

Programme Template

1. Name of the Programme and Code	BTech in Materials Engineering (MS1)
2. Degree (UG/PG)	UG
3. Minimum Duration of the Programme (Specify for FT and PT, if applicable)	48 months (FT)
4. Maximum Duration of the Programme (Specify for FT and PT, if applicable)	48 months (FT)
5. Capacity (Max. Student Strength) of the Programme	40 (FT)
6. Number of Regular Faculty Members Involved as Teaching Faculty in the Programme	21
7. Minimum Credit Requirements for the Degree	147

8. Articulate the Program Learning Outcomes (PLO)

[For example see: Objectives vs. Outcomes and Student Outcomes]

PLO1. Students will learn fundamental concepts in materials science, including structure, properties, processing and performance.

PLO2. Students will be able to explain the relationship between the atomic structure and microstructure of materials and their macroscopic physical as well as chemical properties.

PLO3. Students will apply principles of material selection and design to solve engineering problems, choosing appropriate materials for specific applications.

PLO4. Students will analyze the effects of processing methods on the structure and properties of materials, and predict material behavior based on processing history.

PLO5. Students will critically evaluate the performance of materials in various engineering applications, considering environmental, economic, and ethical factors.

9. Map PLOs with Institute Learning Outcomes (ILOs) of the Degree

[Indicate '1' for weak, '2' for good, and '3' for excellent relation. Leave the cell blank to indicate no relation]

	PLO1	PLO2	PLO3	PLO4	PLO5
ILO1	1	1	3	3	1
ILO2		3	1	1	2
ILO3	3	1	2	1	2
ILO4	2	2	2	2	3
...	...	...	...	...	

10. Number of Programme Core Credits 60

11. Number of Programme Elective Credits 15

12. Number of Open Credits 9

13. Number of Project Core Credits 3

14. Details of Creative Expression and Ethical Reasoning (CEER) Component in the Programme [Only for UG]

Number of Credits Assigned	
Courses Involved and Credits Accounted [e.g., If one module in AMLXXX with contact hours YY satisfies Z credits, then write AMLXXX (Z credits)]	1. Materials Selection and Design (3 credits)

15. Details of Emerging Trends (ETT) Component in the Programme [Only for UG]

Number of Credits Assigned	
Courses Involved and Credits Accounted [e.g., If one module in AMLXXX with contact hours YY satisfies Z credits, then write AMLXXX (Z credits)]	1. Modern Data Analytics in Materials Science (3 credits)

16. Details of Environment and Sustainability (E&S) Component in the Programme [Only for UG]

Number of Credits Assigned	
Courses Involved and Credits Accounted [e.g., <i>If one module in AMLXXX with contact hours YY satisfies Z credits, then write AMLXXX (Z credits)</i>]	1. Materials and Sustainable Development (2 credits) 2. Energy Materials (3 credits)

17. Details of Research/Technical Communication Component in the Programme [Only for PG]

Number of Credits Assigned	
Courses Involved and Credits Accounted [e.g., <i>If one module in AMLXXX with contact hours YY satisfies Z credits, then write AMLXXX (Z credits)</i>]	3. xxx (Z1 credits) 4. xxx (Z2 credits) 5. ...

18. Details of Professional Ethics Component in the Programme [Only for PG]

Number of Credits Assigned	
Courses Involved and Credits Accounted [e.g., <i>If one module in AMLXXX with contact hours YY satisfies Z credits, then write AMLXXX (Z credits)</i>]	1. xxx (Z1 credits) 2. xxx (Z2 credits) 3. ...

19. Details of External Connect Component in the Programme [Only for PG]

Number of Credits Assigned	
Courses Involved and Credits Accounted [e.g., <i>If one module in AMLXXX with contact hours YY satisfies Z credits, then write AMLXXX (Z credits)</i>]	4. xxx (Z1 credits) 5. xxx (Z2 credits) 6. ...

20. List of prescribed courses in all baskets (BS, GE, DC/PC, DE/PE, ...)

Basic Sciences (BS)	General Engineering (GE)	Departmental/Programme Core (DC/PC)	Departmental/Programme Elective (DE/PE)
Structural Insights into Atoms and Molecules	Intro to Computer Science	Introduction to Materials Science and Engineering	Independent study
Introduction to Electrodynamics	Programming with Data Structures	Materials Selection and Design	Iron and Steel Making
Biology for Engineers: Microbes in health and disease	Introduction to Electrical Engineering	Modern Data Analytics in Materials Science	Metallography Lab
Experimental Biology for Engineers Lab	Engineering Mechanics	Materials and Sustainable Development	Metal Casting Technology
Chemistry Lab	Engineering Visualization	Energy Materials	B. Tech. Project (Part -2)
Physics Lab	Manufacturing for Product Innovation	Introduction to Thermodynamics	Major project in Polymeric Materials
Math-1	Intro to Computer Science	Phase Transformations	Major project in Metallurgy
Math-2	GE Elective 1	Structure and Characterization of Materials	Characterization of Materials-II
BS Elective		Mechanical Behaviour of Materials	Engineering Biomaterials
		Electronic, Optical and Magnetic Properties of Materials	Physical Chemistry of Polymers
		Materials Modeling	Polymer and Elastomer Technology
		Introduction to Polymeric Materials	Rheology and processing of polymers
		Materials Processing	Polymer Matrix composites
		Corrosion and Degradation of Materials	Welding Metallurgy
		Metal Extraction and Urban Mining	Powder Metallurgy

		Mechanical Behaviour of Materials Lab	Heat Treatment and Surface Engineering
		Characterization of Materials Lab	Diffusion & Kinetics
		Functional Materials Lab	Porous Materials
		Dept. Capstone / BTP-1	Texture and Grain Boundary Engineering in metals and alloys
			Tribology and Surface Engineering of Materials
			Electronic Devices and Characterization
			Nanostructures and Nanomaterials
			Micro and nanofabrication in Materials Engineering
			Materials for Additive Manufacturing
			Crystals, Symmetry and Tensors
			Polymer Blends and Composites Materials
			Polymer Reaction Engineering
			Polymer Product and Mould Design
			Biodegradable Polymeric Materials
			Fracture Mechanics
			Advanced Engineering Materials
			Engineering Failure Analysis & Prevention
			Engineering Plastics and Specialty Polymers
			Science and Technology of thin films
			Principles and practices of NMR and optical spectroscopy
			Multiscale Modelling of Crystalline Materials
			Chemistry of Nanostructured Materials
			Nanostructures and Nanomaterials
			Data-driven Methods for Materials designing

21. Nominal Semester-wise Academic Plan

	Course 1	Course 2	Course 3	Course 4	Course 5	Course 6	Course 7	L	T	P	Credits
Sem I	COP0100 Computer Literacy	COL1000 Intro to Computer Science (1-0-1)	CML Structural Insights into Atoms and Molecules (2-1-0)	MTL Math-1 (3-1-0)	MCPXXXX Manufacturing for Product Innovation (1-0-3)	MCPXXXX Engineering Visualization (1-0-3)	CMP Chemistry Lab (0-0-4)				
L-T-P-C	0 0 2 1	1 0 1 1.5	2 1 0 3	3 1 0 4	0.5 0 3 2	0.5 0 3 2	0 0 4 2	7	2	13	15.5
Sem II	PYL Electrodynamics (2-1-0)	COL1001 Intro to Computer Science (1-0-1)	ELL Introduction to Electrical Engineering (2-1-2)	MTL Math-2 (3-1-0)	MLL1001 Intro to Material Science and Engineering (3-0-2)		PYP Physics Lab (0-0-4)				
L-T-P-C	2 1 0 3	1 0 1 1.5	2 1 2 4	3 1 0 4	3 0 2 4		0 0 4 2	11	3	9	18.5
Sem III		MLL2001 Introduction to Thermodynamics (3-1-0) 4 credits	MLL2002 Structure and Characterization of Materials (3-1-0)	MLL2003 Introduction to Polymeric Materials (3-0-2)	GE Elect / BS Elec/HUL (3-0-0)	COL Programming with Data Structures (3-0-2)	APLXXXX Engineering Mechanics (3-1-0)				
L-T-P-C		3 1 0 4	3 1 0 4	3 0 2 4	3 0 0 3	3 0 2 4	3 1 0 4	18	3	4	23
Sem IV	MLL2004 Phase Equilibria and Transformations (2-1-0)	MLL2005 Mechanical Behaviour of Materials (3-1-0)	MLL2006 Modern Data Analytics in Materials Science (2-0-2)	MLP2007 Characterization Lab (0-0-4)	SBL Biology for Engineers: Microbes in health and disease (2-0-0)	GE Elect / BS Elec/HUL (3-1-0)	SBP Experimental Biology for Engineers (0-0-2)				
L-T-P-C	2 1 0 3	3 1 0 4	2 0 2 3	0 0 4 2	2 0 0 2	3 1 0 4	0 0 2 1	12	3	8	19
Sem V	MLL 3001 Electronic Optical and Magnetic Properties of Materials (3-0-0)	MLL3002 Materials Modeling (2-0-2)	MLL3003 Materials Processing (2-0-2)	MLP3004 Mechanical Behaviour Lab (0-0-3)	DE-1 (3-0-0)	GE Elect / BS Elec/HUL (3-0-0)	GE Elect/BS Elec/HUL (3-0-0)				
L-T-P-C	3 1 0 4	2 0 2 3	2 0 2 3	0 0 3 1.5	3 0 0 3	3 0 0 3	3 0 0 3	16	1	7	20.5
Sem VI	MLL3005 Corrosion and Degradation of Materials (3-0-2)		MLL3006 Materials Selection and Design (2-0-2)	MLL3007 Metal Extraction and Urban Mining (3-1-0)	MLP3008 Functional Materials Lab (0-0-3)	GE Elect / BS Elec/HU (3-0-0)	DE-2 (3-0-0)				
L-T-P-C	3 0 2 4		2 0 2 3	3 1 0 4	0 0 3 1.5	3 0 0 3	3 0 0 3	14	1	7	18.5
Sem VII	MLD4001 BTP-1/Capstone (0-0-6)	MLL4002 Energy Materials (3-0-0)	DE-3 (3-0-0)	GE Elect / BS Elec/HU (3-0-0)	MLL4003 Materials and Sustainable Development (2-0-0)	OC-1 (3-0-0)					
L-T-P-C	0 0 6 3	3 0 0 3	3 0 0 3	3 0 0 3	2 0 0 2	3 0 0 3		14	0	6	17
Sem VIII	DE-4 (3-0-0)	OC -2 (3-0-0)	DE-5 (3-0-0)	OC -3 (3-0-0)	GE Elect / BS Elec/HU (3-0-0)						
L-T-P-C	3 0 0 3	3 0 0 3	3 0 0 3	3 0 0 3	3 0 0 3			15	0	0	15
											147

22. Average Contact Hours per Faculty *per Week*, for this Programme

2.110 ((contact hr DE DC / 8 sem) * 4 yr)/faculty no

23. Average Credit Students per Faculty per Semester, for this Programme

71.4 ((total credit DC +DE) * students)/8) * 4 yr)/facult no

24. If the program is a revision of an existing program, please list the major changes made.	NA
25. Please elaborate on,	
a) how flexibility for the students has increased?	• Labs have been reshuffled. Additional department electives will be floated. Students can choose any courses running at the institute level as OCs. Students can form their own team to perform cornerstone project and propose their own topics.
b) how engagement and interaction with the student have increased?	a) New courses are introduced (Energy Materials, Modern Data Analytics Materials Science) considering emerging trends in materials for various applications. b) The changes that increase engagement and interaction with the students are: • Internship/minor project • Cornerstone project • Industry visits

c) how hands-on learning is emphasized in the program?	Lab courses have been reshuffled and lab experiments will be upgraded based on discussions with students and faculty members. A separate lab course for materials characterization is proposed. Lab and lectures of Materials Selection and Design are combined into a single course.
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