attested photocopy of the result of such candidates must be submitted to the Registrar, Central University of Punjab, Bathinda.**
- **All the candidates desirous of having admission to the programmes being offered by the university have to personally appear for the interview as per the schedule to be notified later.**
- Eligible SC/ST, OBC, PWD students etc. should submit their scholarship form for the academic year by February for processing scholarship to SC/ST, OBC, PWD etc. each year**.**

## 2. Test Centres

**Ahmedabad, Bangaluru, Bathinda, Bhubaneswar, Chandigarh, Chennai, Guwahati, Hyderabad, Jammu, Kolkata, Lucknow, Ludhiana, Mumbai, Nagpur, Noida and Shimla**

- The university reserves the right to change/cancel any centre for the admission examination due to administrative reasons or when the number of candidates appearing at a particular centre is low.
- The candidates will have to submit the online application form and send a print out of the completed online application form along with the required enclosures (see section 12; How to Apply) and requisite fee by registered post to:

**Chairman, Admission Committee**
**Central University of Punjab**
**City Campus, Mansa Road**
**Bathinda – 151 001**

## 3. Important Dates

| | |
|---|---|
| Start of the online submission of application**:** | **April 21, 2014 (Monday)** |
| Last date for submission of online application: | **June 05, 2014 (Thursday)** |
| Last date for receipt of application print out along with enclosures: | **June 12, 2014 (Thursday)** |
| Date of Entrance Examination: | **June 28-29, 2014 (Saturday, Sunday)** |
| Date of declaration of Result: | **July 07, 2014 (Monday)** |
| Last date to submit detailed marks-sheet of the qualifying examination**:** | **On or before the date of interview** |
| Date of Interview | **To be announced Later** |

## 4. Pattern and Syllabus of Entrance Test

### Pattern of Entrance Examination for Research Programmes (M.Phil.)

**(A) Instructions regarding pattern of entrance examination**

a. The question paper for entrance examination will consist of sections **A**, B, C, D, E, F and G (Seven sections).
b. Section **A** will be common to all M.Phil. candidates and it will consist of 40 multiple choice questions (MCQs).
c. Sections B, C, D, E, F and G will pertain to the fields of specialization and each of these will consist of 60 MCQs.
d. Each question will have only one correct answer. Each correct answer to a question will carry '1' (one) mark and an un-attempted question will carry '0' (zero) mark.
e. There will be negative marking i.e., for each wrong answer ¼ (one by four) mark will be deducted from the score obtained.

**(B) Details**

a. The duration of entrance examination shall be 90 minutes for all programmes.
b. The questions in Section-**A** are based on general science, current events, general mental ability, reasoning and interactive English.
c. The questions in Section-B are based on specific topics of Biosciences.
d. The questions in Section-C are based on specific topics of Comparative Literature.
e. The questions in Section-D are based on specific topics of Development Economics.
f. The questions in Section-E are based on specific topics of Environmental Science & Technology.
g. The questions in Section-F are based on specific topics of Physics.
h. The questions in Section-G are based on specific topics of South and Central Asian Studies.

**For detailed syllabus, please refer annexure-I at the end of document.**

### Pattern of Entrance Examination for Post Graduate and PG Diploma Programmes

**(A) Instructions regarding pattern of entrance examination**

a. The question paper for entrance examination will consist of sections **H**, I, J, K, L, M, N, O, P, Q, R, S, T, U, V, W, X, and Y (Eighteen sections).
b. Section **H** will be common to all candidates applying for PG and PG Diploma programmes and it will consist of 40 multiple choice questions (MCQs).
c. Sections I, J, K, L, M, N, O, P, Q, R, S, T, U, V, W, X, and Y will pertain to the programme chosen and each of these will consist of 60 MCQs.
d. Each question will have only one correct answer. Each correct answer to a question will carry '1' (one) mark and an un-attempted question will carry '0' (zero) mark.

e. There will be negative marking i.e., for each wrong answer ¼ (one by four) mark will be deducted from the score obtained.

**(B) Details**

a. The duration of entrance examination shall be 90 minutes for all programmes.
b. The questions in Section-**H** are based on general science, current events, general mental ability, reasoning and interactive English.
c. The questions in Section-I are based on specific topics of Comparative Literature.
d. The questions in Section-J are based on specific topics of Development Economics.
e. The questions in Section-K are based on specific topics of Education.
f. The questions in Section-L are based on specific topics of International Studies.
g. The questions in Section-M are based on specific topics of Punjabi language, literature and culture. The medium of examination for this section will be Punjabi.
h. The questions in Section-N are based on specific topics of Bioinformatics.
i. The questions in Section-O are based on specific topics of Life Sciences and Environmental Sciences.
j. The questions in Section-P are based on specific topics of Chemical Sciences.
k. The questions in Section-Q are based on specific topics of Chemistry, Life Sciences, Physics and Mathematics.
l. The questions in Section-R are based on specific topics of Genetic Diseases and Molecular Medicine.
m. The questions in Section-S are based on specific topics of Human Genetics.
n. The questions in Section-T are based on specific topics of Physics.
o. The questions in Section-U are based on specific topics of Pharmaceutical Sciences.
p. The questions in Section-V are based on specific topics of Engineering Mathematics and Computer Science & Technology.
q. The questions in Section-W are based on specific topics of Law.
r. The questions in Section-X are based on specific topics of Museology, Archaeology and Conservation.
s. The questions in Section-Y are based on specific topics of Translational Biomedical Research.

**For detailed syllabus, please refer annexure-II at the end of document.**

## 5. Entrance Test Fee and Mode of payment

| **Programme\Category** | **General/OBC Candidates** | **SC/ST/PWD Candidates** |
|---|---|---|
| Research Programmes (M.Phil.) | Rs. 600/- | Rs. 300/- |
| PG Programmes and PG Diploma Programmes | Rs. 500/- | Rs. 250/- |

The candidates may apply for more than one programme among the following combinations, subject to fulfillment of eligibility conditions, but they have to submit **separate application form** and **fee** for each programme. Entrance test syllabi will be same for these programmes for a particular combination.

| Combination | Programmes |
|---|---|
| I. | M.A. in Education/M.Ed. |
| II. | M.Sc. Biosciences/M.Sc. Environment Science and Technology/M.Sc. Molecular Genetics |
| III. | M.Pharm. Pharmaceutical Sciences (Medicinal Chemistry)/M.Pharm. Pharmaceutical Sciences (Pharmacognosy and Phytochemistry) |
| IV. | M.Tech. Computer Science & Technology/M.Tech. Cyber Security |

**Mode of Payment:**

A Demand Draft drawn from any nationalized/scheduled bank in favour of "**Central University of Punjab**", payable at **Bathinda** should accompany the application form failing which the application will be rejected.

Note: Entrance Test fee once paid will not be refunded under any circumstances.

## 6. Details of Fee

**i. Academic Fee:**

**i. Academic Fee (Sciences):**

| S.No. | Details | M.Phil. (Sciences) | M.Sc./M.Tech. (Cyber Security)[##]/ PGDTBR | M.Pharm./ M.Tech. Computer Science & Tech. |
|---|---|---|---|---|
| 1. | Tuition fee | Rs.1,430/-sem | Rs.1,070/-sem | Rs.2,640/-sem |
| 2. | Examination fee | Rs.800/-sem | Rs.480/-sem | Rs.800/-sem |
| 3. | Laboratory fee | Rs.1,450/-sem | Rs.1,070/-sem | Rs.2,640/-sem |
| 4 | Computer and internet fee | Rs.500/-sem | Rs.350/-sem | Rs.500/-sem |
| 5 | Sports fee | Rs.200/-sem | Rs.200/-sem | Rs.200/-sem |
| 6 | Library and e-library fee | Rs.550/-sem | Rs.280/-sem | Rs.550/-sem |
| 7 | Students welfare fund | Rs.130/-sem | Rs.130/-sem | Rs.130/-sem |
| 8 | Identity card fee | Rs.50/-ann | Rs.50/-ann | Rs.50/-ann |
| 9 | Admission fee | Rs.800/-ann | Rs.680/-ann | Rs.800/-ann |
| 10 | Literary and cultural fee | Rs.170/-ann | Rs.170/-ann | Rs.170/-ann |
| 11 | Students union fund | Rs.120/-ann | Rs.120/-ann | Rs.120/-ann |
| 12 | Medical fee | Rs.280/-ann | Rs.280/-ann | Rs.280/-ann |
| 13 | Security deposit (Refundable) | Rs.2,400/-ann | Rs.2,400/-ann | Rs.2,400/-ann |
| | **Total amount to be deposited at the time of admission including first semester fee** | **Rs. 8,880/-** | **Rs. 7,280/-** | **Rs. 11,280/-** |
| | **Second semester fee** | **Rs. 5,060/-** | **Rs. 3,580/-** | **Rs. 7,460/-** |
| | **GRAND TOTAL (per annum)** | **Rs. 13,940/-** | **Rs. 10,860/-** | **Rs. 18,740/-** |

[##]Fee structure of M.Tech. (Cyber Security) will be revised if accreditation agency approves fellowship to them.

**Academic Fee (Humanities):**

| S.No. | Details | M.Phil. (Humanities) | M.A./ M.A.(Hons.)/ LL.M./PGDMAC | M.Ed. |
|---|---|---|---|---|
| 1. | Tuition fee | Rs.1,430/-sem | Rs.1,070/-sem | Rs.2,070/-sem |
| 2. | Examination fee | Rs.480/-sem | Rs.280/-sem | Rs.480/-sem |
| 3. | Laboratory fee | Nil | Nil | Rs.2,070/-sem |
| 4 | Computer and internet fee | Rs.500/-sem | Rs.350/-sem | Rs.500/-sem |
| 5 | Sports fee | Rs.200/-sem | Rs.200/-sem | Rs.200/-sem |
| 6 | Library and e-library fee | Rs.550/-sem | Rs.280/-sem | Rs.550/-sem |
| 7 | Students welfare fund | Rs.130/-sem | Rs.130/-sem | Rs.130/-sem |
| 8 | Identity card fee | Rs.50/-ann | Rs.50/-ann | Rs.50/-ann |
| 9 | Admission fee | Rs.800/-ann | Rs.680/-ann | Rs.800/-ann |
| 10 | Literary and cultural fee | Rs.170/-ann | Rs.170/-ann | Rs.170/-ann |
| 11 | Students union fund | Rs.120/-ann | Rs.120/-ann | Rs.120/-ann |
| 12 | Medical fee | Rs.280/-ann | Rs.280/-ann | Rs.280/-ann |
| 13 | Security deposit (Refundable) | Rs.2,400/-ann | Rs.2,400/-ann | Rs.2,400/-ann |
| | **Total amount to be deposited at the time of admission including first semester fee** | **Rs. 7,110/-** | **Rs. 6,010/-** | **Rs. 9,820/-** |
| | **Second semester fee** | **Rs. 3,290/-** | **Rs. 2,310/-** | **Rs. 6,000/-** |
| | **GRAND TOTAL (per annum)** | **Rs. 10,400/-** | **Rs. 8,320/-** | **Rs. 15,820/-** |

ii. **Hostel fee**:**

| S.No. | Item | Amount |
|---|---|---|
| 1. | Hostel registration fee | Rs. 500/- (Non-refundable) |
| 2. | Hostel fee** (for one semester) | Rs. 8,400/- |
| 3. | Hostel security | Rs. 2,000/- (Refundable) |
| 4. | Mess security | Rs. 2,500/- (Refundable) |
| 5. | Total hostel charges to be deposited at the time of admission | Rs. 13,400/- |
| 6. | Hostel fee (for second semester) | Rs. 8,400/- |
| | **GRAND TOTAL (per annum)** | **Rs. 21,800/-** |

****Limited hostel facility is available**

Hostel fee for one semester includes room rent, water charges and charges towards use of air-conditioned reading room. Electricity charges for extra appliances and diet charges will be as per actuals.

## 7. Fellowships and contingency grants

Following fellowship and contingency grant is available to students who are not in receipt of financial assistance from any other source as per the details given below:

i . During M.Phil.- Rs. 5,000/- per month

ii. Contingency during M.Phil.
   a. Science subjects- Rs. 10,000/- per annum
   b. Humanities- Rs. 8,000/- per annum

iii. During M.Pharm./M.Tech. (CS&T) – Rs. 8000/- per month (valid GPAT/GATE required)

iv. No fellowship/stipend is available for LL.M., M.Sc., M.Tech. (Cyber Security), M.A., M.A. (Hons.), M.Ed., PGDTBR, PGDMAC programmes.

v. M.Tech. (Cyber Security) students having valid GATE score may be eligible for fellowship from the date of approval of fellowship, if approved by the accreditation agency.

## 8. Schedule of Admission

| | |
|---|---|
| Declaration of list of candidates to be called for interview<br>Interview and verification of documents<br>Final list of selected candidates<br>Date of admission and payment of fee<br>Date of Registration[###]<br>Date of orientation<br>Date of commencement of classes<br>Date of closure of admission process | **To be notified on the university website** |

[###]Relaxation shall be permitted in last date of registration for categories notified by UGC/ Government of India.

**Note:**

**The candidates are required to deposit the prescribed fee on or before the date to be announced at the time of admission.**

## 9. Documents required at the time of admission

The candidates must submit the originals as well as one set of photocopies of the following documents at the time of admission to the university:

1. Reserve category certificate (SC/ST/OBC/PWD/Kashmiri Migrants), if claimed.
2. Date of birth certificate.
3. Marks sheet of 12th standard or equivalent.
4. Marks sheet for Bachelor's course.
5. Marks sheet for Master's course (s) (if applicable).

6. CSIR-UGC-NET, JRF/GATE/GPAT or any other national level test (with existing validity) recognized by UGC (if applicable).
7. Any other degree/diploma certificate.
8. Character certificate issued by the head of the institute last attended.
9. Any other document supporting the claim for admission.

**Note: Selected candidates will have to submit the Migration Certificate within one month of registration failing which their registration will be cancelled.**

## 10. Selection Criteria for Admission

**All the candidates who are interested to take admission in the university must appear in the entrance examination.**

## 11-A: Distribution and weightage of marks for admission to research programmes

Distribution and weightage of marks to be given to the candidates is given below. (Total marks 100):

| Sr.No. | Details | Weightage for candidates who have qualified national level test or equivalent recognized by UGC/CSIR | Weightage for candidates who have not qualified any national level test or equivalent recognized by UGC/CSIR |
|---|---|---|---|
| 1. | Entrance Test | 30% | 50% |
| 2. | Marks in Post-Graduation | 30% | 30% |
| 3. | Interview and research proposal writing | 20% | 20% |
| 4. | National eligibility test or equivalent | 20% | 0% |

**Explanation:**

**Sr. No. 1: Entrance Test**

(i) Weightage for national level test qualified candidates will be 30% of the score obtained in the entrance test i.e. if a candidate scores 60 marks out of 100 marks in the entrance test he/she will be awarded 18 marks (60x30/100).

(ii) Weightage for candidates who have not qualified any national level test will be 50% of the score obtained in the entrance test i.e. if a candidate scores 60 marks out of 100 marks in the entrance test he/she will be awarded 30 marks (60x50/100).

**Sr. No. 2: Marks in Post-Graduation**

A candidate applying for admission will be awarded 30% of the marks obtained in Post Graduation e.g. if a candidate has scored 60% marks in post graduation, then he/she will be awarded 18 marks i.e. (60x30)/100.

**Sr. No. 3: Interview and research proposal writing**

The candidates called for interview have to bring five copies of a research proposal **in English** of minimum 300 words in their field of specialization (**only for admission evaluation purpose**) and submit that at the time of interview. Candidates without the research proposal will not be allowed to appear in the interview. The weightage for interview and research proposal will be 20 marks.

**Sr. No. 4: National Level Test**

Candidates who have qualified any national level test recognized by UGC/CSIR will be given 20% weightage i.e. 20 marks.

## 11-B: Distribution and weightage of marks for admission to M.A./M.A. (Hons.)/ M.Ed./ M.Sc./M.Pharm./LL.M./M.Tech. CS&T/PGDTBR/PGDMAC Programmes

Distribution and weightage of marks to be given to the candidate is given below: (Total marks 100)

| S.N. | Details | Weightage of Marks |
|---|---|---|
| 1. | Entrance Test | 50% |
| 2. | Marks in graduation/post-graduation | 30% |
| 3. | Interview | 20% |

**Explanation:**

**Sr. No. 1: Entrance Test**

Weightage for entrance test will be 50% of the score obtained in the entrance test i.e. if a candidate scores 60 marks out of 100 marks in the entrance test he/she will be awarded 30 marks (60x50/100).

**Sr. No.2: Marks in Graduation/Post Graduation**

A candidate applying for admission will be awarded 30% of the marks obtained in graduation/post-graduation e.g. if a candidate has scored 60% marks in graduation, then he/she will be awarded 18 marks i.e. (60x30)/100.

**Sr. No.3: Interview**

Weightage for interview will be 20% of the total marks i.e. 20 marks.

## 11-C: Distribution and weightage of marks for admission to M.Tech. Cyber Security Programme

Distribution and weightage of marks to be given to the candidates is given below. (Total marks 100):

| Sr.No. | Details | Weightage for candidates having valid GATE score or any other national level test recognized by UGC/CSIR/AICTE | Weightage for candidates not having valid GATE score or any other national level test recognized by UGC/CSIR/AICTE |
|---|---|---|---|
| 1. | Entrance Test | 30% | 50% |
| 2. | Marks in Graduation | 30% | 30% |
| 3. | Interview | 20% | 20% |
| 4. | GATE or equivalent national level test | 20% | 0% |

**Explanation:**

**Sr. No. 1: Entrance Test**

(i) Weightage for national level test qualified candidates will be 30% of the score obtained in the entrance test i.e. if a candidate scores 60 marks out of 100 marks in the entrance test he/she will be awarded 18 marks (60x30/100).

(ii) Weightage for candidates who have not qualified any national level test will be 50% of the score obtained in the entrance test i.e. if a candidate scores 60 marks out of 100 marks in the entrance test he/she will be awarded 30 marks (60x50/100).

**Sr. No. 2: Marks in Graduation**

A candidate applying for admission will be awarded 30% of the marks obtained in Graduation e.g. if a candidate has scored 60% marks in graduation, then he/she will be awarded 18 marks i.e. (60x30)/100.

**Sr. No.3: Interview**

Weightage for interview will be 20% of the total marks i.e. 20 marks.

**Sr. No. 4: GATE or equivalent National Level Test**

Candidates who have qualified GATE or any other national level test recognized by UGC/CSIR/AICTE will be given 20% weightage i.e. 20 marks.

## 12. How to Apply

**Instructions for submitting Online Application**

1. Please read eligibility criteria and other requirements before submitting the online application form.
2. To apply for admission to a programme, eligible candidates must complete the online application form and submit it.
3. The candidate will also take a printout of the completed online application form after submitting it and send the same with **required enclosures** (see below) by registered post to:

   **Chairman, Admission Committee**
   **Central University of Punjab**
   **City Campus, Mansa Road**
   **Bathinda – 151001**

4. **Enclosures required along with the print out of online application:**
   i. Crossed demand draft in favour of "Central University of Punjab" payable at Bathinda. Write your name, application number, programme for which applied and your address on the back side of the demand draft.
   ii. Paste your recent passport size coloured photograph at the specified space on print-out of your application form.
   iii. The candidate shall put his signature at the space given below the photograph.
   iv. Duly signed undertakings/declaration in the prescribed format.
   v. Self-attested copies of following:
      a. Certificate of SC/ST/OBC/PWD or any other reserved category.
      b. Date of birth certificate.
      c. Marks sheet of $12^{th}$ standard or equivalent.
      d. Marks sheet of Bachelor's course.
      e. Marks sheet of Master's course (for admission in M.Phil. Programmes & wherever applicable).
      f. Certificate of CSIR-UGC-NET, JRF/GATE or any other national level test (with existing validity) recognized by UGC (wherever applicable).
      g. Any other degree/diploma.
5. **Important Instructions:**
   i. The university reserves the right not to offer any particular programme if the response to the programme is not adequate. The decision of the university will be final in this regard.
   ii. If the number of candidates at a particular entrance examination centre is insufficient, the university reserves the right to change the centre.
   iii. The university reserves the right to change the date and time slot for any examination centre.
   iv. Admitted candidates will have to **submit the Migration Certificate within one month of registration**. In case of failure to do so, their admission to the respective programmes shall be cancelled.
   v. Incomplete application form or application received after the scheduled last date shall be summarily rejected and university will not be responsible for any postal delay.
   vi. **Ensuring the eligibility for applying to a particular course will be the sole responsibility of the candidate.**
   vii. This notification is subject to alteration (s) and modification (s) without notice.
   viii. This notification is for information only and it does not constitute a legal document.

# Detailed Syllabus for Research Programmes (M.Phil.)

## Section A
## Aptitude Test

**General aptitude**

1. **General Science:** General appreciation and understanding of science including matters of everyday observation and experience.
2. **Environmental awareness:** Pollution and its impacts, climate change, sustainable development.
3. **Current events: Knowledge of significant national and international events.**
4. **General mental ability and reasoning**: Reasoning and analytical abilities.
5. **Elementary Computer Science:** Basic computer awareness and its uses.
6. **Interactive English:** Grammar, vocabulary, sentence completion, usage, synonyms, antonyms, one word substitute, idioms/phrases, error detection and comprehension.
7. **Information and Communication Technology (ICT):** Terminology and abbreviations used in ICT, applications of ICT in academics and research.

**Research aptitude**

1. Meaning, nature, significance and types of research.
2. End to end process of research, research proposal, synopsis, hypothesis, data collection, literature survey, sampling, interviewing, questionnaire, data processing, interpretation, report writing, bibliography.
3. Thesis/ Dissertation writing.
4. Article, research paper, seminar, conference, symposium, workshop etc.
5. Role of governing bodies/research organizations like UGC, CSIR, ICAR, ICSSR, ICPR, ISRO, DRDO etc. in research and development.
6. Role and use of computers in research.

## Section B
## Biosciences

**1. Instrumentation and Biostatistics:** Principles and applications of microscopy, spectroscopic techniques, radioisotopic techniques, electrophoresis and separation techniques, biostatistics and its applications in data analysis.

**2. Biotechnology:** Genome organization, principles of gene cloning, transgenics, blotting and hybridization techniques, antisense RNA, RFLP, RAPD, AFLP, SSRs and other molecular marker techniques, transposition, applications of biotechnology in agriculture, industry and medicine.

**3. Genetics:** Mendalism, Linkage, crossing over and gene mapping, mutations, sex determination and differentiation, central dogma, regulation of gene expression in prokaryotes and eukaryotes, cell cycle, apoptosis and necrosis.

**4. Immunology:** Immune system, complement systems and antigen-antibody reaction, innate and acquired immunity, components of immune response, lymphokines and interleukins, immunization methods & techniques, monoclonal antibodies and hybridomas**.**

**5. Microbiology:** Classification and Genetics of viruses and bacteria, fermentation, antibiotics and mechanism of action, nitrogen fixation, microbiology of water, air, soil and sewage, microbial animal and plant diseases, epidemiology and control of vector borne diseases (malaria, trypanosomiasis, filariasis, leishmaniasis etc.), tuberculosis and AIDS, waterborne diseases.

**6. Physiology and Biochemistry:** Enzymes and coenzymes, metabolism of biomolecules, animal hormones and mechanism of action, mammalian organ systems, nutrition, digestion and absorption, circulatory system, excretion and osmo-regulation, nerve conduction and neurotransmission, phytohormones, photosynthesis, photorespiration and photoperiodism.

**7. Ecology:** Organizational levels of biosphere, food chain and energy flow, population and community ecology, biogeochemical cycles, biodiversity and its conservation, renewable, non-renewable resources, bioenergy and its prospects in India, forest management and sustainable development.

**8. Atmospheric Chemistry:** Composition of atmosphere, formation of particulate matter, nuclear particle emissions, fission and fusion, properties of different types of radioisotopes, air pollution and control,

greenhouse gases and their effects, elements of climate and climatic control, history of global climate change and Milankovitch's theory of climate change.

**9. Environmental Toxicology and Management:** Environmental toxicology, role of fertilizers, pesticides and heavy metals, indices of toxicology, carcinogens, environmental carcinogenicity testing, molecular toxicology and genetic basis of carcinogenesis, detoxification and biotransformation, waste water management and treatment methods.

**10. Thermodynamics:** Laws of thermodynamics, Carnot's cycle, entropy, Gibb's free energy, catalysis, pH, pK, Henderson-Hesselbalch equation, acids, bases and buffers.

## Section C
## Comparative Literature

**1. Literary Genres:** Fiction and non-fiction (traditional and modern classification); autobiography, biography, diary, drama, essay, novel, poetry, prose, short story etc; types and sub-types.

**2. Comparative Literature:** Definition, scope, aims and objectives; key terms, literary historiography, myth, motif etc; major works and theorists.

**3. Literary trends and literary movements:** Aestheticism, modernism and post-modernism, mysticism, naturalism, progressivism, realism, revolutionary literature, romanticism.

**4. Literary theories and criticism:** Basic terms (Indian and western theories); great contributors and major works; rasa, riti, vakrokati, dhavni, alankara and auchitya school; existentialism, formalism, feminism, marxism, post-structuralism, psycho-analysis, structuralism.

**5. Knowledge of famous authors and texts:** From Indian and foreign literature, world literary classics.

**6. Linguistics and translation:** Linguistics: definition and scope; concepts/aspects of linguistic study; grammar; definitions of morphology, phonology, phonetics, syntax, semantics, lexicography. Translation: Definition, purpose, scope, role, use and problems of translation.

**7. Awareness of current literary events, activities, awards etc.**

## Section D
## Development Economics

**1. Micro Economics:** Demand analysis including pragmatic approaches; Theories of production, Cost and revenue; equilibrium in perfect competition, Monopoly, monopolistic competition, Oligopoly, Macro theories of Distribution, Pareto optimality and its conditions, Theory of Second Best, Arrow's impossibility theorem.

**2. Macro Economics:** The classical and Keynesian models of income determination, Equilibrium in product and money markets (fixed and flexible Prices), Theories of income-consumption relationship, High powered money and money multiplier, Demand for money, Theories of Schumpeter, Kaldor, Samuelson and Hicks Model on business cycles, Philips curve analysis, Samuelson and Solow: the natural rate of unemployment hypothesis.

**3. Mathematics and Statistics:** Rules of partial differential and interpretation of partial derivatives; Homogeneous functions and Euler's Theorem, Problem of maxima and minima in single and multivariable (up to 3) functions; Application of integration to consumer's surplus and producer's surplus, Partial and multiple correlation and regression, Properties of binomial, Poisson and normal distributions, Different laws of probability and its theories.

**4. Developmental Economics:** Growth models: Harrod-Domar, Solow, Meade, Joan Robinson. technological progress–Hicks, Harrod, Learning by doing, Production function approaches, Total factor productivity, Kaldor and Pasinetti, Unlimited supply of labour (Lewis, Ranis and Fei and Jorgenson models), Big push, Balanced growth, Unbalanced growth, Critical minimum efforts thesis, Low level Equilibrium trap, Investment criteria – Rationale and types, Choice of technique-SenDobb thesis, Transfer of technology, Project evaluation–Cost-benefit analysis, Shadow Prices.

**5. Public Finance and International Economics:** Taxation and tax reforms in India, Performance of public expenditure, Public debt and public budget in India, Union-State financial relations in India.Theories of international trade, Terms of trade, Theory of tariffs and non-tariff barriers; Determination of exchange rate (PPP, monetary, portfolio, and balance of payments), Collapse of Bretton Woods system and emergence of WTO, Rationale and economic progress of SAARC/SAPTA and ASEAN regions.

6. **Indian Economic Development:** Priorities and basic strategy, Achievement and failures of Economic planning, Recent Five Year plans, Terms of trade between agriculture And industry, Rural credit and

marketing, W.T.O. and Indian agriculture, Performance of industrial sector, New Economic policy: Liberalization, Privatization, Globalization and Changing profile of public sector, Issues in disinvestments, Fiscal and financial sector reforms, Foreign capital in India, Recommendations of the latest Finance Commission, Monetary and fiscal policies, W.T.O. and Indian economy: challenges and opportunities.

## Section E
## Environmental Science & Technology

**1. Instrumentation and Biostatistics:** Principles of Analytical techniques- Gravimetry, Titrimetry, Chromatography, Spectroscopy, Colorimetry, Electrophoresis, Flame Photometry, Spectrophotometry; Measures of central tendency and dispersal, probability distributions, Kurtosis and skewness, Correlation and regression, Student's t-test, One-way and two-way analysis of variance (ANOVA), $\chi 2$ test.

**2. Environmental Chemistry:** Fundamentals, Atmospheric Chemistry, Water Chemistry, Geochemistry, Green Chemistry.

**3. Ecology:** Biosphere, Organizational levels of biosphere, Food Chain and Energy Flow, Population and Community Ecology, Biodiversity and its Conservation.

**4. Environmental Pollution:** Air, Water, Soil, Noise Pollution- Sources, Causes, Effects, Consequences, Physico-Chemical and Biological Characteristics, Pollutant Monitoring, Control and Abatement, Quality Standards.

**5. Environmental Geosciences:** Structure of Environment- Atmosphere, Hydrosphere and Lithosphere, Earth Processes, Geological Hazards, Mineralogy, Biogeochemical Cycles, Meteorology, Climate Change, Remote Sensing and GIS.

**6. Environmental Microbiology and Biotechnology:** Principles of Microbiology, Microbiology of Air, Water, Soil, Sewage; Biofertilizers, Fermentation, Vermicomposting, Bioremediation

**7. Environmental Toxicology:** Principles, Dose-Response Relationship, Indices of Toxicology, Environmental Toxicants (Organic and Inorganic- Pesticides, Heavy Metals), Detoxification.

**8. Waste Management:** Solid waste- municipal and hazardous, Generation, Collection, Processing and disposal, Management; Waste Handling and Management Rules, Wastewater- Treatment Technologies, Waste to energy conversion.

**9. Environmental laws and Protocols:** Laws, Conventions and Protocols- Air, Water, Noise, Biodiversity, Environmental Protection- National and International Efforts.

**10. Environmental Management:** Environmental Impact Assessment, Risk Assessment, Environmental auditing, Natural Resources- Forest, Water, Minerals, Marine, Energy (Renewable and Nonrenewable)- Threats, Conservation and Management, Energy management, Current Environmental Issues and Sustainable Development.

## Section F
## Physics

**1. Mathematical Methods of Physics:** Matrices and vector calculus, Linear algebra, differential equations, Special functions, Fourier series, Dirichlet condition, complex analysis, Taylor and Laurent series, probability theory, binomial, Poisson and normal distributions, Green's function.

**2. Classical Mechanics:** Newton's laws of motion, Central force problem, Hamilton's variational principle, Lagrangian and Hamiltonian equations, canonical transformation, Poisson brackets, Keplar laws, small oscillations, special theory of relativity.

**3. Electromagnetic Theory:** Electrostatics, Laplace equations, Uniquness theorem I & II, Magnetostatics, boundary conditions, Maxwell's equations, gauge invariance, Lorentz invariance, Lienard-Wiechert potentials.

**4. Quantum Mechanics:** Elementary ideas, Schrödinger equation, expectation values, Ehrenfest's theorem, particle in a box, potential step, rectangular and square well potential, quantum tunneling, harmonic oscillator, hydrogen atom, commutation relation, perturbation theory, Klein-Gordon and Dirac equations.

**5. Nuclear Physics and Particle Physics:** Binding energy, nuclear force, liquid drop model, Deuteron problem, shell model, nuclear reactions, Fission and fusion, fundamental interaction, C, P, and T invariance, Elementary particles.

**6. Solid State Physics:** Crystal structures, X-ray diffraction, Bravais lattices, specific heat, Lattice heat capacity, Free electron theory of solids, Hall effect, lattice vibration, band theory of solids, superconductors, defects in solids, theory of electrical conductivity.

**7. Atomic, Molecular & Laser Physics:** spin orbit coupling, Zeeman effect, ESR, NMR, Born-Oppenheimer approximation, Molecular Orbital theory, Electronic vibrational and rotational spectra, Raman spectra, harmonic and anharmonic oscillator, Morse potential, Spontaneous and stimulated emission, two, three and four level lasers.

**8. Thermodynamics and Statistical Physics:** Laws of thermodynamics and their applications, Maxwell's equations, micro and macro states. Ensembles, partition functions, Gibbs and Helmholtz free energies, MB, BE and FD statistics.

**9. Electronics:** Network theorems, semiconductor diodes, rectifiers, filters, transistors, amplifiers and oscillators, FET, Op-AMP, Logic gates, Boolean algebra, De Morgan theorem, Karnaugh map adder subtractor, registers, counters, A/D and D/A converters. Microprocessor.

## Section G
## South and Central Asian Studies

**1. Political system of India:** Constitutional framework and governmental structure, relationship between centre and state governments, legislature, executive and judiciary, political theory: history and ideology, political parties and pressure groups, national security system.

**2. Indian history:** Ancient, Medieval and Modern Indian History, nature of Indian society, Economy, polity, Religion. Culture and Social movements, Administrative institutions, Modern Indian History, Colonialism, socio-cultural developments, Nationalism, Freedom movement, Post Independent India, Globalization and contemporary History.

**3. World history:** French revolution, Russian revolution, First world war, Vienna Convention, League of Nations, Rise of Germany, Japan and Italy, Second world war, the United Nations and its organs, Cold war, disintegration of Soviet Union and Post-Soviet Central Asia.

**4. Economic development:** Factors, determinants, approaches and models of growth and development, Indian economy, economic indicators, national income, agriculture, industry, taxes, money and banking, international trade, micro and macroeconomics and globalization.

**5. Physical setting:** Geographical factors, natural resources, geomorphology, climatology, oceanography, economic, political and population geography, geographical thought, regional planning and cartography.

**6. Foreign policy:** Ideology, bases and role as regional and international players, economic, political and nuclear foreign policies.

**7. Alliances and alignments in South Asian Countries:** Concept, features and Organizational relations SAARC, ASEAN etc.

# Detailed Syllabus for Post Graduate and PG Diploma Programmes

## Section H
## General Aptitude Test

1. **General Science:** General appreciation and understanding of science including matters of everyday observation and experience.
2. **Environmental Awareness:** Pollution and its impacts, climate change, sustainable development.
3. **Current Events:** Knowledge of significant national and international events.
4. **General Mental Ability and Reasoning:** Reasoning and analytical abilities.
5. **Elementary Computer Science:** Basic computer awareness and its uses.
6. **Interactive English:** Grammar, vocabulary, sentence completion, usage, synonymous, antonymous, one word substitute, idioms/phrases, error detection and comprehension.
7. **Information and Communication Technology (ICT):** Terminology and abbreviations used in ICT, applications of ICT in academics and research.

## Section I
## Comparative Literature

1. **History of English and Indian Literatures**: General trends
2. **Literary Terms:** Allegory, ballad, blank verse, comedy, connotation and denotation, dissociation of sensibility, dramatic monologue, elegy, enlightenment, epic, fancy and imagination, free verse, imitation, intentional fallacy, meter, motif, ode, onomatopoeia, paradox, plot, point of view, satire, soliloquy, sonnet, tragedy, wit etc.
3. **Literary Genres:** Fiction and non-fiction (traditional and modern classification); autobiography, biography, diary, drama, essay, novel, poetry, prose, short story etc; types and sub-types.
4. **Comparative Literature:** Definition, scope, aims and objectives; key terms, literary historiography, myth, motif etc.
5. **Literary trends and literary movements:** Aestheticism, modernism and post-modernism, mysticism, naturalism, progressivism, realism, revolutionary literature, romanticism.
6. **Elementary knowledge of famous authors and texts:** From Indian, Western and Classical literature.
7. **Awareness of current literary trends, events, activities, awards etc.**

## Section J
## Development Economics

1. **Micro Economics:** Theories of demand, Production and costs, Equilibrium in perfect competition, Monopoly and monopolistic competition, Determination of rent, Wages, Interest (Classical view only) and profit.
2. **Macro Economics:** Classical and Keynesian Models of income determination, Working of multiplier and accelerator, Marginal efficiency of capital and investment - Classical and Keynesian approaches to demand for money, Samuelson and Hicks Models of Trade Cycle.
3. **Mathematics and Statistics:** Differentiation, Integration and their economic applications, Correlation and Regression Analysis, Index Numbers and addition and multiplication Law of Probability.
4. **Public Finance and International Trade:** Concept of impact, Shifting and incidence of tax, Effects of taxation and public expenditure on production and distribution, Budgetary classification of public expenditure, Public debt. Theories of Absolute Advantage, Comparative advantage and Heckscher-Ohlin, Reciprocal demand; Concepts and components of balance of trade and balance of payments, Exchange rate and its determination.
5. **Economic Development:** Dualism, Lewis and Nurkse Model of Unlimited supply of labour; Classical, Marxian, Schumpeter, Keynesian and Harrod–Domar models; Theories of balanced growth and Big push, The unbalanced growth and critical Minimum Effort Thesis; Import replacing vs. export oriented industrialization, Choice of technique.
6. **Indian Economy:** Population and economic development, Factors determining agricultural productivity, Industrial development during planning period, Land reforms and Green Revolution, India's balance of payments problem, current five year plan; New economic reforms: Liberalization, privatization and globalization.

## Section K
## Education

1. **Education & Philosophy:** Nature & Meaning of Education, Relationship between Philosophy & Education
2. **Major Philosophies of Education**: Naturalism; Idealism; Pragmatism
3. **Educational Thinkers & their Contribution in developing Principles of Education:** M. K. Gandhi: Basic Education; Tagore: Shanti Niketan; John Dewey: Learning by doing
4. **Culture & Social Change:** Concept & Dimensions of Culture; Relationship between Culture & Education with special reference to conservative and creativity roles; Concept of social change and Roles of Education for social change.
5. **Psychology & Educational Psychology:** Nature & Meaning of Psychology; Nature, Meaning and functions of Educational Psychology.
6. **Learning & Motivation:** Concept of learning & Motivation; Factors of influencing learning – Personal & Environmental, Techniques of enhancing learner's motivation; S-R Theory of Learning (Thorndike), Operant Conditioning theory of learning (Skinner) and Gestalt theory of Learning (Kohler et al).
7. **Growth and Development:** Concept, Stages of development, Role of hereditary and environment in the development of individual
8. **Intelligence:** Nature & Meaning, Measurement of Intelligence – Concept of I.Q, Verbal, Non-verbal & Performance tests. (One test from each category to be discussed); Two-factor Theory (Spearman); Multifactor Theory (Thurston); Structure of intellect (Guilford)
9. **Personality:** Meaning & nature and Development of Personality – biological & socio-culture determinant a brief overview of Trait-theory of Personality (Allport), Factor-theory of Personality (Cattell), Psycho analytical theory of Personality (Freud) and their Educational .
10. **Current issues:** Universalization of Elementary Education with special Reference to Sarva Siksha Abhyan; Women's Education, Education of Weaker Sections, Right to Education Act 2009
11. **Teaching Process:** Concept of teaching; Characteristics & Functions of teaching; Principles & Maxims of teaching
12. **Techniques of Teacher-Preparation:** Microteaching - Nature & Meaning, Main proposition, Phases, Steps, Merits & Limitations; Simulated - Nature & Meaning, Mechanism, Teaching Role Play & T-group. - Advantages & Limitations; Programmed - Meaning & Characteristics, Learning - Principles & Development of the Programmed instructions. - Types. - Merits & Demerits.
13. **Taxonomy of Educational Objectives & Lesson Planning:** Bloom's Taxonomy of instructional objectives: - Cognitive, Affective & Psychomotor domains; Meaning & Significance of lesson planning, Preparation of Lesson planning.
14. **Methods of teaching:** Play Way Method; Project Method; Heuristic Method.

## Section L
## International Studies

1. **Geography:** Physical setting, Natural resources, Climatology, Oceanography, Economic, Political and Population geography.
2. **Social, Economic and Political History of India:** Ancient, Medieval and Modern Indian history, Indian society and economy, Religious life and culture, British colonialism, social Institutions, civilization perspectives, contemporary social and cultural issues, Nationalism, freedom movement, Post independent India and Globalization.
3. **World History:** French revolution, Russian revolution, First world war, Vienna Convention, League of Nations, Rise of Germany, Japan and Italy, Second world war, the United Nations and its organs/agencies, Cold war, Disintegration of Soviet Union and Post-Soviet Central Asia .
4. **Government and Politics in India:** Colonial legacies, Constitutional framework and Governmental structure, Relationship between Centre and State Governments, Legislature, Executive and Judiciary, judicial activism, Public Interest Litigation, Political parties, Regionalism, Caste, Communalism, Tribal communities, Human rights.
5. **Economic Development:** Approaches and Models of growth and development, Indian economy, Economic indicators, National income, Agriculture, Industry, Taxes, Money and banking, International trade.

## Section M
## Punjabi and Comparative Literature

1. **ਪੰਜਾਬੀ ਭਾਸ਼ਾ ਅਤੇ ਸਾਹਿਤ:** ਬੁਨਿਆਦੀ ਸੰਕਲਪ
2. **ਮੱਧਕਾਲੀ ਪੰਜਾਬੀ ਸਾਹਿਤ:** ਗੁਰਮਤਿ, ਸੂਫ਼ੀ, ਕਿੱਸਾ ਅਤੇ ਬੀਰ ਸਾਹਿਤ
3. **ਆਧੁਨਿਕ ਪੰਜਾਬੀ ਸਾਹਿਤ:** ਕਵਿਤਾ, ਨਾਵਲ, ਕਹਾਣੀ, ਨਾਟਕ, ਨਿਬੰਧ ਆਦਿ
4. **ਪਮੁੱਖ ਪੰਜਾਬੀ ਕਵੀ ਅਤੇ ਲੇਖਕ:** ਬਾਬਾ ਫ਼ਰੀਦ, ਗੁਰੂ ਨਾਨਕ, ਵਾਰਸ ਸ਼ਾਹ, ਨਾਨਕ ਸਿੰਘ, ਗੁਰਬਖਸ਼ ਸਿੰਘ ਪੀਤਲੜੀ, ਪੋ. ਪੀਤਮ ਸਿੰਘ, ਬਲਵੰਤ ਗਾਰਗੀ, ਕੁਲਵੰਤ ਸਿੰਘ ਵਿਰਕ, ਸ਼ਿਵ ਕੁਮਾਰ ਬਟਾਲਵੀ, ਗੁਰਦਿਆਲ ਸਿੰਘ, ਦਲੀਪ ਕੌਰ ਟਿਵਾਣਾ, ਪਾਸ਼, ਸੁਰਜੀਤ ਪਾਤਰ, ਅਜਮੇਰ ਔਲਖ
5. **ਤੁਲਨਾਤਮਕ ਸਾਹਿਤ:** ਸੰਕਲਪ ਅਤੇ ਪਕਿਰਤੀ
6. ਪੰਜਾਬੀ ਲੋਕਧਾਰਾ ਅਤੇ ਸਭਿਆਚਾਰ
7. ਭਾਰਤੀ ਅਤੇ ਵਿਸ਼ਵ ਸਾਹਿਤ ਬਾਰੇ ਮੁਢਲੀ ਜਾਣਕਾਰੀ
8. ਸਾਹਿਤਕ ਜਗਤ ਦੇ ਸਮਕਾਲੀ ਮਸਲੇ, ਪਵਿਰਤੀਆਂ, ਘਟਨਾਵਾਂ, ਇਨਾਮ ਸਨਮਾਨ ਆਦਿ

## Section N
## Bioinformatics

**This section shall have five (5) subsections of Physics, Chemistry, Biology, Maths, and computer sciences respectively. Each subsection shall be of 30 marks and candidates shall have to attempt two sections of their choice.**

**Sub-section-a: Biology**

Carbohydrates structure and metabolism, Properties of amino acids, physical interactions, Enzymes. Bio-membranes and sub cellular organization of eukaryotic cells. Transport across cell membranes, Actin, myosin, intermediate filament, microtubules. Cell cycle. Component of immune system, Ag/Ab - structures and types. reactions. crossing over, sex determination, Gene, mutation and selection, Origin of life. Concept of evolution. Ecosystem, its components and types, food chain and energy flow, biological control, community structure and organization, Environmental pollution, Physiology of Digestion.

**Sub-section-b: Chemistry**

Atomic Structure Nuclear Chemistry, Periodic Properties, Chemical Bonding, Ionic Solids, Weak Interactions, S-Block , P-Block Elements, Noble Gases, First Transition Series, Structure and Bonding, Stereochemistry and Mechanism of Organic Reactions, Optical, Geometric, Conformational isomerism, Alkanes, Alkenes, Alkynes, Arenes and Aromaticity, Gaseous States, Chemical Kinetics and Catalysis, Theories of chemical kinetics, First Law of Thermodynamics, Thermochemistry, Second Law of Thermodynamics.

**Sub-section-c: Maths**

Number system, Permutations & Combinations, Probability, Complex Numbers, Logarithms, Linear & Quadratic equations, Trigonometric equations, Heights & Distances, Coordinate Geometry, Straight line, Circles, Conic sections, Sets, Relations and Functions, Limits and Continuity, Differentiation, first and second Order Derivative, Rate Measure, Maxima & Minima. Integration, Definite integration, Area bounded region, Matrix, Determinants Coordinate Geometry: equations of circle, eclipse, plane, Sphere, Vectors, Statistics- Mean, Median, Mode.

**Sub-section-d: Physics**

Motion in one, two and three dimensions, Newton’s law of motion, Work power and Energy, Rotational motion, Gravitation, Surface tension, viscosity and Bernoulli's principle, liquids and gases, Thermodynamics, isothermal, adiabatic changes, Wave motion, superposition of waves, Chemical effect of current and thermo-electricity, Electromagnetism and magnetism, meters, Electromagnetic induction, alternating current, Diode and triode valves and semi-conducting devices, Solids, atomic models and spectra, radio-activity, nuclear structure and nuclear energy, Cathode rays and positive rays, photo-electric effect, X-rays, Matter waves.

**Sub-section-e: Computer Science**

Logic functions, Minimization, Design and synthesis of combinational and sequential circuits; Machine instructions and addressing modes, ALU and data-path, CPU control design, Memory interface**,** C; Functions, Recursion, Parameter passing, Scope, Binding; Abstract data types, Arrays, Analysis, Asymptotic

notation, Notions of space and time complexity, Worst and average case analysis; Dynamic programming. Runtime environments, Intermediate and target code generation, Basics of code optimization. Processes, Threads. Relational model, Database design, Query languages (SQL), File structures, Transactions and concurrency control, information gathering, requirement and feasibility analysis, data flow diagrams, ISO/OSI stack, LAN technologies, Flow and error control techniques, Routing algorithms, Congestion control, TCP/UDP and sockets, IP(v4), HTML, XML.

## Section O
## Biosciences, Environmental Science and Technology and Molecular Genetics

1. **Techniques**: Principles and applications of microscopy, spectrophotometry, centrifugation, radioisotope techniques, electrophoresis and chromatographic separation techniques. Blotting and hybridization techniques.
2. **Origin of life**: Theories of evolution, genetic drift, speciation, cell organelles, cell division, modes of reproduction, principles of inheritance, epistasis, mutations, chromosomal aberrations, extra-chromosomal inheritance.
3. **Genetic Material**: DNA structure and replication, transcription and translation, chromosome structure, protein structure, mutability and repair of DNA, reverse genetics.
4. **Basic Biotechnology**: Recombinant DNA technology, principles of gene cloning, transposition, applications of biotechnology in medicine, industry and agriculture.
5. **Environment**: Organizational levels of biosphere, food chain and energy flow, population and community ecology, biogeochemical cycles, biodiversity and its conservation, renewable & non-renewable resources, bioenergy and its prospects in India, forest management and sustainable development.
6. **Plant systematics**: Bryophytes, Tracheophytes, Gymnosperms, Angiosperms. Membrane structure and Ion transport, ATPase - structure and function, Photosynthesis, Photoperiodism, Vernalization, RUBISCO.
7. **Animal systematics, physiology and diseases**: Cnidaria, Echinodermata, Chordata, Protostomia; Anatomy and physiology of humans; major classes of bacterial and viral pathogens, Apoptosis and cancer, inherited diseases, animal cell culture.

## Section P
## Chemical Sciences (Medicinal Chemistry)

1. **Basic mathematical concepts**: Differential equations, vectors and matrices.
2. **Atomic Structure**: Fundamental particles. Bohr's theory of hydrogen atom; Wave-particle duality; Uncertainty principles; Schrodinger's wave equation; Quantum numbers, shapes of orbitals; Hund's rule and Pauli's exclusion principle.
3. **Theory of Gases**: Kinetic theory of gases. Maxwell-Boltzmann distribution law; Equipartition of energy.
4. **Chemical Thermodynamics**: Reversible and irreversible processes; First law of thermodynamics and its application to ideal and non-ideal gases; Criteria for spontaneity.
5. **Chemical and Phase Equilibria**: Law of mass action; Kp , Kc, Kx and Kn ; Effect of temperature on K; Ionic equilibria in solutions; pH and buffer solutions; Hydrolysis; Solubility product; Phase equilibria– Phase rule and its application to one-component and two-component systems; Colligative properties.
6. **Electrochemistry**: Conductance and its applications; Transport number; Galvanic cells; EMF and Free energy; Concentration cells with and without transport; Polarography.
7. **Chemical Kinetics**: Reactions of various order, Arrhenius equation, Collision theory; Theory of absolute reaction rate; Chain reactions - Normal and branched chain reactions; Enzyme kinetics; Photophysical and photochemical processes; Catalysis.
8. **Basic concepts in Organic Chemistry**: Isomerism and nomenclature, electronic (resonance and inductive) effects.
9. **Aromaticity and Huckel's rule**: Mono- and bicyclic aromatic hydrocarbons.
10. **Organic reaction mechanism and synthetic applications**: Methods of preparation and reactions of alkanes, alkenes, alkynes, arenes and their simple functional derivatives. Mechanism and synthetic applications of electrophilic aromatic substitution. Stereochemistry and mechanism of aliphatic nucleophilic substitution and elimination reactions. Mechanism of aldol condensation, Claisen condensation, esterification and ester hydrolysis, Cannizzaro reaction, benzoin condensation. Perkin

reaction, Claisen rearrangement, Beckmann rearrangement and Wagner-Meerwein rearrangement. Synthesis of simple molecules using standard reactions of organic chemistry. Grignard reagents, cetoacetic and malonic ester chemistry.

11. **Heterocyclic Chemistry**: Monocyclic compounds with one hetero atom.
12. **Qualitative Organic Analysis**: Functional group interconversions, structural problems using chemical reactions, identification of functional groups by chemical tests.
13. **Periodic Table**: Periodic classification of elements and periodicity in properties; general methods of isolation and purification of elements.
14. **Chemical bonding and shapes of compounds**: Types of bonding; VSEPR theory and shapes of molecules; hybridization; dipole moment; ionic solids; structure of NaCl, CsCl, diamond and graphite; lattice energy.
15. **Main group elements (s and p blocks)**: Chemistry with emphasis on group relationship and gradation in properties; structure of electron deficient compounds of main group elements and application of main group elements.
16. **Transition metals (d block)**: Characteristics of 3d elements; oxide, hydroxide and salts of first row metals; coordination complexes; VB and Crystal Field theoretical approaches for structure, colour and magnetic properties of metal complexes.
17. **Analytical Chemistry**: Principles of qualitative and quantitative analysis; acid-base, oxidation reduction and precipitation reactions; use of indicators; use of organic reagents in inorganic analysis; radioactivity; nuclear reactions; applications of isotopes.

## Section Q
## Computational Sciences
## This section consists of 40% Mathematics, 20% Chemistry, 20% Biosciences and 20% Physics questions)

**Chemistry**

1. **Atomic Structure:** Fundamental particles. Bohr's theory of hydrogen atom; shapes of orbitals; Hund's rule and Pauli's exclusion principle.
2. **Theory of Gases:** Kinetic theory of gases. Equipartition of energy.
3. **Chemical Thermodynamics:** Reversible and irreversible processes; First law of thermodynamics; Criteria for spontaneity.
4. **Chemical and Phase Equilibria:** Law of mass action; Kp, Kc, Kx and Kn; Ionic equilibria in solutions; pH and buffer solutions Hydrolysis; Solubility product; Phase equilibria–Phase rule; Colligative properties.
5. **Electrochemistry:** Conductance; Transport number; Galvanic cells; EMF and Free energy.
6. **Chemical Kinetics:** Reactions of various order, Arrhenius equation, Chain reactions-Normal and branched chain reactions; Enzyme kinetics; Photophysical and photochemical processes; Catalysis.
7. **Basic concepts in Organic Chemistry:** Isomerism and nomenclature, resonance and inductive effects.
8. **Aromaticity and Huckel's rule:** Mono and bicyclic aromatic hydrocarbons.
9. **Organic reaction mechanism and synthetic applications:** Methods of preparation and reactions of alkanes, alkenes, alkynes, arenes. Electrophilic aromatic substitution reactions. Stereochemistry and mechanism of aliphatic nucleophilic substitution and elimination reactions. Mechanism of aldol condensation, Claisen condensation, esterification and ester hydrolysis, Cannizzaro reaction, benzoin condensation. Perkin reaction, Claisen rearrangement, Beckmann rearrangement and Wagner-Meerwein rearrangement. Synthesis of simple molecules using standard reactions of organic chemistry. Grignard reagents.
10. **Chemical bonding and shapes of compounds:** Types of bonding; VSEPR theory and shapes of molecules; hybridization; dipole moment; ionic solids; structure of NaCl, CsCl, diamond and graphite.
11. **Main group elements (s and p blocks):** Chemistry with emphasis on group relationship and gradation in properties; structure of electron deficient compounds of main group elements.
12. **Transition metals (d block):** Characteristics of 3d elements; oxide, hydroxide and salts of first row metals; coordination complexes; VB and Crystal Field theoretical approaches for structure, colour and magnetic properties of metal complexes.
13. **Analytical Chemistry:** Qualitative and quantitative analysis; acid-base and redox reactions.

**Biosciences**

1. **Techniques:** Principles of microscopy, spectrophotometry, centrifugation, radioisotope techniques, electrophoresis and chromatographic separation techniques.
2. **Origin of life:** Theories of evolution, speciation, cell organelles, cell division, modes of reproduction, principles of inheritance, epistasis, mutations, extra-chromosomal inheritance.
3. **Genetic Material:** DNA structure and replication, transcription and translation, chromosome structure, protein structure, mutability and repair of DNA.
4. **Basic Biotechnology:** Recombinant DNA technology, principles of gene cloning, transposition, applications of biotechnology in medicine, industry and agriculture.
5. **Animal systematics, physiology and diseases:** Cnidaria, Echinodermata, Chordata, Protostomia; Anatomy and physiology of humans; major classes of bacterial and viral pathogens, Apoptosis and cancer, inherited diseases, animal cell culture.
6. General introduction, scope & importance of biochemistry. Water and it's biological significance; structure, classification and biological importance of carbohydrates, lipids, proteins, nucleic acids, enzymes, vitamins, steroids, pigments and hormones; chemical equilibrium, biological transport process; biosynthesis of carbohydrates in animal tissues, glycogen metabolism and genetic defects, regulation of lactose synthesis; metabolism of lipids/nucleic acids , proteins; mechanism of enzyme action, kinetics; oxidation of fatty acids in animal tissues, its regulation and inhibition, amino acid catabolism, urea cycle, genetic defects, glycogenesis, glycogenolysis and gluconeogensis etc.

**Physics**

1. **Nuclear Physics:** Proton-neutron hypothesis, isotopes and isobars, binding energy, radioactivity, alpha, beta and gamma decays, fermions and bosons.
2. **Optics, Lasers and Spectroscopy:** Reflection, refraction and transmission, single slit and double slit diffraction, Spontaneous and stimulated emission, population inversion, LS and JJ coupling, Zeeman effect.
3. **Solid State Physics:** Crystal Structure, X-ray diffraction, specific heat, thermal conductivity.
4. **Quantum Mechanics:** Photoelectric effect, Compton effect, de Broglie hypothesis, Heisenberg uncertainty principle, Schrodinger wave equation, one dimensional box, harmonic oscillator.
5. **Electromagnetism:** Divergence and curl of a vector field and their physical significance, Coulomb's law, Gauss Law, dipole, Amperes law.
6. **Thermodynamics and Statistical Physics:** Laws of thermodynamics, Carnot cycle, entropy, thermodynamic variables; Boltzmann's, Bose-Einstein and Fermi-Dirac statistics.
7. **Waves and Oscillation:** Harmonic oscillator, Simple harmonic wave, Wave velocity and group velocity, Differential equation of wave motion, Longitudinal and transverse wave.
8. **Mechanics:** Newton's laws, Conservation law, Work–Energy theorem, Kepler's laws, Elasticity, Hooke's Law, Elastic constants, bending of beams, Special Theory of Relativity, Lorentz Transformations, Doppler effect.

**Mathematics**

1. **Complex numbers and quadratic equations:** Representation of complex numbers and their representation in a plane, modulus and argument of a complex number, triangle inequality, quadratic equations in real and complex number system.
2. **Matrices:** Concept, notation, order, equality, zero matrix, transpose of a matrix, symmetric and skew symmetric matrices. Addition, multiplication and scalar multiplication of matrices.
3. **Determinants:** Determinant of a square matrix, properties, minors, cofactors. Adjoint and inverse of a square matrix.
4. **Permutations and combinations:** Fundamental principle of counting, factorial n(n!), permutations and combinations, derivation of formulae and their connections.
5. **Limit, continuity and differentiability:** Real–valued functions, polynomials, rational, trigonometric, logarithmic and exponential functions, inverse functions. Differentiation of the sum, product and quotient of two functions. Differentiation of trigonometric, inverse trigonometric, logarithmic, exponential; derivatives of order upto two.
6. **Integral calculus:** Integral as an anti–derivative. Fundamental integrals involving algebraic, trigonometric, exponential and logarithmic functions. Integration by substitution, by parts and by partial fractions. Integration using trigonometric identities. Properties of definite integrals.

7. **Vector algebra:** Vectors and scalars, addition of vectors, components of a vector in two dimensions and three dimensional space, scalar and vector products, scalar and vector triple product.
8. **Trigonometry:** Trigonometrical identities and equations. Trigonometrical functions. Inverse trigonometrical functions and their properties.

## Section R
## Genetic Diseases and Molecular Medicine

1. **Techniques:** Principles and applications of microscopy, spectrophotometry, centrifugation, radioisotope techniques, electrophoresis and chromatographic separation techniques. Blotting and hybridization techniques.
2. **Origin of life:** Theories of evolution, genetic drift, speciation, cell organelles, cell division, modes of reproduction, principles of inheritance, epistasis, mutations, chromosomal aberrations, extra-chromosomal inheritance.
3. **Genetic Material:** DNA structure and replication, transcription and translation, chromosome structure, protein structure, mutability and repair of DNA, reverse genetics.
4. **Basic Biotechnology:** Recombinant DNA technology, principles of gene cloning, transposition, applications of biotechnology in medicine, industry and agriculture.
5. **Animal systematics, physiology and diseases:** Cnidaria, Echinodermata, Chordata, Protostomia; Anatomy and physiology of humans; major classes of bacterial and viral pathogens, Apoptosis and cancer, inherited diseases, animal cell culture.
6. **Computer applications:** basics of MS office, various operating system.
7. **Basic Biochemistry:** Nucleic acids, proteins, lipids, carbohydrates, theories of enzyme activity, important metabolic pathways in animals.
8. **Statistics:** Probability, Standard deviation, mean, median, average, student t-test.

## Section S
## Human Genetics

1. **Mendelian genetics and Extension of Mendelian genetics:** Mendel's laws and their applications, genetic counseling, genetic interaction, multiple alleles, linkage analysis, crossing over, sex determination, sex — limited and sex – linked inheritance, patterns of single gene inheritance in humans, Extra nuclear inheritance: chloroplast and mitochondrial DNA.
2. **Chromatin structure and function:** Organization of chromosomes in prokaryotes and eukaryotes, chromatin types, DNA, histone and non-histone protein and organization of nucleosomes, concept of gene.
3. **Chromosome and gene mutations:** variation in chromosome number and arrangement, Clinical Cytogenetics: disorders of autosomes and sex chromosomes, gene mutations spontaneous and induced, DNA repair and transposition.
4. **Gene expression and regulation:** Genetic code, transcription and translation, gene regulation in prokaryotes and eukaryotes.
5. **Population Genetics:** Hardy-Weinberg equilibrium, Genetic variation in Individuals and Populations.
6. **Techniques:** Principles and applications of microscopy, spectrophotometry, centrifugation electrophoresis, chromatographic separation techniques, Blotting and hybridization techniques.
7. **Recombinant DNA technology:** Restriction enzymes, vectors, DNA libraries, PCR, DNA sequencing.
8. **Human Anatomy and Human Physiology:** Skin, Digestive system, Respiratory system, Circulatory system, Excretory, CNS & PNS, Sensory organs - Eyes, Ear, Endocrinology, Reproductive organs and their physiology.

## Section T
## Physics

**1. Mathematical Physics:** Curvilinear coordinates; Beta and gamma functions, Dirac delta functions. Functions of complex variables, Cauchy's theorem, Residue and residue theorem, contour integration differential equation.

**2. Nuclear Physics:** Proton - neutron hypothesis, Semi-Empirical mass formula, Liquid Drop Model, nuclear forces. Van de Graff generator, Radioactivity, Basic interactions and elementary particles

**3. Optics, Lasers and Spectroscopy:** Cardinal points, Newton's formula, Single and double slit experiment, Newton's Rings, Michelson Interferometer, Fresnel and Fraunhofer diffraction, Polarization, double refraction, specific rotation, Spontaneous & stimulated emission, population inversion, pumping, Ruby laser, Helium Neon laser, LS and JJ coupling, Stern and Gerlach experiment.

**4. Electronics:** Semiconductors, drift and diffusion of charges, Zener diode, Transistor biasing, voltage divider bias, h-parameters, amplifier and oscillators, Op-Amp, Power supply; half wave, full wave and bridge rectifier, filter and regulated power supply.

**5. Solid State Physics :** Space lattice and basis, unit cell, coordination number, atomic packing fraction, Miller indices, interplanar spacing, X-ray diffraction, Reciprocal lattice, Brillion zones, Reciprocal lattice of SC, BCC and FCC lattices, atomic form factor, lattice specific heat of solids, thermal conductivity, dielectrics, hysteresis.

**6. Quantum Mechanics:** Black body Radiation, photoelectric effect, Compton effect, de Broglie hypothesis, Davison Germer experiment, Heisenberg uncertainty principle. Schrodinger's equation, probability current density, operators, expectation value, commutation relations, wave packet, group and phase velocities, particle in a box, harmonic oscillator.

**7. Electromagnetism:** Coulomb's law, Electric Field and potentials, Poisson and Laplace Equations, Gauss Law and its application, Electric dipole, quadruple, Electrostatic Energy. Amperes law, Faraday's law, induction, skin depth, displacement current, Maxwell's equations.

**8. Thermodynamics and Statistical Physics:** Kinetic theory of gasses, Law of equipartition of energy, Real Gases, critical constants, Joule expansion of ideal and real gases, Liquefaction of gases, transport phenomena in gases. Carnot cycle, entropy, Maxwell's equations, Joule-Thomson cooling, Clausius-Clapeyron heat equation, Maxwell Boltzman's, Bose-Einstein & Fermi-Dirac statistics.

**9. Waves and Oscillation:** SHO, Lissajous figures, Damped & Forced Oscillations, Sharpness of resonance, Coupled Oscillator, Wave velocity and particle velocity, Longitudinal and transverse wave, phenomenon of Beats, interference and diffraction.

**10. Mechanics:** Newton's laws, Work–Energy theorem, Conservation laws, central force field, Kepler's laws**,** Larmor's frequency, Elasticity, Hooke's Law, Elastic constants, Special Theory of Relativity, Lorentz Transformations, mass energy relation, Doppler effect.

## Section U

## Pharmaceutical Sciences (Medicinal Chemistry) and (Pharmacognosy and Phytochemistry)

**1. Medicinal Chemistry:** Structure, nomenclature, classification, synthesis, SAR and metabolism of the following category of drugs, which are official in Indian Pharmacopoeia and British Pharmacopoeia. Hypnotics and Sedatives, Analgesics, NSAIDS, Neuroleptics, Antidepressants, Anxiolytics, Anticonvulsants, Antihistaminics, Local Anaesthetics, Cardio Vascular drugs–Antianginal agents Vasodilators, Adrenergic & Cholinergic drugs, Cardiotonic agents, Diuretics, Anti-hypertensive drugs, Hypoglycemic agents, Antilipedmic agents, Coagulants, Anticoagulants, Antiplatelet agents. Introduction to drug design. Stereochemistry of drug molecules. Diagnostic agents. Preparation, storage and uses of official Radiopharmaceuticals, Vitamins and Hormones. Eicosanoids and their application**.**

**2. Pharmaceutics:** Development, manufacturing standards Q.C. limits, labeling, as per the pharmacopoeial requirements. Storage of different dosage forms and new drug delivery systems. Biopharmaceutics and Pharmacokinetics and their importance in formulation.

**3. Pharmacology:** General pharmacological principles including Toxicology. Drug interaction. Pharmacology of drugs acting on Central nervous system, Cardiovascular system, Autonomic nervous system, Gastro intestinal system and Respiratory system. Pharmacology of Autocoids, Hormones, Hormone antagonists, chemotherapeutic agents including anticancer drugs. Bioassays,Immuno Pharmacology. Drugs acting on the blood & blood forming organs. Drugs acting on the renal system.

**4. Natural products :** Pharmacognosy & Phytochemistry– Chemistry, tests, isolation, characterization and estimation of phytopharmaceuticals belonging to the group of Alkaloids, Glycosides, Terpenoids, Steroids, Bioflavanoids, Purines, Guggul lipids. Pharmacognosy of crude drugs that contain the above constituents. Standardization of raw materials and herbal products. Quantitative microscopy including modern techniques used for evaluation. Biotechnological principles and techniques for plant development, Tissue culture.

**5. Clinical Pharmacy:** Therapeutic Drug Monitoring Dosage regimen in Pregnancy and Lactation, Pediatrics and Geriatrics. Renal and hepatic impairment. Drug – Drug interactions and Drug – food interactions, Adverse Drug reactions. Medication History, interview and Patient counseling.

**6. Pharmaceutical analysis:** Principles, instrumentation and applications of the following: Absorption spectroscopy (UV, visible & IR). Fluorimetry, Flame photometry, Potentiometry. Conductometry and Polarography. Pharmacopoeial assays. Principles of NMR, ESR, Mass spectroscopy. X-ray diffraction analysis and different chromatographic methods.

**7. Biochemistry:** Biochemical role of hormones, Vitamins, Enzymes, Nucleic acids, Bioenergetics. General principles of immunology. Immunological. Metabolism of carbohydrate, lipids, proteins. Methods to determine, kidney & liver function. Lipid profiles.

**8. Pharmaceutical jurisprudence:** Drugs and cosmetics Act and rules with respect to manufacture, sales and storage. Pharmacy Act. Pharmaceutical ethics.

**9. Microbiology:** Principles and methods of microbiological assays of the Pharmacopoeia. Methods of preparation of official sera and vaccines. Serological and diagnostics tests. Applications of microorganisms in Bio Conversions and in Pharmaceutical industry.

## Section V
## Computer Science and Technology and Cyber Security

**Engineering Mathematics**

1. **Theory of Probability:** Axiomatic definition of Probability, Conditional Probability Baye's Theorem,; Random Variables Functions of random variables; Probability distributions: Binomial Poisson, Exponential and Normal distribution and their moment generating functions.
2. **Set Theory & Algebra:** Sets; Relations; Functions; Composition of function and relations, Groups; Partial Orders; Boolean Algebra.
3. **Combinatorics:** Permutations; Permutations with and without repetition; Combinations; generating functions; recurrence relations.
4. **Graph and Trees:** Introduction to graphs, Directed and Undirected graphs, Homomorphic and Isomorphic graphs, Subgraphs, Cut points and Bridges, Multigraph and Weighted graph, Paths and circuits, Shortest path in weighted graphs, Eurelian path and circuits, Hamilton paths and circuits, Planar graphs, Eulers' formula, Trees, Spanning trees.
5. **Linear Algebra:** Algebra of matrices, determinants, systems of linear equations, Eigen values and Eigen vectors.
6. **Calculus:** Limit, Continuity & differentiability, Mean value Theorems, Theorems of integral calculus, evaluation of definite & improper integrals, Partial derivatives, Total derivatives, maxima & minima.

**Computer Science and Technology**

7. **Theory of Computation:** Finite Automata and Regular Expressions, Non-determinism and NFA**,** Properties of Regular Sets, Context free grammar: Chomsky Normal Form (CNF), Griebach Normal Form (GNF), Push-down automata, Moore and mealy Machines, Turing machines,
8. **Digital Logic:** Number representation and computer arithmetic (fixed and floating point), Logic functions, Minimization, Design and synthesis of combinational and sequential circuits, A/D AND D/A CONVERTERS.
9. **Computer Organization and Architecture:** Machine instructions and addressing modes, ALU and data-path, CPU control design, Memory interface, I/O interface (Interrupt and DMA mode), Instruction pipelining, Cache and main memory, Secondary storage.
10. **Microprocessors and Interfacing:** instruction set, Addressing modes, Memory interfacing, Interfacing peripheral devices, Interrupts. Microprocessor architecture, Instruction set and Programming (8085), Microprocessor applications, DMA, Interrupt and Timer.
11. **Programming and Data Structures**: Programming in C; Functions, Recursion, Parameter passing, Definition of data structure. Arrays, stacks, queues, linked lists, trees, priority queues and heaps, Binary search trees.
12. **Algorithms:** Algorithm concepts, Analyzing and design, asymptotic notations and their properties, Worst and average case analysis; Design: Greedy approach, Dynamic programming, Divide-and-conquer; Tree and graph traversals, Spanning trees, Shortest paths; Hashing, Sorting, Searching.
13. **Compiler Design:** Assemblers, linkers, loaders, compilers and translators, the structure of a compiler, different states in the construction of a compiler, Lexical analysis, Parsing, Syntax directed

translation, Runtime environments, Intermediate and target code generation, Basics of code optimization.

14. **Operating System:** Main functions of operating systems, Processes, Threads, Inter-process communication, Concurrency, Synchronization, Deadlock, CPU scheduling, I/O scheduling, Resource scheduling. Deadlock and scheduling algorithms, Banker's algorithm for deadlock handling. Memory management and virtual memory, File systems, I/O systems, DOS, UNIX and windows.
15. **Databases**: Database Concepts, ER-model, Data Models, Relational model (relational algebra, tuple calculus), RAID, Database design (integrity constraints), Normalization (up to 4th Normal forms), BCNF (Boyce code normal forms), Query languages (SQL), Data mining & data warehousing, Transactions and concurrency control, Database security: Database security issues, Discretionary access control, Mandatory & role based access control, Database audit.
16. **Computer Networks**: OSI model, TCP/IP model, LAN technologies (Ethernet, Token ring), Transmission media - twisted pair, coaxial cables, fibre-optic cables, Flow and error control techniques, Routing algorithms, Congestion control, IP(v4), Application layer protocols (icmp, dns, smtp, pop, ftp, http); sliding window protocols; Internetworking: Switch/Hub, Bridge, Router, Gateways, Concatenated virtual circuits, Firewalls; Network Security: Cryptography - public key, secret key. Domain Name System (DNS) - Electronic Mail and World wide Web (WWW).
17. **Web technologies:** HTML, XML, basic concepts of client-server computing

## Section W
## Environmental Law

**1. Constitutional Law:** Environmental concerns in Constitution such as State, Fundamental Rights, Directive Principles, Fundamental Duties, Judicial Activism, VII schedule: provisions relating to Environment in three lists.

**2. The Water (Prevention and Control of Pollution) Act, 1974:** Definitions, composition of Board, qualification and disqualification of members, functions and powers of the boards, provisions relating to prevention and control of pollution, procedure of appeal, penalty and offences, bar of jurisdiction clause.

**3. The Air Water (Prevention and Control of Pollution) Act, 1981:** Definitions, composition of Board, qualification and disqualification of members, functions and powers of the boards, provisions relating to prevention and control of pollution, procedure of appeal, penalty and offences bar of jurisdiction clause.

**4. The Environment (Protection) Act, 1986:** Object of the Act, Powers of the Central Government.

**5. National Green Tribunal Act, 2010:** Aims and objectives of the Act, Mechanism to provide compensation.

**6. Legal Theory:** Analytical School, Contribution of John Austin, Jeremy Bentham.

**7. Historical School:** Contribution of Fredrick Carl Von Savigny and Sir Henry Maine in the development of historical jurisprudence.

**8. Sociological School:** Social solidarity of Leon Duguit, social engineering by Roscoe Pound.

**9. Realist School of Jurisprudence:** Contribution of Justice Holmes, Prof Grey, Kari Llewlleyn, Oliver Crona. Jerome Frank.

**10. Rights and duties:** definitions of right, Kinds of Rights and Duties, Hohfield's theory of rights and duties.

**11. Liability:** doctrine of strict liability and absolute liability including case law.

**12. Provisions relating to control of Pollution in:**

Indian Penal Code, 1860
Code of Criminal Procedure, 1973
Code of Civil Procedure, 1908

## Section X
## Museology, Archaeology and Conservation

A brief introduction to the Cultural History of India and the World covering the following topics:

1. Major Religions of the world
2. Major Civilizations of the World
3. Sources of Ancient and Medieval Indian History: Literary and archaeological
4. The Harappan/Indus Valley Civilization, its nature and significance.
5. The Aryans and Early Vedic Civilization, their literature, religion, and social

system

6. The later Vedic age, the epics, changes in Vedic society.
7. Alexander's invasion, Gandhara art.
8. Foundation of the Mauryan Empire, life and culture during this period.
9. Shungas and Kushanas
10. The Gupta Empire, social and cultural conditions, religion and literature.
11. Varadhanas: Harsha, Ban Bhatta and Huen-Tsang.
12. South Indian Dynasties: Pallavas, Chalukyas and Rashtrakautas.
13. Rise of Rajput Power, Rajput Dynasties, their art and literature.
14. The Foundation of Muslim rule in India, Slave/Mamluk, Khalji, Tughlaq, Sayyid and Lodi Dynasties; major monuments.
15. Provincial Dynasties: Bahmani, Gujrat, Maiwa and Jaunpur.
16. Hindu Kingdoms during the Sultanate period: Vijaynagar and its art
17. Social conditions during the age of Sultans, the rise and development of Bhakti Movement, Sufism.
18. Foundation of Mughal Rule under Babur, and Humayun
19. Sher Shah Sur
20. Akbar and the synthesis of Hindu-Muslim Culture, his religious and humanitarian Ideas, synthesis in the fields of art and architecture
21. Mughal empire during the reigns of Jahangir, Shah Jahan, Aurangzeb; the decline of the Mughals. Development of art and architecture
22. Shivaji and the rise of Marathas.
23. Advent of Europeans, the British East India Company.
24. Growth of British Power in Bengal and the expansion of British Rule in India.
25. The Sepoy Mutiny of 1857.
26. Western impact on Indian trade, Industry and Crafts.
27. Introduction of Western Education and Establishment of Universities; its impact on Indian social and political life.
28. Socio-Religious reform movements
29. Beginning of archaeology, discovery of the art of the past; major Orientalist scholars.

**TERMS (in context of art and archaeology)**

Abstraction, Aesthetics, Archaeology, Archival quality, Art, Artifact, Bas-relief, Beads, Calligraphy, Canvas, Chiaroscuro, Collage, Collection, Composition, Connoisseur, Conservation, Contraposto, Craft, Crayons, Culture, Curator, Drawing, Epigraphy, Folio, Foreshortening, Form, Fresco, Graphic art, Grafitti, Handicraft, Hieroglyph, Icon, Iconography, Idealism, Image, Inscription, Lithograph, Manuscript, Modelling, Monument, Mosaic, Motif, *Mudra*, Mural, Museum, Mythology, Numismatics, Painting, Pastels, Perspective, Pigment, Poster, Pottery, Primitive, Print, Realism, Relief, Reproduction, Sanskrit, Scaffolding, Sculpture, Seal and Sealing, Serigraphy, Sherd, Symbol, Terracotta

## Section Y
## Translational Biomedical Research

**1. Drugs Development:** Structure, nomenclature, classification, synthesis, SAR and metabolism of the following category of drugs, which are official in Indian Pharmacopoeia and British Pharmacopoeia. Hypnotics and Sedatives, Analgesics, NSAIDS, Neuroleptics, Antidepressants, Anxiolytics, Anticonvulsants, Antihistaminics, Local Anaesthetics, Cardio Vascular drugs–Antianginal agents Vasodilators, Adrenergic & Cholinergic drugs, Cardiotonic agents, Diuretics, Anti-hypertensive drugs, Hypoglycemic agents, Antilipedmic agents, Coagulants, Anticoagulants, Antiplatelet agents. Introduction to drug design. Stereochemistry of drug molecules. Diagnostic agents. Preparation, storage and uses of official Radiopharmaceuticals, Vitamins and Hormones. Eicosanoids and their application**.**

**2. Pharmacology:** General pharmacological principles including Toxicology. Drug interaction. Pharmacology of drugs acting on Central nervous system, Cardiovascular system, Autonomic nervous system, Gastro intestinal system and Respiratory system. Pharmacology of Autocoids, Hormones, Hormone antagonists, chemotherapeutic agents including anticancer drugs. Bioassays,Immuno Pharmacology. Drugs acting on the blood & blood forming organs. Drugs acting on the renal system.

**3. Drugs from Natural origin:** Chemical tests, isolation, characterization and estimation of phytopharmaceuticals belonging to the group of Alkaloids, Glycosides, Terpenoids, Steroids, Bioflavanoids, Purines, Guggul lipids. Histology of crude drugs that contain the above constituents. Standardization of raw materials and herbal products. Biotechnological principles and techniques for plant development, Tissue culture.

**5. Clinical Research:** Therapeutic Drug Monitoring Dosage regimen in Pregnancy and Lactation, Pediatrics and Geriatrics. Renal and hepatic impairment. Drug – Drug interactions and Drug – food interactions, Adverse Drug reactions. Medication History, interview and Patient counseling.

**6. Analytical chemistry:** Principles, instrumentation and applications of the following: Absorption spectroscopy (UV, visible & IR). Fluorimetry, Flame photometry, Potentiometry. Conductometry and Polarography. Pharmacopoeial assays. Principles of NMR, ESR, Mass spectroscopy. X-ray diffraction analysis and different chromatographic methods.

**7. Biochemistry:** Biochemical role of hormones, Vitamins, Enzymes, Nucleic acids, Bioenergetics. Metabolism of carbohydrate, lipids, proteins. Methods to determine, kidney & liver function. Lipid profiles.

**8. Microbiology:** Principles and methods of microbiological assays of the Pharmacopoeia. Methods of preparation of official sera and vaccines. Serological and diagnostics tests. Applications of microorganisms in Bio Conversions and in Pharmaceutical industry. Microbial animal and plant diseases, epidemiology and control of vector borne diseases (malaria, trypanosomiasis, filariasis, leishmaniasis etc.), tuberculosis and AIDS, waterborne diseases.

**9. Immunology:** General principles of immunology. Immune system, complement systems and antigen-antibody reaction, innate and acquired immunity, components of immune response, lymphokines and interleukins, immunization methods & techniques**.**

**10. Biotechnology:** Genome organization, principles of gene cloning, transgenics, blotting and hybridization techniques, antisense RNA, RFLP, RAPD, AFLP, SSRs and other molecular marker techniques, transposition, applications of biotechnology in agriculture, industry and medicine.

**11. Genetics:** Mendalism, Linkage, crossing over and gene mapping, mutations, sex determination and differentiation, central dogma, regulation of gene expression in prokaryotes and eukaryotes, cell cycle, apoptosis and necrosis.