Course / Curriculum / Syllabus revision in compliance of NEP-2020 (B. Tech. / B. S.) with minors – 4 years duration

As per the Senate directives upon adoption of NEP-2020 in its 30th Senate, IIT Patna took up a rigorous curriculum and syllabus revision exercise for all the running programmes (in-campus / hybrid mode of instruction) to ensure implementation of NEP-2020. During the course of revision, renowned resource persons from the respective area of specialization were invited to contribute through their insights and experience on the subject matter. Their experience and inputs have been instrumental in shaping at par curriculum and course structure where every Academic Department, faculty members and Academic section of the Institute have taken keen interest and delivered their best to create the revised structure of the Academic programmes listed below.

Common curriculum for 4-year B. Tech. / B. S. with Minors and 5-year dual degree admitted through JoSAA

Sl. No.	Subject Code	SEMESTER I	L	T	P	C
1.	MA1101	Calculus and Linear Algebra	3	1	0	4.0
2.	CS1101	Foundations of Programming	3	0	3	4.5
3.	PH1101/PH1201	Physics	3	1	3	5.5
4.	CE1101/CE1201	Engineering Graphics	1	0	3	2.5
5.	EE1101/EE1201	Electrical Sciences	3	0	3	4.5
6.	HS1101	English for Professionals	2	0	1	2.5
TOTAL			**15**	**2**	**13**	**23.5**

Sl. No.	Subject Code	SEMESTER II	L	T	P	C
1.	MA1201	Probability Theory and Ordinary Differential Equations	3	1	0	4
2.	CS1201	Data Structure	3	0	3	4.5
3.	CH1201/CH1101	Chemistry	3	1	3	5.5
4.	ME1201/ME1101	Mechanical Fabrication	0	0	3	1.5
5.	ME1202/ME1102	Engineering Mechanics	3	1	0	4
6.	IK1101	Indian Knowledge System (IKS)	3	0	0	3
TOTAL			**15**	**3**	**9**	**22.5**

The syllabus of each of the courses in the curriculum framework listed herein above is available on the following link for perusal by the Senate members a priori for discussion in the Senate. The syllabus structure is vetted by a committee comprising respective Department faculty members and external experts invited during review.

Note: 50% students will swap Physics with Chemistry (Sl. No. 3) and Engineering Graphics with Mechanical Fabrication (Sl. No. 4) and Electrical Sciences with Engineering Mechanics (Sl. No. 5) in semester 1 and 2, respectively.

(1.) B. Tech. Programme from the Department of Chemical and Biochemical Engineering

(i) B. Tech. in Chemical Engineering and Minor in Chemical Engineering.

Sl. No.	Subject Code	SEMESTER III	L	T	P	C
1.	CB2101	Introduction to Chemical Engineering	2	0	0	2
2.	CB2102	Fluid Mechanics	3	1	2	5
3.	CB2103	Heat Transfer	3	0	3	4.5
4.	CB2104	Chemical Process Calculations	3	1	0	4
5.	CB2105	Chemical Engineering Thermodynamics	3	0	0	3
6.	HS21PQ	HSS Elective-I	3	0	0	3
TOTAL			**17**	**2**	**5**	**21.5**

Sl. No.	Subject Code	SEMESTER IV	L	T	P	C
1.	CB2201	Mechanical Operations	2	0	3	3.5
2.	CB2202	Mass Transfer-I	3	0	0	3
3.	CB2203	Fundamentals of Biochemical Engineering	3	0	0	3
4.	CB2204	Process Dynamics and Control	3	0	2	4
5.	CB2205	Chemical Reaction Engineering-I	3	0	0	3
6.	CB22PQ	IDE-I	3	0	0	3
TOTAL			**17**	**0**	**5**	**19.5**

Sl. No.	Subject Code	SEMESTER V	L	T	P	C
1.	CB3101	Mass Transfer-II	3	0	3	4.5
2.	CB3102	Chemical Process Technology	3	0	0	3
3.	CB3103	Process Equipment Design	1	2	0	3
4.	CB3104	Chemical Reaction Engineering-II	3	0	2	4
5.	CB3105	Chemical Process Modeling and Simulation	2	0	3	3.5
6.	CB31PQ	IDE-II	3	0	0	3
TOTAL			**15**	**2**	**8**	**21**

Sl. No.	Subject Code	SEMESTER VI	L	T	P	C
1.	CB3201	Process Plant Design and Economics	3	0	0	3
2.	CB3202	Transport Phenomena	3	1	0	4
3.	CB3203	Numerical Methods in Chemical Engineering	3	1	0	4
4.	CB3204	AI/ML for Chemical Engineers	1	0	4	3
5.	CB3205	Chemical Plant Safety and Hazards	3	0	0	3
6.	CB32PQ	DE-I	3	0	0	3
TOTAL			**16**	**2**	**4**	**20**

Sl. No.	Subject Code	SEMESTER VII	L	T	P	C
1.	CB41PQ	DE-II	3	0	0	3
2.	CB41PQ	DE-III	3	0	0	3
3.	XX41PQ	IDE-III	3	0	0	3
4.	HS31PQ	HSS Elective-II	3	0	0	3
5.	CB4198	Summer Internship*	0	0	12	3
6.	CB4199	Project – I	0	0	12	6
TOTAL			**12**	**0**	**24**	**21**

Note: Summer internship (*) period of at least 60 days' duration begins in the intervening vacation between semester 6 and 7 that may be done in industry/R & D /Academic institutions including IIT Patna. The evaluation would comprise combined grading based on host supervisor evaluation, project internship report after plagiarism check, and presentation evaluation by the parent department with equal weightage of each component.

Sl. No.	Subject Code	SEMESTER VIII	L	T	P	C
1.	CB42PQ	DE-IV	3	0	0	3
2.	CB42PQ	DE-V	3	0	0	3
3.	CB4298	DE-VI	3	0	0	3
4.	CB4299	Project – II	0	0	16	8
TOTAL			9	0	16	**17**

Total Credits (including B. Tech. first year): **166**

List of Departmental Electives (DE)

Elective	Course
DE-I	1. Catalysis Science and Engineering (CB3211) 2. Biopharmaceutical Downstream Processing (CB3212) 3. Material Science and Engineering (CB3213) 4. Introduction to Microfluidics Technology (CB3214)
DE-II	1. Industrial Pollution Control (CB4111) 2. Introduction to Computational Biology (CB4112) 3. Molecular Modeling and Simulation (CB4113)
DE-III	1. Electrochemical Energy Systems (CB4114) 2. Fertilizer Technology (CB4115) 3. Nanomaterials (CB4116) 4. Combustion Engineering and Technology (CB4117)
DE-IV	1. Membrane Separation (CB4211) 2. Energy Storage: Technologies and Applications (CB4212) 3. Process Integration (CB4213)
DE-V	1. Renewable Energy Sources (CB4214) 2. Advanced Separation Processes (CB4215) 3. Fluidization Engineering (CB4216)
DE-VI	1. Energy Management (CB4217) 2. Heterogeneous Catalysis: Fundamentals and Applications (CB4218) 3. Polymer Science and Technology (CB4219)

	4. Petroleum Refinery Engineering (CB4220)

IDE floated by the Department (not applicable for B. Tech. Chemical Engineering students)

1. Environmental Science and Engineering (CB2280)
2. Introduction to Sustainable Engineering (CB3180)
3. Bioprocess Engineering (CB4180)

Minor in Chemical Engineering

Total courses: 5
Total credits: 17

Sl. No.	Semester	Code	Course	L	T	P	C
1.	Sem III	CB2103	Heat Transfer	3	0	3	4.5
2.	Sem IV	CB2201	Mechanical Operations	2	0	3	3.5
3.	Sem V	CB3102	Chemical Process Technology	3	0	0	3
4.	Sem VI	CB2202	Mass Transfer-I	3	0	0	3
5.	Sem VI	CB2205	Chemical Reaction Engineering-I	3	0	0	3
Total				**14**	**0**	**6**	**17**

(2.) B. Tech. Programme from the Department of Civil and Environmental Engineering

(i) B. Tech. in Civil Engineering and Minor in Infrastructure Engineering

Sl. No.	Subject Code	SEMESTER III	L	T	P	C
1.	CE2101	Core I Geomatics Engineering	3	1	2	5.0
2.	CE2102	Core II Structural Mechanics	3	1	0	4.0
3.	CE2103	Core III Fluid Mechanics	3	1	2	5.0
4.	CE2104	Core IV Geology for Engineers	3	0	2	4.0
5.	HS21PQ	HSS Elective I	3	0	0	3.0
TOTAL			**15**	**3**	**6**	**21.0**
1.	CE2102	Minor I: Structural Mechanics	3	1	0	4

Sl. No.	Subject Code	SEMESTER IV	L	T	P	C
1.	CE2201	Core I Structural Analysis	3	0	2	4.0
2.	CE2202	Core II Soil Mechanics	3	0	2	4.0
3.	CE2203	Core III Civil Engineering Materials	3	0	2	4.0
4.	CE2204	Core IV Water Resources Engineering–I	3	0	0	3.0
5.	CE2205	Core V Numerical Methods in Civil Engineering	3	0	0	3.0
6.	CE22PQ	IDE I	3	0	0	3.0
TOTAL			**18**	**0**	**6**	**21.0**
2.	CE2203	Minor II: Civil Engineering Materials	3	0	2	4

Sl. No.	Subject Code	SEMESTER V	L	T	P	C
1.	CE3101	Core I Design of Reinforced Concrete Structures	3	0	2	4.0
2.	CE3102	Core II Foundation Engineering	3	0	2	4.0
3.	CE3103	Core III Transportation Engineering – I	3	1	2	5.0
4.	CE3104	Core IV Environmental Engineering - I	3	0	2	4.0
5.	CE3190	IDE II	3	0	0	3.0
TOTAL			**15**	**1**	**8**	**20.0**
3.	CE3103	Minor III: Transportation Engineering – I	3	1	2	5

Sl. No.	Subject Code	SEMESTER VI	L	T	P	C
1.	CE3201	Core I Design of Steel Structures	3	1	0	4.0
2.	CE3202	Core II Infrastructure Drawing and Estimation	1	2	0	3.0
3.	CE3203	Core II Construction Planning & Management	3	0	0	3.0
4.	CE3204	Core IV Environmental Engg-II	3	1	0	4.0
5.	CE3205	Core V Water Resources Engineering - II	3	0	2	4.0
6.	CE3206	Core VI Transportation Engineering - II	3	0	0	3.0
TOTAL			**16**	**4**	**2**	**21.0**

4.	CE3202	Minor IV: Infrastructure Drawing and Estimation	1	2	0	3
Sl. No.	**Subject Code**	**SEMESTER VII**	**L**	**T**	**P**	**C**
1.	CE41PQ	Departmental Elective – I	3	0	0	3.0
2.	CE41PQ	Departmental Elective – II	3	0	0	3.0
3.	CE41PQ	IDE-III	3	0	0	3.0
4.	HS41PQ	HSS Elective II	3	0	0	3.0
5.	CE4198	Summer Internship*	0	0	12	3.0
6.	CE4199	Project – I	0	0	12	6.0
TOTAL			**12**	**0**	**24**	**21.0**

Note: Summer internship (*) period of at least 60 days' duration begins in the intervening vacation between semester 6 and 7 that may be done in industry/R & D /Academic institutions including IIT Patna. The evaluation would comprise combined grading based on host supervisor evaluation, project internship report after plagiarism check, and presentation evaluation by the parent department with equal weightage of each component.

Sl. No.	**Subject Code**	**SEMESTER VIII**	**L**	**T**	**P**	**C**
1.	CE42PQ	Departmental Elective – III	3	0	0	3.0
2.	CE42PQ	Departmental Elective – IV	3	0	0	3.0
3.	CE42PQ	Departmental Elective – V	3	0	0	3.0
4.	CE4299	Project – II	0	0	16	8.0
TOTAL			**9**	**0**	**16**	**17.0**
GRAND TOTAL (including Semester I & II)			**167.0**			

IDE

Sl. No.	**Subject Code**	**Subject**	**L**	**T**	**P**	**C**
1.	CE2290	IDE I: Construction Technology and Management	3	0	0	3
2.	CE3190	IDE II: Green Building	3	0	0	3
3.	CE4190	IDE III: Smart Transportation	3	0	0	3
4.	CE4191	IDE III: Industrial Pollution and Control	3	0	0	3

Minor in Infrastructure Engineering

Minor						
Sl. No.	**Subject Code**	**Subject**	**L**	**T**	**P**	**C**
1.	CE2102	Minor I: Structural Mechanics	3	1	0	4
2.	CE2203	Minor II: Civil Engineering Materials	3	0	2	4
3.	CE3103	Minor III: Transportation Engineering – I	3	1	2	5
4.	CE3202	Minor IV: Infrastructure Drawing and Estimation	1	2	0	3
TOTAL			10	4	4	16

SEMESTER VII

Department Elective-I						
Sl. No.	**Subject Code**	**Subject**	**L**	**T**	**P**	**C**
1.	CE4101	Introduction to Bridge Engineering	3	0	0	3
2.	CE4102	Prestressed and Precast Concrete Structures	3	0	0	3
3.	CE4103	Fundamentals of Solid Mechanics	3	0	0	3
4.	CE4104	Matrix Method for Structural Analysis	3	0	0	3

Department Elective-II						
Sl. No.	**Subject Code**	**Subject**	**L**	**T**	**P**	**C**
1.	CE4105	Stochastic Hydrology	3	0	0	3
2.	CE4106	Irrigation Engineering and Hydraulic Structures	3	0	0	3
3.	CE4107	Elementary Soil Behaviour	3	0	0	3
4.	CE4108	Fundamentals of Geoenvironmental Engg.	3	0	0	3
5.	CE4109	Biogeotechnical Engineering	3	0	0	3
6.	CE4110	Pavement Geotechnology	3	0	0	3

SEMESTER VIII

Department Elective-III						
Sl. No.	**Subject Code**	**Subject**	**L**	**T**	**P**	**C**
1.	CE4201	Elements of Remote Sensing and GIS	3	0	0	3
2.	CE4202	Introduction to Soil Structure Interaction	3	0	0	3
3.	CE4203	Introduction to Underground Excavation	3	0	0	3
4.	CE4204	Multiphysical Processes in fractured rocks	3	0	0	3
5	CE4205	Rock Engineering for Hydropower Projects	3	0	0	3
6	CE4206	Fundamentals of Forensic Geotech Engineering	3	0	0	3
7	CE4207	Ground Improvement for Civil Engineering Structures	3	0	0	3

Department Elective-IV						
Sl. No.	**Subject Code**	**Subject**	**L**	**T**	**P**	**C**
1.	CE4208	Solid Waste Engineering	3	0	0	3
2.	CE4209	Air Pollution Engineering	3	0	0	3

Department Elective-V						
Sl. No.	**Subject Code**	**Subject**	**L**	**T**	**P**	**C**
1.	CE4210	Introduction to Geotechnical Earthquake Engineering	3	0	0	3
2.	CE4211	Structural Dynamics and Earthquake Engineering	3	0	0	3
3.	CE4212	Rehabilitation of Structures	3	0	0	3

Department Elective-V						
Sl. No.	**Subject Code**	**Subject**	**L**	**T**	**P**	**C**
4.	CE4213	Introduction to Structural Health Monitoring	3	0	0	3

(3.) B. Tech. Programme from the Department of Chemistry

(i) B. Tech. in Chemical Science and Technology (CST) and Minor in CST

Sl. No.	**Subject Code**	**SEMESTER III**	**L**	**T**	**P**	**C**
1.	CH2101	Organic Chemistry	3	1	0	4
2.	CH2102	Inorganic Chemistry	3	1	0	4
3.	CH2103	Introduction to Quantum Chemistry	3	1	0	4
4.	CH2104	Fluid Mechanics	3	1	2	5
5.	CH2105	Chemical Process Calculations	3	0	0	3
6.	HS21PQ	HSS Elective-I	3	0	0	3
TOTAL			**18**	**4**	**2**	**23**

Sl. No.	**Subject Code**	**SEMESTER IV**	**L**	**T**	**P**	**C**
1.	CH2201	Structure and function of Biomolecules	3	0	0	3
2.	CH2202	Introduction to Organometallics	3	1	0	4
3.	CH2203	Chemical Thermodynamics and Equilibrium	3	1	0	4
4.	CH2204	Industrial Chemistry	3	0	0	3
5.	CH2205	Chemical Technology Laboratory I	0	0	6	3
6.	CH2206	IDE-I: Green Science and Technology	3	0	0	3
TOTAL			**15**	**2**	**6**	**20**
7.	CH2202	Introduction to Organometallics (Minor I)	3	1	0	4

Sl. No.	**Subject Code**	**SEMESTER V**	**L**	**T**	**P**	**C**
1.	CH3101	Macromolecular Science and Engineering	3	1	0	4
2.	CH3102	Design and Applications of Nanomaterials	2	1	0	3
3.	CH3103	Chemical Kinetics and Electrochemistry	3	0	0	3
4.	CH3104	Techniques for Chemical Analysis	3	1	0	4
5.	CH3105	Chemical Technology Laboratory II	0	0	6	3
6.	CH3106	IDE-II: Synthesis of Industrially Important Inorganic Molecules	3	0	0	3
TOTAL			**14**	**3**	**6**	**20**
7.	CH3104	Techniques for Chemical Analysis (Minor II)	3	1	0	4

Sl. No.	**Subject Code**	**SEMESTER VI**	**L**	**T**	**P**	**C**
1.	CH3201	Medicinal Chemistry	3	0	0	3
2.	CH3202	Environmental Science & Technology	3	0	0	3

3.	CH3203	Computational Chemistry	3	0	2	4
4.	CH3204	Chemistry for Propellants and Pyrotechnics	3	0	0	3
5.	CH3205	Chemical Technology Laboratory III	0	0	6	3
6.	CH32PQ	Department Elective-I	3	0	0	3
TOTAL			**15**	**0**	**8**	**19**
7.	CH3203	Computational Chemistry (Minor III)	3	0	2	4

List of Department Electives (DE-I) for 6th semester

Sl. No.	Subject Code	Course Name	L	T	P	C
1.	CH3206	Metal Ions in Chemical Biology	3	0	0	3
2.	CH3207	Petroleum and Petrochemicals	3	0	0	3

Sl. No.	Subject Code	SEMESTER VII	L	T	P	C
1.	CH41PQ	Departmental Elective – II	3	0	0	3
2.	CH41PQ	Departmental Elective – III	3	0	0	3
3.	CH4111	IDE-III: Analytical Chemistry	3	0	0	3
4.	HS41PQ	HSS Elective II	3	0	0	3
5.	CH4198	Summer Internship*	0	0	12	3
6.	CH4199	Project – I	0	0	12	6
		TOTAL	**12**	**0**	**24**	**21**
7.	CH3101	Macromolecular Science and Engineering (Minor IV)	3	1	0	4

Note: Summer internship (*) period of at least 60 days' duration begins in the intervening vacation between semester 6 and 7 that may be done in industry/R & D /Academic institutions including IIT Patna. The evaluation would comprise combined grading based on host supervisor evaluation, project internship report after plagiarism check, and presentation evaluation by the parent department with equal weightage of each component.

	List of Department Electives, DE-II, for VIIth semester						
Sl. No.	**Subject Code**	**Course Name**		**L**	**T**	**P**	**C**
1.	**CH4107**	Drug Design and Development	**Bucket – 2 for DE-II**	3	0	0	3
2.	**CH4108**	Dyes, Paints and Pigments		3	0	0	3
List of Department Electives, DE-III, for VIIth semester							
1.	**CH4109**	Group Theory and Spectroscopy	**Bucket – 2 for DE-III**	3	0	0	3
2.	**CH4110**	Application of Statistical Mechanics in Chemistry.		3	0	0	3

Sl. No.	Subject Code	SEMESTER VIII	L	T	P	C
1.	CH42XX	Departmental Elective – IV	3	0	0	3
2.	CH42XX	Departmental Elective – V	3	0	0	3
3.	CH42XX	Departmental Elective – VI	3	0	0	3
4.	CH4299	Project – II	0	0	16	8
TOTAL			**9**	**0**	**16**	**17**
GRAND TOTAL (Semester I to VIII)						**166**

List of Department Electives, DE-IV, for VIIIth semester

Sl. No.	Subject Code	Course Name	L	T	P	C
1.	CH4207	Catalysis	3	0	0	3
2.	CH4208	Colloids and Interface Chemistry	3	0	0	3

List of Department Electives, DE-V, for VIIIth semester

3.	CH4209	Food Chemistry	3	0	0	3
4.	CH4210	Green and Sustainable Chemistry	3	0	0	3

List of Department Electives, DE-VI, for VIIIth semester

5.	CH4211	Materials Chemistry	3	0	0	3
6.	CH4212	Organic Semiconductors: Fundamentals to Applications	3	0	0	3

(4.) B. Tech. Programme from the Department of Computer Science & Engineering

(i) B. Tech. Artificial Intelligence and Data Science (AI&DS) and Minor in AI&DS.

Sl. No.	Subject Code	SEMESTER III	L	T	P	C
1.	CS2101	Algorithm	3	0	3	4.5
2.	CS2102	Digital Logic and Computer Organization	3	0	3	4.5
3.	CS2103	Artificial Intelligence Concepts	2	0	2	3
4.	CS2104	Discrete Mathematics	3	0	0	3
5.	CS2105	Optimization Techniques	3	0	0	3
6.	HS21PQ	HSS Elective I	3	0	0	3
TOTAL			**17**	**0**	**8**	**21**
Minor - I			**2**	**0**	**2**	**3**

Sl. No.	Subject Code	SEMESTER IV	L	T	P	C
1.	CS2201	Formal Language and Automata Theory	3	0	0	3
2.	CS2202	Database and Warehousing	3	0	2	4
3.	CS2203	Artificial Intelligence	3	0	3	4.5
4.	CS2204	IT Workshop	0	2	2	3
5.	CS2206	Data Analytics and Visualization	3	0	3	4.5
6.	CS2209	IDE-I (Introduction to Data Science)	3	0	0	3
TOTAL			**15**	**2**	**10**	**22**
Minor - II						**4**

Sl. No.	Subject Code	SEMESTER V	L	T	P	C
1.	CS3101	Operating System	3	0	3	4.5
2.	CS3102	Computer Network	3	0	3	4.5
3.	CS3103	Machine Learning	3	0	3	4.5
4.	CS3105	Natural Language Processing	3	0	3	4.5
5.	CS3109	IDE-II (Computer Graphics)	3	0	0	3
TOTAL			**15**	**0**	**12**	**21**
Minor – III						**4.5**

Sl. No.	Subject Code	SEMESTER VI	L	T	P	C
1	CS3201	Cyber Security	3	0	2	4
2	CS3202	Deep Learning	3	0	3	4.5
3	CS3204	Computer Vision	3	0	3	4.5
4	CS3299	Capstone Project	0	0	6	3
5	CS32XX	DE-I (AI ELECTIVES LIST)	3	0	0	3
TOTAL			12	0	14	**19**
Minor - IV						**4.5**

Sl. No.	Subject Code	SEMESTER VII	L	T	P	C
1.	CS41XX	DE-II (AI ELECTIVES LIST)	3	0	0	3
2.	CS41XX	DE-III (AI ELECTIVES LIST)	3	0	0	3
3.	CS4109	IDE - III (Data Analysis and Visualization)	3	0	0	3
4.	HS41PQ	HSS Elective II	3	0	0	3
5.	CS4198	Summer Internship*/ Summer Project	0	0	12	3
6.	CS4199	Project – I	0	0	12	6
		TOTAL	**12**	**0**	**24**	**21**

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Sl. No.	Subject Code	SEMESTER VIII	L	T	P	C
1.	CS42XX	DE-IV (AI ELECTIVES LIST)	3	0	0	3
2.	CS42XX	DE-V (AI ELECTIVES LIST)	3	0	0	3
3.	CS42XX	DE-VI (AI ELECTIVES LIST)	3	0	0	3
4.	CS4299	Project – II	0	0	16	8
		TOTAL	**9**	**0**	**16**	**17**
		GRAND TOTAL (including Semester I & II)	**167**			

Minor in AI&DS (List of Courses)						
	Course Code	**Course Name**	**L**	**T**	**P**	**C**
Minor-1	CS2103	Artificial Intelligence Concepts	2	0	2	3
Minor-2	CS2202	Database and Warehousing	3	0	2	4
Minor-3	CS3103	Machine Learning	3	0	3	4.5
Minor-4	CS3202	Deep Learning	3	0	3	4.5
		Total Credits	**16**			

IDE from AI&DS							
	Semester	**Course Code**	**Course Name**	**L**	**T**	**P**	**C**
IDE-I	Semester-4	CS2209	Introduction to Data Science	3	0	0	3
IDE-II	Semester-5	CS3109	Computer Graphics	3	0	0	3
IDE-III	Semester-7	CS4109	Data Analysis and Visualization	3	0	0	3

B. Tech. AI & DS Elective List

Bucket -1	**Semester -6 Subject List for DE- 1**
Course Code	**Course Name**
CS3221	Object-Oriented Programming (3-0-0-3)
CS3222	Agile Computing (3-0-0-3)

CS3223	Software Engineering (3-0-0-3)
CS3224	Bayesian Data Analysis (3-0-0-3)
CS3225	Data Mining (3-0-0-3)
CS3226	Information Retrieval (3-0-0-3)

Bucket -2	**Semester -7 Subject List for DE- 2**
Course Code	**Course Name**
CS4121	Pattern Recognition (3-0-0-3)
CS4122	Principles of Programming Languages (3-0-0-3)
CS4123	Social Networks (3-0-0-3)
CS4124	Multimedia System (3-0-0-3)
CS4126	Nature Inspired Algorithms (3-0-0-3)

Bucket -3	**Semester -7 Subject List for DE- 3**
Course Code	**Course Name**
CS4127	Graph Machine Learning (3-0-0-3)
CS4128	Bioinformatics (3-0-0-3)
CS4129	Time Series Analysis (3-0-0-3)
CS4131	Computational Data Analysis (3-0-0-3)
CS4132	Blockchain Technology (3-0-0-3)
CS4133	Evolutionary Computing (3-0-0-3)

Bucket -4	**Semester -8 Subject List for DE- 4**
Course Code	**Course Name**
CS4221	Multivariate Analysis (3-0-0-3)
CS4222	Generative AI (3-0-0-3)
CS4223	Statistical Machine Learning (3-0-0-3)
CS4224	Text Mining (3-0-0-3)

Bucket -5	**Semester -8 Subject List for DE- 5**
Course Code	**Course Name**
CS4226	Cloud Computing (3-0-0-3)
CS4227	Quantum Computing (3-0-0-3)
CS4228	Drone Data Processing (3-0-0-3)
CS4229	Edge Computing (3-0-0-3)
CS4230	Wireless Networks (3-0-0-3)

Bucket -6	**Semester -8 Subject List for DE- 6**
Course Code	**Course Name**
CS4233	Computer Security (3-0-0-3)
CS4234	Cryptography (3-0-0-3)
CS4235	Big Data Analytics (3-0-0-3)

CS4236	Computer Forensics (3-0-0-3)

(ii) B. Tech. in Computer Science and Engineering (CSE) and Minor in CSE.

Sl. No.	Subject Code	SEMESTER III	L	T	P	C
1.	CS2101	Algorithm	3	0	3	4.5
2.	CS2102	Digital Logic and Computer Organization	3	0	3	4.5
3.	CS2103	Artificial Intelligence Concepts	2	0	2	3
4.	CS2104	Discrete Mathematics	3	0	0	3
5.	CS2105	Optimization Techniques	3	0	0	3
6.	HS21XX	HSS Elective I	3	0	0	3
TOTAL			**17**	**0**	**8**	**21**
Minor - I			**3**	**0**	**3**	**4.5**

Sl. No.	Subject Code	SEMESTER IV	L	T	P	C
1.	CS2201	Formal Language and Automata Theory	3	0	0	3
2.	CS2202	Database and Warehousing	3	0	2	4
3.	CS2203	Artificial Intelligence	3	0	3	4.5
4.	CS2204	IT Workshop	0	2	2	3
5.	CS2205	Computer Architecture	3	0	3	4.5
6.	CS2209	IDE - I (Introduction to Data Science)	3	0	0	3
TOTAL			**15**	**2**	**10**	**22**
Minor - II			**3**	**0**	**2**	**4**

Sl. No.	Subject Code	SEMESTER V	L	T	P	C
1.	CS3101	Operating System	3	0	3	4.5
2.	CS3102	Computer Network	3	0	3	4.5
3.	CS3103	Machine Learning	3	0	3	4.5
4.	CS3104	Compiler	3	0	3	4.5
5.	CS3109	IDE - II (Computer Graphics)	3	0	0	3
TOTAL			**15**	**0**	**12**	**21**
Minor - III			**3**	**0**	**3**	**4.5**

Sl. No.	Subject Code	SEMESTER VI	L	T	P	C
1.	CS3201	Cyber Security	3	0	2	4
2.	CS3202	Deep Learning	3	0	3	4.5
3.	CS3203	Internet of Things	3	0	3	4.5
4.	CS32XX	DE-I (CS ELECTIVES LIST)	3	0	0	3
5.	CS3299	Capstone Project	0	0	6	3
TOTAL			**12**	**0**	**14**	**19**
Minor - IV			**3**	**0**	**2**	**4**

Sl. No.	Subject Code	SEMESTER VII	L	T	P	C
1.	CS41XX	DE-II (CS ELECTIVES LIST)	3	0	0	3
2.	CS41XX	DE-III (CS ELECTIVES LIST)	3	0	0	3
3.	CS4109	IDE-III(Data Analysis and Visualization)	3	0	0	3
4.	HS41PQ	HSS Elective II	3	0	0	3
5.	CS4198	Summer Internship*/ Summer Project	0	0	12	3
6.	CS4199	Project – I	0	0	12	6
		TOTAL	**12**	**0**	**24**	**21**

Note: Summer internship (*) period of at least 60 days' duration begins in the intervening vacation between semester 6 and 7 that may be done in industry/R & D /Academic institutions including IIT Patna. The evaluation would comprise combined grading based on host supervisor evaluation, project internship report after plagiarism check, and presentation evaluation by the parent department with equal weightage of each component.

Sl. No.	Subject Code	SEMESTER VIII	L	T	P	C
1.	CS42XX	DE-IV (CS Elective List)	3	0	0	3
2.	CS42XX	DE-V (CS Elective List)	3	0	0	3
3.	CS42XX	DE-VI (CS Elective List)	3	0	0	3
4.	CS4299	Project – II	0	0	16	8
		TOTAL	**9**	**0**	**16**	**17**
GRAND TOTAL (including Semester I & II)			**167**			

Minor in CSE (List of Courses)						
	Course Code	**Course Name**	**L**	**T**	**P**	**C**
Minor-I	CS2101	Algorithm	3	0	3	4.5
Minor-II	CS2202	Database and Warehousing	3	0	2	4
Minor-III	CS3101	Operating System	3	0	3	4.5
Minor-IV	CS3201	Cyber Security	3	0	2	4
		Total Credits	**17**			

IDE from CSE							
	Semester	**Course Code**	**Course Name**	**L**	**T**	**P**	**C**
IDE- I	Semester-4	CS2209	Introduction to Data Science	3	0	0	3
IDE –II	Semester-5	CS3109	Computer Graphics	3	0	0	3
IDE -III	Semester-7	CS4109	Data Analysis and Visualization	3	0	0	3

B. Tech. CSE Elective List

Bucket -1	**Semester -6 Subject List for DE- 1**
Course Code	**Course Name**

CS3221	Object-Oriented Programming (3-0-0-3)
CS3222	Agile Computing (3-0-0-3)
CS3223	Software Engineering (3-0-0-3)
CS3224	Bayesian Data Analysis (3-0-0-3)
CS3225	Data Mining (3-0-0-3)
CS3226	Information Retrieval (3-0-0-3)

Bucket -2	**Semester -7 Subject List for DE- 2**
Course Code	**Course Name**
CS4121	Pattern Recognition (3-0-0-3)
CS4122	Principles of Programming Languages (3-0-0-3)
CS4123	Social Networks (3-0-0-3)
CS4124	Multimedia System (3-0-0-3)
CS4125	Program Analysis and Verification (3-0-0-3)

Bucket -3	**Semester -7 Subject List for DE- 3**
Course Code	**Course Name**
CS4127	Graph Machine Learning (3-0-0-3)
CS4128	Bioinformatics (3-0-0-3)
CS4129	Time Series Analysis (3-0-0-3)
CS4130	Advanced Graph Theory (3-0-0-3)
CS4131	Computational Data Analysis (3-0-0-3)
CS4132	Blockchain Technology (3-0-0-3)

Bucket -4	**Semester -8 Subject List for DE- 4**
Course Code	**Course Name**
CS4221	Multivariate Analysis (3-0-0-3)
CS4222	Generative AI (3-0-0-3)
CS4223	Statistical Machine Learning (3-0-0-3)
CS4224	Text Mining (3-0-0-3)
CS4225	Combinatorial optimization (3-0-0-3)

Bucket -5	**Semester -8 Subject List for DE- 5**
Course Code	**Course Name**
CS4226	Cloud Computing (3-0-0-3)
CS4227	Quantum Computing (3-0-0-3)
CS4228	Drone Data Processing (3-0-0-3)
CS4229	Edge Computing (3-0-0-3)
CS4230	Wireless Networks (3-0-0-3)
CS4231	Distributed Computing (3-0-0-3)
CS4232	Parallel Computing (3-0-0-3)

Bucket -6	**Semester -8 Subject List for DE- 6**
Course Code	**Course Name**
CS4233	Computer Security (3-0-0-3)
CS4234	Cryptography (3-0-0-3)

CS4235	Big Data Analytics (3-0-0-3)
CS4236	Computer Forensics (3-0-0-3)

(5.) B. Tech. Programme from the Department of Electrical Engineering

(i) B. Tech. in Electronics and Communication Engineering (ECE) and Minor in Communication.

Sl. No.	Subject Code	SEMESTER III	L	T	P	C
1.	EE2101	Measurements and Instrumentation	3	0	2	4
2.	EE2102	Network Analysis and Synthesis	3	0	0	3
3.	EC2101	Analog Circuits	3	0	2	4
4.	EC2102	Signals and Systems	3	1	0	4
5.	EC2103	Semiconductor Devices	3	0	2	4
6.	HS21PQ	HSS Elective I	3	0	0	3
		TOTAL	**18**	**1**	**6**	**22**
1.	EC2102	Minor I	3	1	0	4

Sl. No.	Subject Code	SEMESTER IV	L	T	P	C
1.	EC2201	Digital Electronics	3	0	2	4
2.	EC2202	Microprocessor	2	0	2	3
3.	EE2201	Control Systems	3	0	2	4
4.	EC2203	Computer Organization and Architecture	3	0	0	3
5.	EC2204	Internet of Things	3	0	0	3
6.	XX22PQ	IDE I	3	0	0	3
		TOTAL	**17**	**0**	**6**	**20**
2.	EC2201	Minor II	3	0	2	4

Sl. No.	Subject Code	SEMESTER V	L	T	P	C
1.	EC3101	Microcontroller and Embedded System	3	0	2	4
2.	EE3102	VLSI Design	3	0	2	4
3.	EC3103	Analog Communication	3	0	2	4
4.	EC3104	Engineering Electromagnetics	3	0	0	3
5.	EC3105	Random Signals and Stochastic Processes	3	0	0	3
6.	XX31PQ	IDE II	3	0	0	3
		TOTAL	**18**	**0**	**6**	**21**
3.	EC3103	Minor III	3	0	2	4

Sl. No.	Subject Code	SEMESTER VI	L	T	P	C
1.	EC3201	Digital Communication	3	0	2	4
2.	EC3202	Digital Signal Processing	3	0	2	4
3.	EC3203	Introduction to AI/ML	3	0	0	3
4.	EC3204	Low Power MOSFETs Design and Modeling	3	0	0	3
5.	EC3205	Introduction to Wireless Communications	3	0	0	3
6.	EC3206	RF Systems	3	0	0	3

		TOTAL	**18**	**0**	**4**	**20**
4.	EC3201	Minor IV	3	0	2	4

Sl. No.	**Subject Code**	**SEMESTER VII**	**L**	**T**	**P**	**C**
1.	EC41XX	Department Elective I	3	0	0	3
2.	EC41XX	Department Elective II	3	0	0	3
3.	XX41PQ	IDE III	3	0	0	3
4.	HS41PQ	HSS Elective II	3	0	0	3
5.	EC4198	Summer Internship*	0	0	12	3
6.	EC4199	Project – I	0	0	12	6
		TOTAL	**12**	**0**	**24**	**21**

Note: Summer internship (*) period of at least 60 days duration begins in the intervening vacation between semester 6 and 7 that may be done in industry/R & D /Academic institutions including IIT Patna. The evaluation would comprise combined grading based on host supervisor evaluation, project internship report after plagiarism check, and presentation evaluation by the parent department with equal weightage of each component.

Sl. No.	**Subject Code**	**SEMESTER VIII**	**L**	**T**	**P**	**C**
1.	EC42XX	Department Elective III	3	0	0	3
2.	EC42XX	Department Elective IV	3	0	0	3
3.	EC42XX	Department Elective V	3	0	0	3
4.	EC4299	Project – II	0	0	16	8
		TOTAL	**9**	**0**	**16**	**17**
		GRAND TOTAL (Semester I to VIII)	**167**			

Minor I
EC2102 Signals and Systems

Minor II
EC2201 Digital Electronics

Minor III
EC3103 Analog Communication

Minor IV
EC3201 Digital Communication

List of department electives

Department Elective I	**Department Elective II**
EC4101 Introduction to Quantum Computing	EC4104 Introduction to Information Theory
EC4102 Deep Learning for Video Surveillance Systems	EC4105 Digital Image Processing

EC4103 FPGA based System Design	EC4106 Graph Signal Processing

Department Elective III	**Department Elective IV**	**Department Elective V**
EC4201 Mobile Communications	EC4203 Introduction to Optical Communications	EC4205 Biomedical Signal Processing
EC4202 Opto Electronic Devices	EC4204 Low Power Circuits	EC4206 High Power Semiconductor Devices
EE4203 Introduction to Energy Storage Techniques	EE4206 Fundamentals of Electrical Vehicle Technology	EC4207 Biomedical Instrumentation

(ii) B. Tech. in Electrical and Electronics Engineering (EEE)

Program Learning Objectives:	**Program Learning Outcomes:**
1. Develop a solid foundation in electrical and electronics engineering principles, including circuit analysis, electromagnetic field theory, electrical machines, power systems, control systems, power electronics, signal processing, and microprocessor/microcontroller systems. 2. Develop electrical and electronics project management skills, including the ability to plan, execute, and complete within specified timelines and budgets. 3. Work collaboratively in multidisciplinary teams, demonstrating effective teamwork and communication to solve complex engineering problems. 4. Recognize the importance of ongoing professional development, engaging in activities such as certifications, workshops, and conferences to stay updated of industry trends.	The graduates of this program will have 1. a successful career in an Academia/Industry/Entrepreneur 2. strong fundamentals in electrical and electronics engineering. 3. ability to design prototypes for real world problems related to electrical, electronics, and interdisciplinary fields. 4. ability to develop soft skills such as effective communications in both verbal and written forms, body language, time managements, problem-solving, leadership, work in both team as well as individual in a professional manner
Program Goal 1: Academic excellence by providing a curriculum that aligns with industry standards and encourages critical thinking in electrical and electronics engineering**.**	**Program Learning Outcome 1a:** Highly skilled market ready manpower to serve the emerging electrical and electronic sectors **Program Learning Outcome 1b:** Skilled Human resource to cater the needs of next generation power systems and EV technologies.
Program Goal 2: A culture of research and innovation by promoting faculty and student involvement in innovative projects in electrical and electronic technologies.	**Program Learning Outcome 2a:** Trained researchers for implementing research projects in line with national priorities such as Energy, EVs, Smart Grids, Green Technologies **Program Learning Outcome 2b:** Design and develop innovative smart technologies/products in energy and EVs as per the societal need
Program Goal 3: To design dynamic and flexible course structures for UG and PG programs as per the changing requirement of the industries	**Program Learning Outcome 3a:** Industry relevant UG, PG, and research programs **Program Learning Outcome 3b:** Trained manpower as per the industry requirement
Program Goal 4: To promote entrepreneurship among the students in the field of electrical and electronics engineering	**Program Learning Outcome 4a:** Realization of working prototype towards product development

	Program Learning Outcome 4b: Promotion of in-house technology-based ventures catering societal needs
Program Goal 5: Equip students with effective communication skills, enabling them to articulate technical concepts clearly and effectively in both written and oral forms.	**Program Learning Outcome 5a:** Manpower with enhanced soft skills to support the vision of developed India **Program Learning Outcome 5b:** Responsible citizen for the holistic growth of the country

Sl. No.	Subject Code	SEMESTER III	L	T	P	C
1.	EE2101	Measurements and Instrumentation	3	0	2	4
2.	EE2102	Network Analysis and Synthesis	3	0	0	3
3.	EC2101	Analog Circuits	3	0	2	4
4.	EC2102	Signals and Systems	3	1	0	4
5.	EE2103	Electrical Machines – I	2	0	2	3
6.	HS21PQ	HSS Elective I	3	0	0	3
TOTAL			**17**	**1**	**6**	**21**

Sl. No.	Subject Code	SEMESTER IV	L	T	P	C
1.	EC2201	Digital Electronics	3	0	2	4
2.	EC2202	Microprocessor	2	0	2	3
3.	EE2201	Control Systems	3	0	2	4
4.	EE2202	Electrical Machines-II	2	0	2	3
5.	EC2204	Internet of Things	3	0	0	3
6.	XX22PQ	IDE I	3	0	0	3
TOTAL			**16**	**0**	**8**	**20**

Sl. No.	Subject Code	SEMESTER V	L	T	P	C
1.	EC3101	Microcontroller and Embedded System	3	0	2	4
2.	EE3101	Power Systems-I	2	0	2	3
3.	EE3102	Modern Control Theory	3	0	2	4
4.	EC3104	Engineering Electromagnetics	3	0	0	3
5.	EC3105	Random Signals and Stochastic Processes	3	0	0	3
6.	XX31PQ	IDE II	3	0	0	3
TOTAL			**17**	**0**	**6**	**20**

Sl. No.	Subject Code	SEMESTER VI	L	T	P	C
1.	EE3201	Fundamentals of Electric Drives	3	0	2	4
2.	EC3202	Digital Signal Processing	3	0	2	4
3.	EC3203	Introduction to AI/ML	3	0	0	3

4.	EE3202	Power System II	3	0	2	4
5.	EE3203	Power Electronics	3	0	2	4
6.	EE3204	Electrical Machine Design	1	0	2	2
TOTAL			**16**	**0**	**10**	**21**

Sl. No.	**Subject Code**	**SEMESTER VII**	**L**	**T**	**P**	**C**
1.	EE41xx	Departmental Elective – I	3	0	0	3
2.	EE41xx	Departmental Elective – II	3	0	0	3
3.	HS41PQ	HSS Elective II	3	0	0	3
4.	XX41PQ	IDE III	3	0	0	3
5.	EE4198	Summer Internship*	0	0	12	3
6.	EE4199	Project – I	0	0	12	6
TOTAL			**12**	**0**	**24**	**21**

Sl. No.	**Subject Code**	**SEMESTER VIII**	**L**	**T**	**P**	**C**
1.	EE42xx	Departmental Elective – III	3	0	0	3
2.	EE42xx	Departmental Elective – IV	3	0	0	3
3.	EE42xx	Departmental Elective – V	3	0	0	3
4.	EE4299	Project – II	0	0	16	8
TOTAL			**9**	**0**	**16**	**17**
GRAND TOTAL (Semester I to VIII)			**166**			

List of Department Electives

Department Elective I	**Department Elective II**
EE4101 Electrical Traction and Propulsion	EC4101 Introduction to Quantum Computing
EC4102 Deep Learning for Video Surveillance Systems	EC4105 Digital Image Processing
EC4103 FPGA based System Design	EE4102 Power System Reliability

Department Elective III	**Department Elective IV**	**Department Elective V**
EE4201 Power System Protection	EE4204 Special Electrical Machines	EC4205 Biomedical Signal Processing
EE4202 Digital Control Systems	EE4205 High Voltage Engineering	EC4206 High Power Semiconductor Devices
EE4203 Introduction to Energy Storage Techniques	EE4206 Fundamentals of Electrical Vehicle Technology	EC4207 Biomedical Instrumentation

(6.) BS Programme from the Department of Humanities and Social Sciences

(i) BS in Economics

SEMESTER III						
Sl. No.	**Course Number**	**Course Title**	**L**	**T**	**P**	**C**
1.	HS2101	Mathematical Statistics	3	1	0	4
2.	HS2102	Fundamentals of Economics	3	1	0	4
3.	HS21**	HSS Elective-I	3	0	0	3
4.	HS2103	Multivariate Analysis and Basic Econometrics	3	0	0	3
5.	HS2104	History of Economic Thought	3	0	0	3
6.	MA2102	Probability and Stochastic Processes	3	1	0	4
TOTAL			**18**	**3**	**0**	**21**

SEMESTER IV						
Sl. No.	**Course Number**	**Course Title**	**L**	**T**	**P**	**C**
1.	HS2201	Growth and Development	3	1	0	4
2.	HS2202	Microeconomic Theory	3	1	0	4
3.	HS2203	Macroeconomic Theory	3	1	0	4
4.	HS2204	Econometrics-I	3	1	0	4
5.	****	IDE-1	3	0	0	3
TOTAL			**15**	**4**	**0**	**19**

SEMESTER V						
Sl. No.	**Course Number**	**Course Title**	**L**	**T**	**P**	**C**
1.	HS3101	Econometrics – II	3	1	2	5
2.	HS3102	Mathematical Economics	3	1	0	4
3.	HS3103	International Trade and Investment	3	1	0	4
4.	HS3104	Debate in Indian Economy	3	1	0	4
5.	HSXXXX	IDE-II	3	0	0	3
TOTAL			**15**	**4**	**2**	**20**

SEMESTER VI						
Sl. No.	**Course Number**	**Course Title**	**L**	**T**	**P**	**C**
1.	HS3201	Categorical Data Analysis	3	1	2	5
2.	HS3202	Environmental Economics	3	1	0	4
3.	HS3203	Critical Economic Reading and Seminar	3	3	0	6
4.	HS3204	Indian Financial System	3	1	0	4
5.	HS3205	Health Economics	3	0	0	3
TOTAL			**15**	**6**	**2**	**22**

SEMESTER VII						
Sl. No.	**Course Number**	**Course Title**	**L**	**T**	**P**	**C**
1.	HS41**	Specialization Elective 1	3	1	0	4
2.	HS41**	Specialization Elective 2	3	1	0	4
3.	HS41**	HSS Elective II	3	0	0	3
4.	HSXXXX	IDE-III	3	0	0	3
5.	HS4198	**Summer Internship***	**0**	**0**	**12**	**3**
6.	HS4199	**Project-I** (Lab based project / Industry oriented problem solving / Academic internship / Case Study / Design thinking-based project- Capstone Project)	0	0	12	6
		TOTAL	**12**	**2**	**24**	**23**

Note: Summer internship (*) period of at least 60 days duration begins in the intervening vacation between semester 6 and 7 that may be done in industry/R & D /Academic institutions including IIT Patna. The evaluation would comprise combined grading based on host supervisor evaluation, project internship report after plagiarism check, and presentation evaluation by the parent department with equal weightage of each component.

SEMESTER VIII						
Sl. No.	**Course Number**	**Course Title**	**L**	**T**	**P**	**C**
1	HS42**	Specialization Elective 3	3	1	0	4
2	HS42**	Specialization Elective 4	3	1	0	4
3	HS4299	**Project-II** (Lab based project / Industry oriented problem solving / Academic internship / Case Study / Design thinking-based project- Capstone Project)	0	0	16	8
		TOTAL	**6**	**2**	**16**	**16**
		TOTAL CREDIT				**167**

*A Student is required to complete at least 60 hours of internship with any industry/organization/ academic institution during the summer break.

Pool of Electives

List of Elective for Semester VII and VIII:

There will be 3 tracks of specialization which will be offered. Students will be required to choose at least 4 courses. To have a specialization in any one area, all the four courses must be from one specific track.

Specialization 1: Economic Theories	
HS4161	Game Theory

HS4163	Energy Economics
HS4165	Labour Economics
HS4167	Business Law and Economics
HS4169	Advanced Macroeconomics
HS4261	Institutional Economics
HS4263	Public Finance and Policy
HS4264	Agrarian Economics
HS4265	Political Economy and Development
HS4269	Mechanism Design

Specialization 2: Finance and Risk Management	
HS4101	Financial Analytics
HS4103	Behavioural Economics and Finance
HS4105	Programming/ Coding
HS4107	Corporate Finance
HS4209	Financial Markets and Derivatives
HS4211	Wealth Management

Specialization 3: Data Analytics	
HS4105	Programming/ Coding
HS4173	HR Analytics
HS4175	Financial Analytics
HS4179	Big Data Analytics
HS4272	Artificial Intelligence
HS4274	Statistical Decision Theory
HS4276	Algorithm with Lab
HS4278	Machine Learning and DS

(7.) B. Tech. Programme from the Department of Mathematics

(i) B. Tech. in Mathematics & Computing

Sl. No.	Subject Code	SEMESTER III	L	T	P	C
1.	MA2101	Design and Analysis of Algorithms	3	0	2	4
2.	MA2102	Probability and Stochastic Processes	3	1	0	4
3.	MA2103	Optimization Techniques	3	0	0	3
4.	MA2104	Algebra	3	0	0	3
5.	MA2105	Discrete Mathematics	3	0	0	3
6.	HS21PQ	HSS Elective I	3	0	0	3
TOTAL			**18**	**1**	**2**	**20**

Sl. No.	Subject Code	SEMESTER IV	L	T	P	C
1.	MA2201	Introduction to Machine Learning	2	0	2	3
2.	MA2202	Real Analysis and Measure Theory	3	0	0	3
3.	MA2203	Numerical Linear Algebra	3	0	2	4
4.	MA2204	Computer Architecture and Organization	3	0	3	4.5
5.	MA2205	Database Management Systems	3	0	3	4.5
6.	XX22PQ	IDE I	3	0	0	3
TOTAL			**17**	**0**	**10**	**22**

Sl. No.	Subject Code	SEMESTER V	L	T	P	C
1.	MA3101	Ordinary and Partial Differential Equations	3	0	0	3
2.	MA3102	Complex Analysis	3	0	0	3
3.	MA3103	Theory of Computation	3	0	0	3
4.	MA3104	Computer Networks	3	0	3	4.5
5.	MA3105	Operating Systems	3	0	3	4.5
6.	XX31PQ	IDE II	3	0	0	3
TOTAL			**18**	**0**	**6**	**21**

Sl. No.	Subject Code	SEMESTER VI	L	T	P	C
1.	MA3201	Number Theory and Cryptography	3	0	0	3
2.	MA3202	Numerical Methods	3	0	2	4
3.	MA3203	Mathematical Statistics	3	0	0	3
4.	MA3204	Convex Optimization	3	0	2	4
5.	MA3205	Functional Analysis	3	0	0	3
6.	MA3206	Artificial Intelligence	3	0	2	4
TOTAL			**18**	**0**	**6**	**21**

Sl. No.	Subject Code	SEMESTER VII	L	T	P	C
1.	HSXXX	HSS Elective - II	3	0	0	3
2.	XX41PQ	IDE - III	3	0	0	3
3.	MA41PQ	Departmental Elective – I	3	0	0	3
4.	MA41PQ	Departmental Elective – II				3
5.	MA4198	Summer Internship*	0	0	12	3
6.	MA4199	Project – I	0	0	12	6
TOTAL						**21**

Note: Summer internship (*) period of at least 60 days duration begins in the intervening vacation between semester 6 and 7 that may be done in industry/R & D /Academic institutions including IIT Patna. The evaluation would comprise combined grading based on host supervisor evaluation, project internship report after plagiarism check, and presentation evaluation by the parent department with equal weightage of each component.

Sl. No.	Subject Code	SEMESTER VIII	L	T	P	C
1.	MA42PQ	Departmental Elective – III	3	0	0	3
2.	MA42PQ	Departmental Elective – IV	3	0	0	3
3.	MA42PQ	Departmental Elective – V				3
4.	MA4299	Project – II	0	0	16	8
TOTAL						**17**
GRAND TOTAL (Semester I to VIII)			**168**			

B. Tech. Department Elective I (DE-I)

Sl. No.	Code	Course Name	L	T	P	C
1.	MA4111	Advanced Algorithms	3	0	0	3
2.	MA4112	Cryptography and Network Security	3	0	0	3
3.	MA4113	Rings and Modules	3	0	0	3

B. Tech. Department Elective II (DE-II)

Sl. No.	Code	Course Name	L	T	P	C
1	MA4114	Deep Learning	2	0	2	3
2	MA4115	Fields and Galois theory	3	0	0	3
3	MA4116	Mathematical Finance	3	0	0	3

B. Tech. Department Elective III (DE-III)

Sl. No.	Code	Course Name	L	T	P	C
1.	MA4211	Control Theory	3	0	0	3
2.	MA4212	Finite Element Analysis	3	0	0	3
3.	MA4213	Introduction to Coding Theory	3	0	0	3
4.	MA4214	Portfolio Theory and Risk Management	3	0	0	3
5.	MA4215	Topology	3	0	0	3

B. Tech. Department Elective IV (DE-IV)

Sl. No.	Code	Course Name	L	T	P	C
1.	MA4215	Applied Computational Techniques	3	0	0	3
2.	MA4216	Differential Geometry	3	0	0	3
3.	MA4217	Introduction to Mathematical Biology	3	0	0	3
4.	MA4218	Statistical Decision Theory	3	0	0	3

B. Tech. Department Elective V (DE-V)

Sl. No.	Code	Course Name	L	T	P	C
1.	MA4220	Deep Learning for Computer Vision	2	0	2	3
2.	MA4221	Discrete Differential Geometry	3	0	0	3
3.	MA4222	Integral Equations and Calculus of Variations	3	0	0	3

B. Tech. IDE I

Sl. No.	Code	Course Name	L	T	P	C
1.	MA2251	Introduction to Numerical Methods	3	0	0	3
2.	MA2252	Complex Analysis	3	0	0	3

B. Tech. IDE II

Sl. No.	Code	Course Name	L	T	P	C
1.	MA3151	An Introduction to Computational Commutative Algebra	3	0	0	3
2.	MA3152	Partial Differential Equations	3	0	0	3

B. Tech. IDE III

Sl. No.	Code	Course Name	L	T	P	C
1.	MA4151	Number Theory and Algebra	3	0	0	3
2.	MA4152	Mathematical relativity	3	0	0	3

(8.) B. Tech. Programme from the Department of Mechanical Engineering

(i) B. Tech. in Mechanical Engineering and Minor in Thermal Engineering

Program Learning Objectives:	**Program Learning Outcomes:**
Program Goal 1: Apply basic knowledge of engineering principles to solve technical problems applied to mechanical systems, stress and strain analysis of structures, design of machine elements, control systems to achieve desirable performance and to assess life of mechanical components.	Program Learning Outcome 1: The students should be able to apply the principles of Kinematics and Dynamics of Mechanisms, mechanics of solid, system dynamics and control to the engineering problems of societal relevance.
Program Goal 2: To impart the ability to model and analyse pertinent transport phenomena based on the fundamental conservations laws of thermodynamics and fluid mechanics.	Program Learning Outcome 2: Upon completion of the course, students will possess the capability to design and implement mathematical models and simulation tools specifically tailored to address complex mechanical engineering issues within crucial domains such as energy and the environment.
Program Goal 3: The graduates will be possessing the knowledge of concepts and practices of material removal, material forming, material joining, additive manufacturing-based processes, identify damage and failure of material to meet the present and future demands of the industry.	Program Learning Outcome 3: The students should gain the knowledge of the behaviour and processing of engineering materials through different conventional and state-of-the-art material subtractive and additive based processes.
Program Goal 4: To train the graduates with adequate engineering knowledge to develop skills for solving multi-disciplinary problems and achieving optimal results.	Program Learning Outcome 4: The graduates will be able to embrace leadership and collaborative roles for societal, environmental and economic enterprise.

Sl. No.	**Subject Code**	**SEMESTER III**	**L**	**T**	**P**	**C**
1.	ME2101	Dynamics	3	1	0	4
2.	ME2102	Thermodynamics	3	1	0	4
3.	ME2103	Fluid Mechanics	3	1	2	5
4.	ME2104	Engineering Materials	3	0	2	4
5.	HS21PQ	HSS Elective - I	3	0	0	3
TOTAL			**15**	**3**	**4**	**20**
1.	Minor: Subject-I	ME2102-Thermodynamics	3	1	0	4

Sl. No.	Subject Code	SEMESTER IV	L	T	P	C
1.	ME2201	Kinematics and Dynamics of Mechanisms	3	1	2	5
2.	ME2202	Heat and Mass Transfer	3	1	2	5
3.	ME2203	Mechanics of Solids	3	1	0	4
4.	ME2204	Mechanical Measurements and Instrumentation	3	0	2	4
5.	XX22PQ	IDE-I	3	0	0	3
TOTAL			**15**	**3**	**6**	**21**
2.	Minor: Subject-II	ME2202- Heat and Mass Transfer	3	1	2	5

Sl. No.	Subject Code	SEMESTER V	L	T	P	C
1.	ME3101	Data Analytics and Machine Learning Tools for Engineers	1	2	1	3.5
2.	ME3102	Design of Machine Elements	3	0	3	4.5
3.	ME3103	Manufacturing Technology- I	3	0	2	4
4.	ME3104	Engineering Software Laboratory	1	0	3	2.5
5.	ME3105	Numerical Methods for Engineers	3	0	0	3
6.	XX31PQ	IDE-II	3	0	0	3
TOTAL			**14**	**2**	**9**	**20.5**
3.	Minor: Subject-III	ME3104: Engineering Software Laboratory	1	0	3	2.5

Sl. No.	Subject Code	SEMESTER VI	L	T	P	C
1.	ME3201	Applied Thermodynamics and Turbomachinery	3	1	2	5
2.	ME3202	System Dynamics and Control	3	1	2	5
3.	ME3203	Manufacturing Technology -II	3	0	3	4.5
4.	ME3204	Industrial Engineering and Operations Research	3	1	0	4
5.	ME3205	Technical Writing and Presentations	0	0	4	2
TOTAL			**12**	**3**	**11**	**20.5**
4.	Minor: Subject-IV	ME3201: Applied Thermodynamics and Turbomachinery	3	1	2	5

Sl. No.	Subject Code	SEMESTER VII*	L	T	P	C
1.	ME41XX	Departmental Elective-I	3	0	0	3
2.	ME41XX	Departmental Elective- II	3	0	0	3
3.	XX41PQ	IDE-III	3	0	0	3
4.	HS41PQ	HSS Elective-II	3	0	0	3
5.	ME4198	Summer Internship*	0	0	12	3
6.	ME4199	Project – I	0	0	12	6
TOTAL			**12**	**0**	**24**	**21**

*** For specific cases of internship after 6th Semester, extended over to 7th Semester:**

- In the 7th semester, students can opt for a semester long internship after getting the approval from the DAPC. The DAPC would vet and approve the applications.
- At max two subject for NPTEL and SWAYAM and other two should be done in the institute through course overloading in any other semester (either before or after the internship).
- Further, after coming from internship, students will be evaluated through combined grading based on host supervisor evaluation, project internship report after plagiarism check, and presentation evaluation by the parent department with equal weightage of each component.

Sl. No.	Subject Code	SEMESTER VIII	L	T	P	C
1.	ME42XX	Departmental Elective – III	3	0	0	3
2.	ME42XX	Departmental Elective – IV	3	0	0	3
3.	ME42XX	Departmental Elective – V	3	0	0	3
4.	ME4299	Project – II	0	0	16	8
TOTAL			**9**	**0**	**16**	**17**
GRAND TOTAL (Semester I to VIII)			**166**			

Department Electives (DE)

DE – I	ME4101	Tribology and Surface Engineering
	ME4102	Basics of Computational Fluid Dynamics
	ME4104	Industrial Automation
DE – II	ME4105	Vehicle Dynamics
	ME4106	Mathematical Modelling of Computer Aided Design
	ME4107	Energy Engineering
DE – III	ME4201	Finite Element Method
	ME4202	Refrigeration and Cryogenics
	ME4203	Mechanics, Processing and failure of Composite Materials
DE – IV	ME4204	Mechanical Characterization of Materials
	ME4205	Internal Combustion Engines

	ME4206	Micro-manufacturing
DE – V	ME4207	Energy Methods and Variational Principles in Applied Mechanics
	ME4208	Failure Analysis of Engineering Materials
	ME4209	Hydraulic Machines

Interdisciplinary Elective (IDE) Courses for BTech

ME2205	Manufacturing Processes for Metallic Materials
ME3106	Automotive Technology
ME4103	Nonlinear Dynamics and Chaos

(9.) B. Tech. Programme from the Department of Metallurgical and Materials Engineering

(i) B. Tech. in Metallurgical and Materials Engineering (MME) and Minor in MME

Program Learning Objectives:	Program Learning Outcomes:
Program Goal 1: The B.Tech program in Metallurgical and Materials Engineering aims to equip graduates with the necessary knowledge, skills, and values to succeed in professional careers related to metallurgical and materials engineering.	**Program Learning Outcome 1a:** Upon successful completion of the B.Tech program in Metallurgical and Materials Engineering, graduates will be able to identify, formulate, and analyse complex engineering problems related to metallurgical and materials engineering. **Program Learning Outcome 1b:** Students will be able to understand the science behind the functioning mechanism of metals, ceramics, polymers and glass
Program Goal 2: Apply fundamental principles of science and engineering to solve complex problems in metallurgical and materials engineering and cultivate critical thinking and problem-solving skills in students to address real-world challenges in the metallurgy and materials domain.	**Program Learning Outcome 2:** Student will be able to apply research-based knowledge and methodologies, including experimental design, data analysis, and interpretation, to investigate complex problems in metallurgical and material engineering. Graduates will be capable to carry out research work in their area of interest either in academic area or in industry.
Program Goal 3: Expose the students to the scientific and engineering concepts on metals, ceramics, polymer and composites and apply engineering principles to design, develop, and improve materials and processes for specific applications.	**Program Learning Outcome 3a:** Students will be well versed with the concepts of microscopic analysis, characterization techniques, metallurgical testing, polymer synthesis & analysis, nano & electro ceramics, plasma-coating and flash sintering, mineral beneficiation & process metallurgy. **Program Learning Outcome 3b:** Students will be able to design and develop new engineering materials with desired properties based on demands of various engineering sectors.
Program Goal 4: To impart hand-on exposure to modern laboratory equipment through structured laboratory experiments.	**Program Learning Outcome 4a:** Students will be able to correlate the theoretical concepts with the experiments and will be ready to apply the experimental knowledge in industries. **Program Learning Outcome 4b:** Students will be ready for quality control, higher studies and research work in the domain of metallurgical and materials engineering.

Program Goal 5: To inculcate research aptitude in the students and prepare the students to be industry-ready after the completion of their B. Tech. programme.	**Program Learning Outcome 5:** Students will be able to design solutions for complex engineering problems related to materials, considering public health, safety, cultural, societal, and environmental factors. In addition, apply ethical principles and commit to professional ethics and social responsibility as a metallurgical and materials engineer. Graduate will be able to launch start-ups as entrepreneur to create job opportunities in the country.

Sl. No.	Subject Code	SEMESTER III	L	T	P	C
1.	MM2101	Core I (Introduction to Metallurgical and Materials Engineering)	3	0	0	3
2.	MM2102	Core II (Mineral Processing and Process Metallurgy)	3	0	3	4.5
3.	MM2103	Core III (Thermodynamics and Phase Equilibria)	3	0	3	4.5
4.	MM2104	Core IV (Transport Phenomena)	3	1	0	4
5.	MM2105	Core V (Fundamentals of Polymer Science and Technology)	3	0	0	3
6.	HS21PQ	HSS Elective I	3	0	0	3
TOTAL			**18**	**1**	**6**	**22**
1.	MM2101	Minor I	3	0	0	3

Sl. No.	Subject Code	SEMESTER IV	L	T	P	C
1.	MM2201	Core I (Iron and Steel Making)	3	1	0	4
2.	MM2202	Core II (Techniques of Materials Characterization I)	3	0	3	4.5
3.	MM2203	Core III (Phase Transformation and Diffusion)	3	1	0	4
4.	MM2204	Core IV (Mechanical Behaviour of Materials)	3	0	3	4.5
5.	MM2205	Core V (Welding and Solidification)	3	0	0	3
6.	MM2290	IDE I	3	0	0	3
TOTAL			**18**	**2**	**6**	**23**
2.	MM2202	Minor II	3	0	3	4.5

Sl. No.	Subject Code	SEMESTER V	L	T	P	C
1.	MM3101	Core I (Thermomechanical Processing of Metallic Materials)	3	0	2	4
2.	MM3102	Core II (Computational Materials Science)	2	1	0	3
3.	MM3103	Core III (Engineering Polymers)	3	0	2	4
4.	MM3104	Core IV (Ceramic Science and Technology)	3	0	2	4
5.	MM3111	Metallography and Heat Treatment Laboratory	0	0	2	1
6.	MM3190	IDE II	3	0	0	3
TOTAL			**14**	**1**	**8**	**19**
3.	MM3103	Minor III	3	0	0	3

Sl. No.	Subject Code	SEMESTER VI	L	T	P	C
1.	MM3201	Core I (Techniques of Materials Characterization II)	3	0	3	4.5
2.	MM3202	Core II (Corrosion and Corrosion Prevention)	3	0	2	4
3.	MM3203	Core III (Functional Materials)	3	0	0	3
4.	MM3204	Core IV (Non-ferrous Metals and Alloys)	3	0	0	3
5.	MM3205	Capstone Laboratory	0	0	4	2
6.	MM3210	Metals Processing Laboratory	0	0	3	1.5
TOTAL			**12**	**0**	**12**	**18**
4.	MM3203	Minor IV	3	0	0	3

Sl. No.	Subject Code	SEMESTER VII	L	T	P	C
1.	MM41PQ	Elective I	3	0	0	3
2.	MM41PQ	Elective II	3	0	0	3
3.	HS41PQ	HSS Elective II	3	0	0	3
4.	XX41PQ	IDEIII	3	0	0	3
5.	MM4198	Summer Internship*	0	0	12	3
6.	MM4199	Project – I	0	0	12	6
TOTAL			**12**	**0**	**24**	**21**
5.	MM4123	Minor V	3	0	0	3

Note: Summer internship (*) period of at least 60 days duration begins in the intervening vacation between semester 6 and 7 that may be done in industry/R & D /Academic institutions including IIT Patna. The evaluation would comprise combined grading based on host supervisor evaluation, project internship report after plagiarism check, and presentation evaluation by the parent department with equal weightage of each component.

Sl. No.	Subject Code	SEMESTER VIII	L	T	P	C
1.	MM42PQ	Elective III	3	0	0	3
2.	MM42PQ	Elective IV	3	0	0	3
3.	MM42PQ	Elective V	3	0	0	3
4.	MM4299	Project – II	0	0	16	8
TOTAL			**9**	**0**	**16**	**17**
GRAND TOTAL (Semester I to VIII)			**166**			

Minors:

Minor-I: MM2101 Introduction to Metallurgical and Materials Engineering (3-0-0-3)

Minor-II: MM2202 Techniques of Materials Characterization I (3-0-3-4.5)

Minor-III: MM3103 Engineering Polymers (3-0-0-3)

Minor-IV: MM3203 Functional Materials (3-0-0-3)

Minor-V: MM4123 Semiconductor Materials and Devices (3-0-0-3)

Total Credits: 16.5

(10.) B. Tech. Programme from the Department of Physics

(i) B. Tech. in Engineering Physics and Minors in Physics, Nanoscience, Optics, Energy Storage Technology, Quantum Technology

Sl. No.	Subject Code	SEMESTER III	L	T	P	C
1.	EP2101	Quantum Physics	3	1	0	4
2.	EP2102	Optics and Lasers	3	0	3	4.5
3.	EP2103	Classical dynamics: discrete and continuum systems	3	1	0	4
4.	EP2104	Thermal physics with engineering applications	3	1	0	4
5.	HS21PQ	HSS Elective – I	3	0	0	3
Total Credit			**15**	**3**	**3**	**19.5**

Sl. No.	Subject Code	SEMESTER IV	L	T	P	C
1.	EP2201	Introduction to Nuclear and Particle Physics	2	1	0	3
2.	EP2202	Mathematical Methods for Engineers	3	1	0	4
3.	EP2203	Electromagnetism	3	1	0	4
4.	EP2204	Introductory Statistical Mechanics	2	1	0	3
5.	EP2205	Analog Electronics	2	0	3	3.5
6.	EP22PQ	IDE – I	3	0	0	3
Total Credit			**15**	**4**	**3**	**20.5**

Sl. No.	Subject Code	SEMESTER V	L	T	P	C
1.	EP3101	Computational Techniques	2	0	3	3.5
2.	EP3102	Data Science for Physicists	1	1	3	3.5
3.	EP3103	Digital Electronics and Microprocessors	2	0	3	3.5
4.	EP3104	Solid State Physics	3	1	2	5
5.	EP3105	Instrumentation Techniques	2	0	2	3
6.	EP31XX	IDE – II	3	0	0	3
Total Credit			**13**	**2**	**13**	**21.5**

Sl. No.	Subject Code	SEMESTER VI	L	T	P	C
1.	EP3201	Nonlinear Dynamics	2	1	0	3
2.	EP3202	Interfacing and data analysis	1	0	4	3
3.	EP3203	Atomic and Molecular Physics	3	1	2	5
4.	EP3204	Soft Condensed Matter Physics	3	0	0	3
5.	PH32XX	DE – I	3	0	0	3
6.	PH32XX	DE – II	3	0	0	3
Total Credit			**15**	**2**	**6**	**20**

Sl. No.	Subject Code	SEMESTER VII	L	T	P	C
1.	EP4105	Quantum Technology Laboratory	1	0	3	2.5
2.	PH41XX / PH42XX	DE-III	3	0	0	3
3.	HS41PQ	HSS Elective – II	3	0	0	3
4.	PHXXXX	IDE – III	3	0	0	3
5.	PH4198	Summer Internship*	0	0	12	3
6.	PH4199	Project – I	0	0	12	6
Total Credit			**10**	**0**	**27**	**20.5**

Note: Summer internship (*) period of at least 60 days duration begins in the intervening vacation between semester 6 and 7 that may be done in industry/R & D /Academic institutions including IIT Patna. The evaluation would comprise combined grading based on host supervisor evaluation, project internship report after plagiarism check, and presentation evaluation by the parent department with equal weightage of each component.

Sl. No.	Subject Code	SEMESTER VIII	L	T	P	C
1.	PH41XX / PH42XX	DE-IV	3	0	0	3
2.	PH41XX / PH42XX	DE-V	3	0	0	3
3.	PH41XX / PH42XX	DE-VI	3	0	0	3
4.	PH41XX / PH42XX	DE-VII	3	0	0	3
5.	PH4299	Project – II	0	0	16	8
Total Credit			**9**	**0**	**16**	**20**
Grand Total Credit (Semester I to VIII)			**168**			

Themes/Baskets for Department Electives

1. General Electives
2. Instrumentation and Electronics
3. Condensed matter and Semiconductor Physics
4. Optics and Photonics
5. Quantum Science and Technology
6. Computational Techniques
7. Energy

List of Electives for Semester VI (DE-I and DE-II)

Sl. No.	Course Name	Course Code	L-T-P-C
1.	Engineering Optics	PH3230	3-0-0-3
2.	Laser Physics	PH3231	3-0-0-3
3.	Cryogenic Engineering	PH3232	3-0-0-3
4.	Advanced Quantum Mechanics	PH3233	3-0-0-3
5.	Advanced Mathematical Methods	PH3234	2-1-0-3
6.	Electron Microscopy	PH3235	3-0-0-3
7.	Quantum Computation	PH3236	2-1-0-3
8.	Device Modeling and Design	PH3237	2-1-0-3

9.	Power Sources for Electric Vehicles	PH3238	3-0-0-3

List of Electives for Semester VII and VIII (DE-III to DE-VII)

Sl. No.	Course Name	Course code	L-T-P-C
1.	Thin Film Technology	PH4132/PH4232	2-1-0-3
2.	X-ray and Applications	PH4135/PH4235	3-0-0-3
3.	Optical Quantum Communication	PH4136/PH4236	3-0-0-3
4.	Nanogenerators and Application in self-powered system	PH4137/PH4237	3-0-0-3
5.	Medical Physics and Applications	PH4138/PH4238	2-1-0-3
6.	Superconducting Qubits: Fundamentals and Operation	PH4139/PH4239	2-1-0-3
7.	Atomtronics & Quantum Technology	PH4140/PH4240	3-0-0-3
8.	Emerging Technologies in Photonics	PH4141/PH4241	3-0-0-3
9.	Modeling Complex Systems	PH4142/PH4242	2-0-2-3
10.	Computational methods for classical and quantum physics	PH4143/PH4243	2-0-2-3
11.	AC Network Analysis	PH4144/PH4244	2-1-0-3
12.	Solar Energy and Photovoltaics	PH4135/PH4235	3-0-0-3
13.	Photovoltaics: Concepts and Applications	PH4146/PH4246	3-0-0-3

List of Interdisciplinary Electives

IDE I (Sem IV)
PH2290-Fundamentals of Electromagnetism
PH2291-Waves and Particles
EP2206-Fuel cell fundamentals

IDE II (Sem V)
PH3190- Mechanics in Physics
EP3106-Energy materials processing

IDE III (Sem VII)
PH4190 – Photovoltaics and Fuel Cell Technology
PH6190-Physics of complex systems
PH6191- Physics of Nanoscience
PH6192- Semiconductor Processing: An Interdisciplinary approach

MINOR COURSES FROM DEPARTMENT OF PHYSICS, IIT PATNA

Following three streams are offered as Minor:

1. Physics Minor
2. Nanoscience Minor
3. Optics Minor
4. Energy Storage Technology
5. Quantum Technology

Program Name: Physics Minor			
Paper Code	**Paper Name**	**Credit**	**Minor label**
EP2101	Quantum Physics	x-x-x-x	M I
EP2203	Electromagnetism		M II
EP3104	Solid state physics		M III
Relevant DE I- DE II			M IV
relevant DE III			M V
Program Name: Nanoscience Minor			
Paper Code	**Paper Name**	**Credit**	
EP2101	Quantum Physics	x-x-x-x	M I
EP2203	Electromagnetism		M II
EP3105	Instrumentation Techniques		M III
Relevant DE I and II			M IV
Relevant DE III			M V
Program Name: Optics Minor			
Paper Code	**Paper Name**	**Credit**	
EP2102	Optics and Lasers	x-x-x-x	M I
EP2203	Electromagnetism		M II
EP3105	Instrumentation Techniques		M III
Relevant DE I or DE II			M IV
Relevant DE III			M V

Program Name: Energy Storage Technology

Brief on Minor Program in "Energy Storage Technology"

Emergent issues of global significance comprising fast depleting fossil fuels reserve, carbon foot print, visible climate change, temperature rise and melting of glaciers causing sea level

rise are interrelated. These challenging issues are threatening sustainable growth and even survival of the planet earth.
To exercise an effective control well in time, therefore, requires "zero emission" culture and effective implementation of clean and green energy alternatives without any loss of time. This requirement has put pressing demand for development of newer clean energy technology on R&D institutions, its commercialization on industry, creation of talent pool in the area under demand by academic institutions and better industry-academia tie up in this emergent area. A positive signal has already become visible with faster adoption of electric vehicles (EVs) on road that is likely to emerge as a multiplicative technology market in near future.
Keeping this realistic fact in mind, the department of Physics has come up with a Minor program in "Energy Storage Technology". The course structure of this Minor program is herein below

1. Power Sources for Electric Vehicles (Code: PH/EP. , Credit : 3-0-0-3)
2. Fuel Cell Fundamentals (Code: PH/EP. , Credit : 3-0-0-3)
3. Photovoltaics: Concepts and Applications (Code: PH/EP. , Credit : 3-0-0-3)
4. Photovoltaic and Fuel Cell Technology (Code: PH/EP. , Credit : 3-0-0-3). This is to be listed as IDE also.

Paper Code	**Paper Name**	**Credit**	
EP2105	Photovoltaics: Concepts and Applications	x-x-x-x	M I
EP2206	Fuel cell fundamentals		M II
EP3106	Energy Materials Processing		M III
PH3238 /PH3239	Power Sources for Electric Vehicles / Fuel cell fundamentals		M II
Relevant DE III			M V

MINOR: "Quantum Technology"

Sl. No.	**Subject Code**	**Minor: Quantum Technology**	**L**	**T**	**P**	**C**	
1.	EP2101	Quantum Physics	3	1	0	4	M I
2.	EP2204	Introductory Statistical Mechanics	2	1	0	3	M II
3.	EP3101	Computational Techniques	2	0	3	3.5	M III
4.	PH3236	Quantum Computation	2	1	0	3	M IV
5.	PH4140/4240 OR 4136/4236	Atomtronics & Quantum Technology/ Optical Quantum Communication	3	0	0	3	M V
TOTAL			**12**	**3**	**3**	**16.5**	