MINOR PROGRAMMES FOR FIRST DEGREE STUDENTS

"Minor programs" are offered as options for first degree students with the intent of encouraging them to add focus to their supplemental learning (outside a major area) as well as recognizing and certifying the knowledge obtained in an area that is outside of their major area.

General Guidelines

- A minor would allow a Department (or multiple Departments) to offer a package of courses in an area/sub-area to students for whom this area/sub-area would not be part of their (major) program.
- A minor option would allow a student to pursue the study of an area or a sub-area through a set of courses but not as exhaustively as required to obtain a degree (i.e. a major) in that area.
- A minor may be inter-disciplinary (e.g. a minor in Computational Science may include courses in Numerical Analysis, Computational Physics, Computational Chemistry, and Bioinformatics among others).
- A minor will be recognized by means of a separate certificate.

Requirements for a minor

- Courses and Units Requirement:

  Each minor would be defined by coursework requirement with the following conditions:

Category	Courses	Units
Minor – Core	4 (max)	12 (max)
Minor – Electives	2 (min)	6 (min)
Minor – Total	5 (min)	15 (min)

- Elective Pool:
  - The pool of electives specific to a minor may include courses from one or more disciplines and may include project / seminar type courses.
  - A student may use at most one project / seminar type course to meet the requirements of a minor.
- Overlap in requirements:
  - At most 2 courses (and at most 6 units) out of the above requirement (of 5 courses and 15 units) may be met by mandatory courses of the student's degree i.e. major (or degrees i.e. majors) : i.e. from the general institutional requirement (excluding Humanities requirement) or the (Major) discipline Core(s).
  - No course may be used to meet the requirements of two different minors nor may a course be used to the meet the requirements of two majors and a minor.
- GPA requirement:
  - A student – on completion of the requirements for a minor – must have maintained a cumulative GPA of 4.5 or above (out of 10) in the courses applied to the minor.

Process for declaring / obtaining a minor

- A student – if he/she chooses to pursue a minor – must declare at the end of the 2nd year that he/she will pursue a specific minor. The student will charged a small fee for logistics.
- If and when he/she completes the requirements for the minor – as stipulated above and as stipulated for the specific minor, then he/she may apply for a "minor" certificate.
- If it is verified that the requirements are met then he/she will be awarded a "minor certificate" (separate from a degree – i.e. major – certificate).
- A minor certificate will be issued only on completion of a degree (i.e. a major).

At present Twenty Three minor programs viz. Minor in Aeronautics, Biomedical Engineering, Computational Economics, Computational Mechanics, Computing and Intelligence, Data Science, Data Science in Climate & Health, English Studies, Entrepreneurship, Film and Media, Finance, Management, Materials Science and Engineering, Nanoscience and Nanobiotechnology, Philosophy, Economics and Politics (PEP), Physics, Public Policy, Quantum Information and Technologies, Robotics and Automation, Semiconductor Devices and Technology, Supply Chain Analytics, Water and Sanitation, and Tissue Engineering have been designed. The details of which are given below:

Minor in Aeronautics					
Description	Aeronautics is an exhilarating field encompassing the fundamentals of aerodynamics (interaction of air with objects in motion), propulsion (power systems responsible for the generation of thrust for providing motion), structures (design of airframes and material characteristics), and flight mechanics (trajectory study and optimization), as applied to air-borne vehicles within the Earth's atmosphere, and to rockets and spacecrafts outside.				
Courses & Units Req.	06 courses (min) 18 units (min)				
Core Courses	**Course Number**	**Course Title**	**L**	**P**	**U**
	AN F311	Principles of Aerodynamics	3	0	3
	AN F312	Aircraft Propulsion	3	0	3
	AN F313	Flight Mechanics and Controls	3	0	3
Electives	AN F314	Introduction to Flight	3	0	3
	AN F315	Aircraft Structures	3	0	3
	ME F415	Gas Dynamics	3	0	3
	ME F418	Rocket and Spacecraft Propulsion	3	0	3
	ME F435	Shape Memory Alloys: Fundamentals and Applications	2	1	3
	ME F452	Composite Materials and Design	3	0	3
	ME F482	Combustion	3	0	3
	ME F485	Numerical Techniques for Fluid Flow & Heat Transfer	3	0	3
	EEE F242	Control Systems	3	0	3
	EEE F417	Computer Based Control Systems	3	0	3
	ME F376	Design Project			3

Minor in Biomedical Engineering					
Description	Biomedical Engineering is a long sought after package of courses aiming to cater Pharmacy and Engineering students having aspirations to join Bio Medical Industry. This minor aims to blend the expertise of an engineer into the applied realms of bio medicine through design and development of medical devices and systems; solving complex and multi-disciplinary problems in the field of diagnostics, acquisition, imaging, and analysis of bio signals along with the statistical interpretation of the results.				
Courses & Units Requirements	05 courses (min) 15 units (min).				
Core Courses	**Course No.**	**Course Title**	**L**	**P**	**U**
	BITS F418	Introduction to Biomedical Engineering	3	1	4
	PHA F214	Anatomy Physiology & Hygiene	2	1	3
Electives (Science Pool) 01 (min)	BIO F215	Biophysics	3	0	3
	BITS F315	Introduction to Cognitive Neuroscience	3	0	3
	CHEM F414	Bio and Chemical Sensors	3	0	3
	MST F333	Introduction to Biomaterials	3	0	3
	PHA F215	Introduction to Molecular Biology and Immunology	3	0	3
Electives (Engineering Pool) 02 (min)	BITS F415	Introduction to MEMS	3	1	4
	BITS F417	Microfluidics and Its Application			4*
	BITS F441	Robotics	3	0	3
	BIO G532	Biostatistics and Biomodelling	3	1	4
	CS F320	Foundations of Data Science	3	0	3
	EEE F420	Biomedical Signal Processing	3	1	4
	EEE F435	Digital Image Processing	3	0	3
	EEE/INSTR F432	Medical Instrumentation	3	0	3
	ME F324	Cell and Tissue Biomechanics	3	0	3

Minor in Computational Economics					
Description	The joint field of economics, mathematics, and computer science have emerged from converging intellectual needs for interdisciplinary teaching and research. The contemporary tools and techniques used by computer scientists have become increasingly important for economists working with data to address complex business problems. Students interested in learning about computational mechanism design with applications to economics and especially those whose interest is more generally focused on data analytics will be highly benefitted from this programme. This programme is designed to cater to the needs of the cutting-edge industry thereby combining advanced computational tools with economic reasoning. It would help students to develop a deep background in advanced tools for analysis of economic data, which is essential for making sound economic decisions. The programme combines the strengths of multiple departments to educate students in these important computational skills linked to economics, and to prepare them for careers in economics, finance, and business. Reflecting on this strong interdisciplinary relationship, this programme will also be excellent preparation for graduate study in economics or decision sciences.				
Courses & Units Req.	**05 courses (min) 15 units (min)**				
	Course Number	**Course Title**	L	P	U
Core Courses	ECON F215	Computational Methods for Economics	3	0	3
	ECON F241	Econometric Methods	3	0	3
	ECON F242	Microeconomics	3	0	3
Electives	BITS F314	Game Theory and its Applications	3	0	3
	BITS F464	Machine Learning	3	0	3
	CS F320	Foundations of Data Science	3	0	3
	ECON F342	Applied Econometrics	3	0	3
	ECON F419	Advanced Microeconomics	3	0	3
	ECON F420	Applied Macroeconometrics	3	0	3
	MATH F424	Applied Stochastic Process	3	1	4

Minor in Computational Mechanics					
Description	A minor in Computational Mechanics holds significant justification, driven by the evolving industry demands and advancements. Here are key justifications for choosing this field: **Interdisciplinary Relevance:** Computational Mechanics serves as a bridge between engineering, physics, and mathematics. In today's complex technological landscape, industries increasingly require professionals who can integrate knowledge from diverse domains to solve intricate engineering problems. **Advanced Simulation Skills:** Proficiency in computational tools for intricate simulations and analyses. Vital in aerospace, automotive, and materials science for virtual testing and optimization. **Industry 4.0 Integration:** Plays a crucial role in implementing Industry 4.0 principles. Facilitates the development and application of Digital Twins for real-time system monitoring. **Optimizing Engineering Designs:** Enables the modelling and analysis of complex structures for optimized engineering solutions. Aligns with global sustainability goals. **Career Opportunities in Emerging Technologies:** High demand in additive manufacturing, autonomous systems, and renewable energy. Critical for simulating complex interactions in cutting-edge technologies. **Research and Development Involvement:** Provides opportunities for engaging in impactful research. Opens doors for collaboration with leading experts and institutions. **Preparedness for Industry Challenges:** Systematic and data-driven approach to problem-solving. Addresses contemporary challenges in diverse industries.				
Courses & Units Required	**05 courses (min) 15 units (min)**				
	Course Number	**Course Title**	L	P	U
Core Courses	MATH F313	Numerical Analysis	3	0	3
	ME F427	Continuum Mechanics	3	1	4
Electives	BITS F464	Machine Learning	3	0	3
	CS F422	Parallel Computing	3	0	3
	MATH F425	Numerical Linear Algebra	3	1	4
	MATH F426 or ME G512	Mathematical Theory of Finite Element Methods or Finite Element Methods	3 3	1 2	4 5
	ME F321	Data Mining in Mechanical Sciences	2	1	3
	ME F485	Numerical Techniques for Fluid Flow and Heat Transfer	3	0	3
	ME F430	Fluid-structure Interactions	3	0	3
	ME G515	Computational Fluid Dynamics	3	2	5

Minor in Computing and Intelligence					
Description	The Minor in Computing and Intelligence aims to enable the students majoring in disciplines other than Computer Science to gain a deeper understanding of computing and artificial intelligence and apply the same in solving problems in diverse domains. While courses like Foundations of Data Structures and Algorithms would help the students with abstract thinking and problem solving, courses like Operating Systems, Artificial Intelligence etc., will give them exposure to the fundamental aspects of computing and intelligent systems. This minor programme is exclusively designed for first-degree students of non-Computer Science disciplines.				
Courses & Units Required	**06 courses (min)** **18 units (min)**				
Core Courses	**Course Number**	**Course Title**	L	P	U
	BITS F232	Foundations of Data Structures and Algorithms	3	1	4
	CS F372	Operating Systems	3	0	3
	CS F407	Artificial intelligence	3	0	3
Electives	BITS F311	Image Processing	3	0	3
	BITS F452	Blockchain Technology	3	0	3
	BITS F459	Computer Vision	3	1	4
	BITS F463	Cryptography	3	0	3
	BITS F464	Machine Learning	3	0	3
	CS F212	Database Systems	3	1	4
	CS F213	Object Oriented Programming	3	1	4
	CS F301	Principles of Programming Languages	2	0	2
	CS F303	Computer Networks	3	1	4
	CS F314	Software Development for Portable Devices	2	1	3
	CS F315	Information and Communication Technologies and Development	3	0	3
	CS F321	System Security	3	0	3
	CS F415	Data Mining	3	0	3
	CS F437	Generative Artificial Intelligence	3	0	3
	IS F311	Computer Graphics	3	0	3
	IS F341	Software Engineering	3	1	4

Minor in Data Science					
Description	The minor in Data Science aims to enable students to learn the basic skills required by Data Scientist for today's world. Data Science is becoming ubiquitous to all kinds of industry and opening up new avenues of business. This minor will help students to apply knowledge from Mathematics, Statistics and Computing for analyzing data collected from different kinds of sources in their respective engineering applications and make meaningful and actionable insights.				
Courses & Units Required	5 courses (min) 15 units (min)				
Core Courses	**Course Number**	**Course Title**	**L**	**P**	**U**
	BITS F464	Machine Learning	3	0	3
	CS F320	Foundations of Data Science	3	0	3
	MATH F432	Applied statistical Methods	3	0	3
Electives	BITS F453	Computational Learning Theory	3	0	3
	BITS F454	Bio-Inspired Intelligence: Algorithms and Applications	3	0	3
	BITS F459	Computer Vision	3	1	4
	CS F317	Reinforcement Learning	3	0	3
	CS F407	Artificial Intelligence	3	0	3
	CS F415	Data Mining	3	0	3
	CS F425	Deep Learning	3	0	3
	CS F426	Graph Mining	3	1	4
	CS F429	Natural Language Processing	3	0	3
	CS F432	Brain-inspired Deep Learning	3	0	3
	CS F433	Computational Neuroscience	3	0	3

Minor in Data Science					
	CS F434	Data science for Healthcare			3*
	CS F437	Generative Artificial Intelligence	3	0	3
	CS F469	Information Retrieval	3	0	3
	CS G519	Social Media Analytics	3	1	4
	MATH F212 **OR** ME F320	Optimization **OR** Engineering Optimization	3	0	3
	MATH F353	Statistical Inference and applications	3	0	3
	MATH F424	Applied Stochastic Processes	3	1	4
	MATH F471	Nonlinear Optimization	3	0	3

Minor in Data Science in Climate and Health					
Description	The minor in Data Science aims to enable students to learn the basic skills required by Data Scientist for today's world. Data Science is becoming ubiquitous to all kinds of industry and opening up new avenues of business. This minor will equip students as emerging professionals with the interdisciplinary data skills needed to address challenges at the intersection of climate and health. This new minor programme will train data practitioners on the front lines of the climate crisis to help advance solutions to climate-related health issues.				
Courses & Units Required	**06 courses (min)** **17 units (min)**				
Core Courses	**Course Number**	**Course Title**	L	P	U
	BITS F329	Project on Social and Environmental Applications of Data Science			3*
	BITS F464	Machine Learning	3	0	3
	CS F320	Foundations of Data Science	3	0	3
	MATH F432	Applied statistical Methods	3	0	3
Electives (Any two)	CE F326	Impact of Climate Change on Water	2	1	3
	CS F434	Data science for Healthcare			3*
	GS F212	Environmental Development and Climate Change	3	0	3
	MPH G510	Biostatistics and Computers in Public Health	3	2	5

Minor in English Studies					
Description	English has a rich linguistic, literary and cultural heritage. The classic literary masterpieces of English are still widely read and appreciated. English has also evolved over centuries and is now considered as the pre-eminent means of communication in the various sectors such as business, diplomacy, mass media, education, etc., across the globe. The Minor in English Studies introduces students to the language and literary canons, and renders them with adequate exposure not only to the cultural and linguistic aspects but also to practical applications of English language and literature. In particular, the core and elective courses included in the Minor would encourage students to acquire a critical understanding of literary and linguistic analyses, and the capacity to engage meaningfully in analysis, interpretation, and explanation. The Minor also gives an opportunity for students to choose modules and develop their own interests in language or literature. Students who follow the Minor will have an enhanced understanding of the nature of the English language and literature and also of the tools needed for further independent exploration of literary and linguistic phenomena.				
Courses & Units Required	5 courses (min) 15 units (min)				
Core Courses	**Course Number**	**Course Title**	**L**	**P**	**U**
	GS F241	Creative Writing	2	1	3
	HSS F337	English Literary Forms and Movements	3	0	3
Electives Pool – I (Language)	GS F221	Business Communication	3	0	3
	GS F244	Reporting and Writing for Media	3	0	3

Minor in English Studies					
	GS F245	Effective Public Speaking	3	0	3
	HSS F222	Linguistics	3	0	3
	HSS F227	Cross Cultural Skills	3	0	3
	HSS F228	Phonetics and Spoken English	3	0	3
	HSS F342	Advanced Communicative English	3	0	3
Elective Pool-II (Literature)	GS F242	Cultural Studies	3	0	3
	GS F322	Critical Analysis of Literature and Cinema	3	0	3
	HSS F221	Readings from Drama	3	0	3
	HSS F226	Postmodernism	3	0	3
	HSS F237	Contemporary Indian English Fiction	3	0	3
	HSS F316	Popular Literature and Culture of South Asia	3	0	3
	HSS F327	Contemporary Drama	3	0	3
	HSS F330	Appreciation of Art	3	0	3
	HSS F332	Cinematic Arts	3	0	3
	HSS F335	Literary Criticism	3	0	3
	HSS F336	Modern Fiction	3	0	3
	HSS F338	Comparative Indian Literature	3	0	3
	HSS F340	Postcolonial Literatures	3	0	3
	HSS F349	Ecocriticism	3	0	3
	HSS F373	Shakespeare and Popular Culture	3	0	3
	HSS F399	Introduction to American Literature	3	0	3

Minor in Entrepreneurship					
Description	Entrepreneurship has tremendous impact on development of economy as well as society addressing various market & societal problems through continuous value creation in terms of innovations and job creation. The minor in entrepreneurship aims to equip students from different disciplines with better understanding of entrepreneurial process, necessary skills and experience to translate ideas into real innovative products/services to new entrepreneurial ventures. In this programme, hands-on experiential learning is emphasized giving students an opportunity to learn in a team environment, design innovative products/services and create their own businesses. This will motivate students to pursue entrepreneurship as their career choice.				
Courses & Units Required	**5 courses (min)** **15 units (min)**				
Core Courses	**Course Number**	**Course Title**	**L**	**P**	**U**
	BITS F468	New Venture Creation	3	0	3
	BITS F482 or ECON F414	Creating and Leading Entrepreneurial Organizations	3	0	3
	ECON F212	Fundamentals of Finance and Accounting	3	0	3
Electives (minimum of 2 courses and additional units required to make the total to 15)	BITS F322	Venture Team Development and Organization	3	0	3
	BITS F323	Venture Finance	3	0	3
	BITS F324	Strategy for Entrepreneurs	3	0	3
	BITS F325	New Product and Service Design	3	0	3
	BITS F326	Design Thinking for Innovation & Entrepreneurship	3	0	3
	BITS F427	Digital Marketing	3	0	3

Minor in Film and Media					
Description	Film and its derivative forms of media such as television and advertising are dominant cultural forces in the contemporary world. The minor in Film and Media aims to provide: i. An introduction to media studies with a specific focus on film studies ii. A basic introduction to Print and Digital Media including film making and film appreciation iii. Hands-on training in writing for media and film production				
Courses & Units Required	6 courses (min) 18 units (min)				
Core Courses	**Course number**	**Course Title**	**L**	**P**	**U**
	GS F223	Introduction to Mass Communication	3	0	3
	GS F244	Reporting and Writing for Media	3	0	3
	GS F322	Critical Analysis of Literature and Cinema	3	0	3
Elective Courses	GS F224	Print and Audio Visual Advertising	3	0	3
	GS F242	Cultural Studies	3	0	3
	GS F321	Mass Media Content and Design	3	0	3
	GS F343	Short Film and Video Production	3	0	3
	HSS F332	Cinematic Arts	3	0	3

Minor in Finance					
Description	The minor in Finance aims at providing the student a grounding in the basic concepts of accounting and finance so as to complement their existing disciplinary knowledge, enrich their educational experience, enable them to make better financial decisions, and expand their career opportunities. It will also give students an opportunity to learn more about investments and quantitative applications in finance.				
Courses & Units Required	5 courses (min) 15 units (min)				
Core Courses	**Course Number**	**Course Title**	**L**	**P**	**U**
	ECON F212	Fundamentals of Finance and Accounting	3	0	3
	FIN F315	Financial Management	3	0	3
Elective Courses	ECON F241	Econometric methods	3	0	3
	ECON F312	Money banking and Financial markets	3	0	3
	ECON F355	Business Analysis & Valuation	3	0	3
	ECON F411	Project Appraisal	3	0	3
	ECON F413	Financial Engineering	3	0	3
	FIN F242	Introduction to Financial Mathematics	3	0	3
	FIN F243	Functions & Working of Stock Exchanges	3	0	3
	FIN F311	Derivatives & Risk Management	3	0	3
	FIN F312	Fundamentals of Taxation and Audit	3	0	3
	FIN F313	Security Analysis & Portfolio Management	3	0	3
	FIN F314	Investment Banking & Financial Services	3	0	3
	FIN F414	Financial Risk Analytics and Management	3	0	3

Minor in Management					
Description	"Minor in Management" is designed for the student who wants a general introduction to the functioning of a business and develops a business acumen. By gaining an understanding of the areas of management, the student will have a competitive advantage in the marketplace and throughout their career. The student shall be better equipped to handle their projects in practice school by understanding organizational and managerial issues. It would also enable him/her to combine their technical and managerial skills and explore the field of business consulting, role of management trainees, etc. Those interested in pursuing an MBA would get an opportunity to explore the management field and assess its fit with their career interest.				
Courses & Units Required	**05 courses (min)** **15 units (min)**				
	Course Number	**Course Title**	L	P	U
Core Courses	BITS F428	Essentials of Strategic Management	3	0	3
	MGTS F211	Principles of Management	3	0	3
	MGTS F314	Essentials of Financial Management	3	0	3
Electives	BITS F326	Design Thinking for Innovation and Entrepreneurship	3	0	3
	BITS F330	Negotiation Skills and Techniques			3*
	ECON F415	New Venture Creation	3	0	3
	ECON F434	International Business	3	0	3
	ECON F435	Marketing Research	3	0	3
	HSS F328	Human Resources Development	3	0	3
	MF F219	Operations Management	3	0	3
	MF F319	Supply Chain Management	3	0	3
	ME F443	Quality Control, Assurance and Reliability	3	0	3
	MGTS F311	Marketing	3	0	3
	MGTS F313	Product and Brand Management	3	0	3
	MGTS F315	Foundations of Business Analytics	3	0	3
	MGTS F316	Managerial and Leadership Skills	3	0	3
	MGTS F351	Organizational Behaviour	3	0	3

Minor in Materials Science and Engineering					
Description	Materials Science and Engineering is an interdisciplinary subject that makes use of knowledge from Physics, Chemistry, Engineering, Mathematics, Biology and Biotechnology, but which has its own special character. It is always evolving – new and exciting materials such as nanomaterials, high-temperature and lightweight materials, green materials and sustainable biomaterials for tissue engineering are continually emerging. The field of Material Science combines a wide knowledge base and puts it to diverse practical and commercial use.				
Courses & Units Required	5 courses (min) 15 units (min)				
	Course Number	**Course Title**	**L**	**P**	**U**
Core Courses	CHE F243 / ME F213	Materials Science and Engineering	3 2	0 0	3 2
	MST F331	Materials Characterization	3	1	4
	MST F332	Materials Processing	3	0	3
Elective Courses	BITS F416	Introduction to Nanoscience	3	0	3
	CHE F433	Corrosion Engineering	3	0	3
	CHEM F223	Colloid and Surface Chemistry	3	0	3
	CHEM F326	Solid State Chemistry	3	0	3
	CHEM F336	Nanochemistry	3	1	4
	ME F452	Composite Materials and Design	3	0	3
	MST F333	Introduction to Biomaterials	3	0	3
	MST F334	Materials for Catalytic Applications	3	0	3
	MST F335	Coating and thin film technology	3	0	3
	MST F336	Glass Technology	3	0	3
	MST F337	Materials for Energy Applications	3	0	3
	MST F338	Metals and Alloys	3	0	3
	MST F339	Polymer Materials	3	0	3
	PHY F379	Thin Film Technology	3	0	3
	PHY F414	Physics of Advanced Materials	3	1	4
	PHY F416	Soft condensed Matter Physics	3	1	4

Minor in Nanoscience and Nanobiotechnology					
Description	Nanoscience and nanotechnology a cutting edge branch of science and engineering in which we understand the control of the formation of structures and materials on scales ranging from the atomic to the nanometer, their unique properties due to their nanostructures, and their applications in myriad fields including, alternative energy, energy storage and conversion, electronic devices, sensors, catalysis, medical diagnostics, therapeutics etc. This interdisciplinary subject makes use of knowledge from Physics, Chemistry, Engineering, Biology, Biotechnology, etc. This Minor program in "Nanoscience and Nanobiotechnology" will provide the students deep understanding of nanostructured materials including their synthesis, characterizations, properties, and applications.				
Courses & Units Required	05 courses (min) 15 units (min)				
Core Courses	**Course Number**	**Course Title**	L	P	U
	BIOT F422	Nanobiotechnology	3	0	3
	BITS F416	Introduction to Nanoscience	3	1	4
	CHE F243/ME F216 / MF F216	Material Science and Engineering	3 2	0 1	3 3
Electives (Any Two)	BIO F417	Biomolecular Modelling	3	0	3
	CHEM F223	Colloid and Surface Chemistry	3	0	3
	CHEM F327	Electrochemistry: Fundamentals and Applications	3	0	3
	CHEM F328	Supramolecular Chemistry	3	0	3
	CHEM F333	Chemistry of Materials	3	0	3
	CHEM F336	Nanochemistry	3	1	4
	CHEM F414	Bio and Chemical Sensors	3	0	3
	MST F333	Introduction to Biomaterials	3	0	3

Minor in Philosophy, Economics, and Politics					
Description	The minor in *Philosophy, Economics & Politics & (PEP)* aims at introducing students to a wide range of approaches to understand the social and human world we live in and to develop skills useful for a range of career opportunities in national and international organizations. It would particularly interest and enthuse those students who wish to complement their core expertise in science and engineering with a good grasp of the humanities and social sciences. As a multi-disciplinary minor, this option will provide a judicious mix of knowledge in social sciences (economics, sociology and politics) and the humanities (philosophy) that would enable students to draw connections among political, economic, and social phenomena as well as equip them with the necessary skills to think through complex challenges of our society in a creative and critical manner.				
Courses & Units Required	6 courses (min) 18 units (min)				
Core Courses	**Course Number**	**Course Title**	**L**	**P**	**U**
	ECON F211	Principles of Economics	3	0	3
	GS F211	Modern Political Concepts	3	0	3
	HSS F235	Introductory Philosophy	3	0	3
Elective Courses	BITS F 385	Introduction to Gender Studies	3	0	3
	GS F231	Dynamics of Social Change	3	0	3
	GS F234	Development Economics	3	0	3
	GS F243	Current Affairs	3	0	3
	GS F312	Applied Philosophy	3	0	3
	GS F313	Marxian Thoughts	3	0	3
	GS F332	Contemporary India	3	0	3
	GS F333	Public Administration	3	0	3
	HSS F232	Introduction to Development Studies	3	0	3
	HSS F236	Symbolic Logic	3	0	3
	HSS F315	Society, Business, and Politics	3	0	3
	HSS F322	Social and Political Ecology	3	0	3
	HSS F331	Sankara's Thoughts	3	0	3
	HSS F333	Comparative Religion	3	0	3
	HSS F343	Professional Ethics	3	0	3
	HSS F345	Gandhian Thoughts	3	0	3
	HSS F346	International Relations	3	0	3

Minor in Philosophy, Economics, and Politics					
	HSS F350	Human Rights: History, Theory and Practice	3	0	3
	HSS F353	Philosophy of Aesthetics	3	0	3
	HSS F354	Introduction to Islamic Economy	3	0	3
	HSS F355	Dictatorship, Democracy & Development	3	0	3
	HSS F356	Social Movements and Protest Politics	3	0	3

Minor in Physics					
Description	The theories in physics are all-pervading and their applications are found in varied branches of engineering and sciences. The minor in Physics aims to introduce the student to fundamental theories in physics. The core courses cover the basics and by choosing from the large pool of electives, the student will be able to pursue to a deeper level the areas of her/his interest. This minor would equip the students with the skill and knowledge which will help them in gaining insights in their own primary area of study.				
Courses & Units Required	5 courses (min) 15 units (min)				
Core Courses	**Course Number**	**Course Title**	**L**	**P**	**U**
	PHY F212 **or** ECE F212/ EEE F212/ INSTR F212	Electromagnetic Theory – 1 **or** Electromagnetic Theory	3	0	3
	PHY F242	Quantum Mechanics – 1	3	0	3
	PHY F312	Statistical Mechanics	3	0	3
Elective Courses	BITS F316	Nonlinear Dynamics and Chaos	3	0	3
	BITS F386	Quantum Information and Computing	3	0	3
	PHY F211	Classical Mechanics	3	1	4
	PHY F213	Optics	3	0	3
	PHY F214	Electricity Magnetism and Optics Lab	0	2	2
	PHY F215	Introduction to Astronomy and Astrophysics	3	0	3
	PHY F241	Electromagnetic Theory – 2	3	1	4
	PHY F243	Mathematical Method of Physics	3	0	3
	PHY F244	Modern Physics Lab	0	2	2
	PHY F311	Quantum Mechanics – 2	3	0	3
	PHY F313	Computational Physics	3	0	3
	PHY F315	Theory of Relativity	3	0	3
	PHY F318	Atoms and Photons	3	0	3
	PHY F341	Solid State Physics	3	0	3
	PHY F342	Atomic and Molecular Physics	3	0	3
	PHY F343	Nuclear and Particle Physics	3	0	3
	PHY F346	Laser Science and Technology	3	0	3
	PHY F418	Lasers and Applications	3	1	4
	PHY F426	Physics of Semiconductors Devices	3	1	4
	PHY F427	Atmospheric Physics	3	0	3
	PHY F428	Quantum Information Theory	3	0	3
	PHY F434	Foundations of Quantum Mechanics	3	0	3

Minor in Public Policy					
Description	The Minor in Public Policy aims at providing the students a clear and contextualised understanding of conceptual and empirical aspects of public policy, the nature of public policy interventions in India and their varying impacts. Also, it intends to provide the students an understanding of the dynamics of policymaking, central aspects of governance and core features and functions of institutions, and equip them with skills of policy analysis.				
Courses & Units Required	5 courses (min) 15 units (min)				
Core Courses	**Course Number**	**Course Title**	**L**	**P**	**U**
	GS F233	Public Policy	3	0	3
	GS F333	Public Administration	3	0	3
Elective Courses	HSS F232	Introduction to Development Studies	3	0	3
	HSS F317	Introduction to Globalisation	3	0	3
	HSS F322	Social and Political Ecology	3	0	3
	HSS F361	Urban Policy and Governance	3	0	3

	HSS F362	Local Governance and Participation	3	0	3
	HSS F363	Disaster and Development	3	0	3

Minor in Quantum Information and Technologies					
Description	Quantum Information Technology is a current area of interest the world over, throwing up many opportunities for employment in industry, start-ups and pure research. Equipping undergraduates with the basic tools and introducing them to the language of this area is of prime importance in today's age. Especially in light of the National Mission on Quantum Technologies and competition from other premier institutions in India, it is imperative that BITS play an important role in training manpower for the second quantum revolution. This program will definitely serve Physics and Engineering students in enhancing their knowledge and skills in this current area.				
Courses & Units Required	**05 courses (min)** **15 units (min)**				
Core Courses	**Course Number**	**Course Title**	L	P	U
	BITS F386	Quantum Information and Computations	3	0	3
Electives	BITS F463	Cryptography	3	0	3
	BITS F464	Machine Learning	3	0	3
	CS F316	Quantum Architecture and Programming	3	0	3
	PHY F242 OR PHY F345 OR CHEM F213	Quantum Mechanics I OR Quantum Mechanics for Engineers OR Physical Chemistry II	3 3 3	0 0 0	3 3 3
	PHY F420 OR PHY F318	Quantum Optics OR Atoms and Photons	3 3	1 0	4 3
	PHY F428	Quantum Information Theory	3	0	3
	PHY F434	Foundations of Quantum Mechanics	3	0	3

Minor in Robotics and Automation					
Description	This minor aims to impart specialized knowledge and skills in robotics and automation required by engineers to the current demands of various industrial sectors. Automobile, aerospace & defense, logistics engineering and factory automation companies are currently asking for engineering graduates with add-on skills in these areas. Feedback has established that several sectors of industry need the newly recruited employees with knowledge and skills in 'automation', 'robotics', and 'mechatronics'. Currently, the need of core courses of any B.E. programme of the Institute limits sufficient coverage of these topics in the existing core and hence the only way students can complement their learning with these specialized courses is through a minor programme. This minor programme has been designed by keeping that need in focus. This minor programme consists of a fairly generic core so as to be relevant to students of any discipline and a broad set of elective courses covering application of the fundamentals of robotics and automation to various industry sectors.				
Courses & Units Required	05 courses (min) 15 units (min)				
Core Courses	**Course Number**	**Course Title**	**L**	**P**	**U**
	BITS F441	Robotics	3	0	3
	EEE/INSTR/ECE F242	Control Systems	3	0	3
	BITS F327	Artificial Intelligence for Robotics	2	1	3
Electives	BITS F312	Neural Network & Fuzzy Logic	3	0	3
	BITS F415	Introduction To MEMS	3	1	4
	BITS F442	Remote Sensing and Image Processing	3	0	3
	BITS F451	Autonomous Mobile Robotics	3	0	3
	BITS F464	Machine Learning	3	0	3
	ECE F434	Digital Signal Processing	3	1	4
	EEE F411	Internet of Things (IoT)	3	1	4
	EEE F422	Modern Control Systems	3	0	3
	EEE G512	Embedded System Design	3	1	4
	INSTR F343	Industrial Instrumentation and Control	3	0	3
	INSTR G611	Advanced Control Systems	3	2	5
	ME F221 or	Mechanisms and Machines	3	0	3

Minor in Robotics and Automation					
	MF F221				
	ME F426	Industry 4.0 in Manufacturing	3	0	3
	ME F432	Computer Aided Manufacturing	2	1	3
	MF F311	Mechatronics & Automation	2	1	3
	MSE G511	Mechatronics	3	2	5

Minor in Semiconductor Devices and Technology					
Description	As the need for semiconductor chips increases globally, there will be a greater need for engineers who specialize in semiconductor-device and circuit design. There is a huge investment by government as well as the leading semiconductor industries to set up semiconductor manufacturing units across the globe. Hence, there is an urgent need to train manpower in this specialized field. The minor will also lay foundation for the more complex design level (both analog and digital) thinking thereby expanding the scope and expertise of the student and making them ready for the competitive job market. Further, the minor will also introduce the component of semiconductor manufacturing, which is totally aligned with the government National Semiconductor Mission.				
Courses & Units Required	05 courses (min) 15 units (min)				
	Course Number	**Course Title**	L	P	U
Core Courses	EEE F437	Semiconductor Fabrication Technology	3	1	4
	EEE/ECE/INSTR/ECOM F214	Electronic Devices	3	0	3
Electives	BITS F415	Introduction to MEMS	3	1	4
	EEE/ECE/INSTR F216	Electronic Devices Simulation Laboratory	0	2	2
	EEE/ECE/INSTR F423	Electronic Material Design and Simulation Laboratory	1	2	3
	EEE F477	Modelling of Field-Effect Nano Devices	3	0	3
	EEE G595	Nanoelectronics and Nanophotonics			5
	MEL G514	Nanoelectronic Memories and Technology	3	2	5
	MST F331	Material Characterization	3	1	4
	PHY F341	Solid State Physics	3	0	3
	PHY F379	Thin Film Technology	3	0	3

Minor in Supply Chain Analytics					
Description	Supply chain analytics help organizations to take better, faster and more informed decisions about their business operations. The global market for supply chain analytics is projected to exceed $10 billion by 2025 and has a compound annual growth rate (CAGR) of 16%. Today's supply chain analytics solutions already have impressive capabilities, and with future advancements will only become more of a game-changer for businesses across all industries. Supply chain analytics minor programme will enable the students to develop foundations and to broaden their knowledge base of supply chain in general and supply chain analytics in specific. It will cover three verticals such as supply chain management, supply chain modelling and empirical analysis (qualitative data analysis) & supply chain analytics (quantitative data analysis). The minor programme is designed to create supply chain professionals for present and future business environment.				
Courses & Units Required	**05 courses (min)** **15 units (min)**				
	Course Number	**Course Title**	**L**	**P**	**U**
Core Courses	BITS F455	Analytics for Supply Chain	3	0	3
	MF F319	Supply Chain Management	3	0	3
	MF F422	Supply Chain Modelling and Empirical Analysis	3	1	4
Electives	ME F443	Quality Control Assurance and Reliability	3	0	3
	MF F321	Procurement Management	3	0	3
	MF F418	Lean Manufacturing	3	0	3
	MF F485	Sustainable Manufacturing	3	0	3
	MATH F212 **OR** ME F320 **OR** MF F320	Optimization **OR** Engineering Optimization **OR** Engineering Optimization	3	0	3
	MATH F242	Operations Research	3	0	3
	MATH F353	Statistical Inference and Applications	3	0	3

Minor in Water and Sanitation					
Description	Sustainable Development Goal 6 (SDG 6) focusses on Water and Sanitation and the tasks mentioned in SDG 6. Sanitation is also high on agenda of the Indian Government as evident from Swachh Bharat Mission. Trained Postgraduate and working professionals are of high demand. Bill and Melinda Gates foundation had significantly invested in Water, Sanitation and Hygiene programme and they had funded UNESCO IHE and its 8 partners in developing e learning alliance. The foundation's investment strategy in sanitation requires qualified and trained professionals. This minor would equip the students with the skill and knowledge which will help them in gaining insights in the area of water and sanitation.				
Courses & Units Required	05 courses (min) 15 units (min)				
Core Courses	**Course Number**	**Course Title**	L	P	U
	BIO F216	Water Sanitation and Solid Waste Management	3	0	3
	BIO F217	Laboratory for Water Sanitation and Solid Waste management	1	2	3
Electives	BIO F266	Study Project			3
	SAN G511	Sanitation Technology	3	2	5
	SAN G512	Sanitation and Public Health	3	2	5
	SAN G513	Sanitation Governance Behaviour change and Advocacy			5*
	SAN G514	Sanitation Finance and Project Management			5*
	SAN G515	Emergency Sanitation & Leadership			5*

Minor in Tissue Engineering					
Description	Tissue Engineering is an upcoming field which required interdisciplinary knowledge of Engineering as well as Biological Sciences (specially Tissue Culture). The objective is to train students to do research and innovate to repair damaged tissues or produce organs or tissues for replacement in damaged patients. Its basically a field of Biomedical Engineering wherein skill sets of Cell & Tissue Culture, Materials Sciences and Engineering skills in terms of Mechanical or Chemical Engineering is required to develop or repair damaged tissues or organs.				
Courses & Units Required	**05 courses (min)** **15 units (min)**				
Core Courses	**Course Number**	**Course Title**	L	P	U
	BIO F352	Cell and Tissue Culture Technology	3	1	4
	BIO F422	Fundamentals of Tissue Engineering	2	1	3
	MST F333	Introduction to Biomaterials	3	0	3
Electives	BITS F417 or ME F423	Microfluidics and Its Application or Microfluidics and Its Application	3	0	3 4*
	BITS F418	Introduction to Biomedical Engineering	3	1	4
	BIOT F422	Nanobiotechnology	3	0	3
	BIO F311	Recombinant DNA Technology	3	0	3
	CHE F414	Transport Phenomena	3	0	3
	CHE F421	Biochemical Engineering	3	0	3
	DE G513	Tribiology	3	2	5
	ME F211	Mechanics of Solids	3	0	3
	ME F216	Materials Science & Engineering	2	1	3
	ME F452	Composite Materials and Design	3	0	3