2+2 International Collaborative Programmes at First Degree Level

Programmes' Curriculum of BITS-UB Collaborative Programmes

BITS Pilani (an Institution of Eminence in India) and University at Buffalo (UB) have partnered to offer an exciting opportunity for students to pursue unique collaborative academic programmes at the international level. Students can opt to pursue a dual degree program whereby they can obtain an engineering degree from BITS Pilani and an engineering degree from University at Buffalo upon successful completion of the program requirements.

Students admitted under this collaboration will have the unique opportunity to immerse themselves in diverse cultures and gain a truly global perspective. In this 4-year collaborative 'dual degree' programme, students will spend the first two years along with a summer term at BITS Pilani campuses before getting transferred to University at Buffalo, USA for the remaining two years (i.e., years 3 and 4) of their study period. Our innovative curriculum combines the strengths of both academic environments, offering an outstanding education that would prepare them for success in today's rapidly changing world. With state-of-the-art facilities, inspiring faculty, and a wide range of extracurricular activities, this collaboration would be the perfect place to launch students' productive academic and professional journeys.

The partnership between BITS Pilani and University at Buffalo (UB) will include programmes spanning different academic disciplines that are desirable to students and expected to produce graduates who are in demand by industry and academia. Degrees will be awarded separately and simultaneously by the respective universities. Prospective students are required to meet the admission requirements of both BITS Pilani, India, and the collaborating university. Finally, students shall be awarded degrees in the same discipline and at the same level.

The details of BITS-UB ("UBITS") 2+2 International Collaborative First Degree Programmes offered under this scheme from Academic Year 2024-25 are given below:

- B.E. Computer Science at BITS Pilani, India and B.S. Computer Engineering by University at Buffalo, USA
- B.E. Mechanical at BITS Pilani, India and B.S. Mechanical Engineering by University at Buffalo, USA
- B.E. Electrical & Electronics at BITS Pilani, India and B.S. Electrical Engineering by University at Buffalo, USA
- B.E. Electronics & Communication at BITS Pilani, India and B.S. Electrical Engineering by University at Buffalo, USA.

Input Qualification:

(a) BITS Pilani minimum eligibility requirement

Applicant should also fulfil the minimum eligibility requirement of BITS Pilani for admission as follows:

(i) The applicant has passed the 12th examination of 10+2 system from a recognized National/State/International board or its equivalent with Physics, Chemistry and Mathematics (PCM) and adequate proficiency in English; Also, the applicant has obtained a minimum of aggregate 75% marks in PCM in 12th examination, with at least 60% marks in each of the PCM subjects.

(ii) The applicant undertakes the BITS Admission Test (BITSAT) and achieves a score that meets or exceeds the relevant cut-off score for admission to the BITS Award, as determined by BITS from time to time.

(b) University at Buffalo minimum eligibility requirement

Applicants should also fulfil the minimum eligibility requirements of the University at Buffalo for admission as follows. The UB admission eligibility requirement is as follows.

(i) One of the following must be achieved:

Successful completion of one of the following secondary qualifications in India:

1. All India Senior School Certificate (AISSC) 10+2 with a minimum average of 65%*
2. Indian School Certificate (ISC) with a minimum average of 65%*
3. State Boards of Education Higher Secondary Certificate, (HSC) with a minimum average of 70%*

*Overall average for graded academic subjects, excluding work experience, physical and health education, art, religious and general studies.

(ii) Successful completion of the AISSC; ISC; State Board HSC Mathematics/ HSC Mathematics with a minimum grade of 60%.

(iii) Where an applicant does not have an Indian secondary qualification, they must meet the UB criteria for their respective country of secondary education study as approved by UB and notified to BITS by UB (listed on the UB website under entry requirements by country, from time to time).

(iv) English Language Entry Requirements

Applicants must meet UB's English Language proficiency requirements as follows:

1. Applicants are required to provide evidence of English language proficiency for admission into the above UBITS 2+2 International Collaborative Programmes in accordance with the requirements published on UB's website from time to time.
2. Where an English language proficiency test is used for admission, the test must be taken no more than 2 years prior to the applicant's Commencing Date for the UBITS 2+2 International Collaborative Programmes.
3. Applicants who have not completed one of the English proficiency tests listed above or as published on the UB website from time to time can be deemed to have met the English language entry requirements if they can provide evidence of one of the following:

English Proficiency Test Type & Minimum Scores

Below are the minimum scores to be eligible for consideration for admission to UB's undergraduate programmes.

TEST	MINIMUM SCORES*
TOEFL (IBT) (including MyBest scores) TOEFL Home Edition	70
TOEFL Essentials	8.5
TOEFL (PBT) and TOEFL ITP Plus	523
IELTS and IELTS Indicator	6.0
PTE Academic or PTE Academic Online	50
ACT (English AND reading sections)	18
SAT I ERWS	500
CAEL	70
CanTEST	4.5
Cambridge English Proficiency (CPE)	185
Cambridge English Advanced (CAE)	185
IB Higher Level English A Literature	4
IB Higher Level English A Language and Literature	4

TEST	MINIMUM SCORES*
AS Level or A Level English or English Language Subject	C
Duolingo English Test (DET)	105

More information is available at https://www.buffalo.edu/internationaladmissions/get-ready-to-apply/apply/freshman-admissions-criteria.host.html/content/shared/www/internationaladmissions/admissionscriteriatabs/english.detail.html

Note: UBITS students are required to achieve the following sub-section scores on the TOEFL, IELTS or Duolingo tests to be placed in the ELI 105 course offered remotely by UB in the first semester of the UBITS Collaborative Programmes. Students whose sub-section scores are lower than the sub-section minimums below will be placed in ELI 100, and will take ELI 105 remotely in summer 2025.

Sub-Section Skill	iBT TOEFL Minimum Sub-Section Score	IELTS Minimum Sub-Section Score
Reading	21	6.5
Listening	21	6.5
Speaking	23	6.5
Writing	24	6.5

Duolingo English Test (DET) (Sub-Section Skills)	Duolingo English Test (DET) (Minimum Sub-Section Score)
Comprehension	125
Conversation	130
Literacy	140
Production	145

In addition, during their second year after being admitted to UB, students in the UBITS programme must successfully apply for an **F-1 student visa** needed to enter the United States as a student. Once admitted to UB and having provided evidence of financial sufficiency, UBITS students will receive an I-20 visa document to apply for an F-1 student visa. Complete information about applying for an F-1 visa may be found here.

Mode of Admission:

Admissions will be made purely on merit. The merit position of the candidate will be based on the score obtained by the candidate in a Computer based Online Test (BITSAT) conducted by BITS, Pilani. The candidates should also fulfil the essential requirement of a minimum of aggregate **75% marks** in Physics, Chemistry and Mathematics subjects in the 12th examination with at least 60% marks in each of the Physics, Chemistry, and Mathematics subjects.

Upon completion of the BITSAT successfully, students will make their Programme selections which will include the BITS-UB programmes. Details of applicants who meet BITS admission criteria will be forwarded to University at Buffalo for assessment against their eligibility criteria such as proof of year 12 marks and proof of English language proficiency to the UB standard.

Admission into the Academy for UAE (Dubai) based offerings will include details of applicants who meet BITS admission criteria being forwarded to UB for assessment against UB eligibility criteria such as proof of year 12 marks and proof of English language proficiency to the UB standard. Students that UB deems to have met their criteria will be confirmed with BITS Pilani. Successful applicants will be provided admission offers.

According to the UGC Regulations mentioned above, dual-degree programmes will be those which are offered by both the Indian and foreign university in the same subject area and at the same qualification level. Degrees will be awarded separately and simultaneously from both universities. Prospective students must meet the admission requirements of both the Indian and Foreign universities and shall apply to and be admitted separately to both universities.

Duration:

The normal duration of the programme will be 8 semesters (Four Semesters and a summer term at any of the Campuses of BITS Pilani and another four Semesters at University at Buffalo, USA).

Internship opportunities

- Engineering programmes at the University at Buffalo include a required capstone design experience that spans the senior year (fall and spring semesters). Students work in teams to tackle a real-world engineering design problem. It is common for students to work with industry partners on senior design projects. The experiences leverage the technical and professional skills (e.g., teamwork, communication, creativity, critical thinking, problem solving, leadership) students acquire over the span of the four-year programme. At the end of the spring semester, project teams present their work in various forums. Below are programme-specific details.

- UB, New York State's flagship university and member of the Association of American Universities (AAU), is a world-class university with a worldwide impact. With an enrollment of more than

30,000, including more than 5,000 international students, UB is consistently recognized as one of the world's most exceptional universities, making it a top choice for students and faculty around the globe.

- UB's School of Engineering and Applied Sciences (SEAS), founded in 1946, provides an inclusive environment that supports big thinking, creative freedom, and vast possibilities for achievement. The program of study includes extensive hands-on experiences in the curriculum and is complemented by both research and employment opportunities during the academic semesters and summer.
- Students in SEAS have access to world-class facilities and laboratories, including an electrical engineering clean room, a digital manufacturing lab, a machine shop with CNC equipment and 3D printers, a motion-base driving simulator, a 24,000-square-foot outdoor UAV research structure, a leading academic supercomputing facility, and so much more.
- In addition to UB's vibrant international student clubs, SEAS offers over 45 science and engineering-related clubs and organizations where students can explore ideas, network with SEAS professors and industry professionals, and gain hands-on research experience.
- Engineering students take advantage of internships and cooperative education opportunities that provide paid and supervised work experience to complement formal academic classwork. The University office provides career advising and preparation support for internships, and post-graduation employment.
- International students on a study visa (F-1) can also pursue off-campus employment opportunities prior to the completion of an academic program or degree by availing of the Curricular Practical Training (CPT), for example for internships and co-ops during the summer or academic semester. Students are eligible for upto 365 days of CPT while completing their bachelor's degree.
- Post-completion Optional Practical Training (OPT) is a 12-month period of work authorization (up to 24 months for engineering fields), or practical training. OPT is an opportunity for F-1 students to take what they learned in the classroom and apply their knowledge to a work setting. Generally, these work experiences are off-campus or for non-student positions at UB.

The four dual degree programmes in collaboration with University at Buffalo (UB) are proposed to be launched in AY 2024-25 as part of partnership arrangement. The UB engineering programmes proposed for this partnership are fully accredited by ABET and require capstone projects. These are

either industry sponsored or faculty led research projects. Students will apply their technical knowledge, research, design and professional engineering skills to either discipline specific, or cross disciplinary engineering problems, through robust research and established engineering design processes.

The proposed semester-wise pattern of the following programmes, for students admitted to this programme are given in Annexure 1:

- B.E. Computer Science at BITS Pilani, India and B.S. Computer Engineering by University at Buffalo, USA
- B.E. Mechanical at BITS Pilani, India and B.S. Mechanical Engineering by University at Buffalo, USA
- B.E. Electrical & Electronics at BITS Pilani, India and B.S. Electrical Engineering by University at Buffalo, USA
- B.E. Electronics & Communication at BITS Pilani, India and B.S. Electrical Engineering by University at Buffalo, USA.

The collaborative 'dual degree' programmes at the international level are proposed to be offered in collaboration with University at Buffalo in the same specialization and at the same qualification level. The general curricular structure for the students admitted under Augmented Collaborative Articulation Pathway (ACAP) under BITS-UB collaboration is given in **Annexure 1**. Also, the proposed semester-wise pattern for students admitted to B.E. Computer Science, B.E. Electronics and Communication, B.E Electrical and Electronics programmes, and B.E Mechanical to be offered under BITS – UB international collaboration is given in **Annexure 2(A), (B), (C) and (D) respectively**. To fulfil the requirements, a few new courses may be introduced later, if required.

In this 4-year collaborative 'dual degree' programme, students will spend the first two years alongwith a summer term (if required) at BITS Pilani campuses before getting transferred to University at Buffalo in USA for the remaining two years (i.e., years 3 and 4) of their study period. The courses mentioned in the semester-wise pattern in years 1 and 2 alongwith the summer term (if any) will be offered at BITS Pilani Campuses whereas those courses specified in years 3 and 4 will be offered at UB. The Equivalent Unit may be considered by assuming that a course of 1 units offered at BITS Pilani is equivalent to a 1 credit points course offered by UB. The actual units mapping of the courses shall be decided based on the equivalent courses offered at BITS Pilani and UB. Accordingly, the UB credit points will be converted into BITS course units and vice versa by making appropriate equivalency of these courses. The Cross Campus Departmental Committee on Academics (CCDCA) of the respective department will work out all minute details of offering various courses to refine the semesterwise pattern of the respective programme from time to time in consultation with Dean, AUGS and will report back to the Senate.

Annexure 1

Table 1: Required Category wise structure of each program to fulfill Degree requirement of BITS Pilani under BITS-UB 2+2 Joint International First Degree Programmes

Category	Courses to be offered at BITS Pilani		Courses to be offered at UB (for BITS Requirement)		Total	
	Courses	Unit	Courses	Eq. Unit*	Courses	Unit
Humanities Elective	(0-3)	(0-9)	(0-3)	(0-9)	3	9
Science Foundation	6 (6)	12 (12)			6	12
Mathematics Foundation	4 (4)	12 (12)			4	12
Engineering Foundation	2 (2)	6 (6)			2	6
Technical Arts	(3-4)	(7-10)	(0-1)	(0-3)	4	10
General Awareness / Professional Courses	2 (2)	6 (6)			2	6
Sub-Total	**(17-21)**	**(43-55)**	**(0-4)**	**(0-12)**	**21**	**55**
Core	(7-11)	(26-37)	(3-8)	(14-24)	(10-16)	(33-48)
Discipline Elective	(0-4)	(0-15)	(0-4)	(0-15)	(4-9)	(12-27)
Sub-Total	**(7-15)**	**(26-52)**	**(3-12)**	**(14-39)**	**(14-20)**	**62**
Open Elective	(0-9)	(0-27)	(0-9)	(0-27)	(5-9)	(15-27)
Capstone Project			2	8	2	8
Grand Total	**(24-32)**	**(69-92)**	**(14-23)**	**(52-68)**	**(46-54)**	**144**

***Equivalent Unit:** Assuming a course of 3-4 units offered at BITS Pilani is equivalent to a 3-4 credit points course offered by UB. The Unit of each Capstone Project offered at UB is proposed to be considered equal to 4 units at BITS Pilani. The actual units mapping of the courses shall be decided based on the equivalent courses offered at BITS Pilani.

Note:

1. Unlike other BITS students, BITS-UB students need not to register for Practice School or Thesis. Such students will have to complete two Capstone Projects in place of Practice School II or First Degree Thesis to meet the requirements of their degree programmes.

2. Some of the courses which are offered at UB may have different credit points, the grades earned by the students at UB will be converted appropriately by making equivalency of the courses and by converting UB credit points into BITS units, and the CGPA shall be calculated accordingly based on their grades earned in all the respective courses. Senate is requested to authorize the Chairman, Senate, to approve the details of unit mapping of equivalent courses once it is submitted by the Cross-Campus Departmental Committee on Academics (CCDCA) through Dean AUGS for the respective programmes.

3. Table 1 given above describes the general curricular structure for the 2+2 International Collaborative First Degree Programmes offered under BITS-UB collaboration. Accordingly, the semesterwise pattern of each specific programme is designed as given in Annexure 2(B), (C), (D) and (E) to fulfil degree requirement of BITS Pilani for BITS-UB students.

Annexure 2(A)

Semester-wise Pattern for Students Admitted to B.E. Computer Science at BITS Pilani and B.S. Computer Engineering at UB under BITS – UB 2+2 International Collaborative Programmes

Table 3(A): Semester-wise Pattern for Students Admitted to B.E. Computer Science under BITS – UB								
Year	**First Semester**			**U**	**Second Semester**			**U**
	BIO	F110	Biology Laboratory	1	MATH	F112	Mathematics II	3
	BIO	F111	General Biology	3	ME	F112	Workshop Practice	2
	CHEM	F110	Chemistry Laboratory ①	1	BITS	F111	Thermodynamics	3
	CHEM	F111	General Chemistry ②	3	CS	F111	Computer Programming ⑧	4
	MATH	F111	Mathematics I ③	3	MATH	F113	Probability and Statistics ⑨	3
	PHY	F110	Physics Laboratory ④	1	EEE	F111	Electrical Sciences ⑩	3
	PHY	F111	Mechanics, Oscillations and Waves ⑤	3	PHY	108	Physics ⑪	4
	BITS	F110	Engineering Graphics ⑥	2				
	ELI	100 or 105	Intro to Academic Writing (offered by UB to fulfill UBC CL1 requirement ⑦	3 Or 4				
				20				**22**
Summer Term								
ELI 105: Writing and Rhetoric only if students were placed into ELI 100 in first fall term (Students who do not meet placement requirements. These students would then take ELI 105 in the summer between Year 1 and Year 2, remotely online offered by UB). ⑫								4
Humanities Elective (The course is required to offered to fulfill Humanities Elective Requirement at BITS Only ⑫-A								3
Year	**First Semester**			**U**	**Second Semester**			**U**
II	MATH	F211	Mathematics III ⑬	3	ECON Or MGTS	F211 Or F211	Principles of Economics Or Principles of Management	3
	CS	F214	Logic in Computer Science	3	CS	F211	Data Structures & Algorithms ⑱	4
	CS	F222	Discrete Structure for Computer Science ⑭	3	CS	F212	Database Systems	4
	CS	F213	Object Oriented Programming ⑮	4	CS	F351	Theory of Computations	3
	CS	F215	Digital Design ⑯	4	BITS	F225	Environmental Studies ⑲ **<PW1>**	3
	EAS	360	STEM Communications ⑰	3	DIV		Thematic Pathway List 1 Course to satisfy Diversity requirement ⑳ **<PW2>**	3
				20				**20**
Year	**First Semester**			**U**	**Second Semester**			**U**
III	EE	310	Electronic Devices and Circuits I ㉑	3	CSE	305	Introduction to Programming Languages ㉖	4
	CSE	220	Systems Programming㉒	4	CSE	341	Computer Organization ㉗	4

Table 3(A): Semester-wise Pattern for Students Admitted to B.E. Computer Science under BITS – UB								
Year	**First Semester**			**U**	**Second Semester**			**U**
	MTH	309	Linear Algebra ㉔	4	CSE	379	Microprocessors ㉘	4
	EE	312	Basic Electronic Instrumentation Lab ㉕	2	CSE	431	Algorithms Analysis and Design ㉙	3
	EAS	198	UB Seminar ㉕	1				
	PHY	158	General Physics II Lab	1				
				15				**15**
IV	CSE	450	Hardware/Software Integrated Systems Design I ㉛	3	CSE	453	Hardware/Software Integrated Systems Design 2 ㉜	3
	CSE	321	Real -Time and Embedded Operating Systems ㉝	4	CSE	489	Modern Networking Concepts ㊱	3
	CSE	460	Data Models and Query Languages ㉞	3	CSE	490	Computer Architecture ㊲	3
	PW		Pathway Course ㉟ **<PW3>**	3	PW		Pathway Course ㊳ **<PW4>**	3
	CSE	421	Introduction to Operating Systems ㉓	3	CSE	443	Compilers ㉚	4
					UBC	399	UB Curriculum Capstone	1
				16				**17**

Note: Units/Credit points earned for the course(s) in BITS Pilani and UB shall be considered towards degrees to be awarded by both institutions in accordance with the following:

1. To complete the BITS Pilani Degree, students need to complete a minimum total of 146 units with a minimum number of 47 courses (four courses with 13 units offered jointly by UB (online) and BITS + twenty-five courses with 72 units (min.) offered by BITS in first two years + eighteen courses with 61 equivalent units offered by UB). The Equivalent Unit is considered by assuming that a course of 1 units offered at BITS Pilani is equivalent to a 1 credit points course offered by UB.
2. To complete the UB Degree, students need to complete 124 credit points in total (4 courses with 14 credit points offered jointly by UB (online) and BITS + 15 mapped courses with 47 equivalent credit points offered by BITS in the first two years + 21 courses with 63 credit points offered by UB).
3. Upon completion of all BITS Pilani Courses during Years 1 and 2 (including summer term, if any) at the BITS Campus, students will receive 47 credit points as an UB credit exemption against the 15 mapped courses to complete the UB Degree in accordance with UB's policies and procedures.
4. Upon completion of all UB Courses, students will receive 74 (=13+61) units of transfer credit for the 22 (=4+18) mapped courses to complete the BITS Pilani Degree in accordance with BITS' policies and procedures.
5. The actual units mapping of the courses shall be decided based on the equivalent courses offered at BITS Pilani and UB.

6. The details of an encircled number given against the selected courses in the semester-wise pattern are given below:

Symbol	Description
①	Course CHEM F110: Chemistry Laboratory is a compulsory foundation course at BITS Pilani. It will be considered as equivalent to CHE 113LAB: General Chemistry for Engineers Laboratory 1a required course offered at UB.
②	Course CHEM F111: General Chemistry is a compulsory foundation course at BITS Pilani. It will be considered as equivalent to CHE 999: Chemistry 1 a required course offered at UB.
③	Course MATH F111: Mathematics I is a compulsory foundation course at BITS Pilani. It will be considered as equivalent to MTH 241: Calculus 3 a required course offered at UB. (Note: Though the Courses MTH 141: Calculus 1 & MTH 142: Calculus 2 are the foundation courses offered at UB, their course contents are overlapping with the NCERT syllabus, which are studied by the students at their Higher secondary level. Therefore, MTH 141: Calculus 1 & MTH 142: Calculus 2 requirements at UB shall be waived).
④	Course PHY F110: Physics Laboratory is a compulsory foundation course at BITS Pilani. It will be considered as equivalent to PHY 151LAB - Physics Lab 1 a required course offered at UB.
⑤	Course PHY F111: Mechanics, Oscillations and Waves is a compulsory foundation course at BITS Pilani. It will be considered as equivalent to PHY 107LR: General Physics 1 a required course offered at UB.
⑥	Course BITS F110: Engineering Graphics is a compulsory foundation course at BITS Pilani. It will be considered as equivalent to EAS 999TR177/MAE 177: Engineering Drawing and CAD a required course offered at UB.
⑦	Course ENG 105: Writing and Rhetoric is the required course offered at UB. It would be offered by UB to fulfill UB requirement through online mode. It may be considered as Open Elective for BITS requirement by mapping with courses such as GS F223 Introduction to Mass Communication or GS F325 Journalism or GS F326 Creative Thinking or GS F344 Copywriting. This course can be considered as the 1st Open Elective course out of 5 required at BITS.
⑧	Course CS F111: Computer Programming is a compulsory foundation course at BITS Pilani. It will be considered as equivalent to CSE 115/EAS 230: Engineering Computations a required course offered at UB.
⑨	Course MATH F113: Probability and Statistics is a compulsory foundation course at BITS Pilani. It will be considered as equivalent to STA 301: Introduction to Probability is a course available for Senior Students at UB.
⑩	Course EEE F111: Electrical Sciences is a compulsory foundation course at BITS Pilani. It will be considered as equivalent to EE 202: Circuit Analysis a required course offered at UB.
⑪	Course PHY 108: Physics 2 is the required course offered at UB. It would be offered by UB to fulfill UB requirement through online mode. It may be considered as Open Elective for BITS Requirement.

⑫	ELI 105: Writing and Rhetoric is required only if students were placed into ELI 100 in first fall term (Students who do not meet placement requirements. These students would then take ELI 105 in the summer between Year 1 and Year 2, remotely online offered by UB).
⑫-A	The course is required to offered to fulfill Humanities Elective Requirement at BITS Only. This would be the 1st Humanities Elective (HUEL) out of total required 3 HUELs.
⑬	Course MATH F211: Mathematics III is a compulsory foundation course at BITS Pilani. It will be considered as equivalent to MTH 306: Differential Equations a required course offered at UB.
⑭	Course CS F222: Discrete Structure for Computer Science is a required core course at BITS Pilani. It will be considered as equivalent to CSE 191: Introduction to Discrete Structures a required course offered at UB.
⑮	Course CS F213: Object Oriented Programming is a required core course at BITS Pilani. It will be considered as equivalent to CSE 116: Introduction to Computer Science II a required course offered at UB.
⑯	Course CS F215: Digital Design is a required core course offered at BITS Pilani. It will be considered as equivalent to CSE 241: Digital Systems a required course offered at UB.
⑰	Course EAS 360: STEM Communications is the required course offered at UB. It will be considered as an equivalent to BITS F112: Technical Report Writing a required foundation course at BITS Pilani.
⑱	Course CS F211: Data Structures & Algorithms is a required core course at BITS Pilani. It will be considered as an equivalent to CSE 250: Data Structures a required course offered at UB.
⑲	BITS F225: Environmental Studies is the required foundation course at BITS. It will be considered as equivalent to EVS 118: Intro Environment and Sustainability Studies offered at UB. Course EVS 118 Intro Environment and Sustainability Studies will also fulfill the requirement of a course at UB offered under Thematic or Global Pathway category. Thus it will fulfill the requirement of 1st course under Thematic or Global Pathway category out of the total required 4 courses required under this category. (It would be offered by UB to fulfill UB requirement of all students through online mode).
⑳	This would be the 2nd Humanities Elective (HUEL) out of total required 3 HUELs. Students should select this course from the pool of Humanities electives offered at BITS in such a way that the selected course will also fulfill the requirement of a course at UB offered under Thematic or Global Pathway category. Thus it will fulfill the requirement of 2nd course under Thematic or Global Pathway category out of the total required 4 courses required under this category.
㉑	Course EE 310: Electronic Devices & Circuits 1 is the required course offered at UB. Also, this course will be considered as the 3rd Open Elective for BITS Requirement.
㉒	Course CSE 220: Systems Programming is the required course offered at UB. Also, this will be considered as the 1st Discipline Elective course out of 4 required at BITS.
㉓	The course CSE 421: Introduction to Operating Systems required to be offered by UB to fulfill the requirements of BITS Pilani. BITS-UB Students shall take the course and this will be considered as equivalent to a required core course CS F372: Operating Systems

	offered at BITS Pilani in 3rd Year.
㉔	Course MTH 309: Introductory Linear Algebra is the required course offered at UB. Also, this course will be considered as the 4th Open Elective for BITS requirement.
㉕	Course EE 312: Basic Electronic Instrumentation Lab is a required course offered at UB. If students will complete EE 312 and EAS 198, BITS will consider it equivalent to CS F366: Lab Project and this course will be considered as the 5th Open Elective for BITS Requirement.
㉖	The course CSE 305LR: Introduction to Programming Languages required to be offered by UB to fulfill the requirements of BITS Pilani. BITS-UB Students shall take the course and this will be considered as equivalent to a required core course CS F301: Principles of Programming Language offered at BITS Pilani in 3rd Year.
㉗	Course CSE 341: Computer Organization is the required course offered at UB. Also, this will be considered as the 2nd Discipline Elective course out of 4 required at BITS.
㉘	CSE 379: Introduction to Microprocessor is the required course at UB. This course will be equivalent to CS F241: Microprocessors and Interfacing, a required core course offered at BITS.
㉙	The course CSE 431: Algorithms Analysis and Design required to be offered by UB to fulfill the requirements of BITS Pilani. BITS-UB Students shall take the course and this will be considered as equivalent to a required core course CS F364: Design & Analysis of Algorithms offered at BITS Pilani in 3rd Year.
㉚	The course CSE 443: Compilers required to be offered by UB to fulfill the requirements of BITS Pilani. BITS-UB Students shall take the course and this will be considered as equivalent to a required core course CS F363: Compiler Construction offered at BITS Pilani in 3rd Year.
㉛	Course CSE 450: Hardware/Software Integrated Systems Design I is a course offered at UB. Also, this course will be considered as equivalent to the course BITS F456: Capstone Project I a required course offered at BITS Pilani. This is the 1st Capstone Project out of 2 required at BITS. All BITS-UB students have to do two Capstone Projects in place of Practice School II/Thesis.
㉜	Course CSE 453: Hardware/Software Integrated Systems Design 2 is a course offered at UB. Also, this course will be considered as equivalent to the course BITS F457: Capstone Project II a required course offered at BITS Pilani. This is the 2nd Capstone Project out of 2 required at BITS. All BITS-UB students have to do two Capstone Projects in place of Practice School II/Thesis.
㉝	Course CSE 321: Real -Time and Embedded Operating is a required course offered at UB. Also, this course will be considered as the 3rd Discipline Elective out of 4 required at BITS.
㉞	Course CSE 460: Data Model and Query Languages is the CSE 400-Level Elective course offered at UB. Also, this will be considered as the 4th Discipline Elective course out of 4 required at BITS.
㉟	This would be the 3rd Humanities Elective (HUEL) out of total required 3 HUELs. Students should select this course in such a way that the selected course will not only fulfill the requirement of a course at UB offered under Thematic or Global Pathway category but

	also fulfill Humanities electives requirement of BITS Pilani. Thus it will fulfill the requirement of 3rd course under Thematic or Global Pathway category out of the total required 4 courses required under this category.
㊱	The course CSE 489: Modern Networking Concepts required to be offered at UB. BITS-UB Students shall take the course as CSE 400-Level Technical Elective required at UB and this course will be considered as equivalent to a required core course CS F303: Computer Networks offered at BITS Pilani in 3rd Year.
㊲	Course CSE 490: Computer Architecture is the required course offered at UB. Also, this course will be considered as equivalent to CS F342: Computer Architecture a required core course offered at BITS Pilani in 3rd Year.
㊳	This course will be considered as an additional Open Elective for BITS Requirement. Students should select this course in such a way that the selected course will not only fulfill the requirement of a course at UB offered under Thematic or Global Pathway category but also fulfill open elective requirement of BITS Pilani. Thus it will fulfill the requirement of 4th course under Thematic or Global Pathway category out of the total required 4 courses required under this category.

Annexure 2(B)

Semester-wise Pattern for Students Admitted to B.E. Electronics and Communication at BITS Pilani and B.S. Electrical Engineering at UB under BITS – UB 2+2 International Collaborative Programmes

Table 3(B): Semester-wise Pattern for Students Admitted to B.E. Electronics and Communication under BITS – UB

Year	First Semester			U	Second Semester			U
	BIO	F110	Biology Laboratory	1	MATH	F112	Mathematics II	3
	BIO	F111	General Biology	3	ME	F112	Workshop Practice	2
	CHEM	F110	Chemistry Laboratory ①	1	BITS	F111	Thermodynamics	3
	CHEM	F111	General Chemistry ②	3	CS	F111	Computer Programming ⑧	4
	MATH	F111	Mathematics I ③	3	MATH	F113	Probability and Statistics ⑨	3
	PHY	F110	Physics Laboratory ④	1	EEE	F111	Electrical Sciences ⑩	3
	PHY	F111	Mechanics, Oscillations and Waves ⑤	3	PHY	108	Physics 2 ⑪	4
	BITS	F110	Engineering Graphics ⑥	2				
	ELI	100 or 105	Intro to Academic Writing (offered by UB to fulfill UBC CL1 requirement ⑦	3 Or 4				
				20				**22**
Summer Term								
ELI 105: Writing and Rhetoric ONLY if students were placed into ELI 100 in first fall term ⑫								4
1st Humanities Elective (The course is required to offered to fulfill Humanities Elective Requirement at BITS Only ⑫-A								3
Year	**First Semester**			**U**	**Second Semester**			**U**
II	MATH	F211	Mathematics III ⑬	3	ECON Or MGTS	F211 Or F211	Principles of Economics Or Principles of Management	3
	ECE	F211	Electrical Machines ⑭	4	ECE	F241	Microprocessors and Interfacing ⑱-A	4
	ECE	F314	EM Fields and Microwave Engineering ⑮	3	ECE	F242	Control Systems	3
	ECE	F215	Digital Design ⑯	4	ECE	F243	Signals & Systems ⑱	3
	EAS	360	STEM Communications ⑰	3	BITS	F225	Environmental Studies ⑲ **<PW1>**	3
	ECE	F312	EM Fields and Microwave Engineering Laboratory	1	DIV		Thematic Pathway List 1 Course to satisfy Diversity requirement **<PW2>** ⑳	3
			Open Elective	3				
				21				**19**
Year	**First Semester**			**U**	**Second Semester**			**U**
III	EE	310	Electronic Devs & Circs 1 ㉑	3	EE	311	Electronic Devs & Circs 2 ㉕	3
	EE	352	Intro Electronics Lab ㉒	3	EE	383	Communications Systems I ㉖	3
	EAS OR	230 OR	Engineering Computations OR	3	EE	336	Fundamentals of Energy Systems ㉗	3

Table 3(B): Semester-wise Pattern for Students Admitted to B.E. Electronics and Communication under BITS – UB								
Year	**First Semester**			**U**	**Second Semester**			**U**
	MTH	309	Intro Linear Algebra ㉓	4				
			Thematic or Global Pathway Course ㉔ **<PW3>**	3	EE	353	Electronic Circuits ㉘	3
	EAS	198	UB Seminar	1	PHY	207	General Physics 3 ㉙	4
	PHY	158	General Physics II Lab	1	PHY	257	Physics 3 Lab	1
				14				**17**
Year	**First Semester**			**U**	**Second Semester**			**U**
IV	EE	408	Senior Seminar	1	EE	494	Senior Capstone Design Project ㉛	3
	EE	499	Independent Study ㉚	3				
	EE	478	HDL Based Digital Design with Programmable Logic ㉜	3	EE	434	Principles of Networking ㊱	4
	EE	491	Analog Integrated Circuits ㉝	3	EE	439	Principle of Information Theory and Coding ㊲	3
			EE Electives ㉞	3	ECE	434	Digital Signal Processing ㊳	3
			Thematic or Global Pathway Course (Humanities Elective for BITS) ㉟ **<PW4>**	3	UBC	399	UB Curriculum Capstone	1
				13				**14**

Note: Units/Credit points earned for the course(s) in BITS Pilani and UB shall be considered towards degrees to be awarded by both institutions in accordance with the following:

1. To complete the BITS Pilani Degree, students need to complete a minimum total of 144 units with a minimum number of 49 courses (four courses with 12 units offered jointly by UB (online) & BITS + 25 courses with 68 units (min.) offered by BITS in first two years + 18 with 60 equivalent units offered by UB). The Equivalent Unit is considered by assuming that a course of 1 units offered at BITS Pilani is equivalent to a 1 credit points course offered by UB.
2. To complete the UB Degree, students need to complete 119 credit points in total (2 courses with 8 credit points waived + 4 courses with 14 credit points offered jointly by UB (online) & BITS + 15 mapped courses with 45 equivalent credit points offered by BITS in the first two years + 23 courses with 60 credit points offered by UB).
3. Upon completion of all BITS Pilani Courses during Years 1 and 2 (including summer term, if any) at the BITS Campus, students will receive 45 credit points as an UB credit exemption against the 15 mapped courses to complete the UB Degree in accordance with UB's policies and procedures.
4. Upon completion of all UB Courses, students will receive 72 (=12+60) units of transfer credit for the 22 (=4+18) mapped courses to complete the BITS Pilani Degree in accordance with BITS' policies and procedures.
5. The actual units mapping of the courses shall be decided based on the equivalent courses offered at BITS Pilani and UB.

6. The details of an encircled number given against the selected courses in the semester-wise pattern are given below:

Symbol	Description
①	Course CHEM F110: Chemistry Laboratory is a compulsory foundation course at BITS Pilani. It will be considered as equivalent to CHE 113LAB: General Chemistry for Engineers Laboratory 1a required course offered at UB.
②	Course CHEM F111: General Chemistry is a compulsory foundation course at BITS Pilani. It will be considered as equivalent to CHE 999: Chemistry 1 a required course offered at UB.
③	Course MATH F111: Mathematics I is a compulsory foundation course at BITS Pilani. It will be considered as equivalent to MTH 241: Calculus 3 a required course offered at UB. (Note: Though the Courses MTH 141: Calculus 1 & MTH 142: Calculus 2 are the foundation courses offered at UB, their course contents are overlapping with the NCERT syllabus, which are studied by the students at their Higher secondary level. Therefore, MTH 141: Calculus 1 & MTH 142: Calculus 2 requirements at UB shall be waived).
④	Course PHY F110: Physics Laboratory is a compulsory foundation course at BITS Pilani. It will be considered as equivalent to PHY 151LAB - Physics Lab 1 a required course offered at UB.
⑤	Course PHY F111: Mechanics, Oscillations and Waves is a compulsory foundation course at BITS Pilani. It will be considered as equivalent to PHY 107LR: General Physics 1 a required course offered at UB.
⑥	Course BITS F110: Engineering Graphics is a compulsory foundation course at BITS Pilani. It will be considered as equivalent to EAS 999TR177/MAE 177: Engineering Drawing and CAD a required course offered at UB.
⑦	Course ENG 105: Writing and Rhetoric is the required course offered at UB. It would be offered by UB to fulfill UB requirement through online mode. It may be considered as Open Elective for BITS requirement by mapping with courses such as GS F223 Introduction to Mass Communication or GS F325 Journalism or GS F326 Creative Thinking or GS F344 Copywriting. This course can be considered as the 1st Open Elective course out of 5 required at BITS.
⑧	Course CS F111: Computer Programming is a compulsory foundation course at BITS Pilani. It will be considered as equivalent to EAS 240: Introduction to Programming for Engineers a required course offered at UB. Both courses are mapped to fulfill the requirement of the respective Institutes.
⑨	Course MATH F113: Probability and Statistics is a compulsory foundation course at BITS Pilani. It will be considered as equivalent to EE 305: Applied Probability a required course at UB.
⑩	Course EEE F111: Electrical Sciences is a compulsory foundation course at BITS Pilani. It will be considered as equivalent to EE 202: Circuit Analysis a required course offered at UB.
⑪	Course PHY 108: Physics 2 is the required course offered at UB. It would be offered by UB

	to fulfill UB requirement through online mode. It will be considered as equivalent to ECE F212 Electromagnetic Theory offered at BITS.
⑫	ELI 105: Writing and Rhetoric is required only if students were placed into ELI 100 in first fall term (Students who do not meet placement requirements. These students would then take ELI 105 in the summer between Year 1 and Year 2, remotely online offered by UB).
⑫-A	The course is required to offered to fulfill Humanities Elective Requirement at BITS Only. This would be the 1st Humanities Elective (HUEL) out of total required 3 HUELs. Students shall choose one course from the following three courses: HSS F234 or HSS F318 or HSS F333; HSS F235 or HSS F313 or HSS F343 or HSS 353 or HSS F399.
⑬	Course MATH F211: Mathematics III is a compulsory foundation course at BITS Pilani. It will be considered as equivalent to MTH 306: Differential Equations a required course offered at UB.
⑭	Course ECE F211: Electrical Machines is the required core course offered at BITS. Also, this course will be considered as equivalent to EE 425: Electrical Devices offered at UB.
⑮	Course ECE F314: EM Fields and Microwave Engineering is a required core course at BITS. It will be considered as equivalent to EE 324 Electromagnetic Theory required at UB.
⑯	Course ECE F215: Digital Design is a required core course at BITS in 2nd Year. Also, this course will be considered as equivalent to EE 178: Digital Principles offered at UB.
⑰	Course EAS 360: STEM Communications is the required course offered at UB. It will be considered as an equivalent to BITS F112: Technical Report Writing a required foundation course at BITS Pilani.
⑱-A	Course ECE F241: Microprocessors and Interfacing is a required core course at BITS. Also, this course will be considered as equivalent to EE 379: Embedded Systems and Application a required course at UB.
⑱	Course ECE F243: Signals & Systems is a required core course offered at BITS. Also, this course will be considered as equivalent to EE 205: Signal Analysis and Transform Methods offered at UB.
⑲	BITS F225: Environmental Studies is the required foundation course at BITS. It will be considered as equivalent to EVS 118: Intro Environment and Sustainability Studies offered at UB. Course EVS 118 Intro Environment and Sustainability Studies will also fulfill the requirement of a course at UB offered under Thematic or Global Pathway category. Thus it will fulfill the requirement of 1st course under Thematic or Global Pathway category out of the total required 4 courses required under this category. (It would be offered by UB to fulfill UB requirement of all students through online mode).
⑳	This would be the 2nd Humanities Elective (HUEL) out of total required 3 HUELs. Students should select this course in such a way that the selected course will not only fulfill the requirement of a course at UB offered under Thematic or Global Pathway category but also fulfill Humanities electives requirement of BITS Pilani. Thus it will fulfill the requirement of 2nd course under Thematic or Global Pathway category out of the total required 4 courses required under this category.
㉑	Course EE 310: Electronic Devs & Circs 1 is a required course at UB. Also, this course will be considered as equivalent to ECE F214: Electronic Devices a required core course

	offered at BITS.
㉒	Course EE 352: Introduction to Electronic Laboratory is a required course offered at UB. Also, this course will be considered as 1st Discipline Elective course out of 4 required at BITS.
㉓	Course EAS 230: Engineering Computations/ MTH 309: Introductory Linear Algebra is the required course offered at UB. This will be as the 3rd Open Elective course required at BITS.
㉔	This would be the 3rd Humanities Elective (HUEL) out of total required 3 HUELs. Students should select this course in such a way that the selected course will not only fulfill the requirement of a course at UB offered under Thematic or Global Pathway category but also fulfill Humanities electives requirement of BITS Pilani. Thus it will fulfill the requirement of 3rd course under Thematic or Global Pathway category out of the total required 4 courses required under this category.
㉕	Course EE 311: Electronic Devs & Circs 2 is a required course at UB. Also, this course will be considered as equivalent to ECE F244: Microelectronic Circuits a required core course offered at BITS.
㉖	Course EE 383: Communications Systems is a required course offered at UB. Also, this course will be considered as equivalent to a required core course ECE F311: Communication Systems offered at BITS.
㉗	Course EE 336: Fundamentals of Energy Systems is a required course offered at UB. Also, this course will be considered as 2nd Discipline Elective course out of 4 required at BITS.
㉘	Course EE 353: Electronic Circuits is a required course offered at UB. Also, this course will be considered as 3rd Discipline Elective course out of 4 required at BITS.
㉙	Course PHY 207: General Physics 3 is a required course offered at UB. Also, this course will be considered as 4th Open Elective course required at BITS.
㉚	The students would be registering in both Courses EE 408: Senior Seminar and EE 499: Independent Study that would be tied to the senior design project for these students. Also, these two courses can be considered as equivalent to First Capstone Project, namely BITS F456: Capstone Project I to be offered at BITS Pilani. All BITS-UB students have to do two Capstone Projects in place of Practice School II/Thesis.
㉛	Course EE 494: Senior Capstone Design Project is the core course offered at UB. Also, this will be equivalent to BITS F457: Capstone Project II to be offered at BITS Pilani. All BITS-UB students have to do two Capstone Projects in place of Practice School II/Thesis.
㉜	Course EE 478: HDL Based Digital Design with Programmable Logic is the required course offered at UB. Also, this course will be considered as 5th Open Elective course required at BITS.
㉝	BITS-UB Students shall be advised to take the course EE 491: Analog Integrated Circuits mandatorily. This will be the 1st Technical Elective course out three from list of Technical Electives required at UB and will be treated as equivalent to a required core course offered at BITS, namely ECE F341: Analog Electronics.
㉞	BITS-UB Students will take the 1st course out two from list of Electrical Engineering Electives required at UB. Also, this course will be considered as 4th Discipline Elective

	course out of 4 required at BITS.
㉟	This would be the 4th course at UB offered under Thematic or Global Pathway category. Also, this course will be considered as the 6th Open Elective course required at BITS.
㊱	BITS-UB Students shall be advised to take the course EE 434: Principles of Networking mandatorily. This will be the 2nd course out two from list of EE Electives required at UB and will be treated as a required core course offered at BITS, namely ECE F343: Communication Networks.
㊲	Course EE 439: Principle of Information Theory and Coding is to be offered at UB. BITS-UB Students shall be advised to take this course mandatorily as one of the Technical Electives required at UB and will be considered as equivalent to a required core course namely ECE F344 Information Theory and Coding offered at BITS.
㊳	Course ECE F434: Digital Signal Processing is a required core course at BITS. The UB Team shall develop a course that aligns with BITS' ECE F434. Once a course is developed by UB Team, the new introduced course will be substituted with it (=ECE F434 Digital Signal Processing) as one of the Technical Electives required at UB for UBITS students.

Annexure 2(C)

Semester-wise Pattern for Students Admitted to B.E. Electrical and Electronics at BITS Pilani and B.S. Electrical Engineering at UB under BITS – UB 2+2 International Collaborative Programmes

Table 3(C): Semester-wise Pattern for Students Admitted to B.E. Electrical and Electronics under BITS – UB								
Year	**First Semester**			**U**	**Second Semester**			**U**
	BIO	F110	Biology Laboratory	1	MATH	F112	Mathematics II	3
	BIO	F111	General Biology	3	ME	F112	Workshop Practice	2
	CHEM	F110	Chemistry Laboratory ①	1	BITS	F111	Thermodynamics	3
	CHEM	F111	General Chemistry ②	3	CS	F111	Computer Programming ⑦	4
	MATH	F111	Mathematics I ③	3	MATH	F113	Probability and Statistics ⑧	3
	PHY	F110	Physics Laboratory	1	EEE	F111	Electrical Sciences ⑨	3
	PHY	F111	Mechanics, Oscillations and Waves ④	3	PHY	108	Physics 2 ⑩	4
	BITS	F110	Engineering Graphics ⑤	2				
	ELI	100 or 105	Intro to Academic Writing (offered by UB to fulfill UBC CL1 requirement ⑥	3 Or 4				
				21				**22**
Summer Term								
ELI 105: Writing and Rhetoric ONLY if students were placed into ELI 100 in first fall term ⑪								4
1st Humanities Elective ⑫								3
Year	**First Semester**			**U**	**Second Semester**			**U**
II	MATH	F211	Mathematics III ⑬	3	ECON Or MGTS	F211 Or F211	Principles of Economics Or Principles of Management	3
	EEE	F211	Electrical Machines	4	EEE	F241	Microprocessors and Interfacing ⑰-A	4
	EEE	F214	Electronic Devices ⑭	3	EEE	F242	Control Systems	3
	EEE	F215	Digital Design ⑮	4	EEE	F243	Signals & Systems ⑰	3
	MATH ME	F212 **OR** F344	Optimization Engineering Optimization	3 2	EEE	F244	Microelectronics Circuits ⑱	3
	EAS	360	STEM Communications ⑯	3	BITS	F225	Environmental Studies ⑲ **<PW1>**	3
					DIV		Thematic Pathway List 1 Course to satisfy Diversity requirement **<PW2>** ⑳	3
				20				**22**
III	EE	352	Intro Electronics Lab ㉑	3	PHY	207	General Physics 3 ㉕	4
	EE	324	Applied Electromagnetics ㉒	4	PHY	257	General Physics 3 Laboratory	1
	EE OR MTH	230 OR 309	Engineering Computations OR Intro Linear Algebra ㉓	3 4	EE	383	Communications Systems I ㉖	3

Table 3(C): Semester-wise Pattern for Students Admitted to B.E. Electrical and Electronics under BITS – UB								
Year	**First Semester**			**U**	**Second Semester**			**U**
			Thematic or Global Pathway Course ㉔ **<PW3>**	3	EE	336	Fundamentals of Energy Systems ㉗	3
	EAS	198	UB Seminar	1	EE	353	Electronic Circuits ㉘	3
	PHY	158	General Physics II Lab	1				
				15				**14**
Year	**First Semester**			**U**	**Second Semester**			**U**
IV	EE EE	408 499	Senior Seminar Independent Study ㉙	1 3	EE	494	Senior Capstone Design Project ㉚	3
	EE	478	HDL Based Digital Design with Programmable Logic ㉛	3	EE	467	Power Electronics ㉟	3
	EE	491	Analog Integrated Circuits ㉜	3	CSE	493	Introduction to VLSI Electronics ㊱	4
			Thematic or Global Pathway Course ㉝ **<PW4>**	3	EE	482	Power Systems Engineering I ㊲	4
			Technical Elective 2 ㉞	3	UBC	399	UB Curriculum Capstone	1
				16				**15**

Note: Units/Credit points earned for the course(s) in BITS Pilani and UB shall be considered towards degrees to be awarded by both institutions in accordance with the following:

1. To complete the BITS Pilani Degree, students need to complete a minimum total of 147 units with a minimum number of 47 courses (four courses with 12 units offered jointly by UB (online) and BITS + 26 courses with 77 units (min.) offered by BITS in first two years + 18 courses with 58 equivalent units offered by UB). The Equivalent Unit is considered by assuming that a course of 1 units offered at BITS Pilani is equivalent to a 1 credit points course offered by UB.
2. To complete the UB Degree, students need to complete 129 credit points in total (2 courses with 8 credit points waived + 4 courses with 14 credit points offered jointly by UB (online) & BITS + 16 mapped courses with 47 equivalent credit points offered by BITS in the first two years + 22 courses with 60 credit points offered by UB).
3. Upon completion of all BITS Pilani Courses during Years 1 and 2 (including summer term, if any) at the BITS Campus, students will receive 47 credit points as an UB credit exemption against the 16 mapped courses to complete the UB Degree in accordance with UB's policies and procedures.
4. Upon completion of all UB Courses, students will receive 70 (=12+58) units of transfer credit for the 21 (=4+17) mapped courses to complete the BITS Pilani Degree in accordance with BITS' policies and procedures.
5. The actual units mapping of the courses shall be decided based on the equivalent courses offered at BITS Pilani and UB.
6. The details of an encircled number given against the selected courses in the semester-wise pattern are given below:

Symbol	Description
①	Course CHEM F110: Chemistry Laboratory is a compulsory foundation course at BITS Pilani. It will be considered as equivalent to CHE 113LAB: General Chemistry for Engineers Laboratory 1a required course offered at UB.
②	Course CHEM F111: General Chemistry is a compulsory foundation course at BITS Pilani. It will be considered as equivalent to CHE 999: Chemistry 1 a required course offered at UB.
③	Course MATH F111: Mathematics I is a compulsory foundation course at BITS Pilani. It will be considered as equivalent to MTH 241: Calculus 3 a required course offered at UB. (Note: Though the Courses MTH 141: Calculus 1 & MTH 142: Calculus 2 are the foundation courses offered at UB, their course contents are overlapping with the NCERT syllabus, which are studied by the students at their Higher secondary level. Therefore, MTH 141: Calculus 1 & MTH 142: Calculus 2 requirements at UB shall be waived).
④	Course PHY F111: Mechanics, Oscillations and Waves is a compulsory foundation course at BITS Pilani. It will be considered as equivalent to PHY 107LR: General Physics 1 a required course offered at UB.
⑤	Course BITS F110: Engineering Graphics is a compulsory foundation course at BITS Pilani. It will be considered as equivalent to EAS 999TR177/MAE 177: Engineering Drawing and CAD a required course offered at UB.
⑥	Course ENG 105: Writing and Rhetoric is the required course offered at UB. It would be offered by UB to fulfill UB requirement through online mode. It may be considered as Open Elective for BITS requirement by mapping with courses such as GS F223 Introduction to Mass Communication or GS F325 Journalism or GS F326 Creative Thinking or GS F344 Copywriting. This course can be considered as the 1st Open Elective course out of 5 required at BITS.
⑦	Course CS F111: Computer Programming is a compulsory foundation course at BITS Pilani. It will be considered as equivalent to EAS 240: Introduction to Programming for Engineers a required course offered at UB. Both courses are mapped to fulfill the requirement of the respective Institutes.
⑧	Course MATH F113: Probability and Statistics is a compulsory foundation course at BITS Pilani. It will be considered as equivalent to EE 305: Applied Probability a required course at UB.
⑨	Course EEE F111: Electrical Sciences is a compulsory foundation course at BITS Pilani. It will be considered as equivalent to EE 202: Circuit Analysis a required course offered at UB.
⑩	Course PHY 108: Physics 2 is the required course offered at UB. It would be offered by UB to fulfill UB requirement through online mode. It will be considered as equivalent to EEE F212 Electromagnetic Theory offered at BITS.
⑪	ELI 105: Writing and Rhetoric is required only if students were placed into ELI 100 in first fall term (Students who do not meet placement requirements. These students would then take ELI 105 in the summer between Year 1 and Year 2, remotely online offered by UB).
⑫	The course is required to offered to fulfill Humanities Elective Requirement at BITS Only.

Symbol	Description
	This would be the 1st Humanities Elective (HUEL) out of total required 3 HUELs. Students shall choose one course from the following three courses: HSS F234 or HSS F318 or HSS F333; HSS F235 or HSS F313 or HSS F343 or HSS 353 or HSS F399.
⑬	Course MATH F211: Mathematics III is a compulsory foundation course at BITS Pilani. It will be considered as equivalent to MTH 306: Differential Equations a required course offered at UB.
⑭	Course EEE F214: Electronic Devices is a required core course offered at BITS. Also, this course will be considered as equivalent to EE 310: Electronic Devs & Circs 1 offered at UB.
⑮	Course EEE F215: Digital Design is a required core course at BITS in 2nd Year. Also, this course will be considered as equivalent to EE 178: Digital Principles offered at UB.
⑯	Course EAS 360: STEM Communications is the required course offered at UB. It will be considered as an equivalent to BITS F112: Technical Report Writing a required foundation course at BITS Pilani.
⑰-A	Course EEE F241: Microprocessors and Interfacing is a required core course at BITS. Also, this course will be considered as equivalent to EE 379: Embedded Systems and Application a required course at UB.
⑰	Course EEE F243: Signals & Systems is a required core course offered at BITS. Also, this course will be considered as equivalent to EE 205: Signal Analysis and Transform Methods offered at UB.
⑱	Course EEE F244: Microelectronic Circuits is a required core course offered at BITS. Also, this course will be considered as equivalent to a required course EE 311: Electronic Devs & Circs 2 offered at UB.
⑲	BITS F225: Environmental Studies is the required foundation course at BITS. It will be considered as equivalent to EVS 118: Intro Environment and Sustainability Studies offered at UB. Course EVS 118 Intro Environment and Sustainability Studies will also fulfill the requirement of a course at UB offered under Thematic or Global Pathway category. Thus it will fulfill the requirement of 1st course under Thematic or Global Pathway category out of the total required 4 courses required under this category. (It would be offered by UB to fulfill UB requirement of all students through online mode).
⑳	This would be the 2nd Humanities Elective (HUEL) out of total required 3 HUELs. Students should select this course in such a way that the selected course will not only fulfill the requirement of a course at UB offered under Thematic or Global Pathway category but also fulfill Humanities electives requirement of BITS Pilani. Thus it will fulfill the requirement of 2nd course under Thematic or Global Pathway category out of the total required 4 courses required under this category.
㉑	Course EE 352: Introduction to Electronic Laboratory is a required course offered at UB. Also, this course will be considered as 1st Discipline Elective course out of 4 required at BITS.
㉒	Course EE 324: Applied Electromagnetics is a required course offered at UB. Also, this course will be considered as 2nd Open Elective course out of 5 required at BITS.
㉓	Course EAS 230: Engineering Computations/ MTH 309: Introductory Linear Algebra is the

Symbol	Description
	required course offered at UB. This will be as the 3rd Open Elective course required at BITS.
㉔	This would be the 3rd Humanities Elective (HUEL) out of total required 3 HUELs. Students should select this course in such a way that the selected course will not only fulfill the requirement of a course at UB offered under Thematic or Global Pathway category but also fulfill Humanities electives requirement of BITS Pilani. Thus it will fulfill the requirement of 3rd course under Thematic or Global Pathway category out of the total required 4 courses required under this category.
㉕	Course PHY 207: General Physics 3 is a required course offered at UB. Also, this course will be considered as 4th Open Elective course required at BITS.
㉖	Course EE 383: Communications Systems is a required course offered at UB. Also, this course will be considered as equivalent to a required core course EEE F311: Communication Systems offered at BITS.
㉗	Course EE 336: Fundamentals of Energy Systems is a required course offered at UB. Also, this course will be considered as 2nd Discipline Elective course out of 4 required at BITS.
㉘	Course EE 353: Electronic Circuits is a required course offered at UB. Also, this course will be considered as 3rd Discipline Elective course out of 4 required at BITS.
㉙	The students would be registering in both Courses EE 408: Senior Seminar and EE 499: Independent Study that would be tied to the senior design project for these students. Also, these two courses can be considered as equivalent to First Capstone Project, namely BITS F456: Capstone Project I to be offered at BITS Pilani. All BITS-UB students have to do two Capstone Projects in place of Practice School II/Thesis.
㉚	Course EE 494: Senior Capstone Design Project is the core course offered at UB. Also, this will be equivalent to BITS F457: Capstone Project II to be offered at BITS Pilani. All BITS-UB students have to do two Capstone Projects in place of Practice School II/Thesis.
㉛	Course EE 478: HDL Based Digital Design with Programmable Logic is the required course offered at UB. Also, this course will be considered as 5th Open Elective course required at BITS.
㉜	BITS-UB Students shall be advised to take the course EE 491: Analog Integrated Circuits mandatorily. This will be the 1st Technical Elective course out three from list of Technical Electives required at UB and will be treated as equivalent to a required core course offered at BITS, namely EEE F341: Analog Electronics.
㉝	This would be the 4th course at UB offered under Thematic or Global Pathway category. Also, this course will be considered as the 6th Open Elective course required at BITS.
㉞	BITS-UB Students shall take this course as 2nd Technical Elective required at UB and will be treated as the 4th Discipline Elective required at BITS. This course is required to fulfill 4th Discipline Course requirement of BITS.
㉟	BITS-UB Students shall be advised to take the course EE 467: Power Electronics mandatorily. This will be the 2nd course out two from list of EE Electives required at UB and will be treated as a required core course offered at BITS, namely EEE F342: Power Electronics.

Symbol	Description
㊱	Course CSE 493: Introduction to VLSI Electronics is to be offered at UB. BITS-UB Students shall be advised to take this course mandatorily as one of the Technical Electives required at UB and will be considered as equivalent to EEE F313: Analog & Digital VLSI Design a required core course offered at BITS.
㊲	Course EE 482: Power Systems Engineering I is to be offered at UB. BITS-UB Students shall take this course mandatorily as one of the EE Electives required at UB and will be considered as equivalent to EEE F312: Power Systems a required core course offered at BITS.

Annexure 2(D)

Semester-wise Pattern for Students Admitted to B.E. Mechanical at BITS Pilani and B.S. Mechanical Engineering at UB under BITS – UB 2+2 International Collaborative Programmes

Table 3(D): Semester-wise Pattern for Students Admitted to B.E. Mechanical under BITS – UB								
Year	**First Semester**			**U**	**Second Semester**			**U**
	BIO	F110	Biology Laboratory	1	MATH	F112	Mathematics II	3
	BIO	F111	General Biology	3	ME	F112	Workshop Practice ⑧	2
	CHEM	F110	Chemistry Laboratory ①	1	BITS	F111	Thermodynamics	3
	CHEM	F111	General Chemistry ②	3	CS	F111	Computer Programming ⑨	4
	MATH	F111	Mathematics I ③	3	MATH	F113	Probability and Statistics ⑩	3
	PHY	F110	Physics Laboratory ④	1	EEE	F111	Electrical Sciences ⑪	3
	PHY	F111	Mechanics, Oscillations and Waves ⑤	3	PHY	108	Physics 2 ⑫	4
	BITS	F110	Engineering Graphics ⑥	2				
	ELI	100 or 105	Introduction to Academic Writing (offered by UB to fulfill UBC CL1 requirement ⑦	3 Or 4				
				20				**22**
Summer Term								
ELI 105: Writing and Rhetoric ONLY if students were placed into ELI 100 in first fall term ⑬								**4**
Humanities Elective ⑬-A								3
Year	**First Semester**			**U**	**Second Semester**			**U**
II	MATH	F211	Mathematics III ⑭	3	ECON Or MGTS	F211 Or F211	Principles of Economics Or Principles of Management	3
	ME	F211	Mechanics of Solids ⑮	3	ME	F218	Advanced Mechanics of Solids ⑳	3
	ME	F216	Materials Science and Engineering ⑯	3	ME	317	Engines, Motors, and Mobility	2
	ME	F217	Applied Thermodynamics ⑰	4	BITS	F225	Environmental Studies ㉑	3
	ME	F320	Engineering Optimization ⑱	3	ME	F221	Mechanisms and Machines	3
	ME	F219	Manufacturing Processes ㉒	4	ME	F315	Advanced Manufacturing Processes	3
	EAS	360	STEM Communications ⑲	3	EAS	208	Dynamics ㉓	3
				23 (min)				**20 (min)**
Year	**First Semester**			**U**	**Second Semester**			**U**
	MAE	277	Introduction to ME Practice ㉔	3	MAE	311	Machines & Mechanisms 1 ㉙	3
	MAE	335	Fluid Mechanics ㉕	3	MAE	336	Heat Transfer ㉚	3
	MAE	340	Dynamic Systems ㉖	3	MAE	334	Mechanical & Aerospace Engg	2

Table 3(D): Semester-wise Pattern for Students Admitted to B.E. Mechanical under BITS – UB								
Year	**First Semester**			**U**	**Second Semester**			**U**
III							Laboratory I ㉛	
	MAE	376	Applied Math for MAEs ㉗	3	MAE	385	Engineering Materials Lab ㉜	1
	EAS	198	UB Seminar ㉘	1			Professional/Science Track ㉝	3
	PHY	158	General Physics II Lab	1	MAE	467	Vibration and Shock I ㉞	3
				14				**15**
Year	**First Semester**			**U**	**Second Semester**			**U**
IV	MAE	451	Design Process & Methods ㉟	3	MAE	494	Design Project ㊱	3
	MAE	338	MAE Laboratory II ㊲	2	UBC	399	UB Capstone	1
	MAE	377	Product Design in a CAE Environment ㊳	3			MAE Technical Electives ㊷	3
			MAE Technical Electives ㊴	3			Professional/Science Track ㊸	3
			Thematic/Global Pathway Course ㊵	3			Thematic Pathway List 1 Course to satisfy Diversity requirement ㊹	3
			Thematic/Global Pathway Course ㊶	3				
				17				**13**

Note: Units/Credit points earned for the course(s) in BITS Pilani and UB shall be considered towards degrees to be awarded by both institutions in accordance with the following:

1. To complete the BITS Pilani Degree, students need to complete a minimum total of 144 units with a minimum number of 49 courses (four courses with 10 units offered jointly by BITS and UB + 27 courses with 72 units (min.) offered by BITS in first two years + 19 courses with 59 equivalent units offered by UB). The Equivalent Unit is considered by assuming that a course of 1 units offered at BITS Pilani is equivalent to a 1 credit points course offered by UB.
2. To complete the UB Degree, students need to complete 122 credit points in total (4 courses with 14 credit points offered jointly by UB and BITS + 17 mapped courses with 49 equivalent credit points offered by BITS in the first two years + 23 courses with 59 credit points offered by UB).
3. Upon completion of all BITS Pilani Courses during Years 1 and 2 (including summer term, if any) at the BITS Campus, students will receive 49 credit points as an UB credit exemption against the 17 mapped courses to complete the UB Degree in accordance with UB's policies and procedures.
4. Upon completion of all UB Courses, students will receive 59 units of transfer credit for the 19 mapped courses to complete the BITS Pilani Degree in accordance with BITS' policies and procedures.
5. The actual units mapping of the courses shall be decided based on the equivalent courses offered at BITS Pilani and UB.
6. The details of an encircled number given against the selected courses in the semester-wise pattern are given below:

Symbol	Description
①	Course CHEM F110: Chemistry Laboratory is a compulsory foundation course at BITS

Symbol	Description
	Pilani. It will be considered as equivalent to CHE 113LAB: General Chemistry for Engineers Laboratory 1a required course offered at UB.
②	Course CHEM F111: General Chemistry is a compulsory foundation course at BITS Pilani. It will be considered as equivalent to CHE 999: Chemistry 1 a required course offered at UB.
③	Course MATH F111: Mathematics I is a compulsory foundation course at BITS Pilani. It will be considered as equivalent to MTH 241: Calculus 3 a required course offered at UB. (Note: Though the Courses MTH 141: Calculus 1 & MTH 142: Calculus 2 are the foundation courses offered at UB, their course contents are overlapping with the NCERT syllabus, which are studied by the students at their Higher secondary level. Therefore, MTH 141: Calculus 1 & MTH 142: Calculus 2 requirements at UB shall be waived).
④	Course PHY F110: Physics Laboratory is a compulsory foundation course at BITS Pilani. It will be considered as equivalent to PHY 151LAB - Physics Lab 1 a required course offered at UB.
⑤	Course PHY F111: Mechanics, Oscillations and Waves is a compulsory foundation course at BITS Pilani. It will be considered as equivalent to PHY 107LR: General Physics 1 a required course offered at UB.
⑥	Course BITS F110: Engineering Graphics is a compulsory foundation course at BITS Pilani. It will be considered as equivalent to EAS 999TR177/MAE 177: Engineering Drawing and CAD a required course offered at UB.
⑦	Course ENG 105: Writing and Rhetoric is the required course offered at UB. It would be offered by UB to fulfill UB requirement through online mode. It may be considered as Open Elective for BITS requirement by mapping with courses such as GS F223 Introduction to Mass Communication or GS F325 Journalism or GS F326 Creative Thinking or GS F344 Copywriting. This course can be considered as the 1st Open Elective course out of 5 required at BITS.
⑧	ME F112: Workshop Practice is a required foundation course at BITS. This course will be considered as equivalent to Course EAS 999TR100 as a 100-level technical elective at UB.
⑨	Course CS F111: Computer Programming is a compulsory foundation course at BITS Pilani. It will be considered as equivalent to CSE 115/EAS 230: Engineering Computations a required course offered at UB. Both courses are mapped to fulfill the requirement of the respective Institutes.
⑩	Course MATH F113: Probability and Statistics is a compulsory foundation course at BITS Pilani. It will be considered as equivalent to STA 301 Introduction to Probability, a course available for Senior Students at UB.
⑪	Course EEE F111: Electrical Sciences is a compulsory foundation course at BITS Pilani. It will be considered as equivalent to EE 202LR: Circuit Analysis a required course offered at UB.
⑫	Course PHY 108: Physics 2 is the required course offered at UB. It would be offered by UB to fulfill UB requirement through online mode. It will be considered as Open Elective for BITS Requirement.

Symbol	Description
⑬	ELI 105: Writing and Rhetoric is required only if students were placed into ELI 100 in first fall term (Students who do not meet placement requirements. These students would then take ELI 105 in the summer between Year 1 and Year 2, remotely online offered by UB).
⑬-A	The course is required to offered to fulfill Humanities Elective Requirement at BITS Only. This would be the 1st Humanities Elective (HUEL) out of total required 3 HUELs. Students shall choose one course from the following three courses: HSS F234 or HSS F318 or HSS F333; HSS F235 or HSS F313 or HSS F343 or HSS 353 or HSS F399.
⑭	Course MATH F211: Mathematics III is a compulsory foundation course at BITS Pilani. It will be considered as equivalent to MTH 306: Differential Equations a required course offered at UB.
⑮	Course ME F211: Mechanics of Solids is a required core course at BITS Pilani. This course will be considered as equivalent to EAS 207: Statics as one of the foundation course offered at UB.
⑯	Course ME F216: Materials Science and Engineering is a required core course at BITS Pilani. This course will be considered as equivalent to MAE 381: Engineering Materials 1 a required course offered at UB.
⑰	Course ME F217: Applied Thermodynamics is a required core course at BITS Pilani. This course will be considered as equivalent to MAE 204: Thermodynamics 1 a required course offered at UB.
⑱	Course ME F320: Engineering Optimization is shifted from 3rd Year to Second Year to fulfill overall course requirement of BITS Pilani.
⑲	Course EAS 360: STEM Communications is the required course offered at UB. It will be considered as an equivalent to BITS F112: Technical Report Writing a required foundation course at BITS Pilani.
⑳	Course ME F218 Advanced Mechanics of Solids is a required core course at BITS Pilani. This course will be considered as equivalent to EAS 209: Mechanics of Solids a required course offered at UB.
㉑	BITS F225: Environmental Studies is the required foundation course at BITS. It will be considered as equivalent to EVS 118: Intro Environment and Sustainability Studies offered at UB. Course EVS 118 Intro Environment and Sustainability Studies will also fulfill the requirement of a course at UB offered under Thematic or Global Pathway category. Thus it will fulfill the requirement of 1st course under Thematic or Global Pathway category out of the total required 4 courses required under this category. (It would be offered by UB to fulfill UB requirement of all students through online mode).
㉒	Course ME F219: Manufacturing Processes is a required core course at BITS Pilani. This course will be considered as equivalent to MAE 364: Manufacturing Processes a required course offered at UB.
㉓	The course EAS 208: Dynamics is the required course offered at UB. It would be offered by UB to fulfill UB requirement through online mode.
㉔	Course MAE 277: Introduction to Mechanical and Aerospace Engineering Practice is the required course offered at UB. Also, this course will be considered as equivalent to ME

Symbol	Description
	F316: Manufacturing Management a required core course offered at BITS.
㉕	Course MAE 335: Fluid Mechanics is the required course offered at UB. Also, this course will be considered as equivalent to ME F212: Fluid Mechanics a required core course offered at BITS.
㉖	Course MAE 340: Dynamic Systems is the required course offered at UB. Also, this course will be considered as equivalent to ME F319: Vibrations and Control a required core course offered at BITS Pilani.
㉗	Course MAE 376: Applied Math for Mechanical and Aerospace Engineering is the required course offered at UB. Also, this will be considered as the 3rd Open course out of 4 required courses at BITS, either as a project type course or a new elective to be introduced.
㉘	Course EAS 198: UB Seminar is a required course offered at UB.
㉙	Course MAE 311: Machines & Mechanisms 1 is the required course offered in 3rd year at UB. Also, this will be equivalent to ME F314: Design of Machine Elements a required core course offered at BITS Pilani.
㉚	Course MAE 336: Heat Transfer is the required course offered at UB. Also, this course will be considered as equivalent to ME F220: Heat Transfer a required core course offered at BITS Pilani.
㉛	Course MAE 334: MAE Laboratory I is the required course offered at UB. Also, this will be considered as the 1st Discipline course out of 4 required courses at BITS, either as a project type course or a new elective to be introduced.
㉜	Course MAE 385: Engineering Materials Lab is the required course offered at UB. Also, this lab will be part of ME F216: Materials Science and Engineering required at BITS as specified under 14 above.
㉝	This course would be the 1st required course under the Professional/Science Track pool out of the total 2 required courses under this category at UB. Also, this course will be considered as the 4th Open Elective course out of 5 required at BITS.
㉞	MAE 467: Vibration and Shock I would be offered as an MAE technical elective, which would be the 1st MAE Technical Elective out of the total required 3 courses required under this category at UB. This will also be considered as the 2nd Discipline Elective course out of 4 required at BITS. Students should select this course from the pool of MAE technical electives offered at UB in such a way that the selected course will also fulfill the requirement of a course at BITS offered under the pool of Discipline electives category.
㉟	Course MAE 451: Design Process & Methods is the required course offered at UB. Also, this will be equivalent to BITS F456: Capstone Project I to be offered at BITS Pilani. All BITS-UB students have to do two Capstone Projects in place of Practice School II/Thesis.
㊱	Course MAE 494: Design Project is the required course offered at UB. Also, this will be equivalent to BITS F457: Capstone Project II to be offered at BITS Pilani. All BITS-UB students have to do two Capstone Projects in place of Practice School II/Thesis.
㊲	Course MAE 338: MAE Laboratory II is the required course offered in 3rd year at UB. Also, this will be equivalent to ME F341: Prime Movers & Fluid Machines a required core course offered at BITS Pilani.

Symbol	Description
㊳	Course MAE 377: Product Design in a CAE Environment offered at UB. Also, this will be treated as equivalent to ME F318: Computer Aided Design a required core course offered at BITS Pilani.
㊴	This course would be the 2nd MAE Technical Elective out of the total required 3 courses required under this category at UB. This would also be considered as the 3rd Discipline Elective course out of 4 required at BITS. Students should select this course from the pool of MAE technical electives offered at UB in such a way that the selected course will also fulfill the requirement of a course at BITS offered under the pool of Discipline electives category.
㊵	This would be the 2nd Humanities Elective (HUEL) out of total required 3 HUELs. Students should select this course in such a way that the selected course will not only fulfill the requirement of a course at UB offered under Thematic or Global Pathway category but also fulfill Humanities electives requirement of BITS Pilani. Thus it will fulfill the requirement of 2nd course under Thematic or Global Pathway category out of the total required 4 courses required under this category.
㊶	This would be the 3rd Humanities Elective (HUEL) out of total required 3 HUELs. Students should select this course in such a way that the selected course will not only fulfill the requirement of a course at UB offered under Thematic or Global Pathway category but also fulfill Humanities electives requirement of BITS Pilani. Thus it will fulfill the requirement of 3rd course under Thematic or Global Pathway category out of the total required 4 courses required under this category.
㊷	This course would be the 3rd MAE Technical Elective out of the total required 3 courses required under this category at UB. This would also be considered as the 4th Discipline Elective course out of 4 required at BITS. Students should select this course from the pool of MAE technical electives offered at UB in such a way that the selected course will also fulfill the requirement of a course at BITS offered under the pool of Discipline electives category.
㊸	This course would be the 2nd required course under the Professional/Science Track pool out of the total 2 required courses under this category at UB. Also, this course can be considered as the 5th Open Elective course out of 5 required at BITS.
㊹	This would be the 4th course at UB offered under Thematic or Global Pathway category. Also, this course may be considered as the 6th Open Elective course out of 5 required at BITS.