Somaiya School of Basic and Applied Sciences

Faculty of Science

Somaiya Vidyavihar University, Mumbai

Admission Manual

PhD Programme – Computer Science

AY 2025-26 onwards

Visit for Further Details: https://www.somaiya.edu/en/phd/

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About Somaiya Vidyavihar University, Mumbai

On 26th August 2019, Somaiya Vidyavihar University, Mumbai became a reality!

After six decades of fostering a holistic teaching and learning experience and establishing reputed educational institutions, Somaiya Vidyavihar University, Mumbai, has achieved a significant milestone. It has become the first self-financed private university in Mumbai under the Maharashtra Self-Financed Universities (Establishment and Regulation) Act, 2013.

We aspire to build and support a world-class institution—one that is proudly Indian and excels in education, research, and service. Somaiya Vidyavihar University, Mumbai, will be a hub for preserving, disseminating, and creating knowledge. It will have a global impact through its ideas and a universal commitment to service. Here, students and faculty can embrace the "Freedom of Possibilities," pursue their passions, and, most importantly, discover themselves.

Our History and Vision

An all-round education must integrate Indian culture, values & morality into the curriculum.

Somaiya Vidyavihar was founded on September 9, 1959, by Padmabhushan Shri K.J. Somaiya (1902–1999), a visionary leader with sharp business acumen, a balanced perspective, and a deep commitment to social progress. His dream of shaping young minds through quality education led him to establish the Somaiya Trust in 1953, acquiring a vast expanse of land in Ghatkopar—then a sparsely populated area.

Driven by his passion for education and inclusivity, he later founded the Girivanvasi Pragati Mandal, the K.J. Somaiya Medical Trust, and the Girivanvasi Education Trust, along with several sister institutions, to provide greater access to learning and opportunity. Inspired by Swami Vivekananda's words, *"We want that education by which character is formed, strength of mind is increased, the intellect expanded, and by which one can stand on one's own feet,"* he dedicated his life to fostering knowledge and empowerment.

Over the past six decades, Somaiya Vidyavihar has grown into a thriving educational ecosystem with 34 institutions across diverse fields, including Humanities & Social Sciences, Engineering, Medicine, Management, Education, Dharma Studies, Pure Sciences, and Commerce & Business Studies. Today, with a vibrant 50-acre campus, it is home to over 39,000+ students and 3,000+ faculty and staff, continuing its legacy of excellence in education and innovation.

With PhD programmes in various faculties, we provide an innovative platform for research aspirants to make a niche of their own to impact society and life.

About Somaiya School of Basic and Applied Sciences, SVU

The Somaiya School of Basic and Applied Sciences (SSBAS) is a newly established institution under the Faculty of Sciences at Somaiya Vidyavihar University, Mumbai. Initially it is a part of S.K. Somaiya College, SSBAS has grown into a center of academic and research excellence. With six departments, the school offers six undergraduate and eight postgraduate programs, along with a Doctor of Philosophy (Ph.D.) program in six disciplines. SSBAS is equipped with state-of-the-art research laboratories, advanced instrumentation, and cutting-edge software, fostering a seamless integration of science and technology research. The school has successfully secured ₹1 crore+ in research funding from various governmental agencies, reinforcing its commitment to advancing fundamental research for societal development.

1.	**Eligibility criteria for PhD Admission**
Subject to the conditions stipulated in the SVU PhD Regulations, the following candidates are eligible to seek admission to the PhD Programme	
1.	**Education Qualification**
i.	Master's degree (2 years or 1 year) or a professional degree declared equivalent to the Master's degree by the corresponding statutory regulatory body, with at least 55% marks in aggregate or its equivalent as per UGC regulations.
ii.	Candidate seeking admission after a 4-year/8-semester bachelor's degree programme (B.Tech / B.E, B.Pharma, MBBS or BDS or BAMS or BHMS or B.Sc (Honors) should have a minimum of 75% marks in aggregate or its equivalent as per UGC regulations
iii.	A person whose master's dissertation has been evaluated, and the viva-voce is pending may be admitted to the PhD Programme but subject to completion of Master's degree before provisional admission to SVU PhD Programmes.
iv.	Candidates possessing a Degree considered equivalent to Master's Degree of an Indian Institution, from a Foreign Educational Institution accredited by an Assessment and Accreditation Agency which is approved, recognized or authorized by an authority, established or incorporated under a law in its home country or any other statutory authority in that country for the purpose of assessing, accrediting or assuring quality and standards of educational institutions, shall be eligible for admission to PhD Programme.
2.	**PhD Entrance Exam**
i.	MUST qualify for a passing score of PhD Entrance Examination of SVU. This is a mandatory eligibility criterion for all candidates with exemptions mentioned in Point 2. (ii)
ii.	Exemption Criteria from SVU PhD Entrance Examination are: 1. Candidates who qualified in UGC - CSIR -NET-JRF/ ICMR-JRF / DBT-JRF (BET)/ INSPIRE/ GPAT/ICAR/JEST/ Qualified/valid GATE scores in relevant branches /Prime Ministers Fellowships and those qualified in any of the UGC recognized national or state level eligibility tests with a valid fellowship/scholarship in the related subject. 2. Candidates with valid GMAT score for the last 2 years (1st Jan 2022 to 31st Dec 2024), minimum GMAT score 350 3. Any candidates having 5 years of teaching/research experience and have published research paper in SCOPUS; Web of science journal/published patents/grants received from government agencies will be exempted from appearing for the SVU PhD entrance exam but will be required to appear for an interview at the respective departments. The exemption criteria will be applicable ONLY when relevant documents are uploaded during application submission. If relevant documents are not submitted, the candidate must appear for the Entrance exam.
Note: However, the candidates who fulfill the above criteria MUST fill in the application form as per the schedule displayed on the website.	
3. Other Documents	

1. UG Degree or equivalent Mark List 2. UG Degree certificate 3. PG Degree or equivalent Mark List 4. PG Degree or equivalent certificate 5. AADHAR card 6. Degree equivalence / eligibility certificate – wherever is applicable 7. Transfer Certificate and /or Leaving Certificate 8. Migration certificate 9. Two colour passport size Photograph 10. If appearing the PG degree examination – bonafide certificate 11. If employed, then No Objection Certificate (NOC) from the employer – at the time of provisional admission
4. Important Links
UGC Notification 2022 (Link)

2. Categories of Ph D Students

1. Candidates with externally funded scholarships/Fellowships; (a full tuition fee waiver will be provided to candidates who join as JRF/SRF under government of INDIA research funded scheme)
2. Candidates who work in funded projects within the University or in approved research centers which are collaborating with the University.
3. Jointly guided PhD or Co-supervised PhD with International Universities.
4. Teaching/work integrated research candidates who are the faculty/employees in pursuit of advancing their academic qualification, recommended by the Head of the Institution and the Academic Advisory Committee. This provision is for those candidates who shall take an undertaking that their routine responsibilities would be duly attended and under no circumstances compromised. The university shall reserve the rights to consider the registration of candidates who do not adhere to these guidelines.
5. Teaching and Research Associates of the Somaiya Vidyavihar University.
6. "Somaiya Vidyavihar University Research fellow under Chancellor's Scholarships Programme".
7. "Any candidates having 5 year of teaching/research experience and have publish research paper in SCOPUS; Web of science journal/published patents/grant received from government agencies will be excepted from appearing for the SVU PhD entrance exam but will be required to appear for an interview at the respective departments"
8. Candidate is permitted to pursue studies on a part-time basis provided all the conditions stipulated in UGC 2022 regulations are fulfilled.

3. Overview of Steps involved in PhD Programme	
Sr.No.	Steps
PhD Pre-selection Phase	
1.	Advertisement / Call for SVU PhD entrance exam on website /media handles
2.	Acceptance of the applications for PhD entrance examination along with the applications processing fee

3.	Execution of PhD entrance examination for all PhD programmes
4.	Declaration of PhD entrance examination results
5.	Selection process - Display of list of eligible shortlisted candidates for interview
6.	One-on -one Interviews of shortlisted candidates before an expert panel
7.	Display of selected candidates for provisional admission - Selection process complete
Provisional Admission Phase	
8.	Provisional admission and payment of fees in accounts/admin office of the constituent unit of Somaiya Vidyavihar University, Mumbai.
9.	Orientation and initiation of course work (1 year – 2 semesters)
10.	The first semester encompasses research methodology & publication ethics along with subject specific topics. The second semester majorly focuses on building research, technical & soft skills. It includes research activities, lab rotation and research proposal drafting & presentation and its evaluation.
11.	ATKT examination for semester I and II for unsuccessful candidates or for grade improvement
12.	Issue of mark sheets for course work for semester I and II
Allotments & Registrations	
13.	Allotment of the guide at individual constituent unit-level /department (within the first six months of provisional admission)
14.	Topic approval of the thesis work within 2-3 months after Qualifying course work examination
15.	Registration for PhD programme
PhD Phase	
16.	Appointment of Examiners and chairman from Research Committee
17.	Annual Progress Seminars (APS) and Intermediate Progress Seminar (IPS) for the academic year by Doctoral Advisory Committee (DAC)
Submission & defence	
18.	Approval of examiners to present pre-synopsis in one of the APS and IPS
19.	Presentation of pre-synopsis and its approval by the examiners
20.	Submission of thesis to COE office
21.	Sending the thesis to reviewers
22.	Receipt of reviews about thesis from the reviewers
23.	The final defense of the thesis
24.	Submission of the final corrected thesis after defense
25.	Issue of provisional PhD certificate
26.	Issue of PhD certificate
	The steps and the progress evaluation of PhD students by the committee/examiners/experts will be as per the provisions of PhD regulations

4. Pattern and syllabus of SVU PhD Entrance Examination
Paper-1 Qualitative Test – 40 marks a) Essay Writing – 20 marks b) Comprehension – 20 marks (50% choice in selecting questions in paper I)
Paper – 2 Subject Specific Test – 60 marks a) Multiple Choice Questions – 20 marks (Attempt 20 out of 30 questions) b) Subjective Questions – 40 marks (with 50% Choice)

5. About Course Work
The course will be for one academic year (two semesters) and out of which the first semester will be full-time. It is expected that during the first semester, the student will report to the school/department/section/laboratory for attending the sessions as per Timetable. The student will have to complete a total of 14 credits (semester I) + 5 credits (semester II) = a total of 19 credits with CGPI as per the PhD regulations to become eligible for the registration to PhD programme..

6. Fee Structure of PhD Program
(This is common across disciplines, all categories of students)

Particulars	Total Fees per annum (₹)	
	First Year	Second Year Onwards
Tuition Fee	30,000/-	30,000/-
Development Fee	10,000/-	10,000/-
Examination Fee	10,000/-	10,000/-
Caution money Deposit (Refundable)	1,000/-	-----
Library Deposit (Refundable)	2,000/-	-----
Total (₹)	53,000/-	50,000/-
If paid provisional admission fee, then it should be deducted from total fee		
Link for fees payment (Fees will be accepted via online payment gateway only and in no case can it be paid using any other type of mode of payment and to any office/person)	https://myaccount.somaiya.edu/#/login	

7. Registration, Synopsis & Ph D Thesis Submission Fees	
Particulars	Amount
Registration fees	5000
Approval of Synopsis of PhD Thesis Topic	5000
PhD Thesis Submission	10000
Total	20,000/-

Note:

1. Registration fees to be paid by the PhD scholars before submitting the application for Registration for Ph D.
2. Synopsis PhD Thesis Submission fees to be paid by the PhD scholars before submission of synopsis.

8. Payment of fees schedule for Provisional admission and subsequent years of PhD programme			
Program Academic Year	Particulars	Amount in Rupees (₹)	Payment Schedule
First Year	Total fee	53,000/-	Within eight days from the date of receiving the offer letter
Second Year and Onwards	Total fee	50,000/-	Within the first week from the commencement of the new Academic Year
Link for fees payment (Fees will be accepted via online payment only and in no case, can it be paid using any other mode of payment and to any office/person)		https://myaccount.somaiya.edu/#/login	
Note: Students have to pay the full fees of the program per year till the submission of the thesis			

9. Guidelines to make fee payment in Online Mode
There is a provision of ONLINE PAYMENT of School fees for students' convenience 24x7 on or before the scheduled due date. Students will get notification from the institute in three ways. 1) SMS 2) Email 3) Notification on myaccount.somaiya.edu portal In the notification there will be a link to make the payment. You just need to click on the link and follow below simple steps to make the payment.

STEP 1: Link will take you to myaccount.somaiya.edu portal. Use Somaiya SVV Net ID and password to login. Want to know more about myaccount.somaiya.edu click on https://somaiya.edu/media/pdf/SVVNetID_and_EmaiI%20id.pdf

STEP 2: Login, select 'instalments' and click on "Pay Now".

STEP 3: System will redirect to Online Payment Gateway. Fill in the required information and follow payment options to complete the payment cycle.

STEP 4: After the successful payment, the payment receipt will be available at student's MyAccount portal

10. Admission Cancellation policy of PhD programme
(All Categories of PhD Students)

If the candidate has accepted the allotted seat by paying the fees and later chooses/decides to withdraw from the programme of study, then cancellation option is available at his/her MyAccount login.

The school shall follow the system below for deduction of fees against the cancellation request for the candidate.

Sr. No.	Point of time when the application for admission cancellation is received by the school	Applicable Deduction
1	15 days or more before the date of commencement of academic term	Rs 5,000/-
2	Less than 15 days before the date of commencement of the academic term	10% of total fees
3	Less than 15 days from the date of commencement of the academic term	20% of total fees
4	On or beyond the 15th day but within six weeks of the date of commencement of the academic term	50% of total fees
5	More than six weeks from the date of commencement of the academic term	100% of total fees

Note:

- Total Fees for the program per year is Rs. 50,000/- for All Categories of PhD Students
- Tentative date of commencement of every academic term will be announced on website.

Typical Sample example for further illustration to know about cancellation charges with reference to the date of commencement of term

Refer the below example for clarification of PhD admission cancellation policy

Assume that the academic term commences from 15th July of a particular academic year. Based on this assumption, the following table illustrates important dates of cancellation policy:

Illustration:

Sr. No.	**The point of time when an application for admission cancellation is received by school**	**Applicable Deduction**

1	Cancellation on or before 30th June (up to 11.59pm)	Rs 5,000/-
2	Any time from 1st July to 14th July (up to 11.59pm)	10% of total fees
3	Any time from 15th July to 28th July (up to 11.59pm)	20% of total fees
4	Any time from 29th July to 25th August (up to 11.59pm)	50% of total fees
5	After 25th August	100% of total fees

11. Process of getting documents submitted return
After verification of documents, within 7 days, documents will be returned to students.

Somaiya School of Basic and Applied Sciences Faculty of Science

Computer Science

About Research Center

The computing and information revolution is transforming society. Computers have changed the way the world produces, manages, processes, computes and analyses data. The diverse area where computer science impacts does not have boundaries.

The Computer Science research centre has been established in the Department of Information Technology and Computer Science, Somaiya School of Basic and Applied Sciences, Somaiya Vidyavihar University. The Computer Science Ph.D. centre is committed towards transforming and producing cutting-edge research in numerous areas of Computer. The Computer Science Research Centre educational mission is to stay tuned to the needs of researchers. The Ph.D. Research programme has started from the academic year 2020-21.

We organize research programs that provide a mechanism and organizational structure within which collective research activities can take place. Our aim is to work toward advancing software and information technology through research partnerships and educating the next generation of software researchers and practitioners in advanced software technologies. In the Computer Science research centre, we address the entire range of research problems that arise from the different sectors.

The faculty of the Computer Science Research Centre engages students to conduct cutting-edge and impactful research in various areas of computer science.

The Computer Science Research Centre is committed to expanding our goal to provide impactful solutions in computer science research. We offer a supportive environment in which our faculty and students are empowered to pursue the next great advances whether at the core of the field, or in emerging areas that address humankind's greatest challenges through the transformative power of computing.

SALIENT FEATURES

- Best research practices with research laboratories.
- Qualified and experienced research guides to foster the knowledge.
- Touches every aspect of computer science possibilities and outcomes.
- Provide exposure to research opportunities worldwide.
- Opportunity for students to carry out interdisciplinary research projects across Medical Science, Business Tools, Embedded System, Analytical models, etc.
- Enriched student development programs.
- Machine Learning and Artificial Intelligence
- Big Data Analytics, Data Management
- Data Analytics and Data Visualization
- Machine Learning
- Natural Language Processing
- Agile Methodology
- Computational Linguistics
- Database and Data Mining
- Scientific Computing

Eligibility at UG/PG Degree	
Branch of study at UG	Computer Science Information Technology Mathematics and Statistics Data Science Any branch of Computer Science and Engineering
Branch of study at PG	Computer Science Information Technology Mathematics and Statistics Data Science Any branch of Computer Science and Engineering

Syllabus for Entrance Examination in Computer Science

Engineering Mathematics

Mathematical Logic: - Propositional Logic; First Order Logic.
Probability: - Conditional Probability; Mean, Median, Mode and Standard Deviation; Random Variables; Distributions; uniform, normal, exponential, Poisson, Binomial.
Set Theory & Algebra: - Sets; Relations; Functions; Groups; Partial Orders; Lattice; Boolean Algebra.

Digital Logic

Boolean algebra. Combinational and sequential circuits. Minimization. Number representations and computer arithmetic (fixed and floating point).

Computer Organization and Architecture

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

Data Structures

Data, Information, Definition of data structure. Arrays, stacks, Queues, Linked lists, Trees, Binary trees and traversal, Graphs, priority queues and heaps and assimilated algorithms. File structures: Fields, Records and files. Sequential, Direct, index-sequential and relative files. Hashing, Inverted lists and multi-lists, B trees and B+ trees.

Programming in C and C++

Programming language concepts, paradigms and models. Programming in C: Elements of C-Tokens, identifiers, data types, operators in C. Control structures in C. Sequence, Selection and iterations (s). Structured data types in C-arrays, struct, union, String and pointers. I/O statements, User defined and built in functions, Parameter passing. C++ Programming: Elements of C++-Tokens, identifiers, Variables and constants. Data types. Operators, Control statements, Functions parameter passing, Class and objects. Constructors and destructors. Overloading, Inheritance, Templates, Exception handling. Object Oriented Programming Concepts: Class, Object,

Instantiation, Inheritance, polymorphism and overloading, dynamic biding, reference semantics and their implementation.

Operating System:

Processes, Threads, Inter-process communication, Concurrency, Synchronization, Deadlock, CPU scheduling, Memory management and virtual memory, File systems, I/O systems, Protection and security.

Databases: ER-model, Relational model (relational algebra, tuple calculus), Database design (integrity constraints, normal forms), Query languages (SQL), File structures (sequential files, indexing, B and B+ trees), Transactions and concurrency control.

Data Mining and Data Warehousing: Concept of Data Mining, Data Warehousing Architecture, Data Mart, OLAP and OLTP Systems. Software Engineering: information gathering, requirement and feasibility analysis, data flow diagrams, process specifications, input/output design, process life cycle, planning and managing the project, design, coding, testing, implementation, maintenance.

Computer Networks: ISO/OSI stack, LAN technologies (Ethernet, Token ring), Flow and error control techniques, Routing algorithms, Congestion control, TCP/UDP and sockets, IP(v4), Application layer protocols (icmp, dns, smtp, pop, ftp, http); Basic concepts of hubs, switches, gateways, and routers. Network security basic concepts of public key and private key cryptography, digital signature, firewalls.

Web technologies: HTML, XML, basic concepts of client-server computing

Artificial Intelligence & Machine Learning: Fundamentals of AI: Turing Test, Rational Agents, Search Strategies (BFS, DFS, A*), Game Theory (Minimax, Alpha-Beta Pruning). Machine Learning Basics: Supervised, Unsupervised, Reinforcement Learning. Neural Networks: Perceptron, Multi-Layer Perceptron (MLP), Backpropagation. AI Ethics & Bias: Fairness in AI, Explainability, Adversarial Attacks

Details of PhD Coordinator

School Code	School / Institute Name	Name of PhD	Email ID
31	Somaiya School of Basic and Applied Sciences (SSBAS)	Dr. Nilesh Wagh	nilesh.wagh@somaiya.edu
Common Email ID			svu.phdcoordinators@somaiya.edu

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Ph. D Course Work Semester I

Credit Scheme

Course Code	Course Name	Teaching Scheme (Hrs.) Per Week TH – P – TUT	Total (Hrs.) Per week	Credits Assigned TH – P – TUT	Total Credits
135D01C101	*Research Methodology	2 – 0 – 2	4	2 – 0 – 2	**4**
135D01C102	*Research and Publications Ethics	2 – 0 – 0	2	2 – 0 – 0	**2**
135D01E101	Machine Learning	3 – 0 - 0	3	2 – 1 - 0	**3**
135D01E102	Cybersecurity	3 – 0 – 0	3	2 – 1 – 0	**3**
135D01T101	*Intellectual Property Rights and infringement protection	0 – 0 – 2	2	0 – 0 – 2	**2**
	Total	**10– 0 – 4**	**14**	**10– 0 – 4**	**14**

*Common to all

^NPTEL course with in-house monitoring and research article discussion

Examination Scheme

Course Code	Course Name	Examination Scheme							
		Marks							
		CA							
		ISE	IA	ESE	TW	O	P	P&O	Total
135D01C101	*Research Methodology	--	50	50	--	--	--	--	**100**
135D01C102	*Research and Publications Ethics	--	50	--	--	--	--	--	**50**
135D01E101	Machine Learning	--	50	--	50	--	--	--	**100**
135D01E102	Cybersecurity	--	50		50	--	--	--	**100**
135D01T101	Intellectual Property Rights and infringement protection	--	50	--	--	--	--	--	**50**
	Total	--	**250**	**100**	**50**	-	-	-	**400**

*Common to all

^NPTEL course with in-house monitoring and research article discussion

Semester I

Course Code	Course Title			
135D01C101	Research Methodology			
	TH	P	TUT	Total
Teaching Scheme (Hrs.)	02	--	02	04
Credits Assigned	02	--	02	04
Examination Scheme	Marks			
	IA	ESE	Total	
	50	50	100	

Course Objectives:

In this course the student will become acquainted with research methodologies such as survey and field research, questionnaire design, content analysis, analysis of existing data, focus group, individual and group observation (including participatory observation) etc. The course will also introduce students to the safeguards against errors in both data collection and data analysis and reporting.

Course Outcomes

At the end of successful completion of the course the student will be able to

CO 1. Develop an understanding of introduction to research
CO 2. Understand about Formulation of Research Problem and Research design
CO 3. Develop the Data Analysis and interpretation.
CO 4. Understand about importance of reporting results and publications

Module No.	Unit No.	Topics	Hrs.
1		**Fundamentals of research**	**05**
	1.1	Definition of research	
	1.2	Types of Research	
	1.3	Process of Research	
2		**Formulation of the Research Problem and Development of the research Hypothesis**	**10**
	2.1	The Scientific thought	
	2.2	Defining the Research problem	
	2.3	Formulation of the research Hypothesis	
3		**Research Design**	**10**
	3.1	Formulation of the Research Designs	
	3.2	The nature of research Design	
	3.3	Exploratory research Design	
	3.4	Descriptive research Design	
4		**Data Collection, Measurement and Scaling**	**10**
	4.1	Secondary Data Collection Methods	
	4.2	Qualitative Methods of Data Collection	
	4.3	Attitude Measurement and scaling	
	4.4	Questionnaire Designing	
5		**Respondent Section and Data Preparation**	**05**
	5.1	Sampling Techniques	
	5.2	Data Processing	
6		**Preliminary Data Analysis and Interpretation**	**10**
	6.1	Univariate & Bivariate Data Analysis	
	6.2	Testing of Hypothesis	
	6.3	Analysis of Variance Technique	
	6.4	Non-parametric Test	
7		**Reporting Research Results**	**10**
	7.1	Report Writing	
	7.2	Presentation of Research	
	7.3	Preparing Final Thesis	
		$Total	**60**

$The no of hours includes the theory and tutorial sessions

Recommended Books

Sr. No.	Name/s of Author/s	Title of Book	Name of Publisher with country	Edition and Year of Publication
1	William G. Zikmund, Barry J. Babin, Jon C. Carr, Atanu Adhikari, Mitch Griffin	Business Research Methods	Cengage Learning	8th Edition
2	Donald R. Cooper, Pamela S. Schindler, J K Sharma	Business Research Methods	McGraw Hill Education	12th Edition

3.	Wayne C. Booth ,Gregory Colomb ,Joseph M. Williams ,William Fitzgerald	The Craft of Research	Chicago Guides to Writing, Editing and Publishing	4th Edition
4.	Naresh K Malhotra, Satyabhushan Dash	Marketing Research: An Applied Orientation	Pearson	7th Edition

Course Code	Course Title			
135D01C102	#Research and Publication Ethics			
	TH	P	TUT	Total
Teaching Scheme (Hrs.)	02	--	--	02
Credits Assigned	02	--	--	02
Examination Scheme	Marks			
	IA	ESE	Total	
	50	--	50	

#Syllabus as per UGC guidelines

Course Outcomes

At the end of successful completion of the course the student will be able to

CO 1. Develop an understanding of philosophy of science and ethics
CO 2. Understand about research ethics and publication ethics
CO 3. Identify predatory journals and frauds in research
CO 4. Develop the competencies to use plagiarism software's
CO 5. Understand about indexing and citation databases
CO 6. Gain understanding about open access publications

Module No.	Unit No.	Topics	Hrs.
1	**Philosophy and Ethics, Scientific conduct and Publications Ethics**		**15**
	1.1	Introduction to philosophy: definition, nature and scope, concept and branches	
	1.2	Ethics- definition, moral philosophy, nature of moral judgements and reactions.	
	1.3	Ethics with respect to science or research.	
	1.4	Intellectual Honesty and Research integrity	
	1.5	Scientific misconducts: Falsifications, Fabrications and Plagiarism (FFP)	
	1.6	Selective reporting and misrepresentation of data. Redundant Publications: duplicate and overlapping publications, salami slicing. Publication ethics- definition, importance	
	1.7	Best practices / standards setting initiatives and guidelines: COPE, WAME etc.	
	1.8	Conflict of interest. Publication misconduct: definition concept, problems that lead to unethical behavior and vice versa. Violation of Publication ethics, authorship and contributor ship. Identification of publication misconduct, complaints and appeals.	
	1.9	Predatory publishers and journals	
2		**Open Access Publishing**	**15**
	2.1	Open access publications and initiatives	
	2.2	SHERPA/RoMEO online resource to check publisher copyright and self-archiving policies	
	2.3	Software tool to identify predatory publications developed by SPPU	
	2.4	Journal finder /journal suggestion tools viz JANE, Elsevier Journal Finder, Springer Journal Suggester	
	2.5	Subject specific ethical issues, FFP authorship. Complaints and appeals: examples and Fraud from India and Aboard. Use of plagiarism software like Turnitin, Urkund and other open source software tools	
	2.6	Databases- Indexing databases, citation databases: Web of Sciences, Scopus etc.	
	2.7	Research metrics- Impact factor of journal as per Citation Report, SNIP, SJR, IPP, Cite Score. Metrics: h index, g index, i10 index, almetrics	
		Total	**30**

Recommended Books

Sr. No.	Name/s of Author/s	Title of Book	Name of Publisher with country	Edition and Year of Publication
1	Adil E. Shamoo; David B. Resnik	*Responsible Conduct of Research, 2003*	Oxford University Press	2003
2	Amit Ghosh Ashok, Kambadur Muralidhar, Kumar Singhvi	*Ethics in Science education Research and Governance*	Indian National Science Academy, ISBN: 978-81-939482-1-7	2019
3	Anderson B.H., Dursaton, and Poole M	*Thesis and assignment writing*	Wiley Eastern	1997
4	Bijorn Gustavii:	*How to write and illustrate Scientific papers?*	Cambridge University Press	1990
5	Bird, A	*Philosophy of Science*	Routledge	2006
6	Borg, B. L.	*Qualitative Research Methods*	Boston: Pearson.	2004
7	MacInytre, A	*A short history of Ethics*	London	1967
8	Nicholas H. Steneck	*Introduction to the Responsible Conduct of Research. Office of Research Integrity. 2007*	https://ori.hhs.gov/sites/default/files/rcrintro.pdf	2007

Course Code	Course Title			
135D01E101	Machine Learning			
	TH	P	TUT	Total
Teaching Scheme (Hrs.)	02	01	00	03
Credits Assigned	02	01	00	03
Examination Scheme	Marks			
	IA	TW	Total	
	50	50	100	

Course Objectives:

This course intents to develop a comprehensive understanding of core concepts of machine learning and its various types. This Course even develop proficiency in data preprocessing and exploration techniques, including data cleaning, transformation and feature selection, and engineering. This course will help in gaining hands-on experience in applying machine learning and AI techniques to real-world problems, culminating in a final project that showcases practical skills and knowledge.

Course Outcomes

At the end of successful completion of the course the student will be able to

CO1. Demonstrate proficiency in advanced machine learning techniques, including deep neural networks, natural language processing, and reinforcement learning, and apply these methods to solve complex problems in diverse domains.

CO2: Evaluate and apply ethical principles in AI development and deployment, recognizing and mitigating bias, ensuring fairness, and promoting responsible AI practices in both research and industry contexts.

CO3: Independently conceive, design, and execute a machine learning or AI project, applying advanced methodologies to address real-world challenges, and effectively communicate the results through a final project presentation and documentation.

Module No.	Unit No.	Topics	Hrs.
1	**Introduction to Machine Learning**		10
	1.1	Introducing Machine Learning	
	1.2	Types of Machine Learning (Supervised, Unsupervised, Reinforcement)	
	1.3	Data Preprocessing and Exploration	
	1.4	Data Cleaning and Transformation	
	1.5	Feature Selection and Engineering	
	1.6	Evaluation Metrics (Accuracy, Precision, Recall, F1 Score)	
2	**Supervised Learning**		
	2.1	Linear Regression, Logistic Regression	13
	2.2	Decision Trees	
	2.3	Boosting Techniques	
	2.4	Support Vector Machines	
	2.5	k-Nearest Neighbors	
	2.6	Ensemble Learning (Boosting, Bagging), Random Forests	
3	**Unsupervised Learning and Neural Networks**		
	3.1	Clustering (K-Means, Hierarchical, DBSCAN)	12
	3.2	Dimensionality Reduction-Principal Component Analysis (PCA)	
	3.3	Introduction to Neural Networks	
	3.4	Feedforward Neural Networks, Backpropagation	
	3.5	Activation Functions, Convolutional Neural Networks (CNNs)	
	3.6	Sequence-to-sequence models and recurrent neural networks (RNNs).	
4	**Model Evaluation and Advanced Topics**		
	4.1	Model Evaluation and Validation	10
	4.2	Cross-Validation, Overfitting and Underfitting	
	4.3	Bias-Variance Tradeoff	
	4.4	Hyperparameter Tuning	
	4.5	Ethics and Bias in Machine Learning	
	TOTAL		**45**

Recommended Books

Sr. No.	Name/s of Author/s	Title of Book	Name of Publisher with country	Edition and Year of Publication
1	*Andriy Burkov Publishing, Canada*	*The Hundred-Page Machine Learning Book*	*Andriy Burkov Publishing, Canad*	*1st Edition, 2019*
2	*Aurelien Geron*	*Hands-On Machine Learning with Scikit-Learn, Keras, and TensorFlow*	*O'Reilly Media, USA*	*2nd Edition, 2019*
3	Oliver Theobald	Machine Learning For Absolute Beginners	Scatterplot Press, USA	3rd Edition, 2021
4	Laurent Younes	Introduction to Machine Learning	arXiv.org	1st Edition, 2024
5	Stuart J. Russell and Peter Norvig	Artificial Intelligence: A Modern Approach	Pearson, USA	4th Edition, 2020

Course Code	Course Title			
135D01E102	Cybersecurity			
	TH	P	TUT	Total
Teaching Scheme (Hrs.)	03	--	--	03
Credits Assigned	03	--	--	03
Examination Scheme	Marks			
	IA	ESE	Total	
	50	50	100	

Course Objectives:

- Understand the fundamentals of cybersecurity, including key concepts, threats, and defensive measures, to establish a strong foundation in cybersecurity principles.
- Explore advanced topics in machine learning and artificial intelligence, including neural networks, dimensionality reduction, and ethical considerations, to prepare students for AI-driven security challenges.
- Develop practical skills in both cybersecurity and machine learning through hands-on exercises, ethical hacking, and model evaluation, enabling students to apply knowledge effectively.

Course Outcomes

At the end of successful completion of the course the student will be able to

CO1: Demonstrate a comprehensive understanding of cybersecurity principles, including key concepts, historical context, network security, and common threats, to assess and implement security measures effectively.

CO2: Apply advanced machine learning techniques, such as neural networks, clustering, and dimensionality reduction, to solve complex problems and enhance cybersecurity practices, while being aware of ethical and bias-related considerations.

CO3: Engage in hands-on activities, including ethical hacking and penetration testing, to evaluate system vulnerabilities, formulate incident responses, and implement security best practices in real-world scenarios.

CO4: Evaluate and validate machine learning models, mitigate overfitting and underfitting, and fine-tune hyperparameters, demonstrating the ability to build and deploy AI systems while addressing ethical concerns and bias in machine learning applications.

Module No.	Unit No.	Topics	Hrs.
1	**Introduction to Cybersecurity**		
	1.1	Understanding Cybersecurity: Definitions and Importance	**10**
	1.2	Historical Overview and Evolution of Cyber Threats	
	1.3	Key Cybersecurity Concepts: Confidentiality, Integrity, Availability (CIA Triad)	
	1.4	Cybersecurity Threat Actors and Motivations	
	1.5	Network Security Basics	
2	**Ethical Hacking and Threat Detection**		
	2.1	Firewalls and Intrusion Detection Systems	**08**
	2.2	Secure Network Protocols	
	2.3	Common Network Attacks and Mitigation Strategies	
	2.4	Operating System Security	
	2.5	User Authentication and Access Control	
	2.6	Malware Types and Prevention	
	2.7	Security Policies and Procedures	
3	**Advanced Cybersecurity Topics**		
	3.1	Cryptography: Principles and Applications	
	3.2	Public Key Infrastructure (PKI)	**14**
	3.3	Virtual Private Networks (VPNs)	
	3.4	Security Assessment Tools and Scanning	
	3.5	Security in the Cloud	
	3.6	Cloud Security Models (IaaS, PaaS, SaaS)	
	3.7	Cloud Security Best Practices	
4	**Cybersecurity Defense and Future Trends**		
	4.1	Blockchain-Based Security	**13**
	4.2	Incident Response and Handling	
	4.3	Cyber Threat Intelligence	
	4.4	Ethical Hacking and Penetration Testing	
	4.5	Security Best Practices and Future Trends	
	TOTAL		**45**

Recommended Books

Sr. No.	Name/s of Author/s	Title of Book	Name of Publisher with country	Edition and Year of Publication
1	*Shawn Walker*	*The Cybersecurity Bible*	*Independently Published, USA*	*1st Edition, 2023*
2	*Peter H. Gregory*	*CISSP For Dummies*	*John Wiley & Sons, USA*	*8th Edition, 2024*
3	*Scott J. Shapiro*	*Fancy Bear Goes Phishing: The Dark History of the Information Age, in Five Extraordinary Hacks*	*Farrar, Straus and Giroux, USA*	*1st Edition, 2023*
5	*Jaydip Sen et al.*	*Information Security and Privacy in the Digital World: Some Selected Topics*	*arXiv.org*	*1st Edition, 2024*
6	*Joseph Steinberg*	*Cybersecurity All-in-One For Dummies*	*John Wiley & Sons, USA*	*1st Edition, 2019*

Course Code	Course Title			
135D01T101	Intellectual Property Rights and Infringement Protection			
	TH	P	TUT	Total
Teaching Scheme (Hrs.)	--	--	02	02
Credits Assigned	--	--	02	02
Examination Scheme	Marks			
	IA	ESE	Total	
	50	--	50	

Course Objectives:

Completion of the course will enable students to understand the legalities and take necessary actions to protect their research outcome through copyright, patents, designs and trademarks depending on the nature of invention/findings

Course Outcomes

At the end of successful completion of the course the student will be able to

CO1. Understand the Concept of Intellectual Property.
CO2. Identify what is Patentable and not Patentable in India and abroad.
CO3. Understand the various steps in the journey of patenting-From drafting to filing to the grant.
CO4. Appreciate the advanced aspects of patent landscaping.
CO5. Beware of the legal complications of patent infringement.

Module No.	Unit No.	Topics	Hrs.
1	**Concept of Intellectual Property**		**12**
	1.1	Concept of Intellectual Property and its Types-Patent, Trademark, Copyright, Trade secret, Industrial Design and Geographical Indications	
	1.2	Patentability Criteria for invention: Non-Obviousness, Inventive step, Industrial Application. Enablement Requirement	
	1.3	Patentable and Non-Patentable Inventions. Patentability of Life Forms	
	1.4	Plant varieties protection: objectives, justification, plant varieties protection in India	
	1.5	TRIPS, GATT, WTO, PCT, BUDAPEST treaty, Madrid Agreement and WIPO-A brief overview	
2	**Processing of Indian Patent Application**		
	2.1	Preparing a patent application, Types of Patent Application, Documents necessary for patent application, Rules regarding fees and the requisite Forms, Patent Specifications and Claims	**8**
	2.2	Publication, Patent Examination and Grant. Exercise: 1. Navigating through the Indian Patent Office Website 2. Prior art Search: Google Patents website	
	2.3	Global Scenario in Patenting: USPTO, EPO, JPO, AUSPAT, CNIPA.	
3	**Advances in IPR and Patent Infringement**		
	3.1	Pat-informatics -Patent Landscape	**10**
	3.2	Patent thickets and Patent clusters	
	3.3	Ethics in Patenting; IPR Protection and Patent Infringement and consequences.	
	3.4	Case studies: Disputes in Pharma patents	
	3.5	Traditional knowledge: objective, concept of traditional knowledge, knowledge digital library Case study related to basmati rice/Neem/Turmeric	
	TOTAL		**30**

Recommended Books

Sr. No.	Name/s of Author/s	Title of Book	Name of Publisher with country	Edition and Year of Publication
1	Wadhera B. L.	*Laws relating to Patent, Trademarks, copyright and Designs*	Universal Law Publishing Company Pvt.Ltd, New Delhi.	1999
2	Narayanan P.	*Intellectual Property Law*	Swamy Publishers - Central Government Books & Forms ... Brand: Eastern Law House; Edition: 3 Ed Second Impression (Revised)	2018
3	Useful Websites:	I. Cell for IPR Promotion and Management (http://cipam.gov.in/) II. World Intellectual Property Organization (https://www.wipo.int/about-ip/en/) III. Office of the Controller General of Patents, Designs & Trademarks		
4	Reference Journal:	Journal of Intellectual Property Rights (JIPR): NISCAIR		

Semester II
Credit Scheme

Course Code	Course Name	Teaching Scheme (Hrs.) Per Week TH – P – TUT	Total (Hrs.) Per week	Credits Assigned TH – P – TUT	Total Credits
135D01E201	^ Biostatistics and Design of Experiments	3 – 0 – 0	3	3 – 0 – 0	**3**
135D01S201	**Research Management	0 – 0 – 0	0	0 – 0 – 0	**5**
	Total	3 – 0 – 0	3	3 – 0 – 0	**8**

^NPTEL course with in-house monitoring and research article discussion.
**Will include seminar/workshop/lecture/expert guidance on research proposal writing/journal club/research review drafting/research communication.

Examination Scheme

Course Code	Course Name	Examination Scheme							
		Marks							
		CA							
		ISE	IA	ESE	TW	O	P	P&O	Total
135D01E201	^ Biostatistics and Design of Experiments	--	50	--	--	--	--	--	**50**
135D01S201	**Research Management	--	--	--	50	50	--	--	**100**
	Total	--	50	--	50	50	--	--	**150**

^NPTEL
**Will include seminar/workshop/lecture/expert guidance on research proposal writing/journal club/research review drafting/research communication.

Details of PhD Coordinator

School Code	School / Institute Name	Name of PhD	Email ID
44	S K Somaiya College (SSBAS)	Dr. Nilesh Wagh	nilesh.wagh@somaiya.edu
Common Email ID			svu.phdcoordinators@somaiya.edu

Course Code	Course Title			
135D01E201	Biostatistics and Design of Experiments			
	TH	P	TUT	Total
Teaching Scheme (Hrs.)	03	--	--	03
Credits Assigned	03	--	--	03
Examination Scheme	Marks			
	IA	ESE	Total	
	50	--	50	

Course Objectives:

In this course, students will learn importance of experimental data, data size, parameters and its selection and various statistical techniques of data interpretation. This basic knowledge will assist the students to apply statistical theory to real-world problems; design of experiments consisting multiple parameters; elucidate and validate the significance of research

Course Outcomes

At the end of successful completion of the course the student will be able to

CO1. Understand biostatistics and modes of implementation

CO2. Ability to design experiments considering multiple parameters and sample sizes

CO3. Decide on the best statistical tool or method to evaluate and interpret hypothesis/result.

Module No.	Unit No.	Topics	Hrs.
1	**Basics of Statistics**		**05**
	1.1	Measure of Central Tendency: Arithmetic Mean, Geometric Mean, Median, Mode, Measures of Dispersion: Range, Variance, Standard deviation, Mean deviation, Quartile deviation	
	1.2	Coefficient of Range, Standard deviation, Quartile deviation, Mean deviation, Correlation & Types of correlation, Scatter Diagram	
2	**Correlation & Regression**		
	2.1	Experimental design strategy, Data types/Binomial Distribution, Poisson Distribution, Normal Distribution	**20**
	2.2	Standardized Normal Distribution/ T distribution/confidence interval, Statistical tests	
	2.3	T-Tests , Annova, Normality Test/odds ratio/C2 distribution/test	
3	**Statistical Inference**		
	3.1	Weibull distribution, Nonparametric tests/Homogeneity of variance/Beta distribution, Exponential / Hypergeometric distribution/Log normal distributions,	**20**
	3.2	Design of Experiments (DOE), Factorial design, Full Factorial design, Fractional Factorial design, Second order design, Regression Analysis Control Charts	
	3.3	Chi-Square test; Mann- Whitney test; Wilcoxon Sign rank test, Kruskal Wallis test	
	TOTAL		**45**

Recommended Books

Sr. No.	Name/s of Author/s	Title of Book	Name of Publisher with country	Edition and Year of Publication
1	Dutta, N. K	*Fundamentals of Biostatistics*	Kanishka Publishers	2004
2	Rosner, B	*Fundamentals of Biostatistics-*	Brooks Cole Publishers	2015
3	Gurumani N	*An Introduction to Biostatistics*	MJP Publishers	2005
4	Daniel, W. W.	*Biostatistics- A Foundation for Analysis in the Health Sciences*	Wiley	2007
5	Rao, K. V.	*Biostatistics – A Manual of Statistical Methods for use in Health Nutrition and Anthropology*	Jaypee	2007
6	Pagano, M.& Gauvreau, K.	*Principles of Biostatistics*	CRC Press	2007
7	Rohatgi, V. K. & Saleh, A. K. Md.	*An Introduction to Probability and Statistics*	John Wiley & Sons	2001
8	Sundaram, K. R.	*Medical Statistics-Principles & Methods*	BI Publications, New Delhi.	2010