

Annexure – 138/3

Interdisciplinary M. Tech. Programme in Data Science

Preamble

Automation taking front seat in technology, percolating in every aspect of business, engineering and science. Today automation is bringing a new information revolution. Its roots stems from the inter-disciplinary domain which includes artificial intelligence, data mining, machine learning and data analytics. At IIT Guwahati, independent efforts to offer related courses across departments, conduct and carryout research & development studies and train resources adding momentum to the field. Existing M.Tech. programme in CSE and EEE demand specific background. In addition, these programmes largely cater to the respective department's objectives. However, the fields like artificial intelligence / machine learning / data mining being interdisciplinary needs flexible background requirements and specialized / focused training. In order to achieve this, there is a need to introduce a new inter-department/interdisciplinary M. Tech. Programme in which the participating departments brings their core strength to offer *new courses*, conduct interdisciplinary research and add to the development efforts. This will open new opportunities to large number of students from diverse backgrounds to get involved in carryout interdisciplinary research for specified duration. In addition, the participating departments collectively celebrate the silver jubilee of this Institute by offering a new M. Tech. interdisciplinary programme.

Objectives

- Offer for the first time interdisciplinary M. Tech. programme
- Train resources to strength the foundations of students
- Enhance collaborative teaching and interdisciplinary research activities

A committee comprising of six faculty members was formed by heads of three departments CSE, EEE and Mathematics. Members of the committee are:

Name	Department	Role
Dr. V. Vijaya Saradhi	Computer Science & Engineering	Convener
Dr. Ashish Anand	Computer Science & Engineering	Member
Dr. Prithwijit Guha	Electronics & Electrical Engineering	Member
Dr. Tony Jacob	Electronics & Electrical Engineering	Member
Dr. Ayon Ganguly	Mathematics	Member
Dr. Subhamay Saha	Mathematics	Member

Terms of reference given for the committee are to have a detailed discussion on course structure, admission procedure, eligibility criteria, identify core faculty members, identification of list of electives and any other point which is of relevance to the proposed M. Tech. (DS) programme.

Course Structure

Given the interdisciplinary nature of the programme with diverse student background and the fact that three departments are coming forward to offer this programme the committee came up with the proposal of having 5 core course comprising of 10 modules, 7 lab courses, 3 electives and 2 projects. Every core course is proposed to be comprising of two half courses. This is designed in order to have a cap on the expected load from this programme to faculty of participating department to be ½ core course and one lab course per year.

Core Courses & Labs

This is where significant amount of time has been spent by the committee. List of core courses, core labs and electives that should be part of the curriculum for the proposed M. Tech. programme are deliberated. Committee deliberated on those *existing* electives offered CSE, EEE & Mathematics that have *relation* to the present programme. Committee felt the need to introduce new core courses which are foundations for data science. Foundational courses are discussed. Five core courses and five core labs are identified. These core courses and core labs are divided among departments which will be offered every semester.

1. Core Courses
 - i. Statistical Foundations for Data Science
 - ii. Scientific Computing & Matrix Computations
 - iii. Data Structures & Algorithms and Databases
 - iv. Stochastic Models and Numerical Optimization
 - v. Machine Learning
2. Core Labs
 - i. Data Structures and Databases Lab
 - ii. Numerical Computation Lab
 - iii. Python Programming Lab
 - iv. Machine Learning Lab
 - v. R Programming Lab
 - vi. Data Visualization Lab

Semesterwise detailed course structure is as given below

Semester I					
Course No.	Course Title	L	T	P	C
MA 589	Statistical Foundations for Data Science	3	0	0	6
MA 579H	Scientific Computing	3	0	0	3
MA 580H	Matrix Computations	3	0	0	3
CS 591H	Data Structures and Algorithms	3	0	0	3
CS 592H	Databases	3	0	0	3
XX ddd	Elective – I	3	0	0	6
CS 593	Data structures and Databases Lab	0	0	3	3
MA 581	Numerical Computations Lab	0	0	3	3
CS 594	Python Programming Lab	0	0	3	3
Total		12	0	9	33

Semester II					
Course No.	Course Title	L	T	P	C
EE 595H	Stochastic Models	3	0	0	3
EE 596H	Optimization Techniques	3	0	0	3
EE xxx	Machine Learning	3	0	0	6
XX ddd	Elective II	3	0	0	6
XX ddd	Elective III	3	0	0	6
EE xxx	Machine Learning Lab	0	0	3	3
MA 588	R Programming Lab	0	0	3	3
CS 595	Data Visualization Lab	0	0	3	3
Total		12	0	9	33

Semester III					
Course No.	Course Title	L	T	P	C
DS 698	Project - I	0	0	24	24
Total		0	0	24	24

DS: Data Science

DS Explanation should be given in the transcript about DS thesis course

Semester IV					
Course No.	Course Title	L	T	P	C
DS 699	Project - II	0	0	24	24
Total		6	0	24	24

DS: Data Science

DS Explanation should be given in the transcript about DS thesis course

Model Summary

S. No	Description	No.	L	T	P	C
1	Core Courses	5	15	0	0	30
2	Labs	6	0	0	18	18
3	Electives	3	9	0	0	18
4	Projects	2	0	0	48	48
Total		16	24	0	66	114

The lab courses connected with the theory courses should be renamed appropriately.

New Core Courses Syllabi

Course Number & Title: MA 589 Statistical Foundations for Data Science
L-T-P-C: 3-0-0-6
Type of Letter Grading (Regular Letter Grades / PP or NP Letter Grades): Regular Letter Grades
Kind of Proposal (New Course / Revision of Existing Course): New Course
Offered as (Compulsory / Elective): Compulsory
Offered to: M.Tech. (DS)
Offered in (Odd/ Even / Any): Odd
Offered by (Name of Department/ Center): Mathematics
Pre-Requisite: None
Course Contents: Probability spaces, conditional probability, independence; Random variables, distribution functions, probability mass and density functions, functions of random variables, standard univariate discrete and continuous distributions; Mathematical expectations, moments, moment generating functions, inequalities; Random vectors, joint, marginal and conditional distributions, conditional expectations, independence, covariance, correlation, standard multivariate distributions, functions of random vectors; Law of large numbers, central limit theorem. Sampling distributions; Point estimation - estimators, minimum variance unbiased estimation, maximum likelihood estimation, method of moments, consistency; Interval estimation; Testing of hypotheses - tests and critical regions, likelihood ratio tests; Linear regression.
Texts/References: B. L. S. Prakasa Rao, A First Course in Probability and Statistics, World Scientific/Cambridge University Press India, 2009. R. V. Hogg, J. W. McKean and A. Craig, Introduction to Mathematical Statistics, 6th Ed., Pearson Education India, 2006.

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Course Number & Title: MA 579H Scientific Computing
L-T-P-C: 3-0-0-3
Type of Letter Grading (Regular Letter Grades / PP or NP Letter Grades): Regular Letter Grades
Kind of Proposal (New Course / Revision of Existing Course): New Course
Offered as (Compulsory / Elective): Compulsory
Offered to: M.Tech. (DS)
Offered in (Odd/ Even / Any): Odd
Offered by (Name of Department/ Center): Mathematics
Pre-Requisite: None
Definition and sources of errors, solutions of nonlinear equations; Bisection method, Newton's method and its variants, fixed point iterations, convergence analysis; Newton's method for non-linear systems; Finite differences, polynomial interpolation; Numerical integration - Trapezoidal and Simpson's rules, Gaussian quadrature; Initial value problems - Taylor series method, Euler and modified Euler methods, Runge-Kutta methods.
Texts/References: D. Kincaid and W. Cheney, Numerical Mathematics and Computing, 7th Edn., Cengage, 2013. K. E. Atkinson, Introduction to Numerical Analysis, 2nd Edn., John Wiley, 1989.

Course Number & Title: MA 580H Matrix Computations
L-T-P-C: 3-0-0-3
Type of Letter Grading (Regular Letter Grades / PP or NP Letter Grades): Regular Letter Grades
Kind of Proposal (New Course / Revision of Existing Course): New Course
Offered as (Compulsory / Elective): Compulsory
Offered to: M.Tech. (DS)
Offered in (Odd/ Even / Any): Odd
Offered by (Name of Department/ Center): Mathematics
Pre-Requisite: None
Course Contents: Linear systems – All variants of Gaussian elimination and LU factorization, Cholesky factorization. Linear least-squares problem - Normal equations, rotators and reflectors, QR factorization via rotators, reflectors and Gram Schmidt orthonormalisation, QR method for linear least-squares problems, rank deficient least-squares problems. Singular value decomposition (SVD) – numerical rank determination via SVD, solution of least squares problems, Moore- Penrose inverse, low rank approximations via SVD, Principal Component Analysis, applications to data mining and image recognition. Eigenvalue Decomposition - Power, inverse power and Rayleigh quotient iterations, Schur's decomposition, unitary similarity transformation of Hermitian matrices to tridiagonal form, QR algorithm, implementation of explicit QR algorithm for Hermitian matrices.
Texts/References: L. N. Trefethen and David Bau, Numerical Linear Algebra, SIAM, Philadelphia, 1997. D. S. Watkins, Fundamentals of Matrix Computation, 2nd Edition, Wiley, 2002. L. Elden Matrix Methods in Data Mining and Pattern Recognition, SIAM, Philadelphia, 2007.

Course Number & Title:CS 591H Data Structures and Algorithms
L-T-P-C: 3-0-0-3
Type of Letter Grading (Regular Letter Grades / PP or NP Letter Grades): Regular Letter Grades
Kind of Proposal (New Course / Revision of Existing Course): New Course
Offered as (Compulsory / Elective): Compulsory
Offered to: M.Tech. (DS)
Offered in (Odd/ Even / Any): Odd
Offered by (Name of Department/ Center): Computer Science & Engineering
Pre-Requisite: None
Preamble/Objectives (Optional): Fundamentals of data structures, algorithm build foundations for the students of diverse background
Course Contents: Review of fundamental Data Structures Models of Computation: random access machines, space and time complexity measures, lower and upper bounds Design techniques: the greedy method, divide-and-conquer, dynamic programming, backtracking; Sorting and Searching Graph algorithms Hashing: separate chaining, linear probing, quadratic probing Search Trees: binary search trees, AVL trees, B-trees.
Texts/References: T H Cormen, C E Leiserson, R L Rivest and C Stein, Introduction to Algorithms, 3/e, MIT Press, 2009. Jon Kleinberg and Eva Tardos, Algorithm Design, 1/e, Pearson Education, 2006.

Course Number & Title:CS 592H Databases
L-T-P-C: 3-0-0-3
Type of Letter Grading (Regular Letter Grades / PP or NP Letter Grades): Regular Letter Grades
Kind of Proposal (New Course / Revision of Existing Course): New Course
Offered as (Compulsory / Elective): Compulsory
Offered to: M.Tech. (DS)
Offered in (Odd/ Even / Any): Odd
Offered by (Name of Department/ Center): Computer Science & Engineering
Pre-Requisite: None
Preamble/Objectives (Optional): Fundamentals of databases with specific focus on SQL build foundations for the students of diverse background
Course Contents: Data Models: Data models with emphasis on the relational model Database Design: Database design with E-R model, From E-R model to relational database design Algebra: Relational algebra and calculus SQL queries, constraints, triggers Database application development: Stored procedures
Texts/References: R. Ramakrishnan and J. Gehrke, Database Management Systems, 3/e, McGraw Hill, 2003

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Course Number & Title:CS 593 Data Structures and Databases Lab
L-T-P-C: 0-0-3-3
Type of Letter Grading (Regular Letter Grades / PP or NP Letter Grades): Regular Letter Grades
Kind of Proposal (New Course / Revision of Existing Course): New Course
Offered as (Compulsory / Elective): Compulsory
Offered to: M.Tech. (DS)
Offered in (Odd/ Even / Any): Odd
Offered by (Name of Department/ Center): Computer Science & Engineering
Pre-Requisite: None
Preamble/Objectives (Optional):
Course Contents: Programming assignments are based on the theory courses CS ddd Data Structures and algorithms and CS ddd Databases.
Texts/References: T H Cormen, C E Leiserson, R L Rivest and C Stein, Introduction to Algorithms, 3/e, MIT Press, 2009. Jon Kleinberg and Eva Tardos, Algorithm Design, 1/e, Pearson Education, 2006. R. Ramakrishnan and J. Gehrke, Database Management Systems, 3/e, McGraw Hill, 2003

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Course Number & Title: CS 594 Python Programming Lab
L-T-P-C: 0-0-3-3
Type of Letter Grading (Regular Letter Grades / PP or NP Letter Grades): Regular Letter Grades
Kind of Proposal (New Course / Revision of Existing Course): New Course
Offered as (Compulsory / Elective): Compulsory
Offered to: M.Tech. (DS)
Offered in (Odd/ Even / Any): Odd
Offered by (Name of Department/ Center): Computer Science & Engineering
Pre-Requisite: None
Preamble/Objectives (Optional):
Course Contents: Fundamental concepts: Literals, variables and identifiers, operators, expressions and data types; Control structures: Boolean expressions, selection control, iterative control; Lists: List structures, Lists, (sequences), iterating over lists; Functions: Program routines, calling value-returning functions, calling non value-returning functions, parameter passing, variable scope; Dictionaries and Sets; Recursion; Text Files: Using text files, string passing, exception handling;
Texts/References: Charles Dierbach, Introduction to computer science using Python a computational problem solving focus, John-Wiley & Sons, 2012.

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Course Number & Title: MA581 Numerical Computations Lab
L-T-P-C: 0-0-3-3
Type of Letter Grading (Regular Letter Grades / PP or NP Letter Grades): Regular Letter Grades
Kind of Proposal (New Course / Revision of Existing Course): New Course
Offered as (Compulsory / Elective): Compulsory
Offered to: M.Tech. (DS)
Offered in (Odd/ Even / Any): Odd
Offered by (Name of Department/ Center): Mathematics
Pre-Requisite: None
Preamble/Objectives (Optional):
Course Contents: Programming assignments are based on the theory courses MA ddd Scientific Computing and MA ddd Matrix Computation.
Texts/References: L. N. Trefethen and David Bau, Numerical Linear Algebra, SIAM, 1997. D. S. Watkins, Fundamentals of Matrix Computation, 2nd Edn., Wiley, 2002. D. Kincaid and W. Cheney, Numerical Analysis: Mathematics of Scientific Computing, 3rd Edn., AMS, 2002. K. E. Atkinson, Introduction to Numerical Analysis, 2nd Edn., John Wiley, 1989.

Course Number & Title: EE595H Stochastic Models
L-T-P-C: 3-0-0-3
Type of Letter Grading (Regular Letter Grades / PP or NP Letter Grades): Regular Letter Grades
Kind of Proposal (New Course / Revision of Existing Course): New Course
Offered as (Compulsory / Elective): Compulsory
Offered to: M.Tech. (DS)
Offered in (Odd/ Even / Any): Even
Offered by (Name of Department/ Center): EEE
Pre-Requisite: None
Course Contents: Stochastic Processes: Definition and classification of random processes; Discrete-time Markov chains; Poisson process; Continuous-time Markov chains; Bayesian statistics; Monte Carlo; Gibbs Sampler: data augmentation, burn-in, convergence; Metropolis-Hastings algorithm: independent sampler, random walk Metropolis, scaling, multi-modality; Approximate Bayesian Computation.
Texts/References: Sheldon M. Ross, Stochastic Processes, Wiley, 1995. W. R. Gilks, S. Richardson and D. Spiegelhalter, Markov chain Monte Carlo methods in Practice, Chapman and Hall.

Course Number & Title:EE596H Optimization Techniques
L-T-P-C: 3-0-0-3
Type of Letter Grading (Regular Letter Grades / PP or NP Letter Grades): Regular Letter Grades
Kind of Proposal (New Course / Revision of Existing Course): New Course
Offered as (Compulsory / Elective): Compulsory
Offered to: M.Tech. (DS)
Offered in (Odd/ Even / Any): Even
Offered by (Name of Department/ Center): EEE
Pre-Requisite: None
Course Contents: optimization - sequences and limits, derivative matrix, level sets and gradients, Taylor series; unconstrained optimization - necessary and sufficient conditions for optima, convex sets, convex functions, optima of convex functions, steepest descent, Newton and quasi Newton methods, conjugate direction methods; constrained optimization - linear and non-linear constraints, equality and inequality constraints, optimality conditions, constrained convex optimization, projected gradient methods, penalty methods
Texts/References: E. K. P. Chong and S. H. Zak, <i>An Introduction to Optimization</i>, 2nd Edn., Wiley India Pvt. Ltd., 2010. D. G. Luenberger and Y. Ye, <i>Linear and Nonlinear Programming</i>, 3rd Edn., Springer, 2010.

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Course Number & Title: EE xxx Machine Learning
L-T-P-C: 3-0-0-6
Type of Letter Grading (Regular Letter Grades / PP or NP Letter Grades): Regular Letter Grades
Kind of Proposal (New Course / Revision of Existing Course): New Course
Offered as (Compulsory / Elective): Compulsory
Offered to: M.Tech. (DS)
Offered in (Odd/ Even / Any): Even
Offered by (Name of Department/ Center): EEE
Pre-Requisite: None
Course Contents: Introduction to learning; Bayesian Classification; Feature Selection; PCA; K-Means Clustering; DBSCAN; Hierarchical Agglomerative Clustering; GMM; Mean-shift Clustering; Multilayer Perceptron; RBF Networks; Classification Performance Analysis; Decision Trees; SVM; Introduction to Multiple Kernel Learning; Ensemble Methods – Bagging and Boosting, Hidden Markov Models; Introduction to CNN and RNN; Introduction to Reinforcement Learning
Texts/References: E. Alpaydin, <i>Introduction to Machine Learning</i>, 3rd Edition, Prentice Hall (India) 2015. R. O. Duda, P. E. Hart and D. G. Stork, <i>Pattern Classification</i>, 2nd Edn., Wiley India, 2007. C. . Bishop, <i>Pattern Recognition and Machine Learning (Information Science and Statistics)</i>, Springer, 2006. S. O. Haykin, <i>Neural Networks and Learning Machines</i>, 3rd Edition, Pearson Education (India), 2016 J. Shawe-Taylor and Nello Cristianini, <i>Kernel Methods for Pattern Analysis</i>, Cambridge University Press, 2004. I. Goodfellow, Y. Bengio , A. Courville, <i>Deep Learning</i>, MIT Press, 2017 R. Sutton, <i>Reinforcement Learning – An Introduction</i>, MIT Press, 1998 Relevant Research Papers in the area of Machine Learning

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Course Number & Title:EExxx Machine Learning Lab
L-T-P-C: 0-0-3-3
Type of Letter Grading (Regular Letter Grades / PP or NP Letter Grades): Regular Letter Grades
Kind of Proposal (New Course / Revision of Existing Course): New Course
Offered as (Compulsory / Elective): Compulsory
Offered to: M.Tech. (DS)
Offered in (Odd/ Even / Any): Even
Offered by (Name of Department/ Center): EEE
Pre-Requisite: None
Course Contents: Design of experiments in Machine Learning; Introduction to popular Machine Learning Datasets and Toolkits; Face Recognition using PCA; Practical applications of clustering; Experiments on supervised classification using MLP, RBF ANN, SVM and Decision Trees; Application of Classifiers Ensembles; Sequence classification using HMM; Applications of CNN and RNN; Path planning with Reinforcement Learning
Texts/References:

Course Number & Title: MA588 R Programming Lab
L-T-P-C: 0-0-3-3
Type of Letter Grading (Regular Letter Grades / PP or NP Letter Grades): Regular Letter Grades
Kind of Proposal (New Course / Revision of Existing Course): New Course
Offered as (Compulsory / Elective): Compulsory
Offered to: M.Tech. (DS)
Offered in (Odd/ Even / Any): Even
Offered by (Name of Department/ Center): MA
Pre-Requisite: None
Course Contents: Introduction to R: basic commands, graphics, indexing data, loading data; Regression: linear regression, test of significance, residual analysis, polynomial regression, qualitative predictor, logistic-regression; Resampling methods: crossvalidation, bootstrap; Subset selection: best subset selection, forward and backward stepwise selection, choosing among models using the validation; Markov chain monte carlo. Optimization in R: Common R Packages for Linear, Quadratic and Non-linear optimization, Built-in Optimization functions, Linear Programming in R: Ipsolve, Quadratic Programming: quadprog, Non-Linear Optimization: One-Dimensional: Golden Section Search; Multi-dimensional: Gradient-based, Hessian based, Non-gradient based
Texts/References: An Introduction to Statistical Learning: with Applications in R (Springer Texts in Statistics), G. James, D. Witten, T. Hastie and R. Tibshirani, Springer, 2013. A First Course in Statistical Programming with R, W John Braun, Duncan J Murdoch, Cambridge University Press 2008. https://cran.r-project.org/web/views/Optimization.html

Course Number & Title: CS595 Data Visualization Lab
L-T-P-C: 0-0-3-3
Type of Letter Grading (Regular Letter Grades / PP or NP Letter Grades): Regular Letter Grades
Kind of Proposal (New Course / Revision of Existing Course): New Course
Offered as (Compulsory / Elective): Compulsory
Offered to: M.Tech. (DS)
Offered in (Odd/ Even / Any): Even
Offered by (Name of Department/ Center): CSE
Pre-Requisite: None
Course Contents: Defining data visualization; Visualization workflow: describing data visualization workflow, process in practice; Data Representation: chart types: categorical, hierarchical, relational, temporal & spatial; 2-D: bar charts, Clustered bar charts, dot plots, connected dot plots, pictograms, proportional shape charts, bubble charts, radar charts, polar charts, Range chart, Box-and-whisker plots, univariate scatter plots, histograms word cloud, pie chart, waffle chart, stacked bar chart, back-to-back bar chart, treemap and all relevant 2-D charts. 3-D: surfaces, contours, hidden surfaces, pm3d coloring, 3D mapping; multi-dimensional data visualization; manifold visualization; graph data visualization; Annotation;
Texts/References: Andy Kirk, Data Visualization A Handbook for Data Driven Design, Sage Publications, 2016 Philipp K. Janert, Gnuplot in Action, Understanding Data with Graphs, Manning Publications, 2010.

Elective Courses

List of electives offered by each department which are *related to the proposed programme* were discussed. Following is the comprehensive list of elective courses offered by each of the department *relevant to this programme*. In any given semester a minimum of one elective course belonging to this list from each department should be offered. In addition to this, a student is permitted to credit an elective which is one of the electives offered by CSE, EEE or Mathematics. In which case permission from the course instructor and approval from faculty advisor is necessary.

Course ID	Title	Credits
Elective Offered by CSE		
CS508	Optimization Methods	3-0-0-6
CS511	Learning With Kernels	3-0-0-6
CS534	Approximation Algorithms	3-0-0-6
CS561	Artificial Intelligence	3-0-0-6
CS562	Machine Learning	3-0-0-6
CS565	Intelligent Systems And Interfaces	3-0-0-6
CS566	Speech Processing	3-0-0-6
CS567	Pattern Recognition	3-0-0-6
CS568	Data Mining	3-0-0-6
CS569	Multimedia Systems	3-0-0-6
CS570	Fundamentals of Information Retrieval	3-0-2-8
CS572	Computations Systems Biology	3-0-0-6
CS573	Data Analysis For Machine Learning	1-0-4-6
CS574	Computer Vision Using Machine Learning	3-0-0-6
CS529	Topics and Tools in Social Media Data Mining	3-0-0-6
CS530	Machine Learning Using Cloud Computing	2-0-3-7
CS559	Advanced Topics in Artificial Intelligence	3-0-0-6
Electives Offered by EEE		
EE624	Image Processing	3-0-0-6
EE625	Computer Vision	3-0-0-6
EE626	Biomedical Signal Processing	3-0-0-6
EE627	Speech Signal Processing and Coding	3-0-0-6
EE657	Pattern Recognition and Machine Learning	3-0-0-6

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EE660	Biometrics	3-0-0-6
EE664	Introduction to Parallel Computing	3-0-0-6
EE636	Detection and Estimation Theory	3-0-0-6
Electives Offered by Mathematics		
MA504	Combinatorial Optimization	3-0-0-6
MA544	Wavelets and Applications	3-0-0-6
MA562	Mathematical Modeling and Numerical Simulation	3-0-0-6
MA576	Large Scale Scientific Computation	3-0-0-6
MA577	Perturbation Methods	3-0-0-6
MA593	Statistical Methods and Time Series Analysis	3-0-0-6
MA601	Graphs and Matrices	3-0-0-6
MA681	Applied Stochastic Processes	3-0-0-6
MA682	Statistical Inference	3-0-0-6
MA691	Advanced Statistical Algorithms	3-0-0-6

MTP

Second year students of this programme should register for MTP. MDSCCYYYY will help students in assigning supervisors. It is mandatory that MTPs to be offered jointly by the participating departments' faculty. The two supervisor must be from distinct participating departments of this programme. MDSCCYYYY will evolve a method for MTP allocation and evaluation strategies.

Administration Related Points

The proposed M. Tech. in Data Science is an interdisciplinary programme with three participating departments CSE, EEE and Mathematics. In order to smoothly run the academic activities of this programme, this programme should have the following administrative machinery.

1. Adminstrating Department (for each batch)
2. MTech(DS) Coordination Committee (for each batch)
3. MTech(DS) Admission Committee (for each batch)
4. MTech(DS) Disciplinary Committee (for each batch)
5. Budget associated with running of the programme

Administration Related Points

The proposed M. Tech. in Data Science is an interdisciplinary programme with three participating departments CSE, EEE and Mathematics. In order to smoothly run the academic activities of this programme, this programme should have the following administrative machinery.

Definitions

Administrating department	The department which is taking up over all administration for a particular batch of students and conducted the admissions for that batch.
Head of the administrating Department	HoD of the department which is taking up the administrating department role.

Activities starting from admission to course completion of a particular academic batch of students should be administered by one of the three participating departments on rotation basis as per the alphabetical order of the department name. The department which has conducted the admissions for the given academic year is referred as administrating department. Every department will assume the role of administrating department once in three years. All the administrative issues pertaining to that batch of students, till all the students of that batch graduate, will be handled by the department which has conducted the admissions to the batch in question.

Committees

Following distinct committees are required in order to oversee various administrative activities involving this programme and the students of this interdisciplinary M. Tech. Programme.

1. (Admission Year YYYY) M.Tech.(DS) Coordination Committee (yyyy MDSCC)
2. (Admission Year YYYY) M.Tech.(DS) Admission Committee (yyyy MDSAC)
3. (Admission Year YYYY) M.Tech.(DS) Disciplinary Committee (yyyy MDSDC)

These committees are constituted for each batch of the students (That is, batch specific). These committees shall take care of all matters related to that particular batch. The administrating department shall maintain records of all students of that particular batch.

Composition, their functions and tenure of the members are detailed below.

M.Tech. (DS) Coordination Committee (MDSCC)

M. Tech.(DS) Coordination Committee has the following compositions and functions.

(Admission Year yyyy) M.Tech.(DS) Coordination Committee (yyyy MDSCC)		
Composition:		
(i)	Head of Administrating Department	Chairman
(ii)	Heads of other Participating Departments	Vice-chairmen
(iii)	One faculty member from each of the participating departments to be nominated by the respective Heads. The nominated faculty member from the administrating department will be the member secretary.	Members
(iv)	One faculty member from outside the participating departments. The department will be chosen by the committee. A faculty member from the chosen department will be nominated by the HOD of the chosen department	Member
(v)	Faculty Advisors of current two batches (First Year and Second Year) M.Tech.(DS).	Members
(vi)	Two students with CPI not less than 7.5 and not subjected to any disciplinary action in the institute to be elected / selected by the M.Tech. Students of the programme of that particular batch.*	Members
Tenure:		
*The tenure is one academic year for student members. For the first year, the CPI not less than 7.5 is to be considered in qualifying degree (Bachelors degree).		
The member secretary of MDSCC will be a member of the Institute Postgraduate Programme Committee (IPPC).		
Functions:		
(i)	To oversee the conduct of the courses of the interdisciplinary M.Tech.(DS) programme.	
(ii)	To ensure academic standard and excellence of the courses of interdisciplinary M.Tech.(DS) programme offered by the participating departments.	
(iii)	To discuss and recommend the syllabi of all courses of interdisciplinary M.Tech.(DS) programme offered by participating departments from time to time before sending the same to the Institute Postgraduate Programme Committee (IPPC).	
(iv)	To consider any matter related to the interdisciplinary M.Tech.(DS) programme of that particular batch.	

The genesis of the proposal for the above type of committee is to have continuity and consistency in the policies, with involvement of all the participating departments. Here, the word 'administrating department' is used to refer to the department that conducts the admissions in that year and takes care of all matters related to that particular batch. For

example, the chairman, vice-chairmen and faculty advisors are part of two MDSCCs of two batches (2019 batch, 2020 batch) simultaneously in the AY 2020-2021.

M.Tech.(DS) Admission Committee

The following committee takes care of admission process of the interdisciplinary M.Tech. Programme in Data Science and it is normally constituted in the month of January and starts functioning from the first of February.

(Admission Year yyyy) M.Tech.(DS) Admission Committee (yyyy MDSAC)		
Composition:		
(i)	Head of administrating department	Chairman
(ii)	Heads of the other participating departments	Vice-chairmen
(iii)	At least one faculty member from each of the participating departments to be nominated by the respective Heads. The faculty member from the administrating department will be the member secretary.	Members
Tenure:		
1 st February to 30 th November of the calendar year in which it is constituted.		
(i)	To oversee the admissions process; this includes short listing of the candidates based on GATE score, question paper setter identification, setting the question papers, evaluation, obtaining the final list of selected students. Keeping records pertaining the admission process.	
Note: MDSAC shall be constituted in the month of January of every calendar year. For the admission in the AY 2019-2020, it will be constituted immediately after the approval for the commencement of programme by the Senate.		

M.Tech.(DS) Disciplinary Committee

Each department has departmental disciplinary committee (DDC) to regulate the students. Similarly, the following committee takes care of the role of DDC and its functions are as given in the code of conduct and disciplinary ordinance.

(Admission Year YYYY) M.Tech.(DS) Disciplinary Committee (yyyy MDSDC)		
(i)	Head of administrating department	Chairman
(ii)	Heads of other participating departments	Vice-chairmen
(iii)	Member Secretary of MDSCC of that batch	Member
(iv)	One student member selected from the MDSCC of that batch	Member

Eligibility Criteria for Applying:

Committee discussed eligibility criteria for this programme. As the proposed M. Tech. programme an interdisciplinary one in nature offered by three departments namely CSE, EEE and Mathematics the criteria for eligibility must be an inclusive one from both engineering and science. To this end it has studied the eligibility criteria of three institutes which are offering programs which are similar to the proposed M.Tech. in Data Science.

S. No.	Degree Offered	Institute	Criteria
1	M.Tech. in Computational Data Science	IISc Bangalore, Bangalore	<i>B.E./B.Tech./M.Sc./MCA/Four year B.S. or equivalent</i> in any science/engineering discipline, and a valid <i>GATE Score in any paper</i> , are eligible.
2	M.Tech. in Machine Learning	IIT Hyderabad, Hyderabad	Admission to the MTech programme is based on the GATE score either in the CS or EC papers.
3	M.Sc. in Data Science	CMI, Chennai	Undergraduate degrees such as B.A., B.Sc., B.Math., B.Stat., B.E., B.Tech. etc. with a background in Mathematics, Statistics or Computer Science.

Keeping in view the proposed curriculum and the objectives of the offered programme, committee agreed that **candidates with a minimum CPI of 6.0 out of 10 point scale or aggregate/ total of 60% of marks in *B.E./ B.Tech./ M.Sc./ MCA/ Four year B.S. degrees or equivalent* in any engineering/ science discipline and having a valid GATE score in any one of the following papers: CS, EC, EE, IN, MA, ST and XE are eligible for the programme.**

Admission Procedure

1. Short-listing of candidate on the basis of GATE score.
2. A written test will be conducted by programme committee to the short listed candidates.
3. 70% weightage will be given to the obtained GATE score.
4. 30% weightage will be given to the written exam.
5. Final result will be prepared based on all the above points by the programme committee.

Proposed Intake

It is proposed to have an intake of 20 students per year for this new programme.

General & Non-EWS	EWS	OBC-NCL	SC	ST	Total
8	2	5	3	2	20

Seating / Working Place for the Admitted Students:

Students of M. Tech. (DS) shall have a dedicated work space and a desktop for the entire duration of the programme. Presently, two data science labs are proposed for this purpose where the students of this programme will be seating.

IPPC suggested that the administrating department's staff and space to be utilized for the administrative work pertaining to the students of that batch. The administrating department may be assigned on rotation basis as follows:

- For example, CSE department is the administrating department for the 2019-20 batch of M.Tech.(DS) students. The CSE department office will be responsible for maintaining all files and taking care of all administrative activities of this batch of students till they graduate. The seating/working place for this batch of students will be given in the Department of CSE.
- EEE department is the administrating department for the 2020-21 batch of M.Tech.(DS) students. The EEE department office will be responsible for maintaining all files and taking care of all administrative activities of this batch of students till they graduate. The seating/working place for this batch of students will be given in the Department of EEE.
- Mathematics department is the administrating department for the 2021-22 batch of M.Tech.(DS) students. The Mathematics department office will be responsible for maintaining all files and taking care of all administrative activities of this batch of students till they graduate. The seating/working place for this batch of students will be given in the Department of Mathematics.

Response: The departments of CSE, EEE and Mathematics have agreed to incorporate the suggestions of the IPPC.

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