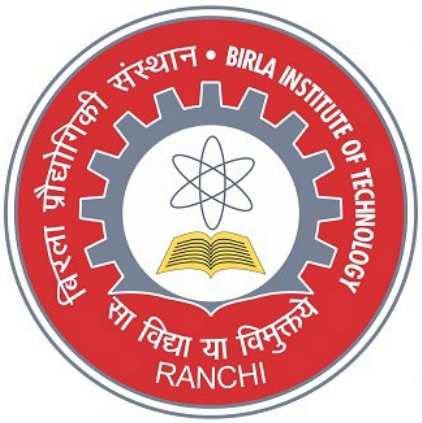
NEP-Based Programme (CBCS)
5 Year Integrated M.Sc. QEDS

NEP (2020)-based 5 -Year Integrated M.Sc. Programme in Quantitative Economics and Data Science

Degree Options as per NEP:

I. 1 Year-Certificate QEDS
II. 2 Year-Diploma QEDS
III. 3 Year-B.Sc. QEDS
IV. 4 Year-B.Sc. QEDS (Honors with Research)/B. Sc. QEDS (Honors)
V. 2 Year M.Sc. QEDS
VI. 5 Year-Integrated M.Sc. QEDS



Centre for Quantitative Economics and Data Science
Birla Institute of Technology Mesra
Ranchi-835215, Jharkhand

NEP-Based Programme (CBCS)
5 Year Integrated M.Sc. QEDS

NEP-based Integrated *M.Sc. QEDS*

Program Highlights:

- The essential criteria followed as per NEP 2020 guidelines from UGC for preparing the course structure of this program.
- **Admission Criteria: Indian students -** Based on AIR in JEE-Main through CSAB (Central Seat Allocation Board) / JoSAA (Joint Seat Allocation Authority). **NRI/OCI/ Foreign National (FN) –** Based on marks obtained by the candidates in Class 12 / equivalent qualifying examination
- Students will get a degree of Integrated M.Sc. QEDS (Research) after completing the 5th year if required eligibility is fulfilled.
- After completing each year course, the multiple entry-exit option will be available to obtain 1-Yr-Certificate QEDS, 2-Yr-Diploma QEDS, 3-Yr-B.Sc. QEDS, 4-Yr-B. Sc. QEDS (Honors)/B.Sc. QEDS (Honors with research), 2 Year M.Sc. Program in QEDS
- Lateral entry at each level is allowed in MO sessions as per eligibility and qualifying tests.

Centre's Vision

To become a globally recognized Centre of excellence in teaching and research by producing academicians, professionals, and innovators to create a better world where a profound understanding of the field of Quantitative Economics and Data Sciences drives positive change in business and society.

Centre's Mission

- To set-up a world-class Quantitative Economics and Data Science centre by producing original & robust research insights, delivering high-quality & evidence-based education and engaging with people & organisations worldwide, across the private & public sectors, who are motivated to transform the world by tackling real world challenges.
- To intellectually transform students for productive and stimulating careers by providing them a strong grasp of fundamentals through a diverse living environment, exposure to new ideas and interaction with people who come from different walks of life and have evolving identities.

Programme Outcomes (POs)

A graduate of this program is expected to gain:

1. **Knowledge:** attainment of in-depth understanding of basic principles and concepts of Economic theories and Data Sciences to facilitate their applications in fields related to economics, mathematics, statistics, finance, and others.

2. **Problem Analysis:** be capable of searching for new research questions, analysing data, apply latest methodologies, and develop insights using the results obtained to solve real-life problems.
3. **Design/Development of Solution:** be able to ask difficult questions, explore unfamiliar terrain, and indulge in the passion for discovery to arrive at innovative solutions, while keeping in mind public health and safety, and the cultural, societal, and environmental considerations.
4. **Conduct Investigations of Complex Problems:** ability to actively engage with accepted thinking and constantly questioning the relevance, impact, and potential of different positions.
5. **Modern Tool Usage:** Able to think critically and strategically to apply innovations in data analytics by incorporating visual analytics, predictive models, as well as recent advances in computational and machine learning tools.
6. **The Professional and Society:** ability to understand the socio-economic dynamics of societies to shape critical academic achievement; collective obligation; critical consciousness.
7. **Environment and Sustainability:** understand the scientific and economic dimensions of environmental issues and apply the practical tools of analysis and quantitative methods for a sustainable future.
8. **Ethics:** develop an understanding of how psychological, organizational, and cultural forces influence ethical behaviour and explore ways to nurture the ethical behaviours.
9. **Individual and Team Player:** demonstrate the ability to work together with others in a group while taking accountability as an individual, a member or a leader of a team in a multi-disciplinary setting.
10. **Communication skills:** ability to express his/her ideas and findings in the right way for the right audience as thorough professionals.
11. **Project Management and Finance:** demonstrate active decision-making skills to manage projects that involve economic, legal, and ethical responsibilities to multiple parties.
12. **Lifelong Learning:** Engage in mastering new skills and knowledge for keeping pace in a world where automation technologies are reshaping roles and institutions.

Programme Specific Outcomes (PSOs)

1. **PSO 1**: Apply in-depth knowledge gained during the Integrated Quantitative Economics and Data Analytics program in order to become society's most innovative thinkers, leaders, and doers.
2. **PSO 2**: Apply modern technical tools of empirical analysis and mathematical methods to be successful assets in workplace to foster intellectual, social, and personal transformations.
3. **PSO 3**: Capable of using his/her knowledge of Quantitative Economics and Data Sciences to usher development at the frontiers of research.

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Program Educational Objectives (PEOs)

1. **PEO1.** To provide a well-founded educational base as well as well-resourced learning environment in Quantitative Economics and Data Sciences for formulating and analysing real-world problems with a sustainable approach.
2. **PEO2.** To enable students to take up the fundamental and genuine challenges of Data in the current era for better analytical approaches to assimilating data, and demonstrative applications in various fields such as economics, mathematics, statistics, finance, and others, from the convergence of third paradigm technologies point of view.
3. **PEO3.** To train the students in analytical decision making and strategic policy formulation for organizations in domains like Banking, Finance, Energy, Technology, Environment, Healthcare etc.
4. **PEO4.** To equip the students with the tools of analytical and computational skills in Quantitative Economics and Data Sciences.
5. **PEO5.** To develop a deep understanding of the theory and practice for building a strong academic-industrial relationship, with a focus on collaboration projects, including research-data partnerships.
6. **PEO6.** To nurture and nourish strong communication and interpersonal skills for working in a team as well as upholding ethical standards.

1. Introduction

The program is designed to provide a deep interdisciplinary experience to the students.

The **B.Sc. QEDS (Honors with Research)** is a 4-year programme organized into eight semesters. Students who complete all requirements for the award of the **B.Sc. QEDS (Honors)/B. Sc. QEDS (Honors with Research)** has the option of getting an **Integrated M.Sc. QEDS (Research) degree by studying at the Institute for the fifth year**.

As per NEP guidelines, the following levels will be given to the candidates to opt for entry and exit the programme:

- ***1-Year Programme: Certificate QEDS***
- ***2-Year Programme: Diploma QEDS***
- ***3-Year Programme: B.Sc. QEDS***
- ***4-Year Programme: B. Sc. QEDS (Honours)/B.Sc. QEDS (Honours with research)***
- ***2 Year M.Sc. QEDS***
- ***5-Year Programme: Integrated M.Sc. QEDS (Research)***

NEP-Based Programme (CBCS)
5 Year Integrated M.Sc. QEDS

2. Academic Details

Undergraduate Programme (Semesters I - VI)								
Semester/ Session of Study		**Category of Structure**	**Course Code**	**Subjects**	**Mode of delivery and credits: L- Lecture T- Tutorial P- Practical**			**Total Credits**
					L (Periods/week)	**T (Periods/ week)**	**P (Periods/week)**	
SEMESTER I	**THEORY**							
		PC (Program Core)	**ED24101**	**Introductory Analysis**	**3**	**1**	**0**	**4**
			ED24103	**Statistical Methods - I**	**3**	**0**	**0**	**3**
			ED24105	**Introduction to Economics and Essential Mathematics**	**3**	**0**	**0**	**3**
			ED24107	**Probability I**	**3**	**1**	**0**	**4**
		Generic Elective (GE)	**ED24109**	**Introduction to Programing and Data Structure**	**3**	**0**	**0**	**3**
		Humanities and Social Sciences (HSS)	**MT24132**	**Communication Skill 1**	**0**	**0**	**3**	**1.5**
	LABORATARIES							
		MC	**MC 24101/24102/24103/24104/24109**	**Choice of: NCC/NSS/ PT & Games / Creative Arts (CA)/ Entrepreneurship**	**0**	**0**	**2**	**1**
		PC	**ED24104**	**Statistical Methods – I Lab**	**0**	**0**	**3**	**1.5**
		GE	**ED24110**	**Introduction to Programing and Data Structure Lab**	**0**	**0**	**3**	**1.5**
Total (Semester I)								**22.5**

NEP-BASED CBCS PROGRAMME

B.Sc. (Honours with Research) and M.Sc. (Research) in Quantitative Economics and Data Science (QEDS)

SEMESTER II				**THEORY**				
		PC	ED24111	Intermediate Analysis	3	1	0	4
		PC	ED24113	Statistical Methods II	3	1	0	4
		PC	ED24115	Introductory Microeconomics	3	1	0	4
		PC	ED24117	Linear Algebra and Vectors and Matrices	3	0	0	3
		GE	ED24119	Programming Language and Data Base Management System	3	0	0	3
		Foundation Science (FS)	CE24101	Environmental Science	1	0	2	2
				LABORATORIES				
		MC	MC 24105/24106/24107/24108/24110	Choice of: NCC/NSS/ PT & Games / Creative Arts (CA)/ Entrepreneurship	0	0	2	1
		PC	ED24114	Statistical Methods II Lab	0	0	3	1.5
		GE	ED24120	Programming Language and Data Base Management System Lab	0	0	3	1.5
Total (Semester II)								**24**
GRAND TOTAL (FIRST YEAR)								***46.5***
Vocational Course			**Linear Statistical Models and Regression Analysis**					***3***
Minimum requirement for *Certificate in QEDS* (After First Year)								***49.5***
				THEORY				
		PC	ED24201	Differential Equations	3	1	0	4

NEP-BASED CBCS PROGRAMME

B.Sc. (Honours with Research) and M.Sc. (Research) in Quantitative Economics and Data Science (QEDS)

SEMESTER III			**ED24203**	**Intermediate Microeconomics**	**3**	**1**	**0**	**4**
			ED24205	**Introductory Macroeconomics**	**3**	**1**	**0**	**4**
			ED24207	**Probability II**	**3**	**1**	**0**	**4**
		HSS	**ED24209**	**Introduction to Sociology and Political Science**	**3**	**0**	**0**	**3**
		Skill Enhancement Course (SEC)	**ED24211**	**Linear Statistical Models and Regression Analysis**	**3**	**0**	**0**	**3**
	LABORATORIES							
		MC	**MC 24201/24202/24203/24204/24209**	**Choice of: NCC/NSS/ PT & Games / Creative Arts (CA)/ Entrepreneurship**	**0**	**0**	**2**	**1**
		SEC	**ED24212**	**Linear Statistic Models and Regression Analysis Lab**	**0**	**0**	**2**	**1**
Total (Semester III)								**24**
SEMESTER IV		**THEORY**						
		PC	**ED24213**	**Optimization Techniques**	**3**	**1**	**0**	**4**
			ED24215	**Intermediate Macroeconomics**	**3**	**0**	**0**	**3**
			ED24217	**Stochastic Processes**	**3**	**1**	**0**	**4**
			ED24219	**Economic Development and Demography**	**3**	**0**	**0**	**3**
		GE	**ED24221**	**Introduction to Psychology**	**3**	**0**	**0**	**3**

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		SEC	ED24223	Sampling Techniques and Design of Experiments	3	1	0	4
			MC	Indian Knowledge System				NC
		LABORATORIES						
		MC	MC 24205/24206/24207/24208/24210	Choice of: NCC/NSS/ PT & Games / Creative Arts (CA)/Entrepreneurship	0	0	2	1
		PC	ED24218	Stochastic Processes Lab	0	0	2	1
		SEC	ED24224	Sampling Techniques and Design of Experiments L	0	0	2	1
Total (Semester IV)								**24**
GRAND TOTAL (SECOND YEAR)								***94.5***
Vocational Course			**Basic Econometrics**					3
Minimum requirement for Diploma in QEDS (After second year)								***97.5***
SEMESTER V		**THEORY**						
		PC	ED24301	International Trade	3	0	0	3
			ED24303	Multivariate Data Analysis	3	0	0	3
			ED24305	Basic Econometrics	3	0	0	3
			ED24307	Parametric Inference	3	0	0	3
		HSS	MT24133	Communication Skill 2	0	0	3	1.5

		Major (Discipline Specific Elective (DSE))	Major (DSE-1) (Anyone)	ED309 Topics on Indian Economy/ ED323 Behavioural Economics/ ED325 Economics of Social Sector	3	0	0	3
			Major (DSE-2) (Anyone)	ED311 Public Economics/ ED327 Environmental Economics-I/ ED329 Open Economy Macroeconomy	3	0	0	3
	LABORATORIES							
		PC	ED24304	Multivariate Data Analysis Lab	0	0	2	1
			ED24306	Basic Econometrics Lab	0	0	2	1
			ED24308	Parametric inference Lab	0	0	2	1
Total (Semester V)								22.5
SEMESTER VI		PC	ED24313	Nonparametric Methods and Decision Theory	3	1	0	4
			ED24315	Applied Econometrics	3	0	0	3
			ED24317	Statistical Machine Learning I	3	0	0	3
			ED24319	Game Theory	3	1	0	4

NEP-BASED CBCS PROGRAMME

B.Sc. (Honours with Research) and M.Sc. (Research) in Quantitative Economics and Data Science (QEDS)

		Major (DSE)	Major (DSE-3) (Anyone)	ED321 Financial Economics/ ED331 Money and Financial Institutions/ ED333 Entrepreneurial Economics	3	1	0	4
	LABORATORIES							
		PC	ED24314	Nonparametric Methods and Decision Theory Lab	0	0	2	1
			ED24316	Applied Econometrics Lab	0	0	3	1.5
			ED24318	Statistical Machine Learning I Lab	0	0	3	1.5
		Dissertation	ED24300	Dissertation				6
Total (Semester VI)								28
GRAND TOTAL (THIRD YEAR)								*145*
Minimum requirement for the award of the degree *B.Sc. in Quantitative Economics and Data Science* (Semesters I-VI)								145

Postgraduate Programme (Semesters VII-X)								
Semester/ Session of study		Category of Structure	Course Code	Subjects	Mode of delivery and credits: L-Lecture T- Tutorial P-Practical's			Total Credits
					L (Periods /week)	T (Periods /week)	P (Periods /week)	
	THEORY							
		PC	ED24401	Advance	3	1	0	4

SEMESTER VII				Analysis				
			ED24403	Large Sample Theory	3	0	0	3
			ED24405	Time Series Econometrics	3	0	0	3
			ED24407	Statistical Machine Learning II	3	0	0	3
			ED24409	Regression Techniques	3	0	0	3
			ED24411	Advance Microeconomics	3	0	0	3
	LABORATORIES							
		PC	ED24404	Large Sample Theory Lab	0	0	3	1.5
			ED24408	Statistical Machine Learning II Lab	0	0	3	1.5
Total (Semester VII)								22
		Research Project*	ED24400A	Research project	-	-	-	6
Total (Semester VII)								22
Total (Semester VII for B.Sc. Hons. with Research)								28
SEMESTER VIII	THEORY							
		PC	ED24413	Advance Optimization	3	0	0	3
			ED24415	Categorical Data Analysis and Statistics in Bayesian Paradigm	3	0	0	3
			ED24417	Algorithms For Big Data I	3	0	0	3
			ED24419	Resampling Techniques and Statistical Computation	3	0	0	3
			ED24421	Developmental Economics	3	0	0	3

			ED24423	Advance Macroeconomics	3	0	0	3
	LABORATORIES							
		PC	ED24416	Categorical Data Analysis and Statistics in Bayesian Paradigm Lab	0	0	3	1.5
		PC	ED24418	Algorithms For Big Data I Lab	0	0	3	1.5
		PC	ED24420	Resampling Techniques and Statistical Computation Lab	0	0	2	1
		Research Project*	ED24400B	Research Project II				6
Total (Semester VIII)								22
Total (Semester VIII for B.Sc. Hons. With Research*)								28
GRAND TOTAL (FOURTH YEAR)								*189*
(B.Sc. QEDS (Honors) 189) (B.Sc. QEDS (Honors with research) 201								
@NOTE: The students wiling to avail Hons. with research will do 12 Credit research projects in Sem VII and VIII								
SEMESTER IX		THEORY						
		PC	ED24501	Design and Analysis of Algorithms	3	0	0	3
			ED24503	Randomized Control Trials	3	0	0	3
			ED24505	Cross- section and Panel Econometrics	3	0	0	3
		PE		Track I/ Track II/ Track III	3	0	0	3
				Track I/ Track II/ Track III	3	0	0	3

				Track I/ Track II/ Track III	**3**	**0**	**0**	**3**
			ED24500	**Project I**				**6**
		PC						
	LABORATORIES							
		PC	**ED24502**	**Design and Analysis of Algorithms Lab**	**0**	**0**	**3**	**1.5**
			ED24504	**Randomized Control Trials Lab**	**0**	**0**	**3**	**1.5**
Total (Semester IX)								**27**
SEMESTER X								
		PC	**ED24511**	**Project II /Industry Internship**				**7**
		PC	**ED24512**	**Comprehensive Viva**				**2**
Total (Semester X)								**9**
TOTAL (FIFTH YEAR)								***36***
GRAND TOTAL FOR THE POSTGRADUATE (M. Sc.) PART OF THE 5-YEAR INTEGRETAED COURSE **Minimum requirement for the award of the degree 'M.*Sc. in Quantitative Economics and Data Science*' (Semesters VII-X)**								**80**
Minimum requirement for the award of the degree '5-Year Integrated M.*Sc. in Quantitative Economics and Data Science'* (Semesters I-X)								**225**

The students of Final year are required to take a total of three courses from the below listed courses in the Ninth semester.

Track I: Economics: - Public Policy, Health Economics, Environmental Economics II, Agricultural Economics, Industrial Economics, Growth Theory, Labour Economics, International Macroeconomics and Policies, and International Finance.

Track II: Finance: -Quantitative Finance, Computational Finance, Corporate Finance, Financial Econometrics, and International Finance.

Track III: Data Analytics: - Data Mining and Data Visualizations, Digital Signal & Image Processing, Social and Economic Network: Theory and Applications, Algorithms for Big Data II, Business Intelligence and Data Engineering,

Foundations of Data Science, Big Data Analytics, Introduction to Artificial Intelligence, Probabilistic Machine Learning, Deep Learning

Track I Economics		Track II Finance		Track III Data Analytics	
ED24507	Public Policy	ED24527	Quantitative Finance	ED24535	Data Mining and Data Visualization
ED24509	Health Economics	ED24529	Computational Finance	ED24537	Digital Signal and Image Processing
ED24513	Environmental Economics II	ED24531	Corporate Finance	ED24539	Social and Economic Networks: Theory and Applications
ED24515	Agricultural Economics	ED24533	Financial Econometrics	ED24541	Algorithms for Big Data II
ED24517	Industrial Economics			ED24543	Business Intelligence and Data Engineering
ED24519	Growth Theory			ED24545	Foundations of Data Science
ED24521	Labour Economics			ED24547	Big Data Analytics
ED24523	International Macroeconomics and Policies			ED24549	Introduction to Artificial Intelligence
ED24525	International Finance			ED24551	Probabilistic Machine Learning
				ED24553	Deep Learning

In Summary, the following criteria needs to be completed for the awards/degrees at different levels.

Awards/Degrees	Credits
1-Year Programme: Certificate	49.5 (46.5 + 3)
2-Year Programme: Diploma	97.5 (94.5 + 3)
3-Year Programme: B.Sc.	145
4-Year Programme: B. Sc. QEDS (Honours)/B.Sc. QEDS (Honours with research)	201 (189+ 12)
2 Year M.Sc. QEDS	80
5-Year Programme: Integrated M.Sc. QEDS	225