

# PROGRAMME GUIDE

## B. Sc. (Honours) Biochemistry



Indira Gandhi National Open University  
New Delhi

**Printed study material is our mainstay in learning paradigm. Our study material is prepared by a team of experts keeping in view the interest of the learner. Each course has a course Expert Committee with distinguished academics and professionals involved in the course preparation. The course material is written in such a manner that the learners can study it by themselves with a minimum assistance from our Academic Counsellors at the Study Centres. Further, text books and reference books are available in the libraries attached to the Study Centres and Regional Centres. Therefore, there is no need for any cheap or condensed guides for pursuing courses of IGNOU. In fact these may harm the learners. The University strongly advises the learners not to take recourse to such type of guides available in the market.**

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July, 2020

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*Further information about the Indira Gandhi National Open University courses may be obtained from the University's office at MaidanGarhi, New Delhi-110 068.*

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QR Code of Some of the Useful Web Links



eGyankosh Online  
(for Online Course Materials)



For Registration online



iGram  
(IGNOU Grievance control Room)



To watch Live Telecast/  
To listen live Broadcast



Assignments



Online Examination form

**Note: To open the above QR Codes can be scanned and open through the QR Code Scanner Application/App of your smart mobile phone.**

Dear Learner,

Welcome to IGNOU and the degree programme: B. Sc. (Hons) Biochemistry [BSCBCH]. As you have joined one of the world's largest university imparting education through Open and Distance mode, it is important that that you are well aware of the university and how it functions. You may also be keen to know in some detail about the programme you have joined and the way in which the university imparts instruction. This Programme Guide gives you the necessary information that will help you in knowing the university and pursuing the programme. We therefore advice you to **keep this Programme Guide safely till you complete the Programme.**

**Part I** of this Programme Guide gives you the 'Programme Details' in terms of The University, B. Sc. (Hons) Biochemistry Programme, Planning your Studies, Fee Structure and Schedule of Payment, Instructional System, Evaluation, etc.

**Part II** of this Programme Guide gives the syllabus of all the courses that are on offer in BSCBCH. This will you help you, among other things, in familiarizing yourself with the exact courses you would be studying under each type of courses in the programme viz. Core Courses, Discipline Specific Electives, Generic Electives, Ability Enhancement Courses and Skill Enhancement Courses.

**Programme Coordinators, BSCBCH**

**PART I**  
**PROGRAMME DETAILS**

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## 1. THE UNIVERSITY

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The Indira Gandhi National Open University (IGNOU) is the world's largest University. It is a Central University established by an Act of Parliament in 1985, to advance and disseminate learning and knowledge by diverse means, including information communication technology. The objective is to provide opportunities for higher education to a large segment of the population and promote educational wellbeing of the larger society.

The University has continuously striven to build a knowledge society through inclusive education. It has imparted higher education by offering high quality teaching through the Open and Distance Learning (ODL) mode.

IGNOU in a relatively short time has made a significant contribution in the areas of higher education, community education, extension activities and continual professional development. As a world leader in distance education, it has been conferred with an Award of Excellence by the Commonwealth of Learning (COL), Canada.

IGNOU offers its academic programmes through its 21 Schools of Studies and a network of 67 Regional Centres (including 11 Recognised Regional Centres for the Indian Army, Navy and Assam Rifles), and about 3500 Study Centres (SCs). The University also has a network of 12 Overseas Study Centres (OSC).

Currently, IGNOU is offering over two hundred academic, professional, vocational, awareness generating and skill oriented programmes at the level of Certificate, Diploma, Bachelor's Degree, Master's Degree and Doctoral Degree through its Schools of Studies.

The 21 Schools of Study which design and develop academic programmes and courses at different levels are:

- School of Agriculture (SOA)
- School of Computer and Information Sciences (SOCIS)
- School of Continuing Education (SOCE)
- School of Education (SOE)
- School of Engineering and Technology (SOET)
- School of Extension and Development Studies (SOEDS)
- School of Foreign Languages (SOFL)
- School of Gender and Development Studies (SOGDS)
- School of Health Sciences (SOHS)
- School of Humanities (SOH)
- School of Interdisciplinary and Trans-disciplinary Studies (SOITS)
- School of Journalism and New Media Studies (SOJNMS)
- School of Law (SOL)
- School of Management Studies (SOMS)
- School of Performing and Visual Arts (SOPVA)
- School of Sciences (SOS)
- School of Social Sciences (SOSS)
- School of Social Work (SOSW)
- School of Tourism and Hospitality Service Management (SOTHSM)
- School of Translation Studies and Training (SOTST)
- School of Vocational Education and Training (SOVET)

The University provides multi-channel, multiple media teaching/learning packages for instruction and self-learning. The different components used for teaching/learning include, self-learning print and audio-video materials, radio and television broadcasts, face-to-face counseling/tutoring, laboratory and hands-on-experience, teleconferencing, video conference,

interactive multimedia CD-ROM and internet based learning, and the use of mobile phones for messaging and e-content.

Currently, the emphasis is being laid by the University on developing an interactive multimedia supported online learning as well as adding value to the traditional distance education delivery mode with modern technology-enabled education within the framework of blended learning. The recent initiatives of the University include: SWAYAM based Massive Open Online Courses (MOOCs), Shodhganga (UGCINFLIBNET Project), 24x7SWAYAMPBHA, National Digital Library (MHRD Project), e-Gyankosh and IGNOU e-Content App for digital study material.

## **2. School of Sciences**

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The School of Sciences was established in 1985 and has been offering Science programmes successfully through the distance mode of education. Presently, there are eight disciplines, namely, Biochemistry, Chemistry, Geography, Geology, Life Sciences, Mathematics, Physics and Statistics in the School. At present, there are 42 faculty members and 15 administrative staff members in the School of Sciences.

The functions of the School are to:

- ❖ plan, develop and offer academic programmes at the Awareness, Certificate, Diploma, Under-Graduate, Post-Graduate and Research levels;
- ❖ collaborate with the other Schools of the University in the development of various programmes/courses;
- ❖ participate in the development and academic monitoring of the student services; and
- ❖ carry out research in systemic and discipline-based areas of Science.

## **3. Bachelor's Degree Programmes under UGC CBCS Programme**

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Ministry of Human Resource Development (MHRD), Govt. of India, has initiated the process for developing New Education Policy (NEP) in our country to carry out reforms in Indian education system with the help of University Grants Commission (UGC). UGC has initiated several steps to bring equity, efficiency and academic excellence in the National Higher Education System. The important ones include innovation and improvement in course curricula, bringing about a paradigm shift in learning and teaching pedagogy, examination and education system. B.Sc. under UGC CBCS (choice based credit system) programme, an internationally acclaimed system has been developed for offer all over the country.

The design of B.Sc. under UGC CBCS programme offers opportunities and avenues to learn core subjects but also to explore additional avenues of learning beyond the core subjects for holistic development of an individual. This programme will facilitate the learner to equip themselves with the best international academic practices.

The salient advantages of the choice based credit system are as follows:

- ❖ Shift in focus from the teacher-centric to learner-centric education.
- ❖ Learner may undertake as many credits as they can cope with without repeating all the courses in a given semester if they fail in one/more courses.



- ❖ CBCS allows learner to choose inter-disciplinary, intra-disciplinary courses, skill oriented papers (even from other disciplines according to their learning needs, interests and aptitude) and have more flexibility.
- ❖ CBCS makes education broad-based and at par with global standards.
- ❖ CBCS offers flexibility for learner to study at different times and at different institutions to complete one course (ease of mobility of learner). Credits earned at one institution can be easily transferred to other universities.

The CBCS provides an opportunity for the learners to choose courses from the prescribed courses comprising core, elective/minor or skill based courses. Under the CBCS scheme the UGC has introduced a uniform grading system in the entire higher education in India. This will benefit the students to move across institutions within India to begin with and across countries. The uniform grading system will also enable potential employers in assessing the performance of the candidates. In order to bring uniformity in evaluation system and computation of the Cumulative Grade Point Average (CGPA) based on learner's performance in examinations, the UGC has formulated the guidelines to be followed. Hence, adoption of CBCS helps to overcome the gap between university degree and employability by inculcating skills and competencies in our graduates.

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#### **4. B. Sc. (HONS) BIOCHEMISTRY**

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With the academic session of July 2019, the Indira Gandhi National Open University has adopted the Choice Based Credit System introduced by the University Grants Commission. The Choice Based Credit System provides flexibility for the students to study the subjects/courses of their choice and offer easy mobility between different institutions in the country. There are two programmes under CBCS: viz. B. Sc. (General) [BSCG] and B. Sc. (Honours) [BSCH]. While the BSCG programme was launched from July 2019, the BSCH is launched from July, 2020.

While IGNOU has been one of the earliest to introduce credit based academic programmes with a wider choice of courses, with the CBCS, it is now introducing semester system and point based evaluation system under a 10 point grading system. The Programme Code of B. Sc. (Hons) Biochemistry is BSCBCH. This programme is of 148 credits. The distribution of credits under the different type of courses is as follows:

- i) Core Courses (CCs): 14 courses of 6 credits each (i.e. 84 credits)
- ii) Discipline Specific Electives (DSEs): 4 courses of 6 credits each (i.e. 24 credits)
- iii) Ability Enhancement Compulsory Courses (AECCs): 2 courses of 4 credits (i.e. 8 credits)
- iv) Skill Enhancement Courses (SECs): 2 courses of 4 credits (i.e. 8 credits)
- v) Generic Electives (GEs): 4 courses of 6 credits each (i.e. 24 credits)

The programme can be completed in a minimum period of three years (six semesters) or in a maximum period of six years. A credit is equivalent to 30 hours of study time. This comprise all learning activities (i.e. reading and comprehending the print material, listening to audios, watching videos, attending counselling sessions, teleconferencing and writing assignment responses). Most courses of this programme (CCs, DSEs and GEs) are of six credits. This means that you will have to put in 180 hours (6x30) of study time to complete each of these courses. The programme also has 4 Ability Enhancement and Skill Enhancement courses,

each of four credit weightage (2 courses each). These require a total of 120 hours (4x30) of study time. Table 4.1 gives an overview of the programme structure.

**Table 4.1: Structure of BSc Biochemistry (Honours) BSCBCH**

Sem ester	Core Courses	Discipline Specific	Ability/Skill Enhancement	Generic	Credits
I	BBCCT101& BBCCL102: Molecules of Life (Theory and Practical)  BBCCT103& BBCCL 104: Cell Biology (Theory and Practical)	None	BEVAE 181: Environmental Studies	BCHCT 131& BCHCL 132: Atomic Structure, Bonding, General Organic Chemistry and Aliphatic Hydrocarbons (Theory and Practical)	22
II	BBCCT 105& BBCCL 106:Proteins (Theory and Practical)  BBCCT 107& BBCCL 108: Enzymes (Theory and Practical)	None	Any one*:  BEGAE 182: English Communication  BHDAE 182: Hindi Bhasha Aur Samprashan	BCHET 147 &BCHEL 148: Organometallics, Bioinorganic Chemistry, Polynuclear hydrocarbons and UV, IR Spectroscopy (Theory and Practical)	22
III	BBCCT 109& BBCCL 110: Metabolism of Carbohydrates and Lipids (Theory and Practical)	None	BBCS 183: Tools and Techniques in Biochemistry	BBYCT 131& BBYCL 132: Biodiversity (Microbes, Algae, Fungi and Archegoniaties) (Theory and Practical)	

	<p>BBCCT 111&amp; BBCCL 112: Membrane Biology and Bioenergetics (Theory and Practical)</p> <p>BBCCT 113&amp; BBCCL 114: Metabolism of Amino Acids and Nucleotides(Theory and Practical)</p>				28
IV	<p>BBCCT 115&amp; BBCCL 116: Human Physiology (Theory and Practical)</p> <p>BBCCT 117&amp; BBCCL 118: Gene Organization Replication and Repair (Theory and Practical)</p> <p>BBCCT 119&amp; BBCCL 120: Hormone: Biochemistry and Function (Theory and Practical)</p>	None	BBCS 185: Bioinformatics	BZYCT 131& BZYCL 132: Animal Diversity (Theory and Practical)	28
V	<p>BBCCT 121&amp; BBCCL 122: Concepts in Genetics (Theory and Practical)</p> <p>BBCCT 123&amp; BBCCL 124: Gene Expression and Regulation (Theory and Practical)</p>	<p>BBCET 141&amp;BBCEL 142: Nutritional Biochemistry(Theory and Practical)</p> <p>BBCET 145&amp; BBCEL 146: Molecular basis of non-infectious human diseases (Theory and Practical)</p>			

			None	None	24
<b>VI</b>	<p>BBCCT 125&amp; BBCCL 126: Genetic Engineering and Biotechnology (Theory and Practical)</p> <p>BBCCT 127&amp; BBCCL 128: Immunology (Theory and Practical)</p>	<p>BBCET 143 &amp; BBCEL 144: Basic Microbiology (Theory and Practical)</p> <p>BBCET 151 &amp;BBCEL 152: Plant Biochemistry (Theory and Practical)</p>	None	None	24

\* Choice depends on the medium of instruction.

#### **4.1 Core Courses (CC)**

The programme has fourteen core courses. All these are discipline specific and are distributed over all the six semesters. Each core course is of six credits. Over 14 courses, these courses cover a total of 84 credits (from out of 148 credits) of the programme.

#### **4.2 Elective Courses**

These are Discipline Specific Elective Courses offered in the 5th and 6th semesters of the programme. These courses are also of six credits each. The Discipline Specific Electives (DSEs) are specialised courses and are meant to provide an extended knowledge of the discipline. They are allied in nature in which the foundation knowledge derived from the Core Courses and includes specific fields like nutrition, microbiology, clinical biochemistry and plant biochemistry. The programme has four DSEs, two courses to be studied in each of the two semesters in the 3rd year of the programme. They carry 24 credits weight (4 × 6 credits). The specific DSEs are shown in Table 4.1 above. With inclusion of these 4 DSEs, there are total 18 courses of biochemistry discipline worth 108 credits in the programme. The remaining courses are from other disciplines and are meant to give you exposure in an inter-disciplinary perspective. These are outlined below.

#### **4.3 Ability/Skill Enhancement Compulsory Courses**

You will study 2 Ability Enhancement Courses (AECs) one each in the 1<sup>st</sup> and 2<sup>nd</sup> semester of the first year of the 3 year programme. These are meant to enhance your language and communication skills and provide awareness on the importance of environment. You will study two Skill Enhancement Courses (SECs), one each in the third and the fourth semester of your second year programme. While the course offered in the third semester gives exposure to the application of different tools and techniques used in field of biochemistry, the course offered in the fourth semester would help you to apply bioinformatics tools to explore challenges in biochemistry. The course titles are available in Table 4.1 above.

#### **4.4 Generic Electives**

Generic Electives (GEs) are also inter-disciplinary in nature. They provide an exposure to other disciplines/subjects which would complement the learning in core courses. The courses which are presently on offer are listed in Table 4.1.

The University will add new electives and SECs later. The new courses added would be updated on the University website from time to time. You can choose them at the time of re-registration for the second or third year.

Now that you know the structure of the BSCBCH programme and its components, let us focus on how to plan your studies.

#### **4.5 Laboratory Work**

Laboratory courses are an integral component of the B.Sc. programme. While designing the curricula for laboratory courses, particular care has been taken to weed out experiments not significant to the present day state of the discipline. Importance has been given to the utility of an experiment with respect to real life experience, development of experimental skills, and industrial applications. It is planned to phase the laboratory courses during suitable periods (such as summer or autumn vacations) so that in-service persons can take them without difficulty. Laboratory courses worth 2 credits will require full-time presence of the student at the Study Centre for one week continuously. During this time a student has to work for around 60 hours. Around 40 hours would be spent on experimental work and the remaining

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time will be used for doing calculations, preparations of records, viewing or listening to the video/audio programmes.

You should bear in mind that the attendance in the Laboratory course is compulsory. Every experiment is evaluated and is included for final evaluation, the weightage being 70%. Hence, a student has to perform all the experiments in order to be able to secure maximum marks. The remaining 30% will be assigned for the unguided experiments to be performed by the student at the end of the Lab course.

You are advised to pace your laboratory courses. As far as possible, you should complete the laboratory courses in the year in which you register for them.

## **5. PLANNING YOUR STUDIES**

The programme offers flexibility in the duration for the completion of the programme. You can take full advantage of this flexibility. A little bit of systematic planning is all you can ensure you to realize your goal of completing the 148 credits of the programme within the minimum period of three years. If, for any reason, you are unable to complete the programme within three years, please note that your registration for the programme is valid for six years. You can also get additional two years by applying for readmission.

As already mentioned, each credit of this programme is equivalent to 30 hours of learner study comprising all learning activities (i.e. reading and comprehending the print material, listening to audios, watching videos, attending counselling sessions, teleconferencing and writing assignment responses). This means that you will have to devote approximately 180 hours of study for a six-credit course and 120 study hours for a four credit course. Since you have 22 courses of six credits and four courses of four credits, you should approximately try to put in a total of 1480 hours of study in a year. This means that you will have to devote around five hours of study everyday for about 300 days in a year. You have to adjust your reading schedule keeping this workload in view. With this schedule, you will be able to complete all courses in the minimum number of years i.e. 3 years. Since the number of courses are not the same in all the semesters (i.e. you have more courses to clear in the second year as compared to the first and the third year), to complete the three-year programme in the minimum period of three years, you need to plan somewhat. It is helpful to study consistently throughout the year. You should not let the studies accumulate requiring you to speed up before the examinations as that will put undue pressure on you and you may not be able to cope up.

If you are not able to fully devote yourself to the programme, you can set your targets for a particular semester/year. If you feel that you can focus only on 30 credits in a year, plan for it accordingly from the beginning of the year. Study only the selected courses. Do the assignments of only those courses for which you plan to appear in the Term End Examination (TEE) and carry over the rest to next year. Again next year, decide your goals for the two semesters of that year. Whenever you decide to complete the previous semesters/years course and have not submitted the Assignments for evaluation, make sure that you attempt the current year's assignment (s) for that course. Always submit your assignments well in timekeeping in view the eligibility to appear in the TEE (For details see Section 6.1 of this Programme Guide). Through a proper planning suitable to you, you can complete this programme at your convenience.

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## **6. FEE STRUCTURE AND SCHEDULE OF PAYMENT**

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Rs. 43,500/- for full programme to be paid year wise @ Rs. 14,500/- per year. Fee to be paid in 1st year, including Registration Fee of Rs.200/-is Rs.14,700/. The programme fee should be paid only by means of Debit Card/Credit Card through online mode only. Fee once paid is not refundable. The University can revise the programme fee. In that case, the revised fee shall be payable by you as per the schedule of payment notified by the university.

Although the BSCBCH programme is a semester-based programme, registration is done annually. Just as you have registered for the first two semesters at the start of the programme, you will have to re-register for the Second year (third and fourth semesters) and third year (fourth and fifth semesters) before the beginning of the academic year as per the schedule given below.

### **Schedule for Re-Registration**

Learners are advised to submit the Re-Registration (RR) forms Online only on the web portal [www.ignou.ac.in](http://www.ignou.ac.in) as per the schedule notified by the University on its website from time to time.

**The programme fee has to be paid at the beginning of each year by online mode only by means of Debit Card/Credit Card.**

Timely payment of programme fees is the responsibility of the learner. The learner is expected to remit the fees as early as possible without waiting for the last date. Non-payment of fee would result in the withdrawal of access to study material and permission to write the examinations. It may also result in the cancellation of admission. In case any learner willfully

appears in an examination without proper registration for a course, appropriate action can be taken against him or her as per the rules of the University.

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## **7. INSTRUCTIONAL SYSTEM**

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The methodology of instruction adopted by the University is different from that in the conventional universities. The Open University system is more learner-oriented in which the learner is an active participant in the teaching-learning process. Most of the instruction is imparted through distance rather than face-to-face communication.

The University follows a multi-media approach for instruction. It comprises of

- Self-Learning Material
- Audio-video programmes transmitted through radio and television
- Teleconferencing sessions
- Face-to-face counselling at Study Centres by Academic Counsellors
- Assignments/ Tutorials/ Practicals/ Dissertation/ Project work

### **7.1 Course Material**

Course material, in print or e-book format, is the primary form of instruction. You should concentrate mainly on the course materials that are sent to you in the form of printed books or

ebooks. The course material would be sufficient to write assignment responses and prepare for the Term End Examination (TEE). We would, however, advise you to read additional material, especially those given in the Suggested Reading section of the course material.

The course material prepared by the University is self-learning in nature. Each course is printed in the form of a single book or e-book. The course is divided into a number of **Blocks**. Each Block consists of few Units with the **Units** covered in a Block have a thematic unity. The section on 'course introduction' in the book provides an overview of the entire course, its objectives, guidelines for studying the material, etc. Besides, each unit has an introductory section to the unit.

Each unit of the block begins with an Introduction which provides an overview of the major theme of the unit. This is followed by the expected learning outcomes which will give you an idea on what you are expected to learn from the Unit. Usually, subsequent units forge a link with the topics of the previous Units. This is followed by the main text, which is divided into various sections and subsections. At the end of one or two sections, some self-check questions for self-evaluation are provided. These are given under the heading of **Check Your Progress or self assessment questions (SAQ)**. You should attempt this part. It will help you in assessing the immediate absorption. You can then check your answers with the hints/solutions given at the end of the unit. Questions in Check Your Progress are for your practice only. You should not submit the answers to these questions to the University for assessment. Answers furnished to the Check Your Progress exercises at the end of the unit are sometimes only hints. This is done with a view to encouraging you to write the answers in your own words.

There is a section on **Let Us Sum Up/ Summary** at the end of each unit. This gives a brief account of what has been discussed in the Unit. The summary enables you to recall the main points covered in the Unit. Each unit then ends with a list of **References**. They may be suggested books for further reading or articles that have been consulted to prepare the unit. Some of the books listed in this section will be available in the Study Centre library.

In order to comprehend the SLMs, you must read the Units carefully noting down the important points. You can use the space in the margin of the printed pages for making notes and writing your comments. While reading the Units, you may mark the difficult words and look for the meaning of such words in a dictionary. If you still do not understand something, consult your counsellor during the face-to-face sessions at the Study Centre for clarification.

## **7.2 Dispatch of Study Material**

The dispatch of material will start once the online process of registration is complete. You can expect to receive your study material within one month of closing of the registration for the programme. If any course material is missing or you receive wrong or defective material, please address your query to the Regional Centre or write to Student Services Centre at [ssc@ignou.ac.in](mailto:ssc@ignou.ac.in).

For the students who have applied for digitized version, detailed information is available on the IGNOU website.



### **7.3 Academic Counselling**

In distance education, face-to-face contact between the learners and their academic tutors/counsellors is an important activity. The purpose of such an interaction is to answer some of your questions and clarify your doubts, which may not be possible through any other means of communication. It is also intended to provide you an opportunity to meet fellow learners.

There are experienced academic counsellors at the Study Centres to provide academic counselling and guidance to you in your courses. The academic counselling sessions for each of the courses will be held at suitable intervals throughout the academic session. Attendance in the academic counselling sessions for theory courses is not compulsory, but we would suggest you to attend these sessions as they may be useful in certain respects. These could be to share your views on the subject with teachers and fellow learners, comprehend some of the complex ideas or difficult issues, get clarifications for any doubts which you would not otherwise try to raise, etc. However, it is compulsory to attend practical sessions for the courses that have practicals or laboratory work.

Face-to-face counselling will be provided to you at the Study Centre assigned to you. You should note that the academic counselling sessions will be very different from the usual classroom teaching or lectures. Academic counsellors will not be delivering lectures or speeches. They will try to help you to overcome difficulties, which you face while studying for this programme. In these sessions, you must look into the subject-based difficulties and any other issues arising out of such difficulties. The University normally organizes six to seven academic counselling sessions for a 4-credit. In case there are less than 10 students in a Study Centre, then intensive counselling sessions will be held which essentially means that 40 per cent of the prescribed counselling sessions will be conducted within a week's time.

Before you go to attend the academic counselling sessions, please go through your course material and note down the points to be discussed. Unless you have gone through the Units, there may not be much to discuss. Try to concentrate on relevant and important issues. Try also to understand each other's points of view. You may also establish personal contact with your fellow participants to get mutual help for academic purposes. Try to get the maximum possible help from your academic counsellors.

### **7.4 Study Centre**

To provide effective student support, we have set up a number of Study Centres all over the country. You will be allotted one of these Study Centres taking into consideration your place of residence or work. However, each Study Centre can handle only a limited number of students and despite our best efforts, it may not always be possible to allot the Study Centre of your choice. The particulars regarding the Study Centre to which you are assigned will be communicated to you.

Every Study Centre will have:

- A Coordinator who will coordinate different activities at the centre.
- An Assistant Coordinator and other support staff appointed on a part-time basis.
- Academic Counsellors in different courses to provide counselling and guidance to you in the courses you have chosen.

A Study Centre will have four major functions:

**Counselling:** Face-to-face counselling for the courses will be provided at the Study Centres. As mentioned earlier, six to seven sessions for a 4-credit course.

The schedule of the counselling sessions will be communicated to you by the Coordinator of your Study Centre.

Study Centre is the contact point for you. The University cannot send all the communication to all the students individually. All important information is communicated to the Coordinators of the Study Centers and Regional Directors. The Coordinators would display a copy of such important circular/notification on the notice board of the Study Centre for the benefit of all IGNOU learners. You are, therefore, advised to get in touch with your Study Centre for day-to-day information about assignments, submission of examination forms, TEE date-sheet, declaration of result, etc.

**Evaluation of Assignments:** Tutor Marked Assignments (TMA) will be evaluated by the Academic Counsellors appointed for different courses at the Study Centre. These assignments will be returned to you with tutor's comments and marks obtained. These comments will help you to know where improvement can be made in your studies.

**Information and Advice:** At the Study Centre, you will get relevant information regarding the courses offered by the University, academic counselling schedules, examination schedule, etc. You will also get guidance in choosing your elective and application oriented courses.

**Interaction with Fellow-learners:** The Study Centre gives you an opportunity to interact with fellow learners.

## 7.5 Interactive Radio Counselling

The University has the facility of interactive counselling through the All India Radio network. You can participate in it by tuning in to your area Radio station. Experts from various areas of the discipline participate in the sessions. Students can put across their questions to these experts by using the telephone. The telephone numbers are announced by the respective Radio Stations. This counselling is available on all days. The topic for each session of the interactive radio programme is available in the Gyanvani section of the University website.

## 7.6 Gyan Darshan

IGNOU in collaboration with Doordarshan now has an exclusive Educational TV Channel called Gyan Darshan. It is available through cable TV network. The channel telecasts educational programmes for 24 hours every day. Live telecast is from 3-5 p.m. and repeat telecast from 8-10 p.m. Apart from programmes of IGNOU, it will have educational programmes produced by various national education institutions. You should try to get access to it through your cable operator. The schedule of programmes and live sessions is available at the study centers one month in advance. You can also get the schedule of programmes and live sessions from the University website: <https://www.ignouonline.ac.in/gyandarshan/>.

## 7.7 Gyan Vani

Gyan Vani is an educational FM Radio network (105.7FM) providing programmes covering different aspects and levels of education including Primary and Secondary Education, Adult Education, Technical and Vocational Education, Higher Education and Extension Education. There will be programmes on various aspects and courses of the B. A. programme (both General and Honours). The schedule of the programmes is uploaded on the University website: <https://www.ignouonline.ac.in/gyandhara/>.

## 7.8 Teleconference/EDUSAT

To reach our learners spread in different parts of the country we take the help of teleconferencing. These sessions are conducted from Delhi. The students can attend these at the regional centres and specified study centres of IGNOU. It is a one way video and two way audio facility. The teleconferencing is available on Gyan Darshan-2 and Edusat. The time-slot for B.A. programmes is 5.00 p.m. to 7.45 p.m. in the evening on all week-days. The faculty members at Delhi and other experts as resource persons participate in these sessions. You can put your problems and questions to these experts through the telephone available at receiving centres. These will help in resolving your queries related to courses and other general information pertaining to the programme.

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## 8. EVALUATION

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The system of evaluation followed by the University is also different from that of conventional universities. IGNOU has a multitier system of evaluation.

- Self-assessment exercises within each unit of study.
- Continuous evaluation through assignments which are tutor-marked, practical assignments and seminar/workshops/extended contact programmes, etc. (depending on the nature of the course).
- Term End Examinations.
- Project/Practical work (depending upon the requirement of the course).

The weightage given for the continuous evaluation through assignments and the term end examination is 30 : 70. This means, in the final result, the assignments of a course carry 30% weightage while 70% weightage is given for the Term End Examination (TEE). University follows a grading system for continuous evaluation as well as term-end examination. It is done on a ten point scale using the letter grades as given below.

Letter Grade	Numerical Grade	Percentage
O (Outstanding)	10	$\geq 85$
A+ (Excellent)	9	$\geq 75$ to $< 85$
A (Very Good)	8	$\geq 65$ to $< 75$
B+ (Good)	7	$\geq 55$ to $< 65$
B (Above Average)	6	$\geq 50$ to $< 55$
C (Average)	5	$\geq 40$ to $< 50$
D (Pass)	4	$\geq 35$ to $< 40$
F (Fail)	0	$< 35$
Ab (Absent)	0	Absent

In the grade card issued, the University also provides numerical marking with award of division for the programme. You are required to score at least 35% marks (Grade D) in both continuous evaluation (assignments) as well as the term-end examination of each course. In the overall computation also you must get at least 35% marks (Grade D) in each course to complete the B.Sc. degree.

Students who do not qualify in the term-end examination are allowed to take up the Term End Examination in the next year. It means you can take the TEE of the first year courses in the second year of your study. But you can appear in the examination for not more than 48 credits in one TEE. Similarly, the first and second year courses can be carried over to the third year.

### 8.1 Assignments

Assignments constitute the continuous evaluation. **The marks that you secure in the assignments will be counted in your final result.** As mentioned earlier, an assignment of a course carries 30% weightage. You are therefore advised to take your assignment seriously. A simple omission on your part may put you in great disadvantage later. However, there will be no written assignments for Lab courses.

For each course of this programme, you have to do two to three Tutor Marked Assignments (TMAs) depending upon the nature of the course. **The TMA for each semester can be downloaded from the Student Zone of the University website.** Ensure that your assignment responses are complete in all respects. Before submission, you should ensure that you have answered all the questions in all the sections/parts of the assignments. Incomplete assignment responses may affect your grades adversely.

**You have to complete the assignment within the due dates specified in the assignment booklet. You will not be allowed to appear for the term-end examination for any course if you do not submit the assignment in time for that course. If you appear in term-end examination, without submitting the assignments, the result of the term-end examination is liable to be cancelled.**

The main purpose of TMA is to test your comprehension of the learning materials you receive from us and also to help you get through the courses. The evaluators/academic counselors, after correcting the assignments, return them back to you with their comments and marks. The comments will guide you in your study and help in improving it. It is therefore important that you collect the evaluated TMA along with a copy of the assessment sheet containing the comments of the evaluator on your performance.

The content provided in the printed course materials should be sufficient for answering the assignments. Please do not worry about the non-availability of extra reading materials for working on the assignments. However, if you have access to other books, you may make use of them. The assignments are designed in such a way as to help you concentrate mainly on the course material and apply your personal experience.

**You have to submit your assignment response sheets to the Coordinator of the Study Centre assigned to you.** For your own record, you must retain a copy of all the assignment responses which you submit to the Coordinator. If you do not get back your duly evaluated tutor marked assignments (along with a copy of the assessment sheet containing comments of the evaluator on your assignment), within a month after submission, please try to get it personally from your Study Centre. **Always keep duplicate copies of assignment responses of TMAs submitted to Study Centres.** They may be required to be produced at Student Evaluation Division on demand. Also, maintain an account of the corrected assignment responses received by you after evaluation. This will help you to represent your case to the University in case any problem arises.

If you do not get a pass grade in any assignment, you have to submit it again. Get fresh assignments from the Student Zone tab of the University website. However, once you get the pass grade in an assignment, you cannot re-submit it for improvement of grade. Assignments are not subject to re-evaluation except for factual errors, if any, committed by the evaluator. The discrepancy noticed by you in the evaluated assignments should be brought to the notice of the Coordinator of the Study Centre, so that the correct score is forwarded by him/her to the Student Evaluation Division at Headquarters.

In case you find that the score indicated in the assignment sheet of your Tutor Marked Assignment has not been correctly reflected or is not entered in your grade card, you are

advised to contact the Coordinator of your Study Centre with a request to forward the correct award list to the Student Evaluation Division at the Headquarters.

Do not enclose or express doubts for clarification, if any, about study material or assignment along with the assignment. **Send your doubts in a separate cover to the Director of the concerned School at IGNOU, Maidan Garhi, New Delhi - 110068.** Give your complete enrolment number, name, address, title of the Course, and the number of the Unit or the assignment, etc. on top of your letter.

### **SPECIFIC INSTRUCTIONS FOR TUTOR MARKED ASSIGNMENTS (TMA)**

- 1) Write your Enrolment Number, Name, Full Address, Signature and Date on the top right hand corner of the first page of your response sheet.
- 2) Write the Programme Title, Course Code, Course Title, Assignment Code and Name of your Study Centre on the left hand corner of the first page of your response sheet.

**Course Code and Assignment Code may be reproduced from the assignment.**

The top of the first page of your response sheet should look like this:

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**ENROLMENT NO.:**

<b>PROGRAMME TITLE</b>	: .....	<b>NAME</b>	: .....
<b>COURSE CODE</b>	: .....	<b>ADDRESS</b>	: .....
			.....
<b>COURSE TITLE</b>	: .....		.....
<b>ASSIGNMENT CODE</b>	: .....	<b>SIGNATURE</b>	: .....
<b>STUDY CENTRE</b>	: .....	<b>DATE</b>	: .....

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- 3) Read the assignments carefully and follow the specific instructions, if any, given on the assignment itself about the subject matter or its presentation.
- 4) Go through the Units on which the assignments are based. Make some points regarding the question and then rearrange those points in a logical order and draw up a rough outline of your answer. While answering an essay type question, give adequate attention to introduction and conclusion. The introduction must provide a brief interpretation of the question and how you propose to develop it. The conclusion must summarise your response to the question. Make sure that the answer is logical and coherent, and has clear connections between sentences and paragraphs. The answer should be relevant to the question given in the assignment. Make sure that you have attempted all the main points of the question. Once you are satisfied with your answer, write down the final version neatly and underline the points you wish to emphasise. While solving numerical problems, use proper format and give working notes wherever necessary.

- 5) Use only foolscap size paper for your response and tie all the pages carefully. Avoid using very thin paper. Allow a 4 cm margin on the left and at least 4 lines in between each answer. This would facilitate the evaluator to write useful comments in the margin at appropriate places.
- 6) Write the responses in your own handwriting. Do not print or type the answers. Do not copy your answers from the Units/Blocks sent to you by the University. It is advised to write your answers in your own words as it will help in grasping the study material.
- 7) Do not copy from the response sheets of other students. If copying is noticed, the assignment will be rejected.
- 8) Write each assignment separately. All the assignments should not be written in continuity.
- 9) Write the question number with each answer.
- 10) The completed assignment should be submitted to the Coordinator of the Study Centre allotted to you. TMAs submitted at any other place will not be evaluated.
- 11) After submitting the TMA, get the acknowledgement from the Coordinator on the prescribed assignment remittance-cum-acknowledgement card.
- 12) In case you have requested for a change of Study Centre, you should submit your TMA only to the original Study Centre until the change of Study Centre is notified by the University.
- 13) If you find that there is any factual error in evaluation of your assignments e.g. any portion of your assignment response has not been evaluated or the total of score recorded on your assignment response is incorrect, you should approach the Coordinator of your study centre for correction and transmission of correct score to headquarters.

## **8.2 Term End Examination**

As stated earlier, the term-end examination is the major component of the evaluation system. It carries 70% weightage in the final result.

You must fill the Term End Examination (TEE) form online before the last date i.e. 31st March for June exam and 30th September for December exam.

The University conducts term end examinations (TEE) twice a year i.e. in June and December. You can take the examination only after completing one year of study. The TEE for first and second semesters will be held together at the end of the First year. Similarly, in the Second and Third years of the programme, the TEE for the third and fourth semesters (Second year courses) and for the fifth and sixth semesters (Third year courses) will be conducted together. If you are unable to appear in any TEE, you may appear in the next TEE in December or June.

A learner is permitted to appear in the TEE, subject to the following conditions:-

- Registration for the courses is valid and not time barred.

- Required number of assignments in the course has been submitted by the due date.
- Minimum time to pursue these courses as per the provision of the programme has been completed.
- Examination fee is paid for all the courses in which the learner is writing the examination.

In case of non-compliance of any of the above conditions, the result of all such courses is liable to be withheld by the University.

In case you fail to get a pass score (35% marks) in the Term End Examination, you will have to reappear at the next Term End Examination for that course within the total span of the programme i.e. six years.

### **8.3 Submission of Online Examination Form**

Learners are required to fill in the Examination form to appear in the TEE each time i.e. for every exam (June/December) a learner has to apply afresh. Open online link: <http://exam.ignou.ac.in/>. Only one form is to be submitted online for all the courses that a learner plans to appear in a TEE. To avoid discrepancies in filling up examination forms and avoid hardship in appearing in the TEE, you are advised to:

- 1) Remain in touch with the Study Centre/ Regional Centre/Student Evaluation Division for change in schedule of submission of examination form
- 2) Fill up all the particulars carefully and properly in the examination form to avoid rejection/delay in processing of the form
- 3) Retain proof of submission of examination form till you download your Hall Ticket.

### **8.4 Examination Fee and Mode of Payment**

The schedule for submission of Term End Examination Form is available at the IGNOU website during each session.

#### ***Examination Fee***

Rs. 150/- per theory course

Rs. 150/- per practical course

#### ***Mode of Payment***

Credit Card/Debit Card/Net Banking

Examination fee once paid is neither refundable nor adjustable even if the learner fails to appear in the examination.

### **8.5 Hall Ticket for Term End Examination**

No hall ticket shall be dispatched to the examinees. Hall Tickets of all examinees are uploaded on the University website 7-10 days before the commencement of the Term End Examinations.



Students are advised to take the print out of the Hall Ticket from the University website after entering the enrolment number and name of the programme of study, and report at the examination centre along with the Identity Card issued by the University attested by the Director of the Regional Centre. Without a valid IGNOU Student ID Card issued by the Regional Centre/University, examinees will not be permitted to appear in the examination.

Every student must bring his/her identity card for appearing in the TEE along with the Hall Ticket. Students will be allowed to appear in the TEE for those courses only for which registration is valid and the prescribed minimum duration of study is completed. In case, any learner has misplaced the Identity Card issued by the University, it is mandatory to apply for a duplicate Identity Card to the Regional Centre concerned well before the commencement of the examinations. Learners without valid ID Card will not be allowed to enter the Examination Centre premises.

### **8.6 Examination Date Sheet**

Examination date sheets (i.e. schedule which indicates the date and time of examination for each course) are sent to all the Study Centers a month in advance. These are printed in IGNOU Newsletters and posted. The datasheet is also displayed on website of IGNOU ([www.ignou.ac.in](http://www.ignou.ac.in)). You are advised to see whether there is any clash in the examination dates of the courses you wish to take, i.e. Examination of any two courses you wish to take are scheduled on the same day at the sametime. **If there is any clash, you are advised to take the TEE for one course and the other course in the next TEE.**

### **8.7 Declaration of Result**

It is your duty to check whether you are registered for a course and whether you are eligible to appear for that examination. If you neglect this and take the examination without being eligible for it, your result will be cancelled.

All efforts are made to declare the results well before the deadline for submission of Examination Form for the next TEE. In case, result for a course is not declared you should fill the Examination Form for that course without Examination Fee. In case, you appear in the TEE of that course, you have to send a demand draft (drawn in favour of IGNOU, New Delhi) of requisite amount to the Registrar, Student Evaluation Division (SED) Division, New Delhi failing which your result of that course will not be declared.

### **Early Declaration of Result**

In order to facilitate learners who have secured admission for higher studies or got selected for employment, etc. and are required to produce statement of marks/grade cards by a specified date, the University provides for early declaration of result. The learner can apply for early processing of his/her answer scripts and declaration of result. Such a student is required to apply in prescribed form (available on the University website) along with (i) fee of Rs. 1000/- per course through demand draft drawn in favour of IGNOU and payable at New Delhi, and (ii) attested photocopy of the admission/employment offer. You must submit the request for early declaration of result before the commencement of TEE, that is, before June 1st or December 1st for June and December TEE respectively. In such cases, the

University will make arrangement for early processing of answer scripts and declare the result as a special case possibly within a month's time from the conduct of examination.

### **8.8 Re-Evaluation of Examination Scripts**

Students who are not satisfied with the marks/grade awarded to them in the TEE may apply in prescribed form for re-evaluation within one month from the date of declaration of results, i.e. the date on which results are made available on the University website on payment of Rs. 750/-per course to be paid online. The better of the two scores of original marks/grade and marks/grade after re-evaluation will be considered and updated in the student's record.

Re-evaluation is permissible in TEE only and not in practical, project report, workshop, assignment, tutorials, seminar, etc. A sample application form with rules and regulations for this purpose is available at the University's website.

#### **Improvement in Division/Class**

Students of the Bachelor degree programme who have completed the programme and wish to improve their Division/Class may do so by appearing in TEE. Only those students of the programme who fall short of less than 2% marks to secure 2nd and 1st division are eligible for reexamination.

Students may apply in the prescribed form from the 1st to the 30th of April for June TEE and from the 1st to the 31st of October for December TEE along with a fee of Rs.750/- per course by means of a demand draft drawn in favour of IGNOU and payable at New Delhi.

**Improvement is permissible in TEE only and not in Practicals /Lab courses, Project, Workshop, Assignment, Seminar, tutorials, etc.**

Students wishing to improve their marks will have to apply within six-months from the date of issue of final statement of marks/grade card to them, subject to the condition that their registration for the programme/course being applied for improvement is valid till the next TEE in which they wish to appear for improvement. Rules and regulations for this purpose are available in detail at the University's website.

**Obtaining Photocopy of Answer Scripts:** After the declaration of result, if the learner is not satisfied with the marks awarded, he or she can request the University for obtaining Photocopy of Answer Scripts on payment of Rs. 100/- per course. The request for obtaining Photocopy of Answer Scripts by the student must be made within 45 days from the date of declaration of result to the Student Evaluation Division, IGNOU, New Delhi in the prescribed format along-with a fee of Rs. 100/- per course to be paid online.

**While communicating with the University regarding examinations, please write your enrolment number and complete address clearly. In the absence of such details, the Student Evaluation Division will not be able to attend to your problems.**

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## 9. OTHER USEFUL INFORMATION

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## **Scholarships and Reimbursement of Fees**

Reserved Categories, viz., Scheduled Castes, Scheduled Tribes and Physically Handicapped students etc. have to pay the fee at the time of admission to the University along with other students. Physically Handicapped students admitted to IGNOU are eligible for Government of India scholarships. They are advised to collect scholarship forms from the respective State Government Directorate of Social Welfare or Office of the Social Welfare Officer and submit the filled-in forms to them through the Regional Director of IGNOU concerned. Similarly, SC/ST students have to submit their scholarship forms to the respective State Directorate of Social Welfare or Office of the Social Welfare Officer, through the Regional Director of IGNOU concerned for suitable reimbursement. The Application for reimbursement of Programme Fee to SC/ST students can be downloaded from the link: <http://ignou.ac.in/userfiles/Application%20form%20for%20Reimbursement%20of%20fee.pdf>

**Fee Exemption for SC/ST Students under the SCSP and TSP Schemes:** Detail information regarding this scheme may be obtained from the link: <http://www.ignou.ac.in/userfiles/Joint%20Notification%20of%20SCSP%20TSP.pdf>

SC and ST students who are availing any kind of fellowship or fee exemption from other agencies are not eligible for fee exemption under SCSP/TSP scheme. The exemption of fee is confined to Programme Fee mentioned in this Admission Prospectus. The scheme will not exempt late fee, term-end-exam fee, convocation fee, etc. Eligible and interested students may contact the Regional Centre concerned. Details of the scheme and notification are uploaded on [www.ignou.ac.in](http://www.ignou.ac.in)

**Waiver of IGNOU Programme fee to Inmates lodged in Prisons** Inmates lodged in Prisons in the country are exempted from payment of programme fee, including cost of Prospectus. The under-trial/short term prisoners are also eligible for the same benefit of FREESHIP as is extended to other prisoners with the condition that when they go out of jail, they will be treated as normal students and shall pay subsequent fees wherever applicable (examination fee, re-registration fee, pro-rata fee for readmission, registration fee for convocation etc.).

**Change of Medium** is permitted within 30 days from the receipt of first set of course material in the first semester/year ONLY, on payment of Rs. 350/- plus Rs. 350/- per 4 credit course and Rs. 700/- per 6 credit course for the programme. Payment should be made by way of a Demand Draft drawn in favour of —IGNOU, payable at the place of concerned Regional Centre. All such requests for change of Medium should be addressed to the concerned Regional Centre only, as per schedule.

## **Change or Correction of Address**

There is a printed form for the change/correction of address/name. A copy of the same is available online on the university websites under Student Zone. In case there is any correction or change in your address, you are directed to make use of that form addressed to the Registrar, Student Registration Division (through concerned Regional Director). You are advised not to write letters to any other officer in the University in this regard. Normally, it takes four to six weeks to effect the change. Therefore, you are advised to make your own arrangements to redirect the mail to the changed address during this period.

## **Change of Study Centre**

A student is required to opt for only such study centre which is activated for the programme. As far as possible the university will allot the study centre opted for by the student. However, the university may change the study centre for administrative reasons without concurrence of the student at any time.

For the purpose of change of Study Centre, you have to send a request to the Director of your Regional Centre. A copy of the same may be sent to the Student Evaluation Division at the headquarters.

Counselling facilities for a programme may not be available at all the Centres. Therefore, you are advised to make sure that counselling facilities are available for the programme you have chosen, at the new Centre opted for. As far as possible, the request for change of Study Centre is considered favourably. However, the allotment of a new Study Centre is subject to availability of seats for the programme at the new Centre asked for.

## **Change of Regional Centre**

If you want to transfer from one region to another, you have to send your application seeking transfer to the Regional Centre from where you are seeking a transfer marking copies to the Regional Centre where you would like to be transferred to. Further, you have to obtain a certificate from the Coordinator of the Study Centre from where you are seeking transfer regarding the number of assignments submitted. The Regional Director from where the learner is seeking the transfer will transfer all records including details of fee payment to the new Regional Centre under intimation to the Registrar, Student Registration Division (SRD) and the learner. In case any learner is keen for transfer from Army/Navy/Air Force Regional Centre to any other Regional Centre of the University during the cycle/session, he/she would have to pay the fee-share money to the Regional Centre. In case the learner seeks transfer at the beginning of the session/cycle, the required programme course fee for the session/cycle shall be deposited at the Regional Centre. However, the transfer shall be subject to availability of seats wherever applicable.

## **Issue of Duplicate Grade Card/Mark sheet**

A duplicate Grade Card is issued after a request is made on the prescribed form along with a draft of Rs. 200/- to be paid in favour of IGNOU, New Delhi. The form for the purpose is available on the IGNOU website.

## **Issue of Duplicate Degree Certificate**

A duplicate degree certificate can be issued after a request is made on the prescribed form along with a demand draft of Rs. 750/- in favour of IGNOU, New Delhi. The following documents are required to be attached with the requests for issue of duplicate degree certificate:

- 1) Affidavit on non-judicial stamp paper of Rs.10/- .
- 2) Copy of FIR lodged with the police station regarding loss of Degree Certificate.
- 3) Demand Draft/IPO for requisite fee.

The form and the format for the purpose is given on the University website.

## **Re-admission**

If you are not able to complete the programme in a maximum period of 6 years, the University has a provision for re-admission. You have to take the following two steps for re-admission:

- a) Take admission afresh in the Programme like other students by fulfilling the admission criteria and paying requisite fee for the Programme.
- b) Apply to the University for the transfer of credits you have earned under the old enrolment with applicable fee.

Full credit transfer may be allowed if the syllabus and methodology now in vogue are similar to that governing the students under the old enrolment.

### **Simultaneous Registration**

A learner is permitted to register for only one programme in the given academic session. You are, therefore, advised to seek admission to only one programme in the given academic session. However, you are allowed to take a certificate programme of 6 months duration along with other programmes. Violation of this rule will result in cancellation of admission to all the programmes and forfeiture of the programme fees.

### **Migration Certificate**

For Migration Certificate, requisition may be sent to the Regional Director along with the following documents:

- 1) Application (can be obtained from the IGNOU website).
- 2) Attested copy of the marksheet.
- 3) Fee of Rs. 500/- in the form of demand draft drawn in favour of IGNOU payable at the city where the Regional Centre is located.

### **Refund of Fees**

The refund request will be considered as under:

- a) Before the last date for submission of admission form, Programme fee will be refunded after deduction of Rs. 200/-
- b) Within 15 days from the last date for submission of admission form, Programme fee will be refunded after deduction of Rs. 500/-
- c) Within 30 days from the last date for submission of admission form, Programme fee will be refunded after deduction of Rs. 1,000/-.
- d) After 30 days from the closure of the last date, no refund will be allowed.
- e) The last dates for submission of admission form will be considered separately i.e. last date without late fee and last date with late fee. However, late fee, if any, will not be refunded.
- e) In cases of (a) to (c) above, the candidate will make a written request to the Regional Director (RD) concerned for such a refund. The Regional Centre (RC) will process the cases as soon as possible after ascertaining the credit of the same in IGNOU Accounts.

### **Disputes on Admission and other University Matters**

The place of jurisdiction for filing of a Suit, if necessary, will be only at New Delhi/Delhi.

**Study Material and Assignments** The University has a provision to provide softcopy of the self-learning material in place of printed material. A student opting for the softcopy will be given a discount of 15% in the Programme Fee. The Option to this effect has to be indicated by the students while filling in the Online Admission Form. Such students will not be given printed self-learning material. The University sends study materials by Registered post/

Speed Post/ Courier etc. and if a student does not receive the same for any reason, whatsoever, the University shall not be held responsible for that. You can check status of dispatch of study materials on the IGNOU website using the web link: [www.ignou.ac.in/ignou/aboutignou/division/mpdd/material](http://www.ignou.ac.in/ignou/aboutignou/division/mpdd/material), provided by MPDD.

The assignments for each semester can be downloaded from the Student Zone of the University website-[www.ignou.ac.in](http://www.ignou.ac.in). For non-receipt of study material, students are required to write to the Registrar, Material Production and Distribution Division, IGNOU, Maidan Garhi, New Delhi –110 067 or e-mail to [mpdd@ignou.ac.in](mailto:mpdd@ignou.ac.in).

**Change of Programme/ Medium** The students will not be allowed programme change from B.Sc. to BA and vice versa. However, students may get the admission to one programme cancelled and register for another programme. For CBCS Based Bachelor's Degree Programme, Change of medium will be allowed as per current practice on payment of applicable fee. Change of Medium is permitted within 30 days from the receipt of first set of course material in the first year ONLY, on payment of Rs.350/- plus Rs.350/- per 2/4 credit course and Rs.700/- per 6/8 credit course for undergraduate courses. For Master's Degree Programme it is Rs.350/- plus Rs.600/- per 2/4 credit course and Rs.1200/- per 6/8 credit course. Payment should be made by way of a Demand Draft drawn in favour of "IGNOU" payable at the place of concerned Regional Centre. All such requests for change of Medium should be addressed to the concerned Regional Centre only, as per schedule

**Change of Elective/Course For CBCS Based Bachelor's Degree Programme** Change of course is NOT permitted in CBCS-Based BAG/ BCOMG and BSCG Programmes.

**Credit Transfer** For the time being credit transfer is not allowed in CBCS based Bachelor's degree programme.

**Counselling and Examination Centre** All study centres, Programme study centres, special study centres are not Examination centres. Practical Examination need not necessarily be held at the centre where the learner

## 10. SOME USEFUL ADDRESSES

During the course of your study you might require some additional information about rules and regulations as well as how to resolve some of the issues in completing your studies at IGNOU. You must know whom to contact for specific information. Here is a list of addresses and contact numbers and emails of offices in the University to contact for specific information or problem.

1	Identity Card, Fee receipt, Bonafide Certificate, Migration, Scholarship Forms	Concerned Regional Centre
2	Non-receipt of study material	Material Production and Distribution Division (MPDD)
3	Schedule/information regarding Examform, Entrance test, Date-sheet, IGNOU Hall ticket	Asst. Registrar ( Exam-II), SED, Block-12, IGNOU, Maidan Garhi, New Delhi-110068 E-mail: <a href="mailto:evaluationosed@ignou.ac.in">evaluationosed@ignou.ac.in</a> , Ph. 29536743, 29535924-32 / Extn-2202, 2209
4	Result, Re-evaluation, Grade Card, Provisional Certificate, Early declaration of Result, Transcript	Dy. Registrar ( Exam.III), SED, Block-12, IGNOU, Maidan Garhi, New Delhi-110068 E-mail: <a href="mailto:mailedgrievance@ignou.ac.in">mailedgrievance@ignou.ac.in</a>

		Ph. 29536103,29535924-32/Extn. 2201, 2211, 1316
5	Non- reflection of Assignment Grades/Marks	Asst. Registrar (Assignment), SED, Block-3, Room No-12, IGNOU, MaidanGarhi, New Delhi-110068E-mail : <a href="mailto:assignments@ignou.ac.in">assignments@ignou.ac.in</a> Ph. 29535924, Extn-1312, 1319, 1325
6	Original Degree/ Diploma/ Verification of Degree/Diploma	Dy. Registrar ( Exam.I), SED, Block-9, IGNOU,MaidanGarhi, New Delhi-110068E- <a href="mailto:mailevaluationsed@ignou.ac.in">mailevaluationsed@ignou.ac.in</a> Ph.29535438, 29535924-32/Extn-2224, 2213
7	Student Grievances related to Evaluation	Asst. Registrar (Student Grievance), SED, Block-3,IGNOU, MaidanGarhi, New Delhi- <a href="mailto:110068E-mailsedgrievance@ignou.ac.in">110068E-mailsedgrievance@ignou.ac.in</a> Ph. 29532294, 29535924-32/Extn-1313
8	Academic Content	Director of the School concerned
9	Student Support Services and StudentGrievances, Pre-admission inquiry ofvarious courses in IGNOU	Regional Director, Student Service Centre, IGNOU,MaidanGarhi, New Delhi-110068 E-mail <a href="mailto:ssc@ignou.ac.in">ssc@ignou.ac.in</a> Ph. 29535714,29533869, 2953380 Fax-29533129

## 11. LINKS TO FORMS AND ENCLOSURES

Most of the operations of the University are online. Wherever you are required to submit a hard copy, the University has made available different application forms on its website. Please download these forms from the Student Zone of the University website and use them diligently. The detailed instructions for all these-forms are provided in form itself.

*Note: You may download the Forms from the Website*

### The forms include:

- *Link to Latest Assignment(s)*
- *Link to Online Re-Registration for BSC programme*
- *Link to Re-admission form for BSC programme*
- *Link to Online Term end Examination form*
- *Link to form for early declaration of result*
- *Link to form for obtaining photocopy of the answer script*
- *Link to form for Re-evaluation of Answer script*
- *Link to Application form for improvement in Division/Class*
- *Link to form for obtaining Duplicate Grade Card / Mark-sheet*
- *Link to form for issue of Official Transcript*
- *Link to form for issue of Migration Certificate*
- *Link to Date sheet of all programmes*
- *Some other useful links*



**PART II**  
**SYLLABI OF COURSES**

## 12. CORE COURSES

### 12.1 Details of Core Courses

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<b>Course Code: BBCCT-101</b>	<b>Course Title: Molecules of Life</b>	<b>Credits: 4</b>
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#### **Block-I Introduction to Biochemistry**

##### **Unit 1 Foundation of Biochemistry**

Origin of Biochemistry. Biochemistry as a Discipline and Interdisciplinary subject. Cellular and chemical foundations of life: Chemical elements of Cells and living systems. Frequently used Units of Measurement.

##### **Unit 2 Water**

Unique properties, Non-covalent interactions in aqueous systems, ionization of water, buffers, Henderson Hasselbalch Equation, water as a reactant and fitness of the aqueous environment.

##### **Unit 3 Amino acids**

Structure of  $\alpha$ -amino acids and classification, physical, chemical and optical properties of amino acids. Non-standard amino acids.

##### **Unit-4 Peptides and Proteins**

Peptide bond formation and its significance. Introduction to proteins. Organization of protein structure into primary, secondary, tertiary and quaternary structures.

#### **Block-II Carbohydrates**

##### **Unit 5 Monosaccharides**

Introduction to carbohydrates and classification. Monosaccharides- structure of aldoses and ketoses, ring structure of sugars, conformations of sugars, optical properties of aldoses and ketoses, mutarotation, anomers, epimers and enantiomers, structure of biologically important sugar derivatives,

##### **Unit 6 Oligosaccharides**

Glycosidic bond formation and stability. Formation of disaccharides, reducing and non-reducing disaccharides. Structure and importance of Oligosaccharides.

##### **Unit 7 Polysaccharides**

Polysaccharides-homo-and heteropolysaccharides, structural and storage polysaccharides. Structure and role of proteoglycans, glycoproteins and glycolipids (gangliosides and lipopolysaccharides).

##### **Unit 8 Glycobiology**

Carbohydrates as informational molecules, Blood group antigens and working with carbohydrates.

### **Block-III Lipids**

#### **Unit 9 Lipids**

Introduction of lipids and classification. Building blocks of lipids – fatty acids, glycerol, ceramide. Storage lipids – triacyl glycerol and waxes. Derived lipids.

#### **Unit 10 Membrane lipids**

Structural lipids in membranes – glycerophospholipids, galactolipids and sulpholipids, sphingolipids and sterols, structure, distribution and role of membrane lipids.

#### **Unit 11 Specialized functions of lipids**

Lipids as signaling molecules, cofactors and pigments. Plant steroids.

### **Block-IV Vitamins and Nucleic acids**

#### **Unit 12 Vitamins**

Structure and active forms of water soluble and fat soluble vitamins, deficiency diseases and symptoms, hypervitaminosis. Vitamins as antioxidants and coenzymes.

#### **Unit 13 Nucleic acids**

Nucleic acids as genetic material. Constituents of nucleic acids: Nitrogenous bases, nucleosides, nucleotides – structure and properties. Nucleic acid structure – Watson-Crick model of DNA and other forms of DNA. Structure of major species of RNA – mRNA, tRNA and rRNA.

#### **Unit 14 Dynamics of nucleic acids**

Nucleic acid chemistry –UV absorption, effect of acid and alkali on DNA. Other functions of nucleotides – source of energy, component of coenzymes, second messengers.

<b>Course Code: BBCCL-102</b>	<b>Course Title: Molecules of Life: Laboratory</b>	<b>Credits: 2</b>
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1. Cleaning and Maintenance of glass ware, Safety measures in laboratories.
2. Preparation of normal and molar solutions.
3. Measuring pH, calibration of pH meter and Preparation of buffers.
4. Determination of pKa of acetic acid and glycine.
5. Qualitative tests for carbohydrates.
6. Qualitative tests for amino acids and proteins
7. Qualitative tests for lipids.
8. Qualitative tests for nucleic acids.

9. Separation of amino acid/ sugars/bases by thin layer chromatography.

7. Estimation of vitamin C.

<b>Course Code: BBCCT-103</b>	<b>Course Title: Cell Biology</b>	<b>Credits: 4</b>
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## **BLOCK -1 Introduction to Cell Biology**

### **Unit 1 The Cell**

Introduction, Cell Theory, Prokaryotic (Archaea and Eubacteria) and eukaryotic cell (Animal and Plant cells), features of cell organization in prokaryotes and eukaryotes, differences between plant and animal cell, Cells as experimental models.

### **Unit 2 Microscopy**

Principle, cell fixation, Light microscopy- Bright and Light Field microscopy, phase contrast microscopy, fluorescence microscopy, confocal microscopy,

### **Unit 3 Electron Microscopy**

Preparation of biological specimen (Fixation & staining), Electron microscopy- Transmission Electron Microscope (TEM) and Scanning Electron Microscope (SEM).

### **Unit 4 Centrifugation**

Principle, Principle of Centrifugation, Svedberg Unit, Instrumentation, Differential Centrifugation for subcellular fractionation, Ultra centrifugation- Preparative and Analytical centrifugation, Density Gradient Centrifugation, Application of Centrifugation.

## **BLOCK- 2 Structure and Function of the Cell**

### **Unit 5 Structure and function of sub cellular organelles**

Introduction, Nucleus, Structure of nuclear envelope, nuclear pore complex. ER structure (SER & RER). Organization of Golgi. Lysosome. Structure and functions of mitochondria, chloroplasts and peroxisomes.

### **Unit 6 Cell wall and Extracellular matrix**

Introduction, Prokaryotic and eukaryotic cell wall, Cell matrix proteins. Cell-matrix interactions and cell-cell interactions. Adherence junctions, tight junctions, gap junctions, desmosomes, hemidesmosomes, focal adhesions and plasmodesmata.

### **Unit 7 Cytoskeletal proteins and Cell Movements**

Introduction, Structure and organization of Microtubules and actin filaments. Treadmilling and role of ATP in microfilament polymerization, organization of actin filaments. Non-muscle myosin. Intermediate filament proteins, assembly and intracellular organization. Assembly, organization and movement of cilia and flagella.

## **BLOCK-3 Protein Transport**

### **Unit 8 Protein Trafficking I**

Introduction, Translocation of proteins across the ER membrane, Insertion of proteins into the ER Membrane, Co-translational modification of proteins and sorting signals (Signal

Hypothesis-Signal recognitions peptide, SRP), Export of proteins to ER, selective type of proteins and its regulation, Transport of proteins from ER and into ER.

### **Unit 9 Protein Trafficking II**

Vesicular transport, modification of vesicular protein, Protein sorting and export from Golgi, Receptor mediated selective transport.

### **Unit 10 Protein Trafficking III**

Transport of proteins into and out of nucleus, Import and export of proteins into mitochondria, chloroplast and peroxisomes.

## **BLOCK-4 Cell cycle and its regulation**

### **Unit 11 Cell cycle**

Introduction, Cell cycle, Cell division- mitosis & meiosis

### **Unit 12 Regulation of Cell division**

Introduction, Control of cell cycle (Cyclin-dependent Kinases and Cyclins and), restriction point and checkpoints.

### **Unit 13 Cell death and Cell renewal**

Apoptosis (Intrinsic pathway and extrinsic pathway), Cell proliferation, Programme cell death, Brief outline of Necrosis- pathogenic necrosis, Salient features of a transformed cell, Fluorescence-activated cell sorting (FACS).

<b>Course Code: BBCCL-104</b>	<b>Course Title: Cell Biology: Laboratory</b>	<b>Credits: 2</b>
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1. Compound Microscope
2. Preparation of slide
3. Visualization of animal and plant cell by methylene blue.
4. Identification of different stages of mitosis in onion root tip
5. Identification of different stages of meiosis in onion buds.
6. Micrographs of different cell components (dry lab).
7. Visualization of nuclear fraction by acetocarmine stain.
8. Staining and visualization of mitochondria by Janus green stain.

<b>Course Code: BBCCT-105</b>	<b>Course Title: Proteins</b>	<b>Credits: 4</b>
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## **BLOCK-I Proteins: Isolation and Separation**

### **Unit 1 Amino acids, peptides and proteins**

Amino acids and their properties - hydrophobic, polar and/ charged. Biologically important peptides - hormones, antibiotics and growth factors. Multimeric proteins, conjugated proteins and metallo proteins. Diversity of function

## **Unit 2 Extraction of proteins**

Solubilization of proteins from their cellular and extracellular locations. Use of simple grinding methods, homogenization, ultrasonication, French press and centrifugation.

## **Unit 3 Separation techniques-I**

Ammonium sulphate fractionation, solvent fractionation, dialysis and lyophilization.

## **Unit 4 Separation techniques-II**

Ion-exchange chromatography, molecular sieve chromatography, hydrophobic interaction/reverse phase chromatography, affinity chromatography, HPLC and FPLC

## **BLOCK-II Characterization and Analysis of Proteins**

### **Unit 5 Characterization of proteins**

Determination of purity, molecular weight, extinction coefficient and sedimentation coefficient, IEF, SDS-PAGE and 2-D electrophoresis.

### **Unit 6 Sequencing and analysis of proteins**

N-terminal and C-terminal amino acid analysis. Sequencing techniques - Edman degradation. Generation of overlap peptides using different enzymes and chemical reagents. Disulfide bonds and their location.

### **Unit 7 Mass spectrometry**

Mass spectrometric analysis, tandem MS. Solid phase peptide synthesis

## **BLOCK-III Structure of proteins**

### **Unit 8 Three dimensional structures of proteins**

Nature of stabilizing bonds - covalent and non-covalent. Importance of primary structure in folding. The peptide bond - bond lengths and configuration. Dihedral angles psi and phi. Helices, sheets and turns. Ramachandran map.

### **Unit 9**

Techniques used in studying 3-D structures - X-ray diffraction and NMR. Motifs and domains. Tertiary and quaternary structures. Structures of myoglobin and haemoglobin

### **Unit 10 Protein folding**

Introduction to protein folding. Denaturation and renaturation of proteins. Introduction to thermodynamics of folding. Defects in protein folding. Diseases –Alzheimer's and Prion based.

### **Unit 11 Introduction to protein structure databases**

Protein sequence and structure databases (PDB). Use of sequence and domain information. Viewing protein structures using *in silico* tools.

## **BLOCK-IV Diversity of protein function**

### **Unit 12 Overview of protein diversity**

Introduction to diversity of proteins. Specified functions of proteins: Transport, storage, receptor, signaling. Structural proteins like Keratin, Collagen, Actin, Myosin; globular proteins.

### **Unit 13 Myoglobin and haemoglobin**

Oxygen binding curves, influence of 2,3-BPG, CO<sub>2</sub> and Cl<sup>-</sup>. Hill plot. Cooperativity between subunits and models to explain the phenomena - concerted and sequential models. Haemoglobin disorders.

### **Unit 14 Specialized proteins - antibodies and actin-myosin motors**

Antibody structure and binding to antigens. ATP activated actin - myosin contractions.

seeds; Dispersal of seeds; Types of fruit; Fruit development and structure; Parthenocarpy

<b>Course Code: BBCCL-106</b>	<b>Course Title: Proteins: Laboratory</b>	<b>Credits: 2</b>
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1. Estimation of proteins using UV absorbance and Biuret method.
2. Estimation of proteins using Biuret method.
3. Assay of proteins using Lowry/Bradford method.
4. Assay of proteins using Bradford method.
5. Determination of Isoelectric pH of casein.
6. Ammonium sulphate fractionation of serum proteins.
7. Separation of serum proteins using paper electrophoresis
8. SDS-PAGE analysis of proteins.

<b>Course Code: BBCCT-107</b>	<b>Course Title: Enzymes</b>	<b>Credits: 4</b>
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## **BLOCK-1: Enzymes as Biocatalysts**

### **Unit 1 Introduction to enzymes**

Nature of enzymes - protein and non-protein (ribozyme). Cofactor and prosthetic group, apoenzyme, holoenzyme. IUBMB classification of enzymes.

### **Unit 2 Features of enzyme catalysis**

Factors affecting the rate of chemical reactions, collision theory, activation energy and transition state theory, catalysis, reaction rates and thermodynamics of reaction. Catalytic power and specificity of enzymes (concept of active site), Fischer's lock and key hypothesis, Koshland's induced fit hypothesis.

### **Unit 3 Factors affecting enzyme activity**

Introduction, Effect of pH, temperature and metal ions on the activity of enzyme.

## **BLOCK-2: Enzymes Kinetics**

#### **Unit 4 Enzyme kinetics**

Relationship between initial velocity and substrate concentration, steady state kinetics, equilibrium constant - monosubstrate reactions. Michaelis-Menten equation, Lineweaver-Burk plot, Eadie-Hofstee and Hanes plot.  $K_m$  and  $V_{max}$ ,  $K_{cat}$  and turnover number.

#### **Unit 5 Bisubstrate reactions**

Types of bi bi reactions (sequential – ordered and random, ping pong reactions). Differentiating bi substrate mechanisms (diagnostic plots, isotope exchange).

#### **Unit 6 Enzyme inhibition**

Reversible inhibition (competitive, uncompetitive, non-competitive, mixed and substrate). Irreversible inhibitors, Mechanism based inhibitors - antibiotics as inhibitors.

### **BLOCK-3: Mechanism and Regulation of Enzyme Activity**

#### **Unit 7 Mechanism of action of enzymes**

General features - proximity and orientation, strain and distortion, acid base and covalent catalysis (chymotrypsin, lysozyme). Metal activated enzymes and metalloenzymes, transition state analogues.

#### **Unit 8 Regulation of enzyme activity**

Control of activities of single enzymes (end product inhibition) and metabolic pathways, feedback inhibition (aspartate transcarbamoylase), Allosteric enzymes, reversible covalent modification phosphorylation (glycogen phosphorylase). Proteolytic cleavage- zymogen.

#### **Unit 9 Multienzyme complexes**

Introduction, Multienzyme complex as regulatory enzymes. Occurrence and isolation, phylogenetic distribution and properties (pyruvate dehydrogenase, fatty acyl synthase) Isoenzymes - properties and physiological significance (lactate dehydrogenase).

### **BLOCK-4: Application of Enzymes**

#### **Unit 10 Involvement of coenzymes in enzyme catalysed reactions**

Introduction, Biological significance, TPP, FAD, NAD, pyridoxal phosphate, biotin, coenzyme A, tetrahydrofolate, lipoic acid.

#### **Unit 11 Applications of enzymes**

Introduction, Application of enzymes in Starch, Detergent, Baking, Dairy, Wine and Brewing industry, Food industry, diagnostics (SGPT, SGOT, creatine kinase, alkaline and acid phosphatases), enzyme immunoassay (Horse radish peroxidase (HRPO)), enzyme therapy (Streptokinase).

#### **Unit 12 Immobilized enzymes**

Introduction, Types and Methods, Gel, fibre and microencapsulation, Binding-covalent, physical adsorption and metal binding, Cross linked enzymes. Enzyme Electrodes.

<b>Course Code: BBCCL-108</b>	<b>Course Title: Enzymes: Laboratory</b>	<b>Credits: 2</b>
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1. Assay of enzyme activity and specific activity, e.g. acid phosphatase.
2. Partial purification of acid phosphatase from germinating mung bean by ammonium sulfate fractionation.
3. Effect of pH on enzyme activity
4. Determination of  $K_m$  and  $V_{max}$  using Lineweaver-Burk graph.



5. Determination of Activation energy of acid phosphatase
6. Continuous assay of lactate dehydrogenase.
7. Coupled assay of glucose-6-phosphate dehydrogenase.

<b>Course Code: BBCCT-109</b>	<b>Course Title: Metabolism of Carbohydrates and Lipids</b>	<b>Credits: 4</b>
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## **BLOCK I: Carbohydrate Metabolism-I**

### **Unit 1 Introduction to metabolism**

Autotrophs, heterotrophs, metabolic pathways, catabolism, anabolism, anaplerotic and secondary metabolic pathways, ATP as high energy currency, reducing power of the cell.

### **Unit 2 Glycolysis**

Glycolysis - a universal pathway, fermentation, feeder pathways for glycolysis, Cory's cycle, regulation of glycolysis, fates of pyruvate.

### **Unit 3 Tricarboxylic Acid Cycle (TCA)**

Production of acetyl CoA, reactions of TCA cycle, anaplerotic reactions, amphibolic role, regulation of TCA cycle, glyoxalate pathway, coordinated regulation of TCA cycle and glyoxalate pathway, pentose phosphate pathway and its importance.

## **BLOCK II: Carbohydrate Metabolism II**

### **Unit 5 Gluconeogenesis**

Synthesis of glucose from non-carbohydrate sources, reciprocal regulation of glycolysis and gluconeogenesis,.

### **Unit 6 Glycogen metabolism**

Glycogenesis and glycogenolysis, regulation of glycogen metabolism, glycogen storage diseases.

### **Unit 7 Synthesis of carbohydrates**

Calvin cycle, regulation of calvin cycle, regulated synthesis of starch and sucrose, photorespiration, C 4 and CAM pathways,

### **Unit 8 Integration of carbohydrate metabolism**

Integration of carbohydrate metabolism in plant and animal cells

## **BLOCK III: Lipid Metabolism I**

### **Unit 8 Oxidation of fatty acids**

Mobilisation and transport of fatty acids and triacyl glycerols, fatty acid transport to mitochondria,  $\beta$  oxidation of saturated and unsaturated fatty acids (odd and even numbered), regulation of fatty acid oxidation.

### **Unit 9 Minor pathways of fatty acid oxidation**

Peroxisomal  $\beta$  oxidation,  $\omega$  oxidation,  $\alpha$  oxidation, Ketone bodies metabolism, regulation, ketoacidosis

### Unit 10 Fatty acid synthesis

Fatty acid synthase complex. Synthesis of saturated, unsaturated, odd and even chain fatty acids and regulation.

## BLOCK IV: Lipid Metabolism II

### Unit 11 Biosynthesis of TAG and cholesterol

Biosynthetic pathways of triacylglycerol, cholesterol and their regulation. .

### Unit 12 Biosynthesis of membrane lipids

Synthesis of membrane phospholipids in prokaryotes and eukaryotes, respiratory distress syndrome, biosynthesis of plasmalogens, sphingolipids and glycolipids.

### Unit 13 Integration of metabolism

.Well- fed state, early fasting state, fasting state, early re-fed state, energy requirements, reserve and caloric homeostasis, five phases of glucose homeostasis.

### Unit 14 Disorders of lipid metabolism

Lipid storage diseases

<b>Course Code: BBCCL-110</b>	<b>Course Title: Metabolism of Carbohydrates and Lipids: Laboratory</b>	<b>Credits: 2</b>
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1. Estimation of blood glucose by coupled assay.
2. Sugar fermentation by microorganisms.
3. Demonstration of starch digestion by salivary amylase.
4. Isolation and fractionation of egg lipids by TLC, and its estimation.

<b>Course Code: BBCCT-111</b>	<b>Course Title: Membrane Biology and Bioenergetics</b>	<b>Credits: 4</b>
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## Block I BIOMEMBRANES

### Unit 1 Introduction to biomembranes

Composition of biomembranes, Study of membrane proteins. Fluid mosaic model with experimental proof. Monolayer, planar bilayer and liposomes as model membrane systems.

### Unit 2 Membrane structures

Polymorphic structures of amphiphilic molecules in aqueous solutions - micelles and bilayers. CMC, critical packing parameter. Membrane asymmetry. Macro and micro domains in membranes, freeze fracture technique and etching. Lipid rafts, caveolae. RBC membrane architecture.

### Unit 3 Membrane dynamics

Lateral, transverse and rotational motion of lipids and proteins. Techniques used to study membrane dynamics – FRAP (Fluorescence Recovery After Photo bleaching) and TNBS labeling. Transition studies of lipid bilayer, transition temperature, Membrane fluidity- factors affecting membrane fluidity.

## Block II MEMBRANE TRANSPORT

### Unit 4 Membrane transport I

Simple and facilitated diffusion. Active and Passive transport -

glucose transporter, anion transporter and porins. Na<sup>+</sup>-glucose symporter.

### **Unit 5 Membrane transport II**

ABC family of transporters - MDR. Group translocation. Ion channels - voltage-gated ion channels (Na<sup>+</sup>/K<sup>+</sup> voltage-gated channel), ligand-gated ion channels (acetyl choline receptor), aquaporins, bacteriorhodopsin. Ionophores - valinomycin, gramicidin.

### **Unit 6 Vesicular transport and membrane fusion**

Types of vesicular transport and their function - clathrin, COP I and COP II coated vesicles. Molecular mechanism of vesicular transport. Membrane fusion. Receptor mediated endocytosis.

## **Block III BIOENERGETICS**

### **Unit 7 Introduction to bioenergetics**

Laws of thermodynamics; application in biological systems, free energy change during biochemical reactions ( $\Delta G$ ), introduction to non-equilibrium thermodynamics, Redox reactions, standard redox potentials and Nernst equation. Universal electron carriers.

### **Unit 8 ATP and high energy molecules**

ADP-ATP cycle, phosphorylation potential, phosphoryl group transfers. Chemical basis of high standard energy of hydrolysis of ATP, other high energy phosphorylated compounds.

### **Unit 9 Oxidative phosphorylation**

Mitochondrial. Electron transport chain - its organization and function. Peter Mitchell's chemiosmotic hypothesis. Proton motive force. F<sub>0</sub> F<sub>1</sub> ATP Synthase complex- structure and mechanism of ATP synthesis. Metabolite transporters in mitochondria. Regulation of oxidative phosphorylation. Inhibitors of ETC and uncouplers, Thermogenesis.

## **Block IV PHOTOPHOSPHORYLATION**

### **Unit 10 Photophosphorylation**

Historical background, General features of photophosphorylation, Structure of chloroplast and photosynthetic pigments. Hill's reaction.

### **Unit 11 Electron transport in chloroplast**

Light harvesting systems of plants- molecular architecture of Photosystem I and Photosystem II, Z-scheme of photosynthetic electron flow, generation of proton motive force across photosynthetic membrane, structure and function of CF<sub>0</sub> CF<sub>1</sub> ATP Synthase complex. Cyclic and non-cyclic electron transport and its significance. Marginal remarks: (oxygen evolving complex and action of herbicides)

### **Unit 12 Bacterial photophosphorylation**

Light harvesting systems in microbes, photophosphorylation in purple bacteria, Green sulfur bacteria and *Halobacterium salinarum*.

<b>Course Code: BBCCL-112</b>	<b>Course Title: Membrane Biology and Bioenergetics: Laboratory</b>	<b>Credits: 2</b>
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1. RBC ghost cell preparation and to study the effect of detergents on membranes.
2. Study photosynthetic O<sub>2</sub> evolution in hydrilla plant.
3. Isolation of chloroplast from spinach leaves, estimation of chlorophyll.
4. Extraction and separation of photosynthetic pigments by TLC/ paper chromatography.

5. Isolation of mitochondria from liver and assay of marker enzyme SDH.

<b>Course Code: BBCCT-113</b>	<b>Course Title: Metabolism of Amino Acids and Nucleotides</b>	<b>Credits: 4</b>
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### **BLOCK-1: Nitrogen Metabolism and Degradation of Amino Acids**

#### **Unit 1 Overview of amino acid metabolism**

Nitrogen cycle, incorporation of ammonia into biomolecules. Metabolic fates of amino groups. Protein calorie malnutrition - Kwashiorkar and Marasmus.

#### **Unit-2: Nitrogen Excretion and Urea Cycle**

Nitrogen balance, transamination, role of pyridoxal phosphate, glucose-alanine cycle, Krebs's bicycle, urea cycle and inherited defects of urea cycle.

#### **Unit 3 Catabolism of amino acids**

Catabolic pathways of individual amino acids. Glucogenic and ketogenic amino acids.

#### **Unit-4 Disorders of amino acids metabolism**

Phenylketonuria, alkaptonuria, maple syrup urine disease, methylmalonic acidemia (MMA), homocystinuria and Hartnup's disease.

### **BLOCK-2 Biosynthesis of Amino acids and Related molecules**

#### **Unit 4 Biosynthesis of amino acids**

Overview of amino acid synthesis. Biosynthesis of non-essential amino acids and its regulation.

#### **Unit 5 Precursor functions of amino acids**

Biosynthesis of creatine and creatinine, polyamines (putresine, spermine, spermidine), catecholamines (dopamine, epinephrine, norepinephrine) and neurotransmitters (serotonin, GABA).

#### **Unit 6 Porphyrins**

Porphyrin biosynthesis, catabolism and disorders of porphyrin metabolism.

### **BLOCK-3 Biosynthesis of Nucleotides**

#### **Unit 7 Biosynthesis of purine nucleotides**

*De novo* synthesis of purine and pyrimidine nucleotides, regulation and salvage pathways.

#### **Unit 8 Biosynthesis of pyrimidine nucleotides**

*De novo* synthesis of purine and pyrimidine nucleotides, regulation and salvage pathways.

#### **Unit 9 Deoxyribonucleotides and synthesis of nucleotide triphosphate**

Biosynthesis of deoxyribonucleotides and its regulation, conversion to triphosphates, biosynthesis of coenzyme nucleotides.

### **BLOCK-4 Nucleotide Degradation**

#### **Unit 10 Degradation of purine and pyrimidine nucleotides**

Digestion of nucleic acids, Catabolism of purine and pyrimidine nucleotides.

#### **Unit 11 Disorders of purine and pyrimidine metabolism**

Introduction – Lesch-Nyhan syndrome, Gout, severe combined immune deficiency (SCID),

adenosine deaminase deficiency. Inhibitors of nucleotide metabolism.

### **Unit 12 Integration of metabolism**

Integration of metabolic pathways (carbohydrate, lipid and amino acid metabolic pathways), tissue specific metabolism (brain, muscle, and liver).

<b>Course Code: BBCCL-114</b>	<b>Course Title: Metabolism of Amino Acids and Nucleotides: Laboratory</b>	<b>Credits: 2</b>
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1. Assay of serum transaminases – SGOT and SGPT.
2. Estimation of serum urea.
3. Estimation of serum uric acid.
4. Estimation of serum creatinine.

<b>Course Code: BBCCT-115</b>	<b>Course Title: Human Physiology</b>	<b>Credits: 4</b>
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## **BLOCK 1 HOMEOSTASIS AND CARDIAC PHYSIOLOGY          No. of Hours: 16**

### **Unit 1 Homeostasis and the organization of body fluid compartments**

Introduction, Basics of Human Physiology, Homeostasis, Composition of the body fluids and their Organization: Intracellular, Extracellular and Interstitial fluid, General Characteristics of homeostatic Control systems and their components.

### **Unit 2 Blood Coagulation and Disorders**

Introduction, Composition of Blood, Hemostasis, Mechanism of blood coagulation, role of vitamin K in coagulation, anticoagulant and fibrinolytic systems. Blood Disorders: Anemias, polycythemia, Haemophilia and thrombosis.

### **Unit 3 Cardiac Physiology**

Introduction, Overview of the circulatory system, Blood Pressure, flow and resistance, Structure of blood vessels. Physiology of the cardiac muscle, contraction, excitation contraction coupling. Control of cardiac output.

### **Unit 4 Cardiovascular System and Disorders**

Introduction, The arterial system, venous system, the microcirculation and mechanics of capillary fluid exchange. Control of blood flow to the tissues. Arterial pressure and its regulation. Cardiovascular diseases: Hypertension, congestive heart disease, atherosclerosis and myocardial infarction.

## **BLOCK 2 RESPIRATORY AND RENAL PHYSIOLOGY**

### **Unit 5 Respiratory Physiology**

Introduction, Organization of the Pulmonary system. Mechanics of respiration, pulmonary ventilation, pulmonary circulation. Mechanism of gas exchange in alveoli and tissue, Transport of O<sub>2</sub> and CO<sub>2</sub>. Regulation of respiration.

### **Unit 6 Respiratory Disorders**

Introduction, Pulmonary oedema and regulation of pleural fluid. Hypoxia, Emphysema, hypercapnea, Acute respiratory distress syndrome (ARDS).

### **Unit 7 Renal Physiology**

Introduction, Basic principles of Renal physiology, Anatomy of the nephron. Bowmans' capsule. Regulation of renal blood flow. Physiology of glomerular filtration, Mechanism of Urine formation: Filtration and reabsorption, Micturition- Micturition reflex and voluntary control of micturition.

**Unit 8 Renal Regulation and Disorders**

Introduction, Regulation of ECF electrolyte and water content, Role of ADH, blood volume and long term blood pressure. Blood buffer systems, renal and pulmonary control of blood pH. Assessment of kidney function. Renal Disorders: Acidosis and alkalosis, Glomerular nephritis, renal failure, dialysis and diuretics. Anti-diuretic hormone (ADH)

**BLOCK 3 GASTROINTESTINAL AND REPRODUCTIVE PHYSIOLOGY**

**Unit 9 Gastrointestinal System**

Introduction, Overview of the Gastrointestinal System, Structure of the Gastrointestinal tract (GIT). Ultrastructure of Small intestine and stomach, Secretary functions of the gastrointestinal tract, digestion and absorption of Carbohydrate, Fats and Proteins. Pathophysiology of the Gastrointestinal Tract: Peptic ulcer, Sprue, Celiac disease, Inflammatory bowel disease (IBD), Regurgitation, Diarrhea and Constipation.

**Unit 10 Hepatic Physiology**

Introduction, Structure and functions of Liver, Anatomy of the hepatic lobule and blood flow into the liver. Portal Circulation, Formation and secretion of bile. enterohepatic cycle, reticuloendothelial system, metabolic importance of liver. Hepatopathy: Jaundice, liver cirrhosis and fatty liver, Liver function tests.

**Unit 11 Reproductive Physiology**

Introduction, Sex determination and differentiation. Development of female and male genital tracts. Spermatogenesis, capacitation and transport of sperm, blood testis barrier. , Ovarian function and its control. Uterine changes, fertilization and implantation. Placenta as a fetomaternal unit, gestation and parturition.

**BLOCK 4 MUSCULOSKELETAL AND NERVOUS PHYSIOLOGY**

**Unit 12 Musculoskeletal System**

Introduction, Bone structure and formation. Anatomy of Bone, Structure of muscle and striated smooth muscle, Physiology of muscle contraction in striated and non-striated muscle.

**Unit 13 Nervous System I**

Introduction, Structure of Neurons, Central Nervous system. Peripheral Nervous system. Blood brain barrier and CSF. Membrane potentials: action potential, generation & propagation. Synaptic transmission. Neurotransmitters.

**Unit 14 Nervous System II**

Introduction, Sensory receptors and neural pathways. Somatic sensation, sleep, learning and memory, Neural Disorders: Alzheimer and Dementia.

<b>Course Code: BBCCL-116</b>	<b>Course Title: Human Physiology: Laboratory</b>	<b>Credits: 2</b>
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1. Hematology: Methods of Blood Collection, Processing and Storage of Blood.
  - a. RBC and WBC counting
  - b. Differential leucocyte count.
  - c. Clotting time.

2. Estimation of hemoglobin.
3. Determination of Ratio of Albumin and Globulin.
4. Determination of pH of Urine using pH strips.
5. Measurement of blood pressure and Pulse rate.
6. Histology of connective tissue, liver and/ brain permanent slides.

<b>Course Code: BBCCT-117</b>	<b>Course Title: Gene Organization Replication and Repair</b>	<b>Credits: 4</b>
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## **BLOCK I GENES AND GENOMES**

### **Unit 1 Structure of DNA**

Introduction to gene and the genetic material, Forms of DNA (A, B and Z) and their structural features, DNA Melting,  $T_m$  and its significance

### **Unit 2 Genes and genomic organization-I**

C-value paradox, Reassociation kinetics ( $C_0t$  curves), One gene-one enzyme hypothesis, Interrupted gene: Exons and introns, Micro and mini satellites, Organization of genes in prokaryotes (viruses and bacteria), and eukaryotes.

### **Unit 3 Genes and genomic organization-II**

DNA Supercoiling, Enzymes involved in DNA supercoiling, Chromatin: complex of DNA and histones, Histone and non-histone proteins, Nucleosomes, Packaging of DNA into higher order structures

### **Unit 4: Chromosomes**

Chromosomal nomenclature: Chromatid, centromere, telomere, satellite, secondary constriction, nucleolar organization, Metaphase chromosome, Euchromatin and heterochromatin, Structural characteristics of bacterial, viral and eukaryotic chromosomes.

## **BLOCK 2 DNA REPLICATION**

### **Unit 5 Introduction to Replication**

Chemistry of DNA polymerization: Phosphodiester bond formation, Conservative, Semiconservative and Dispersive replication, Direction of DNA synthesis, Semidiscontinuous model of DNA replication, Okazaki fragments, Replication fork, Fidelity of DNA replication: Rationale of Priming, Proofreading

### **Unit 6 Enzymes in Replication**

Enzymes and proteins in DNA replication: DNA polymerases in prokaryotes: subunit structure, roles of different subunits, enzyme activities associated with different prokaryotic DNA polymerases, processivity, Replication of telomeric DNA

### **Unit 7 DNA Replication**

Modes of DNA replication (Rolling circle model or theta model etc.), Replication of *E. coli* genome, Relationship between replication and cell division, Replication in eukaryotes: A brief introduction to DNA polymerases in eukaryotes. Comparison of replication in prokaryotes and eukaryotes, Inhibitors of DNA replication and applications in medicine

## **BLOCK III RECOMBINATION, TRANSPOSITION AND EXTRANUCLEAR DNA**

**No. of Hours: 14**

### **Unit 8 Recombination**

Introduction to recombination, Proteins and enzymes in recombination, Homologous recombination, Holliday model, Site-specific recombination, Biological roles of site-specific recombination

### Unit 9 Transposition

Introduction to transposition, Transposons and retrotransposons, Insertion sequences as transposition modules, Replicative and non-replicative mechanisms of transposition, Types of transposable elements with examples, Importance of transposable elements

### Unit 10 Extranuclear Genome

Organization of extranuclear genome: mitochondrial and chloroplast genome. Overview of extranuclear inheritance with examples, and maternal effect.

## BLOCK IV MUTATIONS AND DNA REPAIR

### Unit 11 Molecular basis of mutations

Introduction to mutation and their role in evolution, Spontaneous mutations, Mutagens, Mutations induced by base analogs, chemicals and radiation. Types of mutations (Transition, Transversion, Frame shift mutations), Molecular basis of mutation, Point mutations, Ames test.

MR on SNP

### Unit 12 DNA damage and repair

DNA damage: Replication errors, Repair of DNA damage: Direct repair, Base excision repair, Nucleotide excision repair, Mismatch repair system, Recombination repair, Translesion DNA synthesis

### Unit: 13 DNA Replication and Human Diseases

Introduction, Xeroderma pigmentosum, Chromosome breakage syndromes (Bloom's syndrome, Fanconi's anaemia and ataxia-telangiectasia), Cockayne's syndrome and Hereditary nonpolyposis colon cancer (HN-PCC)

<b>Course Code: BBCCL-118</b>	<b>Course Title: Gene Organization Replication and Repair: Laboratory</b>	<b>Credits: 2</b>
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1. Colorimetric estimation of DNA by diphenylamine method
2. Ultraviolet absorption spectrum of DNA and RNA.
3. Determination of DNA and RNA concentration by UV absorption.
4. Isolation of plasmid DNA from E. coli cells.

<b>Course Code: BBCCT-119</b>	<b>Course Title: Hormone: Biochemistry and Function</b>	<b>Credits: 4</b>
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## Block I: Hypothalamic and pituitary hormones (16 h)

### Unit 1 Introduction to endocrinology

**No. of Hours : 6**

Endocrine glands, Chemical signaling - endocrine, paracrine, autocrine, intracrine and neuroendocrine mechanisms. Chemical classification of hormones, transport of hormones in the circulation and their half-lives, metabolism and excretion. Functions of hormones and their regulation.

### Unit 2 Hypothalamic hormones

**No. of Hours : 4**

Hypothalamic - pituitary axis, hypothalamic hormones. Hypothalamic disease.



### **Unit 3 Pituitary hormones**

Hormones of anterior pituitary hormones - GH, prolactin, TSH, LH, FSH, Proopiomelanocortin (POMC) peptide family, Pathophysiology - gigantism, acromegaly, dwarfism. Posterior pituitary hormones- Oxytocin and vasopressin, feedback regulation cycle. Disorders- diabetes insipidus.

## **Block II Growth and development hormones II (14 h)**

### **Unit 4: Thyroid hormone**

**No. of Hours : 4**

Thyroid gland. Biosynthesis of thyroid hormone and its regulation; its physiological and biochemical action. Pathophysiology - Goiter, Graves disease, cretinism, myxedema, Hashimoto's disease.

### **Unit 5: Reproductive hormones**

**No. of Hours : 6**

Male sex hormones, Female sex hormones. Interplay of hormones during reproductive cycle, pregnancy, parturition and lactation. Hormone based contraception.

### **Unit 6: Growth hormone and factors**

**No. of Hours : 4**

Platelet derived growth factor, Epidermal growth factor, Insulin like growth hormones, and erythropoietin.

## **Block III Metabolic and stress hormones (16 h)**

### **Unit 7: Hormones regulating Ca<sup>2+</sup> and phosphorus homeostasis**

**No. of Hours : 6**

PTH, Vitamin D and calcitonin. Mechanism of Ca<sup>2+</sup> regulation and pathways involving bone, skin, liver, gut and kidneys. Pathophysiology - rickets, osteomalacia, osteoporosis.

### **Unit 8: Pancreatic and GI tract hormones**

**No. of Hours : 6**

Regulation of release of insulin, glucagon, gastrin, secretin, CCK, GIP, adipoleptin, leptin and ghrelin. Summary of hormone metabolite control of GI function. Physiological and biochemical action. Pathophysiology - diabetes type I and type II.

### **Unit 9: Adrenal Hormones**

**No. of Hours : 4**

Aldosterone, renin angiotensin system, cortisol, epinephrine and norepinephrine. Fight or flight response, stress response. Pathophysiology – Addison's disease, Conn syndrome, Cushing syndrome.

## **Block IV Mechanism of hormone action (14 h)**

### **Unit 10 Hormone mediated signaling-I**

**No. of Hours : 6**

Hormone receptors - extracellular and intracellular. Receptor - hormone binding, Scatchard analysis. G protein coupled receptors, G proteins, second messengers - cAMP, cGMP, IP<sub>3</sub>, DAG, Ca<sup>2+</sup>, NO. Effector systems - adenylyl cyclase, guanylyl cyclase, PDE, PLC.

### **Unit 11 Hormone mediated signaling-II**

**No. of Hours : 6**

Protein kinases (PKA, PKB, PKC, PKG). Receptor tyrosine kinases - EGF, insulin, erythropoietin receptor; ras - MAP kinase cascade, JAK - STAT pathway. Steroid hormone/ thyroid hormone receptor mediated gene regulation. Receptor regulation and cross talk.

### **Unit 12 Methods of hormone assays**

**No. of Hours : 2**

General introduction to Endocrine methodology- RIA, ELISA. Hormone therapy.

	<b>Function: Laboratory</b>	
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1. Determination of glucose in urine (glycosuria).
2. Estimation of serum Ca<sup>2+</sup>.
3. Estimation of serum T4.
4. HCG based pregnancy test.
5. Estimation of serum electrolytes.

<b>Course Code: BBCCT-121</b>	<b>Course Title: Concepts in Genetics</b>	<b>Credits: 4</b>
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### **BLOCK I MENDELISM**

**No. of Hours: 14**

#### **Unit 1 Introduction to model organisms and Mendelism**

Model organisms: *Escherichia coli*, *Saccharomyces cerevisiae*, *Drosophila melanogaster*, *Caenorhabditis elegans*, *Danio rerio* and *Arabidopsis thaliana*, Basic principles of heredity, Mendel's Laws of inheritance, Gene and allele.

#### **Unit 2 Applications of Mendel's principles & chromosomal basis of heredity**

Laws of probability & binomial expansion, formulating and testing genetic hypothesis, chromosomal basis of Mendelism: experimental evidences.

#### **Unit 3 Extensions of Mendelism**

Allelic variation and gene function - dominance relationships, multiple alleles, lethal alleles and null alleles. Pleiotropy, gene interaction - epistatic and non epistatic, interaction between gene(s) and environment. Penetrance and expressivity, norm of reaction and phenocopy.

### **BLOCK II GENE MAPPING**

**No. of Hours: 16**

#### **Unit 4 Genetic definition of a gene**

Complementation test, limitations of *cis-trans* test, intragenic complementation, rII locus of phage T4 and concept of cistron

#### **Unit 5 Microbial Genetics**

Mechanism of genetic exchange - conjugation, transformation and transduction. Gene mapping in bacteria.

#### **Unit 6 Linkage, crossing over and mapping techniques**

Linkage and crossing over, genetic mapping in eukaryotes, centromere mapping with ordered tetrads, cytogenetic mapping with deletions and duplications in *Drosophila*, detection of linked loci by pedigree analysis in humans and somatic cell hybridization for positioning genes on chromosomes.

### **BLOCK III GENETIC BASIS OF DEVELOPMENT AND SEX DETERMINATION**

**No. of Hours: 16**

#### **Unit 7 The genetic control of development and sex determination**

Model organism for genetic analysis, *Drosophila* development, maternal effect genes, morphogens and zygotic gene activity in development, sex chromosomes and sex determination, dosage compensation of X-linked genes.

#### **Unit 8 Organelle heredity and epigenetics**

Extra nuclear inheritance, tests for organelle heredity and maternal effect, epigenetic

mechanisms of transcriptional regulation & genomic imprinting.

### **Unit 9 Human pedigree analysis**

Pedigree conventions, characteristics of dominant and recessive inheritance. Applications of pedigree analysis.

## **BLOCK IV GENETIC BASIS OF EVOLUTION**

### **Unit 10 Chromosomal aberrations**

Variations in chromosome number- monosomy and trisomy of sex and autosomes. Variations in chromosome structure - inversions, deletions, duplications and translocations.

### **Unit 11 Inheritance of complex traits & population genetics**

Inheritance of complex trait, analysis of quantitative traits, narrow and broad sense heritability, quantitative trait loci (QTL) and their identification. Hardy-Weinberg law, predicting allele and genotype frequencies and exceptions to Hardy-Weinberg principle.

### **Unit 12 Evolutionary genetics**

Molecular evolution - analysis of nucleotide and amino acid sequences, molecular phylogenies, homologous sequences, phenotypic evolution and speciation.

<b>Course Code: BBCCL-122</b>	<b>Course Title: Concepts in Genetics: Laboratory</b>	<b>Credits: 2</b>
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1. Squash preparation of salivary glands of Dipteran larva to observe polytene chromosomes.
2. Induction of polyploidy in onion roots.
3. Smear technique to demonstrate sex chromatin in buccal epithelial cells.
4. PTC testing in a population and calculation of allele and genotype frequencies.
5. Study of abnormal human karyotype and pedigrees (dry lab)

<b>Course Code: BBCCT-123</b>	<b>Course Title: Gene Expression and Regulation</b>	<b>Credits: 4</b>
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## **BLOCK-I TRANSCRIPTION**

### **Unit 1 Transcription in prokaryotes-I**

Prokaryotic RNA polymerases (Structure and functions of subunits), Elements and factors involved in transcription cycle in bacteria, sigma factor, bacterial promoters, identification of DNA binding sites by DNA foot printing.

### **Unit 2 Transcription in prokaryotes-II**

Three stages of RNA synthesis: initiation, elongation and termination. Rho-dependent and rho-independent termination. Inhibitors of transcription and applications as anti-microbial drugs.

### **Unit 3 Transcription in eukaryotes-I**

Transcription by RNA polymerase I and III. Inhibitors of eukaryotic transcription and their applications. Comparison of fidelity of transcription and replication.

### **Unit 4 Transcription in eukaryotes-II**

Comparison between prokaryotic and eukaryotic transcription. Transcription by RNA polymerase II, RNA polymerase II core promoters, general transcription factors, various types of RNA processing.

## **BLOCK-II RNA PROCESSING**

### **Unit 5 Maturation of 5' and 3' ends of m-RNA**

Capping, cleavage and polyadenylation. Functions of the cap and of the Ploy-A tail of eukaryotic m-RNA

### **Unit 6 RNA splicing**

Exons and Introns, classification and properties of Introns. Chemistry of RNA splicing, the spliceosome machinery, splicing pathways, group I and group II introns, alternative splicing, trans splicing, riboswitches exon shuffling.

### **Unit 7 RNA editing and Intron encoded Transcription**

Types of editing and their significance. Introns with ORF having and retro having introns.

## **BLOCK-III GENETIC CODE AND TRANSLATION**

### **Unit 8 Genetic code**

What is genetic code, features of the genetic code, degeneracy of the genetic code, wobble in the anticodon, , nearly universal code.

### **Unit 9 Translation-I**

Structure and functions of Messenger RNA and transfer RNA. Attachment of amino acids to tRNA. Protein translation factors.

### **Unit 10 Translation -II**

Initiation, elongation and termination of protein translation, regulation. Comparison of prokaryotic and eukaryotic protein synthesis. Use of antibiotics in understanding protein synthesis and applications in medicine.

## **BLOCK-IV GENE EXPRESSION AND REGULATION**

### **Unit 11 Basic concepts of Gene Expression and regulation**

Principles of gene regulation, negative and positive regulation. Concept of operons, regulatory proteins, activators, repressors, DNA binding domains, regulation of lac operon and trp operon.

### **Unit 12 Regulation of Gene expression in prokaryotes**

Induction of SOS response, synthesis of ribosomal proteins, regulation by genetic recombination, transcriptional regulation in  $\lambda$  bacteriophage.

### **Unit 13 Regulation of gene expression in eukaryotes**

Heterochromatin, euchromatin, chromatin remodeling, regulation of galactose metabolism in yeast, regulation by phosphorylation of nuclear transcription factors, Regulatory RNAs, RNA interference, synthesis and function of miRNA molecules, phosphorylation of nuclear transcription factors.

<b>Course Code: BBCCL-124</b>	<b>Course Title: Gene Expression and Regulation: Laboratory</b>	<b>Credits: 2</b>
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1. Extraction of total nucleic acids from plant tissue.
2. Diauxic growth curve effect.
3. Isolation of mRNA from yeast by Trizol method.
4. Estimation of RNA by Orcinal method
5. Determination of Purity of RNA by spectrophotometry

<b>Course Code: BBCCT-125</b>	<b>Course Title: Genetic Engineering and Biotechnology</b>	<b>Credits: 4</b>
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## **BLOCK-I TOOLS OF GENETIC ENGINEERING**

### **Unit 1 Introduction to recombinant DNA technology and Gene Cloning**

Overview of recombinant DNA technology. Restriction and modification systems, restriction endonucleases and other enzymes used in manipulating DNA molecules, Electrophoretic separation of nucleic acids by gel electrophoresis. Extraction and purification of plasmid and bacteriophage DNA.

### **Unit 2 Joining of DNA fragments**

Ligation of DNA molecules. DNA ligase, sticky ends, blunt ends, linkers and adapters. Synthetic oligonucleotides, synthesis and use.

### **Unit 3 Cloning vectors for eukaryotes**

Vectors for yeast, higher plants and animals.

### **Unit 4 Cloning vectors for prokaryotes**

Plasmids and bacteriophages as vectors for gene cloning. Cloning vectors based on *E. coli* plasmids, pBR322, pUC8, pGEM3Z. Cloning vectors based on M13 and  $\lambda$  bacteriophage.

## **BLOCK-II GENE CLONNING**

### **Unit 5 Introduction of DNA into cells :Transformation**

Uptake of DNA by cells, preparation of competent cells. Selection for transformed cells. Introduction of phage DNA into bacterial cells. Introduction of DNA into animal cells, methods of Gene transfer: heat shock, shotgun, sonication and electroporation.

### **Unit 6 Selection for recombinants**

Identification for recombinants - insertional inactivation. Identification of recombinant phages. Principles of various selection methods used for identification of transformed cells.

### **Unit 7 Methods for clone identification**

Gene libraries: Genomic, C-DNA libraries, identification of a clone from gene library.

## **BLOCK-III INVITRO DNA AMPLIFICATION AND SEQUENCING OF DNA**

### **Unit 8 Polymerase chain reaction**

Fundamentals of polymerase chain reaction, designing primers for PCR. Studying PCR products. PCR based gene cloning methods. Real time and reverse transcriptase PCR

### **Unit 9 DNA sequencing**

Methods of DNA sequencing: Sanger's method, modifications based on Sanger's method. Automated DNA sequencing. Pyrosequencing.

### **Unit 10 Expression of cloned genes**

Vectors for expression of foreign genes in *E. coli*, cassettes and gene fusions (His). Challenges in producing recombinant protein in *E. coli*. Production of recombinant protein by eukaryotic cells. Fusion tags and their role in purification of recombinant proteins.

## **BLOCK-IV APPLICATIONS OF GENETIC ENGINEERING IN BIOTECHNOLOGY**

### **Unit 11 Gene manipulation**

Introduction to Site-directed mutagenesis and its applications in Biotechnology (Agriculture, Medicine, Veterinary, Industrial)

### **Unit 12 Applications of recombinant DNA technology**

Applications in medicine, production of recombinant pharmaceuticals such as insulin, human growth hormone, factor VIII. Recombinant vaccines. Gene therapy. Applications in agriculture

- plant genetic engineering, herbicide resistant crops, problems with genetically modified plants, safety concerns.

### **Unit 13 Protein engineering**

Introduction to protein engineering, Applications of protein engineering in purification of enzymes, hormones and in Biopharmaceuticals.

<b>Course Code: BBCCL-126</b>	<b>Course Title: Genetic Engineering and Biotechnology: Laboratory</b>	<b>Credits: 2</b>
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1. Isolation of plasmid DNA from E. coli cells.
2. Digestion of plasmid DNA with restriction enzymes.
3. Amplification of a DNA fragment by PCR.
4. Preparation of competent cells.

<b>Course Code: BBCCT-127</b>	<b>Course Title: Immunology</b>	<b>Credits: 4</b>
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## **BLOCK -1: IMMUNOLOGY-I(IMMUNE SYSTEM-AN OVERVIEW)**

### **Unit 1 Cells and organs of the immune system**

Hematopoiesis, cells of the immune system, primary and secondary lymphoid organs and tissues (MALT).

### **Unit 2 Innate immunity and leukocyte extravasation**

Anatomical barriers, cell types of innate immunity, soluble molecules and membrane associated receptors (PRR), connections between innate and adaptive immunity, cell adhesion molecules, chemokines, leukocyte extravasation, localized and systemic response.

### **Unit 3 Complement system**

Complement activation by classical, alternate and MB lectin pathway, biological consequences of complement activation, regulation and complement deficiencies.

## **BLOCK -2: IMMUNOLOGY-II (B-Cell Biology)**

### **Unit 4 Immunogens and antigens**

Antigens and haptens, factors that dictate immunogenicity, B and T cell epitopes.

### **Unit 5 Antibody structure and function**

Structure and distribution of classes and subclasses of immunoglobulins (Ig), Ig fold, effector functions of antibody, antigenic determinants on Ig and Ig super family.

### **Unit 6 Generation of receptor diversity**

Dreyer-Bennett hypothesis, multigene organization of Ig locus, mechanism of V region DNA rearrangement, ways of antibody diversification.

### **Unit 7 Biology of the B lymphocyte**

Antigen independent phase of B cell maturation and selection, humoral response – T-dependent and T-independent response, anatomical distribution of B cell populations.

## **BLOCK-3: IMMUNOLOGY-III (T-Cell Biology)**

### **Unit 8 MHC complex and antigen presentation**

General organization and inheritance of MHC, structure, distribution and role of MHC class I and class II proteins, linkage disequilibrium, pathways of antigen processing and

presentation.

### **Unit 9 Biology of the T lymphocyte**

Structure and role of T cell receptor, and co-receptor, T cell development, generation of receptor diversity, selection and differentiation.

### **Unit 10 Cell mediated cytotoxic responses**

General properties of effector T cells, cytotoxic T cells (T<sub>c</sub>), natural killer cells; NKT cells and antibody dependent cellular cytotoxicity (ADCC).

### **BLOCK-4: IMMUNOLOGY-IV (Advanced Immunology)**

### **Unit 11 Tolerance, autoimmunity and hypersensitivity**

Organ specific and systemic autoimmune diseases, possible mechanisms of induction of autoimmunity, Gell and Coombs classification, IgE mediated (Type I) hypersensitivity, antibody mediated cytotoxic (Type II)

### **Unit 12 Hypersensitivity (Type III and IV)**

Hypersensitivity, immune complex mediated (type III) hypersensitivity and delayed type (Type IV) hypersensitivity.

### **Unit 13 Transplantation immunology and vaccines**

Immunological basis of graft rejection, clinical manifestations, immunosuppressive therapy and privileged sites. Vaccines - active and passive immunization, types of vaccines.

<b>Course Code: BBCCL-128</b>	<b>Course Title: Immunology: Laboratory</b>	<b>Credits: 2</b>
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1. Isolation of lymphocytes from blood and macrophages from peritoneal cavity or spleen.
2. Assays based on precipitation reactions - Ouchterlony double diffusion (ODD) and Mancini radial immunodiffusion.
3. Assays based on agglutination reactions - Blood Grouping.
4. Demonstration of Enzyme linked immune-sorbent assay (ELISA).

### **CORE COURSE C-14 : IMMUNOLOGY (PRACTICALS)**

**SEMESTER – VI**

**TOTAL HOURS : 60**

**CREDITS: 2**

1. Isolation of lymphocytes from blood and macrophages from peritoneal cavity or spleen.
2. Assays based on precipitation reactions - Ouchterlony double diffusion (ODD) and Mancini radial immunodiffusion.
3. Assays based on agglutination reactions - Blood Grouping.
4. Demonstration of Enzyme linked immune-sorbent assay (ELISA).

<b>Course Code: BBCET-141</b>	<b>Course Title: Nutritional Biochemistry</b>	<b>Credits: 4</b>
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### **Block 1: Introduction to nutrition and energy metabolism**

#### **Unit 1 Introduction to Nutrition**

Nutrition, Macro and micronutrients, their role. Estimation of nutrient requirements- Dietary reference values; Reference Nutrient Intakes (RNI) and Recommended Dietary Allowances (RDA) for different age groups. Measurement of toxicity and dietary guidelines.

## **Unit 2 Energy metabolism**

Unit of energy, Biological oxidation of foodstuff, Energy content of food, Physiological energy value of foods, Specific dynamic action (SDA). Energy expenditure and its measurement- Direct and Indirect Calorimetry. Basal and Resting metabolism- definition and factors affecting. Components of energy expenditure. Energy balance.

## **Unit 3 Assessment of Nutritional status**

Anthropometric measurements- Z scores, BMI, skin fold, circumference ratios. Clinical signs of nutritional deficiencies. Clinical symptoms of nutritional deficiencies, Biochemical lab assessment; Basal and Comprehensive metabolic panel- Complete blood Count (CBC), Urine Analysis, Assessment of Anemia, Glucose tolerance test (GTT) and glycosylated Hb. Determination of deficiencies of following: Iodine, vitamin A, D.

## **Block 2: Macronutrients in health**

### **Unit 4 Dietary carbohydrates and health**

Review of functions of carbohydrates. Digestion, absorption, utilization and storage, hormonal regulation of blood glucose. Dietary requirements and source of carbohydrates and dietary fiber, role of fibre in lipid metabolism, colon function, blood glucose level and GI tract functions.

### **Unit 5 Dietary fats and health**

Review of classification, sources, functions, digestion, absorption, utilization and storage of fats. Essential Fatty Acids; Functions of EFA, RDA, – excess and deficiency of EFA. Lipotropic factors- role of saturated fat, cholesterol, lipoprotein and triglycerides. Importance of the following:a) Phospholipids b) Cholesterol in the body c) Mono, Polyunsaturated and Saturated Fatty Acids.

### **Unit 6 Dietary Proteins and health**

Review of functions of proteins in the body, Digestion and absorption. Essential and nonessential amino acids. Bioavailability of amino Acid availability. Amino acid Supplementation, effects of deficiency. Food source and Recommended Dietary Allowances for different age groups. Amino acid pool. NPU, Biological Value, Nitrogen balance. PEM (Marasmus and Kwashiorkor).

## **Block 3: Micronutrients in health (16h)**

### **Unit 7 Water soluble vitamins**

Biological role of Vitamin C and Vitamin B complex: Niacin, Vitamin B6, Vitamin B12 and folate. RDA, dietary sources, chemically active forms in the body, biochemical basis of deficiency symptoms.

### **Unit 8 Fat soluble Vitamins**

Vitamin A, D, E and K. Dietary sources, RDA, Adsorption, Distribution, Metabolism and Excretion (ADME), Biological role, Chemically active forms in the body, Biochemical basis of deficiency diseases and Toxicity, their symptoms.

### **Unit 9 Minerals**

Na, K, Calcium, Phosphorus, Mg, and Iron - Absorption, Utilization, Transport, Excretion, Balance, Deficiency, Toxicity, Sources, RDA.Trace minerals- Iodine, Fluoride, Mg, Cu, Zn, Se, Manganese, Chromium, Molybdenum Distribution in the human body, Physiology, Function, deficiency, toxicity and sources.

## **Block 4 Special topics**

### **Unit 10 Food and drug interactions**



Nutrient interactions affecting ADMES of drugs, Alcohol induced nutrient deficiency, Interactions of Antidepressants, psychoactive drugs and nutrients. Appetite changes with drug intakes and malnutrition. Nutraceuticals, functional foods and diet therapy.

### Unit 11 Life style diseases

Obesity, Type II diabetes, Cardiovascular diseases.

### Unit 12 Food toxicity

Food allergies, naturally occurring toxicants in food; mycotoxins, contaminants- pesticides, industrial contaminants, microbial contaminants. Food additives.

<b>Course Code: BBCEL-142</b>	<b>Course Title: Nutritional Biochemistry: Laboratory</b>	<b>Credits: 2</b>
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1. Estimation of vitamin C by titration method.
2. Determination of salivary amylase.
3. Anthropometric measurement for normal and Obese subjects.
4. Calculation of BMI.
5. Determination of oxidative stress: Assay of TBARS/ MDA, antioxidant enzymes in hemolysate.
6. Vitamin A/E estimation in serum.
7. Bone densitometry /bone ultrasound test demonstration (visit to a nearby clinic)

<b>Course Code: BBCET-143</b>	<b>Course Title: Basic Microbiology</b>	<b>Credits: 4</b>
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## Block 1: History of microbiology and classification of microbes

### Unit 1 History of Development of Microbiology

Development of microbiology as a discipline, Spontaneous generation vs. biogenesis. Contributions of Antonie von Leeuwenhoek, Louis Pasteur, Robert Koch, Joseph Lister, Alexander Fleming. Role of microorganisms in fermentation, Germ theory of disease, Development of various microbiological techniques. Establishment of fields of medical microbiology and immunology.

### Unit 2 Microbial taxonomy

Introduction to taxonomy and classification systems. Binomial Nomenclature, Whittaker's and Carl Woese's classification systems and their utility. Brief introduction to phylogeny.

### Unit 3 Diversity of the microbial world

Prokaryotic and eukaryotic microorganisms. General characteristics Viruses, virusoids Viroids, Prions and Cellular microorganisms (Bacteria, Algae, Fungi and Protozoa) with emphasis on distribution and occurrence, morphology, mode of reproduction.

## Block 2: Bacteria and Viruses

### Unit 4 Eubacteria

An account of typical Eubacteria: Classification and structure of eubacteria. Proteobacteria and non proteobacteria.

### Unit 5 Archae bacteria and unusual bacteria

Archaeobacteria (extremophiles), chlamydiae & rickettsiae (obligate intracellular parasites), Mycoplasma.

### **Unit 6: Viruses**

An introduction to viruses with special reference to the structure and replication of the following: Poliovirus, HIV, Influenza, SARS-CoV-2 and  $\lambda$  phage, lytic and lysogenic cycles.

### **Block 3: Eukaryotic organisms**

#### **Unit 7 Algae**

History of phycology; General characteristics of algae including occurrence, thallus organization, algal cell ultra structure, pigments, flagella and vegetative, asexual and sexual reproduction.

#### **Unit 8 Fungi**

Historical developments in the field of Mycology. General characteristics of fungi including habitat and distribution, nutritional requirements, fungal cell ultra- structure, thallus organization and aggregation, fungal wall structure and asexual reproduction, sexual reproduction, heterokaryosis, heterothallism and parasexual mechanism. Mycotoxins

#### **Unit 9 Protozoa**

General characteristics, classification, distribution, nutrition and reproduction.

### **Block 4: Interaction of microbes with environment**

#### **Unit 10 Microbial Nutrition, growth and control**

Common Nutrient requirements, growth factors, uptake of nutrients by cell and culture media. Growth curve and measurement of microbial growth. Effect of environmental factors on microbial growth. Antimicrobial agents, such as growth factors analogs, antibiotics, germicides, disinfectants and antiseptics. Evaluation of antimicrobial effectiveness- phenol index.

#### **Unit 11 Microbial interactions**

Interaction of microbes with other living organisms and non living entities, symbiotic and non symbiotic interactions. Biofilm formation.

#### **Unit 12 Applications of microbiology**

Applications of microbes in industry, environment, agriculture and medicine.

<b>Course Code: BBCEL-144</b>	<b>Course Title: Basic Microbiology: Laboratory</b>	<b>Credits: 2</b>
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1. Microbiology Laboratory Practices and Biosafety.
2. To study the principle and applications of important instruments (biological safety cabinets, autoclave, incubator, BOD incubator, hot air oven, light microscope, pH meter)
3. Preparation and sterilization of culture media for bacterial cultivation
4. Study of different shapes of bacteria, fungi, algae, protozoa using permanent slides/ pictographs
5. Staining of bacteria using Gram stain
6. Isolation of pure cultures of bacteria by streaking method.
7. Qualitative detection of antibiotic action.

<b>Course Code: BBCET-145</b>	<b>Course Title: Molecular basis of non-infectious human diseases</b>	<b>Credits: 4</b>
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## **BLOCK 1 NUTRITIONAL DISORDERS**

### **Unit 1 Balanced Diet**

Introduction, Importance of Balanced diet. Balanced diet, Overview of major and minor nutrient components in the diet. Healthy diet for public health.

### **Unit 2 Nutritional Disorders: Vitamins and Diseases**

Introduction, Water soluble vitamins, Nutrient deficiencies- Kwashiorkor and Marasmus, Scurvy, Beri-Beri, Pellagra and B<sub>12</sub> deficiency. Fat soluble vitamins and deficiencies diseases- Xerophthalmia and Night blindness, Vitamin D deficiency, Vitamin K deficiency. Discuss with relation to biochemical basis for symptoms.

### **Unit 3: Deficiency Diseases of Other Nutrients**

Introduction to other Nutrient- Minerals, Deficiency Diseases (Anemia, thalassemia, Goitre, Hyponatremia, Keshan disease), and their symptoms. Discuss with relation to biochemical basis for symptoms.

## **BLOCK 2 LIFESTYLE DISEASES**

### **Unit 4 Metabolic Disorders**

Introduction, Eating disorders like Anorexia nervosa and Bulimia, Diabetes mellitus- A metabolic syndrome and the relationship with hypertension, obesity, hypothyroidism and stress.

### **Unit 5 Cardiovascular Disorders**

Introduction, Cardiovascular disorders and Atherosclerosis- defining the broad spectrum of ailments that fall in this category, understanding the factors that contribute to the syndrome, stages of disorder and the management of the condition.

### **Unit 6 Lifestyle Disorders**

Introduction, Definition of syndrome and diseases, Irritable bowel syndrome- biochemistry behind the disorder and the influence of diet, stress and environment on the condition.

## **BLOCK 3 PROTEIN DISORDERS**

### **Unit 7 Proteins Misfolding Disorders**

Introduction, Review of Protein folding and removal of misfolded proteins. Protein conformational disorders: Etiology and Brief molecular basis for Alzheimer's, Prion diseases, Huntington's Chorea, sickle cell anemia, Thalassemia.

### **Unit 8 Monogenic Diseases I**

Introduction, In-born errors of Metabolism: Phenylketonuria (PKU), Alkaptonuria, Maple syrup disease.

### **Unit 9 Monogenic Diseases II**

Introduction, Receptor and Transport defects, Cystic fibrosis, Long QT syndrome, familial hypercholesterolemia, Achondroplasia. Hemoglobinopathies and Blood clotting disorders.

## **BLOCK 4 MULTIFACTORIAL DISORDERS**

Introduction to General account of Disorders.

### **Unit 10 Multifactorial Complex Disorders**

Introduction. Definition of multifactorial Disorders. Polygenic diseases and the relationship with environmental and genetic factors.

### **Unit 11 Neurological Disorders**

Introduction, Disorders of mood: Schizophrenia, dementia and anxiety disorders. Polycystic ovarian syndrome, Parkinson's disease, Amyotrophic lateral sclerosis (ALS).

### Unit 12 Cancer and other Disorders

Introduction, Cancer: characteristics of a transformed cell, causes and stages of Cancer, molecular basis for neoplastic growth and metastasis, Proto-oncogenes and tumor suppressor genes. Cancer causing mutations, Tumor viruses; Biochemical analysis of cancer. Molecular approaches to cancer treatment.

<b>Course Code: BBCEL-146</b>	<b>Course Title: Molecular basis of non-infectious human diseases: Laboratory</b>	<b>Credits: 2</b>
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1. Anthropometric measurements for normal and high risk individuals.
2. Identifications for Kwashiorkor, and Obesity.
3. Determination of glucose by Benedicts test.
4. Estimation of glycosylated hemoglobin.
5. Permanent slides for different types of cancer.
6. Determination of proteins, urea and creatinine in Urine sample.
7. Bone densitometry test demonstration (visit to a nearby clinic.)
8. Maze Learning test.

<b>Course Code: BBCET-147</b>	<b>Course Title: Molecular basis of infectious human diseases: Laboratory</b>	<b>Credits: 4</b>
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### **BLOCK-1: EPIDEMIOLOGY OF INFECTIOUS DISEASES      No of Hours: 12**

Overview of Infectious diseases

#### **Unit 1 Classification of infectious agents**

**No. of Hours : 4**

Introduction and definition of epidemiology, Difference of infectious diseases from Communicable diseases, related terminologies (epidemic, endemic, pandemic etc), Infectious agents, Microbial pathogenesis, Molecular perspective.

#### **Unit 2 Emerging and Reemerging Infectious Disease Threat**

**No. of Hours : 4**

Past and present emerging and re-emerging infectious diseases and pathogens. Source, reservoir and transmission of pathogens for AIDS, Ebola virus and few other diseases.

#### **Unit 3 Types and management of Infectious Diseases**

**No. of Hours : 4**

Host parasite relationship, types of infections associated with parasitic organisms. Biology of viral and bacterial diseases. Infection and evasion.

### **BLOCK-2: BACTERIAL DISEASES**

**No of Hours: 18**

Overview of diseases caused by bacteria

#### **Unit 4 Epidemiology of Tuberculosis**

**No. of Hours : 8**

Detailed study of tuberculosis: History, global perspectives, causative agent, molecular basis of host specificity, infection and pathogenicity, diagnostics, therapeutics, inhibitors and vaccines. Drug resistance and implications on public health.

#### **Unit 5 Other Bacterial Diseases-1**

**No. of Hours : 4**

Mechanism of bacterial diseases such as Typhoid, Diphtheria, Pertussis, causative agent, infection and pathogenicity, diagnostics, therapeutics, inhibitors and vaccines. Implications of these diseases on public health.

**Unit 6 Other Bacterial Infections-II****No. of Hours : 6**

Bacterial diseases such as Tetanus, Typhoid and Pneumonia, causative agent, infection and pathogenicity, mechanism, diagnostics, therapeutics, inhibitors and vaccines. Implications of these diseases on public health.

**BLOCK-3: VIRAL DISEASES****No of Hours: 12**

Overview of diseases caused by Viruses

**Unit 7 AIDS: Acquired Immunodeficiency Syndrome-1****No. of Hours : 4**

Global Perspectives, Detailed study of AIDS, history, causative agent and pathogenesis. Diagnosis of Infection, Immunology and Clinical Manifestations, Drugs and inhibitors.

**Unit 8: Other Viral Diseases-I****No. of Hours : 4**

Mechanism of viral diseases such as Hepatitis, influenza, rabies, causative agent, infection and pathogenicity, diagnostics, therapeutics, inhibitors and vaccines. Implications of these diseases on public health.

**Unit 9 Other Viral Diseases-II****No. of Hours : 4**

Mechanism of viral diseases such as dengue, Ebola and Zika, chikungunya and polio, Diagnosis of Infection, Immunology and Clinical Manifestations, Drugs and inhibitors.

**BLOCK-4: PARASITIC AND OTHER INFECTIONS****No of Hours: 18**

Overview of diseases caused by Parasites and other agents

**Unit 10 Parasitic Diseases-1****No. of Hours : 8**

Detailed study of Malaria, history, causative agents, Vectors, life cycle, Host parasite, carriers interactions, Diagnostics, Drugs, Resistance, Vaccine development.

**Unit 11 Parasitic Diseases-11****No. of Hours : 4**

Parasitic diseases such as leishmaniasis and amoebiasis. Host parasite, mechanism, diagnostics, immunology, clinical manifestations and treatment.

**Unit 12 Fungal Diseases****No. of Hours : 6**

Introduction, overview of fungal diseases such as filarisis, candida and dermal infections, General characteristics. Medical importance, pathogenesis, treatment, antihelminthic drugs.

<b>Course Code: BBCEL-148</b>	<b>Course Title: Molecular basis of infectious human diseases: Laboratory</b>	<b>Credits: 2</b>
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1. Permanent slides of pathogens. Mycobacterium tuberculosis, Leishmania, Plasmodium falciparum
2. WIDAL test
3. Gram staining
4. Acid fast staining

<b>Course Code: BBCET-149</b>	<b>Course Title: Advanced Cell Biology</b>	<b>Credits: 4</b>
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**BLOCK 1 CELL STRUCTURE AND FUNCTION****Unit 1 Plasma Membrane**

Introduction, Properties, Composition of Plasma Membrane; Fluid-Mosaic model, Membrane Asymmetry, Membrane permeability, Glycosylation of membrane constituents and their importance.

## **Unit 2 Nuclear Transport**

Introduction, Structure of Nuclear Envelope; Nuclear Pore Complex; Transport Across Nuclear Envelope; Regulation of Nuclear Protein Import and Export.

## **Unit 3 Cell-Cell Interaction**

Introduction, Cell-Cell Interactions and Cell-Matrix Interactions; Components of Extracellular Matrix: Collagen and Non-Collagen Components; Tight Junctions; Gap Junctions; Desmosomes; Hemidesmosomes; Focal Adhesions and Plasmodesmata; Cell Wall; Role of Cell Interaction in Development.

## **BLOCK 2 PROTEIN TRANSPORT AND CYTOSKELETON**

### **Unit 4 Protein Sorting in Mitochondria, chloroplast & Peroxisomes**

Overview of the Endomembrane system; Targeting, modification and sorting of proteins from and into endoplasmic reticulum; synthesis and targeting mitochondrial proteins; chloroplast proteins and peroxysomal proteins.

### **Unit 5 Vesicular Transport**

Introduction, Mechanism of vesicular transport; Coat Proteins and Vesicle Budding; Vesicle Fusion; Targeting of Proteins to Membranes ; Receptor Mediated Endocytosis.

### **Unit 6 Cytoskeleton and Cell Motility**

Introduction, Functions and origin of the Cytoskeleton; Organization and Assembly of Actin Filaments and Myosin; Assembly and Dynamics of Microtubules and Intermediate Filaments; Assembly and organization of Cilia and Flagella, Muscle Contractility; Cell Polarization and migration.

## **BLOCK 3 Regulation of Cell Cycle**

### **Unit 7 Cell Cycle**

Introduction, Review of the Cell Cycle; Eukaryotic Cell Cycle; Events of Mitotic Phase; Cytokinesis; Events of Meiosis And Fertilization

### **Unit 8 Regulation of Cell Cycle**

Introduction, Control of cell cycle (Cyclins and Cyclin-dependent Kinases), restriction point and checkpoints.

### **Unit 9 Introduction to Cancer**

Introduction, Development and causes of Cancer; Genetic Basis of Cancer; Oncogenes, Tumor Viruses.

### **Unit 10 Programmed Cell Death**

Introduction, Apoptosis and Necrosis, Autophagy, Stem Cells and Maintenance of Adult Tissues, Hematopoiesis. Embryonic stem cells and therapeutic cloning

## **BLOCK 4 Techniques in Cell Biology**

### **Unit 11 Introduction to Centrifugation**

Introduction, Basic Principle and Svedberg Unit, Review of different methods of Centrifugation, Application of Centrifugation in Cell Biology

### **Unit 12 Microscopic Techniques**

Principle, Fluorescence Microscopy, Fluorescence-activated cell sorting (FACS), Fluorescence Resonance Energy Transfer (FRET), Confocal Microscopy, Electron microscopy- Transmission Electron Microscope (TEM) and Scanning Electron Microscope (SEM), Application of microscopy in Cell Biology.

### **Unit 13 Plant and Animal Tissue Culture**

Introduction, Basics cell culture, Sterilization, media and supplies. Preparation of culture media. Types of Plant cell culture and animals cell lines, Basic plant and animal cell culture techniques. Application of plant and animal cell culture.

### **Unit 14 Immunohistochemistry**

Introduction, Principle of Immunohistochemistry; Sample preparation: Tissue Collection and Perfusion, Tissue Fixation, Sectioning, Tissue Embedding, Sample labeling, Immunostaining, Sample Visualization and Application.

<b>Course Code: BBCEL-150</b>	<b>Course Title: Advanced Cell Biology: Laboratory</b>	<b>Credits: 2</b>
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1. Demonstration microscope
2. Isolation of Nuclei by Centrifugation.
2. Study of cell viability /death assay by use of trypan blue and MTT assay.
3. Identification and quantification of different Blood cells.
4. Identification and study of cancerous cells using permanent slides and photomicrographs.

<b>Course Code: BBCET-151</b>	<b>Course Title: Plant Biochemistry</b>	<b>Credits: 4</b>
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## **BLOCK I CARBON ASSIMILATION**

### **Unit 1 Plant Cell Structure**

Cell wall, Plasma membrane, Vacuole and tonoplast membrane, plastids and peroxisomes, plant pigments.

### **Unit 2 Photosynthesis: Light Reaction**

PSI and PSII complexes, Reaction centre, Light Harvesting Complex, Photosynthetic electron transport, Cyclic and non cyclic photophosphorylation, photosynthetic oxygen reduction, Hill reaction.

### **Unit 3 Photosynthesis: Dark Reaction**

Calvin cycle and its regulation; C4 cycle and Crassulacean acid metabolism (CAM), Biosynthesis of starch and sucrose, Photorespiration.

## **BLOCK II RESPIRATION**

### **Unit 4 Glycolysis**

Overview of glycolysis, Alternative reactions of glycolysis, Regulation of glycolysis in plants, Respiratory Quotient

### **Unit 5 TCA Cycle**

Translocation of metabolites across mitochondrial membrane. TCA cycle, Glyoxalate pathway and its coordinated regulation.

### **Unit 6 Mitochondrial Respiration**

Mitochondrial electron transport, Oxidative phosphorylation, Alternative NAD(P)H oxidative pathways, Cyanide resistant respiration.

## **BLOCK III NITROGEN METABOLISM AND PLANT GROWTH HORMONES**

### **Unit 7 Nitrogen Fixation**

Biological Nitrogen fixation by free living and in symbiotic association, structure and function of Nitrogenase, Nitrate assimilation: Nitrate and Nitrite reductase.

### **Unit 8 Nitrogen metabolism**

Primary and secondary ammonia assimilation in plants; ammonia assimilation by Glutamine synthetase-glutamine oxoglutarate amino transferase (GS-GOGAT) pathway.

Marginal Remarks: Seed storage proteins in legumes and cereals

### **Unit 9 Plant hormones**

Introduction to plant hormones and their effect on plant growth and development: Auxin, Gibberellin, Cytokinin, Ethylene and Absisic acid. Regulation of plant morphogenetic processes by light, Phytochrome.

## **BLOCK IV SPECIALIZED TOPICS IN PLANT BIOCHEMISTRY**

### **Unit 10 Secondary metabolites**

Overview of Secondary metabolism, types of secondary metabolites, Representatives alkaloids and their functions. Biological roles of major phenolic groups; simple phenylpropanoids, Coumarins, flavonoids, tannins and lignin. Important terpenoids and their biological functions.

### **Unit 11 Plant tissue culture**

Plant tissue culture techniques: an overview, Types of cultures: organ and explant culture, callus culture, cell suspension culture and protoplast culture. Plant regeneration, organogenesis and somatic embryogenesis. Applications of plant tissue culture, and somaclonal variation.

### **Unit 11 Stress metabolism in Plants**

Abiotic stressors: salinity, water stress, heat, chill, anaerobiosis, heavy metals, radiations and their impact on plant growth and productivity.

<b>Course Code: BBCEL-152</b>	<b>Course Title: Plant Biochemistry: Laboratory</b>	<b>Credits: 2</b>
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1. Extraction and estimation of chlorophyll from plant tissues.
2. Separation of photosynthetic pigments by TLC
3. Preparation of culture media /MS media.
4. Isolation and quantification of starch.
5. Extraction and assay of Urease from Jack bean

<b>Course Code: BBCET-153</b>	<b>Course Title: Research Methodology</b>	<b>Credits: 4</b>
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<b>Course Code: BBCS-183</b>	<b>Course Title: Tools and Techniques in Biochemistry</b>	<b>Credits: 4</b>
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### **Unit 1 Introduction to the Biochemistry Laboratory**

Introduction, Good laboratory Practices (GLP), Safety practices in the laboratory.

### **Unit 2 Biochemical Reagents and Solutions**



Introduction, Preparation of Distilled water, Cleaning Laboratory Glassware, biochemical solution and reagents- water purity, Preparation and storage of solutions. Concepts of solution concentration- molarity, molality, normality, percent (% v/v) by volume and weight per volume (v/wt) and storing solutions. Quantitative transfer of liquids.

### **Unit 3 Buffers**

Introduction, Concept of a buffer, Henderson-Hasselbach equation, Zwitterionic Buffers (Good's Buffers), Principle and function of pH meter and application.

### **Unit 4 Spectrophotometric techniques**

Introduction, Beer-Lambert laws, Principle, Instrumentation and application of UV-visible and Fluorescence spectroscopy.

### **Unit 5 Introduction and importance of virtual labs in biochemistry**

**Introduction**, Virtual labs, Role of ICT-enabled Virtual Laboratories in Biochemistry, Importance of virtual labs, Online labs and educational resources.

1. Preparation of molar and normal solution.
2. Preparation of a buffer of given pH and molarity.
3. Preparation of hygroscopic solution.
4. Determination of the absorption maxima and molar extinction coefficient (of a relevant a. organic molecule).
5. Measurement of fluorescence spectrum.
6. Determination of concentration of a protein solution by Lowry/BCA method.
7. Biochemistry virtual lab <http://www.vlab.co.in/lab> Under the National Mission on Education through ICT (MHRD)

<b>Course Code: BBCS-184</b>	<b>Course Title: Clinical Biochemistry</b>	<b>Credits: 4</b>
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## **BLOCK-1: BIOCHEMICAL TESTS FOR EVALUATION OF BIOCHEMICAL CHANGES**

### **Unit 1 Introduction**

Organization of clinical laboratory, Introduction to instrumentation and automation in clinical biochemistry laboratories safety regulations and first aid. General comments on specimen collection, types of specimen for biochemical analysis. Precision, accuracy, quality control, precautions and limitations. Glassware washing, Protective clothing, Handling of chemical agents, Disposal of waste and Lab regulations.

### **Unit 2 Evaluation of biochemical changes in diseases**

Basic hepatic, renal and cardiovascular physiology. Biochemical symptoms associated with disease and their evaluation. Diagnostic biochemical profile.

### **Unit 3 Assessment of glucose metabolism in blood**

Clinical significance of variations in blood glucose, Diseases associated with glucose metabolism such as diabetes mellitus.

### **Unit 4 Lipid profile**

Composition and functions of lipoproteins. Clinical significance of elevated lipoprotein, diseases associated with lipid disorders.

## **BLOCK-2: LFT, RFT AND CARIOVASCULAR TESTS**

### **Unit 5 Liver function tests**

Introduction and Biochemical functions of liver

### **Unit 6 Renal function tests and urine analysis**

Introduction and biochemical importance of kidney

### **Unit 7 Tests for cardiovascular diseases**

Involvement of enzymes in diagnostics of heart disease including aspartate transaminase, isoenzymes of creatine kinase and lactate dehydrogenase and troponin.

1. Collection of blood and storage.
2. Separation and storage of serum.
3. Estimation of creatine kinase MB.
4. Estimation of blood glucose by glucose oxidase peroxidase method.
5. Estimation of Total Lipids
6. Estimation of Cholesterol in human serum
7. Estimation of triglycerides in human serum
8. Estimation of GOT/GPT in serum
9. Quantitative estimation of serum creatinine
10. Quantitative estimation of blood urea
11. Use of urine strip / dipstick method for urine analysis.

<b>Course Code: BBCS-185</b>	<b>Course Title: Bioinformatics</b>	<b>Credits: 4</b>
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### **Unit 1 Introduction to bioinformatics**

**No. of Hours : 10**

Computer fundamentals: Basics of computer operations, Internet usage, Microsoft office (Basics), important terms used in Bioinformatics. Programming languages in bioinformatics, role of supercomputers in biology. Historical background. Scope of bioinformatics - genomics, proteomics, computer aided drug design (structure based and ligand based approaches) and Systems Biology. Applications of bioinformatics.

### **Unit 2 Biological databases and data retrieval**

Introduction to biological databases - primary, secondary and composite databases, NCBI, nucleic acid databases (GenBank, EMBL, DDBJ, NDB), protein databases (PIR, Swiss-Prot, TrEMBL, PDB), metabolic pathway database (KEGG, EcoCyc, and MetaCyc), small molecule databases (PubChem, Drug Bank, ZINC, CSD). Structure viewers (RasMol, J mol), file formats.

### **Unit 3 Sequence alignment**

Similarity, identity and homology. Alignment – local and global alignment, pairwise and multiple sequence alignments, alignment algorithms, amino acid substitution matrices (PAM and BLOSUM), BLAST and CLUSTALW.

1. Microsoft Office: Word, Excel, Power point,

2. Introduction to Internet: LAN, WAN, web browsers, Search engines,
3. Basic of Electronic mail, creating an email account, sending and receiving email
4. DATA bases: NCBI, PDB, SCOP, PubMed, Gene Bank, Uniport,
5. Sequence retrieval (protein and gene) from NCBI
6. Structure download (protein and DNA) from PDB.
7. Molecular file formats - FASTA, GenBank, Genpept, GCG, CLUSTAL, Swiss-Prot, FIR.
8. Molecular viewer by visualization software: PyMol
9. BLAST suite of tools for pairwise alignment.
10. Multiple sequence alignment using CLUSTALW.

## 12.2 General electives

### Chemistry

<b>Course Code: BCHCT-131</b>	<b>Course Title: Atomic Structure, Bonding, General Organic Chemistry and Aliphatic Hydrocarbons</b>	<b>Credits: 4</b>
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Bohr's Theory: Earlier Atomic Models; Dalton, Thomson and Rutherford Models; Bohr Atom Model: Calculation of Radius of Orbits, Energy of an Electron in an Orbit; Hydrogen Atom Spectrum and Bohr's Theory; Critical Analysis and Limitations of Bohr's Theory, Sommerfeld Modification.

Dual Behaviour of Radiation and Matter: The Nature of Radiation: Light as an Electromagnetic Wave, Particle Nature of Radiation; Nature of Matter: de-Broglie's Relation, Matter Waves, Davisson and Germer Experiment; Heisenberg Uncertainty Principle.

Quantum Mechanical Approach: Need for a New Approach to Atomic Structure; What is Quantum Mechanics?: Postulates of Quantum Mechanics, Observables and Operators, Eigenfunctions, Eigenvalues; Time-independent Schrödinger Equation; Significance of  $\psi$  and  $\psi^2$ . Applications of Schrödinger Equation: Energy States of the Hydrogen-like Atoms.

Hydrogen Atom: Schrödinger Equation for Hydrogen Atom, Significance of Quantum Numbers; Radial Distribution Functions, The Most Probable Distance; Angular Dependence of the Wave Function and Shapes of Atomic Orbitals; Radial and Angular Nodes and their Significance; Discovery of Spin, Spin Quantum Number ( $s$ ), Magnetic Spin Quantum Number ( $m_s$ )

Electronic Configuration of Multi-Electron Atoms: Energy Levels for Multi-Electron Atoms; Rules for Filling of Electrons in Various Orbitals, The aufbau Principle, Hund's Rule, Pauli Exclusion Principle; Electronic Configuration of Some Multi-Electron Atoms, Stability of Half-Filled and Completely Filled Orbitals, Concept of Exchange Energy, Anomalous Electronic Configurations.

Ionic Bond: Chemical Bonding: Basic Concepts, Effective Nuclear Charge, Ionisation Energy, Electron Affinity, Electronegativity; Ionic Bond, Characteristics of Ionic Compounds,

Ionic Radii, Lattice Energy; Solubility and Solvation Energy; Polarising Power and Polarizability of Ions, Fajan's Rules; The Bonding Continuum; Bond Polarity, Dipole Moments, Determination of Dipole Moment, Application of Dipole Moment Studies.

Covalent Bond: Classical Theory of Covalent Bond, Lewis Concept of Covalent Bond, Writing Lewis Structures, Formal Charge: Predicting Preferred Lewis Structure, Coordinate Covalent Bonds; Characteristics of Covalent Compounds, Covalent Bond Parameters; Molecular Geometry: Valence Shell Electron Pair Repulsion Theory, Central Atom having only Bond Pairs, Central Atom having Bond Pairs and Lone Pairs, Central Atom having Multiple Bonds.

Valence Bond Theory: The Origin of Valence Bond and Molecular Orbital Theories; Principles of Valence Bond Theory; Valence Bond Theory of Hydrogen Molecule; Resonance or Electron Delocalisation; Resonating Structures; Hybridisation of Orbitals.

Molecular Orbital Theory: Molecular Orbital Theory, LCAO method, Bonding and Antibonding Molecular Orbitals, Molecular Orbitals and their Characteristics, *s-s* combination of Atomic Orbitals, *s-p* combination of Atomic Orbitals, *p-p* combination of Atomic Orbitals, Non-bonding combination of Atomic Orbitals; Rules for Linear Combination of Atomic Orbitals; Molecular Orbital treatment of Homonuclear Diatomic Molecules; Heteronuclear Diatomic Molecules; Comparison of Valence Bond and Molecular Orbital Theories.

Stereochemistry I: Geometrical and Optical Isomerisms: Isomerism; Geometrical Isomerism, *cis-*, *trans-* Nomenclature, *E/Z* Nomenclature, Cahn-Ingold-Prelog Rules; Characterisation of Geometrical Isomers; Optical Isomerism; Plane Polarised Light and Optical Activity, Origin of Optical Activity; Chirality, Enantiomers, Diastereomers, *Meso* Compounds.

Stereochemistry-II: Configurational Isomers: Configuration and Fischer Projection Formulae; Configurational Notations, *R/S System*, *Erythro* and *threo Nomenclature*; Racemic Mixtures and their Resolution.

Stereochemistry-III: Conformational Isomerism: Conformational Isomers: Newman and Sawhorse Representations; Conformations of Ethane; Conformations of Butane; Conformations of Cyclic Systems, Conformations of Cyclohexane.

Structure - Reactivity Relationships: What are Acids and Bases?; Strengths of Acids and Bases; Factors Affecting the Strengths of Acids and Bases, Inductive Effect, Resonance Effect, Hyperconjugation, Hydrogen Bonding, Steric Effect; Tautomerism.

Reactions and Reactive Intermediates: Cleavage of Bonds, Bond Heterolysis, Bond Homolysis; Types of Reagents, Nucleophiles, Electrophiles; Types of Reactions, Substitution Reactions, Addition Reactions, Elimination Reactions, Polymerisation Reactions; Reactive Intermediates, Carbocations, Carbanions, Free Radicals.

Alkanes: Petroleum: A Source of Alkanes, Composition of Petroleum; Physical Properties; Preparation of Alkanes and Cycloalkanes, Wurtz Reaction, Kolbe's Electrolytic Method, Hydrogenation of Unsaturated Hydrocarbons, Reduction of Alkyl Halides; Decarboxylation of the Carboxylic Acids, Preparation of Cycloalkanes; Reactions of Alkanes, Halogenation, Nitration, Isomerisation, Aromatisation, Pyrolysis, Reactions of Small Ring Compounds.

Alkenes-I: Alkenes and their Classification; Physical Properties; Preparation of Alkenes, Dehydrohalogenation of Alkyl Halides, Dehydration of Alcohols, Hydrogenation of Alkynes, Preparation of Dienes.

Alkenes-II: Reactions of Alkenes, Halogenation, Hydrohalogenation, Hydration, Oxymercuration-demercuration Reaction, Hydroboration, Ozonolysis, Hydroxylation.

Alkynes: Alkynes and their Types; Physical Properties and Uses; Preparation of Alkynes, Dehydrohalogenation of Dihalides, Dehalogenation of Tetrahalides, Alkylation of Ethyne; Reactions of Alkynes, Hydrogenation, Hydrohalogenation, Halogenation, Hydration, Ozonolysis, Hydroboration,

Aromaticity: Aromatic Compounds- an Introduction; Physical Properties; IUPAC Nomenclature of Aromatic Compounds, Nomenclature of Benzene and its Derivatives, Disubstituted Benzenes; Structure of Benzene; Resonance, Molecular orbital model of benzene, Representation of Benzene Ring; Aromaticity, Cyclobutadiene, Cyclopentadiene, Benzene, Cyclooctatetraene.

<b>Course Code: BCHCL-132</b>	<b>Course Title: Chemistry Lab I: Atomic Structure, Bonding, General Organic Chemistry and Aliphatic Hydrocarbons</b>	<b>Credits: 2</b>
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Titrimetry: An Introduction: Introduction: Apparatus Commonly Used, How to Use a Pipette, How to Use a Burette, How to Use a Volumetric Flask, How to Use an Analytical Balance; Expression of Concentration; Standard Solution; Titration, Types of Indicators, Types of Titrations; Instrumental Determination of Equivalence Point; Safety Measures in the Laboratory.

#### **List of Experiments:**

Experiment 1: Determination of Sodium Carbonate and Sodium Hydrogen Carbonate in a Mixture by indicator method

Experiment 2: Estimation of Oxalic Acid by Redox Titration

Experiment 3: Estimation of Water of Crystallisation in Mohr's Salt

Experiment 4: Estimation of Copper ions by Chromatometry using internal indicator

Experiment 5: Estimation of Copper Iodometrically

Experiment 6: Detection of Extra Elements (N, S, X) in the Organic Compounds

Experiment 7: Separation and Identification the Components of a given Mixture of Amino Acids by Paper Chromatography

Experiment 8: Separation and Identification the Sugars present in the given Mixture by Paper Chromatography.

#### **12.3 Ability Enhancement Compulsory Courses**

<b>Course Code: BEVAE-181</b>	<b>Course Title: Environment Studies</b>	<b>Credits: 4</b>
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Earth is the only known planet in the solar system that supports life. Despite the vastness of the earth, life exists only in a very thin layer enveloping the earth called biosphere. Sun is the only source of energy which enables continuous interaction among various life forms. For a long period of time, there has been a symbiotic relationship between human being and nature. Due to excessive human interference and unsustainable practices, millions of

people's life and livelihoods and other living organisms on the earth are at risk. These environmental issues have now become common problems and shared responsibility of each individual on the earth to act judiciously to reverse these negative impacts. Therefore, there has been a growing need to create awareness amongst all the stakeholders. Keeping this in view, Environmental Study is being introduced as a compulsory course for all the learners at under-Graduate level.

Our Environment: Concept of environment; Different components of environment and their relationship; Human-environment relationship: concept of Sustainability and Sustainable development; Multidisciplinary nature of the environmental studies, its scope and importance.

Ecosystems: What is an ecosystem? (Concept of ecosystem, Components of ecosystem-producer consumers, decomposers); Structure and function of ecosystem; Energy flow in ecosystem: trophic levels, food chains, food web, and ecological pyramid; Ecological succession.

Major Ecosystems: Forest, grassland, desert and aquatic ecosystems: Case studies.

Land and Water: Renewable and non-renewable resources; Land as a resource; Land-use change; Land degradation; Soil erosion and desertification; Conservation and management of land resources: Case studies. Water as a resource; Over-exploitation of surface and ground water; Floods and droughts; International and inter-state conflict over water; Conservation and Management of water resource: Case studies.

Forest Resources: Forest as a resource; Deforestation and its Causes; Impact of mining and dam building on environment, forest, biodiversity and tribal populations; Conservation and management of forest resources: Case studies.

Biodiversity: Value And Services: Levels of biodiversity: genetic, species and ecosystem diversity; Bio-geographic zones of India; Biodiversity patterns and global biodiversity hot spots; India as a mega-biodiversity nation; Endangered and endemic species of India; Ecosystem and biodiversity services: ecological, economic, social ethical, aesthetic informational value.

Energy Resources: Renewable and non-renewable energy sources; uses of alternate energy sources; growing energy needs; conservation and management of energy resources: Case studies.

Unit 8: Biodiversity: Threats and Conservation: Threats to biodiversity: habitat loss, poaching of wildlife, Human-wildlife conflicts in Indian context, biological invasions; Conservation of biodiversity: In situ and Ex-situ conservation of biodiversity.

Environmental Pollution and Hazard: Definitions; Types, causes, effects and controls of: air, water, soil and noise pollution; Nuclear Hazard. Hazard and Pollution Case Studies (human health risks).

Waste Management: Solid waste management: Control measures of urban and industrial waste. Case Studies.

Global Environmental Issues: Global warming, climate change, ozone layer depletion, acid rain and their impact.

Environmental Legislation: Environment Protection Act; Air (Prevention & control of Pollution) Act; Water (Prevention and Control of Pollution) Act; Wildlife Protection Act; Forest

Conservation Act, International Agreements: Montreal protocols and conventional on Biological Diversity (CBD).

Human Communities and Environment: Human population growth: Impacts on environment, human health and welfare; Resettlement and rehabilitation of project affected person case studies. Disaster Management; Natural Disasters: Floods, earthquake, cyclones and landslides.

Environmental Ethics: Role of Indian and other religions and cultures in environmental conservation. Environmental communication and public awareness, case studies.

TMA-Based on Field Work- Report of be submitted – 5 hours

- Visit to an area to document environmental assets: river/forest/ flora/ fauna etc.
- Visit to a local polluted site- Urban/ Rural / Industrial/ Agricultural
- Study of common plants, insects, birds and basic principles of identification
- Study of simple ecosystems-pond, river, Delhi Ridge, etc.

<b>Course Code: BHDAE 182</b>	<b>Course Title: fgUnh Hkk"kk vkSj laizs'k.k</b>	<b>Credits: 4</b>
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bl ikB~;Øe esa fganh Hkk'kk vkSj laizs'k.k ls lacaf/kr fcanqvksa dk v/;;u dj;k;k tk,xkA ;g ikB~;Øe 4 ØsfMV dk gSA bl ikB~;Øe eas fganh Hkk'kk vkSj laizs'k.k ls lacaf/kr fuEufyf[kr fcanqvksa dks "kkfey fd;k x;k gS %

fgUnh Hkk'kk dk fodkl] Hkk'kk dh ifjHkk'kk] izd`fr ,oa fofok :i( **fganh Hkk'kk dh fo'ks'rk**,i % fØ;k] foHkfDr] loZuke] fo'ys'k.k ,oa vO;; lacaf/khA **fganh dh o.kZ&O;oLFkk** % Loj ,oa O;atuA Loj ds izdkj &âLo] nh?kZ rFkk la;qDrA O;atu ds izdkj&Li'kZ] vUrLFk] Å'e] vYiizk.k] egkizk.k] ?kks'k rFkk v?kks'kA **oxksZa dk mPpj.k LFkk** % d.B~;] rkyO;] ew)ZU;] nUR;] vks'B~; rFkk nUrks'B~;A cyk?kkr] laxe] vuqrku rFkk laf/kA **Hkk'kk laizs'k.k ds pj.k** % Jo.k] vfHkO;fDr] okpu rFkk ys[kuA fgUnh okD; jpu] okD; vkSj miokD;A okD; HksnA okD; dk :ikUrjA HkkokFkZ vkSj O;k;k] vk'k; ys[ku] fofok izdkj ds i= ys[kuA

<b>Course Code: BEGAE 182</b>	<b>Course Title: English Communication Skills</b>	<b>Credits: 4</b>
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English Communication Skills is of 4 credits and has 3 Blocks and 11 Units. Communication involves both verbal and non-verbal communication. In this Course we give you an understanding of the communication process, the barriers to it, the skills involved in communication i.e. listening, speaking, reading and writing in both formal and informal contexts. We discuss the differences between spoken and written forms of the language and make you sensitive to conversational skills which include to a large extent body language.

**Note:** Detail Syllabi of some courses are not added at this stage as these are in the process of finalization.

### **13. ADDRESS AND CODES OF REGIONAL CENTRES AND STUDY CENTRES**

**List of existing B.Sc. Study Centres for B.Sc. Programme with botany, chemistry, mathematics, physics and zoology**

Sl. No.	RC Name	RC Code	SC Code	Category	Place of LSC	Address
1	AGARTALA	26	2601		AGARTALA	COORDINATOR IGNOU STUDY CENTRE TRIPURA UNIVERSITY UNIVERSITY CAMPUS AGARTALA TRIPURA 799004
2	AGARTALA	26	2606		KAILASHAHAR	COORDINATOR IGNOU STUDY CENTRE R.K. MAHAVIDYALAYA PO KAILASHAHAR NORTH TRIPURA TRIPURA 799277
3	AGARTALA	26	2607		BELONIA	COORDINATOR IGNOU STUDY CENTRE I.C.V. COLLEGE PO BELONIA SOUTH TRIPURA TRIPURA 799155
4	AGARTALA	26	2608		AGARTALA	COORDINATOR IGNOU STUDY CENTRE M.B.B. COLLEGE COLLEGE TILLA, PO AGARTALA COL AGARTALA WEST TRIPURA TRIPURA 799004
5	AHMEDABAD	09	0901		AHMEDABAD	COORDINATOR IGNOU STUDY CENTRE L.D. ARTS COLLEGE NAVRANGPURA AHMEDABAD GUJARAT 380009
6	AHMEDABAD	09	0902		VADODARA	COORDINATOR IGNOU STUDY CENTRE M.S. UNIVERSITY GENERAL EDUCATION BUILDING



						VADODARA GUJARAT 390002
7	AHMEDABAD	09	0909		MEHSANA	COORDINATOR IGNOU STUDY CENTRE NEW PROGRESIVE EDUCATION TRUST ABOVE HOMEOPATHY COLLEGE MEHSANA GUJARAT 384002
8	AHMEDABAD	09	0922	R	ANKLESHWAR	COORDINATOR IGNOU RECOG. STUDY CENTRE ANKLESHWAR IND. DEV. SOCIETY PLOT NO. 910 GIDC ESTATE ANKLESHWAR GUJARAT 390002
9	AHMEDABAD	09	0928	R	RAJKOT	COORDINATOR IGNOU RECOG. STUDY CENTRE N.I.M.I.T. C/O PARAG AD. JANSATTA PRESS RAJKOT GUJARAT 360005
10	AHMEDABAD	09	0943		PATAN	COORDINATOR IGNOU STUDY CENTRE HEMCHANDRACHARYA NORTH GUJRAT UNIVERSITY PATAN GUJARAT -
11	AHMEDABAD	09	0952	P	AHMEDABAD	PROG. I/C IGNOU PROG. STUDY CENTRE MG SCIENCE INSTITUTE MAVLANKAR CAMPUS NAVRANGPURA AHMEDABAD GUJARAT

						380009
12	AHMEDABAD	09	2901		DAMAN & DIU	COORDINATOR IGNOU STUDY CENTRE DAMAN GOVERNMENT ARTS COLLEGE DAMAN & DIU DAMAN & DIU 396210
13	AIZAWL	19	1901		AIZAWL	COORDINATOR IGNOU STUDY CENTRE GOVERNMENT AIZAWL COLLEGE AIZAWL MIZORAM 796001
14	AIZAWL	19	1902		LUNGLEI	COORDINATOR IGNOU STUDY CENTRE LUNGLEI GOVERNMENT COLLEGE LUNGLEI MIZORAM 796701
15	AIZAWL	19	1903		KOLASIB	COORDINATOR IGNOU STUDY CENTRE GOVERNMENT KOLASIB COLLEGE KOLASIB MIZORAM 796081
16	AIZAWL	19	1923		AIZWAL	COORDINATOR IGNOU STUDY CENTRE PACHHUNGA UNIVERSITY COLLEGE DIST. AIZWAL AIZAWL MIZORAM 796001
17	ALIGARH	47	2713		ALIGARH	COORDINATOR IGNOU STUDY CENTRE ALIGARH MUSLIM UNIVERSITY ALIGARH UTTAR PRADESH 202002
18	BANGALORE	13	1319		TUMKUR	COORDINATOR IGNOU STUDY CENTRE SRI SIDDARTHA INSTT. OF

						TECH TUMKUR KARNATAKA 572105
19	BANGALORE	13	1320		BANGALORE	COORDINATOR IGNOU STUDY CENTRE GOVERNMENT SCIENCE COLLEGE NRUPATHUNGA ROAD BANGALORE KARNATAKA 560001
20	BHAGALPUR	82	0505		BHAGALPUR	COORDINATOR IGNOU STUDY CENTRE MARWARI COLLEGE (T.M. BHAGALPUR UNIVERSITY) BHAGALPUR BIHAR 812007
21	BHAGALPUR	82	0571		MUNGER	COORDINATOR IGNOU STUDY CENTRE RD & DJ COLLEGE MUNGER BIHAR 811201
22	BHOPAL	15	1501		BHOPAL	COORDINATOR IGNOU STUDY CENTRE MOTILAL VIGYAN MAHAVIDYALAYA BHOPAL MADHYA PRADESH 462008
23	BHOPAL	15	1506		INDORE	COORDINATOR IGNOU STUDY CENTRE HOLKAR SCIENCE COLLEGE INDORE MADHYA PRADESH 452001
24	BHUBANESHWAR	21	2103		ROURKELA	COORDINATOR IGNOU STUDY CENTRE GOVERNMENT COLLEGE ROURKELA ORISSA 796004

25	BHUBANESHWAR	21	2104		BERHAMPUR	COORDINATOR IGNOU STUDY CENTRE KHALIKOTE COLLEGE GANJAM BERHAMPUR ORISSA 760001
26	BHUBANESHWAR	21	2108		SAMBALPUR	COORDINATOR IGNOU STUDY CENTRE GANGADHAR MEHER COLLEGE SAMBALPUR ORISSA 768004
27	BHUBANESHWAR	21	2111		BHUBANESHWAR	COORDINATOR IGNOU STUDY CENTRE B.J.B. COLLEGE ARTS BLOCK BHUBANESHWAR ORISSA 751014
28	BHUBANESHWAR	21	2135		BHANJANAGAR	COORDINATOR IGNOU STUDY CENTRE K.S.U.B. COLLEGE BHANJANAGAR GANJAM DISTRICT ORISSA 761126
29	BIJAPUR	85	1303		DHARWAD	COORDINATOR IGNOU STUDY CENTRE J.S.S. COLLEGE VIDYAGIRI DHARWAD KARNATAKA 580004
30	BIJAPUR	85	1324		BAGALKOT	COORDINATOR IGNOU STUDY CENTRE BASAVESHWAR SCIENCE COLLEGE BAGALKOT KARNATAKA 587101
31	CHANDIGARH	06	06007		CHANDIGARH	COORDINATOR IGNOU STUDY CENTRE SHRI GURU GOBIND SINGH COLLEGE

						SECTOR - 26 CHANDIGARH HARYANA 160019
32	CHENNAI	25	2501		CHENNAI	COORDINATOR IGNOU STUDY CENTRE DDGD VAISHNAVA COLLEGE 445, E.V.R. PERIYAR HIGH ROAD ARUMBAKKAM CHENNAI TAMILNADU 600106
33	CHENNAI	25	2509		TIRUPATTUR	COORDINATOR IGNOU STUDY CENTRE SACRED HEART COLLEGE TIRUPATTUR TAMILNADU 635601
34	CHENNAI	25	2513		DHARMAPURI	COORDINATOR IGNOU STUDY CENTRE GOVERNMENT ARTS COLLEGE DHARMAPURI TAMILNADU 636705
35	CHENNAI	25	2543	D	NAMAKKAL	COORDINATOR IGNOU SPL STUDY CENTRE-SC/ST C.R.S.T.C. 4/38, DR. SANKARAN ROAD GANDHI NAGAR NAMAKKAL TAMILNADU 637001
36	CHENNAI	25	2554		CUDDALORE	COORDINATOR IGNOU STUDY CENTRE SAINT JOSEPH COL.OF ARTS & SCI MANJAI NAGAR DISTT.CUDDALORE CUDDALORE TAMILNADU 607001
37	CHENNAI	25	2570		PERAMBALUR	COORDINATOR

						IGNOU STUDY CENTRE THANTHAI HANS ROEVER COLLEGE PERAMBALUR TAMILNADU 621212
<b>38</b>	CHENNAI	25	2593		VELLORE	COORDINATOR IGNOU STUDY CENTRE VOORHEES COLLEGE OFFICERS LINE VELLORE TAMILNADU 632001
<b>39</b>	COCHIN	14	1402		COCHIN	COORDINATOR IGNOU STUDY CENTRE SACRED HEART COLLEGE THEVARA COCHIN KERALA 682013
<b>40</b>	DARBHANGA	46	0504		MUZAFFARPUR	COORDINATOR IGNOU STUDY CENTRE BRA BIHAR UNIVERSITY LIBRARY CAMPUS MUZAFFARPUR BIHAR 842001
<b>41</b>	DARBHANGA	46	0522		DARBHANGA	COORDINATOR IGNOU STUDY CENTRE C.M. COLLEGE KILA GHAT DARBHANGA BIHAR 846004
<b>42</b>	DARBHANGA	46	0550		BEGUSARAI	COORDINATOR IGNOU STUDY CENTRE GANESH DUTT COLLEGE BEGUSARAI BIHAR 851101
<b>43</b>	DEHRADUN	31	2705		DEHRADUN	COORDINATOR IGNOU STUDY CENTRE D.A.V. PG COLLEGE D A V COLLEGE ROAD DEHRADUN UTTRANCHAL

						248001
44	DEHRADUN	31	2711		HALDWANI	COORDINATOR IGNOU STUDY CENTRE MB GOVERNMENT PG COLLEGE HALDWANI UTTRANCHAL 263141
45	DEHRADUN	31	2715		GOPESHWAR	COORDINATOR IGNOU STUDY CENTRE GOVERNMENT PG COLLEGE GOPESHWAR UTTRANCHAL 246401
46	DEHRADUN	31	2717		ALMORA	COORDINATOR IGNOU STUDY CENTRE KUMAON UNIVERSITY ALMORA UTTRANCHAL 263601
47	DEHRADUN	31	2726		PITHORAGARH	COORDINATOR IGNOU STUDY CENTRE GOVERNMENT P.G. COLLEGE PITHORAGARH UTTRANCHAL 262501
48	DEHRADUN	31	2748		UTTARKASHI	COORDINATOR IGNOU STUDY CENTRE GOVERNMENT P.G. COLLEGE UTTARKASHI UTTRANCHAL 249193
49	DEHRADUN	31	2754		PAURI	COORDINATOR IGNOU STUDY CENTRE DR. P.D.B. GOVT. P.G. COLLEGE KOTDWARA (GARHWAL) PAURI DISTRICT (GARHWAL) UTTRANCHAL 246149
50	DEHRADUN	31	2762		NAINITAL	COORDINATOR IGNOU STUDY CENTRE

						KUMAON UNIVERSITY D.S.B. CAMPUS NAINITAL UTTRANCHAL 263001
51	DEHRADUN	31	31017		DEHRADUN	COORDINATOR IGNOU STUDY CENTRE DBS PG COLLGE DEHRADUN UTTARAKHAND 248001
52	DEHRADUN	31	31031		RUDRAPRAYA G	COORDINATOR IGNOU REGULAR STUDY CENTRE GOVT. PG COLLEGE AGASTYAMUNI DISTRICT RUDRAPRAYAG UTTARAKHAND 246421
53	DELHI 1	07	0711		DELHI	COORDINATOR IGNOU STUDY CENTRE GARGI COLLEGE SIRI FORT ROAD NEAR ASIAD VILLAGE NEW DELHI DELHI 110048
54	DELHI 1	07	0765	P	DELHI	PROG. I/C IGNOU PROG. STUDY CENTRE JAMIA MILLIA ISLAMIA DEPARTMENT OF BIOTECHNOLOGY NEW DELHI DELHI 110025
55	DELHI 1	07	1007		FARIDABAD	COORDINATOR IGNOU STUDY CENTRE PT. J.L. NEHRU GOVT. COLLEGE SECTOR - 16A FARIDABAD HARYANA 121001
56	DELHI 2	29	0729		DELHI	COORDINATOR IGNOU STUDY CENTRE SWAMI SHRADDHANAND



						COLLEGE ALIPUR NEW DELHI DELHI 110036
57	DELHI 2	29	29052		DELHI	COORDINATOR IGNOU REGULAR STUDY CENTRE HANSRAJ COLLEGE UNIVERSITY OF DELHI MAHATMA HANSRAJ MARG MALKA GANJ DELHI 110007
58	DELHI 2	29	29058		DELHI	COORDINATOR IGNOU REGULAR STUDY CENTRE ZAKIR HUSSAIN COLLEGE JAWAHARLAL NEHRU MARG UNIVERSITY OF DELHI
59	DELHI 3	38	1006		GURGAON	COORDINATOR IGNOU STUDY CENTRE DRONACHARYA GOVERNMENT COLLEGE GURGAON HARYANA 122001
60	DELHI 3	38	07109		DELHI	COORDINATOR IGNOU STUDY CENTRE INSTITUTE OF PUBLIC HEALTH & HYGIENE,RZ A-44 MAHIPALPUR DELHI DELHI 110037
61	DEOGHAR	87	3604		DUMKA	COORDINATOR IGNOU STUDY CENTRE S.P. COLLEGE DUMKA JHARKHAND 814101
62	DEOGHAR	87	3605		SAHIBGANJ	COORDINATOR IGNOU STUDY CENTRE SAHIBGANJ COLLEGE SAHIBGANJ

					JHARKHAND 816109
63	DEOGHAR	87	3609	DEOGHAR	COORDINATOR IGNOU STUDY CENTRE A.S. COLLEGE DEOGHAR JHARKHAND 814112
64	DEOGHAR	87	87005	DEOGHAR	COORDINATOR IGNOU REGULAR STUDY CENTRE DEOGHAR COLLEGE CIRCULAR BY-PASS ROAD DEOGHAR JHARKHAND 814113
65	DEOGHAR	87	87009	SAHIBGANJ	COORDINATOR IGNOU REGULAR STUDY CENTRE B.S.K. COLLEGE BARHARWA DISTRICT SAHIBGANJ JHARKHAND 816101
66	GANGTOK	24	2401	GANGTOK	COORDINATOR IGNOU STUDY CENTRE SIKKIM GOVERNMENT COLLEGE TADONG GANGTOK SIKKIM 737102
67	GUWAHATI	04	0404	BONGAIGAON	COORDINATOR IGNOU STUDY CENTRE BIRJHORA MAHAVIDYALAYA BONGAIGAON ASSAM 783380
68	GUWAHATI	04	0408	GUWAHATI	COORDINATOR IGNOU STUDY CENTRE HANDIQUE GIRLS COLLEGE DEPT. OF HISTORY PAN BAZAR GUWAHATI ASSAM 781001

69	GUWAHATI	04	0411		BARPETA	COORDINATOR IGNOU STUDY CENTRE BAJALI COLLEGE PETHSALA PETHSALA P.O. BARPETA ASSAM 781325
70	GUWAHATI	04	0419	D	NORTH LAKHIMPUR	COORDINATOR IGNOU SPL STUDY CENTRE-W LAKHIMPUR GIRLS COLLEGE KHELMATI P.O. NORTH LAKHIMPUR ASSAM 787031
71	HYDERABAD	01	0111		HYDERABAD	COORDINATOR IGNOU STUDY CENTRE AURORA'S DEGREE & P G COLLEGE H NO 16-11-210 KRISHNA TULSI NAGAR MOOSARAMBAGH HYDERABAD ANDHRA PRADESH 500036
72	IAEP - JAIPUR	56	5604			COORDINATOR IGNOU ARMY RECOG. STUDY CENTRE ALLAHABAD
73	IAEP - PUNE	54	5405		BIRCHGUNJ, SOUTH ANDAMAN	COORDINATOR IGNOU ARMY RECOG. STUDY CENTRE H Q 108 MOUNTAIN BRIGADE C/O 56 APO 908108
74	IAEP - PUNE	54	5406		PUNE	COORDINATOR IGNOU ARMY RECOG. STUDY CENTRE HQ 31 ARMOURED DIVISION C/O 56 APO 908431
75	IMPHAL	17	1703		MOTBUNG	COORDINATOR IGNOU STUDY CENTRE PRESIDENCY COLLEGE

					MOTBUNG MANIPUR 795107
76	IMPHAL	17	1705	THOUBAL	COORDINATOR IGNOU STUDY CENTRE THOUBAL GOVERNMENT COLLEGE THOUBAL MANIPUR 795138
77	IMPHAL	17	1707	IMPHAL	COORDINATOR IGNOU STUDY CENTRE D.M. COLLEGE OF SCIENCE IMPHAL MANIPUR 795001
78	INEP - KOCHI	74	7401		COORDINATOR IGNOU-NAVY RECOG. STUDY CENTRE COMMAND EDUCATION OFFICE HEAD QUARTERS SOUTHERN NAVAL COMMAND NAVAL BASE KOCHI 682004
79	INEP - KOCHI	74	7402		COORDINATOR IGNOU-NAVY RECOG. STUDY CENTRE INDIAN NAVAL ACADEMY EZHIMALA PAYYANNUR DIST. KANNUR KERALA 670310
80	INEP - MUMBAI	72	7201		COORDINATOR IGNOU-NAVY RECOG. STUDY CENTRE 2ND FLOOR, TARANG NEW NAVY NAGAR MUMBAI MAHARASHTRA 400005
81	INEP - NEW DELHI	71	7101		COORDINATOR IGNOU-NAVY RECOG. STUDY CENTRE NAUSENABAUGH -II

						NARAINA, DELHI CANTT. NEW DELHI 110028
82	INEP - VISAKHAPATNAM	73	7301			COORDINATOR IGNOU NAVY RECOG. STUDY CENTRE NAVY CHILDREN SCHOOL GANDHI GRAM P.O. VISAKHAPATNAM 530005
83	ITANAGAR	03	0303		PASSIGHAT	COORDINATOR IGNOU STUDY CENTRE JAWAHARLAL NEHRU COLLEGE P.O. HILL TOP PASSIGHAT DIST. EAST SIANG ARUNACHAL PRADESH 791103
84	JABALPUR	41	1502		JABALPUR	COORDINATOR IGNOU STUDY CENTRE RANI DURGAWATI UNIVERSITY JABALPUR MADHYA PRADESH 482001
85	JABALPUR	41	1560	D	DISTT. SEONI	COORDINATOR IGNOU SPL. STUDY CENTRE GOVT. POST GRADUATE COLLEGE SEONI DISTT. SEONI SEONI MADHYA PRADESH 480661
86	JABALPUR	41	1565	D	DT. NARSINGPUR	COORDINATOR IGNOU SPL. STUDY CENTRE -RA GOVT. PG COLLEGE NARSINGPUR, KANDELI, ITWARA BAZAR DT. NARSINGPUR MADHYA PRADESH
87	JABALPUR	41	1566	D	DINDORI	COORDINATOR IGNOU SPL. STUDY

						CENTRE -RA GOVT. C.V. COLLEGE DINDORI, DT. DINDORI MADHYA PRADESH
88	JABALPUR	41	1592	D	PANDHURMA	COORDINATOR IGNOU SPL STUDY CENTRE -RA GOVERNMENT SCIENCE COLLEGE PANDHURNA DIST CHHINDWARA CHHINDWARA MADHYA PRADESH
89	JABALPUR	41	1599		JABALPUR	COORDINATOR IGNOU STUDY CENTRE MATA GUJRI MAHILYA MAHAVIDYALA MARHATAL CIVIC CENTRE JABALPUR MADHYA PRADESH 482002
90	JABALPUR	41	41016	D	JUNNARDEO	COORDINATOR IGNOU SPCL STUDY CENTRE GOVERNMENT DEGREE COLLEGE JUNNARDEO CHHINDWARA MADHYA PRADESH 480551
91	JAIPUR	23	2306		AJMER	COORDINATOR IGNOU STUDY CENTRE GOVT COLLEGE AJMER RAJASTHAN 305001
92	JAIPUR	23	2308		ALWAR	COORDINATOR IGNOU STUDY CENTRE RAJRISHI COLLEGE ALWAR RAJASTHAN 301001
93	JAIPUR	23	2318	D	SANGARIA	COORDINATOR IGNOU SPL. STUDY CENTRE-RA

						SWAMI KESHWANAND MAHAVIDYALAYA GRAMOTTHAN VIDYAPEETH SANGARIA RAJASTHAN 335063
94	JAIPUR	23	2328	D	NAWALGARH	COORDINATOR IGNOU SPL. STUDY CENTRE-RA SETH G.B. PODAR COLLEGE RAMBILAS PODAR ROAD NAWALGARH RAJASTHAN 333042
95	JAIPUR	23	2385		DHOLPUR	COORDINATOR IGNOU STUDY CENTRE GOVT P.G.COLLEGE DHOLPUR, RAJASTHAN
96	JAIPUR	23	23132		KARALI	COORDINATOR IGNOU REGULAR STUDY CENTRE GOVERNMENT PG COLLEGE KARALI RAJASTHAN 322241
97	JAIPUR	23	23138		ALWAR	COORDINATOR IGNOU REGULAR STUDY CENTRE GOVERNMENT PG COLLEGE TEHLA ROAD RAJGARH DIST. ALWAR 301408
98	JAIPUR	23	23142		JAIPUR	COORDINATOR IGNOU REGULAR STUDY CENTRE KANORIA P.G. MAHILA MAHAVIDYALAYA NEAR GANDHI CIRCLE J.L.N. MARG, JAIPUR RAJASTHAN 302004

<b>99</b>	JAMMU	12	1201		JAMMU	COORDINATOR IGNOU STUDY CENTRE UNIVERSITY OF JAMMU JAMMU TAWI J & K 180001
<b>100</b>	JAMMU	12	1206		KATHUA	COORDINATOR IGNOU STUDY CENTRE GOVERNMENT DEGREE COLLEGE DEPARTMENT OF GEOGRAPHY KATHUA J & K
<b>101</b>	JAMMU	12	1207		RAJOURI	COORDINATOR IGNOU STUDY CENTRE GOVERNMENT DEGREE COLLEGE RAJOURI J & K 185131
<b>102</b>	JAMMU	12	1208		POONCH	COORDINATOR IGNOU STUDY CENTRE GOVERNMENT DEGREE COLLEGE POONCH J & K
<b>103</b>	JAMMU	12	1232		JAMMU	COORDINATOR IGNOU STUDY CENTRE GOVT. M.A.M. COLLEGE JAMMU J & K
<b>104</b>	JAMMU	12	1267		KISTWAR	COORDINATOR IGNOU STUDY CENTRE GOVT DEGREE COLLEGE KISTWAR J & K 182204
<b>105</b>	JAMMU	12	1268		BHADERWAH	COORDINATOR IGNOU STUDY CENTRE GOVT DEGREE COLLEGE BHADERWAH S DODA J & K
<b>106</b>	JODHPUR	88	2311		KUCHAMAN CITY	COORDINATOR IGNOU STUDY CENTRE KUCHAMAN COLLEGE (NAGAUER)



						KUCHAMAN CITY RAJASTHAN 341508
107	JODHPUR	88	2361		PALI	COORDINATOR IGNOU STUDY CENTRE GOVT. BANGUR P.G. COLLEGE PALI RAJASTHAN 306401
108	JODHPUR	88	2362		SIROHI	COORDINATOR IGNOU STUDY CENTRE GOVT. P.G. COLLEGE (BOYS) SIROHI RAJASTHAN 307001
109	JODHPUR	88	88008		JODHPUR	COORDINATOR IGNOU REGULAR STUDY CENTRE MAHILA P.G. MAHAVIDYALAYA KAMLA NEHRU NAGAR SOOR SAGAR ROAD JODHPUR 342009
110	JODHPUR	88	88014		NAGAUR	COORDINATOR IGNOU REGULAR STUDY CENTRE SHRI TAGORE P.G. COLLEGE JHALARA ROAD KUCHAMAN CITY DIST. NAGAUR RAJASTHAN 341508
111	JORHAT	37	0409	P	JORHAT	PROG. I/C IGNOU PROG. STUDY CENTRE GOVERNMENT SCIENCE COLLEGE JORHAT ASSAM 785010
112	JORHAT	37	0416	D	GOLAGHAT	COORDINATOR IGNOU SPL STUDY

						CENTRE-RA DEBRAJ ROY COLLEGE GOLAGHAT P.O. GOLAGHAT ASSAM 785621
113	JORHAT	37	0421	D	SONITPUR	COORDINATOR IGNOU SPL STUDY CENTRE-RA CHAIDUAR COLLEGE GOHPUR PO SONITPUR ASSAM 784168
114	JORHAT	37	0431		SIVASAGAR	COORDINATOR IGNOU STUDY CENTRE SIBSAGAR GIRL'S COLLEGE SIVASAGAR PO SIVASAGAR ASSAM 785640
115	KARNAL	10	1005		ROHTAK	COORDINATOR IGNOU STUDY CENTRE CHOTU RAM COLLEGE OF EDUCATION ROHTAK HARYANA 124001
116	KARNAL	10	1008		KARNAL	COORDINATOR IGNOU STUDY CENTRE GOVERNMENT P.G. COLLEGE ARTS BLOCK, ROOM NO. 28-29 SECTOR - 14, URBAN ESTATE KARNAL HARYANA 132001
117	KARNAL	10	1009		HISSAR	COORDINATOR IGNOU STUDY CENTRE GOVERNMENT P.G. COLLEGE HISSAR HARYANA 125001

118	KHANNA	22	2206	LUDHIANA	COORDINATOR IGNOU STUDY CENTRE GURU NANAK GIRLS COLLEGE MODEL TOWN LUDHIANA PUNJAB 141008
119	KHANNA	22	2212	JALANDHAR CITY	COORDINATOR IGNOU STUDY CENTRE DOBA COLLEGE TANDA ROAD JALANDHAR CITY PUNJAB
120	KHANNA	22	2214	ABOHAR	COORDINATOR IGNOU STUDY CENTRE DAV COLLEGE ABOHAR FIROZPUR DIST. PUNJAB 152116
121	KHANNA	22	2216	HOSHIARPUR	COORDINATOR IGNOU STUDY CENTRE DAV COLLEGE HOSHIARPUR PUNJAB 146001
122	KHANNA	22	2223	NAVA SHAHR	COORDINATOR IGNOU STUDY CENTRE SIKH NATIONAL COLLEGE CHARAN KANWAL, BANGA NAWASHAHR DT.NAWASHARH PUNJAB 144505
123	KOLKATA	28	2810	KOLKATA	COORDINATOR IGNOU STUDY CENTRE MAULANA AZAD COLLEGE 8 RA KIDWAI ROAD KOLKATA WEST BENGAL 700013
124	KOLKATA	28	2814	KOLKATA	COORDINATOR IGNOU STUDY CENTRE DINABANDHU ANDREWS COLLEGE

						GARIA P.O. KOLKATA WEST BENGAL 700084
125	KORAPUT	44	2107		BOLANGIR	COORDINATOR IGNOU STUDY CENTRE RAJENDRA COLLEGE BOLANGIR ORISSA 767002
126	KORAPUT	44	2110		JEYPORE	COORDINATOR IGNOU STUDY CENTRE VIKRAM DEV COLLEGE KORAPUT JEYPORE ORISSA 764001
127	KORAPUT	44	2174	D	NUAPADA	COORDINATOR IGNOU SPL. STUDY CENTRE-RA KHARIAR COLLEGE AT/PO KHARIAR DISTT. NUAPADA NUAPADA ORISSA 766107
128	LUCKNOW	27	2704		BAREILLY	COORDINATOR IGNOU STUDY CENTRE BAREILLY COLLEGE P O BOX NO 15 BAREILLY UTTAR PRADESH 243005
129	LUCKNOW	27	2712		JHANSI	COORDINATOR IGNOU STUDY CENTRE BIPIN BIHARI PG COLLEGE JHANSI UTTAR PRADESH 284001
130	LUCKNOW	27	2720		LUCKNOW	COORDINATOR IGNOU STUDY CENTRE LUCKNOW CHRISTIAN COLLEGE DEPTT. OF CHEMISTRY LUCKNOW UTTAR PRADESH

						226018
131	LUCKNOW	27	2747		RAIBARELI	COORDINATOR IGNOU STUDY CENTRE FEROZE GANDHI COLLEGE RAEBARILLY UTTAR PRADESH 229001
132	LUCKNOW	27	2767		BANDA	COORDINATOR IGNOU STUDY CENTRE JAWAHAR LAL NEHRU (PG) COLLEGE BANDA UTTAR PRADESH 210001
133	LUCKNOW	27	27126		HARDOI	COORDINATOR IGNOU STUDY CENTRE C S N PG COLLEGE HARDOI UTTAR PRADESH
134	MADURAI	43	2502		COIMBATORE	COORDINATOR IGNOU STUDY CENTRE G.R.D. COLLEGE OF ARTS & SCI. AVANASHI ROAD CIVIL AERODROME POST COIMBATORE TAMILNADU 641014
135	MADURAI	43	2503		MADURAI	COORDINATOR IGNOU STUDY CENTRE THIYAGARAJAR COLLEGE POST BOX NO 107 139-140 KAMARAJAR SALAI MADURAI TAMILNADU 625002
136	MADURAI	43	2504		TIRUCHIRAPALLY	COORDINATOR IGNOU STUDY CENTRE BISHOP HEBER COLLEGE P O BOX 615 TIRUCHIRAPALLY TAMILNADU 620017
137	MADURAI	43	2540	D	TIRUPPUR	COORDINATOR IGNOU SPL STUDY CENTRE-W

						TIRUPPUR KUMARAN COL FOR WOMEN BOX. NO. 18 S.R. NAGAR TIRUPPUR TAMILNADU 641687
138	MADURAI	43	43016		MADURAI	COORDINATOR IGNOU STUDY CENTRE VIVEKANANDA COLLEGE TIRUVEDAKAM WEST MADURAI TAMILNADU 625217
139	MADURAI	43	43053	W	NANGUNERI	COORDINATOR IGNOU COMMUNITY COLLEGE (CLLC) RURAL UPLIFT CENTRE NAGERCOIL ROAD NANGUNERI TAMILNADU 627108
140	MUMBAI	49	1603		MUMBAI	COORDINATOR IGNOU STUDY CENTRE SATHAYE COLLEGE DIXIT ROAD VILE PARLE (E) MUMBAI MAHARASHTRA 400057
141	NAGPUR	36	1607		NAGPUR	COORDINATOR IGNOU STUDY CENTRE NAGPUR UNIVERSITY GURU NANAK BHAWAN NAGPUR MAHARASHTRA 440001
142	NOIDA	39	2702		AGRA	COORDINATOR IGNOU STUDY CENTRE ST. JOHN'S COLLEGE AGRA FORT AGRA UTTAR PRADESH 282002
143	NOIDA	39	2714		MORADABAD	COORDINATOR IGNOU STUDY CENTRE

						HINDU COLLEGE STATION ROAD MORADABAD UTTAR PRADESH 244001
144	NOIDA	39	2718		GHAZIABAD	COORDINATOR IGNOU STUDY CENTRE M.M.H. COLLEGE GHAZIABAD UTTAR PRADESH 201001
145	NOIDA	39	2739		NOIDA	COORDINATOR IGNOU STUDY CENTRE GOVERNMENT P.G. COLLEGE SECTOR - 39 NOIDA UTTAR PRADESH 201303
146	NOIDA	39	2743		SAHIBABAD	COORDINATOR IGNOU STUDY CENTRE LAJPAT RAI (P.G.) COLLEGE SAHIBABAD UTTAR PRADESH 201005
147	NOIDA	39	2749		MUZAFFARNAGAR	COORDINATOR IGNOU STUDY CENTRE S.D. COLLEGE BHOPA ROAD MUZAFFAR NAGAR UTTAR PRADESH 251001
148	NOIDA	39	2761		HAPUR	COORDINATOR IGNOU STUDY CENTRE S.S.V. (P.G.) COLLEGE HAPUR DISTT. GHAZIABAD UTTAR PRADESH -
149	NOIDA	39	2764		MATHURA	COORDINATOR IGNOU STUDY CENTRE BABU SHIVNATH AGRAWAL COLLEGE MATHURA UTTAR PRADESH

						281004
150	NOIDA	39	2798		BARAUT	COORDINATOR IGNOU STUDY CENTRE J.V. POST GRADUATE COLLEGE BARAUT BAGHPAT UTTAR PRADESH 250611
151	NOIDA	39	2799		MEERUT	COORDINATOR IGNOU STUDY CENTRE D.N. POST GRADUATE COLLEGE MEERUT UTTAR PRADESH 250005
152	NOIDA	39	3702		SAHARANPUR	COORDINATOR IGNOU STUDY CENTRE MAHARAJ SINGH COLLEGE SAHARANPUR UTTAR PRADESH 247001
153	NOIDA	39	07107		DELHI	COORDINATOR IGNOU STUDY CENTRE MAHARAJA AGRASEN COLLEGE VASUNDARA ENCLAVE NEAR CHILLA SPORTS COMPLEX DELHI 110096
154	NOIDA	39	39010		MEERUT	COORDINATOR IGNOU STUDY CENTRE NANAKCHAND ANGLO SANSKRIT COLLEGE (NASC) E K RAOD DISTT MEERUT UTTAR PRADESH
155	PANAJI	08	0802		PANJIM	COORDINATOR IGNOU STUDY CENTRE DHEMPE COLL. OF ARTS & SCIENCE P.B. NO. 222 PANJIM GOA 403001



156	PATNA	05	0501		PATNA	COORDINATOR IGNOU STUDY CENTRE VANIJYA MAHAVIDYALAYA PATNA COLLEGE CAMPUS PATNA BIHAR 800005
157	PATNA	05	0509		CHAPRA	COORDINATOR IGNOU STUDY CENTRE RAJENDRA COLLEGE CHAPRA BIHAR 841301
158	PATNA	05	0511		GAYA	COORDINATOR IGNOU STUDY CENTRE GAYA COLLEGE GAYA BIHAR 823001
159	PATNA	05	0524		PATNA	COORDINATOR IGNOU STUDY CENTRE BIHAR NATIONAL COLLEGE ASHOK RAJPATH PATNA BIHAR 800004
160	PATNA	05	0529		PATNA	COORDINATOR IGNOU STUDY CENTRE ANUGRAH NARAYAN COLLEGE BORING ROAD PATNA BIHAR 800013
161	PATNA	05	0568		PATNA	COORDINATOR IGNOU STUDY CENTRE TPS COLLEGE CHIRAIYATARH PATNA BIHAR 800001
162	PATNA	05	0573		BIHARSHARIF	COORDINATOR IGNOU STUDY CENTRE NALANDA COLLEGE BIHARSHARIF

						NALANDA BIHAR 803101
163	PATNA	05	0588		PATNA	COORDINATOR IGNOU STUDY CENTRE PATNA MUSLIM SC. COLLEGE ASHOK RAJPATH OPP SCI. COLLEGE PO MAHENDRU PATNA BIHAR 800006
164	PATNA	05	0591		BUXAR	COORDINATOR IGNOU STUDY CENTRE M V COLLEGE BUXAR BIHAR
165	PORT BLAIR	02	0201		PORT BLAIR	COORDINATOR IGNOU STUDY CENTRE JNR MAHAVIDYALALA PORT BLAIR ANDAMAN & NICOBAR 744104
166	PUNE	16	1608		NASIK	COORDINATOR IGNOU STUDY CENTRE KTHM COLLEGE GANGAPUR ROAD SHIVAJI NAGAR NASIK MAHARASHTRA 422002
167	PUNE	16	1610		AURANGABAD	COORDINATOR IGNOU STUDY CENTRE VIVEKANAND ARTS & SDS COM. COL SAMRAT NAGAR AURANGABAD MAHARASHTRA 431001
168	PUNE	16	1639		BEED	COORDINATOR IGNOU STUDY CENTRE MARTHWDA SHKSHN PRSRK MANDAL B BALBHIM ARTS, SCI & COMM. COLLEG DISTT. BEED

						BEED MAHARASHTRA 431122
169	PUNE	16	16137		JALNA	COORDINATOR IGNOU REGULAR STUDY CENTRE JALNA EDUCATION SOCIETY'S R.G. BAGDIA ARTS, S.B.LAKHOTIA COMMERCE & R. BEZONIJ SCIENCE COLLEGE. JALNA 431203
170	PUNE	16	16144		PUNE	COORDINATOR IGNOU REGULAR STUDY CENTRE ABEDA INAMDAR SENIOR COLLEGE OF ARTS, SCIENCE AND COMMERCE 2390-B, K.B. HIDAYATULLAH ROAD AZAM CAMPUS, PUNE MAHARASHTRA 411001
171	RAGHUNATHGAN J	50	2820	D	MURSHIDABAD	COORDINATOR IGNOU SPL STUDY CENTRE-RA RDK COLLEGE OF COMMERCE JIAGANJ MURSHIDABAD WEST BENGAL 742123
172	RAIPUR	35	1509		JAGDALPUR	COORDINATOR IGNOU STUDY CENTRE GOVERNMENT P.G. COLLEGE JAGDALPUR CHHATTISGARH 494005
173	RAIPUR	35	1510		RAIPUR	COORDINATOR IGNOU STUDY CENTRE PT. RAVI SHANKAR SHUKLA UNIV. ARTS BLOCK EXTN. (RIGHT WING)

						RAIPUR CHHATTISGARH 492010
174	RAIPUR	35	3504		DHANTARI	COORDINATOR IGNOU STUDY CENTRE GOVT POST GRADUATE COLLEGE DHANTARI CHHATTISGARH 493773
175	RAIPUR	35	3505		KANKER	COORDINATOR IGNOU STUDY CENTRE BHANU PRATAP DEV GOVT. PG COLL KANKER DISTT.: UTTAR BASTAR CHHATTISGARH 494334
176	RAIPUR	35	3507		CHAMPA	COORDINATOR IGNOU STUDY CENTRE GOVERNMENT DEGREE COLLEGE CHAMPA CHHATTISGARH 495671
177	RAIPUR	35	3510		RAJNADGAON	COORDINATOR IGNOU STUDY CENTRE GOVT. DIGVIJAYA COLLEGE RAJNANDGAON CHATTISGARH 491441
178	RAJKOT	42	0906		BHUJ	COORDINATOR IGNOU STUDY CENTRE JB THACKER COMMERCE COLLEGE BHUJ DISTRICT KACHCHH BHUJ GUJARAT 370001
179	RAJKOT	42	42020		AMRELI	COORDINATOR IGNOU REGULAR STUDY CENTRE KAMANI SCIENCE COLLEGE & PRATAPRAI ARTS

						COLLEGE AMRELI GUJARAT
180	RANCHI	32	0503		DHANBAD	COORDINATOR IGNOU STUDY CENTRE P.K. ROY MEMORIAL COLLEGE SERAIHELIA DHANBAD JHARKHAND 826001
181	RANCHI	32	0510		PALAMAU	COORDINATOR IGNOU STUDY CENTRE G.L.A. COLLEGE PALAMU DALTONGANJ JHARKHAND 822102
182	RANCHI	32	0513		RANCHI	COORDINATOR IGNOU STUDY CENTRE MARWARI COLLEGE RANCHI JHARKHAND 834001
183	RANCHI	32	0521		DHANBAD	COORDINATOR IGNOU STUDY CENTRE SINDRI COLLEGE P.O. SINDRI DHANBAD JHARKHAND 828122
184	RANCHI	32	0525		WEST SINGHBHUM	COORDINATOR IGNOU STUDY CENTRE MAHILA COLLEGE DEPARTMENT OF HISTORY CHAIBASA P.O. WEST SINGHBHUM DISTRICT JHARKHAND 833201
185	RANCHI	32	0528		HAZARIBAGH	COORDINATOR IGNOU STUDY CENTRE ST. COLUMBA'S COLLEGE P.O. COLLEGE MORE HAZARIBAGH

						JHARKHAND 825301
186	RANCHI	32	3606		GUMLA	COORDINATOR IGNOU STUDY CENTRE KARTIK ORAON COLLEGE PALKOT ROAD GUMLA JHARKHAND 835207
187	SAHARSA	86	0508		PURNEA	COORDINATOR IGNOU STUDY CENTRE PURNEA COLLEGE PURNEA BIHAR 854301
188	SAHARSA	86	0555		SARSA	COORDINATOR IGNOU STUDY CENTRE M.L.T. COLLEGE SAHARSA BIHAR 852201
189	SAHARSA	86	0561		KATIHAR	COORDINATOR IGNOU STUDY CENTRE D.S. COLLEGE KATIHAR BIHAR -
190	SHILLONG	18	1802		TURA	COORDINATOR IGNOU STUDY CENTRE TURA GOVERNMENT COLLEGE W.G. HILLS TURA MEGHALAYA 794001
191	SHILLONG	18	1865		SHILLONG	COORDINATOR IGNOU STUDY CENTRE SANKARDEV COLLEGE BISHNUPUR SHILLONG DIST EAST KHASI HILLS MEGHALAYA 793004
192	SHILLONG	18	1877		LAITUMKHAH	COORDINATOR IGNOU STUDY CENTRE SHILLONG COLLEGE P.O. LAITUMKHAH SHILLONG

					MEGHALAYA 793003
193	SHIMLA	11	1101	SHIMLA	COORDINATOR IGNOU STUDY CENTRE GOVERNMENT DEGREE COLLEGE SANJAULI SHIMLA HIMACHAL PRADESH 171006
194	SHIMLA	11	1102	MANDI	COORDINATOR IGNOU STUDY CENTRE GOVERNMENT P.G. COLLEGE MANDI HIMACHAL PRADESH 175001
195	SHIMLA	11	1104	HAMIRPUR	COORDINATOR IGNOU STUDY CENTRE GOVERNMENT DEGREE COLLEGE HAMIRPUR HIMACHAL PRADESH 177005
196	SHIMLA	11	1105	DHARAMSHALA	COORDINATOR IGNOU STUDY CENTRE GOVERNMENT DEGREE COLLEGE DEPT. OF CHEMISTRY DHARAMSHALA HIMACHAL PRADESH 177005
197	SHIMLA	11	1113	BILASPUR	COORDINATOR IGNOU STUDY CENTRE GOVT. P.G. COLLEGE BILASPUR HIMACHAL PRADESH 174001
198	SHIMLA	11	1115	KINNOUR	COORDINATOR IGNOU STUDY CENTRE GOVT. DEGREE COLLEGE RECONG PEIO KINNOUR DISTRICT HIMACHAL PRADESH 172108
199	SHIMLA	11	1124	SARKAGHAT	COORDINATOR

						IGNOU STUDY CENTRE GOVT. P.G. COLLEGE SARKAGHAT DT. MANDI MANDI HIMACHAL PRADESH 175024
<b>200</b>	SHIMLA	11	1133		DIST.SIRMOUR	COORDINATOR IGNOU STUDY CENTRE GOVT. DEGREE COLLEGE POANTA SAHIB DT. SIRMOUR HIMACHAL PRADESH 173025
<b>201</b>	SILIGURI	45	2805		SILIGURI	COORDINATOR IGNOU STUDY CENTRE ADARSH MAHAVIDYALAYA SEVOKE ROAD SILIGURI WEST BENGAL 734401
<b>202</b>	SILIGURI	45	2821		JALPAIGURI	COORDINATOR IGNOU STUDY CENTRE ST. JAMES HIGH SCHOOL BINNAGURI PO JALPAIGURI WEST BENGAL 735203
<b>203</b>	SILIGURI	45	2846		BALURGHAT	COORDINATOR IGNOU STUDY CENTRE BALURGHAT COLLEGE PO BALURGHAT DIST.: DAKSHIN DINAJPUR WEST BENGAL 733101
<b>204</b>	SILIGURI	45	45015		RAJGANJ	COORDINATOR IGNOU STUDY CENTRE NORTHBENGAL ST.XAVIERS COLLEGE POST BOX NO 1 PO RAJGANJ DIST JALPAIGURI WEST BENGAL 735134
<b>205</b>	SRINAGAR	30	1248		PULWAMA	COORDINATOR IGNOU STUDY CENTRE



						GOVERNMENT DEGREE COLLEGE PULWAMA J & K 192301
<b>206</b>	VARANASI	48	2708		VARANASI	COORDINATOR IGNOU STUDY CENTRE UDAI PRATAP PG COLLEGE VARANASI UTTAR PRADESH 221002
<b>207</b>	VARANASI	48	2737		PRATAPGARH	COORDINATOR IGNOU STUDY CENTRE M.D. POST GRADUATE COLLEGE PRATAPGARH UTTAR PRADESH -
<b>208</b>	VATAKARA	83	1403		CALICUT	COORDINATOR IGNOU STUDY CENTRE JDT ISLAM MARI KUNNU P.O. CALICUT KERALA 673012
<b>209</b>	VATAKARA	83	1405		KANNUR	COORDINATOR IGNOU STUDY CENTRE SHRI NARAYANA COLLEGE KANNUR KERALA 670007
<b>210</b>	VATAKARA	83	1430		WAYANAD	COORDINATOR IGNOU STUDY CENTRE ST. MARRY'S COLLEGE SULTAN BATHERY KUPPADI P.O. WAYANAD KERALA 673592
<b>211</b>	VIJAYAWADA	33	0103		VIJAYAWADA	COORDINATOR IGNOU STUDY CENTRE KBN COLLEGE KOTHAPETA VIJAYAWADA

					ANDHRA PRADESH 520001
212	VISAKHAPATNAM	84	0109	VISAKHAPATNAM	COORDINATOR IGNOU STUDY CENTRE DR. L. BULLAYA COLLEGE VISAKHAPATNAM ANDHRA PRADESH 530013
213	VISAKHAPATNAM	84	84002	RAJAHMUNDRY	COORDINATOR IGNOU STUDY CENTRE GOVERNMENT COLLEGE(AUTONOMOUS) RAJAHMUNDRY EAST GODAVARI DISTRICT ANDHRA PRADESH 533105
214	VISAKHAPATNAM	84	84011	ANAKAPALLE	COORDINATOR IGNOU REGULAR STUDY CENTRE ANAKAPALLI MERCHANTS' ASSO. LINGAMURTHY COLLEGE AMAL COLLEGE, KORHURA-VILLAGE ANAKAPALLE, VISAKHAPATNAM DST. ANDHRA PRADESH 531001

#### 14. IGNOU POLICY REGARDING SEXUAL HARASMENT AT THE WORK PLACE

In compliance with the guidelines of the Supreme Court, IGNOU has adopted a policy that aims to prevent/ prohibit/ punish sexual harassment of women at the workplace. Academic/non-academic staff and students of this University come under its purview. Information on this policy, rules and procedures can be accessed on the IGNOU website ([www.ignou.ac.in](http://www.ignou.ac.in)). Incidents of sexual harassment may be reported to the Regional Director of the Regional Centre you are attached to or to any of the persons whose details are available in following link:

<http://ignou.ac.in/userfiles/IGNOU%20CASH.pdf>

