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THE PEOPLE'S
UNIVERSITY

Pragramme Guide
for
M.Sc. (Applied Statistics)
(MSCAST)

SCHOOL OF SCIENCES
Indira Gandhi National Open University
New Delhi - 110068

PROGRAMME GUIDE

for

M.Sc. (Applied Statistics)

(MSCAST)

IMPORTANT

The Programme Guide contains key information about the programme including the details of courses on offer, the syllabi of courses, advice on choice of courses and how to study the courses, assessment methods, rules and regulations, important forms, lists of Study Centres/Regional Centres of IGNOU. It will help you study the programme and progress in it.

So keep the Programme Guide safe, read it carefully before studying the courses, refer to it for rules and procedures and let it guide you throughout this phase of your student life in IGNOU.

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IMPORTANT

Our course materials are prepared in such a way that you can study them on your own. If you do not understand any part, take help from your counsellor at your Study Centre or from us. **Please do not use any guides for studying the IGNOU MSCAST courses or solving assignments.** Such guides will neither help you in understanding the subject matter nor in passing the examinations.

OUR TERMINOLOGY

In IGNOU, we use different terms from the ones used in conventional Colleges or Universities. So do please learn them. We use the terms

- **Programme for Course,**
- **Course for Paper, and**
- **Discipline for Subject.**

Programme Coordinator(s)

Dr. Neha Garg

Discipline of Statistics,
School of Sciences,
IGNOU New Delhi

Dr. Prabhat Kumar Sangal

Discipline of Statistics,
School of Sciences,
IGNOU New Delhi

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Further information on Indira Gandhi National Open University courses may be obtained from the University's office at Maidan Garhi, New Delhi - 110068.

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CONTENTS

Message from the Programme Team		**4**
The University		**6**
Your Study Centre		***6***
1. M.SC. (Applied Statistics) Programme		**7**
1.1	MSCAST Programme Objectives	7
1.2	Target Group	7
1.3	Duration of the Programme	7
1.4	Medium of Instruction	8
1.5	Eligibility	8
1.6	Programme Fee	8
1.7	Exit Option	8
1.8	Credit System	8
1.9	Recognition	8
1.10	Student Support Services	8
2. Programme Structure and Details		**9**
2.1	Details of the Semester-wise Courses	10
2.2	Scheme of Study	18
3. Instructional System		**18**
3.1	Self-instructional Material	19
3.2	eGyankosh and IGNOU eContent App	19
3.3	Counselling Sessions	19
3.4	Web Based Supports	20
3.5	Browing IGNOU's Website	21
4. Evaluation Scheme		**24**
4.1	Theory Evaluation	24
4.2	Practical Evaluation	25
4.3	Qualifying Marks	25
4.4	Assignments	25
4.5	Guidelines Regarding the Submission of Assignments	27
4.6	Term-End Examination (TEE)	28
4.7	General Guidelines Regarding the Term-End Examination	29
5. Other Useful Information		**31**
6. Some Useful Addresses		**35**
7. Links to Forms and Enclosures		**36**

MESSAGE FROM THE PROGRAMME TEAM

Dear Learner,

Welcome to the family of distance learners and **M.Sc. in Applied Statistics (MSCAST) programme** offered by the Statistics discipline of the School of Sciences, Indira Gandhi National Open University, New Delhi. This programme intends to cater needs of the working professional in Industries, Research & Development Organisations and Academic Institutions. It may also be helpful for the graduates with Statistics/Mathematics aspiring to develop skills and get employment in the field of applied statistics/ data analytics in any of the industries, organisations, academic institutions, etc. You would agree that having to combat competition at the national and international levels, the working professional in the industry and academia need to be familiarised and develop skills in applying appropriate statistical tools for data processing, visualisation, and interpreting of the real-life data. As a working professional, you need to academically revitalise yourself for using statistical tools for efficient data handling, statistical inference, statistical quality control, time series analysis, regression modelling, multivariate analysis, machine learning, etc. along with the data analysis with **R** and **Python** programming. We hope this programme would be able to accomplish all these envisaged targets.

It is a 2-year programme during which you will study a wide range of topics related to Applied Statistics. You will receive support from IGNOU through your Regional Centre (RC), Learner's Support Centre (LSC) (was called Study Centre) and IGNOU's website. We expect you to be directly in contact with yours RC and LSC. This Programme Guide contains the information related to the MSCAST programme like instructional system, syllabi of the programme, details of evaluation scheme and links to assignments, other important information and important forms.

The self-learning material (SLM) for MSCAST programme will reach you after you get registered in this programme. The self-instructional course material will also be uploaded on **eGyankosh Website** and **IGNOU eContent App**. You can download the assignments of the semester in which you have enrolled from IGNOU website. Each theory course contains one assignment that will be assessed by a counsellor at your LSC. You should be very careful about finishing and submitting your assignments at your LSC within the stipulated last date of submission as these are the continuous assessment tools carrying 30% weightage, otherwise you will not be allowed to appear in the Term-end Exam unless the assignments have been submitted. All the details pertaining to the assignments will be given in the assignment booklet itself and will be uploaded on the IGNOU website. Your **registration** for this programme will be valid for **four years from the date of initial registration**.

In order to facilitate your learning, there is a provision of **face-to-face** counselling for all courses. You need to attend practical counselling sessions compulsorily to be eligible for appearing for the Term-end Practical Examinations. **Please note that the counselling schedules for the theory as well as lab courses will be** provided **by the coordinator of the Programme/Learner Support Centre/Study Centre. Therefore, you are advised to be in constant touch with the study centre.**

It is to be noted that the payments that are mentioned in various proformas/formats/forms are as on date and is subject to revision from time to time. You are advised to check these proformas/formats/forms from IGNOU website/LSC/RC for any revision/modification. Some useful forms and formats (or the link to useful forms and formats) are also given at the end of this booklet. The Programme Guide, forms and formats are also available on the IGNOU website. Please confirm the fees with the RC / LSC / Website before you pay. As a distance learner, you may have several queries. You will find answers to many of them in this booklet. This booklet is a very important guide for you.

Please read this Programme Guide very carefully and keep it handy until you successfully complete the MSCAST programme.

However, during your studies, if you have any feedback, suggestions and comments to make, please send an Email to ***mscast@ignou.ac.in***

Or, you can communicate through post to

The MSCAST Programme Coordinator(s),

School of Sciences, Raman Bhavan, D-Block, Academic Complex,

IGNOU, Maidan Garhi, New Delhi – 110068

You may visit the IGNOU website for more information at**:** ***http://www.ignou.ac.in***

We wish you success in pursuing the MSCAST programme.

MSCAST Programme Team

THE UNIVERSITY

The Indira Gandhi National Open University was established in September 1985 by an Act of Parliament to provide opportunities of higher education to large segments of population, vocations and professions. The primary emphasis is on innovation, flexibility and cost-effectiveness. It is a university with a difference!

The major objectives of the university are to:

- promote the educational well-being of the community;
- democratise higher education by providing equitable access to all those who desire to improve their qualifications, skills and competence by taking education to the doorsteps of people living even in remote rural areas;
- disseminate knowledge through an innovative multiple media instructional package for self-learning; and
- provide high quality education at all levels.

In IGNOU, you can study:

- at your own pace and convenience;
- at your own chosen place; and
- courses of your choice from a wide range of Disciplines.

The University uses a variety of communication technologies for teaching-learning. **Student Support services** are provided at **Learner Support Centres** located all over the country. These Centres are located in educational institutions and function on all holidays and Sundays. Some Study Centres open in the evenings on working days and Saturdays. Each Study Centre is supervised by a **Coordinator**. The functioning of Study Centres is monitored by **IGNOU Regional Centres**.

YOUR STUDY CENTRE

At your Learner Support Centre, you get:

- all **information** and **learning support**;
- **face-to-face counselling** for every course by a senior and experienced teacher engaged as Academic Counsellor who will solve your difficulties for that course;
- **library** to read books, **facilities to listen/watch audio/video programmes provided**; and
- **labs to do your practical work.**

IMPORTANT: The Assistant Coordinator for M.Sc. (Applied Statistics) Programme will help you with all your problems. If you face any problems in your Learner Support Centre, please e-mail to your Regional Centre with a copy to sos@ignou.ac.in quoting your enrolment number, SC Code and RC code. Or write to us at the address:

Director, School of Sciences, Block D, Raman Bhawan, IGNOU, Maidan Garhi, New Delhi-110068

1. M.SC. (APPLIED STATISTICS) PROGAMME

The School of Sciences has developed the M.Sc. (Applied Statistics) programme with the help of several eminent experts across India. Applied Statistics is an emerging field which deals with acquisition, representation, analysis and interpretation of data. The demand for statistics professionals is increasing day by day due to its applicational potential in several fields. To cope up this increasing demand, the M.Sc. (Applied Statistics) programme has been developed which caters the needs of working professionals and graduates aspiring for employment in industries (software, manufacturing, agriculture, or pharmaceutical industries), National Laboratories, R & D Organisations and Academic Institutions/ Universities/Colleges, etc. This programme emphasises on the courses which have vast potential for applications of the statistical tools in Industrial, Business, Management, Medical, Research oriented fields, Machine Learning, Data Science, etc. This programme has been built around detailed concepts and skills starting from the basic level to make it easy to understand how Statistics can be applied for the practical use. The programme has been designed to make you aware of the theories and applications of Statistics. Hands-on training is provided in the lab courses to familiarise you with the applications of statistical tools with the help of open-source software like R and Python. This programme is especially useful for the working professionals who are interested in updating their knowledge in Statistics. It would also help fresh Graduates, who wish to continue their education and are interested in getting into the field of Applied Statistics.

1.1 MSCAST Programme Objectives

M.Sc. (Applied Statistics) is intended to provide higher education in Applied Statistics through open and distance learning mode. Many graduates who are working as data analysts, data scientists, statisticians, etc., in different Companies/ Departments/Institutions along with fresher's will get an opportunity for upgrading their knowledge. This programme has been designed in view of NEP 2020 with a semester approach in mind. This programme is aimed at theoretical knowledge and practical skills development in core and advanced statistics courses for providing conceptual framework as well as focused on the project/dissertation work. The objectives of this programme are to:

- provide core knowledge of statistics required for applications.
- familiarise with the real-life problems to the learners and make them able to apply various statistical tools.
- equip them with the skills of using appropriate software for statistical applications in various fields.
- provide opportunities for career progression and higher education in statistics.

1.2 Target Group:

- Working professionals in data science departments, management departments, software industries, pharmaceutical industries, national laboratories, R&D organisations, academic institutions/colleges/universities, agricultural fields, etc.;
- College/university teachers either teaching or interested to teach statistics related courses;
- Working professionals possessing basic or no exposure to applied statistics but are interested to initiate and develop skills in this field; and
- Graduates with statistics/mathematics interested to acquire theoretical understanding and develop practical skills on the aspects of data analysis.

1.3 Duration of Programme:

To fulfil the requirements for acquiring the MSCAST, a learner may successfully complete each course of the programme in a minimum of 2 years and a maximum of 4 years.

Minimum: 2 years and Maximum: 4 years.

1.4 Medium of Instruction

The medium of instruction is English. The course material is in English.

1.5 Eligibility

Graduate with B.A./B.Sc. degree with Statistics/Mathematics as one of the subjects from any recognised University/Institution/Organisation.

1.6 Programme Fee

The total programme fee is ₹ 30800/-* which is divided into four semesters.

₹ 15400/**-** per year

* Registration fee of ₹ 300/- (Non-refundable) is to be paid at the time of admission in addition to the programme fee.

1.7 Exit Option

After successfully completing first two semesters, learner will be awarded **Post Graduate Diploma in Statistics and Applications (PGDSA)**.

1.8 Credit System

The IGNOU follows the '**Credit System**' for its programmes. Each credit is of 30 hours of study comprising all learning activities. Thus, a four-credit course involves 120 study hours. This helps learners to understand the academic effort he/she has to put into successfully completing a course. **Successful Completion of the programme requires successful completion of both assignments and the Term -End Examination of each course in the programme.**

1.9 Recognition

IGNOU is a Central University established by an Act of Parliament in 1985 (Act No.50 of 1985) IGNOU Degrees/Diplomas/Certificates are recognized by all member Universities of Association of Indian Universities (AIU) and are at par with Degrees/Diplomas/Certificates of all Indian Universities/Deemed Universities/Institutions vide UGC Circular No. F1-52/2000 (CPP-II) dated 5 May, 2004 and AIU Circular No. EV/B (449)/94/177115 dated January 14, 1994, and UGC's letter no. UGC/DEB/2013 dated 14.10.2013, and UGC notification on UGC website F.No. 1-18/2018 (DEB-I) dated 21-02-2019, list Master of Computer Application of IGNOU as one the programme recognised from 2018-19 to2022-23. You may download all the recognition related information from the following web links. http://www.ignou.ac.in/ignou/aboutignou/division/srd/new
http://ignou.ac.in/ignou/aboutignou/division/srd/Recognition

1.10 Student Support Services

To provide individualised support to its learners, the University has created a number of Learner Support Centres (LSC)/ Study Centres (SC) throughout the country for this programme. These are administratively coordinated by the Regional Centres (RCs). The LSCs are the contact points for the students on all major aspects of the programme. These include theory and practical counselling sessions, reference library facilities, disseminating information and advice, facilities for audio-visual training aids and teleconferencing. The University may not always be able to communicate to all the learners individually. All important communications are sent to the Regional Directors who in turn will intimate them to the LSC coordinators. The coordinators display such Circulars / Notifications on their notice boards for the benefit of the learners. You are, therefore, advised to be in touch with your LSC coordinator on a more regular basis so as to get the latest information about assignments, submission schedules (assignments and examination forms), declaration of results, etc.

2. PROGRAMME STRUCTURE AND DETAILS

This is a two-year Master's degree programme in Applied Statistics, which is offered in both January and July cycles of admission. The programme has been divided into two semesters per year (July to December and January to June). This programme comprises 16 core and compulsory theory courses worth total 54 credits and 5 core and compulsory lab courses worth 18 credits. There is one project/dissertation worth 8 credits and 2 elective theory courses worth 4 credits each which can be taken together instead of project/dissertation. To successfully complete this programme, you will have to earn 80 credits over a period of 2 to 4 years depending on your convenience. The theory courses are designed to provide the basic knowledge and techniques of statistics, which are necessary for applications in various areas. These theory courses will help you in studying the lab courses well. The lab courses have been designed in this programme separately and each semester has at least one lab course which has been developed based on the theory courses of that semester. **After successfully completing the first two semesters, you will be awarded the Post Graduate Diploma in Statistics and Applications (PGDSA).**

The detailed structure of the MSCAST programme is as follows:

Programme Structure

Course Code	Course Title	Credits	Nature of Course (Theory / Lab)	Core/Elective
Semester I				
MST-011	Real Analysis, Calculus and Geometry	02	Theory	**Core**
MST-012	Probability and Probability Distributions	04	Theory	**Core**
MST-013	Survey Sampling and Design of Experiments-I	04	Theory	**Core**
MST-014	Statistical Quality Control and Time Series Analysis	04	Theory	**Core**
MST-015	Introduction to R Software	02	Theory	**Core**
MSTL-011	Statistical Computing using R-I	04	Lab	**Core**
	Total Credits	**20**		
Semester II				
MST-016	Statistical Inference	04	Theory	**Core**
MST-017	Applied Regression Analysis	04	Theory	**Core**
MST-018	Multivariate Analysis	04	Theory	**Core**
MST-019	Epidemiology and Clinical Trials	02	Theory	**Core**
MSTL-012	Statistical Computing using R-II	06	Lab	**Core**
	Total Credits	**20**		
Semester III				
MST-020	Survey Sampling and Design of Experiments-II	04	Theory	**Core**
MST-021	Classical and Bayesian Inference	04	Theory	**Core**
MST-022	Linear Algebra and Multivariate Calculus	04	Theory	**Core**
MST-023	Research Methodology	04	Theory	**Core**
MSTL-013	Statistical Computing using R-III	04	Lab	**Core**
	Total Credits	**20**		
Semester IV				
MST-024	Data Analysis with Python	02	Theory	**Core**
MSTL-014	Data Analysis with Python Lab	02	Lab	**Core**

MST-025	Categorical and Survival Analysis	02	Theory	**Core**
MST-026	Introduction to Machine Learning	04	Theory	**Core**
MSTL-015	Statistical Computing using R-IV	02	Lab	**Core**
MSTE-011	Operations Research*	04	Theory	**Elective (To be taken together)**
MSTE-012	Stochastic Processes*	04	Theory	
MSTP-011	Project/Dissertation*	08		**Elective**
	Total Credits	**20**		

*** Learner may opt either two theory courses "**Operations Research" (4 credits) and "Stochastic Processes" (4 credits) together or a Project/Dissertation (8 credits).

2.1 Details of the Semester-wise Courses

In this section, a brief introduction of each course is given to provide an overview.

Courses of the Ist Semester

MST-011: Real Analysis, Calculus and Geometry (02 Credits)

Some mathematics concepts are required to be understood by a statistician or data scientist to learn the subject of statistics more effectively. In many courses of statistics, you apply functions to perform some tasks of interest. So, the main aim of this course to provide knowledge of some mathematical concepts use in Statistics and machine learning. This course is organised into two blocks into one volume. This is a compulsory core course of the programme of worth 2 credits. Detail syllabus of this course is given as follows:

Distinction between constant and variable; Interval and its types; Pictorial Presentation of a function; Some special functions having applications in statistics, probability and machine learning.

Types of function; Countable set; combining functions; continuity of a function; differentiability of a function at a point.

Extended real numbers; Binary operations; Set function and measure; Characteristic, Simple and Step functions; Distance function and Metric.

Sequence in the family of real numbers; Convergence and divergence of sequences and series; Absolute and conditional convergence.

How the job of summation is discrete world is done by Integration in the continuous world and in what way; Two definitions of Riemann integration.

Equation of a Line in 2-dimension; A review of vector algebra; Equation of a Line in 3-dimension; Equation of a plane and hyperplane; Inequation in one and two variables.

Linear, Affine, Conic and Convex Combinations; Affine and convex set; Properties of convex set; Definition of convex and concave functions; Epigraph and properties of convex function.

Gamma function and its graphical behaviour; Beta function and its graphical behaviour; Properties of Gamma and Beta functions.

Change of origin of summation; change of order of summation; Double integration; Change of order of integration.

MST-012: Probability and Probability Distributions (04 Credits)

We use tools and techniques of probability theory to model the uncertainty of a phenomenon. Probability is based on the deep concept of measure theory. This course is devoted to describe the probability, measure theory and probability distributions. This course is organised into four blocks and two blocks into one volume. This is a compulsory core course of the programme of worth 4 credits. Detail syllabus of this course is given as follows:

An overview of Conditional probability; Addition and multiplication laws of probability; Independence of events; Total law of probability; Bayes' theorem. Event, class of events and collection of classes; Field and sigma field and properties of sigma field; Probability measure and probability space. Probability assignment to events in discrete and continuous worlds; Borel sigma field; Statement of Caratheodory extension theorem. Definition and Type of Random Variable; pmf and cdf of Discrete Univariate Random Variable; pdf and cdf of Continuous Univariate Random Variable. Definition and Type of Bivariate Random Variable, Joint pmf and cdf of Discrete Bivariate Random Variables; Joint pdf and cdf of Continuous Bivariate Random Variables; Marginal and Conditional Distributions of Random Variables. Expectations of Functions of Random Variables. Moment Generating Function and its Properties; Concept of Jacobian; Transformation of Univariate and Bivariate Random Variables.

Uniform and Bernoulli probability distributions along with their properties and applications. Binomial and Multinomial probability distributions along with their properties and applications. Poisson and Geometric probability distributions along with their properties and applications. Negative Binomial and Hypergeometric probability distributions along with their properties and applications.

Uniform and Exponential probability distributions along with their properties and applications. Normal and lognormal probability distributions along with their properties and applications. Gamma and Beta first and second kind probability distributions along with their properties and applications. Laplace and Cauchy probability distributions along with their properties and applications.

Chebychev's; Markov; Cauchy-Schwartz; Holder; Minkowski; Liapunov and Jensen Inequalities; Borel-Cantelli Lemma; Kolmogorov's 0-1 law; Convergence of Sequence of Random Variables; Various Modes of Convergence: in Probability, in Distribution; Law of Large Numbers for iid Sequences; Weak Law of Large Numbers; Bernoulli and Khintchin's WLLN's; Kolmogorov Inequality; Kolmogorov SLLN for Independent Random Variables and Statement only for non i.i.d. Case; Central Limit Theorem and its Applications.

MST-013: Survey Sampling and Design of Experiments-I (04 Credits)

This course has been designed to cover the contents from the domains of Sampling Theory, Analysis of Variance and Design of Experiments. The aim of this course is to provide the basis knowledge of sampling and design of experiments. This course is organised into four blocks and two blocks into one volume. This is a compulsory core course of the programme of worth 4 credits. The detailed syllabus of this course is given as follows:

Review of Sample Survey; Definition and Procedure of Selecting a Sample in SRSWR; Estimation of Population Mean; Variance of Sample Mean and unbiased Estimate of the variance. Definition and Procedure of Selecting a Sample in SRSWOR; Estimation of Population Mean; Variance of Sample Mean and unbiased Estimate of the variance.

Simple Random Sampling for Attributes; Estimation of Population Proportion; Variance of the Sample Proportion; Confidence Limits; Determination of Sample Size in SRS.

Concepts and Estimation of Population Mean and its Variance in PPSWR; Cumulative Total Method and Lahri's Method of selecting PPSWR sample, their merits and demerits. Concepts and Estimation of Population Mean and its Variance in PPSWOR; Ordered and Unordered Estimators; Issues of non-negativity of the estimate of the variance and its resolution.

Stratified Random Sampling; Estimate of Population Mean; Variance of the Sample Mean. Problem of Allocation; Equal, Proportional, Optimum and Neyman Allocations; Comparison of Stratified Random. Sampling with SRS; Determination of sample size, Construction of Strata, Post Stratification; Estimate of Population Mean under post-stratification; Variance of Sample Mean.

Systematic Sampling; estimate of population mean; Variances of Sample Mean; Comparison of systematic sampling with SRS and stratified sampling for the population with linear trend, circular systematic sampling.

Assumptions; Uses; Terminologies and Different Linear Models in Analysis of Variance, Model, Assumptions and Statistical Analysis of the Model in One-Way and Two-Way Classifications. Model, Assumptions and Statistical Analysis of the Model in Three-Way (one observation per cell) Classifications.

Role, terminology, Definitions of Experimental Design, Experimental Error and Uniformity Trials; Principles of Design of Experiments; Size of Plots. Completely Randomised Design (CRD): Model, Layout and Analysis; Critical Difference; CRD with One Missing Observation. Randomised Block Design Model: Layout and Analysis; Efficiency of RBD over CRD; RBD with One Missing Observation. Latin Square Design (LSD): Model, Layout and Analysis; Efficiency of LSD over RBD and CRD; LSD with one Missing Observation.

MST-014: Statistical Quality Control and Time Series Analysis (04 Credits)

The aim of this course is to develop the skills of learners to apply the statistical techniques and tools in quality control, time series and reliability. This course is organised into four blocks into two volumes. This is a compulsory core course of the programme of worth 4 credits. This course covers the content given as follows:

Brief Review of SQC, Control Chart Technique, Control Chart for Variables, Control Chart for Mean, Range and Standard Deviation, Process Capability Analysis. Control Chart for Attributes: Control Chart for Fraction Defective, Number of Defectives. Control Chart for Number of Defects (c-chart and u-chart), Cu-sum Charts, EWMA, Concept of Six-Sigma.

Sampling Inspections Plans, Implementation of Acceptance Sampling Plan for Attributes, Terms used in Acceptance Sampling Plans, Consumer's Risk and Producer's Risk. Rectifying Sampling Plan, Average Outgoing Quality (AOQ), OC Curve, Average Sample Number (ASN) and Average Total Inspection (ATI). Single and Double Sampling Plans with OC Curve, Consumer's Risk and Producer's Risk, AOQ, ASN, ATI, Design of Respective Sampling Plans.

Introduction to Time Series and Its Components, Measurement of Trend by Linear Filtering (Simple and Weighted Moving Averages) and Method of Least Squares, Estimation of Seasonal Component by simple Average, Ratio to Trend Method and Ratio to Moving Average Method. Strong and Weak Stationarity; Autocovariance; Autocorrelation Function and Correlogram; Autoregressive (AR), Moving Average (MA); Autoregressive Moving Average (ARMA) and Autoregressive Integrated Moving Average (ARIMA) Models.

Introduction, Definition of Reliability, Basic Concepts of Various Reliability Functions, Bathtub Curve, Estimation of Reliability Functions from Constant Hazard Function. Reliability Evaluation for Series, Parallel and k-out-of-n System, Redundancy, Representation of Complex System through Minimal Paths and Minimal Cuts.

MST-015: Introduction to R Software (02 Credits)

This course is designed to acquaint the learners with the basic data structure and fundamentals of coding concepts in R language. You will also study the descriptive statistics and correlation using R in the course. This compulsory core theory course is of 2 credits course of the programme. The course content of this course is given as follows:

Basics of R: Installation Procedure, Seeking Help and Terminologies. Vector Operations, Arithmetic operations with scalars and data vectors. Matrix, Matrix operations: Extraction of sub-vectors and sub-matrices, Matrix addition, subtraction and multiplication. Matrix functions: t, diag, cbind, rbind, rowSums, rowMeans, colSums, colMeans, dim, nrow, ncol, det, solve. Arrays, Factors, Missing Values, Logical operations, Relational operations. Attributes of objects for example: names, dimnames, dimensions, class. Testing commands: is.integer, is.numeric, is.character, is.vector, is.matrix, is.logical, is.factor, is.list, is.data.frame, is.ts. Coercion commands: as.integer, as.numeric, as.character, as.vector, as.matrix, as.logical, as.factor, as.list, as.data.frame, as.ts. Data frame, Sorting, Indexing and Ordering. Data frame Subsetting, attach and detach functions, List, List Subsetting. Formatting commands: (print, cat, format,

Date and Time operations), Data Reading from files (.txt, .csv and spread sheet), Writing and saving to file.

Control Statements: if statement, if else statement, Nested if statement, for loop, nested for loop, while loop, repeat loop, next and break. lapply, sapply, apply, tapply, mapply. functions in R: built-in function, functions in R (Examples of some user defined functions).

Scatterplot, Boxplot, Histogram, Barplot, Stripchart, Stem and Leaf plot, Pie chart, pairs plot, coplot, curve, cloud plot, Arithmetic mean, Geometric mean, Harmonic mean, Median, Variance, Skewness, Kurtosis, Bivariate Plots and Correlation.

MSTL-011: Statistical Computing Using R-I **(04 Credits)**

This lab course is designed on the contents discussed in the four core theory courses, namely, MST-011 (Real Analysis, Calculus and Geometry), MST-012 (Probability and Probability Distributions), MST-013 (Survey Sampling and Design of Experiments-I) and MST-014 (SQC and Time Series Analysis) of Semester-I of the programme. While designing this lab course, the R programming basics and concept discuss in the MST-015 (Introduction to R Software) are used. This lab course is worth 4 credits and a compulsory core component of the programme. This course is organised into various lab sessions which are based on the following topics:

- *Graphical Presentation of some Functions Using R*
- *Integration and Differentiation Using R*
- *Sample Space and Discrete Probability Distributions Using R*
- *Continuous Probability Distributions Using R*
- *Simple Random Sampling Using R*
- *Stratified Random Sampling Using R*
- *Systematic Sampling Using R*
- *Analysis of Completely Randomized Design Using R*
- *Analysis of Randomized Block Design Using R*
- *Analysis of Latin Square Design Using R*
- *Analysis of RBD and LSD with one Missing Observation Using R*
- *Control Charts for Mean and Range Using R*
- *Control Charts for Mean and Standard Deviation Using R*
- *Control Chart for Proportion of Defectives Using R*
- *Control Chart for Number of Defectives Using R*
- *Control Chart for Number of Defects Using R*
- *Operating Characteristic and Average Outgoing Quality Curves Using R*
- *Estimation of Trend by Curve Fitting Using R*
- *Smoothing of Time Series Using R*
- *Seasonal Component Analysis Using R*
- *Estimation of Reliability Using R*

Courses of the IInd Semester

MST-016: Statistical Inference **(04 Credits)**

The purpose of introducing this course is to understand some useful techniques of statistics to draw inferences about the population on the basis of sample(s). This is a compulsory core course of the programme of worth 4 credits. This course organised into four blocks and two blocks into one volume. This course comprises content as follows:

Introduction to Sampling Distribution; Standard Error; Sampling Distributions of Mean, Difference of two Means, Proportion, Difference of Proportions, Variance, Ratio of two Variances. Introduction to Chi-

Square, t and F Distributions, Their Properties and Applications, Relations between t, Chi-square and F-distribution.

Concepts of Estimation; Point and Interval Estimation; Mean Square Error, Unbiasedness, Consistency (BAN or CAN Estimators), Efficiency, Sufficiency, Factorization Theorem, Minimal Sufficiency, Completeness, Pitman's Nearness (definition only)

Concept of Likelihood Function, Method of Maximum Likelihood Estimation, Methods of Moments, Minimum Chi-Square and Least Squares Methods along their Properties (without proof).

Interval Estimation, One side and Two sides confidence Interval (CI), Confidence Level, Length of CI, Pivotal quantity, Methods of Finding Confidence Intervals, Shortest Length Confidence Interval, Confidence Intervals for Mean, Difference of two Means, Proportion, Difference of two Proportions, Variance, Ratio of two Variances. Confidence Interval for Non-normal Population, Determination of Sample Size.

Statistical Hypotheses: Simple and Composite Hypotheses; Null and Alternative Hypotheses; Critical Region; Two Kinds of Errors; One-tailed and Two-tailed Test, Level of Significance; Power of a Test; Concept of p-Value; General Procedure of Testing of Hypothesis. Procedure of testing of hypothesis of Z and t Tests, Tests for Mean, Difference of two Means, Proportion, Difference of two Proportions, Variance, Ratio of two Variances.

MST-017: Applied Regression Analysis (04 credits)

This course is designed to develop the skills of performing regression analysis which is one of the most widely used method for studying the dependence of one dependent (response) variable on one or more independent (explanatory) variables. The course content has been divided into units that are organised into four blocks and two blocks into one volume. This is a compulsory core course of the programme of worth 4 credits. The topics covered in this course are given as follows:

Linear Models, Simple and Multiple Linear Regression Models, Assumptions in Multiple Linear Regression Model, Ordinary Least Squares Estimation, Fitted Linear Regression Model, Properties of the Ordinary Least Squares Estimators (OLSE), Maximum Likelihood Estimation, Testing of Hypotheses and Confidence Interval on the Individual Regression Coefficients, Test of Significance of Regression Coefficient through Analysis of Variance, Goodness of Fit of Regression Model: Coefficient of Determination (R^2) and Adjusted R^2. Prediction of Average and Actual Values of Study Variable. Standardized Regression Coefficients: Unit Normal Scaling, Unit Length Scaling.

Model Adequacy Checking: Checking of the Linear Relationship, Residual Analysis; Methods for Scaling Residuals: Standardized Residuals, Studentized Residuals, PRESS Residuals, Standardized PRESS Residual; Residual Plots: Normal Probability Plot, Plots of Residuals against the Fitted Value, Plots of Residuals against Explanatory Variable, Autocorrelation, Partial Regression and Partial Residual Plots, Statistical Tests on Residuals: The PRESS Statistic, R^2 for Prediction based on PRESS, Detection of Outliers, Test for Lack of Fit of a Regression Model; Variance Stabilizing Transformations, Transformations to Linearize the Model, Diagnostic for Leverage and Influence: Leverage Point, Influence Point, Measures of Influence: Cook's D-Statistics, DFFITS and DFBETAS. Indicator Variables, Linear Regression Model with and without Interaction in case of Indicator Regressor Variables.

Multicollinearity, Multicollinearity Diagnostics, Remedies for Multicollinearity, Heteroskedasticity, Tests for Heteroskedasticity, Bartlett's Test. Autocorrelation, Source of Autocorrelation, First Order Autocorrelation, Durbin Watson Test; Polynomial Models in One Variable, Variable Selection and Model Building: Evaluation of Subset Regression Model, Computational Techniques for Variable Selection: Stepwise Regression Techniques; Regression Shrinking Methods: Ridge and LASSO Regression.

Simple and Multiple Logistic Regression Models, Linear Predictor and Link Functions, Logit Transformation, Maximum Likelihood Estimation of Parameters, Iteratively Reweighted Least Squares Algorithm, Interpretation of Parameters; Probit Model, Complementary Log-Log Model, Polychotomous or

Multinomial Logistic Regression Models, Testing of Hypothesis, Goodness-of-Fit; Poisson Regression Models, Link Function, Maximum Likelihood Estimation of Parameters; Generalized Linear Models: Exponential Family of Distribution, Linear Predictors and Link Functions.

MST-018: Multivariate Analysis (04 Credits)

This course will help you to have deeper learning of the multivariate data and multivariate analysis techniques. This compulsory core theory course is of 4 credits course of the programme. The course content has been divided into units that are organised into four block and two blocks into one volume. This is a compulsory core course of the programme of worth 4 credits. The topics covered in this course are given as follows:

Introduction to Multivariate data, Vectors, Matrices and Scalars, Rank, Determinant, Inverse, Trace, Linear Dependence and Independence in Vectors, Orthogonal Vectors and Matrices, Eigenvalues and Eigenvectors, Positive Definite and Semidefinite Matrices, Quadratic form, Matrix Differentiation, Partition of vector, Partition of Matrices, Square Root Matrix, Cholesky decomposition, Multivariate probability mass/density functions, Distribution function, Mean vector & Dispersion matrix, Marginal & Conditional distributions.

Multivariate Normal distribution and its properties, Marginal and Conditional Distributions of a Sub-Vector of a Normally Distributed Vector, Distribution of Random Vector Y = DX, where D is full rank and non-full rank, Moment Generating Function & Characteristic, Additive property of a p-variate Normal Distribution, Maximum likelihood estimators of Mean Vector and Co-Variance Matrix, Distribution of the Sample Mean Vector, Multiple correlation coefficient, Multivariate central limit theorem, Wishart Distribution (without proof) and its properties.

Hotelling's T^2 Statistic and its Distribution (without proof), Some applications and Invariant property of Hotelling's T^2, Mahalanobis D^2 Statistic, Classification and Discriminant Analysis, Canonical Correlation Analysis, Principal Component Analysis, Factor Analysis.

Hypothesis Testing based on Variance Covariance Matrices, Cluster Analysis, Agglomerative Method: Single Linkage, Complete Linkage, Average Linkage, Divisive Method, k-mean Clustering, One-way MANOVA.

MST-019: Epidemiology and Clinical Trials (02 Credits)

In this course you will study applications of statistics in two areas namely Epidemiology and Clinical Trials. Thus, this course is divided into two blocks where Block 1 is devoted to Epidemiology and Block 2 is devoted to Clinical trials. This is a compulsory core course of the programme of worth 2 credits. The topics covered in this course are given as follows:

Brief historical overview and definition of Epidemiology; Descriptive and Analytic Epidemiology; Epidemiological models of disease causation; Natural history of disease; Levels of disease prevention; Uses of epidemiology. Measurement scales and epidemiological measures; Prevalence and Incidence; Measures of association; Health indicators.
Role of Bias, confounding and chance in epidemiological studies; Experiment and non-experiment studies; Cross-Sectional Studies; Cohort Studies; Case Control Studies; Pilot testing and Research protocol.
What is screening; What type of disease are suitable for screening; Screening test; Screening programme. Meaning of Regimen, efficacy and safety in clinical trials; Types and need of clinical trials; Control group in a clinical trial; Ethics in clinical trials; Clinical trial registration; Statistical Ethics in a clinical trial; Phases of a clinical trial; Random error and bias in a clinical trial.
Clinical trial protocol; Antecedents, outcomes, intervention and confounders in a clinical trial; Choosing cases and controls; Sample size in a clinical trial; Data collection; Data design. Parallel control designs; Self-control designs; Factorial designs. Equivalence, superiority and Noninferiority trials; Multi-Stage designs.

MSTL-012: Statistical Computing Using R-II (06 Credits)

This course is designed with the lab components based on the contents discussed in the theory courses of the second semester of the programme, i.e., courses MST-016: Statistical Inference, MST-017: Applied Regression Analysis and MST-018: Multivariate Analysis. So, we have assumed while developing this lab course that you have already studied MST-016, MST-017 and MST-018. You must study this lab course only after you have studied the theory courses of the second semester. This course is designed with the practical components related to the statistical inference, regression analysis and multivariate analysis.

It demonstrates various lab Sessions with the help of R software based on the following topics:

- *Sampling Distributions of Mean and Difference of two Means*
- *Sampling Distributions of Proportion and Difference of two Proportions*
- *Sampling Distributions of Variance and Ratio of Variances*
- *Confidence Interval based on Mean and Difference of two Means*
- *Confidence Interval based on Proportion and Difference of two Proportions*
- *Confidence Interval based on Variance and Ratio of Variances*
- *Determinations of Sample Size*
- *Tests based on Mean and Difference of two Means*
- *Tests based on Proportion and Difference of two Proportions*
- *Tests based on Variance and Ratio of Variances*
- *Simple Linear Regression Model.*
- *Multiple Linear Regression Model*
- *Multiple Regression Model with Qualitative Predictors*
- *Problems related to Regression Model Adequacy Checking and diagnostics*
- *Problems related to Variable Selection methods in Regression Model*
- *Polynomial Regression Models*
- *Logistic Regression Model*
- *Probit Regression Model*
- *Multinomial Logistic Regression Model*
- *Poisson Regression Model*
- *Computation of Mean Vector, Variance-Covariance and Correlation Matrix*
- *Random Number Generation from Multivariate Normal Distribution using (i) Inbuilt Function and (ii) Cholesky Decomposition Method*
- *Hierarchical Clustering*
- *K-mean Clustering*
- *Principal Components Analysis*
- *Hypothesis Testing based on Mean Vector and Variance-Covariance Matrix*
- *Discriminant Analysis*
- *Factor Analysis*

Courses of the IIIrd Semester

MST-020: Survey Sampling and Design of Experiments-II (04 Credits)

This course is worth four credits and it is offered in the third semester of the M.Sc. (Applied Statistics) programme. This course has been designed to cover the advanced sampling schemes and Design of Experiments. The course content has been divided into different units that are organised into four blocks and two blocks into one volume. The detailed syllabus of this course is given as follows:

Introduction to Ratio Method of Estimation; Ratio estimator of population mean, Bias and MSE of the estimator up to the First Order Approximations; Efficiency Comparison with SRS. Introduction to Product Method of Estimation; product estimator of population mean, Bias and MSE of the estimator up to the First Order Approximation; Efficiency Comparison with SRS. Difference and Regression Estimators of population mean; Bias and MSE of the estimators up to the First Order Approximation; Efficiency Comparison with SRS. Optimisation property of ratio and regression methods (without proof), Concept of Double Sampling; Ratio; Products and Regression Estimators in Double Sampling; Bias and MSE of the estimators up to the First Order Approximation; Efficiency Comparison with SRS.

Cluster Sampling (equal clusters only); Estimation of Population Mean and its Variance; Difference Between Stratified and Cluster Sampling; Relative Efficiency of Cluster Sampling with SRS in Terms of Intra Class Correlation. Two Stage Sampling with equal size clusters only; Estimation of Population Mean and its Variance. Randomised response techniques, Warner's technique.

Introduction, Notations, Basis Notions and concepts of Factorial Experiments, Design and Analysis of Factorial experiments. Advantages and Disadvantages. Brief review of 2^2, 2^3 and 2^n Factorial experiments. Notations, Concepts, Design and Analysis of 3^2 and 3^3 Factorial experiments. Construction of one-half and one-quarter fractions of 2^n ($n \leq 5$) factorial experiments, Alias structure, Resolution of a design.

Confounding in 2^3 experiments, Partial confounding and its analysis. Advantages and disadvantages of Confounding. Definition, parameters, Incidence matrix and its properties. BIBD and its types. Construction of BIBD, Intra Block analysis of BIBD, Comparison of two treatments. Efficiency comparison w.r.t. RBD, missing plot technique of BIBD, split plot design, response surface design.

MST-021: Classical and Bayesian Inference (04 Credits)

The aim of this course is to develop the skills to describe advanced classical and Bayesian estimation with generation of random numbers from different distributions. This course is organised into four blocks and two blocks into one volume. This is a compulsory core course of the programme of worth 4 credits. The course content of this course is given as follows:

Minimum Variance Unbiased Estimators (MVUE) and UMVUE; Fisher Information for one and Several Parameters, Lower Bound of Variance of an Estimator. Cramer-Rao Inequality and its Applications; Rao-Blackwell Theorem and Lehman-Scheffe Theorem, Bhattacharya Bound.

Best Critical Region, Most Powerful Test, Uniformly Most Powerful Test, Unbiased Tests, Neyman-Pearson Lemma (statement only), Concepts of Likelihood Ratio Test along with Properties. Sequential Probability Ratio Tests (SPRT) and their Applications to Binomial, Normal and Other Simple Cases, OC and ASN functions and their Applications, Termination Theorem, Properties of SPRT, Wald's Fundamental Identity and its Uses.

Difference between Parametric and Nonparametric Tests, Advantages, Disadvantages, Types of Non-parametric Tests, Sign Test, Wilcoxon's Signed Rank Test, Run Test, Kolmogorov Smirnov Goodness of Fit Test. Paired Sign Test, Wilcoxon Matched-Pair Signed-Rank Test, Mann-Whitney U Test, Median Test, Kendall's Tau Test, Kolmogorov-Smirnov Two-Sample Tests. Kruskal Wallies Test, Friedman Test. Chi-Square Test for Goodness of Fit, Chi-Square Test for Independence.

Bayesian approach, Concepts of Prior and Posterior Distributions, Types of Priors: conjugate priors and non-informative priors, Computation of Posterior Distribution under these Priors. Concept of Loss Function

and Types of Loss Functions: Symmetric and Asymmetric, Risk Function, Bayes Estimate under these squared error loss function, Credible Intervals: Equal Tails and Highest Posterior Density (HPD).

Random Number, Pseudo Random Number, Pseudo Random Number Generation; Inverse Transform Method. Random Number Generations for Discrete Distributions: Uniform, Bernoulli, Binomial, Poisson, Random Number Generation for Continuous Distributions: Uniform, Exponential, Normal Distribution, Introduction to Simulation, Monte Carlo Integration, Importance Sampling, Accept-Reject Method. Metropolis Algorithm, Metropolis-Hastings Algorithm, Gibbs Sampling, Jackknife and Bootstrap Methods.

MST-022: Linear Algebra and Multivariate Calculus (04 Credits)

In statistics, we have data on different variables. In the introduction of the course MST-011 we have said that the use of vector notations makes the study of multivariate analyse easy. To study vectors in n dimension and operations on vectors we need to develop a structure of vectors. The name of branch of mathematics where we study to perform different operations on a structure of vectors is known as linear algebra. It is organised into four blocks and two blocks into one volume. This is a compulsory core course of the programme of worth 4 credits. The detail syllabus of this course is given as follows.

Vector Space (only over a real field); Vector Sub-Space; Linear Combination of Vectors; Span of a Set; Linear dependence and independence of vectors; Bases and Dimension of a Vector Space; Definition and Examples of Linear Transformation (LT); Matrices associated with a LT; Rank and Nullity of a LT; Operations on Linear Transformations; Singular and Non-singular LT; Change of Basis; Matrix of a LT relative to ordered Basis; Eigen values and Eigen vectors of a LT; Diagonalisation and Eigen Vectors; Definition and examples of Quadratic Form (QF); Representation of a Quadratic Form in Terms of Matrices; Effect of LT on QF; Diagonalisation of a QF; Reduction in the Real Field, Definite; Semi-Definite and Indefinite Quadratic Forms; Definition and Examples of Inner Product Space; Schwarz's Inequality; Triangle Inequality; Distance in an Inner Product Space; Orthogonal Vectors; Orthogonal set; Orthonormal set; Orthonormal Basis; Gram-Schmidt Orthogonalisation Process; Eigen decomposition; Spectral Decomposition of the symmetric matrix; Singular Value Decomposition; Properties of SVD.

Function of Several Variables; Partial Derivative; Total Differentials; Derivative of a vector valued function of a vector variable, Multivariate chain rule and its applications; vector/matrix structures in multivariate calculus; Examine two dimensional problems using the Jacobian and extend the same to general case; Directional Derivatives; Gradient; Taylor series univariate and multivariate case; Its Application behind the use of simple linear approximations to complicated functions; power series approximations to functions; behaviour of power series approximations for ill-behaved functions; meaning and relevance of linearisation; multivariate approximations; principles of gradient descent; optimisation using multivariate calculus; cases where the method fails to return the best solution; gradient descent problems that are subject to a constraints using Lagrange Multipliers.

MST-023: Research Methodology (04 Credits)

Research Methodology in Statistics is one of the important courses in Master of Science in Applied Statistics. To equip the students to undertake any research project, an understanding about the various aspects of research and research methodology is very essential. This course will enable the learners to have deeper learning about research, Identification of research problem and formulation of Research design, Sampling Design, writing a Research Proposal, Managing Research Project, Managing References, Copyrights, Methods of data collection, Statistics in Research, Data processing Communication, Presentation, Publishing Research, Writing Thesis/Project Report/Technical Note, Research Ethics and importance of Literature overview. This course is organised into four blocks and two blocks into one volume. This is a compulsory core course of the programme of worth 4 credits. The course content of this course is given as follows:

Introduction, Objectives, types, Research Approach, Significance of Research, Research Methods versus Methodology, Research Process, Criteria of Good Research.

Research problem meaning, selection and necessity. Research design meaning and its need. Features of a Good Design, Concepts relating to research design, Different research design.

Census and Sample survey, Different types of sample design, Criteria of selecting a sampling procedure, steps in sampling design, Random samples. History of Statistics, Mode of Literature Survey-Books and Monographs, Journals, Conference Proceedings.

Introduction; types; elements of a proposal; steps; do's and don'ts. Overview on how to manage project/dissertation, Funding agencies, do's and don'ts. Managing references using Google Scholar and by using bibliographic software: Zotero. Overview of copyrights.

Different methods of data collection, difference between questionnaires and schedules, primary and secondary data, overview of constructing questionnaire or schedules. Choosing appropriate statistical tools for descriptive and Inferential statistics, Formulation of appropriate hypothesis, Emphasis on practical application in real world. Different types of scales and scaling techniques. Presentations of the research Paper or research proposal, do's and don's.

Introduction, selecting suitable journal/platform, journal impact factor, citation index, formatting, acknowledgement and attributions, dos and don'ts. Introduction, elements, types, do's and don'ts.

Introduction, responsibility and accountability; ethical considerations; plagiarism, use of plagiarism detection s/w.

MSTL-013: Statistical Computing with R-III (04 Credits)

This course is designed with the lab components based on the contents discussed in the core courses of second semester. Lab exercises based on the core courses would be worth 4 credits and compulsory core component for all the learners. This course is organised into various Lab Sessions. The course content of this course is based on the following topics:

Survey Sampling and Design of Experiments-II:

- *Estimation of the population mean and its MSE under ratio, product and regression methods of estimation of compare the efficiencies of ratio, product and regression estimators relative to SRS.*
- *Selection of a sample using cluster sampling. Estimation of its mean and variance of the estimate. Comparison of its efficiency with respect to SRS.*
- *Select a sample using two stage sampling. also estimate mean and variance of the estimate.*
- *Intra Block analysis of a BIBD.*
- *Analysis of 2^2 and 2^3 factorial in CRD and RBD.*
- *Analysis of 2^2 and 2^3 factorial in LSD.*
- *Analysis of a completely confounded two level factorial design in 2 blocks.*
- *Analysis of a completely confounded two level factorial design in 4 blocks.*
- *Analysis of a partially confounded two level factorial design.*
- *Analysis of a single replicate of a 2^n design.*
- *Analysis of a fraction of 2^n factorial design.*

Classical and Bayesian Inference:

- *Sign Test.*
- *Wilcoxon's Signed Rank Test.*
- *Run Test.*
- *Kolmogorov Smirnov Goodness of fit.*
- *Paired Sign Test.*
- *Wilcoxon Matched-Pair Signed-Rank Test.*

- *Mann-Whitney U Test.*
- *Median Test.*
- *Kendall's Tau Test.*
- *Kolmogorov-Smirnov test.*
- *Kruskal Wallies Test.*
- *Friedman Test.*
- *Chi-Square Test for Goodness of Fit.*
- *Chi-Square Test for Independence.*
- *Random Number Generations for Discrete Distributions: Uniform, Bernoulli, Binomial, Poisson, Geometric, Negative Binomial Distributions.*
- *Random Number Generation for Continuous Variables: Uniform, Exponential, Normal Distribution, Gamma, Chi-square and Beta Distributions.*
- *Importance Sampling.*
- *Accept-Reject Method.*
- *Metropolis Algorithm.*
- *Metropolis-Hastings Algorithm.*
- *Gibbs Sampling.*
- *Estimation of Standard Error.*
- *Bootstrap Confidence Intervals.*

Linear Algebra and Multivariate Calculus:

- *Evaluation of Quadratic Form in R.*
- *Gram-Schmidt Orthogonalisation Process in R.*
- *Eigen decomposition of a Matrix in R.*
- *Spectral Decomposition of the Symmetric Matrix in R.*
- *Singular Value Decomposition of a Matrix in R.*

Courses of the IVth Semester

MST-024: Data Analysis with Python (02 Credits)

Programming is an essential part of the data analysis, so along with R programming, we also explored Python programming for statistical data analysis in this programme. This course aims to teach python programming starting from the essential concepts needed for composing a program towards the applications related to applied statistics. This course is designed to bring theoretical concepts of python programming to fruition an intuitive approach for applications of statistical tools. This course contains several units divided into two blocks. This is a compulsory core course of the programme of worth 2 credits. The detailed syllabus of this course is given as follows:

Introduction to Python: Installation & Setup (Getting started with Python); Anaconda; IDEs (Integrated Development Environments) of Python: PyCharm, Jupiter, Spyder; Exploring Python's Modules; Packages and Libraries: Pandas, NumPy, Matplotlib, SciPy etc.

Data Types, Mathematical Operations, Assign Values to Variables, Expressions and Statements, Operators: Arithmetic, Assignment, Comparison, Logical, Boolean Operators, Lists and Tuples, Data Frames, Missing Values, Matrix, Matrix Operations, Arrays.

Conditional Statements: If, If…Else, If…Elif…Else, Nested If Statements, While and For Loops, Break and Continue Statements; Functions: Define, Call and Return; Importing and Exporting Data in Python; Reading Files, Writing Files; Loading Data with Pandas.

Data Visualization: Bar, Line and Pie Charts, Box Plot, Histogram, Scatter Plot;

Statistical Analysis: (Linear and Generalized Linear) Regression Models, Random Number Generation from Multivariate Normal Distribution, Principal Component Analysis, Factor Analysis, Cluster Analysis.

MSTL-014: Data Analysis with Python Lab (02 Credits)

This course is designed with the lab components based on the contents discussed in the theory courses of the programme, i.e., courses MST-017: Applied Regression Analysis, MST-018: Multivariate Analysis, MST-021: Classical and Bayesian Inference and MST-024: Data Analysis with Python. So, we have assumed while developing this lab course that you have already studied MST-017, and MST-018, MST-021 and MST-024. You must study this lab course only after you have studied these theory courses. This is a compulsory core lab course of the programme of worth 2 credits. It demonstrates various lab Sessions with the help of Python software based on the following topics:

- *Matrix Operations.*
- *Construction of Frequency Distributions and Tabulation.*
- *Bar Chart, Line Diagram, Pie Chart, Box Plot, Histogram and Scatter Plot.*
- *Descriptive Statistics*
- *Simple and Multiple Linear Regression Models.*
- *logit, Probit and Poisson Regression Models.*
- *Random Number Generation.*
- *Random Number Generation from Multivariate Normal Distribution.*
- *Principal Component Analysis.*
- *Factor Analysis*
- *Cluster Analysis*.

MST-025: Categorical and Survival Analysis (02 Credits)

This course is designed to develop the skills of performing categorical and survival analysis. this course contains several units divided into two blocks. This is a compulsory core course of the programme of worth 2 credits and organised into one volume. The detailed syllabus of this course is given as follows:

Introduction to Biostatistics, Statistical Tools in Biostatistics, Introduction to 2x2 Contingency Table; Chi Square Test for Association and Homogeneity of Proportions, Yates- Corrected Chi-Square; Fisher's Exact Test and McNemar's Test. (r x c) Contingency Table; Test of Association for (r x c) Contingency Tables; Chi Square Test for Homogeneity of Proportions, Chi-Square Test for Trend; Measure of Agreement and Disagreement (Kappa Statistic). Sensitivity; Specificity; PPV; NPV; Likelihood-Ratio Test, ROC Curve. Odds Ratio and Relative Risk; Matched Pairs Designs, Mantel-Haenszel Method.
Introduction to Survival Analysis; Terminology and Notation; Censored Data, (Left, Right, Interval, Type-I, Type-II and Random Censoring); Descriptive Measures of Survival functions. Kaplan-Meier Estimator of Survival Function; Actuarial Method, Mantel-Haenszel and Log-Rank Tests for Two Groups. Log-Rank Test for Several Groups. Cox PH Model; Adjusted Survival Analysis Using Cox PH Model, Brief Introduction to Competing Risk Analysis.

MST-026: Introduction to Machine Learning (04 Credits)

Nowadays computers are not only used to do computational work. But computers can be trained to learn from past experience and make decisions. This course discusses some machine learning algorithms which work behind the learning of computers from past experience. This course is organised into various units as other theory courses. This is a compulsory core course of the programme of worth 4 credits. The Detail syllabus of this course is given as follows:

Machine Learning; Types/Branches of Machine Learning (Supervised Learning; Unsupervised learning; Reinforcement Learning; Semi-supervised); Historical brief overview of Machine Learning; Basic Definitions; Evaluation and Cross-Validation of Learned Models; Terminologies used in the World of Machine Learning; Confusion Matrix; Accuracy; Precision and Recall; K-fold Cross-Validation as a means of Evaluating the generalization performance of a Learning Algorithm; Linear Regression and Machine Learning; Multivariate Linear Regression and Machine Learning; Polynomial Regression and Machine Learning; Different Metric (Euclidean Metric, Minkowski Distance, Manhattan Distance, Chebyshev Distance); k-Nearest Neighbours (k-NN); k-NN Algorithm; Weighted k-NN; Classification given different Values of k; Choosing the Values of k; Loss Function; Loss Function in Regression Problem; Splitting the Initial Dataset; Problem of Overfitting; k-Fold Cross-Validation; Curse of Dimensionality; Probabilistic Explanation; Laplace Smoothing; Methods of Solving Classification Problem; Logistic Regression and Machine Learning; Types of Algorithms (Generative and Discriminative); Logistic Function or Sigmoid Function and its Properties; Algorithm for Predicting the Class using Logistic Regression; Algorithm for Finding the Extrema of the Function; Algebraic Transformation of Probability Expression; Log-Loss Function; Analytical Expression for Probabilities; Algorithm for Predicting the Class of a New Object; F-Score and ROC Analysis; K-Means Clustering; General Description of K-Means; K-Means Algorithm; Agglomerative Clustering; Support Vector Machine; Kernel Function and Kernel SVM.
Multivariate chain rule to differentiate nested functions; Structure and function of a neural net; Apply multivariate calculus tools to relate network parameters to outputs; Neural Networks; Models of a Neuron; Threshold Logic; Error-correction Learning; Introduction; Single Layer Perceptron Algorithm and its Convergence; XOR Problem; Introduction; Multi-Layer Perceptron (MLP); Backpropagation Learning; Introduction; Function Approximation; Generalization; Selection of Architecture; Introduction; Radial Basis Function Network (RBFN); Forward and Backward Propagation; Applications; Introduction; Related Definitions; Hopfield Networks; Structure of Hopfield Networks; The Functionality of Hopfield Networks; Storage Capacity of Hopfield Networks; Introduction; Competitive Learning; Kohonen Networks; Structure of Kohonen Networks; Methods for Weight Updates; Self-Organising Feature Map.

MSTE-011: Operations Research (04 Credits)

This course is designed to develop the skills to apply the optimisation techniques in real life situations. This course contains several units divided into four blocks and two blocks into one volume. This is an optional course of the programme of worth 4 credits. The detailed syllabus of this course is given as follows:

Nature and definitions of Operations Research (O.R.); Different phases of O.R. study; Model building in O.R.; Types of O.R. models – their construction and general method of solution; Applications of O.R.
Description of general Linear Programming Problem (L.P.P.); Elements of L.P.P.; Canonical, standard and matrix forms of L.P.P.; Mathematical formulation of L.P.P. Optimum solution of L.P.P.: Graphical method; some exceptional cases; Computational algorithm of Simplex method; Gauss- Jordan elimination process. Revised Simplex method; Matrix version of Simplex tableau.
Use of Artificial Variables in L.P.P.: Artificial starting solution using Penalty and Two-Phase methods.
Concept and purpose of Sensitivity Analysis: Study of change in resource values, cost coefficients of objective function and coefficients of constraints.
Principle of duality in L.P.P. Dual problem and its formulation; Duality Theorems; Dual Simplex method.
Cases of Bounded Variable L.P.P.; Computational procedure of bounded variable L.P.P.

Parametric Linear Programming: Study of continuous variations in cost vector, resource vector and constraint coefficients.

Introduction to Transportation Problem (T.P.); Balanced and Unbalanced T.P.; L.P. formulation of a T.P.; Finding first feasible solution of T.P. using North-West Corner Rule, Row Minima, Column Minima, Matrix Minima and Vogel's Approximation Methods; Moving towards optimal solution; the uv method; Degeneracy problem in T.P. and its treatment.

Introduction of Assignment Problem (A.P.); Mathematical formulation of A.P.; Solution methods of A.P.; Hungarian Assignment method; The travelling Salesman problem.

Introduction to Competitive situations; Definition of a Rectangular Game; Two-person zero Sum Game; Pure Strategies; Saddle Point of a function; condition for its existence in a Rectangular Game; Minimax-maximin principle; Optimal Solution of Games with saddle point.

Games without Saddle Point; Concept of Mixed Strategies and Expected Pay-off Function; Graphical solution of 2xn and mx2 games; Dominance and Modified Dominance principles; Solution of mxn Rectangular Game by reducing it into a L.P. problem.

Problem of Sequencing; Elements of sequencing problem; 2 machine n-job and 3–machine n-job problems with identical machines; Processing n-jobs through m-machines; 2-job n-machine problem with different routings; branch and bound method for solving travelling-salesman problem.

Need for replacement; Replacement of Capital Equipment that deteriorates with Time; Replacement of equipment that fails suddenly; Staffing problems; Equipment Renewal problem. Introduction to decision making problems; decision making under risk: expected value criterion; expected value-variance criterion; aspiration-level criterion. Decision trees. Decision under uncertainty: Description of Laplace; minimax-maximin; Savage minimax regret and Hurwicz criteria.

Introduction to Dynamic Programming (D.P.); principle of optimality; Elements of D.P. model; Application of D.P. model on product allocation, Cargo loading and reliability problems; solution of L.P.P. by dynamic programming.

Characteristics of Inventory system. ABC inventory system; A generalized inventory model; Deterministic models. EOQ model and its variations; with and without shortages; Multi-item quantity discount model with price breaks; EOQ model with constant rate of demand and fixed reorder cycle time; EOQ model with gradual replenishment and shortage allowed.

Inventory models with random demand; Single-Period Models without set-up cost: Uniform demand with discrete and continuous replenishment units; Instantaneous demand with discrete and continuous replenishment units.

Introduction to queueing system; elements of queueing system; classification of queueing models; transient and steady states; Poisson process; single and multi-server Poisson queueing models with finite and infinite length.

Non-Poisson queueing processes; Queueing models with Erlangian service time distributions with k-phases; Study of $(M/E_k/1):(\infty/FIFO)$, $(M/E_k/1):(1/FIFO)$,$(M/G/1):(\infty/GD)$ queueing models.

MSTE-012: Stochastic Processes (04 Credits)

This course has been designed to cover the concepts and theories of Markov Chain, Poisson and Wiener Processes, Non-Markovian Stochastic Processes and Applications of Stochastic Processes. The course content has been divided into various units that are organised into four blocks and two blocks into one volume. This is an optional course of the programme of worth 4 credits. The detailed syllabus of this course is given as follows:

Definition, state and parameter spaces of Stochastic Process, Classification of Stochastic Process into Stationary, Gaussian and Markov processes. Brief description of simple random walk and simple queueing process. Classification of S.P. according to nature of state and parameter spaces.

Stochastic processes with discrete state and parameter spaces: Definition and Examples of Markov Chain (M.C.); Polya's urn model and simple queueing model; Historical background of M.C.; Transition probabilities; Transition Probability Matrix; Order of a M.C. Chapman-Kolmogorov equation; Classification of states and chains. Reducible and irreducible chains.

Stability of a Markov Chain: Finite irreducible chains; Stationary Distribution of a M.C.; Ergodic Theorem. Markov Chain with countable state space. General ergodic theorem. Description of behaviour of certain types of reducible chains. M.C. with continuous state space. Non-homogeneous Markov Chain.

Description of Random Walk model. Treatment of Unrestricted simple random walk. Restricted random walk: Concepts of absorbing and reflecting barriers; Treatments of one-dimensional random walk with one and two absorbing barriers and reflecting barriers.

Description of Gambler's ruin problem: its transition matrix; probability of gambler's ruin; Probability distribution of the duration of the game; Expected duration of the game; Probability of ruin at the N^{th} trial.

Discrete state space continuous parameter space Markov processes. Poisson Process; its postulates; Properties of Poisson process. Inter-arrival time in Poisson process and its distribution; Properties of the distribution.

Compound Poisson process; Pure Birth process; Time dependent Poisson process. Combination of several independent Poisson processes. Linear birth-death process; effect of immigration.

Brownian motion. Wiener process as a continuous limit of the simple random walk; Diffusion equations for the Wiener process; First passage problems for Wiener process; Wiener process with absorbing and reflecting barriers.

Preliminary ideas and definition of backward recurrence-time and forward recurrence-time. The Renewal process: discrete time and continuous time renewal processes. Renewal function and renewal density. Ordinary, modified and equilibrium renewal processes and their applications. Probability generating function of renewal processes.

Branching processes: definition. Properties of generating functions of branching processes. Probability of extinction; asymptotic distribution. Distribution of the total number of progeny. Branching processes with immigration. Continuous time Markov branching process.

Stationary processes. Models for time series: Purely random process; first order Markov process; moving average process; autoregressive process; autoregressive moving average process.

Introduction; definition and examples on Martingales; sub-Martingales and super Martingales; Markov time (stopping time) and examples of it; optional stopping theorem; Martingales convergence theorem; stopping rule for birth and death process.

Applications of stochastic processes in waiting line theory. General concepts of queueing systems. Steady state distribution; distributions of arrivals, departures, and inter-arrival times; Poisson queueing systems: treatment of finite and infinite M/M/1 queueing models and their waiting time distributions.

Birth and death process and its application in queueing theory. Treatment of Poisson multichannel queueing systems. Problem of bulk queues: Poisson queue with general bulk service rule.

G. M. Counter and its functioning. Counter of type I and II. Treatment of counter models of type- I and type- II with fixed dead time; Counter model type- II with variable dead time.

Simple epidemic model: Development of the model; duration of an epidemic. General epidemic model. Carrier borne epidemic model.

MSTL-015: Statistical Computing using R-IV (02 Credits)

The objective of this course is to give you hands-on training to apply various tests specially based on Course MST-025: Categorical and Survival Analysis and some machine learning algorithms studied in the course MST-026: This course is organised into various Lab Sessions. This is a compulsory core course of the programme of worth 4 credits. The course content of this course is as follows:

Categorical and Survival Analysis:

1. *Chi Square Test for Association and homogeneity of proportions.*
2. *Yates- Corrected Chi-Square Test.*
3. *Fisher's Exact Test.*
4. *Chi-Square Test for Trend.*
5. *Measures of Agreement and Disagreement (Kappa Statistic).*

6. *Sensitivity; Specificity; PPV; NPV.*
7. *Likelihood-Ratio Test, ROC Curve.*
8. *Matched pairs designs.*
9. *Mantel-Haenszel Method.*
10. *Relative Risk and Odds Ratio.*
11. *Estimation of survival function, cumulative distribution function, probability density function and hazard rate.*
12. *Survival Analysis (Kaplan-Meier Survival Curve; Log-Rank Test for Two and several Groups, Cox Proportional Hazard Model).*

Introduction to Machine Learning:

Practical based on Machine Learning

1. *Difference Metric in R.*
2. *k-NN Algorithm in R.*
3. *K-Means Algorithm in R.*
4. *Implement the back propagation algorithm.*

Practical based on Neural Network.

5. *Perceptron learning algorithm.*
6. *Backpropagation algorithm.*
7. *Average correlation matrix for given input patterns M and N to design and train the Hopfield Network.*
8. *Updated/modified weights for Kohonen Networks.*

MSTP-011: Project/Dissertation **(08 Credits)**

In addition to theoretical and practical components of this programme, a learner has to submit Project/Dissertation (MSTP-011) which is considered as a full course of 8 credits. Project/Dissertation **is optional and a learner may opt either two theory courses MSTE-011: Operations Research (4 credits) and MSTE-012: Stochastic Processes (4 credits)** together or **Project/Dissertation (**8 credits). The objective of the Project/Dissertation is to provide an opportunity to the learners to develop applied statistical skills in the areas which they have studied in the various courses of this programme. It encourages learners to spend efforts equivalent to 8 credits working on a project.

The learner needs to ensure that the topic that is taken up as a project has research significance and follows a proper research methodology. In consultation with the supervisor/guide (supervisor/guide can be either academic counsellor or any other supervisor, subject to the approval by the Discipline of Statistics, School of Sciences, IGNOU, New Delhi), the learner needs to select a topic and work on it. Project proposal or synopsis has to be prepared by the learner in consultation with the supervisor/guide and the same has to be submitted to the concerned regional centre. The final Project report/Dissertation is to be submitted in proper format (given in the Guidelines for Project/Dissertation of MSCAST) to the concerned regional centre only. Topics selected should be complex and large enough to justify as a MSCAST project. The courses studied by the learners during the MSCAST programme provide them the comprehensive background to work on diverse application domains. Learners should strictly follow and adhere to the project guidelines. Project Guidelines will be prepared and uploaded on to the IGNOU website.

A learner has to secure a minimum of 40% pass marks in Project Work/Dissertation Course. For the purpose of Project/Dissertation, a learner has to work in an area related to her/his courses of study. Learners are advised to select a topic for work in consultation with a supervisor/guide and send the proposal/synopsis to the Discipline of Statistics, School of Sciences, IGNOU for the approval. A learner may choose her/his guide according to her/his choice.

Note that Lab courses are compulsory while Project/Dissertation is an optional course where the learner can take Project/Dissertation or opt for two alternative theory courses **MSTE-011: Operations Research (4 credits) and MSTE-012: Stochastic Processes (4 credits)** together.

Note: The Term-end Examination (TEE) for practical courses will be held at the respective Learner Support Centres whereas the TEE (viva-voce) for Project will be held at the concerned Regional Centre.

2.2 Scheme of Study

In order to complete the M.Sc. (Applied Statistics) within the minimum period of two years, you may like to study first six core courses (i.e., MST-011 to MST-015 and MSTL-011) worth 20 credits and appear in the examinations which are held in June and December every year. If you register in July/January cycle, you can appear for these examinations in December/June Term-end Exam. In the same way, you can appear in the Term-end Exam after another six months for the next semester courses. If you would like to spend more than two years (but not more than four years) in completing MSCAST programme, you can concentrate your attention only on those courses for which you intend to appear in the examination. By properly planning your studies, you can complete this programme according to your convenience. You are advised to study the core courses in the same order as given. Note that you have to re-register yourself for each semester.

3. INSTRUCTIONAL SYSTEM

The methodology of instruction in Indira Gandhi National Open University is different from that of the conventional universities. The Open and Distance Learning (ODL) University system is more learner-oriented, and the learner has to be an active participant in the teaching-learning process. Most of the instruction is imparted through distance mode with only a small component of face-to-face communication. The University follows a multi-channel approach for instruction. It comprises a suitable mix of:

- Self-instructional material in pdf or printed form
- Face-to-face counselling at LSC by academic counsellors
- Compulsory practical sessions at the LSCs
- Reference library
- eGyankosh
- Assignments
- Interactive Radio Counselling through Gyan Vani

3.1 Self-instructional Material

Self-instructional materials are the primary form of instructional materials. These are provided to the learners in the form of several booklets called volumes. A volume which comes in the form of a booklet, consists of blocks and a block, comprises several units. The first page of each volume/block indicates the numbers and titles of the blocks/units comprising the volume/block. In the first volume/block of each course, we start with course introduction. This is followed by a brief introduction to the volume/block.

Please read the Course Introduction and the Block Introduction carefully as these will give you an overview of the Course and Block, respectively.

Each unit begins with an introduction in which we tell the learners about the contents of the unit. We also outline a list of learning objectives which we expected from learners to achieve after working through the units. This is followed by the main body of the unit, which is divided into various sections and sub-sections. We finish each unit by summarizing its contents. In each unit, there are several examples, self-assessment

questions and terminal questions. These are meant to help the learner to assess his/her understanding of the subject contents. For all courses of the programme, the learner will be receiving printed study materials in the form of booklets called volumes. The material prepared by us is properly planned, self-content, self-motivated, and self-instructional in nature. The lessons which called units, are structured to facilitate self-study. The printed materials for MSCAST programme along with the Programme Guide are sent to the learners by registered post at their residential address provided by them.

3.2 eGyankosh and IGNOU eContent App

The self-instructional material is also assessable in electronic form through IGNOU eGyankosh website and eContent App. The eGyankosh is a digital repository consists of the reference links Self instructional materials. The links for the eGyankosh related to School of Sciences are:

eGyankosh Homepage: http://www.egyankosh.ac.in/

Self-Learning Material: http://www.egyankosh.ac.in/handle/123456789/25

IGNOU eContent App

The self-instructional course material of various programmes of IGNOU are made available through IGNOU eContent App. You can download this **IGNOU e-Content App** from Google play store.
https://play.google.com/store/apps/details?id=ac.in.ignou.Viewer&hl=en

3.3 Counselling Sessions

In distance education, fact-to-face contact between the learners and their tutors/counsellors is relatively less as compared to the conventional university and, therefore, is an important activity. The purpose of such contacts is to answer some of learners' questions and clarify their doubts which may not be possible through any other means of communication. There are academic counsellors at the Learner Support Centres to provide counselling and guidance to the learner in the courses that they have chosen for study. Normally, these sessions will be held at the Learner Support Centres during weekends **(Saturdays and Sundays)**.

The candidates should note that the counselling sessions will be very different from the classroom teaching or lectures. Counsellors will not be delivering lectures as in conventional teaching. They will try to help the learners to overcome difficulties which they face while studying. In these sessions, the learner must try to resolve his/her subject-based difficulties and any other related problems.

Before going to attend the counselling sessions, you are advised to please go through the course materials and make a plan of the points to be discussed during counselling sessions. Unless you have gone through the units, there may not be much to discuss during counselling sessions.

The MSCAST programme has three types of courses: theory, practical and project/dissertation. **The detailed schedule of the counselling sessions for both theory and lab courses will be informed to the learners by the coordinator of their Study Centre.**

- **Theory Counselling**

Each of all theory courses of this programme will have 4-5 counselling sessions each of two hours for a 4-credit theory course and 2-3 counselling sessions each of two hours for a 2-credit theory course. The sessions for theory counselling are not compulsory to attend. But it is advisable to attend these sessions to clear your doubts and concepts.

- **Lab Counselling**

The number of lab counselling sessions at the learner support centre should be as follows:

(i) Lab counselling of 3 days (2 sessions per day each of 4 hours) should be compulsory for 2 credits lab course.

(ii) Lab counselling of 6 days (2 sessions per day each of 4 hours) should be compulsory for 4 credits lab course.

(iii) Lab counselling of 9 days (2 sessions per day each of 4 hours) should be compulsory for 6 credits lab course.

The learners are advised to complete the lab courses within the same semester, otherwise pro-rata fee of Rs. 400/- per course will be charged for re-registering for the missed/repeat lab sessions.

Please keep in touch with the Coordinator of your Study Centre to know the schedule of the Lab Sessions.

Note: Project/dissertation is an optional course where the learner can take either project/dissertation or opt for alternative theory courses "MSTE-011: Operations Research" (4 credits) and "MSTE-012: Stochastic Processes" (4 credits) together.

3.4 Web Based Supports

The learners can have access to IGNOU's website at the following address (URL): **www.ignou.ac.in**

This website gives relevant information to the general public and learner support facilities to the learners. These include:

- Results of the Term- End Examinations
- Downloadable prospectus/application forms of various programmes
- Catalogue of audio/video programmes
- Schedule of Gyan Darshan/ Gyan Vani/ EDUSAT programmes
- Admission announcements
- Addresses of Regional and Study Centres
- Update on the latest happenings at the University
- Checking of learner's mailing address
- Online submission of Term-End Examination Form
- TEE date-sheet
- Examination Hall Ticket
- Course Completion Status

The learners access **e-Gyankosh** using this website to download their course material. Programme Guide and Assignments are also available at the IGNOU website.

3.5 Browsing IGNOU's Website

The IGNOU's website is a dynamic source of latest information and is subject to continuous updates. Thus, various pages shown here may change in future. IGNOU itself is continuously changing to bring about improvement in quality of its services. You must visit IGNOU website for all latest information, filling up or downloading various form, downloading of assignments, results, etc.

Navigation from Home Page

The learners can have access to IGNOU's website at the following address (URL) ***http:// www.ignou.ac.in*.** As learners get connected to this site, the Home Page of the IGNOU's website will appear (as shown in Fig. 1).

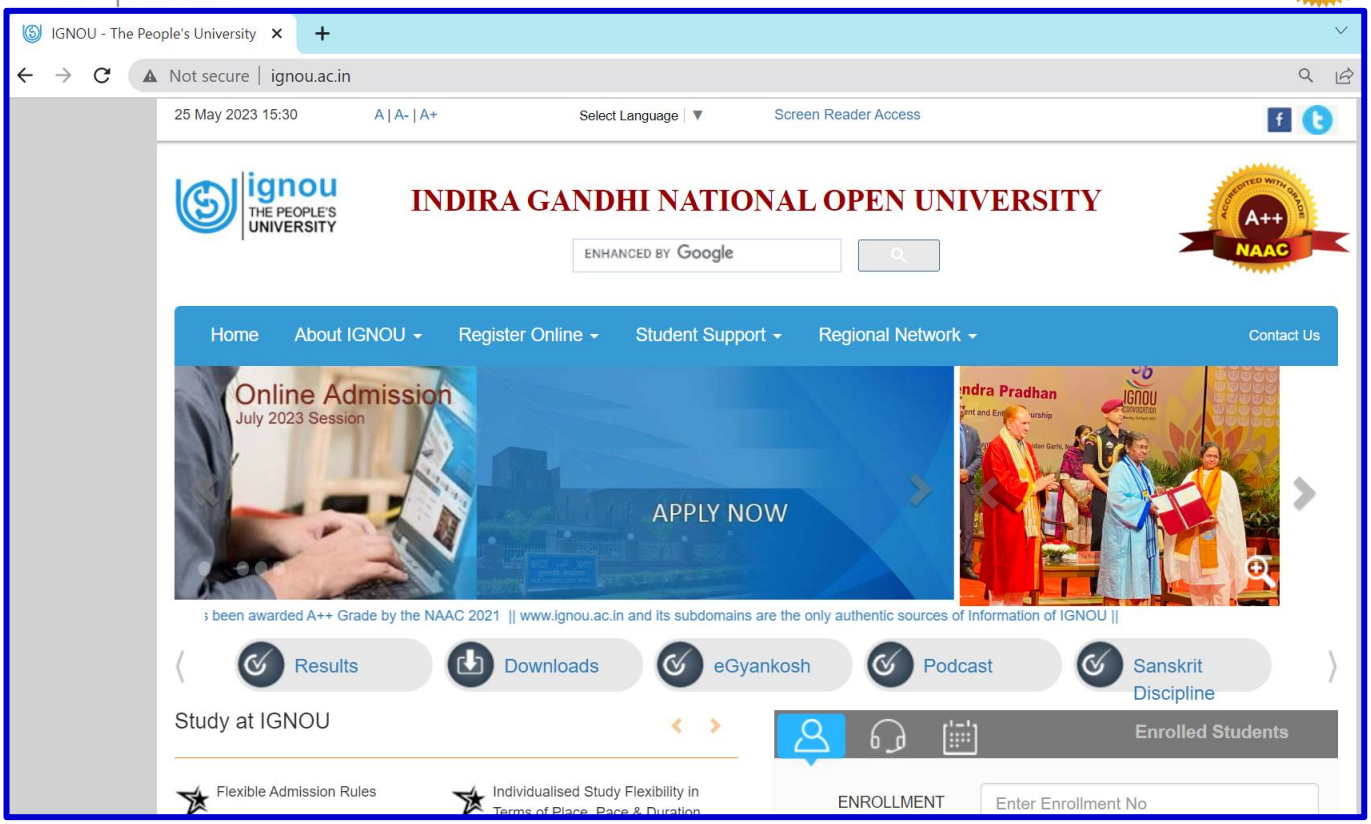
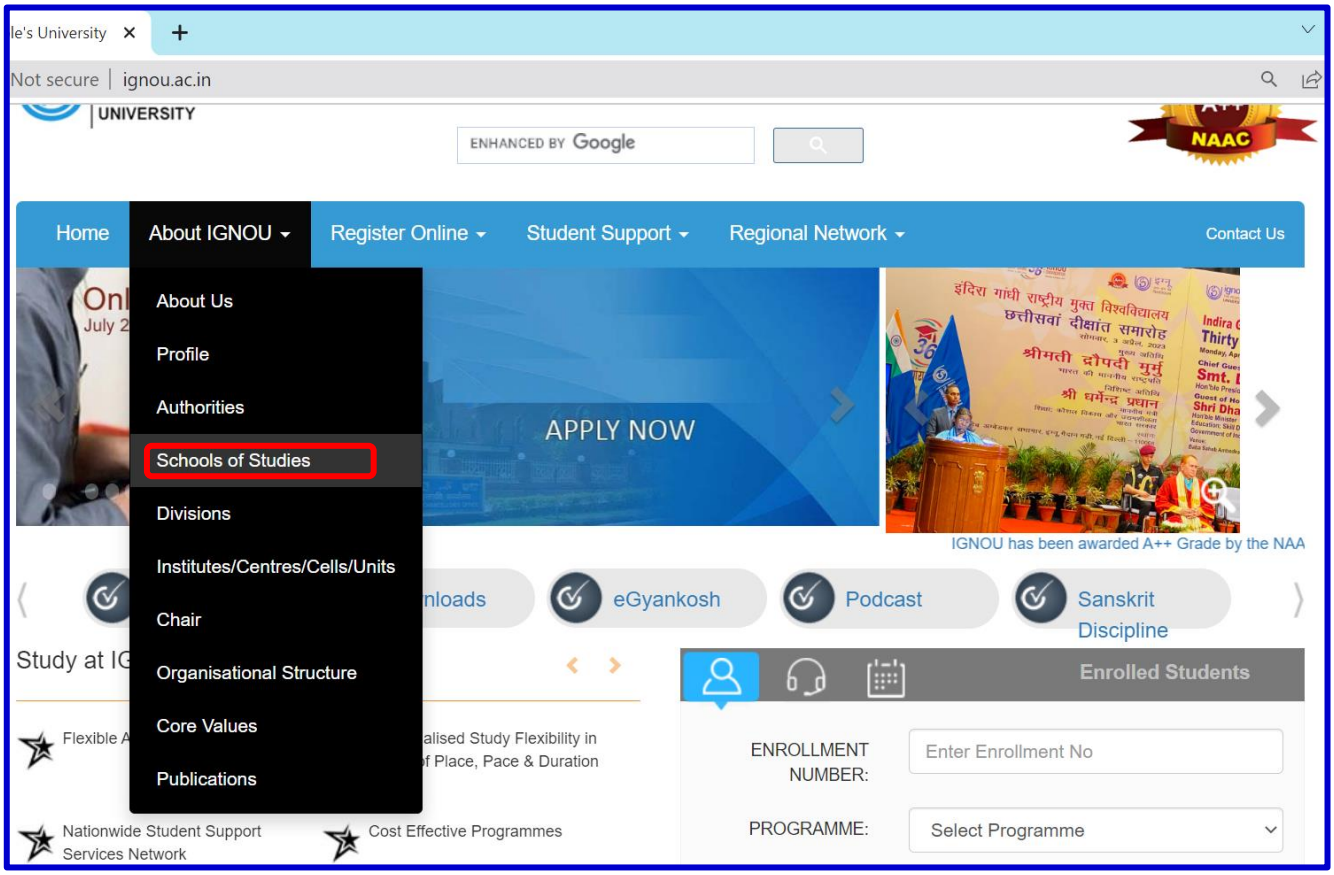
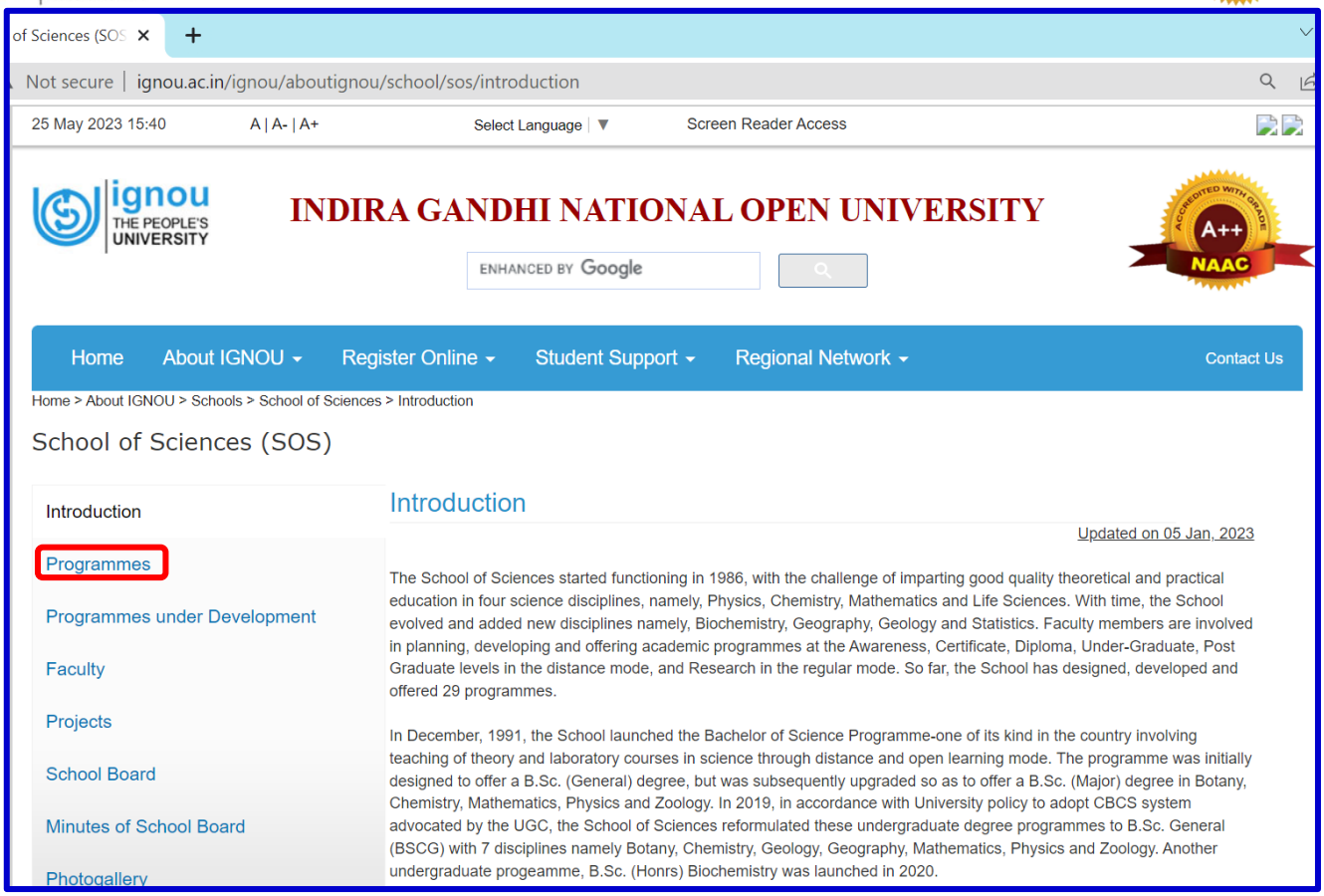


Fig. 1: Home Page of the IGNOU's Website

From this **Home page,** a learner can navigate to various pages by clicking on various options to get the related information. A learner can select **Schools of Studies** from **About IGNOU** option to display various **School of Studies** of IGNOU (Fig. 2a). You can select **School of Sciences (SOS)** to display page of School of Sciences (Fig. 2b).



(a)



(b)

Fig. 2: School of Sciences Home Page

You can click on **Programmes** link on School of Sciences page to get the list of programmes on offer by School of Sciences as shown in Fig. 3.

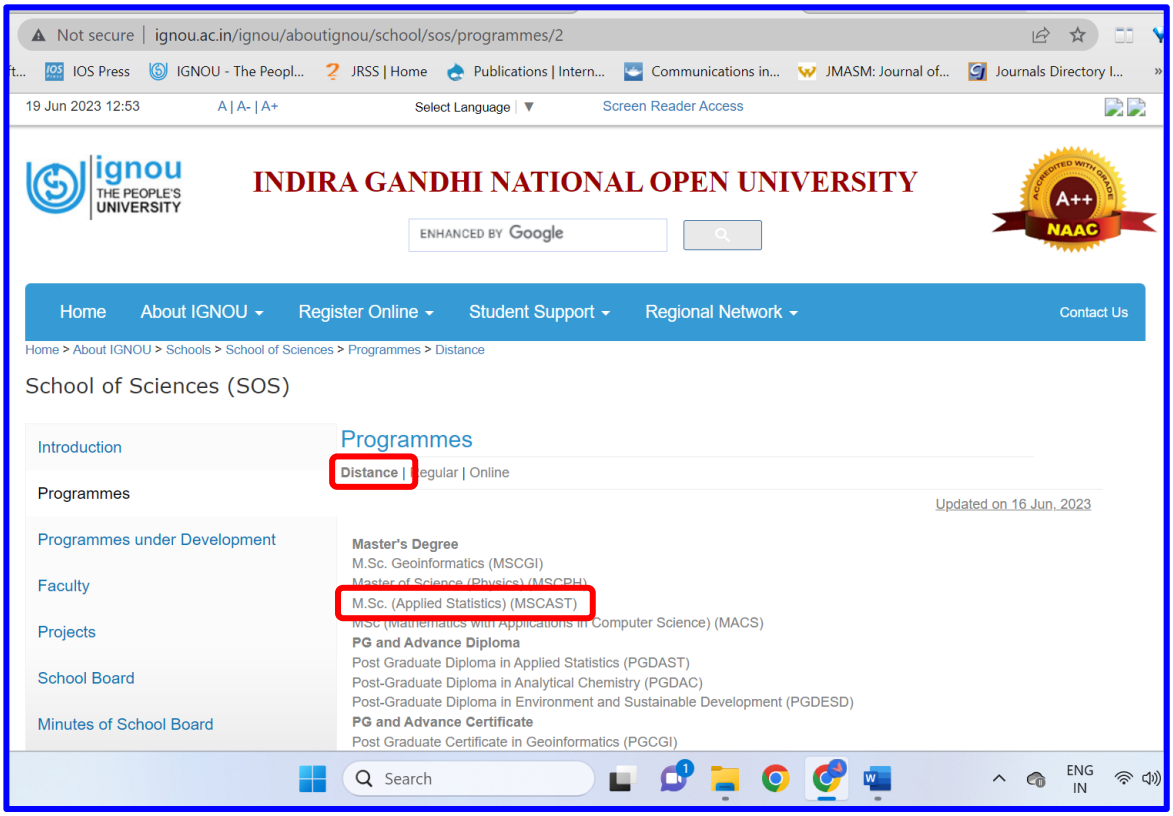
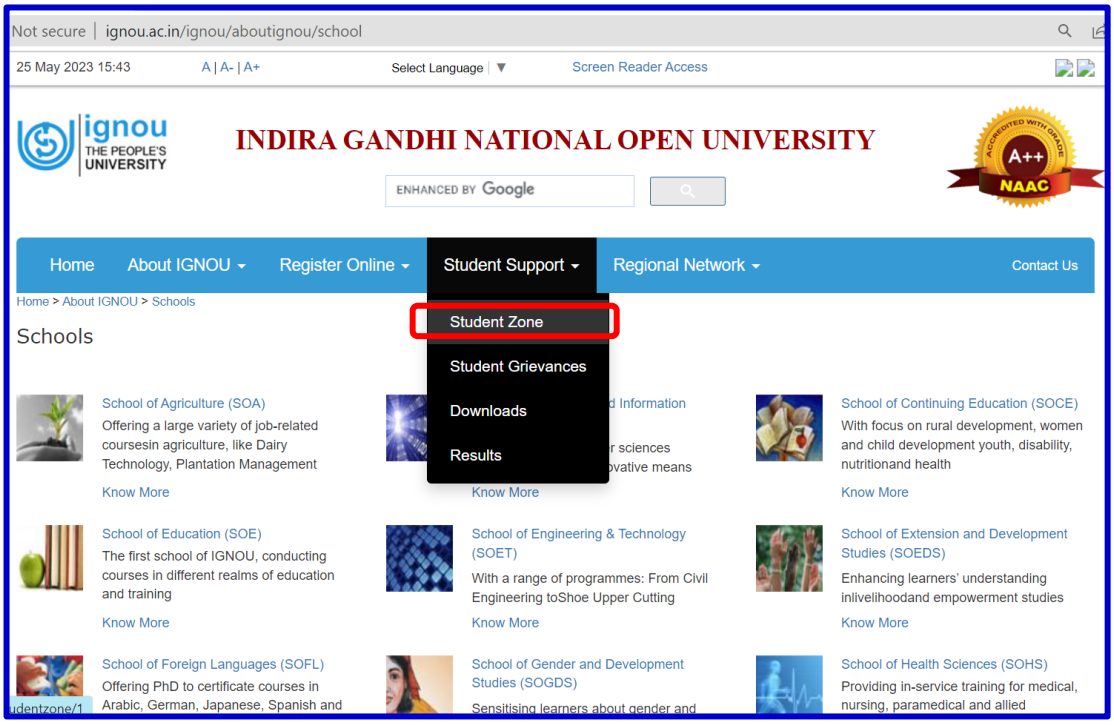
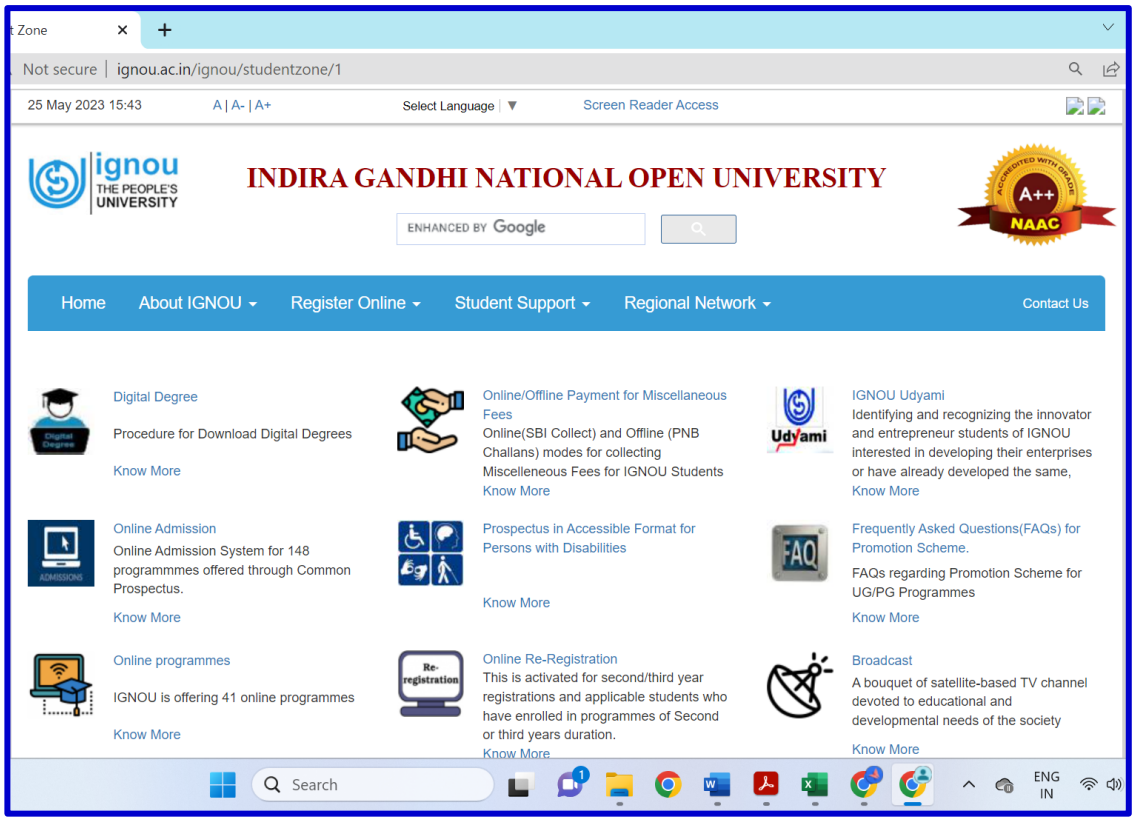


Fig. 3: Programmes of the School of Sciences

One of the most important links for learners is Student Zone which can be reached from Home page by selecting Student Zone option on the Student Support Option List (Link address: *http://www.ignou.ac.in/ignou/studentzone*). Fig. 4 displays the options of the Student Zone page.



(a)



(b)

Fig. 4: Student Zone page

4. EVALUATION SCHEME

The system of evaluation, both for theory courses and practical course is as follows:

4.1 Theory Evaluation: For theory courses, evaluation comprises three aspects:

a) **Self-evaluation exercises** are given within each unit of study material in the form of Self-Assessment Questions (SAQs) and Terminal Questions (TQs). They have no credit. These are given for your practice.

b) **Continuous evaluation** is in the form of compulsory tutor marked assignments. This carries a weightage of 30% for each course.

c) **Term-end evaluation** has a weightage of 70% in each theory course.

4.2 Practical Evaluation: Evaluation of the practical course comprises two aspects given as follows:

a) **Continuous evaluation** of lab exercises is done at the learner support centre by the counsellor. Evaluation of lab exercises which learners do throughout the semester under the guidance of their counsellor(s) at the learner support centre constitutes continuous evaluation and carries 30% weightage. The learners have to submit a record book containing R/Python codes of the solutions of exercises given at the end of each lab session along with the output of the programs and necessary screenshots, hypotheses, interpretations, etc. This record book will be a part of their continuous assessment and will be required to submit before the term-end lab examination to the Programme Coordinator/Counsellor at Study Centre.

Every lab exercise is evaluated and is included for final evaluation, the weightage for the continuous assessment (record book) is 30%.

b) **Term-end evaluation** of performance in the lab exam carries a weightage of 70% for each lab course. The evaluation of lab exercises assigned to the learner in Term-end practical exam on the scheduled date and time at the Programme/Study centre constitutes term-end evaluation and carries 70% weightage out of which 50% is allotted for term-end exam and 20% for Viva-voce. The schedule of term-end lab examination will be notified to the learners by the Coordinator of their Programme/Study Centre and intimated to the eligible candidates by the Regional Centre.

4.3 Qualifying Marks: You will have to obtain at least 40% marks in each course (both in theory and lab) in both continuous and term- end evaluation separately. However, the overall average should also be at least 40% for the successful completion of a course.

Overall Marking: The final marking for each course is computed by combining continuous evaluation score and term-end examination score.

The University is following numerical marking system for continuous evaluation as well as term-end examination. The notional correlates of the letter grades and percentage of marks are as follows:

Letter Grade	Qualitative Value	Division	Equivalent percentage Range of numerical marks
A	Excellent	First division with Distinction	80% and above
B	Very good	First division	60% but less than 80%
C	Good	Second division	50% but less than 60%
D	Satisfactory	Third division	40% but less than 50%
E	Unsatisfactory	Fail	Less than 40%

In order to be able to appear for the term-end examination, it is pre-requisite that the learners submit all assignments according to the prescribed schedule. The learners are required to give an undertaking to this effect in the examination form and it should not be later found that they had, in fact,

not submitted the assignments as prescribed, otherwise the results of the term-end examination will be treated as cancelled.

4.4 Assignments

An assignment is a **compulsory** component of each theory course. Assignments are uploaded on the IGNOU website. The main purpose of the assignments is to test learner's comprehension of the learning material which they receive from the University and also to help them get through the course by providing feedback to them. These assignments will be checked by their counsellors, who will also explain the candidate, where and how he/she can improve his/her understanding. The information given in the printed course material is sufficient for answering the assignments. However, a learner can refer to other books assessable to him/her.

There will be one assignment for each theory course (weightage of 30%). The set of all assignments for each semester is uploaded on the IGNOU's website. These assignments are to be submitted to the learner support centre, according to the submission schedule provided in the assignment's booklet. Before submission, a learner should ensure that he/she has answered all questions in all assignments. Incomplete answers of the assignment's questions bring them poor grades.

The assignments are valid for one year. This means that the assignments uploaded on the website for the semester beginning of January are valid up to December of the same year. Similarly, the assignments of the July semester are uploaded on the website in the month of July are valid up to the June of the next year. In any case, they have to submit assignments once before appearing in the examination for any course.

The learners have to complete the assignments on time. He/She will not be allowed to appear in the term-end examination for a course if he/she does not submit the assignments in time for that course. If he/she appears in term-end examination without submitting the assignments, then the result of term-end examination is liable to be cancelled.

For your own record, please keep a copy of all assignment responses which you submit to the programme coordinator of your learner support centre. If you do not get back your duly evaluated tutor marked assignments along with a copy of the assessment sheet containing comments on your assignments by the evaluator after submission, please try to get it from your learner support centre personally.

Unfair means in attempting the Assignments

If the learners copy the assignments, which is an important component of the ODL system, such assignments will be awarded "zero" and such learners will be directed to re-attempt the fresh assignments pertaining to the next year which will indirectly delay the award of degree by a semester/year.

Specific Instructions for Tutor Marked Assignments

While answering Assignments, you will find it useful to keep the following points in mind:

1. **Planning:** Read the assignment carefully. Go through the units on which they are based. Make some points regarding each question, solve them and rearrange these in logical order.
2. **Organisation:** Be a little more selective and analytical before drawing up a rough outline of your answer. Make sure that your answer:
   (i) is logical and coherent;
   (ii) has clear connection between sentences and paragraphs;
   (iii) is written correctly giving adequate consideration to your expression, style and presentation;
   (iv) mention the formulae, hypothesis tested (if required), interpretation, etc. in the solution of your questions.

3. **Presentation:** Once you are satisfied with your answers, you can write down the final version for submission, writing each answer neatly and underlining the points you want to emphasize.

4. The following format is to be followed for submission of the assignment:

   (i) Write Enrolment Number, Name, Full Address, Signature and Date on the top right and corner of the first page of the response sheet.

   (ii) Write the Programme title, Course code, Course title, Assignment code and Name and Code of the learner support centre and Assignment code may be reproduced from the assignment. The first page of the response sheet for each assignment should be like this:

ENROLLMENT NO. :……

NAME :……

ADDRESS :……

……

PROGRAMME CODE: ……..

COURSE CODE: ……

COURSE TITLE: ……

ASSIGNMENT CODE: ……

STUDY CENTRE CODE: …….. DATE: ……..……...

(iii) Read the assignments carefully and follow the specific instructions, if any, given in the assignment itself.

(iv) The learners should use only A4 size paper for the responses and tie all 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 may facilitate the evaluator to write useful comments on the margin at appropriate places.

(v) Write the assignments response in your own handwriting. Do not print or type the answers. Learners should not reproduce their answers from the units sent to them by the University. If they reproduce from the units, they will get poor marks for the respective question**.**

(vi) The learners should write each assignment separately. All assignments should not be written in continuity.

(vii) **The learners should write the question number with each answer. Photocopy of the submitted assignment is to be retained by the learner for his or her own record and future reference, if any.**

(viii) **The learners should not copy the assignments from other learners. If copying is noticed, the assignments of such learners will be rejected, and disciplinary action will be taken against the learners as per rules of the University.**

(ix) The completed assignments should be sent to the Coordinator of the learner support centre allotted to learners. Under no circumstance the tutor marked assignments should be sent to the Learners Evaluation Division or the School at Headquarter for evaluation.

(x) After submitting the assignment at the learner support centre in person, the learners should get the acknowledgement from the coordinator on the prescribed assignment-cum-acknowledgement card (**Form No. 1**); otherwise, the assignment response should be sent under certificate of posting through post. The learners should get back evaluated assignments from their learner support centre for the feedback and for their future guidance.

(xi) In case the learner has requested for a change of learner support centre, s/he should submit her/his assignments only to the original learner support centre until the University effects the change of learner support centre.

Please remember that Continuous evaluation in the form of an Assignment carries 30% weightage in the final result.

4.5 Guidelines Regarding the Submission of Assignments

1. It is compulsory for the learners to submit all prescribed assignments. They will not be allowed to appear for the term-end examination of a course if they do not submit the specified number of assignments in time for that course.

2. Learners should download the latest assignment from the IGNOU website.

3. The assignment responses should be complete in all respects. Before submission, the learners should ensure that they have answered all the questions in all assignments. Incomplete answer sheets bring poor grades.

4. The coordinator of the learner support centre has the right to reject the assignments received after the due date. Therefore, the learners are advised to submit their assignments before the due date.

5. Learners should enclose a self-addressed stamped assignment remittance-cum- acknowledgement card **(Form No. 2)** with each assignment response to ensure the delivery of assignments before the last dates prescribed for submission of assignments.

6. In case any learner fails to submit the assignments or fails to score minimum qualifying marks, s/he has to wait for fresh assignments meant for the current batch of learners.

7. For their own record, learners should retain a photocopy of all the assignment responses, which they submit to the coordinator of their learner support centre. If they do not get back their duly evaluated assignment after evaluation, they should try to get it from their learner support centre personally. This may help them to improve upon future assignments.

8. As per the University norms, once the learner's scores minimum qualifying marks in an assignment, they cannot re-submit it for improvement of marks.

9. Assignments are not subject to re-evaluation except for factual errors, if any. The discrepancy noticed by the learners in the evaluated assignments should be brought to the notice of the Coordinator of the LSC, so that he forwards the correct score to the SED at the Headquarters.

10. The learners should not enclose or express doubts for clarification, if any, along with the assignments. They should send their doubts in a separate cover to the Registrar, SED, Indira Gandhi National Open University, Maidan Garhi, New Delhi - 110068. While doing so they should give their complete Enrolment number, name, address, programme code. In case of not successfully completed or missed; the assignments should be demanded only if your registration for that course is valid.

> ***Note*:** Please submit your Assignments on or before the due date at your LSC.
>
> There is no provision for re-evaluation of Assignments, practical examination and project evaluation.

4.6 Term-End Examination (TEE)

The University conducts Term-end examinations twice a year in the month of June and December every year. The candidate will be permitted to appear in Term-end examinations subject to the condition that

registration for the courses in which he/she wishes to appear is valid, maximum time to pursue the programme is not over and he/she has also submitted the required number of assignments, if any, in those courses by the due date. **In this programme, a learner is eligible to appear for the Term End examinations one year after admission for all courses of the first and second semesters, and every six months thereafter.** You can also appear for these exams in later cycles as per the validity of your programme.

Examination Fee and Examination Form

Examination fee of Rs 200/- per course is required to be paid. The examination forms can be submitted online through IGNOU website: https://exam.ignou.ac.in/

Date of Submission of Examination Form

JUNE, TEE	DECEMBER, TEE	LATE FEE	WHERE TO SUBMIT THE FORM
1st March to 31st March	1st Sept to 30th Sept	NIL	At the concerned Regional Centre under which your Examination Centre falls.
1st April to 30th April	1st Oct to 31th Oct	` 500/-	
1st May to 15th May	1st Nov to 15th Nov	`1000/-	

To avoid discrepancies in filling up examination form for the Term-end examination you are advised to:

1. remain in touch with the Coordinator of the Learner Support Centre/Regional Centre/SRD & SED for change in schedule of submission of examination form, if any.
2. fill up the examination form for next Term-end examination without waiting for the result of the previous Term-end examination and also filling up the courses, for which result is awaited.
3. fill up all particulars carefully and properly in the examination to avoid rejection and delay in processing of the form.
4. retain a proof of mailing/submission of examination form till you receive examination hall ticket.

4.7 General Guidelines Regarding the Term-End Examination

1. To be eligible to appear the Term-end Exam in any course, the learners are required to fulfil the following conditions:

   a) Registration for the courses, in which they wish to appear is valid.
   b) They should have opted and pursued the prescribed courses.
   c) Minimum time to pursue these courses is elapsed.
   d) They have also submitted the required number of assignment(s), if any.
   e) They have submitted the online examination form of IGNOU and have paid the requisite examination fees.

2. The University conducts term-end examination twice a year, in June and December. The learner can take the examination only after the minimum period prescribed for the course of study has elapsed.

3. Examination schedule indicating the date and time of examination which is available at IGNOU website http://www.ignou.ac.in for each session i.e. June/December.

4. The online examination form is to be filled up from IGNOU website about 2-3 months prior to examination. (You MUST visit IGNOU website for actual cutoff dates. The details of late fee are also displayed on the website.). You are required to pay examination fee per course at the time of filling up of the form. For December 2023 term-end examination this fee was @200/- per course for theory courses and @200/- per course for practical courses. You can pay online using Credit Card / Debit Card /Net Banking while filling up the form. It may also be noted that in case, examination fee needs

to be returned to learner due to technical reasons, the fee will be refunded to the same account (Credit card/ Debit card/ Net Banking) from which the payment was made.

The link to online Examination form, in general, is put on the HOME page of IGNOU website.

You must read and follow all the instructions very carefully. You can save these instructions for any future reference. These instructions relate to:

- Dates for the Submission of Online Term-end Examination form
- Prerequisite for the submission of the Term-end Examination Form
- Process to submit Term-end Examination Form
- Examination fee and Mode of Payment
- Un-successful submission of Exam Form
- Related to Refund excess Examination Fee
- Hall Ticket for Term-end Examination
- Contact details

Important Guidelines and instructions for submission of Term-end Examination form and other forms (Please note that guidelines and fee for forms may change, therefore, you are advised to read guidelines and fee details as per latest forms available online or on the IGNOU website)

1. Please ensure that you have already submitted the assignments as applicable for the courses you are filling in the Examination Form. You are required to pay examination fee for every course of theory as well as practical.

2. Learners are requested to check the result status before filling examination form.

3. Select and enter Programme code and Examination Centre Code from the options available. A learner can choose Exam Centre anywhere throughout India from the list of allotted Exam Centres of IGNOU. But Lab exam will be held at your concern Learner support centre. If the centre opted by the learner is not activated as examination centre or not allotted for any other reason, alternative examination centre will be allotted.

4. Select courses carefully. Courses for theory as well as practical need to be selected separately from the list appearing on the screen.

5. Learners will be allowed to appear in Term-end Examination for the course(s) for which registration is valid and not time-barred and assignment(s) is/are submitted. Examination fee once submitted will not be refunded.

6. Learners should carry their **Identity Card and Hall ticket** (download hall ticket from IGNOU website indicating Centre and Date of Examination) to the Examination Centre.

7. In case a learner fails to receive the intimation slip/Hall ticket may please contact at SED (SE-II) http://www.ignou.ac.in/ignou/aboutignou/division/sed/contact branch.

8. Learners must carry IGNOU Identity-Card in the Examination Hall for writing Examination. In case, learners do not have IGNOU Identity card due to various reasons, they can download from IGNOU website for attending Examination.

9. The learners will be entitled to appear for the examination only at the examination centre allotted to them and **NOT** at any other centre without specific permission from the University. The Examination Centre once opted for in a form shall not be changed.

10. Although all efforts will be made to declare the results in time, there will be no binding on the University to declare the results of the last examination before the commencement of next examination. The learners may, therefore, fill up the examination form without necessarily waiting for the result and get it cancelled at a later date, if so desired. In case the learner gets result after filling up the exam form, s/he should not re-appear in the course qualified by her/ him with a view to improve the qualified score.
11. Learners who fail to complete the minimum required number of course(s) prescribed for the Programme within the allotted period of study shall cease to be on the rolls of this University for that programme till they re-enroll themselves, if they wish to do so. Such learners are advised to get in touch with the Regional Director concerned.

Issue of Examination Hall Ticket

University issues Examination Hall Ticket to the learners at least two weeks before the commencement of Term-end examination and it could also be downloaded from the University's website **www.ignou.ac.in.** In case you fail to receive the Examination Hall Ticket within one week before the commencement of the examination. You can download the hall ticket from the website and approach the exam centre for appearing in the exam.

The enrolment number is the Roll number for examinations of the learner. Be careful in writing it. Any mistake in writing the Roll number will result in non-declaration of the result.

If a learner has missed any Term-end Examination of a course for any reason, or failed in the examination, he/she may appear in the subsequent Term-end Examination. This facility will be available until he/she secures the minimum pass grade but only up to a period of four years from the date of registration.

While communicating with the University regarding examinations please clearly write the enrolment number and complete address. In the absence of such details, we may not be able to attend the learner's problems.

Early Declaration of Result

If candidate has got offer of admission for higher study and or selected for employment, etc. and are required to produce statement of marks/grade cards by a specified given date, he/she may apply online through IGNOU website, for early processing of his/her answer script and declaration of result. The candidates are required to apply online with fee of ₹700/- per course. He/she can submit his/her request for early declaration before the commencement of the Term-end Examination, i.e., before 1st June and 1st December, respectively. The University, in such cases, will make arrangement for early processing of answer scripts and declare the result as a special case possibly within a month time from the date of conduct of examination.

Re-Evaluation of Answer Script(s)

If learners are not satisfied with marks/grade awarded to them in Term-end Examination, they may apply online through IGNOU website for re-evaluation within one month from the date of declaration of results, i.e., the date on which the results are made available on the University's website, on payment of ₹ 750/- per course. The better of the two scores of original marks/grade and marks/grades after re-evaluation will be considered and updated in the learner's record.

Note: Re-evaluation is permissible in Term-End Examination only and is not in Practical courses, Project Workshop and an Assignment.

Photocopy of the Evaluated Answer Script

The learners may obtain the photocopy of the evaluated answer scripts for the Term-end Examination on request. They may apply online, from 1st September to 15th October for June Term-end Examination and from 1st March to 15th April for December Term-end Examination along with the requisite fee of ₹ 100/- per course.

Issue of Official Transcript

The University provides the facility of official transcripts on request made by the learners on plain paper addressed to Registrar, Student Evaluation Division (SED), Block 12, IGNOU, Maidan Garhi, and New Delhi – 110068. The fee for official transcripts is as under:

For Indian Learners:

₹ 300/- for each transcript, if to be sent to the Learner/Institute **within India**

₹ 500/- for each transcript, if to be sent to the Learner/Institute **out of India For SAARC Countries Learners:**

₹ 1200/- for each transcript, if to be sent to the Learner/Institute of **SAARC Countries.**

For Non-SAARC Countries Learners:

$ 120 for each transcript, if to be sent to the Learner/Institute of **Non-SAARC Countries.**

Format is available in the Programme Guide or IGNOU website: **www.ignou.ac.in**

5. OTHER USEFUL INFORMATION

Newsletter

IGNOU Newsletter is published twice in a year (April and October) in English and Hindi. Information regarding Examination schedule, new courses to be launched, admissions etc., is also provided through IGNOU newsletters. It covers various activities at IGNOU Headquarters, Regional Centres and Study Centres. It also carries important notifications from time to time.

Refund of Fee

Fee once paid will not be refunded under any circumstances except the provision of refund of admission fee as notified by the University. It is also not adjustable against any other programme of this University. However, in cases where University denies admission, the programme fee will be refunded after deduction of processing fee, if any, through online mode.

Reservation

The University provides reservation of seats for Scheduled Castes, Scheduled Tribes, Non-Creamy Layer of OBC, Economically Weaker Sections, War Widows, Kashmiri Migrants and Physically Handicapped learners, as per the Government of India rules, for admission to its various programmes. However, submission of forged certificate under any category shall be liable for not only cancellation of admission but also to be legally implicated as per Government of India rules.

Scholarships and Reimbursement of Fee

Reserved Categories, viz., Scheduled Castes, Scheduled Tribes and Physically Handicapped learners etc. have to pay the fee at the time of admission to the University along with other learners. Physically Handicapped learners 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 learners 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 learners can be downloaded from the link: http://ignou.ac.in/userfiles/Application%20form%20for%20Reimbursement%20of%20fee.pdf

Fee Exemption for SC/ST Learners 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/ST learners 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 learners may contact the Regional Centre concerned. Details of the scheme and notification are uploaded on 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 learners and shall pay subsequent fees wherever applicable (examination fee, re-registration fee, registration fee for convocation etc.).

Correction of Address and Study Centre Change

Learners can initiate the request for change of address, Learner Support Centre and Regional Centre online from their user account. The user account is to be created at https://ignou.samarth.edu in by clicking 'New Registration.

Correction/Change of Name/Surname of Learner

Spelling mistakes, if any, committed at the time of data entry stage will be rectified at the Regional Centre and corrected data transmitted to Student Registration Division for updating in the database. However, learners are expected to write their correct name (as indicated in the High School Certificate) in the Admission Form. In case any change in the name (other than the one mentioned in his/her High School Certificate), then it is mandatory for the prospective learners to furnish legal evidence of having changed his/her name/ surname while submitting the admission form.

For 'Change of Name/Surname', after confirmation of admission, the learners are required to submit the following documents at the Regional Centre, for onward transmission to Registrar, SRD:

a) Original copy of Notification in a daily newspaper notifying the change of name;

b) Affidavit, in original, on non-judicial Stamp Paper of the appropriate value sworn in before 1st Class Magistrate specifying the change in the name;

c) Marriage Card/ Marriage Certificate in case of women candidates for change in surname;

d) Gazette Notification, in original, reflecting the change of name/surname; and

e) Demand Draft of Rs. 500/- drawn in favour of IGNOU payable at New Delhi.

Request for correction and/or change of Name / Surname will be entertained only before completion of the programme.

Change of Region

When a learner wants transfer from one region to another, he/she has to write to that effect to the Regional Centre from where he/she is seeking a transfer marking copies to the Regional Centre where he/she would like to be transferred to. Further, he/she has to obtain a certificate from the coordinator of the learner support centre from where he/she is 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 as well. For change of 'Region' in practical oriented Programmes, '**No Objection Certificate**' is to be obtained from the concerned Regional Centre/Study Centre where the learner wishes his/her transfer.

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.

The learner can seek transfer to any other overseas study centre only after six months of Registration or submission of first year/semester assignments for the programme of one year or longer duration.

Disputes on Admission & other University Matters

The place of jurisdiction of filing of suit, if necessary, will be New Delhi/Delhi ONLY.

Pre-admission Counselling of Persons with Disabilities

Persons with disabilities before opting for a programmes for admission may please go through the category of perspective jobs for persons with disabilities and the physical requirements of jobs by visiting the link (http:/www.disabilityaffair.gov.in/content/page/rules-and-regulations.php#ipd2013) of Department of Empowerment of Persons with Disabilities, Ministry of Social Justice and Empowerment, Government of India. After having made this informed decision, the person with disability seeking admission must give an undertaking in the prescribed proforma available on IGNOU Website.

Prevention of Malpractice/Notice for General Public

Learners seeking admission to various academic programmes of Indira Gandhi National Open University are advised to directly contact IGNOU headquarters at New Delhi or Regional Centres of IGNOU only. Learners interacting with intermediaries shall do so at their own risk and cost. However, in case of any specific complaint regarding fraudulent institutions, fleecing learners etc., please contact any of the following members of the Malpractices Prevention Committee:

1. Director, SSC (Tele: 29535714)
2. Director, RSD (Tele: 2953 2118, 29572412)
3. Registrar, SED (Tele: 2953 5828, 29572204)
4. Registrar, SRD (Tele: 2953 2741,9571302)
5. Registrar, MPDD (Tele: 29534521,29572002)
6. Deputy Registrar, F&A (Tele: 29534934)

Alternatively, complaints may be faxed on 29532312.

Email: ignouregistrar@ignou.ac.in

Website: http://www.ignou.ac.in

Note: Except the above-mentioned complaints, no other queries will be entertained at the above phone numbers.

As per directions of Hon'ble Supreme Court of India ragging is prohibited. If any incident of ragging comes to the notice of the authority the concerned learner shall be given liberty to explain and if his explanation is not found satisfactory, authority would expel him from the University. IGNOU admissions are made strictly on the basis of merit. Only those learners who satisfy the eligibility criteria fixed by the university will be admitted. Learners will not be admitted if they are not eligible as per the eligibility criteria. Therefore, the candidates should not be misled by the false promises of admission made by any private individuals or institution.

Placement Services

In order to further extend learner support services to its geographically distributed learner population who are pursuing various IT and Non-IT related Degree, Diploma and Masters Programme, the university has established the Campus Placement Cell (CPC). The mission and endeavour of CPC is to enhance and facilitate the process of prospective suitable employment opportunities that are commensurate with the

personal profiles of our learners. All learners interested in seeking the assistance of CPC for procuring suitable job opportunities are requested to send their current resume/bio-data to campusplacement@ignou.ac.in. They are further advised to visit our home page www.ignou.ac.in for regular updates on placement related activities.

Incomplete and Late Application

Incomplete application forms/Re-registration forms, received after due date or having wrong options of courses or electives or fast information, will be summarily rejected without any intimation to the learners. You are, therefore, advised to fill the relevant columns carefully and enclose the copies of all required certificates duly attested by a Gazetted Officer. **The form is to be submitted to the Regional Director concerned ONLY on or before the due date**. The applications form sent to other offices of the University will not be considered and the application will have no claim whatsoever on account of this.

ALWAYS KEEP A COPY OF YOUR COREESPONDENCE WITH THE UNIVERSITY, ASSIGNMENT, ETC. WITH YOU.

PLEASE MENTION YOUR ENROLMENT NUMBER ON ALL THE CORRESPONDENCE YOU MAKE WITH THE

6. SOME USEFUL ADDRESSES

1.	Identity Card, Fee Receipt, Bonafide Certificate, Migration Certificate, Scholarship forms, Change of Programme/ Medium / Courses / Elective / Opting of left over electives / Project query after submission of Projects	Concerned Regional Centre. The demand Draft should be drawn in favour of 'IGNOU' payable at city of the Regional Centre.
2.	Non-receipt of study material and assignments	Concerned Regional Centre
3.	Schedule/Information regarding Exam-form, Entrance Test, Date-sheet, Hall Ticket	Asst. Registrar (Exam.II), SED, Block-12, Room No. 02, IGNOU, Maidan Garhi, New Delhi-110068 Ph. 011-29536743, 29572202, 29572209
4.	Result, Re-evaluation, Grade Card. Provisional Certificate, Early Declaration of Result, Transcript	Deputy Registrar (Exam.III), SED, Block-12, Room No. 01, IGNOU, Maidan Garhi, New Delhi-110068 Ph. 011-29536103, 29572201, 29571316
5.	Non-reflection of Assignment Grades/marks	Assistant Registrar (Assignment), SED, Block-03, IGNOU, Maidan Garhi, New Delhi-110068, assignment@ignou.ac.in. Ph. 011-29571312, 29571319, 29571325
6.	Deletion of excess credits/Project query after submission	Asst. Registrar (Project), SED, Block-03, IGNOU, Maidan Garhi, New Delhi-110068, Ph. 29571312
7.	Original Degree/Diploma/verification degree/diploma	Deputy Registrar (Exam.I), SED, Block-9, IGNOU, Maidan Garhi, New Delhi-110068 Ph. 011-29535438, 29572224, 29572213

8.	Student Grievance (SED)	Asst. Registrar (Student Grievance), SED, Block-3, Room No. 13, IGNOU, Maidan Garhi, New Delhi-110068 Ph. 011-29532294, 29571313
9.	Purchase of Audio/Video Tapes	Marketing Unit, EMPC, IGNOU, Maidan Garhi, New Delhi-110068 Ph. 011-29532167
10	Academic Content	Director, School of Sciences, IGNOU, Maidan Garhi, New Delhi-110068 sos@ignou.ac.in Ph: 011-29532167; 011-29572832
11	Approval of Project Synopsis	Project Coordinator in the Concerned School
12	Submission of Project Reports	Deputy Registrar, SED, Block-12, Room No. 01, IGNOU, Maidan Garhi, New Delhi-110068, Ph. 29572216
13	Student Support Services and Student Grievances, pre-admission. Inquiry of various courses in IGNOU	Regional Director, Student Service Centre, IGNOU, Maidan Garhi, New Delhi-110068, ssc@ignou.ac.in , Ph. 011-29535714, 29533869, 2953380, Fax: 011-29533129

7. LINKS TO FORMS AND ENCLOSURES

In this section, we are enclosing the IGNOU website links to various forms, which are useful for you. Whenever you have to correspond with the university, please download the form from the Website and fill it carefully and send as per instructions therein. The detailed instructions for all these-forms are provided in form itself. Some of these links may change, in those cases please use search option to find the desired link.

Note: You may download the Forms from the Website

Useful links and Forms

- ***Link to Latest Assignment(s)***
- ***Link to Online Re-Registration for MSCAST 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***

1. Assignments related links

Link to Latest Assignment(s) https://webservices.ignou.ac.in/assignments/

2. Re-registration

Link to Online Re-Registration for MSCAST Programme

https://onlinerr.ignou.ac.in/

Last date of Re-Registration is announced on the IGNOU website. In general, the re-registration is to be done 2-3 months prior to the start of Session. For example, the last date of re-registration for session starting from July cycle is in the last of May. Similarly, the last date for session starting January cycle may be in the last of November. You must verify the cutoff dates and fee from the website prior to filling up this offline form.

3. Term-end Examination and Related Links

Link to online Term End Examination form
https://exam.ignou.ac.in/

Link to form for Early Declaration of Result
http://www.ignou.ac.in/userfiles/APPLICATION%20FORM%20FOR%20EARLY%20DECLARATION%20OF%20RESULT%20OF%20TERMEND%20EXAMINATION.pdf

Link to Application Form for Obtaining Photocopy of the Answer Script
http://www.ignou.ac.in/userfiles/Application%20form%20for%20Reevaluation%20of%20Answer%20Scripts(1).pdf

Link to form for Re-evaluation of Answer script
http://www.ignou.ac.in/userfiles/Application%20form%20for%20Reevaluation%20of%20Answer%20Scripts(1).pdf

Link to Application form for Improvement of Division/Class
http://www.ignou.ac.in/userfiles/Improvement%20form.pdf

Link to form for Duplicate Grade Card/Mark-sheet
http://www.ignou.ac.in/userfiles/Duplicate%20mark%20sheet%20form.pdf

Link to form for Issue of Official Transcript
http://www.ignou.ac.in/userfiles/Official%20Transcript%20form.pdf

Link to form for Issue of Migration Certificate
http://ignou.ac.in/userfiles/Migration%20Certificate.pdf

Link to form for Date sheet of all Prpgramme

http://ignou.ac.in/userfiles/DATE%20SHEET(1).pdf

4. Other Important Links

Link for Old Question Papers
https://webservices.ignou.ac.in/Pre-Question/

Link for Checking Study Material Status
http://www.ignou.ac.in/ignou/aboutignou/division/mpdd/material

In case the learner does not receive the study material from the Regional Centre concerned, the learner may approach ***Regional Director, IGNOU, Regional Centre where they stand enrolled/admitted*** through e-mail/fax/letters along with proof of depositing of fee for the course of study. Link for eGyankosh for Online Course Materials http://egyankosh.ac.in/

Forms

We are enclosing some samples of following forms for your use.

1. Assignment Submission-cum-Acknowledgement form (Form No.1)
2. Change of Address/Correction of Name (Form No.2)

Whenever you have to correspond with the University for any of the above listed subjects, it is better to retain the original form for reuse and get a photocopy of the relevant form, fill it carefully and send as per instruction therein. The detailed instructions for all the above listed subjects are provided in the Programme Guide.

Form No. 1

Assignments Remittance-Cum-Acknowledgement Card

Enrol. No._____

Programme Title _____

Name: _____

Course Code: _____ Medium: _____

S.No.	Assignment	For Office Use Only
		S. No._____
		Date of Receipt: _____
		Name of Evaluator: __

Signature of

the Student

Date: _____

Date of dispatch to the Evaluator:_____

Date of receipt from the Evaluator: _____

INDIRA GANDHI NATIONAL OPEN UNIVERSITY

ASSIGNMENTS REMITTANCE-CUM ACKNOWLEDGEMENT CARD

Enrol No. _____

Name: _____

Course Code:_____

S.No. Assignment

Programme Title: _____

Medium: _____

For Office Use Only

S.No._____

Signature of the receiver_____

Date:_____

Seal

Signature of the student

Name:_____

Address of the Student:_____

Date:

Affix
Stamp
Here

From:

The Coordinator
Study Centre concerned

To

(ADDRESS OF THE STUDENT)

……
……
……

Form No. 2

(For Change of Address, send it duly filled-in to the concerned Regional Director, who will forward it to the Registrar (SRD), Maidan Garhi, New Delhiafter verification)

Application for Change of Address

Date:_____

To

The Regional
Director IGNOU
Regional Center

_____
_____
_____

THROUGH THE REGIONAL DIRECTOR CONCERNED

EnrolmentNo. _____

Programme _____ Name
(in caps) _____

1. DETAILS FOR CHANGE/CORRECTION OF MAILING ADDRESS

New Address **Old Address**

_____

_____

_____

City_____Pin_____ City_____Pin_____
State_____ State_____

_____
Signature of the Student

Please retain a photocopy of any document that you submit to theUniversity.

QR Code of Some of the Useful Web Links

eGyankosh Online
(for Online Course Materials)

Re-Registration Online

iGRAM
(IGNOU Grievance control Room)

To Watch Live Telecast/
To listen live Broadcast

On-line Examination form

Assignments

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