The pattern of JNU 2020-21 will be based on Multiple Choice Questions (MCQs) through Computer Based Test (CBT)

### Master of Arts

<table>
<thead>
<tr>
<th>Sl. No.</th>
<th>Name of Centre</th>
<th>Sub. Code &amp; Sub. Code Number</th>
<th>Syllabus for Entrance Examination</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>School of International Studies</td>
<td>Politics (with specialization in International Studies – PISM (201))</td>
<td>Five disciplines are covered in the test – Sociology, Political Science, International Relations, History and Economics. There is sufficient choice in questions for applicants from each discipline to be able to attempt the required number of questions. The BA syllabi of these disciplines generally found in most Indian universities are kept in mind while setting questions.</td>
</tr>
<tr>
<td>2</td>
<td>International Relations and Area Studies – IRAM (234)</td>
<td>Five disciplines are covered in the test – Sociology, Political Science, International Relations, History and Economics. There is sufficient choice in questions for applicants from each discipline to be able to attempt the required number of questions. The BA syllabi of these disciplines generally found in most Indian universities are kept in mind while setting questions. The emphasis will be on Area Studies in International Relations.</td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>Economics (with specialization in World Economy) – EILM (202)</td>
<td>The entrance examination will contain multiple choice questions and the syllabus will include Microeconomics, Macroeconomics, Mathematics, Statistics, International Trade and Development Economics taught at the Bachelor’s level.</td>
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</tbody>
</table>

### M.Phil & Ph.D.

<table>
<thead>
<tr>
<th>Sl. No.</th>
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<th>Syllabus for Entrance Examination</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Centre for Canadian, US and Latin American Studies (CCUS&amp;LAS)</td>
<td>Canadian Studies – CANP (101) &amp; CANH (826)</td>
<td><strong>Section I</strong></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td><strong>RESEARCH METHODOLOGY</strong></td>
</tr>
</tbody>
</table>
|        |                                                                                  |                              | 1. Social science research vs. natural science research  
2. Inter-disciplinary research  
3. Variables in research  
4. Types of research: descriptive; empirical; analytical; historical and doctrinal  
5. Questionnaires and interviews; participant and non-participant observation  
6. Survey research  
7. Content analysis  
8. Case study research  
9. Managing and reviewing literature for research  
10. Research proposal, research questions and hypothesis formulation  
11. Primary and secondary sources; use of libraries and archives - Research ethics/ ethical practices in research |
| 2      | Latin American Studies – LAMP (103) & LAMH (828)                                 |                              | **Section II**                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |
|        |                                                                                  |                              | **US Studies**                                                                                                                                                                                                                                                                                                                                                                                                                           |
|        |                                                                                  |                              | 1. Bill of Rights – American Constitution  
2. Federalism  
3. Media, political parties and elections  
4. Congress, judiciary and judicial review |
5. Power and role of the US President and domestic factors in Foreign Policy.
6. US Policy towards South Asian Countries
7. US Foreign policy during Cold War (Containment Policy, Marshall Plan, Alliance Politics, Truman Doctrine)
8. Foreign Policy trends and patterns in Post-Cold War America (UN, Middle East, Europe, Asia, international institutions).
9. American ideals: liberty, equality, republicanism, individualism, democracy, faith-neutrality
10. Waves of immigration to America: old, new and newest
11. Ethnicity, race, religion and gender in America
12. Social problems: Gun violence, racism, abortion, teenage pregnancy, homelessness, drugs and alcoholism
13. Terrorism

**Latin American Studies**

Government and politics in Latin America: executive, legislature, judiciary
Political parties and political movements
Role of Labour, peasantry and middle class
Domestic and foreign capital
Church
Military
Environmental issues
Indigenous communities
Independence movements and ideas
Social movements
Latin America in world affairs
Relations with US; Asia, Africa and Europe
India and Latin America
Latin American and Caribbean regionalism
Contemporary political, social and economic issues in major Latin American and Caribbean countries

**Canadian Studies**

Multiculturalism and ethnicity in Canada
Immigration policies and integration
Environmental issues
Canada and India relations
Regional Economic Integration
Inter-American relations
Federalism and Provincial Government
Quebec and issues of regionalism
Political party system and electoral politics
Foreign Policy approaches and trends
Canada and United Nations; Peace-keeping, peace-building and peace-enforcement
Contemporary political, social and economic issues in Canada

<table>
<thead>
<tr>
<th>Centre for European Studies (CES)</th>
<th>United States Studies – USSP (102) &amp; USSH (827)</th>
<th>The test is divided into two sections, research methodology and area studies.</th>
</tr>
</thead>
<tbody>
<tr>
<td>4</td>
<td>European Studies – EUPP (104) &amp; EUPH (829)</td>
<td>Section I - Meaning and importance of Research – Types of Research Concepts in Social Research: Data, Research Methods, Techniques, Concepts and Indicators, Variables, Sample, Research Designs, Selection and formulation of Research Problem, Hypothesis, Research Questions; Issues in social research: Subjectivity and Objectivity, Reliability and Validity,</td>
</tr>
<tr>
<td>5</td>
<td>Int. Legal Studies – ILGP (105) &amp; ILGH (830)</td>
<td>Section II - The syllabus will be on contemporary issues, discourses, debates and developments in politics, society, foreign policy, security and economy of European states/ European Union.</td>
</tr>
</tbody>
</table>

The entrance examination will contain multiple choice questions covering subject-specific knowledge. The syllabus will include the following themes:

1. The history, nature and subjects of International Law; Statehood and International Legal Personality; Individuals, indigenous communities,
| 6 | Centre for International Trade & Development (CITD) | Int. Trade & Development – ITDP (106) & ITDH (831) | The entrance examination will contain multiple choice questions covering research methodology and subject-specific knowledge. The syllabus will include Mathematical Economics, Statistics, Econometrics, Microeconomics, Macroeconomics, International Trade, Development Economics, Public Economics and Environmental Economics taught at the Master’s level. |
| 7 | Centre for East Asian Studies (CEAS) | Chinese Studies – CHIP (107) & CHIH (832) | The syllabus for the examination include subjects related to broader East Asian/Global developments; China's Foreign, Economic, Political & Social Issues; Japan’s Foreign, Economic, Political & Social Issues; Korea’s Foreign, Economic, Political & Social Issues. Major developments in East Asia are highlighted to test the candidates capabilities in conducting research in these areas. |
| 8 |  | Japanese – JPIP (108) & JPIH (833) | |
| 9 |  | Korean – KOIP (109) & KOIH (834) | |
| 12 |  | Diplomacy and Disarmament – DADP (112) & DADH (838) |  |
| 13 |  | Political Geography – POGP (113) & POGH (836) |  |
(C) International Organization (ORG)
1. Concept, definition and classification of international organization(s)
2. Roles, functions and powers of international organizations
3. Theoretical approaches to international organization
4. International organizations in world politics
5. Historical development of international organization during 19th and early 20th centuries
6. League of Nations
7. The second generation international organizations: The United Nations and its system - establishment, activities, problems
8. Global problems (like war and peace, development, human rights, environment) with reference to the role of the United Nations
9. Reform and restructuring of the United Nations including the Security Council
10. Economic and financial organizations - the IMF, the IBRD and the WTO
11. Regional organizations of Europe, Africa, Asia, Americas
12. India’s role in various international organizations
13. Globalization, global governance and international organizations

(D) Diplomacy and Disarmament (DAD)
1. Diplomacy: history, theory and practice
2. Diplomacy: bilateral, multilateral, regional and global
3. Economic and trade diplomacy
4. Negotiations: theory and practice
5. Climate change and environmental negotiations
6. Nuclear politics including arms control, non-proliferation and disarmament
7. Theories of deterrence
8. Chemical and biological weapons
9. War: concept, theory and evolution
10. Peace: concept and theory in mainstream and critical-theoretical perspectives
11. Revolution in military affairs
12. Conflict management and resolution
13. Security: concept, theory and evolution
14. National security
15. Terrorism including nuclear terrorism and counter-terrorism
16. Non-traditional security including human security
17. Environmental security
18. Technology and global politics
20. Critical Terrorism Studies
21. Critical Military Studies

(E) Research Methodology (Common)
1. Inductive and deductive reasoning
2. Preliminary ideas about philosophy of science including the contribution of Karl Popper
3. Positivism and post-positivism: basic ideas
4. Qualitative method: characteristics and application
5. Case study research: single case study and multiple case studies
6. Comparative study
7. Content analysis
8. Sources in research: primary and secondary
9. Archival research: major archives for international research in India
10. Quantitative method: characteristics and application
11. Statistics: descriptive and inferential statistics
12. Sampling: concept, logic and types
13. Correlation and causation
14. Measures of central tendency
15. Measures of variation or dispersion
16. Observation including participant and non-participant observation
17. Ethnography
<p>| Centre for Indo-Pacific Studies (CIPS) | Indo-Pacific Studies – IPSP (116) &amp; IPSH (841) | The Centre for Indo-Pacific Studies broadly covers the areas of Southeast Asia and Southwest Pacific. The entrance will be based on a syllabus covering the following areas: 1) Regional History of Southeast Asia and Southwest Pacific. 2) Government and Politics in the region. 3) Economic issues in the region. 4) Security issues in the region. 5) India’s relations with the region of Southeast Asia and Southwest Pacific. 6) Regionalism multilateralism and institutional mechanisms. |</p>
<table>
<thead>
<tr>
<th>Centre for African Studies (CAS)</th>
<th>African Studies – AFSP (118) &amp; AFSH (843)</th>
</tr>
</thead>
</table>

Geo-cultural Aspects:  
- Land, People, Ecology, Environment, Languages and Culture

Historical Aspects:  
- Ancient African Empires  
- Indigenous political systems  
- Atlantic slave trade-its impact and implications  
- Industrial Revolution and the elimination of slave trade

Colonialism in Africa:  
- European partition of Africa  
- Asian (Indian) migration into Africa  
- Patterns of Colonial rule in Africa  
- Legacy of Colonialism  
- Growth of nationalism and Liberation Movements in Africa

Political Aspects:  
- Political independence and Constitutional changes in Africa  
- Growth of political parties and party-systems  
- The role of military  
- Democratisation process in Africa  
- Rise and fall of Apartheid in South Africa  
- Concepts of Pan-Africanism and African socialism

Economic Aspects:  
- Nature of African Economy  
- Underdevelopment and Dependency patterns in Africa  
- Neo-colonial penetration and problems of economic independence  
- Development strategies in post-independence period  
- Structural adjustment programmes in Africa-an evaluation  
- Problem of poverty in Africa  
- Africa’s debt crisis  
- Globalisation and its impact of Africa  
- Regional economic cooperation and development (ECOWAS, SADC, COMESA, EAC and AEC)

Social Aspects:  
- Problems of nation-building in Africa  
- Role of education  
- State of Human Rights in Africa  
- Role of civil society and women  
- Problem of AIDS in Africa  
- Ethnic conflicts in Africa  
- Social change and structural transformation

Africa and the World:  
- Africa and the emerging International System  
- Africa and European dominance  
- Africa and the Cold War  
- Post-Cold War scenario in Africa
Africa and the New World Order
Africa and the United Nations
Inter-regional Cooperation
Role of the Organization of African Unity (OAU)
Africa and the Non-aligned Movement (NAM)
The Role and Relevance of the African Union (AU) 2001
India-Africa Relations

<table>
<thead>
<tr>
<th>Sl. No.</th>
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<th>Syllabus for Entrance Examination</th>
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<tbody>
<tr>
<td>19</td>
<td>Centre for West Asian Studies (CWAS)</td>
<td>West Asian Studies – WASP (119) &amp; WASH (844)</td>
<td>Syllabus for Entrance Examination covers research methodology and domain knowledge of West Asia and North Africa (WANA) region including its geographical area; Political and Social Systems; Military and Politics; Arab Nationalism, Turkish Nationalism; Zionism; Islamism &amp; Islamist Movement; Political Economy of GCC States, Rentier Economy, Inter and Intra-State Conflicts; Regional Conflicts; Intellectual Traditions in Arab World and Iran; Foreign Policy analysis of major regional powers of the area, notably Egypt, Turkey, Syria, Israel, Saudi Arabia and Iran will be covered. In addition, the syllabus will also focus on the role of global powers in the region along with India’s West Asia Policy, its interests and objectives.</td>
</tr>
<tr>
<td>20</td>
<td>Centre for Comparative Politics and Political Theory (CCPPT)</td>
<td>Comparative Politics and Political Theory – CPTP (120) &amp; CPTH (845)</td>
<td>Questions are set keeping in mind the MA syllabi of disciplines in the Social Sciences and Humanities from which candidates may apply to the Centre. Questions are broad enough for candidates to apply their knowledge of the discipline in which they have their MA degree. It is expected that candidates are widely read in their respective disciplines.</td>
</tr>
</tbody>
</table>

Ph.D.

<table>
<thead>
<tr>
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<th>Name of Centre</th>
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</table>
2) Energy Security and International Relations  
3) Political Economy of Energy Security  
4) Energy and Geopolitics  
5) India’s Energy Security: Policies and Politics  
6) Energy in Foreign policy  
7) Energy Security and Energy Governance  
8) Global energy trends and scenarios  
9) Debating Energy Security Transition: Role of Renewable Energy  
10) Energy Security and Global South  
11) Energy and Environment  
12) Energy Security and Cooperation: South Asia, Gulf, Central Asia and European Energy  
2. SCHOOL OF LANGUAGE, LITERATURE AND CULTURE STUDIES

The pattern of JNUEE 2020-21 will be based on Multiple Choice Questions (MCQs) through

Computer Based Test (CBT)

Part-time courses

CERTIFICATE OF PROFICIENCY

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<tbody>
<tr>
<td>1</td>
<td>Centre for Korean Studies (CKS)</td>
<td>COP-Mongolian – MONC (702)</td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>Centre for Chinese, South East Asian Studies (CCSEAS)</td>
<td>COP-Bhasha Indonesia – BHAC (703)</td>
<td>Entrance exam of COP in Bahasa Indonesia is conducted as a joint test with other part time programme; Urdu, Pashto, Mongolian and Hebrew. The eligibility is 10+2 or equivalent exam pass. The examination is conducted in English. The syllabus covers: 1. General Knowledge; 2. GK of the country of the languages; 3. Aptitude test and General English.</td>
</tr>
<tr>
<td>3</td>
<td>Centre for Indian Languages (CIL)</td>
<td>Urdu – URDC (704)</td>
<td></td>
</tr>
<tr>
<td>4</td>
<td>Centre for Persian and Central Asian Studies (CPCAS)</td>
<td>COP in Pashto – PUSC (701)</td>
<td></td>
</tr>
<tr>
<td>5</td>
<td>Centre for Arabic and African Studies (CAAS)</td>
<td>COP in Hebrew – HEBC (710)</td>
<td></td>
</tr>
</tbody>
</table>

ADVANCE DIPLOMA OF PROFICIENCY

<table>
<thead>
<tr>
<th>Sl. No.</th>
<th>Name of Centre</th>
<th>Sub. Code &amp; Sub. Code Number</th>
<th>Syllabus for Entrance Examination</th>
</tr>
</thead>
</table>
| 1      | Centre for Indian Languages (CIL)     | ADOP-Mass Media in Urdu – URDA (502) | By and large the syllabus will cover the topics related to the general awareness and basic knowledge of Mass Media which will be based on the following topics:  
   a. Types of Mass Media  
   b. Language of Mass Media  
   c. Social relevance of Mass Media  
   d. Journalism  
   e. Origin and development of Print Media  
   f. Origin and development of Electronic Media/Social Media  
   g. Major Mass Media Genres |
### B.A. (Hons.) 1st year

<table>
<thead>
<tr>
<th>Sl. No.</th>
<th>Name of Centre</th>
<th>Sub. Code &amp; Sub. Code Number</th>
<th>Syllabus for Entrance Examination</th>
</tr>
</thead>
</table>
| 1       | Centre for Persian and Central Asian Studies (CPCAS)     | Persian – PERU (401)         | 1. Translation based on the vocabulary of newspapers, journals and magazines.  
2. Essays, short stories, novels from the different authors  
3. (a) History of Persian Language with special reference to Avesta, Old Persian and Pahlavi scripts and Literature.  
(b) Literary History of Persian starting from Arab Invasions up to the end of Pahlavi period with special reference to Samanid, Ghaznavid, Saljuk, Mongol, Safavid, Qajar and Pahlavi periods.  
(c) A special study of Persian Literature produced in India.  
4. Geography and systems of Government in the Persian speaking world (i.e. Iran, Afghanistan, Tajikistan.)  
5. (a) A detailed account of new trends in Modern/Contemporary Persian Prose |
| 2       | Centre for Arabic and African Studies (CA&AS)            | Arabic – ARBU (402)          |                                                                                                                                                                                                                                                                                                |
| 3       | Centre for Pushto Studies (CPS)                         | Pushto – PUSU (410)          |                                                                                                                                                                                                                                                                                                |
| 4       | Centre for Japanese Studies (CJS)                        | Japanese – JAPU (403)        |                                                                                                                                                                                                                                                                                                |
| 5       | Centre for Korean Studies (CKS)                          | Korean – KORU (404)          |                                                                                                                                                                                                                                                                                                |
| 6       | Centre for Chinese, South East Asian Studies (CCSEAS)   | Chinese – CHNU (405)         |                                                                                                                                                                                                                                                                                                |
| 7       | Centre for French and Francophone Studies (CFFS)        | French – FRNU (406)          |                                                                                                                                                                                                                                                                                                |
| 8       | Centre for German Studies (CGS)                          | German – GERU (407)          |                                                                                                                                                                                                                                                                                                |
| 9       | Centre for Russian Studies (CRS)                         | Russian – RSNU (408)         |                                                                                                                                                                                                                                                                                                |
| 10      | Centre for Spanish, Portuguese, Italian and Latin American Studies (CSPILAS) | Spanish – SPNU (409)        |                                                                                                                                                                                                                                                                                                |

The entrance test for this programme is a common test for all languages. Questions pertaining to general knowledge, artificial language, language aptitude and general English would be covered in the syllabus. The test will be conducted in the English language as a Computer Based Test (CBT).

### Master of Arts

<table>
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<tr>
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<th>Name of Centre</th>
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</tr>
</thead>
</table>
| 1       | Centre for Persian and Central Asian Studies (CPCAS)     | Persian – PERM (203)         | 1. Translation based on the vocabulary of newspapers, journals and magazines.  
2. Essays, short stories, novels from the different authors  
3. (a) History of Persian Language with special reference to Avesta, Old Persian and Pahlavi scripts and Literature.  
(b) Literary History of Persian starting from Arab Invasions up to the end of Pahlavi period with special reference to Samanid, Ghaznavid, Saljuk, Mongol, Safavid, Qajar and Pahlavi periods.  
(c) A special study of Persian Literature produced in India.  
4. Geography and systems of Government in the Persian speaking world (i.e. Iran, Afghanistan, Tajikistan.)  
5. (a) A detailed account of new trends in Modern/Contemporary Persian Prose |

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and Poetry.
(b) Comparison between classical and Modern Persian Poetry.
(c) Selection of poems from Modern/Contemporary Persian Literature.
7. Indo-Persian Relations from the pre-historic days up to the Modern times with special reference to the following: (a) Historical, (b) Cultural, (c) Linguistics, (d) Literary, (e) Trade, scientific & technological relations with special reference to Modern times.

<table>
<thead>
<tr>
<th>Centre</th>
<th>Language</th>
<th>Syllabus</th>
</tr>
</thead>
<tbody>
<tr>
<td>2 Pashto - PUSM (236)</td>
<td>Pashto and objective type questions pertaining to Afghanistan &amp; Pashto speaking countries, Pashto Language and literature, Pashto history, culture and tradition, Pashto grammar, Translation, Pashto terminologies and general awareness on Indo- Afghan relations.</td>
<td></td>
</tr>
</tbody>
</table>
| 3 Centre for Arabic and African Studies (CA&AS)    | Arabic – ARBM (204) | 1. History of Arabic literature – pres-Islamic, Islamic, Umayyid, Abbasid and modern periods
2. Modern prose and poetry
3. Arabic studies in India
4. Criticism
5. Major Arab and Indian writers
6. Advanced Arabic grammar
7. Translation (Arabic-English-Arabic) |
| 4 Centre for Japanese Studies (CJS)                | Japanese – JAPM (205) | 1. General Awareness on topics such as Japan’s
- Geography
- History
- Society and Culture
- Famous Works of Literature
- Current affairs
(Course list for B.A. programme given below for reference)
http://www.jnu.ac.in/SLL/CJS/BACoursesJapanese.asp |
| 5 Centre for Korean Studies (CKS)                  | Korean – KORM (206) | The test is conducted in Korean and objective type questions pertaining to Korea, Korean language, basic Korean literature, Korean culture (both traditional and modern) are covered. Questions may also test their knowledge of basic Hanja (Chinese characters). The test is Computer Based in Korean. |
| 6 Centre for Chinese, South East Asian Studies (CCSEAS) | Chinese – CHNM (207) | The test will be conducted in Chinese. Questions on Chinese and Chinese literature, history, civilization and culture of China and Sinophone countries, linguistics and language, translation and didactics of teaching a foreign language are some of the areas covered in the syllabus. |
| 7 Centre for French and Francophone Studies (CFFS) | French and Francophone Studies – FRNM (208) | The test will be conducted in French. Questions on French & Francophone literature, history, civilization and culture of France and Francophone countries, linguistics and language, translation and didactics of teaching a foreign language are some of the areas covered in the syllabus. |
| 8 Centre for German Studies (CGS)                 | German Literature – GRLM (209) | 1. Common for both:
- German history from 1750 till 1914
- German history after 1945. (Two German states: Reunification)
- Basic Linguistics (Word Formation in German; Dependenzgrammatik; IC-analysis; speech act theory etc.)
2. For candidates opting for German literature:
- Trends in German Literature post 1945 till 2000
- History of German Literature from 1750 till 1900. Representative authors and texts - an overview of the different periods from the Enlightenment to Realism
- An overview of the main genres in German literature
- The ability to interpret given texts from these periods. |
| 9 German Translation – GRTM (230)                 |                   |                                                                         |
3. For candidates opting for German translation:

- Good knowledge of German and English

|   | Centre for Indian Languages (CIL) | Hindi – HNDM (210) | Syllabus covers the courses prescribed in B.A./B.A.(Hons.) in various Colleges/Universities all over the Country, comprising the following topics:
  - History of Hindi Literature.
  - Major Literary Genres, Works, Movements and trends.
  - Major Writers and Critics of Hindi Literature. |
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<tbody>
<tr>
<td>10</td>
<td>Centre for Russian Studies (CRS)</td>
<td>Russian – RSNM (212)</td>
<td>The Entrance Examination for this level is Computer Based Test (CBT) in Russian Language. The questions will be based on Advanced Russian Grammar, which may include cases, direct-indirect speech, aspects of verbs, use of verbs with and without prefixes, participles, gerund, active &amp; passive voice etc. It also includes translation from Russian into English and English into Russian and works of prominent authors of 19th &amp; 20th Century Russian Literature.</td>
</tr>
<tr>
<td>11</td>
<td>Centre for Spanish, Portuguese, Italian and Latin American Studies (CSPI&amp;LAS)</td>
<td>Spanish – SPNM (213)</td>
<td>The test will be conducted in Spanish. Questions on Spanish and Latin American literature, history, civilization, culture, linguistics and language, translation are some of the areas covered in the syllabus.</td>
</tr>
<tr>
<td>12</td>
<td>Centre for Linguistics (CL)</td>
<td>Linguistics – LINM (214)</td>
<td>In order to get admitted into the Centre for Linguistics to do an M. A., the students are tested for their aptitude for language, general awareness about language and its function, holistic and scientific approach towards the knowledge of language, analytical abilities, grammatical judgment tasks, linguistics data analysis. The examination will be computer based test and will be conducted in English.</td>
</tr>
<tr>
<td>13</td>
<td>Centre for English Studies (CES)</td>
<td>English – ENGM (215)</td>
<td>Candidates will be examined in Literature in English, Literature in India and Other Parts of the World, English in India, Literary and Cultural Theories, Non-Literary Artistic Forms, the Relationship between Literature, Culture and Society, and Practical Criticism of given literary pieces. The objective of the test is to select those who demonstrate not just in-depth knowledge of literature and culture, but literary sensibility and a capacity for original thinking.</td>
</tr>
<tr>
<td>Sl. No.</td>
<td>Name of Centre</td>
<td>Sub. Code &amp; Sub. Code Number</td>
<td>Syllabus for Entrance Examination</td>
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</tr>
<tr>
<td>1</td>
<td>Centre for Persian and Central Asian Studies (CPCAS)</td>
<td>Persian – PERP (121) &amp; PERH (848)</td>
<td><strong>1. Research Methodology</strong>&lt;br&gt;i) References&lt;br&gt;ii) Applied Mechanisms of Research&lt;br&gt;iii) Research Writings&lt;br&gt;iv) Use of Manuscripts, Archives and Texts in Research Works&lt;br&gt;<strong>2. Trends in Persian Literature: Prose and Poetry</strong>&lt;br&gt;This will cover major works of the contemporary authors/poets, their age and society in which they lived. The texts of literary works shall be studies from political, historical and sociological point of views to discern the currents and cross currents of society. The contributions of authors/poets to bring positive upheaval in society shall be the focal point of study.&lt;br&gt;<strong>3. History of Persian Literature</strong>&lt;br&gt;This will cover the history of Persian Literature in which the major works, their influences and movements caused by them in the Persian speaking world will be taken into account. The entire study shall be undertaken within the framework of socio-political history and the major events of the country having literary relevance will be properly emphasized.&lt;br&gt;<strong>4. Indo-Persian Cultural Interactions</strong>&lt;br&gt;This will briefly cover Indo-Persian Cultural interactions under the following broad topics:&lt;br&gt;i) Contacts between Indian &amp; Persian Courts and their impact on life and letters of the countries.&lt;br&gt;ii) Translation of Indian texts and traditions in Persian and vice versa.&lt;br&gt;iii) Literary interactions between India and the Persian World&lt;br&gt;iv) Cultural events of literary significance, etc.&lt;br&gt;v) Cultural Exchange Programme after 1947 and diplomatic contacts between India and the Persian world.&lt;br&gt;<strong>5. Literary Interactions</strong>&lt;br&gt;a) Persian literary translations in Indian languages and European language.&lt;br&gt;b) European works of universal significance in Persian Language.&lt;br&gt;c) Indian literature etc. in Persian language.&lt;br&gt;d) Contemporary themes and subjects in Persian literature vis a vis world literature.&lt;br&gt;<strong>6. Indo-Persian Literature:</strong>&lt;br&gt;Historiography, Mysticism, Indian Style of writing (Prose &amp; Poetry) etc.</td>
</tr>
<tr>
<td>3</td>
<td>Centre for Japanese Studies (CJS)</td>
<td>Japanese – JAPP (123) &amp; JAPH (850)</td>
<td>• Major literary works in Japanese literature&lt;br&gt;• In depth Knowledge to discuss about some literary works and authors such as Kawabata Yasunari, Akutagawa Ryunosuke, etc in Japanese&lt;br&gt;• Literary trends in Japan&lt;br&gt;• Current affairs in Japan&lt;br&gt;• Indo-Japanese relations in social, cultural, economic, political spheres&lt;br&gt;• Cultural, and social history of Japan, contemporary society in Japan.&lt;br&gt;• The research theme in which the candidate is interested, Details of the area in which the candidate would like to pursue research.</td>
</tr>
<tr>
<td>4</td>
<td>Centre for Korean Studies (CKS)</td>
<td>Korean – KORP (172) &amp; KORH (851)</td>
<td>The questions for the exam will cover research methodology, Korean language, linguistics, literature, culture, history, current affairs of Korea and translation studies. The examination will be in Korean language. The exam will be Computer Based Test (CBT) in Korean.</td>
</tr>
<tr>
<td>5</td>
<td>Centre for Chinese, South East Asian Studies (CCSEAS)</td>
<td>Chinese – CHNP (124) &amp; CHNH (852)</td>
<td>The questions for the exam will cover research methodology, Chinese and Chinese literature, history, civilization and culture, linguistics &amp; language, translation studies, didactics of teaching a foreign language, etc. the examination will be conducted in the Chinese language.</td>
</tr>
<tr>
<td>6</td>
<td>Centre for French and Francophone Studies (CFFS)</td>
<td>French – FRNP (125) &amp; FRNH (853)</td>
<td>The questions for the exam will cover research methodology, French &amp; Francophone literature, history, civilization and culture, linguistics &amp; language, translation studies, didactics of teaching a foreign language. The examination will be conducted in the French language.</td>
</tr>
</tbody>
</table>
| 7 | Center for German Studies (CGS) | German Literature – GERP (126) & GERH (854) | 1. Common for all streams  
- Research methodology  
- Research Interest  
- Research proposal  
2. Particular streams  
- German Literature  
- German Linguistics  
- Translation  
- German History  
- Didactics / German as Foreign Language |
| 8 | Centre for Indian Languages (CIL) | Hindi – HNDP (127) & HNDH (855) | Syllabus covers the courses prescribed in  
- M.A.(Hindi) in various Colleges/Universities all over the country  
in general comprising the following topics:  
- Origin and development of Hindi Language & Literature  
- Major literary works and Authors, Genres, Movements, trends of Hindi Literature  
- Basics of Research Methodology & Hindi Literary Traditions & Criticism. Sanskrit & Western poetics. |
| 9 | | Urdu – URDP (128) & URDH (856) | Syllabus will cover by and large the curriculums/ Syllabus as prescribed of M.A. (Urdu) level in various Universities all over the country, comprising the following topics:  
- Basics of Research Methodology  
- Basics of Textual Criticism  
- Origin and development of Urdu Language  
- History of Urdu Literature  
- Dakkani Urdu Literature  
- Classical Urdu Poetry and Prose  
- Major genres of Urdu Poetry and Prose  
- Major Literary movements and trends  
- Major Critical Theories, Ideas and Critics  
- Major works of research in Urdu and Researchers  
- Major literary schools (dabistan) of Urdu. |
| 10 | Tamil – TAMP (129) & TAMH (857) |  
- Basic Research Methodology.  
- History of Tamil Literature: Sangam period to Modern period.  
- History of Tamil Language: Sangam Period to Modern period and Calduvel concept.  
- History of Tamil Criticism: Commentators, Modern Criticism.  
- History of Tamil Folklore: Tales, Ballads, Proverbs.  
- History of Tamil Journals: Colonial Period, Post Colonial Period.  
- History of Tamil Drama and Film: Puranic/ Dravidian Movement / Social Oriented.  
- History of Comparative Literature: Reception and Influence Theory, Parallel Theory, Genres, Translations.  
- History of Tamil Nadu and Culture: Sangam Period to Post Colonial Period.  
- History of Fine Arts in Tamil Nadu: Painting, Music, Sculptures. |
<p>| 11 | Hindi Translation – HTLP (130) &amp; HTLH (858) | Candidates seeking admission in Hindi Translation are expected to have detailed knowledge of the tradition of translation in India, specially the tradition of translation in Hindi— |</p>
<table>
<thead>
<tr>
<th>Centre</th>
<th>Language &amp; Code</th>
<th>Details</th>
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</thead>
<tbody>
<tr>
<td>Centre for Russian Studies (CRS)</td>
<td>Russian – RSNP (181) &amp; RSNH (860)</td>
<td>The Entrance Examination for this level is Computer Based Test (CBT) in Russian Language. The questions will be based on Research Methodology, Linguistics, Stylistics, Theory of Translation, Theory of Literature, 19th &amp; 20th Century Russian Literature. Candidates who qualify the CBT will appear for a viva-voce, which will be conducted in Russian.</td>
</tr>
<tr>
<td>Centre for Spanish, Portuguese, Italian and Latin (CSPI&amp;LAS)</td>
<td>Spanish – SPNP (132) &amp; SPNH (861)</td>
<td>The questions for the exam will cover research methodology, Spanish &amp; Latin American literature, history, civilization and culture, linguistics &amp; language, translation studies, didactics of teaching a foreign language. The examination will be conducted in Spanish language.</td>
</tr>
<tr>
<td>Centre for Linguistics (CL)</td>
<td>Portuguese – PRTP (133)</td>
<td>The questions for the exam will cover research methodology, Portuguese and Brazilian literature, Socio political literary movements, history and culture, Discovery of America, Brazilian history culture and civilization, language and translation studies. The examination will be conducted in Portuguese language.</td>
</tr>
<tr>
<td>Centre for English Studies (CES)</td>
<td>English – ENGP (135) &amp; ENGH (864)</td>
<td>Candidates will be examined in Literature in English, Literature in India and Other Parts of the World, English in India, Literary and Cultural Theories, Non-Literary Artistic Forms, and the Relationship between Literature, Culture and Society. The objective of the test would be to specifically assess the research aptitude of the candidates, and their suitability for a rigorous research programme.</td>
</tr>
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</table>
## 3. SCHOOL OF LIFE SCIENCES

The pattern of JNUEE 2020-21 will be based on Multiple Choice Questions (MCQs) through Computer Based Test (CBT)

### M.Sc.

<table>
<thead>
<tr>
<th>Sl. No.</th>
<th>Name of Centre</th>
<th>Sub. Code &amp; Sub. Code Number</th>
<th>Syllabus for Entrance Examination</th>
</tr>
</thead>
</table>
| 1.      | School of Life Sciences (SLS) | Life Sciences – SLSM (225) | 1. Candidates will be tested in their basic knowledge in the core subjects of Life/ Biological Sciences.  
2. The test would contain subject-specific questions encompassing different branches of Life/Biological Sciences taught at the undergraduate level in various UGC affiliated colleges /institutions in the country.  
3. There is no specific syllabus designed for the test, but the candidates are advised to follow the UGC approved syllabus in their respective subjects for guidance. |

### Ph.D.

<table>
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<tr>
<th>Sl. No.</th>
<th>Name of Centre</th>
<th>Sub. Code &amp; Sub. Code Number</th>
<th>Syllabus for Entrance Examination</th>
</tr>
</thead>
</table>
| 1.      | School of Life Sciences (SLS) | Life Sciences – Group-I GONH (892)  
Life Sciences Group-II – GTWH (893)  
Life Sciences Group-III – GTRH (894)  
Life Sciences Group-IV – GFOH (895)  
Life Sciences Group-V – GFIH (896) | 1. Candidates will be tested in their basic knowledge on research methodology and core subjects of Life/Biological Sciences.  
2. The test will contain questions based on research methodology/experimental techniques related to Life/Biological Sciences research. The test would also contain subject-specific questions encompassing different branches of Life/Biological Sciences taught at the postgraduate level in various UGC affiliated universities/ institutions in the country.  
3. There is no specific syllabus designed for the test, but the candidates are advised to consult CSIR/UGC-NET JRF syllabus for guidance. |
## 4. SCHOOL OF SOCIAL SCIENCES

The pattern of JNU e-Prospectus 2020-21 will be based on Multiple Choice Questions (MCQs) through Computer Based Test (CBT)

Master of Arts

<table>
<thead>
<tr>
<th>Sl. No.</th>
<th>Name of Centre</th>
<th>Sub. Code &amp; Sub. Code Number</th>
<th>Syllabus for Entrance Examination</th>
</tr>
</thead>
</table>
| 1 | Centre for Economics studies and Planning (CESP) | Economics-ECOM (216) | Applicants will be tested for their analytical abilities and awareness of national and international economic issues of importance at present and in the recent past. Candidates are expected to be familiar with the content of a standard Economics course taught at the B.A. level. Especially for the benefit of applicants without an undergraduate degree in Economics, an enumeration of the areas to be covered is given below:  
(a) (i) Micro-economics (Demand Curves, Price and Income Elasticity of Demand, Cost Curves, Equilibrium of Firm under Perfect Competition and Monopoly) (ii) Macro-economics (National Income, Theories of Income Determination, Monetary Policy, Trade and Balance of Payments)  
(b) Descriptive Statistics (Mean, Median and Mode, Standard Deviation, Correlation Coefficient), Elementary Probability Theory, Mathematics for Economists (Elementary Algebra, Coordinate Geometry and Elementary Calculus)  
(c) Problems of Economic History, Underdevelopment and Growth: (i) India’s Economic Development prior to Independence: India’s Planning and Development experience since Independence; Basic indicators of Development. (ii) International Economics Issues of Contemporary Relevance. |
| 2 | Centre for Historical Studies (CHS) | Modern History-MODM (217) | The MA exam is structured to test the students on:  
A. General comprehension  
B. A broad understanding of the social sciences and  
C. Themes related to political, economic and social history and on aspects of religion and culture pertaining to Indian and World history for the ancient, medieval, modern and contemporary periods. |
| 3 | Medieval History – MEDM (218) |  |  |
| 4 | Ancient History – ANCM (219) |  |  |
| 5 | Centre for Political Studies (CPS) | Political Science – POLM (220) | The M.A. in Political Science continues to be distinctive in its commitment to teaching through lectures and tutorials in order to maintain high standards of excellence in the discipline. Candidates are expected to be familiar with the content of a standard B.A. course in Political Science. Applicants will be tested from areas given below:  
Unit I  
(a) Social and Political Thought of Modern India  
(b) Western Political Thought  
(c) Concepts and Approaches in Political Theory  
Unit II  
(d) Constitution and Political Institutions of India  
(e) State and Politics in India  
(f) Political Processes and Public Policies in India  
Unit III  
(g) Comparative Government and Politics  
(h) International Relations  
Applicants will be require to show familiarity with each Unit. |
<table>
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<tr>
<th>Centre for the Study of Regional Development (CSRD)</th>
<th>Geography-GEOM (221)</th>
<th>Unit I</th>
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<tbody>
<tr>
<td>3. Regional geography of India- physiographic divisions, patterns and levels of development of agriculture and industries, growth of population, urbanization, and socio-culture diversity.</td>
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</table>

**Unit II** - Questions on Physical, human regional geography and geography of India.

**Unit III** - Question on Cartography, scale and map projections, topographical maps of India, Methods of data representation

**Unit IV** - Question on Statistical Methods – frequency distribution, measures of central tendency and dispersion, Correlation.

<table>
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<tr>
<th>Centre for the Study of Social Systems (CSSS)</th>
<th>Sociology-SOCM (222)</th>
<th>Applicants are expected to have a fair understanding of Social Sciences and Indian Society and Culture</th>
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<tbody>
<tr>
<td>1. Thinkers</td>
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<tr>
<td>o Karl Marx, Emile Durkheim, Max Weber, Georg Simmel, C. Wright Mills, George Herbert Mead, Claude Levi-Strauss</td>
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<tr>
<td>o G.S. Ghurye, M. N. Srinivas, Iravati Karve, Yogendra Singh, Andre Beteille, T.K. Oommen</td>
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<tr>
<td>2. Basic Concepts and Social Institutions</td>
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<td>3. Tools and Techniques of Research Methodology</td>
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<td>4. Social Structure and Social Change</td>
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<td>5. Social Stratification</td>
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<td>o Gender, Caste, Class, Tribe, Disability</td>
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<td>6. Economy and Society</td>
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<td>7. State, Polity and Society</td>
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<td>8. Family, Marriage and Kinship</td>
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<td>9. Religion</td>
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<td>10. Environment and Society</td>
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<td>11. Social Movements</td>
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<td>12. Social Issues</td>
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<td>13. Understanding Indian society</td>
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<td>14. Modernization, Globalization and Development</td>
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</tbody>
</table>

| Centre for Philosophy (CP) | Philosophy-SPHM (229) | The entrance test will be based in a standard BA (major) Philosophy course taught in UGC accredited Indian universities. Students are expected to be familiar with the following problems, themes, and issues. There are five Sections in the syllabus. |

**Section: I**

**Metaphysics**

Questions will be from both Indian and Western philosophical perspective.

1. Proofs for Existence of God
2. Free Will and Determinism
3. Self and No-self
4. Consciousness
5. Personal Identity
6. Substance and Qualities
7. Being and Becoming
8. Actuality and Potentiality
9. Appearance and Reality
10. Mind and Body Problem
11. Universals
12. Realism and Idealism
13. Essence and existence
Section: II
Epistemology
Questions will be from both Indian and western philosophical perspective.

1. Theories of Truth
2. Theories of Error
3. Gettier Problem
4. Definitions of Knowledge
5. Knowledge by acquaintance and Knowledge by Description
6. Sources of Knowledge
7. Skepticism
8. Justification of Knowledge: Foundationalism, Anti-foundationalism, and Coherentism
9. Knowledge that and knowledge How
10. Apriori Knowledge

Section: III
Ethics
Questions will be from both Indian and Western philosophical perspective.

1. Theories of Normative Ethics: Utilitarianism, Kantian Deontology, Virtue ethics, Social contract theory, care ethics
2. Theories of Metaethics: Relativism, Non-naturalism, Emotivism, Universal Prescriptivism,
4. Thoughts of Indian ethical tradition: Nature of Dharma, Morksa, Purusharthas, Rta, Rina, and themes from Buddhist and Jaina ethics

Section: IV
Symbolic Logic
Questions will be from both Indian and western philosophical perspective.

1. Inductive Logic
   a. Analogical Reasoning
   b. Causal Reasoning
   c. Probability
2. Deductive Logic
   a. Categorical proposition
   b. Categorical syllogisms
   c. Symbolic Logic
   d. Methods of Deduction
   e. Quantification Logic
3. Informal Fallacies: Indian and Western
4. Types of Arguments

Section: V
Social and Political Philosophy
Questions will be from both Indian and Western philosophical perspective.

1. Theories of Justice
2. Liberty and Equality
3. Democracy
4. Feminism
5. Global justice
6. Marginalization and Discrimination
7. Gandhi: Non-violence, Satyagraha, Swaraj, Nationalism, State
8. Ambedkar: Genesis of Caste and Annihilation of Castes
9. Tagore: Nationalism, Education and Religion of Man
10. Amartya Sen: Justice (Niti and Nyaya)

The applicants for the M.A. programme will be examined in the light of their knowledge on themes and issues studied in a standard social science bachelor programme. The purpose of entrance exam is to test the candidates’ general awareness on issues related to development and labour studies, their capacity to comprehend and reflect on academic articles, and their ability in analytical reasoning on the contemporary issues of informal sector. Students will be tested in the broad thematic areas of major social science disciplines: Political Economy, Theories and Contemporary History of Development, Development Economics, Indian Economy, Society and Politics in India, Sociological and Political Theories. The purpose of the test is to select candidates who demonstrate aptitude for analytical skills and ability for original thinking.

<table>
<thead>
<tr>
<th>Sl. No.</th>
<th>Name of Centre</th>
<th>Sub. Code &amp; Sub. Code Number</th>
<th>Syllabus for Entrance Examination</th>
</tr>
</thead>
</table>
13. Awareness of programmes for control of non-communicable diseases.
   (a) Planning and investigation of an epidemic of communicable diseases in a community setting.
   (b) Institution of control measures and evaluation of the effectiveness of these measures.

14. Various types of epidemiological study designs.

15. The derivation of normal values and the criteria for intervention in case of abnormal values.

16. Planning an intervention programme with community participation based on the community diagnosis.

17. Applications of computers in epidemiology.

18. Critical evaluation of published research.

D. Epidemiology of Specific Diseases
1. Extent of the problem, epidemiology and natural history of the disease.
2. Relative public health importance of a particular disease in a given area.
3. Influence of social, cultural and ecological factors on the epidemiology of the disease.
4. Control of communicable and non-communicable disease by:
   a. Diagnosing and treating a case and in doing so demonstrate skills in:
      (i) Clinical methods
      (ii) Use of essential laboratory techniques
      (iii) Selection of appropriate treatment regimes.
      (iv) Follow-up of cases.
   b. Principles of planning, implementing and evaluating control measures for the diseases at the community level bearing in mind the relative importance of the disease.
5. Institution of programmes for the education of individuals and communities.
7. National Health Programmes.

E. Biostatistics
a. Collection, classification and presentation of statistical data.
b. Analysis and interpretation of data.
c. Obtaining information, computing indices (rates and ratio) and making comparisons.
d. Apply statistical methods in designing of studies.
e. Choosing of appropriate sampling methods and sample size.
f. Applying suitable test of significance
   g. Use of statistical tables.

F. Entomology
1. Role of vectors in the causation of diseases.
2. Mode of transmission of vector borne diseases.
3. Methods of vector control with advantages and limitations of each.

G. Health planning and Public Health Administration

H. Health Management

I. Health economics

J. Nutrition
1. Role of nutrition in Health and Disease.
2. Nutritional problems of the country
3. Common sources of various nutrients and special nutritional requirement according to age, sex, activity, physiological conditions.
4. Nutritional assessment of individual, families and the community by selecting and using appropriate methods such as: anthropometry, clinical, dietary, laboratory techniques.
5. Compare recommended allowances of individual and families with actual intake.
6. Common nutritional disorders: protein energy malnutrition, Vitamin A
deficiency, anemia, iodine deficiency disorders, fluorosis, food toxin
diseases and their control and management.
8. National programmes in nutrition and their evaluation.

K. Environmental Sanitation
2. Awareness of the concept of safe and wholesome water.
3. Awareness of the requirements of sanitary sources of water.
4. Understanding the methods of purification of
5. Various biological standards.
7. Physical, chemical standards; tests for assessing quality of water.
8. Disposal of solid waste, liquid wastes both in the context of urban and rural conditions in the community.
10. Sources, health hazards and control of environmental pollution.
11. Influence of physical factors – like heat, humidity, cold, radiation and noise – on the health of the individual and community.
12. Standards of housing and the effect of poor housing on health.

L. Demography and Family Planning
1. Definition of demography and its relation to Community Health.
2. Stages of the demographic cycle and their impact on population.
4. Reasons for rapid population growth in the world, especially in India.
5. Need for population control measures and the National Population Policy.
6. Identify and describe the different family planning methods and their advantages and shortcomings.
7. Principles of Counselling; Client satisfaction.
9. Organisational, technical and operational aspects of the National Family Welfare Programme and participation in the implementation of the Programme. Target Free Approach.
10. MTP and infertility services.

M. Mental Health
1. Public health importance of mental health
2. Public health approach to mental health problems: types, diagnosis and management of mental health problems in the community.

N. Application of Social Sciences in Health

O. Impact of urbanisation on health and disease.

P. School Health

Q. Urban health
<table>
<thead>
<tr>
<th>Sl. No.</th>
<th>Name of Centre</th>
<th>Sub. Code &amp; Sub. Code Number</th>
<th>Syllabus for Entrance Examination</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Centre for Economics studies and Planning (CESP)</td>
<td>Economics-ECOP (136) &amp; ECOH (865)</td>
<td>In the examination, the applicants will be examined in the topics covered by a standard M.A Economics programme. These would broadly include Micro-economics, Macroeconomics, Economic Development, Indian Economy and Statistical and: Mathematical Methods in Economics. The distribution of questions in the examination would be in conformity with UGC Regulations, 2016.</td>
</tr>
<tr>
<td>2</td>
<td>Centre for Historical Studies (CHS)</td>
<td>Modern History-MODP (137) &amp; MODH (866)</td>
<td>The exam is structured to test the students on:</td>
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<td>A. Historical methods</td>
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<td>B. Historiographical debates and discussions</td>
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<td>C. Themes related to political, economic and social history and on aspects of religion and culture pertaining to Indian history for the ancient, medieval, modern and contemporary periods (including World history).</td>
</tr>
<tr>
<td>3</td>
<td>Medieval History – MEDP (138) &amp; MEDH (867)</td>
<td></td>
<td>Applicants for the programme will be examined for their analytical ability in topics covered by an M.A. programme in Political Science. These would broadly include Philosophy and Methods of the Social Sciences, Traditions of Political Inquiry, Key Concepts in Political Science, Contemporary Debates in Political Philosophy, Indian Politics (Institutions, Processes and Policies) Key Debates in Indian Politics, Issues in Comparative Politics, and International Relations. Questions in the entrance test will include recent political debates. In addition questions based on the various Masters level courses will also be asked. Questions on the various quantitative and qualitative research methods commonly used in social science research will also feature in the entrance test. For more details about our programme and courses, please visit the website.</td>
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<td>4</td>
<td>Ancient History – ANCP (139) &amp; ANCH (868)</td>
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<td>5</td>
<td>Centre for Political Studies (CPS)</td>
<td>Political Science-POLP (140) &amp; POLH (869)</td>
<td>Students will be tested on research methodology and the relevant areas pertaining to the streams they apply for. The syllabus for the JNU EE has been framed keeping in mind the post graduate programs taught in most Indian universities.</td>
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<td>(i) Regional Development: Geography (code: GEO) Syllabus:</td>
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<td>(A) Research Methodology: Recent trends in geographical thought and research concerns in the field: Cartographic methods; descriptive statistics; sampling techniques; correlation and regression analysis, geographical information system, Remote sensing, and GPS; Morphometric techniques in areal and liner analysis, hydrograph and runoff estimation, evapotranspiration, methods of soil analysis, ground water mapping and estimation, RS in LU-LC and biodiversity mapping, magnitude-frequency classification of natural disasters, methods of graphical representation of economic loss of disasters, age estimation of landforms. Methods of landscape surveying and mapping; socio-economic field survey methods.</td>
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<td>(B) i. Physical Geography : Geomorphology, Oceanography, climatology, climate change, Hydrology, Biogeography, Ecosystems, Natural Resources and Natural Disasters (with special reference to India)</td>
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<td>ii. Human Geography: Population distributed and growth: human settlements, urbanization, migration rural and agricultural geography: Spatial structure and temporal trends of economic activity; Social groups and communities, tourism; (with special reference to India)</td>
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<td>iii. Regional Development: Concepts, strategies of regional development regional imbalances and levels of development in India; inclusive exclusions and exclusive inclusions, Globalization, natural resources and changing spatial division of labour.</td>
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<td>(ii) Regional Development: Population Studies (Code: POP)</td>
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<td>(A) Research Methodology: Basic and advanced statistics, Quantitative methods in population analysis, basic demographic data in India, methods of demographic data analysis, population survey (primary and secondary)</td>
</tr>
</tbody>
</table>
| 9 | Centre of Social Medicine and Community Health (CSMCH) | Social Sciences in Health - CSMP (144) & CSMH (873) | **Basic concepts in Social Sciences and its relevance to public Health**
1. Social Stratification - Caste, Class, Gender, Religion, Ethnicity Exclusion, discrimination, marginalization, humiliation and stigma, Diversity, Social cohesion—comparison with other societies
3. Culture - Norms, values, role and status, culture shock, taboos, ethnocentrism, cultural relativism.
4. Characteristics of Rural and Urban Society - rural society; agrarian class structure, urban, urbanism and urbanization
5. Sanskritisation
6. Social Capital and Cultural Capital
7. Poverty
8. Inequality
9. Globalization, liberalization, privatization
10. Motivation
11. Attitude, Perception and Behavior
12. Socialisation
13. Power
14. Conflict
15. Civil Rights, Democratic Rights and Human Rights
16. Social change
17. Social movements and civil society
18. Understanding Interconnections Between Economy, Polity And Society - Nature of State in India, Welfare state and public health, State and public policy
19. Current Debates in Health

**2. Application of Social Sciences to Health**
1. Social Determinants of Health
2. Development and Health - Primary Health Care Approach & Selective Health Care Approach
3. Social inequalities and marginalisation in health
4. Climate change and its impact on health
5. Population and development.
6. Social exclusion, discrimination and health
7. Importance of large data sets for public health
8. Health promotion and Illness prevention
9. Mental Health and Disability
10. Medical pluralism
11. Accessibility, Availability and Affordability of Health Care
12. Universal Health Care
13. Recent social issues and their implications for health

**3. Research Methodology**
1. Qualitative methods in Social Sciences - observation, life history, case
study, narratives, ethnography
2. Quantitative methods in Social Sciences – survey methods, research instruments
3. Importance of Qualitative and quantitative research methods used in public health
4. Mixed methods
5. Ethics in Research
6. Statistical Methods
   • Mean, Median, Mode and standard deviation
   • Sampling methods
   • Measures of social disparities and spatial variation
   • Basic statistics for public health- birth rate; crude death rate; Infant mortality; child mortality; life expectancy at birth; sex ratio; dependency ratio; morbidity rate; population growth rate; standardisation

| 10 | Centre for the Study of Social Systems (CSSS) | Social Systems - SOCP (146) & SOCH (875) | Candidates are expected to display a good research aptitude, analytical skills and usage of social science perspectives in answering questions from the following list of themes.
1. Thinkers
   0 Classical Thinkers: Karl Marx, Emile Durkheim, Max Weber
   0 Advanced Social Theories : Postmodernism, Postcolonialism and Poststructuralism
   0 Study of Monographs: Evans-Pritchard, Bronislaw Malinowski, Edmund Leach, Margaret Mead, Clifford Geertz
2. Philosophical Foundation of Theories and Methodology
3. Social Research/Research Methodology: Quantitative and Qualitative, Positivism, Interpretivism
4. Social Structure, Continuity and Change
5. Theories of Culture
6. Social Stratification: Gender, Caste, Class, Tribe, Ethnicity, Disability
7. Kinship, Family and Marriage
8. Social Inequalities and Movements
9. Education and Society
10. Religion and Society
11. State, Polity and Society
12. Economy and Society
13. Social Issues
14. Agrarian and Urban Sociology
15. Indian Sociology
16. Industrial/Corporate Sociology
17. Modernization, Globalization and Development
18. Media Studies |

| 11 | Zakir Husain Centre for Educational Studies (ZHCES) | Educational Studies-EDUP (147) & EDUH (876) | Zakir Husain Centre for Educational Studies is a multi-disciplinary centre which approaches the field of education from four social science disciplines such as Economics, Sociology, History and Psychology. The students are expected to fit into any one of these disciplinary areas to carry out their research studies. The syllabus for the entrance examination under each of these areas of specialisation is as follows (the list is only indicative, not exhaustive):

A. History of Education
Historical method and historiography; Modern Indian history; The educational debates; Woods Despatch; The revolt of 1857; Establishment of modern universities; The Hunter Commission; India's freedom movement; Imperialism and nationalism. European History; Enlightenment; Reformation; Revolutions; Global History of modernisation; introduction of modern sciences and science education. Education and knowledge-systems in pre-colonial India.

B. Sociology of Education
Classical and contemporary sociological theory and thinkers; Themes and issues in the Indian society; Rural and urban Sociology; Sociology of backward classes and marginalised; Sociology of education; Sociology of development; Methodology and methods in Sociological research.

C. Psychology of Education
1. Fundamental Psychological Processes: Attention, Perception, Learning, Perception, Memory, Thinking and Problem Solving, Emotion and motivation; Intelligence: Theories and Measurement; Personality Theories; Theories of Human

D. Economics of Education

1. Microeconomics: Theory of Consumer Behaviour- price effect and substitution effects; theory of revealed preference, elasticity of demand; Theory of Production-function, short run and long run, isoquants, cost functions. Theory of the Market Structure: various forms of market and price-output decisions (perfect competition, monopoly, monopsonistic competition, oligopoly); Neo-classical theory of distribution, Welfare Economics and General Equilibrium 2. Macroeconomics: National Income Accounting- national income as a measure of welfare and economic progress; Theories of consumption and investment- Models of income determination; Simple Keynesian model, IS-LM model; Theories of supply and demand for money; Phillips curve and theories inflation; Open economy macroeconomics and Balance of Payments; Theories of growth and international trade. 3. Theories of Development and the Indian Economy: Employment and labour; Income Inequality; Globalisation and Internationalisation; New Economic Policy and its impact on social sector and physical infrastructure in the context of India.

12 Centre for Studies in Science Policy (CSSP)  
Studies in Science Policy-SSPP (148) & SSPH (877)

Questions in the entrance test will be based on the current affairs on science, technology, innovations and related policy debates. To test the domain knowledge of students, questions based on the various Masters level courses will also be asked. Questions on the various quantitative and qualitative research methods commonly used in social science research will also feature in the entrance test. For more details about our programme and courses, Please visit: [http://www.jnu.ac.in/sss/cssp-programme_of_study](http://www.jnu.ac.in/sss/cssp-programme_of_study)

The Centre is pursuing research in areas/fields such as:

a) Science and technology policies including various sectors of economy, S&T in government and S&T policies and development issues in India and other countries;
b) Sociological and Historical Studies on S&T; Social shaping of technology; Scientists in laboratories and organizations; Scientific communities and professionalization of science;
c) Frugal and Grassroots Innovations;
d) Responsible Research and Innovation (RRI);
e) Waste Management;
f) Law, Science and Technology; Cyber & Information Technology Law; Intellectual Property Rights; International S&T Treaties;
g) Economics of technological change and innovation studies; national, sectoral and regional innovation systems; clusters and technological change;
h) Technology Foresight and Assessment; Risk R&D and technology; Technology and hazards including disaster management related to technical change, innovation, methodologies, etc.;
i) Gender issues in S&T;
j) Globalisation and Emerging Technology; TNCs, FDI and impact on R&D; International affairs and relations in S&T for development; Area studies in science and technology policies and development covering developing and developed countries.

13 Centre for Philosophy (CP)  
Philosophy-SPHP (149) & SPHH (878)

Questions would be based on the M.A syllabus taught at the Centre for Philosophy. Please visit [http://www.jnu.ac.in/sss/cop-mphil](http://www.jnu.ac.in/sss/cop-mphil)

Apart from the above the candidate is expected to have sufficient knowledge of the following:

UNIT –I

Research Methodology:

1. Inductive, Deductive and probabilistic reasoning
2. Fallacies formal and informal
3. Logical positivism
4. Dialectics  
5. Positivism  
6. Hermeneutics  
7. Deconstruction  
8. Pragmatism  
9. Sceptical method  
10. Linguistic analysis  
11. Phenomenology and existentialism  
12. Thought experiments  
13. Principles of Verifiability and Falsifiability  
14. Holism and methodological individualism  
15. Types of arguments in Indian philosophy  
16. Nature of inference (Anumāna) in Indian philosophy  
17. Types of inferences  
18. Nature of concomitance (vyāpti) according to different schools of Indian philosophy  
19. Hypothetical reasoning (arthāpatti)

**UNIT – II**

**Philosophical Theories and Concepts**

**1. Metaphysics**

i. Theories of mind and consciousness  
ii. Theories of meaning and truth  
iii. Realism and anti-realism  
iv. Freewill: Determinism, Indeterminism and Compatibalism  
v. Form and matter  
vi. Theories of Self  
vii. Theories of Causation  
viii. Problem of personal identity  
ix. Problem of other minds  
x. Problem of matter  
xi. Essentialism  
xii. Atomism  
xiii. Dualism  
xiv. Epiphenomenalism  
xv. Anomalous Monism  
xvi. Eliminative Materialism  
xvii. Behaviourism  
xviii. Substance Dualism  
xix. Nature of Relations  
xx. Critique of metaphysics

**2. Epistemology**

i. Theories of perception  
ii. Theories of knowing  
iii. Theories of Justification: Internalism and Externalism  
iv. Gettier Problem  
v. Definition of knowledge (Pramā) in Classical Indian philosophy  
vi. Theories of Error in Classical Indian philosophy  
vii. Sources of knowledge Classical Indian philosophy  
viii. Theories of Justification in Classical Indian philosophy (pramāṇyavāda)
UNIT –III

Ethics

a. Normative Ethics
   i. Consequentialism
   ii. Kantian Deontology
   iii. Virtue Theoretical Ethics
   iv. Contractarianism and Contractualism
   v. Natural Rights Theory
   vi. Feminist Ethics

b. Theories of Metaethics
   i. Cognitivism and Non-cognitivism
   ii. Moore’s Non-naturalism
   iii. Error Theory
   iv. Prescriptivism
   v. Relativism
   vi. Moral Realism and anti-realism

c. Applied Ethics
   i. Bio-medical Ethics
   ii. Animal Ethics
   iii. Theories of Punishment
   iv. Environmental Ethics
   v. Business Ethics

d. Indian Ethical Tradition
   i. Mīmāmsā Theory of Dharma, itikartavyatābodha, artha and bhāvnā,
   ii. Buddhist Ethics
   iii. Jaina Ethics
   iv. Theory of Obligation in Bhagvad Gītā

UNIT- IV

Social and Political Philosophy

b. Individual and State
c. Democracy
d. Socialism
e. Marxism
f. Secularism
g. Sarvodaya
h. Gender equality
   i. Contemporary theories and debates: Utilitarianism, Rawls’s Justice as Fairness,
   j. Libertarianism, Communitarianism, Political liberalism, Multiculturalism, Feminism

UNIT - V

Contemporary Indian Philosophy:
   i. Gandhi, Ambedkar, Tagore, Aurobindo, Vivekananda
   ii. Gandhi Tagore Debate
   iii. Gandhi Ambedkar Debate
   iv. Radhakrishnan
   v. K. C. Bhattacharyya
   vi. Jyotiba Phule
   vii. Mohammad Iqbal
   viii. Amartya Sen
| Centre for Women Studies (CWS) | Women Studies – WSPP (176) & WSPH (879) | Since Women’s Studies is interdisciplinary in nature, the entrance exam will expect candidates to bring their disciplinary and interdisciplinary training in historical, political, economic, sociological, cultural, literary and representational perspectives in the way women, gender, and sexuality have been constituted as objects of study. Students are expected to have a thorough understanding of the relationship between gender and other analytical categories like class, race, ethnicity, sexuality, community and nationality not only in a national, but also a cross cultural and transnational context. The candidates are expected to be broadly aware of different dimensions of women, gender and sexuality studies in Feminist Theory; Women's Movements; Gender, Labour and Political Economy; Sexuality Studies; Law; Politics; Development; Globalization and its implications; Religion and Faith Practices; Caste, Ethnicity and Race; Gender and Space; Culture and Modernity; Literature, Art and Performance, and Visuality Studies. Candidates are expected to have knowledge of feminist methodology, especially qualitative research methods such as ethnography, discourse analysis, oral history, archival research, and literary methods, but not just limited to these. |
| Centre for the Study of Social Exclusion and Inclusive Policy | Social Exclusion and Inclusive Policy - SEIP (152) & SEIH (880) | The examination will deal with topics which are covered in any standard Masters level course pertaining to History, Anthropology, Economics, Political Science and Sociology. In addition, the candidates are expected to have comprehensive understanding on the various dimensions of discrimination and exclusion faced by Scheduled Castes (SC), Scheduled Tribes (ST) and various Minority groups in India. The interpretation of these societal dimensions can only be understood through a proper knowledge of research methodology. The definition of research methodology in itself is a difficult task, divided in terms of approaches ranging from the qualitative to quantitative. In addition to research methods the candidate acquainted in their respective subject at the Master level, is also expected to be familiar with the methods and measurement of Discrimination and exclusion. The candidates are expected to be aware of analysis based on large datasets published periodically by the Government and non-governmental agencies. These would include, but not limited to, Decennial Census reports, National Sample Survey Organisation reports (NSSO), National Family and Health Surveys (NFHS), National Crime Records Bureau reports (NCRB) and other alternative reports covering issues of discrimination and exclusion like Sachar Committee Report, Indian Exclusion reports, International Organisational reports like UN, ILO etc. Further the candidates should be aware of reports published by National Commission for Scheduled Castes (NCSC), National Commission for Scheduled Tribes (NCST), National Commission for Backward Classes (NCBC), National Human Rights Commission (NHRC). The candidates should have an in-depth understanding of various facets of the Indian Constitution, Governmental policies for inclusion and developmental schemes addressing the issues of inter-sectionalities of Gender, SCs, STs, disabled and Minority groups. |
| Centre for Media Studies (CMS) | Media Studies- CMSP (173) & CMSH (881) | Envisaged primarily as a centre for research and academic study, the syllabus for the Entrance Examination will cover broader fields of media studies, which include: Histories of media, Political economy of Media, Media and issues of language, Media, democracy, and dimensions of rights and justice, Violence and media, Media, technologies and cultural industries, Media and the nature of connectivities, Visual culture, Theories and methods in media studies. |
### Ph.D.

<table>
<thead>
<tr>
<th>Sl. No.</th>
<th>Name of Centre</th>
<th>Sub. Code &amp; Sub. Code Number</th>
<th>Syllabus for Entrance Examination</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Group of Adult Education (GAE)</td>
<td>Adult Education- GAEH (883)</td>
<td>We insist that the student/candidates should have exposure, understanding and knowledge in wide ranging issues related to adult, continuing education and extension. The main thrust areas include ‘Literacy studies’ (e.g., basic literacy, adult literacy, digital literacy, financial literacy, consumer literacy, legal literacy, health family, media, citizenship literacy etc.), adult, lifelong education, vocational/skill education, sustainable livelihood education, entrepreneurship education and other related continuing education in India and abroad. Moreover, GAE focuses on problems of contemporary youth &amp; their lifestyles; the impact of globalization and market practices on the local communities and society with special emphasis on consumer rights, movements and awareness. We try to enrol students who have interest do research in areas of formal/non-formal education, policy studies and practice in all these areas. GAE makes special efforts in enhancing learning, and improving professionalism among the students in social and education sectors to play constructive roles in nation-building.</td>
</tr>
<tr>
<td>2</td>
<td>Centre for Informal Sector &amp; Labour Studies (CISL)</td>
<td>Informal Sector &amp; Labour Studies- ISLH (884)</td>
<td>The test is intended to evaluate the candidate’s general awareness in the following areas. The Ph.D programme focuses on interdisciplinary research on Indian informal sector and labour scenario. The programme encourages to work on themes such as–Political Economy of State, Development and Underdevelopment in the contemporary world, Labour History, Globalization and the changing forms of Labour, Global Production Systems, Informalisation in various sectors, Labour Market, Forms of Employment, Poverty, Migration, Urbanisation, Labour Rights and Regulation, Workers’ Organizations and Politics, Trade Unions, Resistance, Peasant Production, Non-farm Economy, Agrarian Change and Rural Development, Political Economy of Care, Discrimination on the basis of Caste, Gender and Community, Common Property Resources, Public Policies in the Unorganised Sector, and Sustainable Development. The objective of the programme is to enable students to understand the linkages between the formal and the informal sectors and between theory and empirical investigations in research work.</td>
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</tbody>
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### 5. SCHOOL OF ENVIRONMENTAL SCIENCES

The pattern of JNUEE 2020-21 will be based on Multiple Choice Questions (MCQs) through Computer Based Test (CBT)

**Master of Science**

<table>
<thead>
<tr>
<th>Sl. No.</th>
<th>Name of Centre</th>
<th>Sub. Code &amp; Sub. Code Number</th>
<th>Syllabus for Entrance Examination</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>School of Environmental Sciences (SES)</td>
<td>Environmental Sciences – SESM (223)</td>
<td>The questions will be of multiple choice type. The questions will be in two parts.  <strong>Part I:</strong> This will have questions from the different areas of Science and Mathematics at the 10+2 level.  <strong>Part II:</strong> This will have questions, in the areas of Physics, Chemistry, Mathematics, Geology, Botany and Zoology at the B.Sc. level.</td>
</tr>
</tbody>
</table>
6. SCHOOL OF COMPUTER & SYSTEMS SCIENCES

The pattern of JNU e-Prospectus 2020-21 will be based on Multiple Choice Questions (MCQs) through Computer Based Test (CBT)

MCA

<table>
<thead>
<tr>
<th>Sl. No.</th>
<th>Name of Centre</th>
<th>Sub. Code &amp; Sub. Code (Number)</th>
<th>Syllabus for Entrance Examination</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>School of Computer &amp; Systems Sciences (SC&amp;SS)</td>
<td>Master of Computer Applications-MCAM (224)</td>
<td><strong>Syllabus:</strong> General aptitude, reasoning and 10+2 and Bachelor’s level mathematics and Computer Science as per the topics specified as under: <strong>Maths:</strong> Differential and Integral Calculus, Vector Algebra, Trigonometry, 2D-3D Geometry, Modern Algebra, Numerical Analysis, Probability &amp; Statistics, Real Analysis, Theory of Real Function, Matrices and Determinants. <strong>Computer Science:</strong> Digital Systems Design &amp; Architecture, Programming Languages (C), Data structures, Discrete mathematics.</td>
</tr>
</tbody>
</table>
### M.Phil. & Ph.D.

<table>
<thead>
<tr>
<th>Sl. No.</th>
<th>Name of Centre</th>
<th>Sub. Code &amp; Sub. Code (Number)</th>
<th>Syllabus for Entrance Examination</th>
</tr>
</thead>
</table>
| 1       | School of Computer & Systems Sciences (SC&SS) | M.Phil - SCSP (158) & Ph.D. - SCSH (890) | **Syllabus:** 50% of the questions will be from Research Methodology and remaining 50% from Bachelor's/Master's level Mathematics and Computer Science. The topics for both are specified as under:  
**Research Methodology:** Experimental Design; Fundamentals of Sampling; Data: types, quality measurement; Processing and Analysis of data; Hypothesis Testing (parametric, nonparametric), Theory of Probability.  
**Maths:** Integral and Differential Calculus, Linear Algebra, Numerical Analysis, Modern Algebra.  
**Computer Science:** Data Structures and Algorithms, Programming Languages (C, C++), Operating Systems, Discrete Mathematics, Automata Theory, Computer Architecture, Computer Networks, Database Management System. |

### M.Tech. (Computer Science and Technology)

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<thead>
<tr>
<th>Sl. No.</th>
<th>Name of Centre</th>
<th>Sub. Code &amp; Sub. Code (Number)</th>
<th>Syllabus for Entrance Examination</th>
</tr>
</thead>
</table>
| 1       | School of Computer & Systems Sciences (SC&SS) | M.Tech – MTCT (157) | **Syllabus:** General aptitude, reasoning and Bachelor’s/Master’s level Mathematics and Computer Science as per the topics as under:  
**Maths:** Differential and Integral Calculus, Linear Algebra, Numerical Analysis, Modern Algebra, Probability and Statistics.  
**Computer Science:** Data structures, Programming Languages (C, C++), algorithms, Operating Systems, Database Management System, Computer Architecture, Computer Network, Discrete Mathematics, Automata Theory. |

### M.Tech. (Statistical Computing)

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<tr>
<th>Sl. No.</th>
<th>Name of Centre</th>
<th>Sub. Code &amp; Sub. Code (Number)</th>
<th>Syllabus for Entrance Examination</th>
</tr>
</thead>
</table>
| 1       | School of Computer & Systems Sciences (SC&SS) | Statistical Computing (Data Science) - MTST (183) | **Syllabus:** General aptitude, reasoning and Bachelor’s/Master’s level mathematics, Statistics and Computer Science as per the topics specified below:  
**PART A**  
**Maths and Stats:** Probability, Statistics, Operations Research, Real Analysis, Linear Algebra, Modern Algebra.  
**Computer Science:** Data structures, Programming Languages (C, C++), Operating Systems, Automata Theory, Discrete Mathematics, Digital Systems Design.  
**PART B**  
**Syllabus for Data Science Stream:** Databases, Artificial Intelligence and Machine Learning, Data Warehousing, Data Mining.  
7. SCHOOL OF PHYSICAL SCIENCE

The pattern of JNU UET 2020-21 will be based on Multiple Choice Questions (MCQs) through Computer Based Test (CBT)

Master of Science

<table>
<thead>
<tr>
<th>Sl. No.</th>
<th>Name of Centre</th>
<th>Sub. Code &amp; Sub. Code Number</th>
<th>Syllabus for Entrance Examination</th>
</tr>
</thead>
</table>
| 1       | School of Physical Sciences (SPS) | Physics- SPSM (226) | **Mathematical Methods:** Calculus of single and multiple real variables. Fourier and Laplace transforms. Vector Calculus, Divergence theorem, Green’s theorem, Stokes’ theorem. First order and linear second order differential equations with constant coefficients. Matrices and determinants. Complex numbers.  
PHYSICAL CHEMISTRY

**Basic Mathematical Concepts:** Functions; maxima and minima; integrals; ordinary differential equations; vectors and matrices; determinants; elementary statistics and probability theory.

**Atomic and Molecular Structure:** Fundamental particles; Bohr’s theory of hydrogen-like atom; wave-particle duality; uncertainty principle; Schrödinger’s wave equation; quantum numbers; shapes of orbitals; Hund’s rule and Pauli’s exclusion principle; electronic configuration of simple homonuclear diatomic molecules.

**Theory of Gases:** Equation of state for ideal and non-ideal (van der Waals) gases; Kinetic theory of gases; Maxwell-Boltzmann distribution law; equipartition of energy.

**Solid state:** Crystals and crystal systems; X-rays; NaCl and KCl structures; close packing; atomic and ionic radii; radius ratio rules; lattice energy; Born-Haber cycle; isomorphism; heat capacity of solids.

**Chemical Thermodynamics:** Reversible and irreversible processes; first law and its application to ideal and nonideal gases; thermochemistry; second law; entropy and free energy; criteria for spontaneity.

**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.

**Electrochemistry:** Conductance and its applications; transport number; galvanic cells; EMF and free energy; concentration cells with and without transport; polarography; concentration cells with and without transport; Debye-Huckel-Onsagar theory of strong electrolytes. **Chemical Kinetics:** Reactions of various order; Arrhenius equation; collision theory; transition state theory; chain reactions—normal and branched; enzyme kinetics; photochemical processes; catalysis.

**Adsorption:** Gibbs adsorption equation; adsorption isotherm; types of adsorption; surface area of adsorbents; surface films on liquids.

**Spectroscopy:** Beer-Lambert law; fundamental concepts of rotational, vibrational, electronic and magnetic resonance spectroscopy.

ORGANIC CHEMISTRY

**Basic Concepts in Organic Chemistry and Stereochemistry:** Electronic effects; resonance, inductive, hyperconjugation, aromaticity, tautomerism; organic acids and bases; optical isomerism in compounds with and without any stereocenters (allenenes, biphenyls); conformation of acyclic systems (substituted ethane/n-propane/n-butane) and cyclic systems (mono- and di-substituted cyclohexanes).

**Organic Reaction Mechanism and Synthetic Applications:** Chemistry of reactive intermediates (carbocations, carbanions, free radicals, carbenes, nitrenes, benzynes); Hofmann-Curtius-Lossen rearrangement, Wolff rearrangement, Simmons-Smith reaction, Reimer-Tiemann reaction, Michael reaction, Darzens reaction, Wittig reaction and McMurry reaction; Pinacol-pinacolone, Favorski, benzilic acid rearrangement, dienone-phenol rearrangement, Baeyer-Villiger reaction; oxidation and reduction reactions in organic chemistry; organometallic reagents in organic synthesis (Grignard, organolithium and organocopper); Diels-Alder, electrocyclic and sigmatropic reactions; functional group inter-conversions and structural problems using chemical reactions.

**Spectroscopic Analysis:** Identification of functional groups by UV, IR and 1H NMR spectroscopic techniques as tools for structural elucidation.

**Natural Products Chemistry:** Chemistry of alkaloids, steroids, terpenes, carbohydrates, amino acids, peptides and nucleic acids.

**Aromatic and Heterocyclic Chemistry:** Monocyclic, bicyclic and tricyclic aromatic hydrocarbons, and monocyclic compounds with one hetero atom: synthesis, reactivity and properties.
**INORGANIC CHEMISTRY**

**Periodic Table:** Periodic classification of elements and periodicity in properties; general methods of isolation and purification of elements.

**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.

**Concepts of Acids and Bases:** Bronsted and Lewis acids and bases; Gas phase versus solution phase acidity; solvent levelling effects; hardness and softness.

**Oxidation and Reduction:** Redox potentials; Nernst equation; influence of complex formation; precipitation; change of pH and concentration on redox potentials; analysis of redox cycles; redox stability in water; disproportionation/comproportionation.

**Main Group Elements (s and p blocks):** General concepts on group relationships and gradation in properties; structure of electron deficient compounds involving main group elements.

**Transition Metals (d block):** Characteristics of 3d elements; oxide, hydroxide and salts of first row metals; coordination complexes: structure, isomerism, reaction mechanism and electronic spectra; VB, MO and Crystal Field theoretical approaches for structure, color and magnetic properties of metal complexes; organometallic compounds having ligands with back bonding capabilities such as metal carbonyls, carbenes, nitrosyls and metalloccenes; homogenous catalysis.

**Bioinorganic Chemistry:** Essentials and trace elements of life; basic reactions in the biological systems and the role of metal ions, especially Fe$^{2+}$, Fe$^{3+}$, Cu$^{2+}$ and Zn$^{2+}$; structure and function of hemoglobin and myoglobin and carbonic anhydrase.

**Instrumental Methods of Analysis:** Basic principles; instrumentations and simple applications of conductometry, potentiometry and UV-vis spectrophotometry.

**Analytical Chemistry:** Principles of qualitative and quantitative analysis; acid-base, oxidation-reduction and complexometric titrations using EDTA; precipitation reactions; use of indicators; use of organic reagents in inorganic analysis.

<table>
<thead>
<tr>
<th>Mathematics – MATM (237)</th>
<th>Set Theory and related topics: Elementary set theory, Finite, countable and uncountable sets, Equivalence relations and partitions</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td><strong>Real Numbers, Sequences and Series:</strong> Real number system as a complete ordered field, Archimedean property, supremum, infimum, Sequence of real numbers, convergence of sequences, bounded and monotone sequences, convergence criteria for sequences of real numbers, Cauchy sequences, subsequences, Bolzano-Weierstrass theorem. Series of real numbers, absolute convergence, tests of convergence for series of positive terms - comparison test, ratio test, root test, Leibniz test for convergence of alternating series</td>
</tr>
<tr>
<td></td>
<td><strong>Real Analysis:</strong> Interior points, limit points, open sets, closed sets, bounded sets, connected sets, compact sets. Power series (of a real variable), Taylor’s series, radius and interval of convergence, term-wise differentiation and integration of power series</td>
</tr>
<tr>
<td></td>
<td><strong>Functions of One Real Variable:</strong> Limit, continuity, intermediate value property, differentiation, Rolle’s Theorem, mean value theorem, L’Hospital rule, Taylor’s theorem, maxima and minima</td>
</tr>
<tr>
<td></td>
<td><strong>Functions of Two and Three Real Variables:</strong> Limit, continuity, partial derivatives, differentiability, maxima and minima</td>
</tr>
<tr>
<td></td>
<td><strong>Integral Calculus:</strong> Integration as the inverse process of differentiation, definite integrals and their properties, fundamental theorem of calculus. Double and triple integrals, change of order of integration, calculating surface areas and volumes using double integrals, calculating volumes using triple integrals</td>
</tr>
<tr>
<td></td>
<td><strong>Vector Calculus:</strong> Scalar and vector fields, gradient, divergence, curl, line integrals,</td>
</tr>
</tbody>
</table>
surface integrals, Green, Stokes and Gauss theorems

**Group Theory:** Groups, subgroups, Abelian groups, non-Abelian groups, cyclic groups, permutation groups, normal subgroups, Lagrange's Theorem for finite groups, group homomorphism and basic concepts of quotient groups, Cayley's theorem, class equations

**Linear Algebra:** Finite dimensional vector spaces, linear independence of vectors, basis, dimension, linear transformations, matrix representation, range space, null space, rank-nullity theorem, rank and inverse of a matrix, determinant, solutions of systems of linear equations, consistency conditions, eigenvalues and eigenvectors for matrices, Cayley-Hamilton theorem, Inner product spaces, Orthonormal basis

**Miscellaneous:** Logical reasoning, elementary combinatorics, divisibility in Integers, Congruence, Chinese remainder theorem, Euler's $\varphi$-function

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**Ph.D.**

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<tr>
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<th>Syllabus for Entrance Examination</th>
</tr>
</thead>
</table>
| 1      | School of Physical Sciences (SPS) | Mathematical Sciences – MATH (897) | **Analysis:**  
The structure of the real numbers as an ordered field with the least upper bound property, archimedean property, Bolzano-Weierstrass theorem, Heine-Borel theorem, extended real number system, complex field, Euclidean spaces.  
Definition and examples of metric spaces, completeness, compactness, connectedness, continuous functions and related properties. Convergence of sequences in a metric space, subsequences, Cauchy sequences. Limits of functions, continuity of functions, uniform continuity, continuity and compactness, continuity and connectedness.  
Pointwise and uniform convergence, uniform convergence and continuity, uniform convergence and integration, uniform convergence and differentation, equicontinuity, Arzela-Ascoli theorem, Stone-Weierstrass theorem.  
Differentiation of functions of several real variables (directional derivatives, partial derivatives, differentiability and the total derivative, chain rule, Jacobian, higher derivatives, interchange of the order of differentiation, Taylor's theorem), inverse function theorem, implicit function theorem, rank theorem, differentiation of integrals. Lebesgue measure and Lebesgue integral, convergence Theorems.  
**Linear Algebra:**  
Vector Spaces, subspaces, linear independence, bases, dimension, algebra of linear transformations, rank-nullity theorem, dual spaces, double dual, eigenvalues and eigenvectors, characteristic polynomial and minimal polynomial, Cayley-Hamilton theorem. Diagonalizability and digonalization, primary decomposition theorem, generalized eigenvectors, Jordan canonical form, rational canonical form.  
Bilinear forms, symmetric and skew-symmetric bilinear forms, groups preserving bilinear forms, reduction and classification of bilinear forms.  
**Algebra:**  
Definition and examples of groups - dihedral, symmetric and permutations groups, matrix groups such as GL(n), SL(n), abelian and cyclic groups, subgroups, normal subgroups, quotient groups, centralizer and normalizer of a group, Lagrange's theorem, isomorphism theorems, group actions, class equation, counting orbits, Cayley's theorem, Sylow's theorems, simplicity of alternating groups. Rings and subrings, isomorphisms, ideals, prime and maximal ideals, quotient rings, polynomial rings, unique factorization domain, principal ideal domain, Euclidean domain, Gauss’s lemma, irreducibility criteria. |
Definition and examples of fields, extension of fields, finite and infinite extensions, algebraic and transcendental extensions, homomorphisms, isomorphisms and automorphisms, separable and normal extensions, splitting field of a polynomial, extending field morphisms, algebraic closure of a field, finite fields, cyclicity of the multiplicative group of a finite field, Galois theory.

**Complex Analysis:**
Algebra of complex numbers, conjugates, modulus, argument, roots.

Continuity and derivative of a function of one complex variable, holomorphic functions, Cauchy-Riemann equations, harmonic functions.

Polynomial and rational functions, transcendental functions such as exponential, trigonometric and hyperbolic functions, logarithm.

Paths and contours, contour integral, Cauchy’s theorem, Cauchy’s integral formula, Liouville’s theorem, fundamental theorem of algebra, maximum modulus principle, open mapping theorem, Schwarz’s lemma, Taylor series and Laurent series.

Classification of singularities, orders or zeros and poles, winding number, meromorphic functions, Cauchy’s residue theorem, computation of definite integrals using residue theorem, argument principle. Linear fractional transformations, conformal mappings.

**Topology:**
Definition and examples of topological spaces, basis and subbasis of a topological space, subspace topology, limit points, closure and interior, continuous functions, homeomorphisms, product topology, metric topology, quotient map and quotient topology. Connectedness, path-connectedness, compactness, local compactness and one point compactification.

First and second countable spaces, separable spaces, separation axioms, Urysohn lemma, Tietze extension theorem, Tychonoff theorem and Stone-Čech compactification.

**Functional Analysis:**
Examples of normed spaces (sequence spaces: c, c0, lp spaces; function spaces: C[0, 1], C(R), Lp ([0, 1]), Lp(R)), finite dimensional normed spaces, continuous linear maps, Hahn-Banach Theorem, Hilbert spaces, inner product, linear functionals, orthonormal sets.

**Research Methodology:**
Elementary set theory, finite, countable and uncountable sets, logic, relations and functions, axioms.
Elementary combinatorics, combinatorial probability, pigeon-hole principle, inclusion-exclusion principle.

**Miscellaneous Topics:**
Fundamental theorem of arithmetic, divisibility, congruences, Chinese remainder theorem, Euler’s totient function, primitive roots.
I. Mathematical Physics
Linear vector spaces. Eigenvalues and eigenvectors. Linear ordinary
differential equations of first & second order. Special functions. Partial
differential equations. Green's function. Fourier and Laplace
transforms. Complex analysis: analytic functions, poles and residues,
series expansion, and evaluation of integrals.

II. Classical Mechanics
Lagrangian and Hamiltonian formalism. Equations of motion. Central
modes. Special theory of relativity.

III. Electromagnetic Theory
Gauss's law. Laplace and Poisson equations, boundary value
Conservation laws for electromagnetic fields. Electromagnetic waves in
free space. Dielectrics and conductors. Reflection and refraction of
electromagnetic waves. Dynamics of charged particles in static and
uniform electromagnetic fields.

IV. Quantum Mechanics
Wavefunctions and operators. Heisenberg uncertainty principle.
Schrödinger equation (time-dependent and time-independent).
Eigenvalue problems (particle in a box, harmonic oscillator, hydrogen
atom). Tunneling. Orbital and spin angular momenta. Addition of
angular momenta. Time-independent perturbation theory. Variational
method. Time dependent perturbation theory: Fermi's golden rule and
selection rules. Identical particles and indistinguishability.

V. Thermodynamics and Statistical Physics
Laws of thermodynamics and their consequences. Thermodynamic
potentials. Legendre transformation. Maxwell relations. Chemical
potential, phase equilibria. Micro-canonical, canonical and grand-
canonical ensembles and partition functions. Free energy and its
connection with thermodynamic quantities. Classical and quantum
statistics. Ideal Bose and Fermi gases. Blackbody radiation and
Planck's
distribution. First- and second-order phase transitions.

VI. Atomic & Molecular Physics
Quantum states of electrons in an atom. Relativistic corrections of
atomic energy levels. LS & JJ couplings. Zeeman, Paschen-Bach &
Electronic, rotational, vibrational and Raman spectra of diatomic
molecules. Lasers: spontaneous and stimulated emission, Einstein A &
B coefficients. Optical pumping, population inversion, rate equation.

VII. Condensed Matter Physics
Bravais lattices. Reciprocal lattice. Diffraction and structure factor.
Bonding of solids. Elastic properties, phonons, lattice specific heat. Free electron theory
of metals and electronic specific heat. Drude model of electrical and thermal
conductivity. Hall effect and thermoelectric power. Band theory of solids: metals,
insulators and semiconductors. Superconductivity: type-I and type-II superconductors.
Magnetism: types of magnetic ordering and Curie-Weiss law.

VIII. Nuclear and Particle Physics
Basic nuclear properties: size, shape and charge distribution, spin and parity. Binding
energy, semi-empirical mass formula, liquid drop model. Nuclear force. Single-particle
shell model, its validity and limitations. Rotational spectra. Elementary ideas of alpha,
beta and gamma decays and their selection rules. Fission and fusion. Nuclear reactions. Classification of fundamental forces. Elementary particles and their quantum numbers (charge, spin, parity, isospin, strangeness, etc.).

**IX. Electronics**
Semiconductor devices (diodes, junctions, transistors, and field effect devices), device characteristics. Operational amplifiers and their applications. Digital techniques and applications (registers, counters, comparators and similar circuits).

**X. Research Methodology and Experimental Methods**
Data analysis. Error estimation. Measurement of electrical resistivity, Hall coefficient, magnetic susceptibility and thermal conductivity. Interference and diffraction experiments. Spectroscopic measurements such as Zeeman effect, Electron Spin Resonance, and Raman effect. Experimental determination of fundamental constants such as Planck’s constant, e/m, and Boltzmann constant.

<table>
<thead>
<tr>
<th>Chemical Sciences – CHEH (899)</th>
<th>Research Methodology</th>
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</table>

**Analytical chemistry**, chromatographic separation, crystallization, spectroscopic techniques, electro-and thermoanalytical methods. Data analysis: Mean and standard deviation; absolute and relative errors; linear regression; covariance and correlation coefficient.

**Organic Chemistry**

1. IUPAC nomenclature of organic molecules including regio - and stereoisomers.
2. Principles of stereochemistry: Configurational and conformational isomerism in acyclic and cyclic compounds; stereogenicity, stereoselectivity, enantioselectivity, diastereoselectivity and asymmetric induction.
3. Aromaticity: Benzenoid and non - benzenoid compounds – generation and reactions.
5. Organic reaction mechanisms involving addition, elimination and substitution reactions with electrophilic, nucleophilic or radical species. Determination of reaction pathways.
7. Organic transformations and reagents: Functional group interconversion including oxidations and reductions; common catalysts and reagents (organic, inorganic, organometallic and enzymatic). Chemo, regio and stereoselective transformations.
11. Synthesis and reactivity of common heterocyclic compounds containing one or two heteroatoms (O, N, S).
12. Chemistry of natural products: Carbohydrates, proteins and peptides, fatty
13. Structure determination of organic compounds by IR, UV - Vis, $^1$H & $^{13}$C NMR and Mass spectroscopic techniques.

Inorganic Chemistry

1. Chemical periodicity: Classification of elements and periodicity in properties.

2. Molecular Structure and Bonding: Valence bond theory, molecular orbital Theory, VSEPR theory.

3. Acids and Bases: Lewis acids and bases, HSAB concept, Gas phase versus solution acidity, Solvent levelling effects, Surface acidity.


5. Main group elements and their compounds: Allotropy, synthesis, structure and bonding, industrial importance of the compounds.

6. Transition elements and coordination compounds: structure, bonding theories, spectral and magnetic properties, reaction mechanisms.

7. Inner transition elements: spectral and magnetic properties, redox chemistry, analytical applications.


9. Cages and metal clusters.

10. Bioinorganic chemistry: photosystems, porphyrins, metalloenzymes, oxygen transport, electron-transfer reactions; nitrogen fixation, metal complexes in medicine.

11. Nuclear chemistry: nuclear reactions, fission and fusion, radio- analytical techniques, activation analysis, principles of determination of age of rocks and minerals, and Radio-carbon dating.

12. Characterisation of inorganic compounds by IR, Raman, NMR, EPR, Mössbauer, UV-vis, NQR, MS, electron spectroscopy and microscopic techniques.

Physical Chemistry

1. Basic principles of quantum mechanics: Postulates; operator algebra; exactly-solvable systems; particle-in-a-box, harmonic oscillator and the hydrogen atom, including shapes of atomic orbitals; orbital and spin angular momenta; tunnelling.

2. Approximate methods of quantum mechanics: Variational principle; perturbation theory up to second order in energy; applications.

3. Atomic structure and spectroscopy; term symbols; many-electron systems and
antisymmetry principle.

4. Chemical bonding in diatomics; elementary concepts of MO and VB theories; Hückel theory for conjugated π-electron systems.

5. Chemical applications of group theory; symmetry elements; point groups; character tables; selection rules.

6. Molecular spectroscopy: Rotational and vibrational spectra of diatomic molecules; electronic spectra; IR and Raman activities – selection rules; basic principles of magnetic resonance.

7. Chemical thermodynamics: Laws, state and path functions and their applications; thermodynamic description of various types of processes; Maxwell’s relations; spontaneity and equilibria; temperature and pressure dependence of thermodynamic quantities; Le Chatelier principle; elementary description of phase transitions; phase equilibria and phase rule; thermodynamics of ideal and non-ideal gases, and solutions.


10. Chemical kinetics: Empirical rate laws and temperature dependence; complex reactions; steady state approximation; determination of reaction mechanisms; collision and transition state theories of rate constants; unimolecular reactions; enzyme kinetics; salt effects; homogeneous catalysis; photochemical reactions.

11. Colloids and surfaces: Stability and properties of colloids; isotherms and surface area; heterogeneous catalysis.

12. Solid state: Crystal structures; Bragg’s law and applications; band structure of solids.

13. Polymer chemistry: Molar masses; kinetics of polymerization.
8. SCHOOL OF COMPUTATIONAL AND INTERGRATIVE SCIENCES

The pattern of JNU e-Prospectus 2020-21 will be based on Multiple Choice Questions (MCQs) through Computer Based Test (CBT)

M.Sc. Programme

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</table>
| 1      | School of Computational and Integrative Sciences (SC&IS) | Computational and Integrative Sciences - Track 1 – TROM (232) & Track 2 – TRTM (238) | **Section 1: Physics**
|        |                |                               | **Mathematical Physics:** Linear vector space; matrices; vector calculus; linear differential equations; Fourier analysis. |
|        |                |                               | **Classical Mechanics:** Conservation laws; central forces, Kepler problem and planetary motion; mechanics of a system of particles; rigid body dynamics; moment of inertia tensor; special theory of relativity – Lorentz transformations, mass-energy equivalence. |
|        |                |                               | **Electromagnetic Theory:** Solution of electrostatic and magnetostatic problems including boundary value problems; dielectrics and conductors; Biot-Savart’s and Ampere’s laws; Faraday’s law; Maxwell’s equations; scalar and vector potentials; Electromagnetic waves and their reflection, refraction, interference. Poynting vector, Poynting theorem. |
|        |                |                               | **Quantum Mechanics:** Physical basis of quantum mechanics; uncertainty principle; Schrodinger equation; one, two and three dimensional potential problems -- particle in a box, harmonic oscillator, hydrogen atom. **Thermodynamics and Statistical Physics:** Laws of thermodynamics; macrostates and microstates; phase space; free energy, calculation of thermodynamic quantities; black body radiation and Planck’s distribution law; classical statistics. |
|        |                |                               | **Atomic and Molecular Physics:** Spectra of one- and many-electron atoms; LS and jj coupling; Zeeman and Stark effects; X-ray spectra; lasers. |
|        |                |                               | **Section 2: Chemistry:**
|        |                |                               | General Topics(Inorganic and Basic Organic) |
|        |                |                               | Properties of gases, kinetic theory |
|        |                |                               | Thermodynamics |
|        |                |                               | Chemical Bonding |
|        |                |                               | Molecular Structure |
|        |                |                               | Chemical Kinetics |
|        |                |                               | **Section 3: Mathematics/Statistics:**
|        |                |                               | General topics at the B.Sc. level. Specific focus will be on the following topics:
|        |                |                               | **Linear Algebra:** Vector spaces, Sub spaces, linearly dependent & linearly independent vectors, Basis, Dimension, linear transformation, Matrix representation of a linear transformation, Rank & Nullity theorem. Finite dimensional vector spaces, Existence theorem for basis, Quotient space and its dimension. Rank of a matrix, Eigen values & Eigen vectors. |
|        |                |                               | **Abstract Algebra:** Divisibility in the set of integers, congruence, Groups, Sub groups, Permutation groups, Cyclic groups, Lagrange’s theorem and its consequences, Normal subgroups, Quotient groups, Group homomorphism, Kernel of a homomorphism, Fundamental
theorem of homomorphism of groups, Group isomorphism, Cayley’s theorem.


**Polyhedral sets and cones.** Theory of Simplex Method. Simplex Algorithm. Assignment and Transportation.

Calculus, Differential Calculus, Vector Calculus, Numerical Analysis, Mechanics, Mathematical Methods, Real Analysis

**Probability and Statistics:** Measures of central tendency and dispersion, Skewness and kurtosis, Probability, Conditional probability, Theorem of total probabilities, Bayes theorem, Random variables, Probability mass and density functions, Mathematical expectation and its properties, Moment generating functions, Binomial, Poisson, Geometric, Exponential and Normal distributions and their properties, Method of least squares, Correlation and regression.

**Section 4: Computer Sciences and Programming:**

Questions will be set at the B.Tech/M.Tech Level. Special Focus will be on the following topics

**Computer Organization and Architecture:** Machine instructions and addressing modes. ALU, data- path and control unit. Instruction pipelining. Memory hierarchy: cache, main memory and secondary storage; I/O interface (interrupt and DMA mode).

**Programming and Data Structures:** Programming in C. Recursion. Arrays, stacks, queues, linked lists, trees, binary search trees, binary heaps, graphs.

**Algorithms** Searching, sorting, hashing. Asymptotic worst case time and space complexity. Algorithm design techniques: greedy, dynamic programming and divide- and- conquer. Graph search, minimum spanning trees, shortest paths.

**Theory of Computation** Regular expressions and finite automata. Context-free grammars and push- down automata. Regular and context-free languages, pumping lemma. Turing machines and undecidability.

**Compiler Design** Lexical analysis, parsing, syntax-directed translation. Runtime environments. Intermediate code generation.

**Operating System** Processes, threads, inter- process communication, concurrency and synchronization. Deadlock. CPU scheduling. Memory management and virtual memory. File systems.

**Databases** ER model. Relational model: relational algebra, tuple calculus, SQL. Integrity constraints, normal forms. File organization, indexing (e.g., B and B+ trees). Transactions and concurrency control.


**Section 5: Life Sciences**

Biomolecules & Cellular Organization, Fundamental Processes: Replication, Transcription and Translation, Basic Concepts in Genetics & Immunology, Genome Organization & Regulation, Basic Techniques in Molecular Biology and Recombinant DNA Technology

**Section 6: Biotechnology/ Bioinformatics**

Sequence analysis and alignment algorithms, Phylogenetic Analysis, Fundamentals of Genomics, Structural Bioinformatics, Basic concepts in molecular biology, genetics and biochemistry.
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| 1      | School of Computational and Integrative Sciences (SC&IS) | Post-Graduate Diploma in Big Data Analytics – PGDT (191) | (Separate merit lists of students for Track 1 (Non-biological sciences) and Track 2 (Biological sciences) will be used for final admissions. The categorization in Tracks will be based on students’ choice in the application form irrespective of his/her academic background and section of questions he/she attempts. Total number of seats will be equally divided into the two tracks) PG Diploma course will have a single entrance test of **Data Science Aptitude (Biological data)** with the following break up. General reasoning, Computer programming in Python and C, Basic statistics, Bioinformatics/ Life Science, The syllabus for respective sections is as follows:  

1. **General Reasoning**  
   This section is designed to assess the analytical and quantitative skills of the students acquired throughout their academic career.

2. **Computer programming in Python and C**  

3. **Basic statistics**  

4. **Bioinformatics/Life Sciences**  
   Sequence analysis and alignment, Phylogenetic Analysis, Database Management System, Structural bioinformatics & drug designing, Databases and tools for biological data mining and pathway analysis, Biomolecules & Cellular Organization, Fundamental Processes: Replication, Transcription and Translation, Gene structure, Transcriptional and post-transcriptional Gene Regulation, Genome Organization, Metabolic engineering and Systems Biology, gene regulatory networks, Basic Techniques in Molecular Biology, Fundamentals of Genomics, transcriptomics, proteomics and metabolomics, Next Generation Sequencing Technologies and data analysis |
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<td>1</td>
<td>School of Computational and Integrative Sciences (SC&amp;IS)</td>
<td>Computational Biology and Bioinformatics – Track 1 – TROH (903); Track 2 – TRTH (909) &amp; Track 3 – TRDH (910)</td>
<td><strong>Section 1: Physics:</strong> Mathematical Physics: Linear vector space; matrices; vector calculus; linear differential equations; elements of complex analysis; Laplace transforms, Fourier analysis, elementary ideas about tensors. Classical Mechanics: Conservation laws; central forces, Kepler problem and planetary motion; collisions and scattering in laboratory and Centre of mass frames; mechanics of system of particles; rigid body dynamics; moment of inertia tensor; noninertial frames and pseudo forces; variational principle; Lagrange’s and Hamilton’s formalisms; equations of motion, cyclic coordinates, Poisson bracket; periodic motion, small oscillations, normal modes; special theory of relativity – Lorentz transformations, relativistic kinematics, mass-energy equivalence. Electromagnetic Theory: Solution of electrostatic and magnetostatic problems including boundary value problems; dielectrics and conductors; Biot-Savart’s and Ampere’s laws; Faraday’s law; Maxwell’s equations; scalar and vector potentials; Coulomb and Lorentz gauges; Electromagnetic waves and their reflection, refraction, interference, diffraction and polarization. Poynting vector, Poynting theorem, energy and momentum of electromagnetic waves; radiation from a moving charge. Quantum Mechanics: Physical basis of quantum mechanics; uncertainty principle; Schrodinger equation; one, two and three dimensional potential problems; particle in a box, harmonic oscillator, hydrogen atom; linear vectors and operators in Hilbert space; angular momentum and spin; addition of angular momenta; time independent perturbation theory; elementary scattering theory. Thermodynamics and Statistical Physics: Laws of thermodynamics; macrostates and microstates; phase space; probability ensembles; partition function, free energy, calculation of thermodynamic quantities; classical and quantum statistics; degenerate Fermi gas; black body radiation and Planck’s distribution law; Bose-Einstein condensation; first and second order phase transitions, critical point. Atomic and Molecular Physics: Spectra of one- and many-electron atoms; LS and jj coupling; hyperfine structure; Zeeman and Stark effects; electric dipole transitions and selection rules; X-ray spectra; rotational and vibrational spectra of diatomic molecules; electronic transition in diatomic molecules, Franck-Condon principle; Raman effect; NMR and ESR.</td>
</tr>
</tbody>
</table>
**Special Function:** Calculus of Variation-Functional and its properties, Variational problems with fixed boundaries, Legendre polynomial and functions, Christoffel's summation formula, Bessel's Function, Modified Bessel's function, Bessel's equations. Hermite polynomials, Laguerre polynomials.


**Probability and Statistics:** Measures of central tendency and dispersion, Skewness and kurtosis, Probability, Conditional probability, Theorem of total probabilities, Bayes theorem, Random variables, Probability mass and density functions, Mathematical expectation and its properties, Moment generating functions, Binomial, Poisson, Geometric, Exponential and Normal distributions and their properties, Method of least squares, Correlation and regression.

### Section 4: Computer Science and Programming

**Computer Organization and Architecture**
Machine instructions and addressing modes. ALU, data-path and control unit. Instruction pipelining. Memory hierarchy: cache, main memory and secondary storage; I/O interface (interrupt and DMA mode).

**Programming and Data Structures**
Programming in C. Recursion. Arrays, stacks, queues, linked lists, trees, binary search trees, binary heaps, graphs.

**Algorithms**
Searching, sorting, hashing. Asymptotic worst case time and space complexity. Algorithm design techniques: greedy, dynamic programming and divide-and-conquer. Graph search, minimum spanning trees, shortest paths.

**Theory of Computation**
Regular expressions and finite automata. Context-free grammars and push-down automata. Regular and context-free languages, pumping lemma. Turing machines and undecidability.

**Compiler Design**

**Operating System**
Processes, threads, inter-process communication, concurrency and synchronization. Deadlock. CPU scheduling. Memory management and virtual memory. File systems.

**Databases**
ER-model. Relational model: relational algebra, tuple calculus, SQL. Integrity constraints, normal forms. File organization, indexing (e.g., B and B+ trees). Transactions and concurrency control.

**Computer Networks**
cryptography, digital signatures and certificates, firewalls.

Section 5: Life Sciences/Biotechnology
Biomolecules & Cellular Organization, Fundamental Processes, Basic Concepts in Genetics & Immunology, Developmental Processes, Genome Structure & Organization, Gene Expression and Regulation, Basic Techniques in Molecular Biology and Recombinant DNA Technology

Section 6: Bioinformatics
Sequence analysis and alignment algorithms, Phylogenetic Analysis, Sequencing Technologies, Structural Bioinformatics, Advanced concepts in sequence analysis, Genomics and Transcriptomics

Section 7 Electronics Engineering
Networks, Signals and Systems
Network solution methods: nodal and mesh analysis; Network theorems: superposition, Thevenin and Norton’s, maximum power transfer; Steady state sinusoidal analysis using phasors; Time domain analysis of simple linear circuits, Laplace transform, Linear 2-port network parameters: driving point and transfer functions.
Continuous-time signals: Fourier series and Fourier transform representations, sampling theorem and applications; Discrete-time signals, Z-transform, LTI systems: definition and properties, causality, stability, impulse response, convolution, poles and zeros, parallel and cascade structure.

Electronic Devices
Energy bands in intrinsic and extrinsic silicon; Carrier transport: diffusion current, drift current, mobility and resistivity; Generation and recombination of carriers; Poisson and continuity equations; P-N junction, Zener diode, BJT, MOS capacitor, MOSFET, LED, photo diode, Integrated circuit fabrication process: oxidation, diffusion, ion implantation, photolithography.

Analog Circuits
BJTs and MOSFETs: Simple diode circuits: clipping, clamping and rectifiers; Single-stage BJT and MOSFET amplifiers: biasing, bias stability, BJT and MOSFET amplifiers: multi-stage, differential, feedback, power and operational; Simple op-amp circuits; Active filters; Sinusoidal oscillators: criterion for oscillation, single-transistor and opamp configurations; Function generators, wave-shaping circuits and 555 timers.

Digital Circuits
Number systems; Combinatorial circuits: Boolean algebra, minimization of functions using Boolean identities and Karnaugh map, logic gates, arithmetic circuits, code converters, multiplexers, decoders, Sequential circuits: latches and flip-flops, counters, shift-registers, Data converters: sample and hold circuits, ADCs and DACs; Semiconductor memories: ROM, SRAM, DRAM; 8-bit microprocessor (8085): architecture, programming, memory and I/O interfacing.

Communications
Analog communications: amplitude modulation and demodulation, angle modulation and demodulation, spectra of AM and FM, superheterodyne receivers, Information theory: entropy, mutual information and channel capacity theorem.
Digital communications: PCM, DPCM, digital modulation schemes, amplitude, phase and frequency shift keying (ASK, PSK, FSK), OAM, calculation of bandwidth, SNR and BER for digital modulation; Fundamentals of error correction, Hamming codes; Timing and frequency synchronization, inter-symbol interference and its mitigation; Basics of TDMA, FDMA and CDMA.

Satellite communication: Introduction, need, satellite orbits, advantages and disadvantages of geostationary satellites. Satellite visibility, satellite system – space segment, block diagrams of satellite sub systems, up link, down link, cross link, transponders (C- Band)

Local area networks (LAN): Primary characteristics of Ethernet-mobile IP, OSI model, wireless LAN requirements-concept of Bluetooth, Wi-Fi and WiMAX.

Electromagnetics
Electrostatics; Maxwell’s equations: differential and integral forms and their interpretation, boundary conditions, wave equation, Poynting vector; Plane waves and properties: reflection and refraction, polarization, phase and group velocity, propagation through various media, skin depth; Transmission lines: equations, characteristic impedance, impedance matching, impedance transformation, S-parameters, Smith chart; Waveguides: modes, boundary conditions, cut-off frequencies, dispersion relations; Antennas: antenna types, radiation pattern, gain and directivity, return loss, antenna arrays; Basics of radar; Light propagation in optical fibers.
Microwave and Antennas
Introduction & Wave Propagation Review of Maxwell’s equations, Integral and Point forms; Boundary conditions; Power flow and Poynting vector; Propagation of uniform plane waves, Wave equation; Polarization. Scalar and Vector Potential functions, Retarded Potentials; Radiation phenomenon and equation, Basic antenna parameters: radiation resistance, Gain, directivity, Effective length, Radiation pattern; Radiation from short current element, Radiation from small current loop, radiation from arbitrary current distribution, half wave dipole antenna; Antenna impedance, Monopole antenna, Baluns, Antenna array: Broadside array and end-fire arrays, long wire antenna; Few antenna types: Folded dipole, Loop antenna, Yagi-Uda Antenna; Wave propagation, Travelling waves, Lossless and Lossy transmission lines, pulse propagation; Principle, construction and working of Microwave solid state devices: Transferred Electron devices: Gunn Diode (Gunn Effect), IMPATT diode, PIN diode Attenuators, Terminators, Directional couplers; Hybrid Circuits

9. SCHOOL OF ARTS & AESTHETICS

The pattern of JNUEE 2020-21 will be based on Multiple Choice Questions (MCQs) through Computer Based Test (CBT)

Master of Arts

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</table>
| 1      | School of Arts & Aesthetics (SA&A) | Arts & Aesthetics- SAAM (235) | Note: Candidates attempting the entrance exam of the integrated MA should have a broad sense of the areas listed under all the three streams of the School – Visual Studies, Cinema Studies and Theatre and Performance Studies. Questions set by the School typically ask questions that assess the candidate’s ability to reflect upon and critically engage with themes and issues related to art.  

**Visual Studies**
Broad knowledge of the history of world art in general, and of art in South Asia, from Indus Valley Civilization till the present, in particular. Candidates should have an understanding of formal, stylistic and iconographic aspects of South Asian art and be able to place them in their literary, cultural, historical, religious and liturgical context. In addition, a broad knowledge of the history of Western Art, from the Renaissance to the present day, and of the history of Asian art, including Far Eastern and Islamic art, are valuable. An awareness of current debates and new developments around art, heritage, museums and exhibitions is important, with an emphasis on the ability to critically engage with issues and themes related to art.

**Cinema Studies**
Broad knowledge of World Cinema, Film Movements, and Film/Media Practitioners. There should be awareness of cinema/ media’s status as an aesthetic practice, a mass cultural form, and an instigator of public debates. Candidates should display their knowledge of the public presence of cinema/media and the way certain film practices get linked to political controversies, festival bans, censorship debates, and vandalism at exhibition venues. Some knowledge of the role of film criticism and writing about cinema in the popular press will be helpful.

**Theatre and Performance Studies**
Broad knowledge of the history of theatre and dance including classical Greek theatre, Elizabethan theatre, classical Indian theatre, music, dance and performance cultures, bhakti performance traditions in India, modern theatre and contemporary performance practices. Some familiarity with dance in the larger context of Indian dance history, relationship of dance and society. Likewise, an engagement with musical traditions, both classical and popular. Some awareness of basic concepts like rasa and catharsis, the dynamics of body, space and time in different theatrical and dance traditions, the role of the actor/performer and...
spectator. Basic knowledge of the theoretical writings of Bharata, Bhatkhande, Kapila Vatsyayan, Susan Foster, Stanislavski, Brecht, Augusto Boal, Badal Sircar. An ability to see performances critically with an awareness of their social and political contexts. Emphasis on the capacity to describe the performances of everyday life, including festivals, rituals and ceremonies experienced at a local level within specific regional contexts.

**M.Phil & Ph.D.**

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<td>1</td>
<td>School of Arts &amp; Aesthetics (SA&amp;A)</td>
<td>M.Phil : Visual Studies – VSAP (163) Ph.D. : Visual Studies – VSAH (900)</td>
<td>Note: The programme is suited for students who come from a background in Visual Studies/ Art History and related disciplines. Candidates are expected to already be familiar with the discipline of art history and its theoretical concerns in general and with the development of Indian art and architecture in particular. To appear for the entrance exam, prospective candidates should have a broad understanding of the intellectual history of the discipline and key philosophical concerns of image theories. They should be familiar with the topics listed below which are areas covered by Masters-level programmes. Questions set by the School are designed to assess the candidate’s ability to reflect upon and critically engage with themes and issues related to art and visual culture. Candidates appearing for the entrance examination should be familiar with the following: Contribution of theorists whose work has shaped/ impacted art historical, critical and anthropological discourse on the visual arts and visual culture. Research Methodology and Historiography of the discipline: art criticism and art history writing and archival structures as subjects of inquiry and meta-critical practices. Artworks as modes of symbolic communication and methodologies of decipherment of visual codes and visual language systems. Methodological approaches to interpreting the visual: iconography, semiotics, formalism, cultural materialism, psychoanalysis, narratology, phenomenology, affect theory, theories of gender, feminist and post-colonial critiques. The entanglements of ethno-nationalism and art history The interrelationship of textual and visual traditions in Indian art. The social and political and conditions that govern the agency of art and artists and impact visual representations. The relationship between political, economic and liturgical institutions and monumental built forms. Current debates about the agency and representation of caste, class and gender in pre-modern arts. Capitalism, individualism and the relationship with artistic authorship. Debates around authorship in Indian art. Concepts of space and place in architecture and spatiotemporal understanding of built form including relationships between architecture and ritual performance. The network of institutional agencies in which art works are embedded. Institutional critique and its own institutionalization. Iconophilia, iconopraxis and iconoclasm. Sectarian competetiveness and the “clash of icons.” Technologies of art-making, intentionalities of choice and theoretical understanding of creative labour. Interactivity, community art and relational aesthetics in contemporary visual culture. The construction of heritage vis a vis national and global frameworks. Photography theory, digital convergence and “remediation”.</td>
</tr>
<tr>
<td>2</td>
<td>M.Phil : Theatre &amp; Performance Studies- TPSP (164) Ph.D. : Theatre &amp; Performance Studies- TPSH</td>
<td>Note: Theatre and Performance Studies covers a wide range of subjects, including the history of theatre, dance and music with a particular focus on the study of embodied performance. Students appearing for the entrance exam for the Theatre and Performance Studies stream should have some broad knowledge of the intellectual concerns and issues linked to the discipline. They should be familiar with the topics listed below which are areas covered by Masters level programmes. Questions set by the School are designed to assess the candidate’s ability to reflect upon and critically engage with themes and issues</td>
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</table>
Candidates appearing for the entrance examination should be familiar with the following:

- Concepts related to performance and aesthetics, such as *rasa*, *dhvani*, catharsis, tragedy, alienation, corporeality, embodiment, liminality, efficacy;
- Basic knowledge and understanding of the discourse around primary texts such as *Natyasastra*, *Dhvanyaloka*, *Abhinaya Darpana* and *The Poetics*;
- Institutions of performance such as National School of Drama, Sangeet Natak Akademi, Ninasam, Kalakshetra, Kalamandalam;
- *Sufi* and *bhakti* performing arts traditions;
- Regional culture and performance practices (theatre, dance, music, puppetry and others) in India;
- Histories and theories of political theatre;
- Histories of Indian musical traditions;
- Histories of traditions and transitions in dance;
- Feminism, gender and performance;
- Comic traditions in performance;
- Nation, nationalism and performance;
- Post-colonial performances;
- Debates in modern Indian theatre, music and dance.
- Applied theatre and performance;
- Street theatre;
- Globalisation and performance;
- Performance art
- Discourses, theories and research methodologies around the emergence of disciplines of theatre and performance studies, dance studies, music studies.

**Note:** The programmes draw students either from a background in Cinema/Film Studies or from other disciplines with an interest in the subject. Students appearing for the entrance exam for the Cinema Studies stream should have some broad knowledge of the intellectual concerns and issues linked to the discipline. They should be familiar with the topics listed below which are areas covered by Masters level programmes. Questions set by the School are designed to assess the candidate’s ability to reflect upon and critically engage with themes and issues related to cinema including:

- Indian Cinema History
- Globalization and Indian Cinema
- National Cinema Debates
- Issues and Debates in Research Methodology
- Media and Cultural Studies
- Sound and Colour in the History of Cinema
- Authorship Debates
- Theories of Genre
- Film Stardom and Celebrity Culture
- Early Debates and Discourses on Film
- Modernism, Mass Culture and Cinema
- Theories of the Cinematic Avant Garde
- The Cinematic Apparatus
- Cinema and the Postmodern
- Television and Video Theory
The Post Cinematic and Post Celluloid Debates
Media Sensorium and Media Archaeology Debates
Embodiment and Affect in Film/Media
The Cultural Politics of Speed, Surveillance and Forensics in Cinema/Media
The Archive Effect and Memory
Digital Culture and the Internet

10. SCHOOL OF BIOTECHNOLOGY

The pattern of JNUEE 2020-21 will be based on Multiple Choice Questions (MCQs) through Computer Based Test (CBT)

Ph.D.

<table>
<thead>
<tr>
<th>Sl. No.</th>
<th>Name of Centre</th>
<th>Sub. Code &amp; Sub. Code Number</th>
<th>Syllabus for Entrance Examination</th>
</tr>
</thead>
</table>
| 1      | School of Biotechnology | Biotechnology – SBTH (904) | **Chemistry**

Chemical periodicity, Structure and bonding, Concepts of acids and bases, Properties and functions of metals and non-metals, Transition elements and coordination compounds, Characterisation of inorganic compounds, Analytical chemistry, Nuclear chemistry, Polymer chemistry, Molecular spectroscopy, Chemical thermodynamics, Electrochemistry, Chemical kinetics, Colloids and surfaces, numerical problems related to mole concept, pH, dissociation constants, emf, rate constant etc. IUPAC nomenclature of organic molecules, isomerism, Principles of stereochemistry, Aromaticity, Organic reactive intermediates, Organic reaction mechanism, Common named reactions and rearrangements, Organic transformations and reagents: Functional group interconversion, Asymmetric synthesis, common heterocyclic compounds containing one or two heteroatoms (O, N, S),Chemistry of natural products: (Carbohydrates, proteins and peptides, fatty acids, nucleic acids etc.),Structure determination of organic compounds.

**Physics, Chemistry and Mathematics**

*Class XIIth Syllabus (As per CBSE)*

**Biochemistry**

Biomolecules
Amino Acids, Peptides and Proteins
Nucleic Acids, Carbohydrates and Lipids

Enzyme Kinetics and Inhibition
Introduction about enzymes, classification, activity, cofactors
Chemical Kinetics
Regulation of enzyme activity by various factors such as pH, temperature etc.
Enzyme Inhibition—various types with examples
Kinetics of enzyme inhibition
Enzyme activity and purification—sub cellular fractionation and specific activity
Enzymes: Mechanism, Structure and Regulation
<table>
<thead>
<tr>
<th>Substrate specificity of enzymes</th>
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</thead>
<tbody>
<tr>
<td>Functional Groups Essential for Catalysis</td>
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<tr>
<td>Reaction Mechanism of Enzyme Active sites</td>
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<td>Regulatory Enzymes</td>
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<td>Allosteric Enzymes</td>
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<td>Covalently modulated regulatory enzymes</td>
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<tr>
<td>Covalent Activation of Zymogens</td>
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<tr>
<td>Isozymes</td>
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</tbody>
</table>

**Introduction to Metabolism**
- Metabolic Pathways
- Organic Reaction Mechanisms
- Experimental Approaches to the study of Metabolism
- Thermodynamics of Phosphate compounds
- Oxidation-Reduction Reactions

**Carbohydrate Metabolism**
- Glycolysis
- Fermentation: The Anaerobic Fate of Pyruvate
- Metabolism of Hexoses Other than Glucose

**Glycogen Breakdown & Synthesis**

**Glucoseogenesis**

**Pentose Phosphate pathway**

**Metabolic Regulation and Control**

**Citric Acid Cycle**
- Cyclic Overview
- Metabolic Sources of Acetyl Coenzyme A
- Enzymes of the Citric Acid Cycle
- Regulation of the Citric Acid Cycle

**Electron Transport and Oxidative Phosphorylation**
- The Mitochondrion
- Electron Transport
- Oxidative Phosphorylation
- Control of ATP Production

**Lipid metabolism**

**Lipid Digestion, Absorption and Transport**

**Fatty Acid Oxidation & Biosynthesis**

**Ketone Bodies**

**Regulation of Fatty Acid Metabolism**

**Amino Acid Metabolism**
- Role of essential amino acids
- Amino Acid Deamination
- The Urea Cycle
- Metabolic Breakdown of Individual Amino Acids
- Amino Acids as Biosynthetic Precursors
- Amino Acids Biosynthesis
- Nitrogen Fixation

**Nucleotide Metabolism**
- Synthesis of Purine Ribonucleotides
- Synthesis of Pyrimidine Ribonucleotides
- Formation of Deoxyribonucleotides
- Nucleotide Degradation
- Biosynthesis of Nucleotide Coenzymes

**Glycoproteins & Glycolipids**

**Hormones & Vitamins**

**Metabolic disorders and diseases**
Integration of Metabolism & Organ Specialization
Major Pathways and Strategies of Energy Metabolism: A Summary
Organ Specialization & Metabolic Homeostasis

Structural Biology and Biophysical Chemistry

Interactions in Biological Systems
Intra and inter molecular forces, electrostatic interactions
and hydrogen bonding interactions
van der Waals and hydrophobic interactions
Disulfide bridges
Role of water and weak interactions

Structure of Proteins
Conformational properties of polypeptides
Primary and secondary structure (α-helix and β-sheet structures etc.)
Tertiary and quartenary structure
Structural features of membrane proteins
Secondary and tertiary structure prediction of protein conformation

Multiple equilibrium
Titration of proteins to evaluate net and total charge
Scatchard and Hill plots
Folding-unfolding equilibrium and denaturation of proteins
Effect of temperature and solvent conditions on the thermodynamics of protein
folding-unfolding equilibrium
Kinetics of protein folding

Techniques for the study of Macromolecular structure
Analytical Ultracentrifugation: Sedimentation velocity and equilibrium,
determination of molecular weights
Microcalorimetry (DSC and ITC) and its applications
Circular Dichroism spectroscopy
UV, Visible and Fluorescence spectroscopy
X-ray diffraction
Nuclear Magnetic Resonance (NMR)
Mass Spectrometry

Microbiology
Bacterial diversity
How to classify bacteria
Chemical/Biochemical reactions
Nutrient preference and other biochemical properties
16S rRNA based classification
Three domain classification of microorganisms
Microbial ecology
Carbon and Nitrogen cycles
Phosphorus and Sulfur cycles
Manganese and Mercury cycles
Interaction between elemental cycles
Biogeochemical cycles in relation to climate change
Diversity of bacterial flora in humans
Diversity of microorganisms associated with different anatomical aras in humans
Alterations in microbiome diversity with disease
Structure and Function of the Prokaryotic cell
Peptidoglycan structure and biosynthesis
Cell surface proteins and their role in bacterial pathogenesis
Structure and biosynthesis of cell surface organelles
Chaperone – Usher pilus in Gram negative bacteria
Covalent anchorage of cell-surface proteins in gram positive bacteria
Ultrastructure and assembly of motility structures: Type IV pilus and bacterial flagellum
Atomic structure of the bacterial ribosome
Bacterial Host-Parasite relationships
Mechanism of bacterial pathogenesis
Bacterial structure in relation to pathogenicity
Bacterial protein toxins/endotoxins
Antimicrobial agents used in the treatment of infectious disease
Mechanism of antibiotic action
Antibiotic resistance
Virology
Basic concepts of virus structure
Helical, Icosahedral and Complex structures
Viral genome replication
Viral entry to exit from the infected cells with reference to VSV, adenovirus and retrovirus
Cellular defences against virus infections
Strategies devised by viruses to escape the innate and adaptive immune responses
Antiviral chemotherapy
Antiviral drugs targeting attachment to release of virus particles and their mechanism of action
Modern approaches of virus control
Antisense RNA, siRNA, ribozymes, miRNA
Introduction to eukaryotic viral vectors

Industrial Microbiology
Isolation and Presentation of Microorganism
Improvement of strains
Primary metabolism
Secondary Metabolism
Recombinant proteins
Sterilization
Media Design
Scale up principles
Prokaryotic Molecular Biology

Brief introduction to molecular biology & processes. Denaturation and renaturation of DNA. Tm, GC content from Tm. Renaturation kinetics of DNA and complexity of DNA. Cot curves. DNA-DNA hybridization-relatedness of difference genes and species.

Bacterial Genome organization:
Evolution of genome, Genome content, C-value paradox, Packing ratio, density of genome. Bacterial genome. Short and long range organization, Proteins associated with bacterial genome and their function.

Bacteriophages: Genome and infection and Biology

Plasmids:
### Action of colicins. Colicin genes. Immunity and Lysis proteins. Export and Action

### Insertion sequences and Transposons

Replication.
Elucidation of DNA structure and lead to copying mechanism. Models for DNA replication, Meselson and Stahl experiment 1957. Replication of the E. coli genome: John Cairns experiments: Single origin of replication, and bidirectional replication, Ross Inman’s experiment- denaturation mapping studies, Mechanisms of replication: Theta, rolling circle (sigma), D-loop. Semi discontinuous replication: Pulse chase experiment, Okazaki’s experiment on T4 bacteriophage DNA, Use of T4 ligase mutants. Origin of replication– Commonality among E. coli, yeast and SV40 origin of replication

Enzymes of DNA replication: DNAs polymerases: DNA polymerase I not the primary enzyme: Its other role in maintenance of DNA integrity. Processivitiy, direction of DNA polymerization, fidelity, E. coli DNA polymerase I and its components, Klenow fragment and other domains.


DNA recombination.
Definition, applications of natural recombination, Classification of recombination, Various possibilities of recombination, Models of homologous recombination, Steps involved in homologous recombination, Recombination events during Single and double strand breaks, Holliday Junction and resolution, Protein machinery of recombination, branch migration and resolution

Mutations and Repair.
Mutants, Mutations and Mutagenesis: definition, reasons, measuring mutagenicity. Classifications of mutations: On the basis of location, structure, function and phenotype. Conditional, spontaneous and induced mutations, Missense, nonsense, frameshift mutations, Reversions. Mutagenic agents_ high energy, chemical and natural, Suppressor tRNA, missense repressors, frameshift suppressors

Repair: DNA repair: Mismatch repair, Base excision repair, nucleotide excision repair, direct repair, enzyme of repair, Error prone repair, SOS response

Transcription

Processing of tRNA and rRNA. Cleavage of T7 early mRNAs by RNase III. Control at...
the processing level. Regulation of transcription in bacteria: Introduction and repression. Repressor as a regulatory molecule. Coordinated control of gene clusters. Positive and negative regulation: Regulation of transcription of lac, trp, ara, his, and gal operons. Regulation through catabolite repression. CAP protein as a positive control factor.

Transcriptional regulation in bacteriophage Lambda: Lytic and Lysogenic switch. Role of various regulatory proteins.

Translation

Eukaryotic Molecular biology & Molecular Genetics
Nuclear Matrix and gene regulation: Nuclear matrix, nuclear matrix proteins, nuclear-matris, structure and function, DNA Binding Properties of the Nuclear Matrix and Individual Matrix Prose.
Ins, Association of chromosome territories with the nuclear matrix: Disruption of human chromosome territories correlates with the release of a subset of nuclear matrix proteins, nuclear matrix targeting, signal, higher order chromatin structure and unclear matrix, transcriptional repression and nuclear lamina nuclear matrix and expression of globin gene
Principle of eukaryotic Gene regulation: gene regulating sequences, promoter, enhancers, regulatory elements, locus control region, gene activation and gene repression, transcription activators and repressors, TBP, GTFs, TBP associated factors (TAFs), RNA polymerases I, II, III, structure and function, mediators, general transcription factors, classes of transcription factors, structure and function, DNA-protein recognition in genome, Transcriptional regulatory networking, gene expression and Cancer progression
Programmed cell death: Apoptotic and necrotic cell death, apoptotic and anti-apoptotic genes, tumour suppressor genes, cell fate through decision between cell cycle arrest and apoptosis
Gene regulation and disease: order vs disorder in transcriptional regulation, network disfunction and disease, transcriptional therapeutics in diseases control.

Cell Biology
Composition and organization of biological membranes:
Membrane lipids: Properties and how they affect the curvature and fluidity of the membrane lipid rafts: composition, a platform for organization of signaling complexes
Membrane proteins: Properties and orientation in biological membranes
Membrane asymmetry
Practice questions and discussion

Cellular transport mechanisms
Principles of transport of small molecules across membrane: organization and functioning of carriers and channels, membrane excitability
Practice questions and discussion

Protein transport across membranes:
Transport across nuclear pore
Transport across ER and from ER to other organelles by vesicular transport
Post-translational modifications of proteins and their role in protein transport
Endocytosis, phagocytosis, exocytosis
Practice questions and discussion

Cell cycle
Components of cell cycle regulatory mechanisms: Cyclin-CDK complexes, CKIs and ubiquitin ligases in cell cycle regulation
Cell Cycle control mechanisms: Checkpoints, Regulation and maintenance of G1, control of genome replication, DNA damage and cell cycle regulation
Cell cycle defects and cancer
Practice questions and discussion

Cell Signalling
Proteolysis based signaling (Wnt, Notch, Hedgehog): Structural and functional basis for normal and abnormal signaling
Cross-Talk Between Different Intracellular Pathways: Interactions between GPCRs and tyrosine kinase receptors; cross-cascade signaling of proteins involved in gene transcription. (Example: Cross talk between pattern-recognition receptors and Toll-like receptors.
Molecular biology of ionic signaling: Calcium signaling in excitation-contraction coupling in cardiomyocytes; Neutrophils and inflammation

Cytoskeleton:
Cytoskeleton networks: actin, Microtubules and intermediate filaments.
Physical and biochemical properties of extracellular matrices: Collagen, Fibronectin (Tensional homeostasis and fibrosis)
Role of cytoskeleton network and extracellular matrix in cell migration, cell polarity, and cancer

Cell junctions:
Type of junctions: tight junction, anchoring junction, and Communicating junction
Composition and function of junctions
Cell junctions: tissue development, and disease

Analytical Techniques
Concept of pH buffer and solutions
Electrophoresis techniques
Chromatography techniques
Protein and DNA estimation
Sequencing of proteins and DNA
Spectroscopic techniques (UV – Visible, IR fluorescence, CD, NMR and Mass Spectrometry)

GENETIC ENGINEERING AND ITS APPLICATIONS
Introduction to genetic engineering, general work flow, potentials and its limitations.
Host, vector and steps in cloning. Cloning of cDNA, and construction of cDNA library.
Analysis of a cloned DNA fragment using restriction digestion and DNA sequencing.
Concept, strategies, general workflow and variant of the PCR.
The use of PCR in gene recombination, deletion, insertion and site directed
mutagenesis.
PCR in molecular diagnostics: Detection of the pathogens, and its potentials
PCR based diagnostics of the minimum residual disease (MRD) with case study
Application of real time (RT) PCR in the study of gene expression.
Use of genetic engineering for recombinant protein technology
Expression of foreign gene in E. coli, Baculovirus and Pichia expression systems.
Inclusion bodies formation and strategies for the production of soluble proteins.
Cell synchronization and its importance in the genetic engineering.
Methods of introduction of DNA into mammalian cells.
Transient and stable integration of foreign DNA into mammalian cells.
The viral vectors and their use in gene delivery
The Adeno viral vector, unarmed Herpes and vaccinia viral vectors and their importance
Principles and methods of the gene targeting for model organism.
Strategies for Gene knockouts in animals.
Gene disorder and Gene therapy
The packaging of retroviral vectors and helper cells for gene therapy
Development of animal models for gene therapy.
Detection of mutations in neoplastic diseases
Immuno – Suicide gene therapy in neoplastic diseases.
Somatic and germ line gene therapy in vivo and ex-vivo experiments, Bioethics
Role of integrated OMICS in the genetic engineering
Importance of computational tools and system biology for genetic engineering
Use of genome wide screening in the functional genomics
Recent breakthrough and advances in the genome engineering.
Recent trends and development in the gene therapy.
Plant Genetic Engineering: Introduction to plant tissues culture; Agrobacterium infection biology; Explant selection and regeneration; Plant transformation (Agrobacterium-mediated, Microprojectile bombardment-mediated and Floral-dip method of plant transformation); Transgenic Selection and Regeneration; Discussion.

Applications of plant genetic engineering: Understanding issues encountered in plant biotechnology Germlasm Improvement; Plant and human health; Plant Molecular farming (Bioreactors); Bio-fortification; Discussion. Precise genome engineering.

**Immunology**

**Introduction to the Immune System**
Historical background, cellular and molecular components of immune system

**Innate Immunity**
Innate immune cells, Pathogen associated molecular pattern (PAMP), Pathogen recognition receptors (PRR), Type 1 IFN, Interferon Stimulated Genes (ISGs), Complement system.

**The Recognition of Antigen**
Structure of a typical antibody molecule, Antigen recognition by T cell and B cells, Generation of lymphocyte antigen receptors, TCR gene rearrangement, Antigen presentation to lymphocytes, MHC/HLA complex.

**The Development and Survival of Lymphocyte**
The development of T lymphocytes in the thymus, Development of B lymphocytes, Positive and negative selection of T cells, Maturation of lymphocytes in peripheral lymphoid tissue

**The Adaptive Immune Response**
T cell mediated immunity, Entry of naïve T cells and APCs into peripheral lymphoid organs, Naive T cells priming by pathogen-activated dendritic cells,T cell-mediated toxicity, Macrophage activation by TH1 cells, humoral immune response, Immunological memory, Cytokines

**Immune system in Disease**
Self tolerance, autoimmune diseases, transplant rejection, allergy and anaphylactic shock, AIDS immunology
Immune aging
Immunosenescence, Immune-exhaustion during aging and chronic infection, Gut Immunology

NK cells and Diseases
Inhibitory receptors, KIR receptors, CTL responses in cancer, Immunotherapy

Characterization of lymphocytes specificity, frequency and function
Lymphocyte isolation, ELISPOT assay, Multicolor flow cytometry, HLA-tetramer assay

Plant Biotechnology

Prologue to Plant’s World
Plant and human society; Growth and development; Plant hormones; Photosynthesis

An Introduction to Plant Genetics
Plant genome organisation; Polyploidy; Genetic diversity; Molecular markers and mapping; Phylogenetics and genomics; Breeding and methods; Discussion; Forward vs. reverse genetics;

Basic Aspects/Techniques of Plant Tissue Culture
Introduction; Totipotency and Regeneration; Nutritional media and growth regulators; Problems in plant tissue culture; Discussion.

Transgenic Crops
Global status of transgenic crops; Traits under development; Case Studies; Challenges; Discussion

Applications
Plant Molecular farming (Bioreactors); Renewable energy crops and biofuels; Biofortification for Human Health; Discussion

Safety and Regulations
Understanding issues encountered in plant biotechnology; Risk assessment; Environmental impact and gene flow; Regulation and labelling; Discussion.

Bioinformatics
Biological Databases

Pairwise and Multiple sequence alignments

Genome Analysis
Polymorphisms in DNA sequence, Introduction to Next Generation Sequencing technologies, Whole Genome Assembly and challenges, Sequencing and analysis of large genomes, Gene prediction, Functional annotation, Comparative genomics, Human genome project

Bioprocess Technology
Introduction: A systems approach to Biology
Introduction to material and energy balances
Elemental balances in biological systems: Degrees of reductance
Energy balance in biological systems: Enthalpy efficiencies
Growth kinetics in batch systems
Growth and substrate utilization in continuous systems
Concept of maintenance
Product formation in anaerobic systems
Product formation kinetics  
Continuous reactor systems with recycle  
Fed batch reactors  
Feed design in fed batch reactors and its analysis  
Heat transfer in bioreactors  
Mass transfer in bioreactors: Concept $K_l$  
$L_a$ estimation methods  
Scale up principles  

**Downstream Processing**


Product isolation – extraction, principle of extraction, partition coefficient, extraction factor, batch extraction, cascades, idealized stage operation, differential extraction, height of a transfer unit, number of transfer units, adsorption, adsorption isotherms, batch adsorption, adsorption in a CSTR.

Product Purification – Chromatography, yield and purity and resolution


Membrane filtration: tangential flow filtration, micro-filtration, ultra-filtration, reverse osmosis. Transport equations, gel layer formation, osmotic pressure. Time required for filtration in T.F.F.

Polishing - Crystallization – separation, purity, nucleation, crystal growth, characteristic length, crystal size distribution, dominant crystal length. Lyophilisation and drying.


### 11. SCHOOL OF SANSKRIT AND INDIC STUDIES

The pattern of JNUEE 2020-21 will be based on Multiple Choice Questions (MCQs) through Computer Based Test (CBT)

**SYLLABUS**

**I. REGULAR COURSES**

B.Sc.-M.Sc. Integrated program in Ayurveda Biology

<table>
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<th>Sl. No.</th>
<th>Name of Centre</th>
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<tr>
<td>1</td>
<td>School of Sanskrit and Indic Studies (SSIS)</td>
<td>Ayurveda Biology - AYBU (411)</td>
<td><strong>Syllabus:</strong> The syllabus is 10+2 level CBSE for Sanskrit, Science and General Aptitude questions.</td>
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## M.A.

<table>
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<tr>
<th>Sl. No.</th>
<th>Name of Centre</th>
<th>Sub. Code &amp; Sub. Code Number</th>
<th>Syllabus for Entrance Examination</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>School of Sanskrit and Indic Studies (SSIS)</td>
<td>Sanskrit – SANM (228)</td>
<td><strong>Syllabus:</strong> Test may cover the following areas: Vedic &amp; Agamic Studies, Sanskrit language and literature, Indian Philosophical Systems, Sanskrit Poetics and Aesthetics, Sanskrit and Modern Indian Languages, Sanskrit Linguistics including Computational Linguistics, Indian Intellectual and Cultural Traditions, Social thought, Polity, Economy, Architecture, Fine Arts, Environmental Awareness, Sanskrit Grammar, Indian Logic, Astronomy and Mathematics, Science and Technology, Argumentation and Interpretation, and Role and Place of Sanskrit in Indo European Studies.</td>
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## M.Phil & Ph.D.

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<tr>
<th>Sl. No.</th>
<th>Name of Centre</th>
<th>Sub. Code &amp; Sub. Code Number</th>
<th>Syllabus for Entrance Examination</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>School of Sanskrit and Indic Studies (SSIS)</td>
<td>Sanskrit Studies – SANP (170) &amp; SANH (906)</td>
<td><strong>Syllabus:</strong> The test will cover the following areas: Indian Philosophical Systems; Traditions of Yoga &amp; Sādhanā, Sanskrit literature and Poetics; Sanskrit Grammar and Grammatical Theory; Modes of Disputation and Interpretation of Texts; Sanskrit Linguistics including Computational Linguistics; Vedic, Agamic and Purānic Studies; Pali and Prakrit Studies; Indian Social Thought, Religious Studies; Sanskrit Manuscriptology; Issues in Sanskrit Studies and Researches; Research Methodology &amp; Research Aptitude.</td>
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## II. Part-time Courses

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<tr>
<th>Sl. No.</th>
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<th>Syllabus for Entrance Examination</th>
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</thead>
<tbody>
<tr>
<td>1</td>
<td>School of Sanskrit and Indic Studies (SSIS)</td>
<td>Pali – PALC (705)</td>
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<td>2</td>
<td></td>
<td>Sanskrit Computational Linguistics – SCLC (706)</td>
<td>Candidates seeking admission shall be examined on the basis of the Computer Based Test (CBT). The questions shall be objective type and shall be within the broad spectrum of General Knowledge, general aptitude for the subject and English Language.</td>
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<tr>
<td>3</td>
<td>COP in Yoga Philosophy – YOPC (707)</td>
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<td>4</td>
<td>COP in Vedic Culture – VECC (708)</td>
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<td>5</td>
<td>COP in Sanskrit – SANC (709)</td>
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</table>
12. SPECIAL CENTRE FOR STUDY OF NORTH EAST INDIA

The pattern of JNUEE 2020-21 will be based on Multiple Choice Questions (MCQs) through Computer Based Test (CBT)

**M.Phil. & Ph.D.**

<table>
<thead>
<tr>
<th>Sl. No.</th>
<th>Name of Centre for the Study of North East India (SCSNEI)</th>
<th>Sub. Code &amp; Sub. Code Number</th>
<th>Syllabus for Entrance Examination</th>
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<tbody>
<tr>
<td></td>
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<td>North East India Studies- NESP (175) &amp; NESH (882)</td>
<td>• Understanding North East India and its neighbouring areas: history, culture, society, politics, economic development, ecology and contemporary policies&lt;br&gt;• Research Methodology: Various interdisciplinary methods such as approaches to social sciences, qualitative, quantitative, interpretative and historical methods&lt;br&gt;• In addition to the above, the syllabus covers themes pertaining to North East India, such as religion and society, tribes and ethnicity, government and politics, economic development, frontiers and borderlands, and cultural histories.</td>
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13. SPECIAL CENTRE FOR MOLECULAR MEDICINE

The pattern of JNUEE 2020-21 will be based on Multiple Choice Questions (MCQs) through Computer Based Test (CBT)

**M.Sc. Programme**

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<thead>
<tr>
<th>Sl. No.</th>
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<th>Sub. Code &amp; Sub. Code Number</th>
<th>Syllabus for Entrance Examination</th>
</tr>
</thead>
</table>
Section 6: Medicinal Chemistry: Drug-receptor interaction, DNA, Protein, Hormones as receptor, Pharmacokinetics, G-protein coupled receptor, Pharmacodynamics.
Section 7: Cell biology: Organelles, Cell-cell interaction, Cell signalling/ trafficking, Cell cycle.
Section 8: Drug/ Drug resistance.
Section 9: Immunology: Basic immunology.
Section 10: Aptitude, Bioinformatics, Others.

Ph.D.

<table>
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<th>Syllabus for Entrance Examination</th>
</tr>
</thead>
</table>
| 1      | Centre for Molecular Medicine (SCMM) | Molecular Medicine-CMMH (905) | Section A; General Aptitude/Research Methodology  
Section B; Different Subject Areas of Molecular Medicine  
Section A  
Aptitude / Research Methodology  
Basic Maths: geometry, statistics, Arithmetics, Log. Basic knowledge of Computer science.  
Section B  
Biochemistry: Metabolism, Nutrition, Biomolecules, Hormones, Enzymes, Omics.  
Microbiology: Bacterial genetics, Antibiotics mode of action, Infectious disease, Industrial Biotechnology.  
Physiology, Diseases, Pharmacology, Genetics, Molecular Biology, Developmental Biology, Zoology, Population genetics. Botany, Molecular Biology.  
Advanced Chemistry: Spectroscopy, Molarity/Normality, Radioactivity, Atomic Structure, Acid base, pH.  
Medicinal Chemistry: Drug-receptor interaction, DNA, Protein, Hormones as receptor, Pharmacokinetics, G-protein coupled receptor, Pharmacodynamics.  
Cell biology: Organelles, Cell-cell interaction, Cell signalling/ trafficking, Cell cycle. Drug resistance. Immunology |

14. CENTRE FOR THE LAW & GOVERNANCE

The pattern of JNU 2020-21 will be based on Multiple Choice Questions (MCQs) through Computer Based Test (CBT)

M.Phil & Ph.D.

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<tr>
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</tr>
</thead>
</table>
| 1      | Centre for the Law & Governance (CSL&G) | Law & Governance – CLGP (171) & CLGH (907) | The test will have a 50% weight for social science research methods and 50% weight for domain knowledge covering the disciplines of Economics, Political Science, Sociology, Public Administration, Anthropology, and Law. The questions will be at the level of an advanced Masters and all candidates will be required to attempt questions from all these disciplines.  
The broad coverage of the subject areas of these disciplines are as follows: “  
- Political Science: concept and theories of governance; theories of the State, democracy and development; decentralisation; global governance; politics of identity; multilevel governance; civil society and social capital; neoliberalism and globalisation; social justice; gender, development and governance; and, public administration. |
15. SPECIAL CENTRE FOR NANO SCIENCES

The pattern of JNUEE 2020-21 will be based on Multiple Choice Questions (MCQs) through Computer Based Test (CBT)

M.Tech Programme in Nanoscience (NNST-182) & Nanoelectronics (NNET-190)

<table>
<thead>
<tr>
<th>1</th>
<th>Special Centre for Nano Sciences</th>
<th>Nanoscience – NNST (182)</th>
<th>Chemical Sciences:</th>
</tr>
</thead>
</table>
| 2 | Nanoelectronics – NNET (190) | Unit-I: Electronic Transport in semiconductor, PN Junction, Diode equation and diode equivalent circuit. Breakdown in diodes, Zener diodes, Tunnel diode, Semiconductor diodes, characteristics and equivalent circuits of BJTs, JFETs, MOSFETs, IC fabrication-crystal growth, doping, bonding, Thin film active and passive devices. Rectifiers, Voltage regulated ICs and regulated power supply, Biasing of Bipolar junction transistors and JFET. Single stage amplifiers, Multistage amplifiers, Feedback in amplifiers, oscillators, function generators, multivibrators, Operational Amplifiers (OP AMP): Characteristics and Applications, Computational Applications, Integrator, Differentiator.  
Unit-IV: Microprocessor: INTRODUCTION TO 8085, Basic Concepts of Microprocessors, CENTRAL PROCESSING UNIT:  
CPU, I/O devices, clock, memory, bussed architecture, tristate logic, address bus, data bus and control bus. Development of semiconductor memory, internal structure and decoding, memory read and write timing diagrams, MROM, ROM, EPROM, EEPROM, DRAM: Intel 8085 microprocessor. | enzymes and enzyme kinetics.  
**Cell Biology:** Membrane structure and function; Cell organelles; Cell division and cell cycle. Microbes, infectious disease biology and microbial diseases.  
**Fundamental Processes:** DNA replication, repair and recombination, RNA synthesis and processing and Protein synthesis  
**Immunology:** Innate and adaptive immunity, antigens, antibody, antigen-antibody interactions, immune responses, congenital and acquired immune deficiencies, vaccines.  
**Genetics:** Mendelian principles, Gene: Allele, multiple alleles, mutation types and cause.  
**Human Physiology:** Blood, coagulation, blood groups, Heart, Endocrine glands, Hormones and diseases. |
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<td>[Type of Questions for Entrance Examination: Multiple choice questions]</td>
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<tr>
<td>1</td>
<td>Special Centre for Nano Sciences</td>
<td>Nano Sciences – NNSH (908)</td>
<td><strong>Part-A: Research Methodology (Common for all)</strong></td>
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<td>1. <strong>General Science</strong>: General appreciation and understanding of science including matters of everyday observation and experience.</td>
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<td>2. <strong>Environmental awareness</strong>: Pollution and its impacts, climate change, sustainable development. 3. Current events: Knowledge of significant national and international events.</td>
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<td>4. <strong>General mental ability and reasoning</strong>: Reasoning and analytical abilities.</td>
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<td>5. <strong>Elementary Computer Science</strong>: Basic computer awareness and its uses.</td>
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<td>6. <strong>Interactive English</strong>: Grammar, vocabulary, sentence completion, usage, synonyms, antonyms, one word substitute, idioms/phrases, error detection and comprehension.</td>
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<td>7. <strong>Information and Communication Technology (ICT)</strong>: Terminology and abbreviations used in ICT, applications of ICT in academics and research.</td>
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<td>8. <strong>Research aptitude</strong>: Basic Concepts- 1. Meaning, nature, significance and types of research. 2. End to end process of research, Formulation of research problem, Design strategies in Research- Descriptive Studies, Analytic Studies, Experimental studies, Intervention trials etc., research proposal, Synopsis, Hypothesis, Data collection, Literature survey, Sampling, Interviewing, questionnaire, Data processing, Interpretation, Report writing, Bibliography, Data presentation and summarization, Graphical presentation of data, Research Ethics. 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.</td>
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<td>9. <strong>Basic concepts of Statistical methods for research</strong> (Probability, Test of significance, Standard deviation, Measures of central tendency, Measures of variability, Measures of Relationship – Correlation, Hypothesis Testing – parametric and non-parametric tests;, Proportions, Relative risk, Odds ratio, Student t test, Anova, Error bars)</td>
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<td><strong>Part-B: Subject Specific</strong></td>
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<td>In Part-B, candidate can choose any one of the Subject Streams: (Physical Sciences) or (Biological Sciences) or (Chemical Sciences) or (Engineering Sciences) for appearing in the Entrance Exam</td>
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<td><strong>Physical Sciences</strong></td>
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</table>
Biomolecules and their relevant interactions: Biomolecules (carbohydrates, lipids, proteins, nucleic acids and vitamins). Stabilizing interactions (Van der Waals, electrostatic, hydrogen bonding, hydrophobic interaction, etc.). Biophysical chemistry (pH, buffer, reaction kinetics, thermodynamics, colligative properties). Bioenergetics, glycolysis, oxidative phosphorylation, coupled reaction, group transfer, biological energy transducers. Principles of catalysis, enzymes and enzyme kinetics, enzyme regulation and isozymes.


Fundamental Processes: DNA replication, repair and recombination. RNA synthesis and processing. Protein synthesis.

Immunology: Innate and adaptive immunity, antigens, antibody, antigen-antibody interactions, immune responses, immune response during bacterial (tuberculosis), parasitic (malaria) and viral (HIV) infections, congenital and acquired immunodeficiencies, vaccines.

Genetics: Gene, Allele, mutation types, cause and inheritance biology.

Human Physiology: Blood, coagulation, blood groups, haemoglobin. Endocrine glands, hormones and diseases, neuroendocrine regulation.

Chemical Sciences


Periodic Table: Periodic classification of elements and periodicity in properties. Chemical bonding and shapes of compounds: Types of bonding; VSEPR theory and shapes of molecules, hybridization, dipole moment, lattice energy. Main group elements (s and p blocks): Group relationship and gradation in properties. Transition metals and inner transition metals (d and f block): Characteristics of 3d elements, oxide, hydroxide and salts of first row metals, coordination complexes, metal complexes.

Analytical Chemistry: Principles of qualitative and quantitative analysis, acid-base, oxidation reduction and precipitation reactions, use of indicators and organic reagents in inorganic analysis, radioactivity, nuclear reactions, applications of isotopes.

Engineering Sciences

Unit-I: Electronic Transport in semiconductor, PN Junction, Diode equation and diode equivalent circuit. Breakdown in diodes, Zener diodes, Tunnel diode, Semiconductor diodes, characteristics and equivalent circuits of BJT, JFET, MOSFET, IC fabrication-
crystal growth, epitaxy, oxidation, lithography, doping, etching, isolation methods, metalization, bonding, Thin film active and passive devices.


**Unit-III:** Rectifiers, Voltage regulated ICs and regulated power supply, Biasing of Bipolar junction transistors and JFET. Single stage amplifiers, Multistage amplifiers, Feedback in amplifiers, oscillators, function generators, multivibrators, Operational Amplifiers (OP AMP) -characteristics and Applications, Computational Applications, Integrator, Differentiator, Wave shaping circuits, F to V and V to F converters. Active filters, Schmitt trigger, Phase locked loop.

**Unit-IV:** Logic families, flip-flops, Gates, Boolean algebra and minimization techniques, Multivibrators and clock circuits, Counters-Ring, Ripple. Synchronous, Asynchronous, Up and down shift registers, multiplexers and demultiplexers, Arithmetic circuits, Memories, A/D and D/A converters.

**Unit-V:** Modulation index, frequency spectrum, generation of AM (balanced modulator, collector modulator), Amplitude Demodulation (diode detector Other forms of AM: Double side band suppressed carrier, DSBSC generation ( balanced modulator), Single side band suppressed carrier, SSBSC generation (filter method, phase cancellation method, third method), SSB detection, Frequency and Phase modulation, modulation index and frequency spectrum, equivalence between FM and PM, Generation of FM (direct and indirect methods), FM detector (slope detector)

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**16. SPECIAL CENTRE FOR DISASTER RESEARCH**

The pattern of JNUEE 2020-21 will be based on Multiple Choice Questions (MCQs) through Computer Based Test (CBT)

**M.A. Programme**

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</thead>
</table>
| 1      | Special Centre For Disaster Research (SCDR) | Disaster Studies - DSSM (239) | • Social Science Perspectives of Disasters, Constitution, Law, Governance and Sustainable Development Goals(SDGs)
• Definition, Concepts and Theories around the key terms in disaster studies [Understanding of ‘Disaster’, ‘Risk’, ‘Hazard’, ‘Vulnerability’, ‘Resilience’]
• Development and Disasters, Geography of Disasters and GIS Application [Regional Imbalance, Health Issues, Fragile areas and Critically Endangered Zones]
• Computer, Information and Communication Technologies, Artificial Intelligence, Database Systems [Application of modern scientific tools in early warning systems, relief, rehabilitation and appropriate measurement of damages and losses]
• Ecology and Environment [Dams, Pollution, Climate Change, Effluent Discharges, Human Consumption as cause of environmental destruction and increased vulnerability of ecosystems] |
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<th>Sub. Code &amp; Sub. Code (Number)</th>
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</tr>
</thead>
</table>
| 1      | Special Centre For Disaster Research (SCDR) | Disaster Studies - DSSH (911) | **PART A:**
                                                   Research Methodology in Disaster Studies, Surveys, Statistical Tools & Analysis, Data Management, Techniques of pre and post-disaster needs assessment (PDNA), Comparative Case Study Methods for evaluating governance and community capacity for last mile service delivery.

**PART B:**
2. Social Sciences and Anthropology of Disasters; Vulnerable communities in fragile environmental and ecological regions; Geography, Environment and Disasters; Geospatial Mapping and human security.
3. Disaster Economics, Planning and Preparing against economic losses, Role of Macro and Micro level economic institutions.
4. Database, Artificial Intelligence and Early Warning Systems in the management of rescue and relief operations.