MASTER OF SCIENCE
IN
MATERIALS SCIENCE
(Applicable from the academic session 2019-2020)

Maulana Abul Kalam Azad University of Technology, West Bengal

(Formerly West Bengal University of Technology)
Haringhata-741249, Nadia, West Bengal, INDIA

Preamble

Materials science is a relatively new branch of study that involves both physical and chemical aspects of materials, more specifically it relates between different structures of materials and their performance. Development of human civilization depended strongly on materials and particular age of human development is referred to the prominent material used during the period like Stone Age, Bronze Age etc.

Even today, every imaginable technological development depends on the materials. Therefore, study of materials science has grown into a major thrust area at all levels in most of the institutions. Our university is also offering a post graduate (Master of Science) program in Materials Science that is going to start from this academic year.

The salient features of this program are as follows:

- The duration of the program is of two years with total four semesters.
- The program spans basic to advanced level of physics and chemistry of materials to their mechanical, electrical, magnetic and optical properties and the design, manufacture and applications of metals, alloys, ceramics, polymers, composites, biomaterials, etc.
- The course curriculum also covers most recent and advanced areas in Materials Science such as Computational Material Science, Machine Learning in Materials Science, etc.
- Innovative, dynamic curriculum, appropriate for the current needs of the profession, industry and academia.
- The syllabus of this program has been designed with consultation of few reputed universities such as Calcutta University, Anna University, Mangalore University etc.
- Enhancement of practical skills and experimental learning through seminar and workshops.
- Advanced and relevant topics delivered through MOOCs (NPTEL, Coursera, Udemy, etc.).
- Online mode of delivery through smart class room.
- The program is based on outcome based education approach. Problem based learning is associated to achieve this goal.

Program outcomes

This Master's program in Materials Science is an interdisciplinary program for postgraduate students which will provide knowledge on structure, properties, processing and performance of materials along with application of Data Science and Informatics, Machine learning and various Computational tools used in the field of material science. Theoretical or computational studies are allied with experimental approaches within the program for better understanding. The goal of the Master's program is to produce multi-skilled materials scientists who are able to apply the principles of materials science for carrying out engineering and/or research projects. Materials structure is mainly limited into micro and nano dimension, although in this program major emphasis will be given on nano sized particles.

After completion of the program, our postgraduates will:

- be able to apply core concepts in Materials Science to solve engineering problems.
- be knowledgeable of modern issues relevant to Materials Science.
- be able to select materials for design and construction.
- understand the importance of life-long learning.
- be able to design and conduct experiments, and to analyze data.
- understand the professional and ethical responsibilities of a materials scientist and engineer.
- be able to develop novel computational methodologies and novel routes to address recent challenges on materials design and development.

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MASTER OF SCIENCE IN

MATERIALS SCIENCE PROGRAMME

Curriculum Structure

Semester-I							
Sl No.	**Category**	**Subject Code**	**Subject Name**	**Total Number of contact hours**			**Credits**
				L	**T**	**P**	
Theory							
1	Program Core I	MMS101	Introduction to Materials	4	1	0	4
2	Program Core II	MMS102	Introduction to Quantum Mechanics	4	1	0	4
3	Program Core III	MMS103	Materials Behavior	4	1	0	4
4	Program Core IV	MMS104	Statistical Thermodynamics/ Thermodynamics of Materials/ Advanced Thermodynamics	4	1	0	4
	Total Theory			16	4	0	16
Practical							
1	Laboratory I	MMS191	Programming with MATLAB for Materials Science	0	0	4	2
	Total Practical			0	0	4	2
Sessional							
1	Mini Project	MMS181	Mini Project with Seminar	4	0	0	4
			Total of Semester-I	20	4	4	22
Semester-II							
Theory							
1	Program Core V	MMS201	Structural and Physical Properties of Materials	4	1	0	4
2	Program Core VI	MMS202	Mathematics for Materials Scientists and Engineers	4	1	0	4
3	Program Core VII	MMS203	Solid State of Materials/ Introduction to Solid State Chemistry	4	1	0	4
4	Program Core VIII	MMS204	Materials Kinetics	4	1	0	4
	Total Theory			16	4	0	16
Practical							
1	Laboratory II	MMS291	Synthesis and characterization of Materials	0	0	4	2
	Total Practical			0	0	4	2
Sessional							
1	Mini Project	MMS281	Mini Project with Seminar	4	0	0	4
			Total of Semester-II	20	4	4	22

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MASTER OF SCIENCE IN

MATERIALS SCIENCE PROGRAMME

Curriculum Structure

Semester-III							
Sl No.	**Category**	**Subject Code**	**Subject Name**	**Total Number of contact hours**			**Credits**
				L	**T**	**P**	
Theory							
1	Program Core IX	MMS301	Numerical Methods and Computer Programming/ Numerical Methods in Material Science	4	1	0	4
2	Program Core X	MMS302	Phase equilibrium- Introduction to Material Science	4	1	0	4
3	Program Elective I	MMS303 A/B	Program Elective I (Nano Science and Nanotechnology/ Nanomechanics of Materials)	4	1	0	4
4	Open Elective I	MMS304 A/B	Open Elective I (Block Chain Technology/Principles of Machine Learning)	4	1	0	4
	Total Theory			16	4	0	16
Practical							
1	Laboratory III	MMS391	Materials Simulation Techniques Lab	0	0	4	2
	Total Practical			0	0	4	2
Sessional							
1	Major Project	MMS381	Dissertation-I (Progress)	8	0	0	8
			Total of Semester-III	24	4	4	26
Semester-IV							
Theory							
1	Program Core XI	MMS401	Materials Data Science	4	1	0	4
2	Program Core XII	MMS402	Artificial Intelligence in Material Science	4	1	0	4
3	Program Elective II	MMS403 A/B	Program Elective II (Smart Semiconductor Materials/ Magnetic Materials)	4	1	0	4
4	Open Elective II	MMS404 A/B	Open Elective II (Economic & Environmental Issues in Materials Selection/Internet of Things)	4	1	0	4
	Total Theory			16	4	0	16
Practical							
1	Laboratory IV	MMS491	Materials Behavior Lab	0	0	4	2
	Total Practical			0	0	4	2
Sessional							
1	Major Project	MMS481	Dissertation-II (Completion)	8	0	0	8
			Total of Semester-IV	24	4	4	26

Students will go for internship/industrial training during semester break (between II & III)

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MASTER OF TECHNOLOGY IN

MATERIALS SCIENCE & TECHNOLOGY PROGRAMME

Curriculum Structure

List of Program Electives

❖ Program Elective – I

1. Nano Science and Nanotechnology (MMS303A)
2. Nanomechanics of Materials (MMS303B)

❖ Program Elective – II

1. Smart Semiconductor Materials (MMS403A)
2. Magnetic Materials (MMS403B)

List of Open Electives

❖ Open Elective – I

1. Block Chain Technology (MMS304A)
2. Principles of Machine Learning (MMS304B)

❖ Open Elective – II

1. Economic & Environmental Issues in Materials Selection (MMS404A)
2. Internet of Things (MMS404B)

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DETAILED SYLLABI OF MASTER OF SCIENCE

IN MATERIALS SCIENCE PROGRAMME

Subject Code: MMS101	**Category:** Program Core I
Subject Name: Introduction to Materials	**Semester:** First
L-T-P: 4-1-0	**Credit:** 4

COURSE OUTLINE:

1. Historical perspective
2. Scope of Materials Science and engineering
3. Atomic structure and interatomic bonding
4. Lattices, basic idea of symmetry
5. Bravais lattices, unit cells, crystal structures, crystal planes and directions, co-ordination number
6. Single crystals, polycrystalline, non-crystalline, nano crystalline materials
7. Phases, phase diagrams
8. Diffusion phenomenon
9. Classification of materials, properties of materials

LEARNING RESOURCES:

1. Materials Science and Engineering, an Introduction, William D. Callister. John Willey and Sons Inc. Singapore.
2. Physical Metallurgy: Principle and Practice, V. Raghavan. Prentice Hall India Pvt Ltd.

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DETAILED SYLLABI OF MASTER OF SCIENCE IN MATERIALS SCIENCE PROGRAMME

Subject Code: MMS102	**Category**: Program Core II
Subject Name: Introduction to Quantum Mechanics	**Semester**: First
L-T-P: 4-1-0	**Credit**: 4

COURSE OUTLINE:

1. BASIC FORMULATION

Inadequacy of Classical Mechanics - Postulates of quantum mechanics-wave function, probabilistic interpretation, observables and operators -Eigenvalues and Eigenfunctions, Expectation values-Commutators-Bra & Ket vectors, completeness, orthonormality, Basic theorems-Uncertainty principle-Ehrenfest's theorem-Schrodinger wave equation-stationary state solutions.

2. POTENTIAL PROBLEMS

Free particle in three dimensions, particle in a box-one dimension and three dimension-potential step, potential barrier, tunnel effect, square well potential, periodic potential, linear harmonic oscillator, rigid rotator, the hydrogen atom, atomic orbitals.

3. ANGULAR MOMENTUM

Rotation operators, angular momentum operators, commutation rules, Eigenvalues of angular momentum operator, matrix representations, addition of two angular momenta, Clebsch-Gordon coefficients, properties-Pauli matrices.

4. APPROXIMATION METHODS

Time-independent perturbation theory, non degenerate and degenerate cases, Examples of Anharmonic oscillator and Stark effect, The variation method, Application to the deutron and helium atom, Time dependent perturbation theory, Harmonic perturbation.

LEARNING RESOURCES:

1. L.Schiff, Quantum Mechanics, Mc Graw-Hill Book Co., New York, 1996.

2. K.Ziock, Basic Quantum Mechanics, John Wiley & Sons, New York, 1969.

3. Sathyaprakash, Quantum Mechanics, Kedarnath Ramnath & Co., Meerut, 1994.

4. Chatwal and Anand, Quantum Mechanics, Himalaya Publishing House, New Delhi, 1993.

5. P.M.Mathews and K.Venkatesan, A Text book of Quantum mechanics, Tata McGraw-Hill, New Delhi, 1977.

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DETAILED SYLLABI OF MASTER OF SCIENCE IN MATERIALS SCIENCE PROGRAMME

Subject Code: MMS103	**Category**: Program Core III
Subject Name: Materials Behavior	**Semester**: First
L-T-P: 4-1-0	**Credit**: 4

COURSE OUTLINE:

1. Classes of Materials - Metals, Ceramics, Polymers, Semiconductors, Composites; Correlated Properties - Materials Design Paradigm, Application to Product Design; Mechanical Testing
2. Atomic Structure - Periodic Chart and Electron Orbitals, Modification for Atoms & Crystals, Types of Bonds – Primary Bonds, Ionic Bonds, Covalent Bonds, Mixed Bonds, Weak Bonds; Radius Ratio & Coordination Number, Basic Thermodynamics & Kinetics
3. Symmetry, Dimentional Symmetry, Dimentional Symmetry – Lattice and Basis, Crystal Systems and Bravais Lattices, FCC Hard Sphere Model, BCC Hard Sphere Model, Calculating Density, Hard Sphere Packing, Hard Sphere Packing – Visualization, Miller Indices – Directions, Miller Indices – Planes, Miller Indices – Additional Planes of Interest, Linear and Planar Densities, Crystals with 2 Atoms per Lattice Point, Crystals with 2 Ions or 2 Different Atoms per Lattice Point, Crystals with Several Atoms per Lattice Point, Polycrystalline Materials and Liquid Crystals, X-Ray Diffraction and Crystal Structure
4. Point Defects, Point Defects in Ionic and Covalent Materials, Substitutional Solid Solutions, Solid Solutions – Vegard's Law, Fick's First Law, Self Diffusion, Interstitial Solid Solutions, Grain Boundary Effects, Diffusion in Polymers, Fick's Second Law – The Thin Film Solution, Fick's Second Law – Modifications to the Thin Film Solution

LEARNING RESOURCES:

1. Hyperlink: https://www.coursera.org/learn/material-behavior/home/week/1

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DETAILED SYLLABI OF MASTER OF SCIENCE IN MATERIALS SCIENCE PROGRAMME

Subject Code: MMS104	**Category**: Program Core IV
Subject Name: Statistical Thermodynamics	**Semester**: First
L-T-P: 4-1-0	**Credit**: 4

COURSE OUTLINE:

1. INTRODUCTION

System control volume, process cycles Homogeneous – Heterogeneous system – Quasi static processs – Continuum concept – Zeroth law of Thermodynamics – Conceptof temperature – Pressure volume diagram- pv=c, pvn=c, pv^{γ}=c – Ideal gas – Temperature work and heat transfer – Path and point function, work done in free expansion – Zero work transfer, Work transfer – Heat transfer as a path function.

2. LAWS OF THERMODYNAMICS

First law of thermodynamics – System undergoing change change of state – Energy a property – Specific heat at constant volume and pressure- Second law of thermodynamics – cycle, difference between heat and work, efficiency of heat engine – Kelvin Planck – Clausius statement –Refrigerator – Heat pump – COP –Equality of Kelvin Planck and Clausius statements – Reversibility – Irreversibility – causes, Carnot's cycle – Carnot's theorem – Equality of thermodynamic and Kelvin scale of temperature.

3. ENTROPY

Entropy – Clausius theorem – Entropy as a property – T-S diagram, Clausius inequality – Change in entropy in irreversible process – Entropy principle – Application – Maximum work obtainable – Change in entropy with heat flow, change in entropy of closed system – open system, directional law of nature, entropy and disorder, available energy – Quality of energy – Maximum work done in reversible process with heat exchange – Dead state.

4. CLASSICAL STATISTICS

Fundamental concepts of PHASE SPACE – Microstate and ensemble – Postulates of classical statistical mechanics – Relation between entropy and probability – Microcanonical ensemble (MCE), derivation of thermodynamics from MCE – Equipartition theorem (without proof). Derivation of classical ideal gas equation using MCE –Gibb's paradox – Sackur-Tetrode equation, Canonical ensemble – Introduction and energy fluctuation – Partition function for canonical ensemble – Calculation of thermodynamic quantities from partition function – Derivation of classical ideal gas equation using canonical ensemble.

LEARNING RESOURCES:

1. P. K. Nag, Engg. Thermodynamics Tata Mc. Graw Hill 1995.

2. Federick Reif. Fundamentals of Statistical and Thermal Physics, Mc.Graw Hill, 1985.
3. Hyperlink: https://www.coursera.org/learn/statistical-thermodynamics-cm

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DETAILED SYLLABI OF MASTER OF SCIENCE
IN MATERIALS SCIENCE PROGRAMME

Subject Code: MMS201	**Category**: Program Core V
Subject Name: Structural and Physical Properties of Materials	**Semester**: Second
L-T-P: 4-1-0	**Credit**: 4

COURSE OUTLINE:

Formation is in progress

LEARNING RESOURCES:

Formation is in progress

DETAILED SYLLABI OF MASTER OF SCIENCE IN MATERIALS SCIENCE PROGRAMME

Subject Code: MMS202	**Category**: Program Core VI
Subject Name: Mathematics for Materials Scientists and Engineers	**Semester**: Second
L-T-P: 4-1-0	**Credit**: 4

COURSE OUTLINE:

1. VECTOR CALCULUS AND MATRICES

Laplacian-Vector operators in curvilinear coordinates Gauss, Green and Stokes theorems-Applications - Vector spaces-Linear dependence and independence - Eigenvalue problem - Diagonalisation -Similarity transformation.

2. SPECIAL FUNCTIONS

Beta and Gamma functions-Bessel, Legendre, Hermite, Chebyshev and Laguerre functions and their properties-Series solutions-Recurrence relations-Rodrigue's formulae, Orthogonality, Generating functions-Applications-Dirac delta function.

3. THEORY OF COMPLEX VARIABLES

Functions of complex variables-Cauchy Riemann conditions-Analytic functionsConformal mapping-Simple and Bilinear transformations-Applications-Cauchy's Integral Theorem and Integral Formula-Taylor's and Laurent's series- SingularitiesZeros, Poles and Residues-Residue theorem-Contour integration with circular and semicircular contours.

4. INTEGRAL TRANSFORMS

Harmonic analysis, Fourier transform-properties-transforms of simple functions and derivatives-Convolution theorems-Applications-Laplace's transform-propertiesTransform of simple functions and derivatives-periodic functions-Convolution theoremApplication to solve differential equation.

5. PARTIAL DIFFERENTIAL EQUATIONS AND GROUP THEORY

Transverse vibration of a string - Wave equation - One dimensional heat conduction - Diffusion equation - Two dimensional heat flow - Laplace's equation - Method of separation of variables -Fourier series solution in cartesian coordinates. Definition of group - symmetry elements -Reducible and irreducible representation – Orthogonality theorem.

LEARNING RESOURCES:

1. Pipes L.A. & Harvil, Applied Mathematics for Engineers and Physicists, McGrawHill Book Co., New York, 1980.

2. Kreyszig E., Advanced Engineering Mathematics, 7th edition, John Wiley & Sons, Singapore, 1993.

3. Grewal B.S., Higher Engineering Mathematics, Khanna Publishers, New Delhi, 1998.
4. Hyperlink: https://ocw.mit.edu/courses/materials-science-and-engineering/3-016-mathematics-for-materials-scientists-and-engineers-fall-2005/

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DETAILED SYLLABI OF MASTER OF SCIENCE
IN MATERIALS SCIENCE PROGRAMME

Subject Code: MMS203	**Category**: Program Core VII
Subject Name: Solid State of Materials/ Introduction to Solid State Chemistry	**Semester**: Second
L-T-P: 4-1-0	**Credit**: 4

COURSE OUTLINE:

Formation is in progress

LEARNING RESOURCES:

Formation is in progress

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DETAILED SYLLABI OF MASTER OF SCIENCE
IN MATERIALS SCIENCE PROGRAMME

Subject Code: MMS204	**Category**: Program Core VIII
Subject Name: Materials Kinetics	**Semester**: Second
L-T-P: 4-1-0	**Credit**: 4

COURSE OUTLINE:

Formation is in progress

LEARNING RESOURCES:

Formation is in progress

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DETAILED SYLLABI OF MASTER OF SCIENCE IN MATERIALS SCIENCE PROGRAMME

Subject Code: MMS301	**Category**: Program Core IX
Subject Name: Numerical Methods and Computer Programming/ Numerical Methods in Material Science	**Semester**: Third
L-T-P: 4-1-0	**Credit**: 4

COURSE OUTLINE:

1. SYSTEM OF EQUATIONS

Roots of equations - Methods of bisection and false position - Newton-Raphson method - Solution of simultaneous linear algebraic equations - Gauss elimination - Gauss Jordan methods - matrix inversion and LU decomposition methods - GaussSeidel iterative method-Eigenvalues of Matrices-Power method and Jacobi's method.

2. INTERPOLATION & CURVE FITTING AND ERROR ANALYSIS

Newton's forward and backward interpolation formulae - Lagrange's method - Lagrange's inverse interpolation - curve fitting - principle of least squares.

3. NUMERICAL DIFFERENTIATION AND INTEGRATION

Newton's forward and backward difference formulae - numerical integration - Trapezoidal rule and Simpson's rule - numerical solution of ordinary differential equations - Taylor series - Euler's method, improved and modified methods - RungeKutta methods - Milne's predictor -corrector method.

4. PROBABILITY, STATISTICS AND ERROR ANALYSIS

Probability concepts – Binomial, Poisson, exponential and Normal Distribution -Tests of hypothesis (small and large samples) based on Student's 't' and Chi-square distribution – Testing Goodness of fit - Error analysis – Accuracy and precision – Significant figures.

5. C-PROGRAMMING

Structure – pointers – types of variables-arrays-functions (intrinsic and user defined) – arithmetic operations and shorthand notations – loops (do, for, if loops) – elementary examples of programs (three programs at least from each of the above units)

LEARNING RESOURCES:

1. M.K.Venkatraman, "Numerical Methods in Science and Engineering", National Publishing Company, Madras, 1996
2. S.S.Sastry, "Introductory Methods of Numerical Analysis", Prentice Hall of India, New Delhi, 1992.

3. Walpole,E, Myers,R.M, Myers,S.L and Ye,K, “Probability & Statistics for Engineers and Scientists”, Pearson Education, 2002.
4. B.S.Grewal, Numerical Methods in Engineering and Science, Khanna Publishers, New Delhi, 2006.

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DETAILED SYLLABI OF MASTER OF SCIENCE
IN MATERIALS SCIENCE PROGRAMME

Subject Code: MMS302	**Category**: Program Core X
Subject Name: Phase equilibrium- Introduction to Material Science	**Semester**: Third
L-T-P: 4-1-0	**Credit**: 4

COURSE OUTLINE:

Formation is in progress

LEARNING RESOURCES:

Formation is in progress

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DETAILED SYLLABI OF MASTER OF SCIENCE
IN MATERIALS SCIENCE PROGRAMME

Subject Code: MMS303A	**Category**: Program Elective I
Subject Name: Nano Science and Nanotechnology	**Semester**: Third
L-T-P: 4-1-0	**Credit**: 4

COURSE OUTLINE:

Formation is in progress

LEARNING RESOURCES:

Formation is in progress

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DETAILED SYLLABI OF MASTER OF SCIENCE IN MATERIALS SCIENCE PROGRAMME

Subject Code: MMS303B	**Category**: Program Elective II
Subject Name: Nanomechanics of Materials	**Semester**: Third
L-T-P: 4-1-0	**Credit**: 4

COURSE OUTLINE:

Formation is in progress

LEARNING RESOURCES:

Formation is in progress

Subject Code: MMS304A	**Category**: Open Elective I
Subject Name: Block Chain Technology	**Semester**: Third
L-T-P: 4-1-0	**Credit**: 4

COURSE OUTLINE:

Introduction to this course, The Mathematica notebook, Getting Mathematica, The fancy calculator, Simple arithmetic, Powers and order of arithmetical operation, Trigonometric functions, Collections, The Table function, Manipulating lists, Applying functions to a list, Applying more functions to a list, The Grid function, Algebra and linear algebra, Solving polynomial equations, Transcendental functions and numerical solutions, Vectors, Matrices, Calculus, Derivatives, Derivatives of functions, Limits, Integration, Plotting mathematical functions, Manipulation, Plotting created functions, Plots in 3D, Labels and legends, More labels and legends, Discrete plots and list plots, Function notation, Shorthand notation, The replace operator, Working with data, Data and datasets, Addressing data.

LEARNING RESOURCES:

1. Essentials of Programming in Mathematica: Paul Wellin, Cambridge University Press, 2016, ISBN: 9781107116665.
2. Hyperlink: https://www.udemy.com/mathematica/

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IN MATERIALS SCIENCE PROGRAMME

Subject Code: MMS304B	**Category**: Open Elective II
Subject Name: Principles of Machine Learning	**Semester**: Third
L-T-P: 4-1-0	**Credit**: 4

COURSE OUTLINE:

Formation is in progress

LEARNING RESOURCES:

Formation is in progress

Subject Code: MMS381	**Category**: Major Project
Subject Name: Dissertation-I (Progress)	**Semester**: Third
L-T-P: 0-0-8	**Credit**: 8
Pre-Requisties: Nil	

A Project Dissertation would be of two-semester duration and one project would be allotted to one student. The Progress of project dissertation up to the end of the Third Semester would be evaluated by the concerned supervisor and a panel of examiners through a seminar presentation on the progress of dissertation followed by viva voce. The Progress of project dissertation up to the end of the Third Semester would be presented by the student concerned and viva voce will be conducted by a panel of examiners.

Quality of the project is measured in terms of

- Very clear and concise objectives
- Very clear methodology, articulated using technical terms indicating all steps and tools
- Cites substantial current and good quality literature
- Clarity in design/setting up of experiment.
- Benchmarks used /Assumptions made
- Interpretation of results and justification thereof and validity of the results presented.
- Overall presentation of the report

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DETAILED SYLLABI OF MASTER OF SCIENCE
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Subject Code: MMS401	**Category**: Program Core XI
Subject Name: Materials Data Science	**Semester**: Fourth
L-T-P: 4-1-0	**Credit**: 4

COURSE OUTLINE:

Formation is in progress

LEARNING RESOURCES:

Formation is in progress

DETAILED SYLLABI OF MASTER OF SCIENCE
IN MATERIALS SCIENCE PROGRAMME

Subject Code: MMS402	**Category**: Program Core XII
Subject Name: Artificial Intelligence in Material Science	**Semester**: Fourth
L-T-P: 4-1-0	**Credit**: 4

COURSE OUTLINE:

Introduction, Machine Learning-The Foundation of AI, Text and Speech-Understanding Language, Computer Vision-Seeing the World Through AI, Bots-Conversation as a Platform, Next Steps.

LEARNING RESOURCES:

1. Introduction to Artificial Intelligence: G. Goswami; Paperback-2013.
2. Hyperlink: https://www.edx.org/course/introduction-artificial-intelligence-1

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DETAILED SYLLABI OF MASTER OF SCIENCE IN MATERIALS SCIENCE PROGRAMME

Subject Code: MMS403A	**Category**: Program Elective II
Subject Name: Smart Semiconductor Materials	**Semester**: Fourth
L-T-P: 4-1-0	**Credit**: 4

COURSE OUTLINE:

Formation is in progress

LEARNING RESOURCES:

Formation is in progress

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DETAILED SYLLABI OF MASTER OF SCIENCE IN MATERIALS SCIENCE PROGRAMME

Subject Code: MMS403B	**Category**: Program Elective II
Subject Name: Magnetic Materials	**Semester**: Fourth
L-T-P: 4-1-0	**Credit**: 4

COURSE OUTLINE:

Formation is in progress

LEARNING RESOURCES:

Formation is in progress

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DETAILED SYLLABI OF MASTER OF SCIENCE
IN MATERIALS SCIENCE PROGRAMME

Subject Code: MMS404A	**Category**: Open Elective II
Subject Name: Economic & Environmental Issues in Materials Selection	**Semester**: Fourth
L-T-P: 4-1-0	**Credit**: 4

COURSE OUTLINE:

Formation is in progress

LEARNING RESOURCES:

Formation is in progress

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DETAILED SYLLABI OF MASTER OF SCIENCE IN MATERIALS SCIENCE PROGRAMME

Subject Code: MMS404B	**Category**: Open Elective II
Subject Name: Internet of Things	**Semester**: Fourth
L-T-P: 4-1-0	**Credit**: 4

COURSE OUTLINE:

Generate IoT concepts and design IoT solutions. Map out the process for an IoT solution, and identify the sensors and other devices required. Evaluate different infrastructure components and network systems, and design the basic network for your IoT ideas. Apply software solutions for different systems and Big Data to concept designs, and appreciate how data is managed in the network. Identify and analyse IoT security and privacy risks, and concept design secure hardware and software. Produce a viable IoT concept design that solves a problem, is ready to prototype and test, and has an identified route to market.

LEARNING RESOURCES:

1. Internet of Things with Python: G. C. Hillar, Packt Publishing Limited.
2. Hyperlink: https://www.edx.org/micromasters/curtinx-internet-of-things-iot

Subject Code: MMS481	**Category**: Major Project
Subject Name: Dissertation-II (Completion)	**Semester**: Fourth
L-T-P: 0-0-8	**Credit**: 8
Pre-Requisties: Nil	

Total output of the project work would have to be submitted in form of a bound thesis containing literature review, objective, details of work done, conclusion, reference, etc. The evaluation of the thesis will be done by a panel of examiners.

Final presentation and viva voce of the project will be based on the project thesis submitted to be conducted by a panel of examiners.

Quality of the project is measured in terms of

- Very clear and concise objectives
- Very clear methodology, articulated using technical terms indicating all steps and tools
- Cites substantial current and good quality literature
- Clarity in design/setting up of experiment.
- Benchmarks used / Assumptions made
- Interpretation of results and justification thereof and validity of the results presented.
- Overall presentation of the report