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

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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)	ED25101	Introductory Analysis	3	0	0	3
			ED25103	Statistical Methods - I	3	0	0	3
			ED25105	Introduction to Economics and Essential Mathematics	3	0	0	3
			ED25107	Probability I	3	1	0	4
		Generic Elective (GE)	ED25109	Introduction to Computing & Programming	3	0	0	3
		Humanities and Social Sciences (HSS)	HSS25131	Communication Skill 1	0	0	3	1.5
	LABORATARIES							
		MC	MC 25101/25102/25103/25104/25105	Choice of: NCC/NSS/ PT & Games / Creative Arts (CA)/ Entrepreneurship	0	0	2	1
		PC	ED25104	Statistical Methods – I Lab	0	0	3	1.5
		GE	ED25110	Introduction to Computing & ProgrammingLab	0	0	2	1
Total (Semester I)								21

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SEMESTER II				THEORY				
		PC	ED25111	Intermediate Analysis	3	0	0	3
			ED25113	Statistical Methods II	3	0	0	3
			ED25115	Introductory Microeconomics	3	0	0	3
			ED25117	Linear Algebra	3	0	0	3
		GE	ED25119	Data Structures	3	0	0	3
		Foundation Science (FS)	CE25101	Environmental Science	1	0	2	2
				LABORATORIES				
		MC	MC 25106/25107/25108/25109/25110	Choice of: NCC/NSS/ PT & Games / Creative Arts (CA)/ Entrepreneurship	0	0	2	1
		PC	ED25114	Statistical Methods II Lab	0	0	3	1.5
		GE	ED25120	Data Structure Lab	0	0	3	1.5
Total (Semester II)								21
GRAND TOTAL (FIRST YEAR)								*42*
Vocational Course			Linear Statistical Models and Regression Analysis					*3*
Minimum requirement for *Certificate in QEDS* (After First Year)								*45*
SEMESTER III				THEORY				
		PC	ED25201	Differential Equations	3	1	0	4
			ED25203	Intermediate Microeconomics	3	0	0	3

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			ED25205	Introductory Macroeconomics	3	0	0	3
			ED25207	Probability II	3	0	0	3
		HSS	ED25209	Introduction to Sociology and Political Science	3	0	0	3
			ED25223	Object Oriented Programming Languages	3	0	0	3
		Skill Enhancement Course (SEC)	ED25221	Linear Statistical Models and Regression Analysis	3	0	0	3
	LABORATORIES							
		MC	MC 25201/25202/25203/25204/25205	Choice of: NCC/NSS/ PT & Games / Creative Arts (CA)/ Entrepreneurship	0	0	2	1
			ED25224	Object-Oriented Programming Languages Lab	0	0	2	1
		SEC	ED25222	Linear Statistic Models and Regression Analysis Lab	0	0	2	1
Total (Semester III)								25
SEMESTER IV		THEORY						
		PC	ED25211	Optimization Techniques	3	0	0	3
			ED25213	Intermediate Macroeconomics	3	0	0	3
			ED25215	Stochastic Processes	3	0	0	3

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			ED25217	Economic Development and Demography	3	0	0	3
		GE	ED25219	Introduction to Psychology	3	0	0	3
		SEC	ED25231	Sampling Techniques and Design of Experiments	3	0	0	3
			ED25233	Database Management System	3	0	0	3
			MC	Indian Knowledge System				NC
	LABORATORIES							
		MC	MC 25205/25206/25207/25208/25210	Choice of: NCC/NSS/ PT & Games / Creative Arts (CA)/Entrepreneurship	0	0	2	1
			ED25212	Optimization Techniques Lab	0	0	2	1
		PC	ED25216	Stochastic Processes Lab	0	0	2	1
		SEC	ED25232	Sampling Techniques and Design of Experiments L	0	0	2	1
			ED25234	Database Management System Lab	0	0	2	1
Total (Semester IV)								26
GRAND TOTAL (SECOND YEAR)								*93*
Vocational Course			Basic Econometrics					3
Minimum requirement for Diploma in QEDS (After second year)								*96*

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SEMESTER V		THEORY					
		PC	ED25301	International Trade	3	0	0	3
			ED25303	Numerical Methods	3	0	0	3
			ED25305	Multivariate Data Analysis	3	0	0	3
			ED25307	Basic Econometrics	3	0	0	3
			ED25309	Parametric Inference	3	0	0	3
			ED25321	Design and Analysis of Algorithms	3	0	0	3
		HSS	MT25133	Communication Skill 2	0	0	3	1.5
		Major (Discipline Specific Elective (DSE))	Major (DSE-1) (Anyone)	ED25323 Money and Financial Institutions / ED25325 Behavioral Economics/ ED25327 Economics of Social Sector	3	0	0	3
	LABORATORIES							
			ED25304	Numerical Methods Lab	0	0	2	1
		PC	ED25306	Multivariate Data Analysis Lab	0	0	2	1
			ED25308	Basic Econometrics Lab	0	0	2	1
			ED25310	Parametric inference Lab	0	0	2	1
			ED25321	Design and Analysis of Algorithms	0	0	3	1.5
Total (Semester V)								28

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SEMESTER VI		PC	ED25311	Nonparametric Methods and Decision Theory	3	0	0	3
			ED25313	Applied Econometrics	3	0	0	3
			ED25315	Statistical Machine Learning I	3	0	0	3
			ED25317	Game Theory	3	0	0	3
		Major (DSE-2) (Anyone)		ED25331 Public Economics/ ED25333 Environmental Economics-I/ ED25335 Open Economy Macroeconomy	3	0	0	3
		Major (DSE)	Major (DSE-3) (Anyone)	ED25337 Financial Economics/ ED25339 Topics on Indian Economy / ED25351 Entrepreneurial Economics	3	0	0	3
	LABORATORIES							
		PC	ED25312	Nonparametric Methods and Decision Theory Lab	0	0	2	1
			ED25314	Applied Econometrics Lab	0	0	2	1
			ED25316	Statistical Machine Learning I Lab	0	0	2	1

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		Dissertation	ED25330	Dissertation				3
Total (Semester VI)								24
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							
SEMESTER VII		PC	ED25401	Advance Analysis	3	1	0	4
			ED25403	Large Sample Theory	3	0	0	3
			ED25405	Time Series Econometrics	3	0	0	3
			ED25407	Statistical Machine Learning II	3	0	0	3
			ED25409	Regression Techniques	3	0	0	3
			ED25421	Advance Microeconomics	3	0	0	3
	LABORATORIES							
		PC	ED25404	Large Sample Theory Lab	0	0	3	1.5
			ED25408	Statistical Machine Learning II Lab	0	0	3	1.5
Total (Semester VII)								22
		Research Project*	ED25400	Research project	-	-	-	6
Total (Semester VII)								22

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

Total (Semester VII for B.Sc. Hons. with Research)								**28**
SEMESTER VIII	**THEORY**							
		PC	**ED25411**	**Advance Optimization**	**3**	**0**	**0**	**3**
			ED25413	**Categorical Data Analysis and Statistics in Bayesian Paradigm**	**3**	**0**	**0**	**3**
			ED25415	**Algorithms For Big Data I**	**3**	**0**	**0**	**3**
			ED25417	**Resampling Techniques and Statistical Computation**	**3**	**0**	**0**	**3**
			ED25419	**Developmental Economics**	**3**	**0**	**0**	**3**
			ED25431	**Advance Macroeconomics**	**3**	**0**	**0**	**3**
	LABORATORIES							
		PC	**ED25414**	**Categorical Data Analysis and Statistics in Bayesian Paradigm Lab**	**0**	**0**	**3**	**1.5**
		PC	**ED25416**	**Algorithms For Big Data I Lab**	**0**	**0**	**3**	**1.5**
		PC	**ED25418**	**Resampling Techniques and Statistical Computation Lab**	**0**	**0**	**2**	**1**
		Research Project*	**ED25410**	**Research Project II**				**6**
Total (Semester VIII)								**22**

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

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**					
			ED25501	**Randomized Control Trials**	**3**	**0**	**0**	**3**
			ED25503	**Cross- section and Panel Econometrics**	**3**	**0**	**0**	**3**
			ED25505	**Digital Signal and Image Processing**	**3**	**0**	**0**	**3**
		PE		**Track I**	**3**	**0**	**0**	**3**
				Track II	**3**	**0**	**0**	**3**
				Track III	**3**	**0**	**0**	**3**
		PC	**ED25500**	**Project I**				**6**
		LABORATORIES						
			ED25504	**Randomized Control Trials Lab**	**0**	**0**	**3**	**1.5**
			ED25502	**Digital Signal and Image Processing Lab**	**0**	**0**	**3**	**1.5**
Total (Semester IX)								**27**

SEMESTER X		**PC**	**ED25512**	**Project II /Industry Internship**				**7**
		PC	**ED25514**	**Comprehensive Viva**				**2**
Total (Semester X)								**9**
TOTAL (FIFTH YEAR)								***38***
GRAND TOTAL FOR THE POSTGRADUATE (M. Sc.) PART OF THE 5-YEAR INTEGRETAED COURSE **Minimum requirement for the award of the degree '<u>M.*Sc. in Quantitative Economics and Data Science*</u>' (Semesters VII-X)**								**80**
Minimum requirement for the award of the degree '5-Year Integrated <u>M.*Sc. in Quantitative Economics and Data Science'*</u> (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, Growth Theory, Labour Economics, and International Finance.
Track II: Finance: -Quantitative Finance, Computational Finance, Corporate Finance, and Financial Econometrics
Track III: Data Analytics: - Data Mining and Data Visualizations, Social and Economic Network: Theory and Applications, Big Data Analytics, and Introduction to Artificial Intelligence

Track I Economics		**Track II Finance**		**Track III Data Analytics**	
ED25507	**Public Policy**	**ED25525**	**Quantitative Finance**	**ED25543**	**Data Mining and Data Visualization**
ED25509	**Growth Theory**	**ED25527**	**Computational Finance**	**ED25545**	**Social and Economic Networks: Theory and Applications**
ED25521	**Labour Economics**	**ED25529**	**Corporate Finance**	**ED25547**	**Big Data Analytics**
ED25523	**International Finance**	**ED25541**	**Financial Econometrics**	**ED25549**	**Introduction to Artificial Intelligence**

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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