

Revised Course / Curriculum / Syllabus in compliance of NEP-2020

B. S. in Economics

Program Learning Objectives	Program Learning Outcomes
The program will prepare graduates to: - Understand the economic way of thinking, by which we mean the rational and purposeful utility maximizing choices made by individual agents, with the understanding of the trade-offs and opportunity costs such choices involve. - The ability to parsimoniously and formally model economic decisions. - Demonstrate logical and critical reasoning abilities in various domains of economics, social and ethical impacts of economic interventions along with policy analysis and its role in priority setting to undertake upliftment and betterment of the society at large. - The ability to analyze historical and current events from an economic perspective. - The ability to analyze, interpret and present economic data. - The ability to write clearly expressing an economic point of view. - Be exposed to alternative approaches to economic problems through exposure to course work in allied fields.	- Utilize microeconomic and macroeconomic theory to analyze a specific economic scenario. - Utilize data to gain insight into a specific economic relationship. - Critically evaluate the relationship between the structure and operation of markets, institutions and the economy. - Apply microeconomic theory to produce a written assessment of the industrial structure, firm behaviour, and economic performance of a specific industry. - Formulate an economic research question and produce a review of the relevant scholarly economic literature as part of an independent research project. - Communicate effectively on complex economic activities and solutions towards the development of a better society. - Apply ethical practices in their personal and professional roles with defined norms to achieve egalitarian philosophy.

Sl. No.	Subject Code	SEMESTER I	L	T	P	C
1.	MA1101	Calculus and Linear Algebra	3	1	0	4.0
2.	CS1101	Foundations of Programming	3	0	3	4.5
3.	PH1101/ PH1201	Physics	3	1	3	5.5
4.	CE1101/ CE1201	Engineering Graphics	1	0	3	2.5
5.	EE1101/ EE1201	Electrical Sciences	3	0	3	4.5
6.	HS1101	English for Professionals	2	0	1	2.5
TOTAL			15	2	13	23.5

Sl. No.	Subject Code	SEMESTER II	L	T	P	C
1.	MA1201	Probability Theory and Ordinary Differential Equations	3	1	0	4
2.	CS1201	Data Structure	3	0	3	4.5
3.	CH1201/ CH1101	Chemistry	3	1	3	5.5
4.	ME1201/ ME1101	Mechanical Fabrication	0	0	3	1.5
5.	ME1202/ ME1102	Engineering Mechanics	3	1	0	4
6.	IK1201	Indian Knowledge System (IKS)	3	0	0	3
TOTAL			15	3	9	22.5

SEMESTER III						
Sl. No.	Course Number	Course Title	L	T	P	C
1.	HS2101	Mathematical Statistics	3	1	0	4
2.	HS2102	Fundamentals of Economics	3	1	0	4
3.	HS2103	Multivariate Analysis and Basic Econometrics	3	0	0	3
4.	HS2104	History of Economic Thought	3	0	0	3
5.	HS2105/ MA2102	Probability and Stochastic Processes	3	1	0	4
6.	HS21PQ	HSS Elective - I	3	0	0	3
TOTAL			18	3	0	21

SEMESTER IV						
Sl. No.	Course Number	Course Title	L	T	P	C
1.	HS2201	Growth and Development	3	1	0	4
2.	HS2202	Microeconomic Theory	3	1	0	4
3.	HS2203	Macroeconomic Theory	3	1	0	4
4.	HS2204	Econometrics-I	3	1	0	4
5.	XX22PQ	IDE-I	3	0	0	3
TOTAL			15	4	0	19

SEMESTER V						
Sl. No.	Course Number	Course Title	L	T	P	C
1.	HS3101	Econometrics – II	3	1	2	5
2.	HS3102	Mathematical Economics	3	1	0	4
3.	HS3103	International Trade and Investment	3	1	0	4
4.	HS3104	Debate in Indian Economy	3	1	0	4
5.	XX31PQ	IDE-II	3	0	0	3
TOTAL			15	4	2	20

SEMESTER VI						
Sl. No.	Course Number	Course Title	L	T	P	C
1.	HS3201	Categorical Data Analysis	3	1	2	5
2.	HS3202	Environmental Economics	3	1	0	4
3.	HS3203	Critical Economic Reading and Seminar	3	3	0	6
4.	HS3204	Indian Financial System	3	1	0	4
5.	HS3205	Health Economics	3	0	0	3
TOTAL			15	6	2	22

SEMESTER VII						
Sl. No.	Course Number	Course Title	L	T	P	C
1.	HS41XX	Specialization Elective 1	3	1	0	4
2.	HS41XX	Specialization Elective 2	3	1	0	4
3.	HS41XX	HSS Elective - II	3	0	0	3
4.	XX41PQ	IDE-III	3	0	0	3
5.	HS4198	Summer Internship*	0	0	12	3
6.	HS4199	Project-I (Lab based project / Industry oriented problem solving/ Academic internship / Case Study/Design thinking-based project- Capstone Project)	0	0	12	6
TOTAL			12	2	24	23

*** For specific cases of internship after 6th Semester, the performance evaluation would be made on joining the VIIth Semester and graded accordingly in the VIIth Semester:**

Note :

a) (i) Summer internship (*) period of at least 60 days' (8 weeks) duration begins in the intervening vacation between semester VI and VII that may be done in industry / R&D / Academic Institutions including IIT Patna. The evaluation would comprise **combined grading based on host supervisor evaluation, project internship report after plagiarism check and seminar presentation at the Department (DAPC to coordinate)** with equal weightage of each of the three components stated herein.

a) (ii) Further, on return from internship, students will be evaluated for internship work through combined grading based on host supervisor evaluation, project internship report after plagiarism check, and presentation evaluation by the parent department with equal weightage of each component.

b) (i) In the VIIth semester, students can opt for a semester long internship on recommendation of the DAPC and approval of the Competent Authority.

b) (ii) On approval of semester long internship, at the maximum two courses (properly mapped/aligned syllabus) at par with institute electives may be opted from NPTEL and / or SWAYAM and the other two more should be done at the institute through course overloading in

any other semester (either before or after the internship) and/or during following summer semester.

b) (iii) The candidates opting two courses from NPTEL and / or SWAYAM would be required to appear in the examination at the Institute as scheduled in the Academic Calendar.

SEMESTER VIII						
Sl. No.	Course Number	Course Title	L	T	P	C
1	HS42XX	Specialization Elective 3	3	1	0	4
2	HS42XX	Specialization Elective 4	3	1	0	4
3	HS4299	Project-II (Lab based project / Industry oriented problem solving / Academic internship / Case Study / Design thinking-based project-Capstone Project)	0	0	16	8
		TOTAL	6	2	16	16
TOTAL CREDIT						167

ELECTIVE GROUPS

(List of HSS Electives for all approved B. Tech. / BS Program of the Institute:)

HSS Elective-I						
Sl. No.	Subject Code	Course	L	T	P	C
1.	HS2106	Literature: Voices and Culture	3	0	0	3
2.	HS2107	Diasporic Literature from South Asia	3	0	0	3
3.	HS2108	Soft Skills	3	0	0	3
4.	HS2109	Feminist Writing in India	3	0	0	3
5.	HS2110	Language Human Mind and Indian Society	3	0	0	3
6.	HS2111	Introductory Sociology	3	0	0	3
7.	HS2112	Introduction to Demography	3	0	0	3
8.	HS2113	Fundamentals of Management	3	0	0	3
9.	HS2114	Data Science (<i>Pre-requisite IIM Mumbai</i>)	3	0	0	3
10.	HS2115	Introductory Microeconomics (<i>Pre-requisite IIM Mumbai</i>)	3	0	0	3
11.	HS2116	International Economics	3	0	0	3
HSS Elective-II						
1.	HS4114	IPR: Introduction, Application and Protection	2	0	2	3
2.	HS4115	3Ls: Leadership, Literature and Life	3	0	0	3
3.	HS4116	Gender in Indian Cinema	3	0	0	3
4.	HS4117	Media and Linguistics	3	0	0	3
5.	HS4118	Sociology of Development	3	0	0	3
6.	HS4119	Industrial Psychology (<i>Pre-requisite IIM Mumbai</i>)	3	0	0	3
7.	HS4120	Business Ethics	3	0	0	3

Interdisciplinary Elective (IDE) Course for B.Tech. (Available to students other than Dept. of HSS)

Sl. No.	Subject Code	Subject Name	L	T	P	C
IDE-I						
1.	HS2205	Science, Technology and Society	3	0	0	3
2.	HS2206	Healthcare Management	3	0	0	3
3.	HS2207	Entrepreneurship	3	0	0	3
4.	HS2208	Operations Management (<i>Pre-requisite IIM Mumbai</i>)	3	0	0	3
5.	HS2209	People Management (<i>Pre-requisite IIM Mumbai</i>)	3	0	0	3
IDE-II						
1.	HS3105	Gender and Women's Studies: An Introduction	3	0	0	3
2.	HS3106	Fundamentals of Speech Acoustics	3	0	0	3
3.	HS3107	Globalization and Social Change	3	0	0	3
4.	HS3108	Innovation and Entrepreneurship (<i>Pre-requisite IIM Mumbai</i>)	3	0	0	3
5.	HS3109	Financial Economics	3	0	0	3
6.	HS3110	Development Economics	3	0	0	3
IDE-III						
1.	HS4121	Critical and Creative Writing	3	0	0	3
2.	HS4122	Forensic Linguistics	3	0	0	3
3.	HS4123	Supply Chain Management (<i>Pre-requisite IIM Mumbai</i>)	3	0	0	3

List of Elective for Semester VII and VIII:

The students of B. S. Economics have the flexibility of acquiring specialized skill through three different tracks of specialized course structure noted below under different specializations comprising Economic Theories, Finance & Risk Management and Data Analytics. Students will be required to choose at least 4 courses. To have a specialization in any one area, all the four courses **must be** from one specific track only.

Specialization 1: Economic Theories						
Sl. No.	Subject Code	Course	L	T	P	C
Semester-VII						
1.	HS4101	Game Theory	3	1	0	4
2.	HS4102	Energy Economics	3	1	0	4

3.	HS4103	Labour Economics	3	1	0	4
4.	HS4104	Business Law and Economics	3	1	0	4
5.	HS4105	Advanced Macroeconomics	3	1	0	4
Semester-VIII						
6.	HS4201	Institutional Economics	3	1	0	4
7.	HS4202	Public Finance and Policy	3	1	0	4
8.	HS4203	Agrarian Economics	3	1	0	4
9.	HS4204	Political Economy and Development	3	1	0	4
10.	HS4205	Mechanism Design	3	1	0	4
Specialization 2: Finance and Risk Management						
Sl. No.	Subject Code	Course	L	T	P	C
Semester-VII						
1.	HS4106	Financial Analytics	3	1	0	4
2.	HS4107	Behavioural Economics and Finance	3	1	0	4
3.	HS4108	Programming/ Coding	3	1	0	4
4.	HS4109	Corporate Finance	3	1	0	4
Semester-VIII						
5.	HS4206	Financial Markets and Derivatives	3	1	0	4
6.	HS4207	Wealth Management	3	1	0	4

Specialization 3: Data Analytics						
Sl. No.	Subject Code	Course	L	T	P	C
Semester-VII						
1.	HS4106	Financial Analytics	3	1	0	4
2.	HS4110	Programming/ Coding	3	1	0	4
3.	HS4111	HR Analytics	3	1	0	4
4.	HS4112	Big Data Analytics	3	1	0	4
Semester-VIII						
5.	HS4208	Artificial Intelligence	3	1	0	4
6.	HS4209	Statistical Decision Theory	3	1	0	4
7.	HS4210	Algorithm with Lab	3	1	0	4
8.	HS4211	Machine Learning and DS	3	1	0	4

Minor in Business Studies: (Only open to B. Tech. / BS-MBA Dual Degree)

Sl. No.	Subject Code	Course Title	L	T	P	C
1.	HS2101	Mathematical Statistics (<i>Pre-requisite IIM Mumbai</i>)	3	1	0	4
2.	HS2209	People Management (<i>Pre-requisite IIM Mumbai</i>)	2	1	0	3
3.	HS3102	Mathematical Economics (<i>Pre-requisite IIM Mumbai</i>)	3	1	0	4

4.	HS3202	Environmental Economics (<i>Pre-requisite IIM Mumbai</i>)	3	1	0	4
5.	HS4109	Corporate Finance (<i>Pre-requisite IIM Mumbai</i>)	3	1	0	4
TOTAL			14	5	0	19

Minor in Financial Analytics:

Sl. No.	Subject Code	Course Title	L	T	P	C
1.	HS2204	Econometrics-I	3	1	0	4
2.	HS3101	Econometrics-II	3	1	2	5
3.	HS3204	Indian Financial System	3	1	0	4
4.	HS4106	Financial Analytics	3	1	0	4
TOTAL			12	4	2	17

Sl. No.	Subject Code	SEMESTER I	L	T	P	C
1.	MA1101	Calculus and Linear Algebra	3	1	0	4.0
2.	CS1101	Foundations of Programming	3	0	3	4.5
3.	PH1101/PH1201	Physics	3	1	3	5.5
4.	CE1101/CE1201	Engineering Graphics	1	0	3	2.5
5.	EE1101/EE1201	Electrical Sciences	3	0	3	4.5
6.	HS1101	English for Professionals	2	0	1	2.5
TOTAL			15	2	13	23.5

Course Number	MA1101
Course Credit (L-T-P-C)	3-1-0-4
Course Title	Calculus and Linear Algebra
Learning Mode	Lectures and Tutorials
Learning Objectives	To provide the essential knowledge of basic tools of Differential Calculus, Integral Calculus, Vector spaces and Matrix Algebra.
Course Description	This course provides a foundation for Calculus and Linear Algebra. Topics related to properties of single and two variable functions along with their applications will be discussed. In addition fundamentals of linear algebra and matrix theory with applications will also be discussed.
Course Content	Differential Calculus (12 Lectures): Limit and continuity of one variable function (including ε-δ definition). Limit, continuity and differentiability of functions of two variables, Tangent plane and normal, Change of variables, chain rule, Jacobians, Taylor's Theorem for two variables, Extrema of functions of two or more variables, Lagrange's method of undetermined multipliers. Integral Calculus (10 Lectures): Riemann integral for one variable functions, Double and Triple integrals, Change of order of integration. Change of variables, Applications of Multiple integrals such as surface area and volume. Vector Spaces (12 Lectures): Vector spaces (over the field of real numbers), subspaces, spanning set, linear independence, basis and dimension. Linear transformations, range and null space, rank-nullity theorem, matrix of a linear transformation. Matrix Algebra (8 Lectures): Elementary operations and their use in getting the rank, inverse of a matrix and solution of linear simultaneous equations, Orthogonal, symmetric, skew-symmetric, Hermitian, skew-Hermitian, normal and unitary matrices and their elementary properties, Eigenvalues and Eigenvectors of a matrix, Cayley-Hamilton theorem, Diagonalization of a matrix.
Learning Outcome	Students completing this course will be able to: 1. Understand various properties of functions such as limit, continuity and differentiability. 2. Learn about integrations in various dimension and their applications. 3. learn about the concept of basis and dimension of a vector space. 4. define Linear Transformations and compute the domain, range, kernel, rank, and nullity of a linear transformation. 5. compute the inverse of an invertible matrix. 6. solve the system of linear equations. 7. Apply linear algebra concepts to model, solve, and analyze real-world problems.
Assessment Method	Quiz /Assignment/ MSE / ESE

Textbooks:

1. Thomas, G. B., Hass, J., Heil, C. and Weir M. D., "Thomas' Calculus", 14th Ed., Pearson Education, 2018
2. Kreyszig, E., "Advanced Engineering Mathematics", 10th Ed., Wiley India Pvt. Ltd, 2015

Reference Books:

1. Jain, R. K. and Iyenger, S. R. K., "Advanced Engineering Mathematics", 5th Ed., Narosa Publishing House, 2017
2. Axler, S., "Linear Algebra Done Right", 3rd Ed., Springer Nature, 2015
3. Strang, G., "Linear Algebra and Its Applications" 4th Ed., Cengage India Private Limited, 2005

Course Number	CS1101
Course Credit	3-0-3-4.5
Course Title	Foundations of Programming
Learning Mode	Offline
Learning Objectives	• To understand the fundamental concepts of programming • To develop the basic problem-solving skills by designing algorithms and implementing them. • To learn about various data types, control statements, functions, arrays, pointers, and file handling. • To achieve proficiency in debugging and testing a C program
Course Description	This introductory course provides a solid foundation in programming principles and techniques. Designed for students with little to no prior programming experience, it covers fundamental concepts such as variables, data types, control structures, functions, and basic data structures. Students will learn to write, debug, and execute programs using a high-level programming language. Emphasis is placed on developing problem-solving skills, logical thinking, and the ability to write clear and efficient code. By the end of the course, students will be equipped with the essential skills needed to pursue more advanced studies in computer science and software development.
Course Outline	Introduction and Programming basics, Expressions Control and Iterative statements, Functions, Arrays, Recursion vs. Iteration Pointers, 2D-Array with pointers, Structures, String, Dynamic memory allocation, File handling, Contemporary programming languages, and applications Practical component: Lab to be conducted on a 3-hour slot weekly. It will be conducted with the theory course so the topics for problems given in the lab are already initiated in the theory class.
Learning Outcome	• Understanding of Basic Syntax and Structure in C language • Proficiency in Data Types, Operators, and Control Structures • Function Implementation and learn to use them appropriately • Efficient Use of Arrays and Strings • Pointer Utilization • Ability to perform dynamic memory allocation and deallocation using malloc (), calloc (), realloc (), and free () functions. • Structured data management with structures and unions • Exposure of file Handling • Learning debugging and error Handling
Assessment Method	Internal (Quiz/Assignment/Project), Mid-Term, End-Term

Suggested Reading

- Knuth, Donald E. The art of computer programming, volume 4A: combinatorial algorithms, part 1. Pearson Education India, 2011.
- P.J. Deitel and H.M. Deitel, C How To Program, Pearson Education (7th Edition)

- Brian W. Kernighan and Dennis M. Ritchie, The C Programming Language, Prentice–Hall
- A. Kelley and I. Pohl, A Book on C, Pearson Education (4th Edition)
- K. N. King, C PROGRAMMING A Modern Approach, W. W. Norton & Company

Course Number	PH1101/PH1201
Course Credit	3-1-3-5.5
Course Title	Physics
Learning Mode	Lectures and Tutorials
Learning Objectives	Complies with Program Goals 1 and 2
Course Description	This course deals with fundamentals in Classical mechanics, Waves and Oscillations and Quantum Mechanics. As a prerequisite, the mathematical preliminaries such as coordinate systems, vector calculus etc will be discussed in the beginning.
Course Outline	Orthogonal coordinate systems (Plane polar, Spherical, Cylindrical), concept of generalised coordinates, generalised velocity and phase space for a mechanical system, Introduction to vector operators, Gradient, divergence, curl and Laplacian in different co-ordinate systems. Central force problem and its applications. Rigid body rotation, vector nature of angular velocity, Finding the principal axes, Euler's equations; Gyroscopic motion and its application; Accelerated frame of reference, Fictitious forces. Potential energy and concept of equilibrium, Lennard-Jones and double-well potentials, Small oscillations, Harmonic oscillator, damped and forced oscillations, resonance and its different examples, oscillator states in phase space, coupled oscillations, normal modes, longitudinal and transverse waves, wave equation, plane waves, examples two- and three-dimensional waves. Michelson-Morley experiment, Lorentz transformation, Postulates of special theory of relativity, Time dilation and length contraction, Applications of special theory of relativity.
Learning Outcome	Complies with PLO 1a, 2a, 3a
Assessment Method	Quiz, Assignments and Exams

Suggested Readings:

Textbooks:

1. Engineering Mechanics, M. K. Harbola, 2nd ed., Cengage, 2012
2. D. Kleppner and R. J. Kolenkow, An introduction to Mechanics, Tata McGraw-Hill, New Delhi, 2000.
3. I. G. Main, Oscillations and Waves
4. H. G. Pain, The Physics of Vibrations and Waves, 1968
5. Frank S. Crawford, Berkeley Physics Course Vol 3: Waves and Oscillations, McGraw Hill, 1966.

References:

1. R. P. Feynman, R. B. Leighton and M. Sands, The Feynman Lecture in Physics, Vol I, Narosa Publishing House, New Delhi, 2009.
2. David Morin, Introduction to Classical Mechanics, Cambridge University Press, NY, 2007.
3. P. C. Deshmukh, Foundations of Classical Mechanics, Cambridge University Press, 2019

Course code	CE1101/CE1201
Course Credit (L-T-P-C)	1-0-3-2.5
Course Title	Engineering Graphics
Learning Mode	Lectures and Practical
Learning Objectives	Complies with PLO-1a 1. The course on engineering drawing is designed to introduce the fundamentals of technical drawing as an important form of conveying information. 2. Apply principles of engineering visualization and projection theory to prepare engineering drawings, using conventional and modern drawing tools. 3. Practice drawing orthographic projections, isometric views, and sectional views, of simple and combined solids in different orientations.
Course Description	This course will introduce drawing as a tool to represent a complex three-dimensional object on two-dimensional paper through methods of projections. The course explains the use of different drafting tools and the importance of conventions for uniformity and standardization of the interpretation of the drawings.
Course Outline	Fundamental of engineering drawing, line types, dimensioning, and scales. Conic sections: ellipse, parabola, hyperbola; cycloidal curves. Principle of projection, method of projection, orthographic projection, plane of projection, first angle of projection, Projection of points, lines, planes and solids. Section of solids: Sectional views of simple solids- prism, pyramid, cylinder, cone, sphere; the true shape of the section. Methods of development, development of surfaces. Isometric projections: construction of isometric view of solids and combination of solids from orthographic projections. Introduction to AutoCad and solving isometric problems.
Learning Outcome	After attending this course, the following outcomes are expected: a) The student will understand the basic concepts of engineering drawing. b) The student will be able to use basic drafting tools, drawing instruments, and sheets. c) The student will be able to represent three-dimensional simple and combined solid objects on two-dimensional paper. d) The student will be able to visualize and interpret the orientation of simple and combine solid objects.
Assessment Method	Laboratory Assignments (30%), Mid-semester examination (25%) and End-semester examination (45%).

Suggested Readings:

Textbooks:

1. N.D. Bhatt, Engineering Drawing, Charotar Publishing House.
2. Agrawal & Agrawal, Engineering Drawing, McGraw Hill.
3. Jolhe, Engineering Drawing.

References:

1. Engineering Drawing and Design by David Madsen

Course Number	EE1101/EE1201
Course Credit	3-0-3-4.5
Course Title	Electrical Sciences
Learning Mode	Lectures and Experiments
Learning Objectives	Complies with Program goals 1, 2 and 3
Course Description	The course is designed to meet the requirements of all B. Tech programmes. The course aims at giving an overview of the entire electrical engineering domain from the concepts of circuits, devices, digital systems and magnetic circuits.
Course Outline	Circuit Analysis Techniques, Circuit elements, Simple RL and RC Circuits, Kirchoff's law, Nodal Analysis, Mesh Analysis, Linearity and Superposition, Source Transformations, Thevenin's and Norton's Theorems, Time Domain Response of RC, RL and RLC circuits, Sinusoidal Forcing Function, Phasor Relationship for R, L and C, Impedance and Admittance, Instantaneous power, Real, reactive power and power factor. Semiconductor Diode, Zener Diode, Rectifier Circuits, Clipper, Clamper, UJT, Bipolar Junction Transistors, MOSFET, Transistor Biasing, Transistor Small Signal Analysis, Transistor Amplifier and their types, Operational Amplifiers, Op-amp Equivalent Circuit, Practical Op-amp Circuits, Power Opamp, DC Offset, Constant Gain Multiplier, Voltage Summing, Voltage Buffer, Controlled Sources, Instrumentation Amplifier, Active Filters and Oscillators. Number Systems, Logic Gates, Boolean Theorem, Algebraic Simplification, K-map, Combinatorial Circuits, Encoder, Decoder, Combinatorial Circuit Design, Introduction to Sequential Circuits. Magnetic Circuits, Mutually Coupled Circuits, Transformers, Equivalent Circuit and Performance, Analysis of Three-Phase Circuits, Power measurement in three phase system, Electromechanical Energy Conversion, Introduction to Rotating Machines (DC and AC Machines). <u>Laboratory:</u> Experiments to verify Circuit Theorems; Experiments using diodes and bipolar junction transistor (BJT): design and analysis of half -wave and full-wave rectifiers, clipping and clamping circuits and Zener diode characteristics and its regulators, BJT characteristics (CE, CB and CC) and BJT amplifiers; Experiment on MOSFET characteristics (CS, CG, and CD), parameter extraction and amplifier; Experiments using operational amplifiers (op-amps): summing amplifier, comparator, precision rectifier, Astable and Monostable Multivibrators and oscillators; Experiments using logic gates: combinational circuits such as staircase switch, majority detector, equality detector, multiplexer and demultiplexer; Experiments using flip-flops: sequential circuits such as non-overlapping pulse generator, ripple counter, synchronous counter, pulse counter and numerical display; Power Measurement by two Wattmeter method; Open and Short Circuit Tests of Transformer.
Learning Outcomes	Complies with PLO 1a, 2a and 3a
Assessment Method	Quiz, Assignments and Exams

Texts/References

1. C. K. Alexander, M. N. O. Sadiku, Fundamentals of Electric Circuits, 3rd Edition, McGraw-Hill, 2008.
2. W. H. Hayt and J. E. Kemmerly, Engineering Circuit Analysis, McGraw-Hill, 1993.

3. R. L. Boylestad and L. Nashelsky, Electronic Devices and Circuit Theory, 6th Edition, PHI, 2001.
4. M. M. Mano, M. D. Ciletti, Digital Design, 4th Edition, Pearson Education, 2008.
5. Floyd, Jain, Digital Fundamentals, 8th Edition, Pearson.
6. David V. Kerns, Jr. J. David Irwin, Essentials of Electrical and Computer Engineering, Pearson, 2004.
7. Donald A Neamen, Electronic Circuits; analysis and Design, 3rd Edition, Tata McGraw-Hill Publishing Company Limited.
8. Adel S. Sedra, Kenneth C. Smith, Microelectronic Circuits, 5th Edition, Oxford University Press, 2004.
9. A. E. Fitzgerald, C. Kingsley Jr., S. D. Umans, Electric Machinery, 6th Edition, Tata McGraw-Hill, 2003.
10. D. P. Kothari, I. J. Nagrath, Electric Machines, 3rd Edition, McGraw-Hill, 2004.
11. Del Toro, Vincent. "Principles of electrical engineering." (No Title) (1972).

Course Number	HS1101
Course Credit	L-T-P-W: 2-0-1-2.5
Course Title	English for Professionals
Learning Mode	Offline
Learning Objectives	This course aims to help the students (a) attain proficiency in written English through the construction of grammatically correct sentences, utilization of subject-verb agreement principles, mastery of various tenses, and effective deployment of active and passive voice to ensure coherent and impactful written expression; (b) enhance oral communication skills by honing public speaking abilities, acquiring strategies to deliver persuasive presentations, and cultivating a polished telephone etiquette, enabling confident and articulate verbal communication; (c) foster active listening capabilities by recognizing different types of listening, and applying proven methods and strategies to improve active listening skills; (d) strengthen reading skills, including comprehension, interpretation, and critical analysis, to grasp diverse written materials and derive meaning from various types of texts encountered in academic and professional contexts; (e) develop adeptness in written communication for business purposes, encompassing the understanding of essential writing elements, mastery of appropriate writing styles thereby enhancing prospects for successful job interviews and subsequent professional endeavors.
Course Description	This academic course on communication skills aims to equip students with fluency in spoken and written English for effective expression in both academic and professional settings. By focusing on essential communication principles and providing practical experiences, students develop clarity, precision, and confidence in their communication. Through interactive discussions and exercises, students enhance critical thinking and adaptability in diverse contexts. Upon completion, students will excel in formal presentations, group discussions, and persuasive writing, enhancing their overall communication proficiency.
Course Outline	Unit I: Introduction to professional communication – LSRW - Phonetics and phonology Sounds in English Language – production and articulation – rhythm and intonation – connected speech - Basic Grammar and Advanced Vocabulary Sounds in English Language – production and articulation – rhythm and intonation – connected speech – persuading and negotiating – brevity and clarity in language. Unit II: Characteristics of Technical Communication: Types of communication and forms of communication - Formal and informal communication Verbal and non-Verbal Communication – Communication barriers and remedies Intercultural communication – neutral language Unit III: Comprehension and Composition – summarization, precis writing Business Letter Writing CV/ Resume – E-Communication Unit IV: Statement of Purpose, Writing Project Reports, Writing research proposal, writing abstracts, developing presentations, interviews – combating nervousness Tutorial: Listening Exercises, Speaking Practice (GDs, and Presentations), and Writing Practice Learning Outcome • Attain proficiency in written English, enabling the construction of grammatically correct sentences and coherent written expression through the use of appropriate grammar, tenses, and voice. • Enhance oral communication skills, including public speaking, persuasive presentation, and polished telephone etiquette, fostering confident and articulate verbal expression.

	• Cultivate active listening abilities, recognizing different listening types, overcoming obstacles, and employing strategies for attentive and effective communication. • Develop proficient written communication skills for business purposes, demonstrating understanding of essential writing elements, appropriate styles, and the creation of reports, notices, agendas, and minutes that effectively convey information.
Assessment Method	Class test + Quiz = 20%; Mid-semester = 25%; Assignment = 15%; End semester = 40%

Suggested Reading

1. Balzotti, Jon. Technical Communication: A Design-Centric Approach. Routledge, 2022.
2. Kaul, Asha, Business Communication. PHI Learning Pvt. Ltd. 2009
3. Laplante, Phillip A. Technical Writing: A Practical Guide for Engineers, Scientists, and Nontechnical Professionals. CRC Press, 2018.
4. Lawson, Celeste, et al. Communication Skills for Business Professionals, Second Edition. CUP, 2019.
5. Sharon Gerson and Steven Gerson. Technical Writing: Process and Product (8th Edition), London: Longman, 2013
6. Rentz, Kathryn, Marie E. Flatley & Paula Lentz. Lesikar's Business Communication Connecting in a Digital world, McGraw-Hill, Irwin.2012
7. Allan & Barbara Pease. The Definitive Book of Body Language, New York, Bantam,2004
8. Jones, Daniel. The Pronunciation of English, New Delhi, Universal Book Stall.2010
9. Savage, Alice. Effective Academic Writing. OUP. 2014
10. Swan and Alter. Oxford English grammar course. OUP. 201

Sl. No.	Subject Code	SEMESTER II	L	T	P	C
1.	MA1201	Probability Theory and Ordinary Differential Equations	3	1	0	4
2.	CS1201	Data Structure	3	0	3	4.5
3.	CH1201/CH1101	Chemistry	3	1	3	5.5
4.	ME1201/ME1101	Mechanical Fabrication	0	0	3	1.5
5.	ME1202/ME1102	Engineering Mechanics	3	1	0	4
6.	IK1201	Indian Knowledge System (IKS)	3	0	0	3
TOTAL			15	3	9	22.5

Course Number	MA1201
Course Credit (L-T-P-C)	3-1-0-4
Course Title	Probability Theory and Ordinary Differential Equations
Learning Mode	Lectures and Tutorials
Learning Objectives	To introduce the basic concepts of probability, statistics, and Differential equations.
Course Description	This course aims to cover basic concepts of probability, statistics and ordinary differential equations. In particular, popular distributions, random sampling, various estimators and hypothesis testing will be discussed. Students will also get exposure to the linear ordinary differential equations and their solution techniques.
Course Content	Probability (12 Lectures): Random variables and their probability distributions, Cumulative distribution functions, Expectation and Variance, probability inequalities, Binomial, Poisson, Geometric, negative binomial distributions, Uniform, Exponential, beta, Gamma, Normal and lognormal distributions. Statistics (10 Lectures): Random sampling, sampling distributions, Parameter estimation, Point estimation, unbiased estimators, maximum likelihood estimation, Confidence intervals for normal mean, Simple and composite hypothesis, Type I and Type II errors, Hypothesis testing for normal mean. Ordinary Differential Equations (20 Lectures): First order ordinary differential equations, exactness and integrating factors, Picard's iteration, Ordinary linear differential equations of n-th order, solutions of homogeneous and non-homogeneous equations (Method of variation of parameters). Systems of ordinary differential equations, Power series methods for solutions of ordinary differential equations. Legendre equation and Legendre polynomials, Bessel equation and Bessel functions.
Learning Outcome	Students will get exposure and understanding of: 1. Random variables and their probability distributions 2. Understand popular distributions and their properties 3. Sampling, estimation and hypothesis testing 4. Solution of ordinary differential equations 5. Solution of system of ordinary differential equations 6. Special functions arising as power series solutions of ordinary differential equations
Assessment Method	Quiz /Assignment/ MSE / ESE

Text Books:

1. Hogg, R. V., McKean, J. and Craig, A. T., "Introduction to Mathematical Statistics", 8th Ed., Pearson Education India, 2021
2. S.M. Ross "An introduction to Probability Models, Academic Press INC, 11th edition.
3. Miller, I. and Miller, M., "John E. Freund's Mathematical Statistics with Applications", 8th Ed., Pearson Education India, 2013
4. S. L. Ross, Differential equations, 3rd Edition, Wiley, 1984
5. W. E. Boyce and R. C. Di Prima, Elementary Differential equations and Boundary Value Problems, 7th Edition, Wiley, 2001.

Course Number	CS1201
Course Credit	3-0-3-4.5
Course Title	Data Structure
Learning Mode	Offline
Learning Objectives	• Understand the principles and concepts of data structures and their importance in computer science. • Learn to implement various data structures and understand how different algorithms works. • Develop problem-solving skills by applying appropriate data structures to different computational problems. • Achieving proficiency in designing efficient algorithms.
Course Description	This course provides a comprehensive study of data structures and their applications in computer science. It focuses on the implementation, analysis, and use of various data structures such as arrays, linked lists, stacks, queues, trees, and graphs. Through theoretical concepts and practical programming exercises, this course aims to develop problem-solving and algorithmic thinking skills essential for advanced topics in computer science and software development.
Course Outline	• Introduction to Data Structure, • Time and space requirements, Asymptotic notations • Abstraction and Abstract data types • Linear Data Structure: stack, queue, list, and linked structure • Unfolding the recursion • Tree, Binary Tree, traversal • Search and Sorting, • Graph, traversal, MST, Shortest distance • Balanced Tree Practical component: Lab to be conducted on a 3-hour slot weekly. It will be conducted with the theory course so the topics for problems given in the lab are already initiated in the theory class.
Learning Outcome	• Understand Data Structure Fundamentals • Implement Basic Data Structures using a programming language • Analyse and Apply Algorithms • Design and Analyse Tree Structures • Understand the usage of graph and its related algorithms • Design and Implement Sorting and Searching Algorithms • Debug and Optimize Code
Assessment Method	Internal (Quiz/Assignment/Project), Mid-Term, End-Term

Suggested Reading

- Alfred V. Aho, John E. Hopcroft, Jeffrey D. Ullman, Data Structures and Algorithms, Published by Addison-Wesley
- Thomas H. Cormen, Charles E. Leiserson, Ronald L. Rivest and Clifford Stein., Introduction to Algorithms,
- Mark Allen Weiss, Data Structures and Algorithm Analysis in Java
- Robert Sedgewick and Kevin Wayne, Algorithms
- Narasimha Karumanchi, Data Structures and Algorithms Made Easy

Course Number	CH1201/CH1101
Course Credit	3-1-3-5.5
Course Title	Chemistry
Learning Mode	Offline
Learning Objectives	The course aims to lay a foundation for all three branches of chemistry, viz. Organic, Inorganic, and Physical Chemistry. The course aims to nurture knowledge to appreciate the interface of chemistry with other science and Engineering branches by combining theoretical concepts and experimental studies.
Course Description	This course introduces basic organic chemistry, inorganic chemistry and Physical chemistry to understand fundamental laws that governs various reactions, reaction rates, equilibrium, and their applications in daily life through relevant experimentation.
Course Outline	Module 1: Thermodynamics: The fundamental definition and concept, the zeroth and first law. Work, heat, energy and enthalpies. Second law: entropy, free energy and chemical potential. Change of Phase. Third law. Chemical equilibrium. Conductance of solutions, Kohlrausch's law-ionic mobilities, Basic Electrochemistry. Module 2: Coordination chemistry: Crystal field theory and consequences color, magnetism, J.T distortion. Bioinorganic chemistry: Trace elements in biology, heme and non-heme oxygen carriers, haemoglobin and myoglobin; Organometallic chemistry. Module 3: Stereo and regio-chemistry of organic compounds, conformational analysis and conformers, Molecules devoid of point chirality (allenes and biphenyls); Significance of chirality in living systems, organic photochemistry, Modern techniques in structural elucidation of compounds (UV-Vis, IR, NMR). Module 4 (Lab Component): Experiments based on redox and complexometric titrations; synthesis and characterization of inorganic complexes and nanomaterials; synthesis and characterization of organic compounds; experiments based on chromatography; experiments based on pH and conductivity measurement; experiment related to chemical kinetics and spectroscopy.
Learning Outcome	Students will be able to 1. identify organic and inorganic molecules and relate them to daily life applications through experiments. 2. understand important hypothesis, laws and their derivations to intercept physical phenomenon of chemical reactions and apply them in hands-on experiments. 3. understand the importance of organic and inorganic molecules in our body and environment. 4. know important analytical techniques to intercept chemical entity. 5. approach organic and inorganic synthesis as a skillset for drug manufacturing, calculate limiting reagents and yields, use various analytical tools to characterize organic compounds, interpret and ascertain data related to Physical chemistry aspects and know laboratory safety measures, risk factors and scientific report writing skills.
Assessment Method	Theory: 20% Quiz and assignment, 30% Mid sem and 50% End semester exams for theory part (4 credits). Lab: 60% lab report, lab performance and assignment, 20% End semester exam for practical part, 20% viva/quiz (1.5 credits). Overall Weightage: Theory (70%), Lab (30%).

Suggested Reading:**Text books:**

1. Vogel's Qualitative Inorganic Analysis, G. Svehla, 7th Edition, Revised, Prentice Hall, 1996.
2. A. J. Elias, S. S. Manoharan and H. Raj, "Experiments in General Chemistry", Universities Press (India) Pvt. Ltd., 1997.
3. A. J. Elias, A Collection of Interesting General Chemistry Experiments, revised edition, Universities Press (India) Pvt. Ltd., 2007.
4. F. Albert Cotton, G. Wilkinson, C. A. Murillo, M. Bochmann, Advanced Inorganic Chemistry - 6th Edition New Delhi: Wiley India, 2008.
5. K. Mukkanti, Practical Engineering Chemistry, B.S. Publications, Hyderabad, 2009.
6. Shriver and Atkins inorganic chemistry / Peter Atkins, Tina Overton, Jonathan Rourke, Mark Weller, Fraser Armstrong-5th Edition – Oxford: UOP. 2012.
7. Atkins' Physical Chemistry, Peter Atkins, Julio de Paula, James Keeler, Oxford University Press, 11th Edition 2017.
8. K. L. Kapoor, A Textbook of Physical Chemistry, Vol: 1, 2 (6th Edition, 2019), Vol: 3 (5th Edition, 2020) MaGraw Hill.
9. G. R. Chatwal, S. K. Anand, Instrumental Methods of Chemical Analysis, 5th Edition, Himalaya Publications, 2023.

	PLO-1	PLO-2	PLO-3	PLO-4	PLO-5	PLO-6	PLO-7	PLO-8
CLO-1	X	X	X	X	X	X	X	X
CLO-2	X	X		X	X			
CLO-3	X	X	X	X		X	X	
CLO-4	X	X		X	X	X	X	X
CLO-5			X	X	X			X

Course Number	ME1201/ME1101
Course Credit	0-0-3-1.5
Course Title	Mechanical Fabrication
Learning Mode	Fabrication work – hands on fabrication work in Workshop
Learning Objectives	Complies with PLOs 3-4. • This course aims to develop the concepts and skills of various mechanical fabrication methods. • Fabrication of metallic and non-metallic components, fabrication using bulk and sheet metals, subtractive and additive manufacturing methods, and assemble the parts
Course Description	This course is designed to fulfil the need of hand on experience about various approaches (conventional and CNC, subtractive and additive) of mechanical fabrication approaches. Prerequisite: NIL
Course Outline	The jobs for various shops should be planned such that they are the parts of an assembled item. The student groups will fabricate different parts in various shops which will involve some amount of their creativeness/input particularly in design and/or planning. Various components as required for the assembled part can be made using the following shops: Sheet Metal Working: Development, sheet cutting and fabrication of designated job using sheet metal (ferrous/nonferrous); Joining of required portions by soldering, in case part is desired to be made leak proof. Pattern Making and Foundry: Making of suitable pattern (wood); making of sand mould, melting of non-ferrous metal/alloy (Al or Al alloys), pouring, solidification. Observation/identification of various defects appeared on the component. Joining: Butt/lap/corner joint job fabrication as required of low carbon steel plates; weld quality inspection by dye-penetration test (non-destructive testing approach) of the component made. Demonstration of semi-automatic Gas Metal Arc welding (GMAW). Conventional machining: Operations on lathe and vertical milling to fabricate the required component. The fabrication of the component should cover various lathe operations like straight turning, facing, thread cutting, parting off etc., and operations using indexing mechanism on vertical milling. CNC centre: Fundamentals of CNC programming using G and M code; setting and operations of job using CNC lathe or milling, tool reference, work reference, tool offset, tool radius compensation to fabricate the component with a designed profile on Al/Al-alloy plate. 3D printing (Fused Filament Fabrication): (2 weeks) Create the model, select appropriate slicing and path for fabrication of a 3D job by layer deposition (additive manufacturing approach) using polymeric material. Demonstration on pattern fabrication using 3D printing.
Learning Outcome	• This course would enable the students to develop the concept of design, fabrication (subtractive and additive) for various engineering applications. Fabrication of components and assemble them.

	The practical skill and hands on experience for various fabrication methods from bulk, sheet metal using conventional as well as CNC machines.
Assessment Method	Fabrication of components in each of the shops required for assembly of the given part; submission of reports for each shop, and quiz assessment.

Text and Reference books:

1. Hajra Choudhury, HazraChoudhary and Nirjhar Roy, 2007, Elements of Workshop Technology, vol. I, Mediapromoters and Publishers Pvt. Ltd.
2. W A J Chapman, Workshop Technology, 1998, Part -1, 1st South Asian Edition, Viva Book Pvt Ltd.
3. P.N. Rao, 2009, Manufacturing Technology, Vol.1, 3rd Ed., Tata McGraw Hill Publishing Company.
4. M.Adithan, B.S. Pabla, 2012, CNC machines, New Age International Publishers

Course Number	ME1202/ ME1102
Course Number	Engineering Mechanics
L-T-P-C	3-1-0-4
Pre-requisites	Nil
Semester	Spring
Learning Mode	Lectures
Learning Objectives	Complies with PLOs 1, 4 The objective of this first course in mechanics is to enable engineering students to analyze basic mechanics problems and apply vector-based approach to solve them.
Course Outline	Rigid body statics: Equivalent force system. Equations of equilibrium, Free body diagram, Reaction, Static indeterminacy. Structures: 2D truss, Method of joints, Method of section. Beam, Frame, types of loading and supports, axial force, Bending moment, Shear force and Torque Diagrams for a member. Friction: Dry friction (static and kinetic), wedge friction, disk friction (thrust bearing), belt friction, square threaded screw, journal bearings, Wheel friction, Rolling resistance. Centroid and Moment of Inertia Introduction to stress and strain: Definition of Stress, Normal and shear Stress. Relation between stress and strain, Cauchy formula. Stress in an axially loaded member and stress due to torsion in axisymmetric section
Learning Outcomes:	Following learning outcomes are expected after going through this course. - Learn and apply general mathematical and computer skills to solve basic mechanics problems. - Apply the vector-based approach to solve mechanics problems.
Assessment Method	Mid semester examination, End semester examination, Class test/Quiz, Tutorials

Reference Books

- H. Shames, Engineering Mechanics: Statics and dynamics, 4th Ed, PHI, 2002.
- F. P. Beer and E. R. Johnston, Vector Mechanics for Engineers, Vol I - Statics, 3rd Ed, Tata McGraw Hill, 2000.
- J. L. Meriam and L. G. Kraige, Engineering Mechanics, Vol I - Statics, 5th Ed, John Wiley, 2002.
- E.P. Popov, Engineering Mechanics of Solids, 2nd Ed, PHI, 1998.
- F. P. Beer and E. R. Johnston, J.T. Dewolf, and D.F. Mazurek, Mechanics of Materials, 6th Ed, McGraw Hill Education (India) Pvt. Ltd., 2012.

SEMESTER III						
Sl. No.	Course Number	Course Title	L	T	P	C
1.	HS2101	Mathematical Statistics	3	1	0	4
2.	HS2102	Fundamentals of Economics	3	1	0	4
3.	HS2103	Multivariate Analysis and Basic Econometrics	3	0	0	3
4.	HS2104	History of Economic Thought	3	0	0	3
5.	HS2105/ MA2102	Probability and Stochastic Processes	3	1	0	4
6.	HS21PQ	HSS Elective - I	3	0	0	3
TOTAL			18	3	0	21

Course Number	HS2101
Course Credit	3-1-0-4
Course Title	Mathematical Statistics
Learning Objectives	This course on mathematical statistics is aimed at the undergraduate students who are interested to learn basic concepts of statistics via mathematical approach. It gives essential background to students who further wish to learn statistics at advanced level.
Course Description	This course is designed to cover various important methods of statistical inference. Order statistics and their joint distributions are considered. Various properties of order statistics will be discussed. Then sampling from normal distribution will be discussed. Further different types of estimation problems will be described and illustrated. In this regard point and interval estimation problems will be demonstrated. Both classical and Bayesian methods of estimation will be discussed. Towards the end problem of testing will be covered.
Course Outline	Order Statistics, probability distributions of Sample Range, Minimum and Maximum order Statistics. Random Sampling, Sampling distributions: Chi-square, T, F distributions. Point Estimation: Sufficiency, Factorization theorem, Consistency, Moment method of estimation, Unbiased Estimation, Minimum Variance Unbiased Estimator and their properties, Rao-Cramer lower bound, Fisher Information, Maximum Likelihood Estimator and properties, Criteria for evaluating estimators: Mean squared error. Interval Estimation: Coverage Probabilities, Confidence level, Sample size determination, Shortest Length interval, Pivotal quantities, interval estimators for various distributions. Testing of Hypotheses: Null and Alternative Hypotheses, Simple hypothesis, Composite hypothesis, Test Statistic, Critical region, Error Probabilities, Power Function, Level of Significance, Neyman-Pearson Lemma, One- and Two-Sided Tests for Mean, Variance and Proportions, One and Two Sample T-Test, Pooled T-Test, Paired T-Test, Chi-Square Test. Bayesian Estimation: Prior and Posterior Distributions, Quadratic Loss Function, Posterior Mean, Bayes Estimates for well Known Distributions (Normal, Gamma, Exponential, Binomial, Poisson, Beta etc.)
Learning Outcome	Students will have • understanding of statistics. • theoretical understanding of estimation. • theoretical understanding of hypothesis testing. • understanding of nonparametric methods. • theoretical understanding of basic Bayesian methods.
Assessment Method	Quizzes, Assignments, Midterm, End Term.

Texts:

Bickel, Peter J., and Kjell A. Doksum. Mathematical Statistics: Basic Ideas and Selected Topics, Volume 1. 2nd edition. Chapman and Hall / CRC, 2015.

Hogg, R.V., and Tanis, E.A. (2020). Probability and Statistical Inference, 10th Edition, Pearson.

Course Number	HS2102
Course Credit	3-1-0-4
Course Title	Fundamentals of Economics
Learning Objectives	To provide students with the capacity to understand and apply some of the methodologies available for applied research in economics and aid them in analysis and decision making.
Course Description	The course provides basic knowledge of economics and its concepts which is essential for any students including those who wish to shape up career in the field of economics, management, industry etc. Course do offer how some of the microeconomic theories are associated with out day to day life.
Course Outline	Why Economics, Normative v Positive Economics 1.2 Scarcity of resources and Economics, The Central Economic Problem, Production Possibility Curve (PPC), Consumer Behaviour: Preferences, Utility, Choice, Demand, Budget Constraint, Demand, Determinants of Demand. Supply, Determinants of Supply, Equilibrium, Elasticity. Consumer's Surplus: Demand for a Discrete Good, Producer's Surplus. Theory of Production, Theory of Cost Profit Maximization. Markets. Introduction: Alternative Economic Systems, Government and the Markets, Macroeconomic Issues: Measuring the Economy, how India does it? Aggregate Demand and Supply, Price Adjustment Mechanisms Fiscal Policy, Inflation, Unemployment.
Learning Outcome	• Undergraduate students would be able to able to understand how an economic theory works at individual level such as at the level of a consumer or a firm etc. • Would be able to establish any determining relationships of individual's economic decision. • Develop an intuitive understanding of econometrics that allows the utilisation of the theory and tools effectively and creatively.
Assessment Method	Quizzes, Assignments, Midterm, End Term

Texts:

1. Paul A. Samuelson and William Nordhaus, Economics, 2005, Tata M.Hill.
2. Cowen, T. and Tabarrok, A. 2016, Modern Principles of Economics, 3rd ed, Worth Publishers.

Suggested Readings:

- Besanko, D. and Ronald R. Braeutigam, Microeconomics: An Integrated Approach, 2002 John Wiley and Sons.

Course Number	HS2103
Course Credit	3-0-0-3
Course Title	Multivariate Analysis and Introductory Econometrics
Learning Objectives	This preliminary course aims at explaining the undergraduate students to learn about statistical tools and its applications in economic theories.
Course Description	This course deals with basic statistical tools and theories which are useful in explaining economic ideas and establish empirical causal relationships amongst different variables pertaining to different economic domains.
Course Outline	1) Multivariate Normal Distribution 2) Inferences about Mean Vector 3) Comparison of Several Multivariate Means (ANOVA, MANOVA) 4) Simple Regression Model 5) Multiple Regression Model 6) Multivariate Linear Regression Model (Classical linear Regression Model, Multivariate Multiple Regression Model) 7) Principal Components 8) Factor Analysis 9) Canonical Correlation Analysis 10) Discrimination and Classification 11) Clustering, Distance Methods and Ordination
Learning Outcome	• Undergraduate students would be able to comprehend how statistical theories works at explaining economic ideas. • Students would be able to establish any determining economic relationships with help of statistical tools.
Assessment Method	Quiz (20%), Mid-term examination (30%), End-term examination (50%)

Text Books: 1) Applied Multivariate Statistical Analysis (Johnson & Wichern),
Pearson Publications, Sixth Edition, 2009.

2) Basic Econometrics Damodar N. Gujarati. Mc Graw Hill, 2016

Course Number	HS2104
Course Credit	3-0-0-3
Course Title	History of Economic Thought
Learning Objectives	• Work with information: to find, evaluate and use information from various sources, necessary to solve scientific and professional problems (including those on the basis of a systematic approach) • Critically evaluate and rethink the accumulated experience (own and others'), to reflect on professional and social activities; • Critically evaluate the main trends of modern economics, competently lead a discussion about the arguments in favor of each of them; • Based on the description of economic processes and phenomena, one is able to build theoretical models, analyze and meaningfully interpret the results obtained.
Course Description	The purpose of the course is to give students an overview of the process of development of economic thought from the Antiquity till the second half of the 20th century. Special attention shall be paid to the nature of the problems the economists of all times faced and tried to solve. Understanding of continuity and changes in the problem-solving activity of economists may contribute to a better grasp of the logic of the evolution of economics as a discipline.
Course Outline	Introduction, Economic thought of the Middle Ages, Mercantalism, Theories of value and of money, William Petty and the origins of Political Economy, Physiocratic thought, Adam Smith I: Value Theory, Adam Smith II: Growth and Income Distribution, Adam Smith III: Political Economy and Ideology, Malthus and Ricardo I: Population and Scarcity, Malthus and Ricardo II: The Theory of Value and Distribution, Malthus and Ricardo III: Accumulation and Gluts, Karl Marx I: Value Theory, Karl Marx: Accumulation, Growth and Crises, The Marginalist revolution, General economic equilibrium: Lausanne, Walras, Pareto; Partial equilibrium analysis: Alfred Marshall, American institutionalism: Marshall, John Maynard Keynes and the Keynesian revolution, Economic theory after Keynes
Learning Outcome	• Upon successful completion of the course students should be able to distinguish between the main schools and trends in the history of economic thought • To understand the analytical foundations of the approaches in the economics of the 19th and 20th centuries.
Assessment Method	Quizzes, Assignments, Midterm, End Term

Texts:

- Schumpeter J. A History of Economic Analysis. Oxford University Press, 1954.

Smith, Adam, An Inquiry into the Nature and Causes of the Wealth of Nations 2 Volumes.
 Edited by R. H. Campbell and A. S. Skinner. Indianapolis, IN: The Liberty Fund, 1981.

Course Number	HS2105 / MA2102
Course Credit (L-T-P-C)	3-1-0-4
Course Title	Probability and Stochastic Processes
Learning Mode	Lectures and Tutorials
Learning Objectives	This particular course on probability theory and random processes aims at the undergraduate students to learn about basic properties random variables and their properties. It also covers essential theoretical concepts of random processes which are useful in many fields of practical study.
Course Description	This course is designed to cover basic concepts of probability theory. Particularly properties of random variables like mean, variance, and moment generating functions, quantiles and other important summary of information will be discussed. We also discuss joint distribution of random variables. Probability distributions of transformed random variables will also be discussed. Illustrative discussion on central limit theorems will also be presented. We further discuss basic properties of random processes and also present their classification into different types of processes. We cover both discrete and continuous time Markov chains and study various properties.
Course Content	Axiomatic construction of the theory of probability, independence, conditional probability, and basic formulae, random variables, probability distributions, functions of random variables; Standard univariate discrete and continuous distributions and their properties, mathematical expectations, moments, moment generating function, characteristic functions; Random vectors, multivariate distributions, marginal and conditional distributions, conditional expectations; Modes of convergence of sequences of random variables, laws of large numbers, central limit theorems. Definition and classification of random processes, discrete-time Markov chains, Poisson process, continuous-time Markov chains, renewal and semi-Markov processes, stationary processes, Gaussian process, Brownian motion, filtrations and martingales, stopping times and optimal stopping.
Learning Outcome	(1) Students attending this course will become familiar with different probability laws and properties. (2) This course enables students to get acquaintance with various discrete and continuous probability distributions. Also enable to compute different probabilities for such distributions. Computation of expectations, variance, quantiles and other probabilistic quantities. (3) Learn to compute joint probability distributions, conditional and marginal probability distributions and related properties. (4) Become familiar with the concepts of covariance and correlation. (5) Approximate a distribution using central limit theorem (6) Distribution of transformed random variables (7) Basic concepts of random processes. (8) Poisson processes (9) Markov Chains
Assessment Method	Quiz /Assignment/ MSE / ESE

Text Books:

1. A. Papoulis and S. Unnikrishna Pillai: Probabilities, Random Variables and Stochastic Processes, 4th Edition, Tata McGraw-Hill, 2002.
2. P. G. Hoel, S. C. Port and C. J. Stone: Introduction to Probability Theory, Universal Book Stall, 2000.

HSS Elective-I						
Sl. No.	Subject Code	Course	L	T	P	C
1.	HS2106	Literature: Voices and Culture	3	0	0	3
2.	HS2107	Diasporic Literature from South Asia	3	0	0	3
3.	HS2108	Soft Skills	3	0	0	3
4.	HS2109	Feminist Writing in India	3	0	0	3
5.	HS2110	Language Human Mind and Indian Society	3	0	0	3
6.	HS2111	Introductory Sociology	3	0	0	3
7.	HS2112	Introduction to Demography	3	0	0	3
8.	HS2113	Fundamentals of Management	3	0	0	3
9.	HS2114	Data Science (<i>Pre-requisite IIM Mumbai</i>)	3	0	0	3
10.	HS2115	Introductory Microeconomics (<i>Pre-requisite IIM Mumbai</i>)	3	0	0	3
11.	HS2116	International Economics	3	0	0	3

Course Number	HS2106
Course Credit	L-T-P-W: 3-0-0-3
Course Title	LITERATURE: VOICES AND CULTURES
Learning Mode	Offline
Learning Objectives	This course aims to help the students (a) gain the ability to recognize and conduct a critical analysis of significant cultural themes within the studied works, encompassing topics such as identity, diversity, power dynamics, ideology, and hegemony.; (b) assess how suppressed voices, particularly those of women and marginalized groups, are portrayed and represented in the texts. Through this evaluation, they will grasp the importance of amplifying and giving voice to underrepresented communities, fostering a deeper understanding of their experiences and perspectives.; (c) explore the profound importance of diverse perspectives within the literary works. The students will recognize how multiple viewpoints enrich their understanding of complex themes related to culture, identity, and power dynamics, providing a more comprehensive and nuanced portrayal of the human experience.; (d) to engage with the historical and social contexts pertinent to each literary work, students will gain a deeper understanding of how societal norms and historical events influence the development of themes and character interactions. This exploration will allow them to contextualize the stories within broader historical narratives, fostering a more insightful interpretation of the texts. Through an in-depth exploration of diverse literary works, students will cultivate a heightened sense of empathy and appreciation for various cultures and experiences. They will discern the vital role of literature as a medium for showcasing the intricacies of human diversity and recognize the significance of inclusivity in both literary representation and societal discourse. This scholarly engagement will lead to a more profound comprehension of the complexities of cultural pluralism, encouraging students to embrace a more tolerant and compassionate worldview.
Course Description	Through this engaging and thought-provoking course, students will travel through a multitude of literary masterpieces that intricately weave together cultural themes, ideology, power dynamics, and voices of oppressed women and underdogs in a captivating literary journey. A multitude of cultural narratives will unfold within the course, from the graphic novel <i>Maus</i> to the timeless classic <i>Pride and Prejudice</i>, from the heartbreaking saga of “<i>The Kite Runner</i>” to the inspirational tale of “<i>The Color Purple</i>,” and from the touching memoir “<i>Untouchables</i>” to the evocative <i>Collection of Poetry</i> by Sarojini Naidu and the enriching Japanese manga <i>Your Name</i> by Makoto Shinkai. Students will discover the rich tapestry of human experiences across a wide range of backgrounds and contexts.

Course Outline

Module 1: **Introduction to Culture, Identity & Power**

- Defining culture and its significance in literature
- Unraveling power dynamics in literary works
- Examining the concepts of ideology and hegemony
- Identity – definition, theories, identity theory and social identity theory

Module II: **Empowering Suppressed Voices**

- Amplifying the voices of suppressed women and underdogs
- Feminist voices and gender roles in literature
- The voice of the ‘suppressed others’

Module III: **Disruption of Traditional Roles**

- Challenging societal norms and traditional roles
- Socio-cultural implications of role transformations

Module IV: **Cultural Context and Historical Significance**

- Understanding the historical and social contexts of each literary work
- How cultural settings influence the narrative and themes
- Cultural representations and their relevance in contemporary contexts

Selected Readings

Austen, *Pride and Prejudice* (movie)

Ibsen, *A Doll's House*

Alice Walker, *The Color Purple*

Mulk Raj Anand, *Untouchable*

Sarojini Naidu, *The Palanquin Bearers*, *The Bangle Seller*

Kamala Das, *An Introduction*

Khaled Hosseini, *The Kite Runner*

Makoto Shinkai, *Your Name*

Art Spiegelman, *Maus*

Amar Chitra Katha

Vijay Tendulkar, *Silence! The Court is in Session!*

Learning Outcome	1. Upon completion of the course, students will have gained the ability to recognize and conduct a critical analysis of significant cultural themes within the studied works, including topics such as identity, diversity, power dynamics, ideology, and hegemony. 2. students will be able to assess how suppressed voices, particularly those of women and marginalized groups, are portrayed and represented in the texts. Through this evaluation, they will develop an understanding of the importance of amplifying and giving voice to underrepresented communities. 3. By engaging with the historical and social contexts pertinent to each literary work, students will have gained a deeper understanding of how societal norms and historical events influence the development of themes and character interactions. This exploration will enable them to contextualize the stories within broader historical narratives, fostering a more insightful interpretation of the texts. 4. Through this process, they will foster a deeper understanding of the profound importance of embracing diversity and inclusivity within both literature and society, fostering a more compassionate and open-minded perspective towards the world around them.
Assessment Method	Class test + Quiz = 20%; Mid-semester = 30%; Assignment = 10%; End semester = 40%

Course Number	HS2107
Course Credit	L – T – P – W: 3-0-0-3
Course Title	Diasporic Literature from South Asia
Learning Mode	In-Person
Learning Objectives	This course introduces students to the well-known literary works of some prominent authors of the South Asian (India, Bangladesh, Sri Lanka, and Pakistan) Diaspora. This course will help to examine the themes of home and exile, history and memory, nostalgia and dislocation, and feature in the literary-cultural structuring of diasporic experiences.
Course Description	Diaspora highlights the numerous migrant communities' inescapable experienced trans-local experiences that go beyond the boundaries of the nation-state. The course will investigate the politics of multiculturalism, questions of nostalgia, complex dynamics of co-ethnic identification, and the inter-generational shifts amongst other issue of diaspora.
Course Outline	Module-1: Introduction to the South-Asian Diaspora Studies Key concepts of South-Asian Diaspora Studies (identity, memory, nostalgia, politics of multiculturalism, the heterogeneity of diasporic groups, especially by gender, class, sexuality, caste, and religion, the role of language and other cultural practices in migrant experiences) 1. Sangay K. Mishra's <i>Desi's Divided: The Political Lives of South Asian Americans</i> (2016) 2. Nirmal Puwar and Parvati Raghuram's <i>South Asian Women in the Diaspora</i> (2003) 3. Vijay Mishra's <i>The Literature of the Indian Diaspora: Theorising the Diasporic Imaginary</i> (2007) Module-2: Introducing Writers of the South-Asian Diaspora 1. Kamila Shamsie's <i>Salt and Saffron</i> (2000) 2. Amitav Kumar's <i>Husband of a Fanatic</i> (2004) 3. Nikesh Shukla's <i>Brown Baby: A Memoir of Race, Family and Home</i> (2021) 4. Shehan Karunatilaka's <i>The Seven Moons of Maali Almeida</i> (2020) Module 3: Understanding Diaspora Studies through Cinematic Texts: 1. <i>The Namesake</i> (2007), directed by Mira Nair and adapted from Jhumpa Lahiri's debut novel <i>The Namesake</i> 2. <i>Airlift</i> (2016), directed by Raja Krishnan Menon 3. <i>Titas Ekti Nodir Nam</i> (A River Called Titas, 1973), directed by Ritwik Ghatak 4. <i>Bend It Like Beckham</i> (2002), directed by Gurinder Chadha 5. <i>1947 Earth</i> (2009), directed by Deepa Mehta (film adaptation of Bapsi Sidhwa's novel <i>Ice Candy Man</i>) Module 4: Short Fictions from South Asian Diaspora: 1. Rohinton Mistry's <i>Tales from Firozsha Baag</i> (1987)

	2. Bharati Mukherjee's <i>Jasmine</i> (1989) Module 5: Poems from South Asian Diaspora 1. Michael Ondaatje's "Handwriting" (1999) 2. Vijay Seshadri's <i>3 Sections: Poems</i> (2013) 3. Sujata Bhatt's <i>Search for My Tongue</i> (1988)
Learning Outcomes	Develop an appreciation of the interplay between these literary texts and their historical, political, and cultural contexts to gain insight into South Asia's intricate, traumatic, and fragmented history.
Assessment Method	Class test & quiz (20%), Assignment (15%), Mid-term examination (25%), End term examination (40%)

Suggested Readings:

Brah, Avtar, "Thinking through the Concept of Diaspora." *The Post-colonial Studies Reader*, edited by Bill Ashcroft, Gareth Griffiths, and Helen Tiffin, Routledge, 2006.

Rushdie, Salman. *Imaginary homelands: Essays and criticism 1981-1991*. Random House, 2012.

Hall, Stuart. "Cultural Identity and Diaspora." *Identity: Community, Culture, Difference*, edited by Jonathan Rutherford, Lawrence & Wishart, 1990.

Ajay K. Chabey and Asis De's *Mapping South Asian Diaspora: Recent Responses and Ruminations* (2018)

Joya Chatterji and David Washbrook's *Routledge Handbook of South Asian Diaspora* (2012)

Fatimah Asghar's *If They Come for Us* (2018)

Tarfia Faizullah's *Seam* (2014)

Rajinder Dudrah's *Bollywood Travels: Culture, Diaspora and Border Crossings in Popular Hindi Cinema* (2012)

Ruvani Ranasinha. *Contemporary Diasporic South Asian Women's Fiction: Gender, Narration and Globalisation*. Springer, 2016.

Divya Mehta. "Contemporary diasporic South Asian women's fiction: gender, narration and globalisation." *Textual Practice*, Vol. 32, no. 6, 2018, pp. 1039-1043, DOI: [10.1080/0950236X.2018.1492245](https://doi.org/10.1080/0950236X.2018.1492245)

Susheila Nasta's *Home Truths: Fictions of the South Asian Diaspora in Britain* (2017)

V.S. Naipaul's *A House for Mr. Biswas* (1961)

Amit Sarwal's *South Asian Diaspora Narratives: Roots and Routes* (2017)

Course Number	HS 2108
Course Credit	L-T-P-W: 3-0-0-3
Course Title	Soft Skills
Learning Mode	Offline
Learning Objectives	This course aims to help the students (a) develop their soft skills; (b) enhance oral communication skills by honing public speaking abilities, acquiring strategies to deliver persuasive presentations, and cultivating a polished etiquette; (c) foster team building and leadership skills; (d) strengthen personality and stress management skills; (e) develop adeptness in written communication for business purposes, negotiations and critical and creative thinking.
Course Description	This academic course on soft skills aims to equip students with skills for professional settings. By focusing on essential principles of leadership, stress management, thinking and providing practical experiences, students develop clarity, precision, and confidence in their personalities. Through interactive discussions and exercises, students enhance critical thinking and adaptability in diverse contexts. Upon completion, students will excel in formal presentations, group discussions, and persuasive writing, enhancing their outlook.

Course Outline	Unit I: Soft Skills: Definition, types and importance of soft skills at workplace. Professionalism and Ethical considerations in Communication at Workplace - Use of Technology in Communication Unit II: Intercultural Communication - Interpersonal communication – self presentation - self in relationship – perception – processes of perception – conflict resolution – Thinking and Problem Solving - negotiation skills. Unit III: Team Building and Leadership Skills: Role and Functions of a Leader, Principles of Leadership, Attributes of Leadership, Group Discussion, and Meeting Management. Emotions and Managing emotions – Conflict and power – managing conflict Unit IV: Public Speaking: Speaking to one and to one thousand, Combating Glossophobia, Professional Presentations; Audience Awareness, Voice and Vocabulary, Silence and Pauses, Signposts. Interviews and its types, Steps before, during and post interview. Unit V: Personality Development and Stress Management: Theories of Personality development (Freud, Jung, Eysenck, Carl Rogers and Maslow), Reasons and Remedies of Stress. Negotiation Techniques- Positive Thinking
	Unit VI: Emotional Intelligence: Definition and Characteristics of Emotional Intelligence, Benefits of Emotional Intelligence – self-awareness, Developing personal authenticity – building an emotionally intelligent team - Measures to improve Emotional Intelligence, De Bono’s Six Thinking Hats. Johari Windows - Lateral and Critical Thinking: Techniques. Unit 7: Problem Solving What is a problem? Identifying a problem – data collection methods and tools – 5 Whys – drill down technique – case and effect diagram Prioritizing problem – pareto’s principle Generating solutions – making decisions - Implementing solutions Evaluating solutions Unit 8: Time Management What is Time Management? Time Management Strategies Stumbling Blocks in Time Management Task Prioritization and Delegation Technology and Time Management

	<u>Suggested Reading</u> 1. Butterfield, Jeff. <i>Soft Skills for Everyone</i>. Delhi: Cengage Learning. 2010, 4th rpt 2013 2. Dorsey, Ivory. <i>Soft Skills for Hard Times: A Handbook for High Achievers</i>. Xlibris Corporation, USA. 2004 3. Goleman, Daniel. <i>Emotional Intelligence</i>. India: Bloomsbury, 2021 4. Gordon, John. <i>The Power of a Positive Team</i>. Wiley and Sons. 2018 5. Horton, S. <i>The Learner's Guide to Negotiation: How to Use Soft Skills to get hard Results</i>. FT Publishing International. 2016 6. Maxwell, John C. <i>The Leadership Handbook : 26 Critical Lessons Every Leader Needs</i>. Harper Collins. 2021 7. Odell, Jenny. <i>Saving Time</i>. Random House Publishing. 2023 8. Peter, Francis S. J. <i>Soft Skills and Professional Communication</i>. Tata McGraw-Hill Education Pvt. Ltd., New Delhi.2012 9. Sharma, Sangeeta & Binod Mishra. <i>Communication Skills for Engineers and Scientists</i>. New Delhi: PHI India. 2009, 2nd Edition, 2023. Tracy, Brian. <i>Master Your Time, Master your life</i>. Penguin Publishing Group. 2017
--	---

Course Number	HS 2109
Course Title	Feminist Writing in India
Credit	3-0-0-3
Learning Objectives	This course aims to introduce the historical evolution of feminist literary writing in India.
Course Description	By a close examination of pioneering feminist voices in fiction, poetry, prose and short fiction, the course decodes critical gender issues fostering a comprehensive understanding of feminism's resonance within the Indian context.
Course Outline	Module 1: Introduction to Feminist Writing in India 1. Anagol, Padma (2005). <i>The Emergence of Feminism in India, 1850-1920</i>. Ashgate Publishing 2. Tharu, Susie and Lalita, K (1997). Introduction. <i>Women Writing in India- Volume 1</i>. Oxford University Press. Module 2: Feminist Reflections in Poetry- 1. Kamala Das: <i>An Introduction</i> 2. Meena Kandasamy: <i>Dead Woman Walking (Ms. Militancy)</i> 3. Eunice de Souza: <i>Advice to Women/Sweet Sixteen</i> Module 3: Feminist Short Fiction 1. Chitra Banerjee Divakaruni: <i>The Bats</i> 2. Mahasweta Devi: <i>Draupadi/Breast Giver (Breast Stories)</i> 3. Amrita Pritam: <i>The Weed</i> 4. Sara Joseph: <i>Inside Every Women Writer</i> Module 4: Feminist Reflections in Novels 1. Kane, Kavita. <i>Karna's Wife: The Outcast's Queen</i> (2013)/<i>Sita's Sister</i> (2014) 2. Saran Gaur, Neelum (2018). <i>Requiem in Raga Janki</i>. Penguin Random House India Private Limited. Module 5: Reading Non-fictional prose 1. Jha, Sonora (2021). <i>How to Raise a Feminist Son</i>. Penguin Books.

	Dutt, Yashica (2019). Dalit Women's Movement. <i>Coming Out as a Dalit</i> . Rupa Publications India.
Learning Outcome	2. Through a comprehensive analysis of the selected prose, novels, poetry and critical writing, the course will help students develop an aptitude for extracting and articulating unique viewpoints on gender, identity, and societal dynamics as situated within the broader framework of Indian feminist discourse.
Assessment Method	Class test + Quiz = 20%; Mid-semester = 25%; Assignment = 15%; End semester = 40%

Suggested Readings:

1. Geetha, V (2002). *Gender*. Stree.
 2. Guha, Pallavi (2023). Power to #MeTooIndia: The Future of the Movement in Post-COVID-19 India. *South Asian Review*.
<https://doi.org/10.1080/02759527.2023.2211382>.
 3. John, Mary E (2008). *Women's Studies in India: A Reader*. Penguin.
 4. Mathur, Kanchan (2008), 'Body as Space, Body as Site: Bodily Integrity and Women's Empowerment in India', *Economic and Political Weekly*, 43:17, pp. 54–63.
<http://www.jstor.org/stable/40277391>.
 5. Kumar, Radha. *The History of Doing: An Illustrated Account of Movements for Women's Rights and Feminism in India 1800-1990*. Verso, 1993.
 6. Kirmani, Nida (2011). Beyond the impasse: 'Muslim feminism(s)' and the Indian women's movement. *Contributions to Indian Sociology*, 45(1), 1–26.
<https://doi.org/10.1177/006996671004500101>
- Kurian, Alka (2017). Decolonizing the Body: Theoretical Imaginings on the Fourth Wave Feminism in India. In *New Feminisms in South Asian Social Media, Film, and Literature*. Routledge.

Course Number	HS2110
Course Credit	L-T-P-W: 3-0-0-3
Course Title	Language, Human Mind and Indian Society
Learning Mode	Offline
Learning Objectives	This course has been designed for the undergraduate B. Tech students to be taught as an elective. A) The purpose of this course is to provide students with an understanding of the critical nature of interrelationship between language, human mind and their interaction as visible in the society. B) The objective of the course is also to acquaint the students about the dynamic nature of language in perception and identity formation. C) Drawing from the theories of linguistics, psychology, cognitive science, ecolinguistics and sociology, the course intends to orient students towards the multidisciplinary approach in the investigation of language as a phenomenon. D) The course aspires to sensitize the students about the bidirectional relationship between language use and socio- cognitive behaviour and how it impacts human life.
Course Description	The course is divided into five modules where each module leads to another module with a higher level of application as evident in social context. The first module introduces few key concepts about the forms and functions of human language. The second module provides the context of the course, that is, the Indian multilingual setting. The third module is grounded on some fundamental theoretical breakthroughs of human cognition. The fourth module is about situating human language in the socio- political context. The last module provides the dichotomy between the local and the global issues grounded at the interface of human language, the human mind, and the society which the humans inhabit.

Course Outline	Module 1: Introduction Language: Form and function, design features of language; Language as a rule-governed system, Language constitutive of being human; language behaviour and language- systems; the fiction of homogeneity Module 2: Language and Mind Human mind: Language instinct, biological foundations of language, Language acquisition, Human and non-human systems of communication, Construction of knowledge, Basics of psycholinguistics: Language processing, comprehension and production, Bilingualism and cognitive growth; language and logic Module 3: Perspectives on Indian linguistic contexts Languages of India: Language families (Genealogical classification of languages), India as a linguistic Area; Language and the knowledge systems; language choices, translanguaging Module 4: Language in the Socio-political context Linguistic relativity and linguistic determinism, Identities and language, Language and dialect, Linguistic minorities, Implications for pedagogy (Multilingual approaches to education), Politics of language in India
----------------	--

Learning Outcome	By the end of the course each student is expected to be able to: 1. Evaluate linguistics theories in light of actual language use by adults and children. 2. Understand the significance of language in the context of human knowledge system. 3. Be aware of the idea of identity in local as well as global context and be appreciative of the indigenous culture and knowledge systems. 4. Demonstrate knowledge and critical thinking about the issues of language and politics and the need to innovatively safeguard the minority and endangered languages. 5. Be appreciative of the interdisciplinary aspect of human language and be able to identify various socio- economic and political phenomena rooted in language.
Assessment Method	Class test= 10%; Quiz+ Assignment = 15%; Mid-semester = 25%; End semester = 50%

Suggested Reading:

Textbooks:

- A. Akmajian , R.A. Demers, A.K. Farmer, R.M. Harnish, Linguistics: an introduction to language and communication, Mass:MIT Press, 2017
- John Lyons. Language and Linguistics: An Introduction. CUP, 2003.
- Geoffrey Gill and Sky Marsen (Ed.) 2022. Exploring Language in Global Contexts. Routledge.
- Chandras, J. Sujata. Mother Tongue Prestige. Routledge, 2023.

References:

- Eric H. Lenneberg. Biological Foundations of Language. John Wiley and Sons
- W.K. Estes (Ed.). Linguistics Functions in Cognitive Theory. Routledge. 2016.
- Andrew J. Merrison, A. Bloomer, P. Griffiths and C.J. Hall. Introducing Language in Use. Routledge. 2005.
- Jorgen Christian Bang and Jorgen Door. 2007. Language, Ecology and Society. Bloomsbury Publication.
- Singh, S.K. and Kashyap, Abhishek. Spheres of Indian Sociolinguistics. LP. 2019.

Course Number	HS2111
Course Credit	3-0-0-3
Course Title	Introductory Sociology
Learning Mode	Off-line
Learning Objectives	1. Prepare students with necessary knowledge to systematically understand society. 2. Analyze various social processes based on different perspectives, theories, and techniques. 3. Contextualize everyday experiences through lens of social theories.
Course Description	This course aims to prepare engineering undergraduate students with the necessary knowledge base to understand society through the basic subject matter of the academic discipline of Sociology. Essential concepts, vital perspectives, necessary theories, tools and techniques, and their like will be studied in this course. Link of this understanding will be connected with detailed analysis of the Indian society with the help of the work of prominent social thinkers and the personal everyday experiences of the learners. We will moor our learning through participation with different communities of practice around the campus.
Course Outline	Introduction: Sociological Imagination; Subject matter of Sociology. Theoretical Practice: Durkheim (Foundations of the Science of Society), Weber (Economy and Society), Marx (Political Economy), Foucault (Practices and Knowledge), Butler (Gender Performativity), & Burawoy (Public Sociology). Methodology and Methods: Qualitative, Quantitative, and Mixed. Indian Society: Caste, Class, and Tribe; Women and Children; Health and Education; Culture and Values; Science, Technology and Society; Media and Migration; Diaspora; Bihar- a case study. Eminent Indian Sociologists and their contributions: M N Srinivas, Irawati Karve, Yogendra Singh, Andre Betellie, Hetukar Jha, and their like.

Learning Outcome	1. Examine the evolution and change of different social systems. 2. Learn the methodologies and methods to comprehend social practices and processes. 3. Holistic understanding of the Indian society by being engaged in communities of practices.
Assessment Method	Quizzes, Assignments, Fieldwork, Midterm, End Term

Suggested Readings:

Giddens, Anthony (2009) *Sociology* (Sixth Edition) Cambridge: Polity

Press Jodhka, Surinder S (2012) *Village Society* New Delhi: Orient
Blackswan

Inkeles, Alex (1997) *What is Sociology? An Introduction to the Discipline and Profession*, New Delhi: Prentice-Hall of India

Singh, Yogendra (2014) *Indian Sociology: ICSSR Research Surveys and Explorations*
New Delhi: Oxford University Press

Srinivas, M.N. (1985) *Social Change in Modern India* New Delhi: Orient Longman

Course Number	HS2112
Course Credit	3-0-0-3
Course Title	Introduction to Demography
Learning Mode	Off-line
Learning Objectives	1. Understand the demographic profile of communities and society through processes of population change. 2. Analyse factors that influence population structure and composition of communities at micro level and countries at macro level. 3. Address challenges of population change through concerns of climate change and environmental degradation.
Course Description	The aim of this course is to introduce students to the study of people addressing the changing composition and distribution of population. The course will provide a holistic comprehension of the fundamentals of population change through the processes of fertility, mortality, and migration, emphasising on the importance of age and gender. It will allow the students to understand the impacts these factors have on individual lives and the changing structure of human society. The course will also look into the impact of population on policy formulations for sustainable development and address some of the future challenges of population.

Course Outline	1. Concepts in Demography: Definition of demography; sources of data for study of demography 2. Dynamics of Population Change: Basic theories of fertility, mortality, and migration; social factors influencing population change, with special reference to India. 3. Population Distribution: Density of population, population growth, global scenario of population; determinants of population distribution based on examples from India. 4. Population Composition: Importance of age and gender in population; demographic dividend; aging population; influence of population composition on overall development of a country. 5. Population Policies: Elements of population policies; population policies in India. 6. Future Challenges of Population: Population and sustainable development; population and climate change; population and environmental degradation; debates on dilemma and contradiction of decreasing birth rate and stable total marital fertility rate.
Learning Outcome	1. Comprehend the importance of demography and population studies for holistic understanding of any community and society. 2. Sensitised towards problems created due to population change- both over-population and under-population. 3. Relate emerging challenges of development, such as, climate change and environmental degradation with population dynamics.

Course Number	HS2113
Course Credit	3-0-0-3
Course Title	Fundamentals of Management
Learning Mode	Classroom Lecture and discussion
Learning Objectives	1. To familiarize students with the basic management concepts and applications. 2. To inculcate in students the ability to apply the multifunctional approach to organizational objectives and appreciate the significance and applications of various managerial functions.
Course Description	In today's competitive and demanding workplace, individuals can't succeed on their technical skills alone. To become an accomplished professional one needs to have good people skills and the ability to manage people regardless of whether their job title has the word 'manager' in it. The course aims at providing fundamental knowledge and exposure to the concepts, theories and practices in the field of management. The course will be taught using cases, management simulations, experiential exercises, and discussions to practical exposure and make the learning more meaningful for the students. Prerequisite: NIL
Course Outline	Unit 1: Management Science, Theory and Practice: Definition, Nature, scope and significance of Management, Systems approach to Management, Management functions, Managerial roles, Management skills, Management process, Evolution of Management: Early management, Classical approaches: Scientific management and General administrative theory, Behavioral approach, Quantitative approach, contemporary approaches, Management and society, Managing in a global environment, Modern management challenges Unit 2: Planning and Decision Making: Planning concept, significance, process and tools, Goals and plans, Management by objectives, Decision making: forms, process, approaches: bounded rationality, evidence-based management, and techniques, Strategic planning: Strategies, Tactics, and competitive dynamics

	Unit 3: Organizing and staffing: Fundamentals of organizing, Organizational design and structure, Responsibility, authority and delegation, Managing human resources, Organization change and development Unit 4: Leading: Influencing and communication, Understanding and managing individual behavior, Effective Leadership, Motivation, Creating and managing teams Unit 5: Controlling: Controlling concept, significance, process, and techniques, information systems, production and control: operations management, operations control, total quality management, contemporary issues in control
Learning Outcome	On successful completion of the course, the students will be able to 1. Define manage and describe managerial roles and functions 2. Appreciate the importance of studying management 3. Describe the factors reshaping and redefining management
Assessment Method	Mid Semester Examination (20%), End Semester examination (30%), Class test & quiz (10%), Project, Case discussions and Simulations (40%)

Text Books:

Robbins, Coulter, & Fernandez (2019). Management (14th ed.), Pearson Education.

Koontz, Heinrich, & Cannice (2020). Essentials of Management: An International, Innovation and Leadership Perspective (11th Ed.), McGraw Hills.

Reference Books:

Certo and Certo (2015). Modern Management; Concepts and Skills (15th ed.), Pearson Education.

Course Code	HS2115
Course Credit	3-0-0-3
Course Title	Introductory Microeconomics
Learning Mode	Offline
Learning Objectives	• To provide students with the capacity to understand and apply some of the methodologies available for applied research in economics and aid them in analysis and decision making.
Course Description	The course provides basic knowledge of Microeconomics which is essential for any students including those who wish to shape up career in the field of economics, management, industry etc. Course do offer how some of the microeconomic theories are associated with out day to day life.
Learning Outcome	• Undergraduate students would be able to able to understand how an economic theory works at individual level such as at the level of a consumer or a firm etc. • Would be able to establish any determining relationships of individual's economic decision. • Develop an intuitive understanding of econometrics that allows the utilisation of the theory and tools effectively and creatively.
Assessment Method	Quizzes, Assignments/lab assignments, Midterm, End Term
Course Outline	1. Why Economics , How Microeconomics is important and different , Normative v Positive Economics 1.2 Scarcity of resources and Economics, The Central Economic Problem, Production Possibility Curve (PPC) 1.3 Consumer Behaviour: From Marshall's Utility approach to Revealed Preferences, Hicks and Slutsky compensation and Marshallian Demand, Demand and Supply, Elasticity of Demand and Elasticity of Supply, Efficiency and Equity, Determinants of Demand and Supply: Utility and Demand, Cardinal & Ordinal Approach (Indifference Curve). 2. Theory of Production, Theory of Cost - different cost curves and its interpretation, Return to scale, concept of average and marginal cost and product. 3. Markets for Goods and Services: Price Determination in Perfect Competition, Monopoly, Monopolistic Competition and Oligopoly 4. Factor markets, Income distribution

Course Number	HS2116
Course Credit	3-0-0-3
Course Title	International Trade and Investment (International Economics as per Senate MoM)
Learning Objectives	This main objective of this course is to provide a thorough analysis of modern trade theory, trade policy, and its welfare implications. We will analyze trade models in depth in order to discuss the benefits and consequences of international trade and globalization. We will examine factor movements, imperfect markets, and the effect of trade on wages and income distribution. Time permitting, the course might slightly delve into international finance in order to discuss different exchange rate regimes, their effect on monetary/fiscal policy, and economic integration.
Course Outline	1. Basic Models of Trade 1.1 Ricardian Model: Comparative advantage. 1.2 One factor economy: production possibility frontier, relative demand and relative supply and autarkic terms of trade. 1.2 Trade in Ricardian world: determination of international terms of trade, complete specialization, gains from trade. 2. Resources, Comparative Advantage, and Income Distribution Model of two factor economy: Assumptions, Factor prices and commodity prices (Stolper-Samuelson effect)-correspondence, Resources & output, Rybzynski effect. 2.2 Effects of International Trade between two factor economies, Relative prices and the pattern of Trade, Trade and distribution of Income, Factor Price Equalization. 2.3 Empirical studies - Leontief Paradox. 3. The Standard Trade Model 3.1 Production Possibilities and relative supply, relative prices and demand, welfare effects of changes in terms of trade, determining relative prices. Effects of exchange rate changes on domestic prices and terms of trade, Marshall-Lerner condition, J-curve effect. 3.2 Economic growth: shift of RS curve, growth and production possibility frontier, RS and terms of trade, International effects of growth, International transfers of income: shifting RD curve, Transfer problem, effects of transfer on terms of trade, Tariffs and export subsidies. 4. Trade Policy 4.1 Partial equilibrium analysis: Tariff- cost and benefit, effective rate of protection and intermediate goods, quota, tariff- quota equivalence and non-equivalence, export subsidy, voluntary export restraint. 4.2 Tariff & Import Quotas in presence of monopoly. 6. FDI and its impact on economy 7. Application of Trade maps and WITS data: to show trade relations empirically and validate the standard trade models.
Learning Outcome	• Understand, at the level of formal analysis, the major models of international trade and be able to distinguish between them in terms of their assumptions and economic implications • Understand the principle of comparative advantage and its formal expression and interpretation within different theoretical models • Be able to apply partial equilibrium and general equilibrium models in analysing the economic effects of trade.

	• Be able to critically analyse the main arguments for protection and conversely be able to critically evaluate the relevance and realism of arguments for free trade • Be familiar with the major recent developments in the world trading system, and be able to critically analyse key issues raised both by the current round of WTO negotiations and by the spread of regional trading arrangements
Assessment Method	Quizzes, Assignments, Midterm, End Term

Texts:

1. World Trades and Payments: Caves, Frankel, Jones (10th Ed.), 2007, Pearson Education
2. Open Economy Macroeconomics: R Dornbusch, (International Students Edition), 2017, Basic Books, New York.

Suggested Readings:

- International Economics: Dominick Salvatore (13th Ed.), 2020, Wiley India.
- International Economics: Paul R. Krugman, Maurice Obstfeld, 2017, Pearson Education.

SEMESTER IV						
Sl. No.	Course Number	Course Title	L	T	P	C
1.	HS2201	Growth and Development	3	1	0	4
2.	HS2202	Microeconomic Theory	3	1	0	4
3.	HS2203	Macroeconomic Theory	3	1	0	4
4.	HS2204	Econometrics-I	3	1	0	4
5.	XX22PQ	IDE-I	3	0	0	3
TOTAL			15	4	0	19

Course Number	HS2201
Course Credit	3-1-0-4
Course Title	Growth and Development
Learning Objectives	1.To systematically and comprehensively understand concepts and different aspects of economic development, industrialization, structural change and growth can account for inequality and poverty. 2.To understand how modern theories can be used to undertake institutional transformation and ensure growth of nations. 3.To use economic models to understand how the old and new theories of causal relationships in development economics shape growth and development of nations.
Course Description	As a field of study, Development Economics has both a long history and a rapidly expanding set of social factors that is considered to be within its domain today. The Foundation of Development Economics will provide a long-term perspective to the field, covering topics such as the various concepts of development, the measurement of poverty and inequality, economic growth, structural transformation, industrialisation, institutions and trade. Students will be exposed to classical texts to gain an understanding of how the economic approach to these topics have evolved over time; as well as debates and theories on modern economic approaches to empirical analysis in the study of Development Economics.
Course Outline	Concept and measurement of development; distinction between Growth and Development, Different Theories of growth, Big Push, Balanced-unbalanced growth, Changing definition of growth from Classical to Sen to multi-dimensional poverty, Coordination and Persistent Poverty and Inequality, Education; Health and Nutrition, Structural Changes and Inequality)- Kuznet to Piketty, Lewis Todaro, Baumol and Kaldor three laws. Land and Agriculture in the realm of development, Globalization and Development Policy, Property Rights and Investment Incentives, Informal Economy and Development barriers, Credit, Inequality in the Divergence of Incomes, The Role of Institutions in Development, Political Economy and Corruption, Social Networks and Social Capital with reference to migration, Role of Regulation in Development, Financial Institutions and their role in development.
Learning Outcome	1.Articulate informed opinions on advanced topics and build convincing argumentation on controversial matters of economic policy. 2.Link different and contradictory theories and identify their strengths and shortcomings describing complex socio-economic phenomena.
Assessment Method	Quizzes, Assignments, Midterm, End Term

Texts:

1. Ray, Debraj, (1998), *Development Economics*, OUP
2. Thirlwall, A. P. (2017) *Economics of Development: Theory and Evidence*, Bloomsbury.

Suggested Readings:

1. Sen, Amartya, (2000), *Development as Freedom*, OUP
2. UNDP, Human Development Report
3. Todaro, M and Smith, S. (2017), *Economic Development*, 12/e, Pearson Education.
4. Banerjee, A. & E. Duflo, (2012), *Poor Economics*, Public Affairs.

Course Number	HS2202
Course Credit	3-1-0-4
Course Title	Microeconomic Theory
Learning Objectives	To provide students with the capacity to understand and apply some of the methodologies available for applied research in economics and aid them in analysis and decision making.
Course Description	The course provides advanced knowledge of Microeconomics which is essential for those who wish to shape up career in the field of economics, management, industry etc. Course do offer how some of the microeconomic theories are associated in taking adequate decisions for the firm, individual supplier, consumer etc.
Course Outline	1. Consumer Behaviour: Preferences, Utility, Quasilinear utility, Hicks Slutsky Demand, Marshallian Demand. 2. Theory of the Firm: Transaction cost theory, Team production, Boundaries of the Firm, Economic theory of outsourcing. 3. Markets: Competitive markets, Market Failure, Market imperfection – Monopoly – Non-linear pricing, Price Discrimination, Monopsony, Oligopoly, Duopoly. 4. Welfare Theories Concept of Social Optimum – Equity-efficiency trade-off. Externalities and Public Goods – Coase Theorem. 5. Uncertainty: Expected Utilities, Risk Aversion, Mean-variance utility, Ellsberg Paradox. 6. Introduction to Game Theory a. Non-cooperative games; Normal form – pure vs. mixed strategies; Solution concepts – iterated deletion of dominated strategies, Nash equilibrium. c. Applications: Oligopoly Models.
Learning Outcome	• Undergraduate students would be able to understand how an economic theory works at individual level such as at the level of a consumer or a firm etc. • Would be able to establish any determining relationships of individual's economic decision. • Develop an intuitive understanding of econometrics that allows the utilisation of the theory and tools effectively and creatively.
Assessment Method	Quizzes, Assignments, Midterm, End Term

Texts:

Hal R. Varian, Intermediate Microeconomics, 3rd ed., W. W. Norton & Company, 2019.

Osborne, M. and Rubinstein, A., Models in Microeconomic Theory, Open book Publishers, 2020.

Suggested Readings:

Nicholson, W. and Snyder, C., Microeconomic Theory: Basic Principles and Extensions, Cengage Publishing, 2017.

Henderson, J. and Quandt, R. Microeconomic Theory, McGraw Hill, 2017.

Course Number	HS2203
Course Credit	3-1-0-4
Course Title	Macroeconomic Theory
Learning Objectives	To provide students with the capacity to understand and apply some of the methodologies available for applied research in economics and aid them in analysis and decision making.
Course Description	The course provides advanced knowledge of Macroeconomics which is indispensable for those who wish to shape up professional career in the field of economics, management, industry etc. Course do offer how some of the macroeconomic theories are associated in taking adequate decisions for the local as well as global economy.
Course Outline	Economic growth and the neoclassical model: Solow model, Growth accounting and growth empirics, AK model, Neoclassical growth model in continuous time, Neoclassical growth model in discrete time, IS-LM model, Open economy macroeconomics, Unemployment: Overview and Some Facts, Efficiency Wages, Unemployment Dynamics. Rational and Adaptive Expectations, Policyevaluation and the Lucas critique, New Classical Analysis, New Keynesian Approach, Business cycles: Consumption, Real business cycle models. Fiscal policy: Government expenditures and fiscal multipliers, Budget deficits and debt sustainability. Accounting, Income Determination and Exchange Rates Balance of payment accounts; monetary account; Determination of national Income, multiplier analysis, the transfer problem, introduction of foreign country and repercussion effect. Fixed and Flexible Exchange rates: Adjustments, Demand & Supply of foreign exchange.
Learning Outcome	• Undergraduate students would be able to comprehend how a macroeconomic economic theory works in an economy at advanced level. • Would be able to establish relationships of various tools of macroeconomics for solving advanced macroeconomic problems. • Ripen an instinctive understanding of econometrics that permits the utilisation of the theory and tools effectively and creatively in dealing any advanced macroeconomic problems.
Assessment Method	Quizzes, Assignments/lab assignments, Midterm, End Term

Text:

Andrew Abel, Ben Bernanke, Dean Croushore, Macroeconomics, Global Edition, Pearson Education, 2016.

Blanchard and Fischer (1989): Lectures on Macroeconomics, MIT Press.

Suggested Readings:

Romer, D. (2018): Advanced Macroeconomics, 5th ed, McGraw Hill.

Course Number	HS2204
Course Credit	3-1-0-4
Course Title	Econometrics -I
Course Description	This course discusses the estimation of some common econometric models, the theoretical properties of the estimators, how to make inference and finally apply the models on real-world econometric problems. The estimation methods that will be under focus are Least Squares (LS) and Maximum Likelihood (ML) techniques. The lectures will introduce the theoretical aspects of the econometric models, their estimation and inference. We will complement the lectures by a variety of real-world applications on actual data sets through homework assignments and lab classes. Students are expected to implement the knowledge gained from the class to real-world applications from a complete understanding of the econometric problem.
Learning Objectives	The overall objective of the course is to introduce the students to common econometric models, how to estimate these models and when to employ them for making proper inferences. Ultimately, the material learned during the course should enable the students to make a more informed choice of the econometric models and to better understand, test, and interpret estimation results within the context of a specific problem.
Course Outline	Classical Linear Regression Model, Assumptions and Violations, Autocorrelation, Heteroscedasticity, Autocorrelation, Multicollinearity, Dummy Variables, GLS and FGLS estimators, Spherical disturbances, One way and Two way error components, Fixed and Random effects, Hausman tests, Seemingly Unrelated Regression, Simultaneous Equation with error components: system estimation, Dynamic Panels: Arellano Bond estimator, Arellano Bover estimator, GMM estimator, Interaction terms, Unbalanced panels: rotating panels, pseudo panels, Limited Dependent Variables and Panel Data, Non stationary panels.
Learning Outcome	• Ability to understand, classify economic data. • Ability to analyse data, interpret it and tests for validity of hypothesis.
Assessment Method	Quizzes, Assignments, Midterm, End Term

Texts:

- (1) Introductory Econometrics: A Modern Approach, by Jeffrey M. Wooldridge. South-Western College Publishing, 6th Edition.
- (2) Baltagi, B. H. (2021), Econometric Analysis of Panel Data, Wiley and Sons.

Suggested Readings:

Econometric Analysis, by William Green. Pearson, 9th Edition

SEMESTER V						
Sl. No.	Course Number	Course Title	L	T	P	C
1.	HS3101	Econometrics – II	3	1	2	5
2.	HS3102	Mathematical Economics	3	1	0	4
3.	HS3103	International Trade and Investment	3	1	0	4
4.	HS3104	Debate in Indian Economy	3	1	0	4
5.	XX31PQ	IDE-II	3	0	0	3
TOTAL			15	4	2	20

Course Number	HS3101
Course Credit	3-1-2-5
Course Title	Econometrics - II
Course Description	This course focuses on time series modelling and econometrics application of times series data.
Learning Objectives	Students will be equipped with skills to empirically test and utilize time series data and their application to verify economic theories of different domains. Time series models are also extensively used for financial data analysis.
Course Outline	Notion of difference and differential equations. Realizations and Ensembles. Stationarity and Unit Root Test, DF test and ADF test. Structural break and PP test of unit root AR and MA model, Box Jenkins ARIMA model, AIC and SBI criterion of model selection. VAR model and Impulse Response Function. Granger Causality, Cointegration and ECM. Volatility models: ARCH, GARCH and their variants.
Learning Outcome	Ability to empirically verify economic and financial theories with data. Time series forecasting is a critical learning outcome of this course.
Assessment Method	Quizzes, Assignments, Midterm, End Term

Texts:

- 1) Analysis of Financial Time Series: Ruey s. Tsay, Wiley Publication, 2nd Edition
- 2) Applied Econometrics Time Series: Walter Enders, Wiley and Sons, 2nd Edition

Course Number	HS3102
Course Credit	3-1-0-4
Course Title	Mathematical Economics
Learning Objectives	The objective of the course is to train student about the modelling of linear programming problems and its dual and various algorithms to solve these problems
Course Description	Optimization technique, as a basic subject for undergraduate students, provides the initial knowledge of various models of linear programming problems and different algorithms to solve such problems with its applications in various problems arising in economics, science and engineering.
Course Outline	Linear programming: Introduction and Problem formulation, Geo-metrical aspects of LPP, Graphical solutions, Linear programming in standard form, Simplex, Big M and Two-Phase Methods, Revised simplex method, Special cases of LPP. Static Optimization: Review of Classical Constrained Programming and Nonlinear Programming, Comparative Statics, Envelope Theorem, Saddle Point Theorem, Concave and Convex Programming; Elements of point-set topology and real analysis: Metric Spaces, Continuity, Convergence, Weirstrass Theorem, Fixed-Point theorems; Dynamic Optimization: Optimal Control Theory and Hamiltonian, Dynamic Programming; Choice under uncertainty: Risk and portfolio analysis; matrix algebra and vector analysis; Differential Equations and Stability Issues: Differential Equations, Stability Theory, Phase Diagrams. Theory of games: saddle point, linear programming formulation of matrix games, two-person zero-sum games with and without saddle-points, pure and mixed strategies, graphical method of solution of a game, solution of a game by simplex method. Computational complexity of the Simplex algorithm, Karmarkar's algorithm for LPP. Acquaintance to softwares like TORA and MATLAB.
Learning Outcome	On successful completion of the course, students should be able to: 1. Understand the terminology and basic concepts of various kinds of linear programming problems 2. model several linear programming problems and its dual 3. Develop the understanding of about different solution methods to solve linear Programming problem. 4. Apply and differentiate the need and importance of various algorithms to solve linear programming problems 5. employ programming languages to solve linear programming problems
Assessment Method	Assignments, Quizzes, Mid-semester and End-semester examinations

Texts:

1. Sydsaeter, K. and Hammond, A. Mathematics for Economic Analysis, Eighth edition, Pearson Education India (2002).
2. Chiang, A. and Wainwright (2017), Fundamental Methods of Mathematical Economics, 4th ed, McGraw Hill Inc.

Suggested Readings:

3. Intriligator (2002); Mathematical Optimization and Economic Theory, SIAM ed., Prentice Hall.
4. Carter, M. (2001), Foundations of Mathematical Economics, MIT Press.

Course Number	HS3103
Course Credit	3-1-0-4
Course Title	International Trade and Investment
Learning Objectives	This main objective of this course is to provide a thorough analysis of modern trade theory, trade policy, and its welfare implications. We will analyze trade models in depth in order to discuss the benefits and consequences of international trade and globalization. We will examine factor movements, imperfect markets, and the effect of trade on wages and income distribution. Time permitting, the course might slightly delve into international finance in order to discuss different exchange rate regimes, their effect on monetary/fiscal policy, and economic integration.
Course Outline	1. Basic Models of Trade 1.1 Ricardian Model: Comparative advantage. 1.2 One factor economy: production possibility frontier, relative demand and relative supply and autarkic terms of trade. 1.2 Trade in Ricardian world: determination of international terms of trade, complete specialisation, gains from trade. 2. Resources, Comparative Advantage, and Income Distribution Model of two factor economy: Assumptions, Factor prices and commodity prices (Stolper-Samuelson effect)-correspondence, Resources & output, Rybzynski effect. 2.2 Effects of International Trade between two factor economies, Relative prices and the pattern of Trade, Trade and distribution of Income, Factor Price Equalization. 2.3 Empirical studies - Leontief Paradox. 3. The Standard Trade Model 3.1 Production Possibilities and relative supply, relative prices and demand, welfare effects of changes in terms of trade, determining relative prices. Effects of exchange rate changes on domestic prices and terms of trade, Marshall-Lerner condition, J-curve effect. 3.2 Economic growth: shift of RS curve, growth and production possibility frontier, RS and terms of trade, International effects of growth, International transfers of income: shifting RD curve, Transfer problem, effects of transfer on terms of trade, Tariffs and export subsidies. 4. Trade Policy 4.1 Partial equilibrium analysis: Tariff- cost and benefit, effective rate of protection and intermediate goods, quota, tariff- quota equivalence and non-equivalence, export subsidy, voluntary export restraint. 4.2 Tariff & Import Quotas in presence of monopoly. 6. FDI and its impact on economy 7. Application of Trade maps and WITS data: to show trade relations empirically and validate the standard trade models.
Learning Outcome	• Understand, at the level of formal analysis, the major models of international trade and be able to distinguish between them in terms of their assumptions and economic implications • Understand the principle of comparative advantage and its formal expression and interpretation within different theoretical models • Be able to apply partial equilibrium and general equilibrium models in analysing the economic effects of trade.

	• Be able to critically analyse the main arguments for protection and conversely be able to critically evaluate the relevance and realism of arguments for free trade • Be familiar with the major recent developments in the world trading system, and be able to critically analyse key issues raised both by the current round of WTO negotiations and by the spread of regional trading arrangements
Assessment Method	Quizzes, Assignments, Midterm, End Term

Texts:

3. World Trades and Payments: Caves, Frankel, Jones (10th Ed.), 2007, Pearson Education
4. Open Economy Macroeconomics: R Dornbusch, (International Students Edition), 2017, Basic Books, New York.

Suggested Readings:

- International Economics: Dominick Salvatore (13th Ed.), 2020, Wiley India.
- International Economics: Paul R. Krugman, Maurice Obstfeld, 2017, Pearson Education.

Course Number	HS3104
Course Credit	3-0-0-3
Course Title	Debates in Indian Economy
Learning Objectives	To provide students with the capacity to understand the key issues related to the Indian economy, the major policy debates in the Indian context.
Course Description	The course provides basic knowledge of economics and its concepts which is essential for students to understand the Indian economy, how it has been shaped, what are the major watershed moments in the economy and its progress over time.
Course Outline	i) issues in growth, development, sustainability and factors in developments; (ii) economic development since independence covering major features of Indian economy at independence, planning, market and the state, population and economic development: demographic trends and issues—education, health and malnutrition; (iii) growth and development under different policy regimes: growth and structural change, regional contrast, saving and investment, monetary, fiscal, budgetary developments, policies and fiscal federalism; (iv) assessment of Indian development experience—poverty, inequality, unemployment, labour market and employment: issues of employment and inclusiveness; and (v) comparative picture of Indian economy: international comparisons.
Learning Outcome	• Undergraduate students would be able to understand how the Indian economy is shaped. • Would be able to understand the major issues pertaining to India. • Develop an intuitive understanding of the functioning of the economy.
Assessment Method	Quizzes, Assignments, Midterm, End Term

Texts:

3. Kapila, U. 2023, Indian Economy since Independence, 34th edition, Academic Foundation.
4. Dreze, J. and Sen, A. 2013, India and its Contradictions, Princeton University Press.

SEMESTER VI						
Sl. No.	Course Number	Course Title	L	T	P	C
1.	HS3201	Categorical Data Analysis	3	1	2	5
2.	HS3202	Environmental Economics	3	1	0	4
3.	HS3203	Critical Economic Reading and Seminar	3	3	0	6
4.	HS3204	Indian Financial System	3	1	0	4
5.	HS3205	Health Economics	3	0	0	3
TOTAL			15	6	2	22

Course Number	HS3201
Course Credit	3-1-2-5
Course Title	Categorical Data Analysis
Learning Objectives	• To introduce students to the wide variety of data which are binary or multichotomous. • To equip students for big data framework which enables them to handle special format of spatial data.
Course Description	This course helps students to discover the principles of binary or multichotomous variables. Given widespread use of such data in today's world of Big Data, the course aims at equipping students with fundamentals of specific types of data.
Course Outline	Module:1- Introduction to Data and its categorical nature, Tests of independence and association, Contingency tables and its tests and tests for small count. Collapsibility and graph Module:2- Generalized linear models, Logistic regression model, Probit model and Tobit model for count data, analysis of ordinary variables and statistical inferences Module:3- Multi-Category Logit model and its analysis and its applications, Discriminant functions and model selection and regularizations.
Learning Outcome	Students will be equipped with special nature of data and how to analyse such data for statistical inference.
Assessment Method	Quizzes, Assignments, Midterm, End Term

Text:

- 1) An Introduction to Categorical Data Analysis, Alan Agresti, Wiley Books (2007) –second edition
- 2) Categorical Data analysis and Multilevel Modeling Using R, Xing Liu, Sage Publishing (2022), First Edition)

Course Number	HS3202
Course Credit	3-1-0-4
Course Title	Environmental Economics
Learning Objectives	Expose learners to the problems of environment and their economic costs, solutions and policies of amelioration.
Course Description	The course helps students to understand the environmental impacts of development projects and the problems arising there from. How the social, economic and environmental impacts of such projects are assessed and resulting policies are framed is discussed in this course. It aids the understanding of how such frames, interests and power of various economic actors, as well as political institutions influence feasibility of both the projects and the policies.
Course Content	<u>Section I:</u> Introduction to climate change as an international and national issue; Theories of Environmental economics - demand and Supply in environmental goods, Market failure in the context of environment, Externalities. <u>Section II:</u> Climate policy cooperation - game theory, prisoner's dilemma, free-riding; Economic efficiency, carbon Abatement costs, social cost of carbon, discounting; CC policy process and its elements; Non-State Actors; Getting climate change on the policy agenda; <u>Section III:</u> Compensation/Loss & Damage - The economic impacts of climate change; externalities, cost effectiveness, carbon tax, cap-and-trade, induced innovation; Environmental impact and equity - economic incidence, environmental justice, residential sorting; Why climate policies fail? Regulations: COAP-24, Command and control Vs. Market, Green credit
Learning Outcome	• The student will be able to make informed choices on course of action (s) that would improve governance in climate related issues. • Apply econometric models to arrive at costs and impacts of projects having environmental impact. • Apply economic concepts to develop risk reduction strategies for climate related disasters.
Assessment Method	Assignments, Quizzes, Mid-semester examination and End-semester examination

Texts:

1. Kolstad, C. (2010). Environmental Economics. Oxford University Press, USA.
2. Bhattacharya, Rabindranath (2002), Environmental Economics: An Indian Perspective, Oxford University Press, USA.
3. Dalal-Clayton, B. and Sadler, B. (2005) Strategic Environmental Assessment: A Sourcebook and Reference Guide to International Experience, Earthscan, London.

Course Number	HS3203
Course Credit	3-3-0-6
Course Title	Critical Economic Reading and Seminar
Such a course in line with our NEP, ensures that education has to go beyond the mere transmission of information from professor to student. More than an exercise in memorization or a purely cognitive transaction, education is meant to be a transformational experience that affects the students on all levels—cognitive, certainly, but also emotional and behavioral. The student who has been through this kind of experience will have had old ideas unsettled in the service of developing a fuller understanding of self and the world, and in service of helping that world. Seminars—small classes, typically driven by discussion and critical evaluation of seminal works in the area of Economics in which students often take on teaching roles and responsibilities—offer tremendous opportunities for students and educators to make learning experiential, meaningful, and lasting. But seminars don't run themselves, and this kind of learning doesn't just happen automatically. It comes out of organization, planning, and a thoughtful, responsive harnessing of the energy and interpersonal potential in the room. The advantages of seminar courses are considerable: Seminars and the resultant possibility of more student leadership, can engender a greater sense of community and belonging; everybody in the room has the chance to get to know one another better. Conversations can reasonably involve everyone and provoke deeper thoughts leading to better understandings. This mutual knowledge leads to whole-student education, inclusive pedagogy, and Ignatian pedagogy, all of which are rooted in an understanding of everyone in the learning community as distinct, complex individuals with varied backgrounds and perspectives. Meanwhile, focused discussions and other group meaning-making processes allow for a shared sense of purpose. Such a course is much easier to foster active learning, whether in the form of discussions, activities, and role-reversal learning - having students take turns leading sessions themselves. And the intensity of these interactions ensures that learners can go beyond the transmission of knowledge to higher-order learning like analysis, application, and creation. When an instructor effectively facilitates rich discussion during class, the students are more apt to build upon the existing knowledge frameworks they continue to develop, and achieve better learning outcomes. Seminars with active student voices give the teacher plenty of evidence of student learning, day in and day out, as well as of the success of the teacher's various pedagogical choices. And a vibrant back-and-forth makes it easy to ask for student input on elements of course design and learning outcomes.	

Course Number	HS3204
Course Credit	3-1-0-4
Course Title	Indian Financial System
Learning Objectives	1.To comprehend notions and different aspects of monetary economics and relevant policy and its deep nexus with real economy and financial market. 2. To use economic theories and empirics to understand how monetary policy can be framed under different economic scenario so as to auger real and financial sector growth.
Course Description	Money, Banking and Financial Institutions course is ever evolving and extremely relevant. This Foundation course will provide a broad overview of money's role in economy and its relation with financial market. Students will also get exposure to roles of different institutions like central bank and NBFCs etc. in shaping the financial health of an economy in addition to private sector's contribution.
Course Outline	I. Introduction: Money; Meaning, Functions and Classification; Evolution of money – Gresham's law – Role of Money in Economy – Monetary Standards; Gold Standard and its abandonment – Cost of holding Money. II. Inflation, Interest rate and Demand for Money: Meaning, Types and Effects – Theories of Inflation and Control measures; Inflation and Unemployment – Quantity theory of money and Liquidity preference theory; Post Keynesian theories of demand for money – Interest Rates; Determination – Theories of Interest rates – Interest rates structure in India – Appropriate interest rate policy – International interest rates. III. Banking and Non – Banking Institutions: Institutional structure in India: Commercial, Cooperative banks and Private sector banks – Non – Bank Financial Intermediaries (Development Banks) – Finance Companies – Mutual Funds – Lease finance – Housing Finance – Venture Capital funds – Money Market Mutual Funds – Hedge Funds – Insurance companies – Infrastructure Finance Companies. IV. Commercial Banks: Evolution of banking; Assets and Liabilities – Credit Creation; Money Multiplier; Deposit multiplier; Credit multiplier– Banker and Customer – Deposit Accounts – Cheques – Loans and Advances– Banking Reforms. V. Central Banking: Role and Functions; Balance Sheet; Goals and Instruments of Monetary Policy; Effectiveness and Limitations of Monetary Policy with special reference to India – Government Bonds and Securities – Measures of Money Supply. VI. International Markets and Financial instruments: Money markets - Bond markets - Equity markets - Property markets –Options, futures and other derivatives - Collective investment schemes - Overseas markets. Economic influences on investment markets: interest rates, inflation, exchange rates, demand and supply; International environment: Role of World Bank, IMF, Asian Development Bank and other agencies. Contemporary issues and trends: FII, FDI, Listing in international markets, GDR/IDR. VII. Crisis of Banking
Learning Outcome	1. Upon successful completion of this course, students will be able to understand key theories and concepts of monetary economics and banking theory.

	2. Moreover, the students are expected to have a clear understanding of the theory and its relevance to current events and concepts of monetary economics and banking theory.
Assessment Method	Quizzes, Assignments, Midterm, End Term

Texts:

- F S Mishkin, The Economics of Money, Banking, and Financial Markets, Pearson, 2015, eleventh edition.
- Bhole L.M. and Jitendra Mahakud, Financial institutions and markets Tata McGraw Hill, 2009, 5th edition.

Suggested Reading:

- Bodie Z, Kane Alex Marcus Alan and Pitabas Mohanty, Investments, Tata McGraw Hill, 2017, 10th edition
- Freixas, X and Rochet, J. A., Microeconomics of Banking, 1997, MIT Press

Course Number	HS3205
Course Credit	3-0-0-3
Course Title	Health Economics
Learning Objectives	• Develop in-depth knowledge of key economic principles and concepts related to the healthcare sector, such as supply and demand, efficiency and equity, and market failures • Explore a nuanced perspective on healthcare financing systems and how they can be utilised in the pursuit of universal health coverage • Gain insight into the complex healthcare labour market, including workforce planning and forecasting, workforce shortages, and the impact of external shocks • Develop an understanding of the pharmaceutical market, including the key steps in the life cycle of a pharmaceutical product, and the economic theory underpinning these steps • Cultivate a balanced view of health and social justice by assessing health inequalities and fairness, deconstructing the social determinants of health, and identify potential policy solutions to rectify inequalities in the system
Course Description	This course uses economic principles and teaches how they relate to healthcare to explore the challenges facing the industry. It engages with policy proposals designed to address inequality in the system. Alongside mechanisms such as supply and demand, it gives insight into healthcare financing systems and universal health coverage, and explores the complexities of the healthcare labour market. It develops a balanced view of health and social justice, allowing an assessment of the inequalities and social determinants of health.
Course Outline	• Overview of Health Economics, Theories in health economics, Market for health service, State and Scope of Health Economics, Equity and efficiency of Health Economics, Difference between health and health care, Population, Health and Development. • Epidemiology and Morbidity Transition, Mortality and Morbidity, Burden of Diseases, Concepts of DALY and QALY. • Gender and Health: Women's Health: A life cycle perspective- Early years, Reproductive years, Old age- Women's mental health. • Provision of public health: Political economy of state intervention in health, Preventive and curative care in public health. • Private provision in health and the globalization- Experience in different Countries, • India's experience in health status- Public expenditure in health • Demand for health care: Health care as an input of health- Peculiarities of health care demand- Notion of 'need'- Induced demand Theory. • Providers of medical care- physicians: Payment Schedules, Group practice. • Providers of medical care: Hospitals, Pharmaceutical producers- R&D, pricing. • Providers of medical care: Insurance- uncertainty and moral hazard, private insurance, Social insurance. • Indian health market: Utilization and efficiency in Indian health care facilities

Learning Outcome	Students will be able to: • Apply the fundamental knowledge of economics in healthcare for effective policy decisions. • Identify, formulate, and analyse economic aspects in handling public health problems leading to substantiated conclusions through real-world evidence. • Apply contextual health economics domain knowledge to assess societal, health, safety, legal, and cultural issues and the consequent responsibilities and societal well-being.
Assessment Method	Quizzes, Assignments, Midterm, End Term

Texts:

- Cuyler A J and J P Newhouse (ed) (2000): “Handbook of Health Economics”, Elsevier.
- Folland, Sherman, Allen Charles Goodman, Miron Stano (2017), The Economics of Health and Health Care, 8th ed., Routledge.

Suggested Reading:

- Qadeer Imrana et al (2001): “Public Health and the Poverty of Reforms.” Sage.

SEMESTER VII						
Sl. No.	Course Number	Course Title	L	T	P	C
1.	HS41XX	Specialization Elective 1	3	1	0	4
2.	HS41XX	Specialization Elective 2	3	1	0	4
3.	HS41XX	HSS Elective - II	3	0	0	3
4.	XX41PQ	IDE-III	3	0	0	3
5.	HS4198	Summer Internship*	0	0	12	3
6.	HS4199	Project-I (Lab based project / Industry oriented problem solving/ Academic internship / Case Study/Design thinking-based project- Capstone Project)	0	0	12	6
		TOTAL	12	2	24	23

Specialization 1: Economic Theories						
Sl. No.	Subject Code	Course	L	T	P	C
Semester-VII						
1.	HS4101	Game Theory	3	1	0	4
2.	HS4102	Energy Economics	3	1	0	4
3.	HS4103	Labour Economics	3	1	0	4
4.	HS4104	Business Law and Economics	3	1	0	4
5.	HS4105	Advanced Macroeconomics	3	1	0	4
Semester-VIII						
6.	HS4201	Institutional Economics	3	1	0	4
7.	HS4202	Public Finance and Policy	3	1	0	4
8.	HS4203	Agrarian Economics	3	1	0	4
9.	HS4204	Political Economy and Development	3	1	0	4
10	HS4205	Mechanism Design	3	1	0	4

Course Number	HS4101
Course Credit	3-1-0-4
Course Title	Game Theory
Learning Objectives	• This course aims to teach some strategic considerations to help make strategic choices. • It aims to predict how other people or organizations behave when they are in strategic settings. • It aims to apply these tools to settings from economics and from elsewhere. The course will emphasize examples.
Course Description	This course is an introduction to game theory and strategic thinking. Ideas such as dominance, backward induction, Nash equilibrium, evolutionary stability, commitment, credibility, asymmetric information, adverse selection, and signalling are discussed and applied to games played in class and to examples drawn from economics, politics, the movies, and elsewhere.
Course Outline	Solution Concepts for Static Games: Complete information: rationalizability, Nash equilibrium, epistemic foundations, Incomplete information: Bayesian Nash equilibrium, interim correlated rationalizability; Solution Concepts for Extensive-form Games: Backwards induction, subgame perfection, iterated conditional dominance, Bargaining with complete information Equilibrium Concepts for Games with Imperfect Information: Signaling and Forward Induction: Stable equilibrium, the intuitive criterion, iterated weak dominance, epistemic foundations Repeated Games: Bargaining Reputation Formation: Reputation with short-lived opponents, Screening and reputation in bargaining Games of incomplete information: Auctions, Reputation Asymmetric information: Adverse selection and moral hazard.
Learning Outcome	• Have knowledge of fundamental concepts of non-cooperative game theory. • Have the ability to apply solution concepts to examples of games, and to state and explain them precisely. • The ability to solve unseen games that are variants of known examples
Assessment Method	Quizzes, Assignments, Midterm, End Term

Texts

- Dixit, A. and B. Nalebuff. *Thinking Strategically*, Norton 1991
- J. Watson. *Strategy: An Introduction to Game Theory*, Norton 2002

Suggested Reading

- Osborne (2003): *An Introduction to Game Theory*, OUP
- P.K. Dutta. *Strategies and Games: Theory and Practice*, MIT 1999

Course Number	HS4102
Course Credit	3-1-0-4
Course Title	Energy Economics
Learning Objectives	• Explores key energy economics issues, including pricing mechanisms, macroeconomic impacts of energy price shocks, the importance of energy carriers in developing and developed economies, and energy security. • Analyzes policy options for addressing renewable energy development, environmental sustainability, and green growth.
Course Objectives:	This course explores the theoretical and empirical perspectives on individual and industrial demand for energy, energy supply, energy markets, and public policies affecting energy markets. It discusses aspects of the oil, natural gas, electricity, and nuclear power sectors and examines energy tax, price regulation, deregulation, energy efficiency and policies for controlling emission.
Course Content	Introduction and Background, Review of Price Formation in Competitive Markets, Energy Demand: Short Run and Long Run Price and Income Elasticities, Energy Supply and the Economics of Depletable Resources, World Oil Markets and Energy Security, Natural Gas Price Regulation, Deregulation and Markets, Electricity, Risk Management, Energy and Climate Change Internalizing Environmental Externalities with a Focus on CO₂ Emissions Cap and Trade Mechanisms Coal Nuclear Power Energy Efficiency Policies Renewable Energy Policies
Learning Outcome	Upon successful completion, students will have the knowledge and skills to: • Demonstrate an understanding of energy markets and the role of energy in the economy. • Identify and apply a knowledge of methods to assess alternative energy projects, technologies, and policies. • Examine the economics of energy production and consumption.
Assessment Method	Mid Semester Examination (20%), End Semester examination (40%), Class test & quiz (20%), Project (20%)

Texts:

1. Bhattacharyya, Subhes. C. (2011). Energy Economics: Concepts, Issues, Markets and Governance. Springer. London, UK.
2. Stevens, P. (2000). An Introduction to Energy Economics. In Stevens, P.(ed.) The Economics of Energy, Vol.1, Edward Elgar, Cheltenham, UK.

Course Number	HS4103
Course Credit	3-1-0-4
Course Title	Labour Economics
Learning Objectives	• To discuss recent Labour Market trends. • To understand wage theories. • To understand Labour Market Segmentation Theories. • To analyse the determinants of the various dimensions of labour supply and demand, which interact to determine wages, employment & unemployment. • To discuss the role of collective bargaining in the labour market. • To analyse the importance of skill upgradation in the wake of decent work and globalization. • To develop the understanding of Social Security in the labour market.
Course Description	The course introduces students to the exciting applied field that is labour economics. The leading idea throughout the course is that economics is an empirical science (not a set of theorems) meant to explain actual behaviour. In addition, the labour market is the playing field for numerous important economic policies and institutions: payroll taxes, minimum wages, collective bargaining, etc. A major task for labour economists is to explain how markets function under these regulations.
Course Outline	Employment and unemployment, Labour Demand -Marshall's Rule, Labour Supply, The neoclassical theory of labour supply, Preferences and budget constraint. Extensive and intensive margins. Estimating labour supply elasticity, the competitive labour market, Operation of the labour market under different imperfect market structures, Union behaviour; Investment in human capital and skill formation - Investment in education and training, the signalling debate, Wage dispersion, Segmented labour markets, Women's participation in the labour force, Discrimination; Labour migration, Child labour, Characteristics of the Indian labour force, Wages and employment in agriculture, Industry and services, Importance of the informal sector, Employment and labour welfare policy, Globalisation and labour market reforms, Wage Inequality, Efficiency Wage theory, Introduction to wage and wage rate data: PLFS, New Labour Codes, Indian Labour market, Gig Economy.
Learning Outcome	• Be able to explain, on the supply side, the factors that affect the decision of an individual to work • Be able to explain, on the supply side, the factors that affect the decision of an individual to choose a particular job or a career path • Be able to explain, on the supply side, the factors that affect the decision of an individual to acquire education and on-the-job training to provide effort in a particular job • Assess how governments' policies could affect the decisions of the individual. • Be able to explain, on the demand side, the factors that affect the decision of a firm to hire and fire workers • Be able to explain, on the demand side, the factors that affect the decision of a firm to offer jobs with different characteristics (amenities and training for example)

	• Be able to explain, on the demand side, the factors that affect the decision of a firm to discriminate among different workers • Explain, on the demand side, the factors that affect the decision of a firm to choose particular compensation policies and to offer different career paths • Evaluate how government policies and institutions (such as the unions) affect the decisions of the firm
Assessment Method	Quizzes, Assignments, Mid Term, End Term

Texts

- A.K. Sen(1999): Employment, Technology and Development, OUP.
- Cahuc, P., Zylberberg, A., &Carcillo, S. (2014). Labor Economics (Vol. Second Edition). Cambridge, MA: The MIT Press.

Suggested Reading

Tito Boeri, & Jan van Ours. (2013). The Economics of Imperfect Labour Markets: Second Edition. Princeton University Press.

Course Number	HS4104
Course Credit	3-0-0-3
Course Title	Business Law and Economics
Learning Objectives	Students will gain an understanding of the economic and legal aspects of business decisions and of how the law affects businesses and institutions.
Course Description	The course will teach students to analyse the legal aspects of firms, economies and property. It will also give students an exposure to the economics behind bargaining, contracts and punishment strategy.
Course Outline	Introduction to Law and Economics: Economic analysis of law and the metric of efficiency; introduction of examples; principles and theories; intellectual history; efficiency and equity. An Introduction to Law, Legal Institutions and the Legal Process Civil law and common law, institutions of the court system, the nature of legal dispute, evolution of legal rules, the formation of law, legal terminology. Why sue? Information exchange, settlement bargaining, trial and appeal, empirical assessment of legal process. An Economic Theory of Property Legal concept of property, bargaining theory, protection of property, public versus private goods, the Coase theorem. An Economic Theory of Contract: Bargaining theory with contract, an economic theory of contract. An Economic Theory of Tort Law: Defining tort law, economics and tort liability. Crime and Punishment: Defining criminal deterrence and effective punishment, explain declining crime and efficient law enforcement and administration.
Learning Outcome	Students will learn to discover how changes in policies and external factors impact consumer demand, prices, costs, competition, and financial conditions.
Assessment Method	Quizzes, Assignments, Midterm, End Term

Texts:

1. Polinsky, A. Mitchell. 2011. An Introduction to Law and Economics. Fourth Edition. New York: Aspen
2. Cooter, Robert and Thomas Ulen. 2011. Law and Economics. Sixth Edition. Boston: Pearson Addison Wesley.

Course Number	HS4105
Course Credit	3-1-0-4
Course Title	Advanced Macroeconomics
Learning Objectives	The course will make students familiar with key concepts in modern quantitative macroeconomics and give students a thorough understanding of up-to-date research in a few selected topics. Particular attention will be paid to using economic theory, specifically equilibrium models with heterogeneous agents, to interpret data. The course will be relevant to students wishing to continue to study economics at a postgraduate level, as well as those interested in policy research involving quantitative economic modeling.
Course Description	This course seeks to develop an understanding of Macroeconomic theory as a systematic way of analysing the behaviour of the macro economy. The course focuses on two key issues of economic policy debate, namely economic growth and monetary policy. The emphasis is on the recent developments in macroeconomic theory with particular reference to current problems.
Course Outline	1.Tools for Studying Dynamic Economies Topics include: Dynamic Programming; Numerical Dynamic Programming; Neoclassical Growth and Search, Solow-Swan model and the infinite horizon Cass-Coopmans-Ramsey, overlapping generations Diamond model, Matching and Unemployment – Efficiency Wage Theory 2. Self Insurance and Incomplete Markets Topics include: Self Insurance (partial equilibrium), Bewley Models 3. Inequality in the Macroeconomy Topics include: Measuring risk, endogenously incomplete markets 4. Equilibrium Unemployment Theory Topics include: Theory and applications to European unemployment and business cycle dynamics
Learning Outcome	• Interpret and analyze different models of economic fluctuations • Analyze and extend models of long-run economic development • Describe models in game theory, especially as they relate to economics • Manipulate economic models to incorporate changes in economic policy
Assessment Method	Quizzes, Assignments, Midterm, End Term

Texts:

David Romer, (2018), Advanced Macroeconomics, any edition, McGraw-Hill

Taylor, L. (2009), Reconstructing Macroeconomics: Structuralist Proposals and Critiques of the Mainstream, Harvard University Press.

New Growth Theory: A Supply--Demand View, in Contemporary Macroeconomics, edited by Amitava Bose et al, Oxford, 2001

Course Number	HS4201
Course Credit	3-1-0-4
Course Title	Institutional Economics
Learning Objectives	to form a detailed view about current development of new institutional theory, about main instruments and approaches to develop competences, which allow to implement the methodology of new institutional economics towards solving practical problems to develop competencies, which allow implementing the methodology of new institutional economics towards solving practical problems
Course Objectives:	The main objective of this course is to demonstrate how institutions work in various spheres, what happens if they become weak or inefficient. It discusses the institution of property rights and contracts, and analyze modern cases, with evidence of the fact that institutions are vitally important for the prosperity of countries as well as for making the simplest transactions between citizens possible. The Course gives an overview of modern institutional theory, its development and current state, its basic instruments and approaches. Special focus is made on ways to use these instruments and approaches for solving real-life problems.
Course Content	The New Institutional Economics Property Rights I: Where it all began; Property Rights on Historical Frontiers; Property Rights on Current Frontiers: Why Don't We Get It Right? Why do firms exist? Insights from the NIE for Business Management and Strategy, Technology, Transaction Costs, Transaction Costs and Contracts in Agriculture, Agricultural Contracts and the Growth of the Welfare State, Norms and Contracts Economic Organization Bureaucracy Government and State Law, Economics, and Organization Regulation Empirical Institutional Economics
Learning Outcome	The course will train the students about the important roles played by the property rights, contracts, transaction costs, and norms for economic growth and market exchanges.
Assessment Method	Mid Semester Examination (20%), End Semester examination (40%), Class test & quiz (20%), Project (20%)

Texts:

Furubotn, E. G., & Richter, R. (2005). Institutions and Economic Theory: The Contribution of the New Institutional Economics (Vol. 2nd ed). Ann Arbor: University of Michigan Press.

Course Number	HS4202
Course Credit	3-1-0-4
Course Title	Public Finance and Policy
Learning Objectives	1.A basic understanding of the elements of how government finances its activities and reform agendas that typically succeed versus those that do not, and an analytical framework for interpreting how and why this differs by country. 2. Evidence-based insights about the connection between the quality and the outputs of systems in functional areas such as budgeting, accounting, auditing and procurement.
Course Description	Explores the role of government in the economy, applying tools of basic microeconomics to answer important policy questions such as government response to global warming, Social Security versus private retirement savings accounts, government versus private health insurance, setting income tax rates for individuals and corporations.
Course Outline	Introduction to public economics -the nature, scope and significance of public economics, Forms and Functions of Government, Different forms of government – unitary and federal. Tiers of government in the federal form- Central, State, Local; Functions of Government - Economic functions -allocation, distribution and stabilization; Regulatory functions of the Government and its economic significance, Federal Finance - Federal Finance: Different layers of the government, Inter governmental transfer—horizontal vs. vertical equity, Grants—merits and demerits of various types of grants—unconditional vs. conditional grants, tied grants, matching grants; Public Goods and Public Sector -concept of public goods—characteristics of public goods, national vs. local public goods, determination of provision of public good, Externality, concept of social versus private costs and benefits, merit goods, club goods., Provision versus production of public goods. Market failure and public provision, pricing of public goods—vertical summation; Government Budget and Policy - government budget and its structure – Receipts and expenditure – concepts of current and capital account, balanced, surplus, and deficit budgets, concept of budget deficit vs. fiscal deficit, functional classification of budget, concept of Revenue Deficit; Tax Structure, Distribution and Stabilization.
Learning Outcome	1. Articulate informed opinions on advanced topics and build convincing argumentation on controversial matters of economic policy. 2. Link different and contradictory theories and identify their strengths and shortcomings describing complex socio-economic phenomena.
Assessment Method	Quizzes, Assignments, Midterm, End Term

Texts:

Musgrave, R. P and Musgrave, P. B. (2017): *Public Finance in Theory and Practice* (5th Edition), McGraw Hill Education.

Suggested Readings:

Bhatia, H. L. (2022), *Public Finance*, S Chand And Company Ltd.

Course Number	HS 4205
Course Credit	3-1-0-4
Course Title	Mechanism Design
Learning Objectives	This course is an introduction to mechanism design. This course covers introductory and advanced materials on the theory of mechanism design. The aim of the course is to build a solid background for economics students in mechanism design as well as introduce selected material on the frontiers. Even though it is targeted to graduate students who would like to do theoretical work, other students may benefit as well.
Course Description	The goal is to equip students with a general purpose tool to analyze strategic behavior in multi-agent interaction. Though primarily a topic of economic flavor, it has significant applications in the decision process of a multi-agent environment like sponsored advertisements, crowdsourcing, social media, internet-based trade, and several settings of social choice and welfare. This course is a backend of such applications and discusses the mathematical details of analyzing and designing strategic interactions.
Course Outline	Introduction to mechanism design, revelation principle, introduction and proof of Arrow's impossibility result, introduction to social choice setup Introduction and proof of Gibbard-Satterthwaite theorem, domain restriction, median voter theorem Task sharing domain, uniform rule, mechanism design with transfers, examples of quasi-linear preferences, Pareto optimality and Groves payments Introduction to VCG mechanism, VCG in Combinatorial allocations, applications to Internet advertising, slot allocation and payments in position auctions, pros and cons of VCG mechanism Affine maximizers, single object allocation, Myerson's lemma, optimal mechanism design Single and multi-agent optimal mechanism design, examples of optimal mechanisms, Multiple agent optimal mechanism design.
Learning Outcome	Students will have • understanding of statistics. • theoretical understanding of estimation. • theoretical understanding of hypothesis testing. • understanding of nonparametric methods. • theoretical understanding of basic Bayesian methods.
Assessment Method	Quizzes, Assignments, Midterm, End Term.

Texts:

1. An Introduction to the Theory of Mechanism Design, Tilman Börgers (Recommended)
2. Mechanism Design, A Linear Programming Approach Rakesh V. Vohra
3. Auction Theory Vijay Krishna
4. Putting Auction Theory to Work Paul Milgrom

Specialization 2: Finance and Risk Management						
Sl. No.	Subject Code	Course	L	T	P	C
Semester-VII						
1.	HS4106	Financial Analytics	3	1	0	4
2.	HS4107	Behavioural Economics and Finance	3	1	0	4
3.	HS4108	Programming/ Coding	3	1	0	4
4.	HS4109	Corporate Finance	3	1	0	4
Semester-VIII						
5.	HS4206	Financial Markets and Derivatives	3	1	0	4
6.	HS4207	Wealth Management	3	1	0	4

Course Number	HS 4101 HS4106
Course Credit	3-0-2-4 3-1-0-4
Course Title	Financial Analytics
Learning Objectives	1.To understand different notions of time series theories and its application in Finance. 2. To use different time series and statistical techniques to explain behaviour of financial markets and interconnectedness of these markets.
Course Description	The course mainly deals with fundamental statistical modelling for financial time series techniques. This includes time series pattern recognition at univariate as well as multivariate framework and out of sample forecasting. Interconnected markets can be analysed with respect to volatility spillover etc.
Course Outline	Module 1: Notion of Ensemble and realization in financial time series. Convergence and parsimony of a financial variable and its transformation for cleansing of data. Distributions and statistical properties of financial variables. Concept of fat tail and irregularities in financial data. Module 2: Statistical analysis of univariate model with Box-Jenkin's approach and prediction of out- of-sample forecasting of stock prices. Seasonality (additive and multiplicative form) of financial data. Trend (linear and non-linear) analysis of stock price. Techniques to de-seasonalize and de-trend the data. Analyzing financial cycle and structural change and event analysis. Module 3: Concept of financial contagion across countries and spillover effect. Multivariate analysis for analyzing contagion. Intervention analysis for multi-country financial index and its implication. Dynamic forecasting of contagion and impulse through intervention analysis and its time series variants. Modelling market integration and error correction mechanism. Module 4: Modelling volatility and risk of financial indices. Autoregressive Conditional Heteroscedasticity model and its variants like GARCH, EGARCH, TARCH, IGARCH etc. Dynamic and constant conditional correlation GARCH model. Volatility smile and implication of Greek letters in financial market.
Learning Outcome	Students will be able to: 1. Upon successful completion of this course, students will be able to comprehend key statistical models and time series application in Finance. 2.Further, the course also offers hand-on tools to analyze financial market and forecasting of critical financial variables. Growing demand for expertise in the domain of finance, both professional as well as academics, will be served at preliminary level through this course.
Assessment Method	Quizzes, Assignments, Midterm, End Term

Texts:

1. Options, Future and other Derivatives: John C. Hull (Pearson Education)
2. Analysis of Financial Time Series: Ruey S. Tsay (John Wiley and Sons, Inc)

Course Number	HS 4103 HS4107
Course Credit	3-0-2-4 3-1-0-4
Course Title	Behavioural Economics and Finance
Learning Objectives	• To learn a new domain of modern economics and finance which challenges traditional theories of decision making of different economic entities. • To equip learners with theories which encapsulates economic rationale alongside 'irrational' psychological biases and 'anomalies' • To analyze operations of markets under varying competitive conditions and make optimal business decisions.
Course Description	The course will provide a broad understanding of behavioral economics and finance where rational decision making of economic entities will be analyzed from the perspective of heuristic ways, cognitive biases, and psychological kinks.
Course Outline	Introduction to Behavioural Economics and Finance; Rational Choice theory and Its Limitations; Understanding decision science; Key themes and issues in neuro-economics; Choice under uncertainty; Behavioural biases of individuals: cognitive errors and emotional biases; Psychological biases and Prospect Theory; Heuristics and Biases: Challenges for Rationality; Behaviourally modified asset allocation; Money Illusion, Asset Price, Animal Spirit and Market Anomalies in world of Finance; Regulation of behavioural factors in analyst forecasting and portfolio construction; Consumption and Savings Behaviour; Nudge and Policy Implication.
Learning Outcome	Upon successful completion of the course one should be able to- • Understand how traditional economic and financial theories are revised to address behavioural anomalies. • Apply critical behavioral concepts in decision making. • Critically discuss and deliberate suitable policies where market failure is plausible.
Assessment Method	Quizzes, Assignments, Midsem and End Semester

Suggested Readings:

- An Introduction to Behavioral Economics, N. Wilkinson and M. Klaes (2012), Palgrave Macmillan.
- Irrationally Rational, V. Raghunathan (2022), Penguin Viking
- Journal Articles Case Studies and public writings by D Kahneman, A. Tversky, R. Thaler, G. Akerlof, R. Shiller etc.

Course Number	HS4109
Course Credit	3-1-0-4
Course Title	Corporate Finance
Learning Objectives	The core objective of the course is to make students aware of corporate finance theories and global practices along with Indian experiences. Students will comprehend basic notions of Time value of money, risk management and corporate capital structure etc.
Course Description	1) Time Value of Money, interest rate, discounting, Spot concepts 2) Fixed Income Securities, Arbitrage, Bond and Yield curve 3) Valuation of Stock, capital Gain, DD model, 4) Risk and the Cost of Capital and CAPM and APT 5) Corporate Capital Structure Equity Versus Debt Financing) (Modigliani-Miller I: Leverage, Arbitrage, and Firm Value) (Modigliani-Miller II: Leverage, Risk, and the Cost of Capital) (The Interest Tax Deduction) (Valuing the Interest Tax Shield) (Recapitalizing to Capture the Tax Shield) (Personal Taxes) (Optimal Capital Structure with Taxes) (Default and Bankruptcy in a Perfect Market) (The Costs of Bankruptcy and Financial Distress) (Financial Distress Costs and Firm Value) (Optimal Capital Structure: The Trade-off Theory 6) Risk Management (Insurance) (Commodity Price Risk) (Exchange Rate Risk) (Interest Rate Risk) (Option Basics) (Option Payoffs at Expiration) (The Binomial Option Pricing Model) (The Black-Scholes Option Pricing Model)
Course Outline	This course presents the foundations of finance with an emphasis on applications vital for corporate managers. We discuss most of the major financial decisions made by corporate managers both within the firm and in their interactions with investors. Essential in most of these decisions is the process of valuation, which will be emphasized throughout the course. Topics include criteria for making investment decisions, valuation of financial assets and liabilities, relationships between risk and return, capital structure choice, payout policy, the effective use and valuation of derivative securities (futures, options, and convertible securities), and risk management.
Learning Outcome	On successful completion of the course, students will be able to: ● Assess practical importance of differ notions of corporate finance

	● Gauge Risk and mitigate such risk for portfolio's optimal return as well companies' profit point of view. ● Provide solutions to companies' financial issues
Assessment Method	Quizzes, Assignments, Midterm, End Term

Text Books:

Corporate Finance Jonathan Berk and Peter De Marzo, 3rd ed., Pearson - Prentice Hall, 2014.

Course Number	HS 4206
Course Credit	3-1-0-4
Course Title	Financial Market and Derivative
Learning Objectives	The major objective of the course is to develop an analytical and critical thinking abilities of students in the dynamic financial world. Students will comprehend basic notions of risk management and utility of derivatives to mitigate potential risks related to finance activities. Finally, the course offers students ability to explore and construct arbitrage, trading and hedging strategies.
Course Description	The course introduces three general classes of derivative instruments: forwards/futures, options, and swaps. Within each class, students will be discussed specific derivative products such as commodity, index and interest rate forwards/futures, equity/index options, currency and interest rate swaps etc. The major arbitrage, trading and hedging techniques are introduced throughout the course for each type of the derivative instrument. Students will also learn derivatives' pricing and valuation models using conceptual problems and practical assignments.
Course Outline	Introduction to derivative markets Vocabulary of the market Trading of financial assets and some discussion of commodities Stock, bond, currency markets Basic aspects of derivatives and defining basis risk Buying and shorting financial assets Discounting and the time value of money Annual discounting Periodic compounding Continuous compounding Changing interest rates Pure discount vs coupon paying bonds Present Value (PV) and Future Value (FV) Leverage Forward and Futures Markets How time value is reflected in forward markets Cross-market interest rates and currency forwards Settlement issues for Forward Markets How futures markets differ from forwards Futures on indices Pain Vanilla Options and Basic Strategies Payoffs and profits from options, futures, and forwards Insurance strategies Spreads, straddles, and related strategies Simple hedging Put-Call parity Style and maturity Black-Scholes valuation Basic formula Volatility, historical and implied The Greeks Dynamic delta hedging and extended hedging Volatility “smirks” and “smiles” The VIX ‘fear gauge’

	Interest rate swaps and related topics (M Ch. 7, 8) The yield curve and discounting Valuation of the two sides The swap rate and the swap rate term structure An introduction to swap options
Learning Outcome	• Discuss the major varieties of derivative instruments (forwards, futures, options, swaps), futures, option and swap markets; Understand the pricing mechanism of different derivatives products; • Understand the nature of swap products; distinguish between different types of swaps; Learn about past financial disasters (derivatives related) • Determine option prices • Be able to construct hedging strategies • Apply the mechanics of Futures and Options markets via Stock track portfolio simulation
Assessment Method	Quizzes, Assignments, Midterm, End Term

Texts:

1. John C. Hull, Options, Futures, and Other Derivatives (10th Edition).
2. Sheldon Natenberg, Option Volatility and Pricing: Advanced Trading Strategies and Techniques (2nd Edition).
3. Kerry Back, A Course in Derivative Securities: Introduction to Theory and Computation

Course Number	HS 4207
Course Credit	3-1-0-4
Course Title	Wealth Management
Learning Objectives	• Apply risk and return principles to investment decision making • Learn about investment psychology, including the role of risk perception, optimism, and herding behavior in investment decisions. • Learn the principles of wealth management and the strategies used to manage and grow wealth.
Course Objectives:	The course provides a comprehensive introduction to the financial planning and wealth management space. Students learn what wealth management entails, the different client segments in the wealth management universe, and the career paths available within financial planning and wealth management. This course will introduce the skills that are needed to succeed as a financial advisor or private banker and will walk the participants through the various planning services provided by wealth managers. Finally, it steps through the traditional and alternative asset classes accessible at the different levels of wealth management.
Course Content	Introduction to Financial Planning, Investment Planning & Asset Management Regulatory Environment & Legal Compliances, Risk Management & Insurance Estate and Tax Planning Cash Management Behavior Finance Net Worth and Investible Assets Wealth and Estate Planning Services Commodities – G, M, E, O investment Financial Planning for Life Stages, Diversified Investment Management and Analysis. Investment Management
Learning Outcome	The participants will be able to 1. describe the various services that make up wealth management - Outline the various career paths within wealth management 2. Understand how wealth management is segmented by client type 3. Explain the skills needed for success in wealth management 4. Build a simple retirement planning model in Excel 5. Outline the various asset classes available to wealth management clients
Assessment Method	Mid Semester Examination (20%), End Semester examination (40%), Class test & quiz (20%), Project (20%)

Texts:

Dun & Bradstreet (2017), Wealth Management, McGraw Hill Education.

Specialization 3: Data Analytics						
Sl. No.	Subject Code	Course	L	T	P	C
Semester-VII						
1.	HS4106	Financial Analytics	3	1	0	4
2.	HS4110	Programming/ Coding	3	1	0	4
3.	HS4111	HR Analytics	3	1	0	4
4.	HS4112	Big Data Analytics	3	1	0	4
Semester-VIII						
5.	HS4208	Artificial Intelligence	3	1	0	4
6.	HS4209	Statistical Decision Theory	3	1	0	4
7.	HS4210	Algorithm with Lab	3	1	0	4
8.	HS4211	Machine Learning and DS	3	1	0	4

Course Number	HS 4173
Course Credit	3-0-2-4
Course Title	HR Analytics
Learning Objectives	The objective of this course is to help the students ● Understand the concepts and analytical framework in HR analytics. ● Learn to use data to make key employee decisions throughout the staffing cycles of hiring: development, evaluation, promotion; and attrition. ● Understand the ethical responsibility and limitations associated with the usage of data
Course Description	This course is designed to help students understand the role of analytics in making effective and informed decisions related to people management. It will help students use analytics effectively to develop a deeper understanding of data and people management and find appropriate solutions to difficult HR challenges. It aims to enhance decision making capabilities of students by imparting critical thinking and analytical abilities.
Course Outline	HR analytics: concept, need and importance HR information systems and data Analysis strategies, HR analytics continuum: Descriptive, Diagnostic, Predictive and prescriptive analytics, Diversity analytics, Recruitment and Selection analytics, Talent engagement analytics, Analytical performance management, Retention Analytics, Advanced HR analytics techniques, Usage, Ethics, and limitations.
Learning Outcome	On successful completion of the course, participants will be able to: ● Analyze and synthesize data to make important HR decisions ● Use a range of HR assessment tools to improve organizational performance ● Develop HR metrics and apply them and align them with organizational strategy
Assessment Method	Class Participation, Project/assignments, presentations, Mid Term, End Term

Text book

Edwards, M.R. and Edwards, K. Predictive HR Analytics: Mastering the HR Metric. Kogan Page.

Suggested Readings:

Khan, N., Millner, D., & Marr, B. (2020). *Introduction to People Analytics: A Practical Guide to Data Driven HR*. India, Kogan Page.

Waters, S.D. & Streets, V. N. (2018). *The Practical Guide to HR Analytics: Using Data to Inform, Transform and Empower HR Decisions*. Virginia: SHRM.

Data-driven HR by Bernard Marr, Kogan Page Ltd

Fitz-Enz, J. (2010). *The new HR analytics*. American Management Association.

Course Number	HS 4179 HS4112
Course Credit	3-0-2-4 3-1-0-4
Course Title	Big Data Analytics
Learning Objectives	• how to collect, describe and visualise data; • how to build quantitative models to explain phenomena; • how to quantitatively evaluate the effectiveness of policies; • how to map and analyse complex social networks; • how to implement key machine learning algorithms; • how to implement data analytic techniques and data science algorithms using statistical softwares.
Course Description	The purpose of the course is to teach data analytic and data science techniques to evaluate the effectiveness of economic policy, understand economic behaviour, predict and classify economic phenomena and describe and analyse networks of relationships between economic agents, firms, institutions and society.
Course Outline	What is Big Data? Understanding Open data, Administrative data, Real time data; Data Pre-processing, Data Visualization data analytics; New Insights into IO, Finance and high frequency trading; Using Big Data for Prediction and Public Policy; Regularization (e.g. LASSO and Ridge Regression); Dimensionality reduction techniques; Additive & Multiplicative models Exponential smoothing techniques, Forecasting Accuracy, Auto-regressive and Moving Average models, ARCH, GARCH; Risk Analysis; Supervised Machine Learning, U-mean, Unsupervised Learning (e.g. model based clustering, hierarchical non-hierarchical clustering); Machine learning and the art of sparsity, More machine learning techniques; Limitations and Concerns.
Learning Outcome	• Appreciate the unique economic, accounting, and legal characteristics of information. • Understand and apply methods for conceiving and generating broad-based and transformative business benefits from available information assets. • Identify and adapt traditional asset management principles and practices toward the improved management of information assets. • Measure information's various value characteristics to help justify or prove information-related expenditures.
Assessment Method	Quizzes, Assignments, Midterm, End Term

Texts:

Foster Provost, Tom Fawcett, (2013), Data Science for Business, O'Reilly Media, Inc.

Suggested Readings:

Balamarugan Balusamy, Nandhini Abirami R, Seifedine Kadry and Amir Gandomi (2023), Big Data: Concepts, Technology and Architecture, Wiley.

Course Number	HS 4278 HS4211
Course Credit	3-0-2-4 3-1-0-4
Course Title	Machine Learning & DS
Learning Objectives	1) This course aims to train the students with the basic concepts of machine learning. 2) Showcase the utility of machine learning in the analysis of real-world problems. 3) Students will get acquainted with various models and algorithms of supervised learning, reinforcement learning, unsupervised learning, feature selection, and some recent real-life applications of these techniques
Course Description	This course will provide knowledge on different paradigms of machine learning, namely supervised learning, unsupervised learning, semi-supervised learning, reinforcement learning, etc. It will help in understanding various algorithms and application areas of machine learning.
Course Outline	Supervised learning: decision trees, nearest neighbour classifiers, generative classifiers like naive Bayes, linear discriminate analysis, Support vector Machines, feature selection techniques: wrapper and filter approaches, back-ward selection algorithms, forward selection algorithms, PCA, LDA Unsupervised learning: K-means, hierarchical, EM, K-medoid, DB-Scan, cluster validity indices, similarity measures, some modern techniques of clustering; Graphical models: HMM, CRF, MEMM Semi-supervised learning, Active Learning, Topic Modelling: LDA
Learning Outcome	1) This course would enable the students to apply machine learning concepts for solving engineering problems. 2) The students would be able to understand the theory behind machine learning and will be capable of designing new algorithms for real-life problems 3) This course would enable the students to grasp the mathematical concepts behind machine learning
Assessment Methods	Assignment/Quiz: 30%, MidSem: 30%, Endsem:40%

Suggested Readings

1. Pattern recognition and machine learning by Christopher Bishop, Springer Verlag, 2006.
2. Hastie, Tibshirani, Friedman *The elements of Statistical Learning* Springer Verlag
3. T. Mitchell. *Machine Learning*. McGraw-Hill, 1997.
4. Probability, Random Variables and Stochastic processes by Papoulis and Pillai, 4th Edition, Tata McGraw Hill Edition.

5. Linear Algebra and Its Applications by Gilbert Strand. Thompson Books.
6. Data Mining: Concepts and Techniques by Jiawei Han, Micheline Kamber, Morgan Kaufmann Publishers.
7. A. K. Jain and R. C. Dubes. *Algorithms for Clustering Data*. Prentice Hall, 1988.
