B.E. Computer Science at BITS Pilani and B.S. Computer Science at UB

Program Plan, Semester wise Pattern and Credit Arrangements

Schedule A1 – Credit Map detailing

The collaborative 'dual degree' programmes at the international level will 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 under BITS-UB collaboration is given in Table 1. In this 4-year collaborative 'dual degree' programme, students will spend the first two years along with a summer term (if required) at BITS Pilani campuses before transferring to the University at Buffalo in the USA for the remaining two years (i.e., years 3 and 4) of their study period. To fulfil the requirements, the programme mapping has been done to fulfil the degree requirements of both the Universities. The semester-wise pattern for students admitted to B.E. Computer Science (BITS) / B.S. Computer Science (UB) programme to be offered under BITS – UB is given below.

The courses mentioned in the semester-wise pattern in years 1 and 2 along with 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 unit offered at BITS Pilani is equivalent to a 1 credit point 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 for the UB degree UB will transfer the number of credits assigned by BITS to its courses.

Students enrolled into the 2+2 UBITS International Collaborative Programme are required to transfer to the UB Campus in USA to complete Year 3 and Year 4 program requirements. In order to progress to the University at Buffalo as part of the BITS-UB International Collaboration Programme, students should have at the end of their first two years a CGPA of at least 6.0, with no BITS course fulfilling a UB degree requirement having a grade below D (grade point 4.0) in such courses. In addition, students must receive passing grades (D grade or better) in courses completed via the UB online mode that serve as prerequisites for other UB degree requirements.

Table 1: Semester-wise Pattern for Students Admitted to B.E. Computer Science at BITS Pilani and B.S. Computer Science at UB under BITS – UB 2+2 International Collaborative Programmes

Table 1: Semester-wise Pattern for Students Admitted to B.E. Computer Science under BITS – UB									
Year	**First Semester**			**U**	**Second Semester**				**U**
	BIO	F101	Introduction to Biological Sciences①	3	ME	F112	Workshop Practice⑧		2
	CHEM	F101	Fundamentals of Chemistry②	3	BITS	F111	Thermodynamics⑨		3
	MATH	F101	Multivariable Calculus③	3	CS	F111	Computer Programming⑩		4
	PHY	F101	Oscillations and Waves ④	3	EEE	F111	Electrical Sciences⑪		3
	BITS	F110	Engineering Graphics⑤	2	MATH	F102	Linear Algebra and Complex Variables ⑫		3
	BITS	F101	Navigating Campus Life and Living Well⑥	1	MATH	F113	Probability and Statistics ⑬		3
	BITS	K101	Physical Fitness, Health Well-being and Creative Arts ⑥	1	BITS	F102	Innovation and Design Thinking⑭		1
	ELI	100 or 105	Intro to Academic Writing or Writing and Rhetoric (offered by UB to fulfill UBC CL1 requirement)⑦	3 Or 4	PHY	108	Physics ⑮		4
				19/20					**23**
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). ⑯									4
Humanities Elective (The course is required to offered to fulfill Humanities Elective Requirement at BITS and <PW1> at UB) ⑰**<PW1>**									3
Year	**First Semester**			**U**	**Second Semester**				**U**
II	MATH	F211	Mathematics III ⑱	3	ECON Or MGTS	F211 Or F211	Principles of Economics ㉔ Or Principles of Management ㉔		3
	CS	F214	Logic in Computer Science ⑲	3	CS	F211	Data Structures & Algorithms ㉕		4
	CS	F222	Discrete Structure for Computer Science⑳	3	CS	F212	Database Systems ㉖		4
	CS	F213	Object Oriented Programming㉑	4	CS	F351	Theory of Computations ㉗		3
	CS	F215	Digital Design㉒	4	BITS	F225	Environmental Studies ㉘**<PW2>**		3
	EAS	360	STEM Communications ㉓	3	DIV		Thematic Pathway List 1 Course to satisfy Diversity requirement ㉙**<PW3>**		3
				20					**20**
Year	**First Semester**			**U**	**Second Semester**				**U**
III	CSE	331	Algorithms and Complexity ㉚	3	CSE	305	Introduction to Programming Languages ㉟		4
	CSE	220	Systems Programming ㉛	4	CSE	3/400	CSE Elective㊱		4
	MTH	309	Linear Algebra ㉜	4	CSE	379	Microprocessors (HW Area course) ㊲		4
	CSE	341	Computer Organization㉝	3	CSE	431	Algorithms Analysis and Design (Theory Area course) ㊳		3

Table 1: Semester-wise Pattern for Students Admitted to B.E. Computer Science under BITS – UB									
Year	**First Semester**			**U**	**Second Semester**			**U**
	EAS	198	UB Seminar ㉝	1				
	PHY	158	General Physics II Lab㉞	1				
				16				**15**
IV	CSE	3/400	Security Area course ㊴	3	CSE	442	Software Engineering (Capstone 2) ㊸	3
	CSE	3/400	AI Area course ㊵	4	CSE	489	Modern Networking Concepts (HW area specialization course) ㊹	3
	CSE	450	Hardware Software Integrated Design 1 (Capstone 1) ㊶**<PW4>**	3	CSE	490	Computer Architecture (HW area specialization course) ㊺	3
	PW		Pathway Course ㊷**<PW5>**	3			Pathway Course ㊼**<PW6>**	3
	CSE	421	Introduction to Operating Systems (SS course) ㊸	3	CSE	443	Compilers ㊽	4
					UBC	399	UB Curriculum Capstone㊾	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. The actual units mapping of the courses shall be decided based on the equivalent courses offered at BITS Pilani and UB.
2. The details of an encircled number given against the selected courses in the semester-wise pattern are given below:

Symbol	Description
①	Course BIO F101: Introduction to Biological Sciences is a required course at BITS Pilani. It will be offered to meet the graduation requirements of BITS Pilani. This course will satisfy a 100-Level Technical Elective (CSE 199 substitute) requirement at UB. (Students may be allowed to choose even other BITS courses (e.g., BITS F111, MATH F102, CS F212, CS F214, CS F351) to satisfy UB's 100-level requirement, but this course seems just as good as any other, and can be used consistently between programs).
②	Course CHEM F101: Fundamentals of Chemistry is a compulsory foundation course at BITS Pilani. It will be considered as equivalent to CHE 999 at UB, and an acceptable substitute for the CHE 107: General Chemistry for Engineers 1 & CHE 113: General Chemistry at UB, and an acceptable substitute for the CHE 127: General Chemistry for Engineers Laboratory 1 degree requirement at UB.
③	Course MATH F101: Multivariable Calculus 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 F101: Oscillations and Waves is a compulsory foundation course at BITS Pilani. It will be considered as equivalent to PHY 107: 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 at UB. This course will not satisfy a degree requirement at UB.
⑥	Course BITS F101: Navigating Campus Life and Living Well, and course BITS K101: Physical Fitness, Health Well-being and Creative Arts are the required courses at BITS Pilani. These will be offered to meet the graduation requirements of BITS Pilani only.
⑦	Course ELI 105: Writing and Rhetoric is the required UB Curriculum 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 HSS F224 English Skills for Academic, 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 BITS F110: Workshop Practice is a required course at BITS Pilani. It will be offered to fulfil the requirements of BITS Pilani only.
⑨	Course BITS F111: Thermodynamics is a required course at BITS Pilani. It will be offered to meet the graduation requirements of BITS Pilani only.
⑩	Course CS F111: Computer Programming is a compulsory foundation course at BITS Pilani. It will be considered as equivalent to CSE 115: Introduction to Computer Science I / EAS 230: Engineering Computations a required course offered at UB.
⑪	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.
⑫	Course MATH F102: Linear Algebra and Complex Variables is a required course at BITS Pilani. It will be offered to meet the graduation requirements of BITS Pilani only.
⑬	Course MATH F113: Probability and Statistics is a compulsory foundation course at BITS Pilani. It will be considered as equivalent to EAS 305: Applied Probability and Statistics, a required course offered at UB.
⑭	Course BITS F102: Innovation and Design Thinking are the required courses at BITS Pilani. It will be offered to meet the graduation requirements of BITS Pilani only.
⑮	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.
⑯	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 would then take ELI 105 in the summer between Year 1 and Year 2, offered remotely by UB).

⑰	The course is required to fulfill Humanities Elective Requirement at BITS. This would be the 1st Humanities Elective (HUEL) out of total required 3 HUELs at BITS. At UB this course will satisfy the global pathway list 2. – These courses need to articulate to Global 2 TR 999TRHUM
⑱	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.
⑲	Course CS F214: Logic in Computer Science is a required course at BITS Pilani. It will be offered to meet the graduation requirements of BITS Pilani only.
⑳	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.
㉑	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.
㉒	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.
㉓	Course EAS 360: STEM Communications is the required course offered at UB. It will be offered by UB through online mode. It will be considered as an equivalent to BITS F112: Technical Report Writing a required foundation course at BITS Pilani.
㉔	Course ECON F211 Principles of Economics OR MGTS F211: Principles of Managements is a required course at BITS Pilani. It will be offered to meet the graduation requirements of BITS Pilani only.
㉕	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.
㉖	Course CS F212: Database Systems is a required course at BITS Pilani. It will be offered to meet the graduation requirements of BITS Pilani only.
㉗	Course CS F351: Theory of Computations is a required course at BITS Pilani. It will be offered to meet the graduation requirements of BITS Pilani only.
㉘	BITS F225: Environmental Studies is a required foundation course at BITS. It will be considered equivalent to EVS 118: Intro Environment and Sustainability Studies offered at UB. EVS 118: Intro Environment and Sustainability Studies also fulfills the requirement of a course at UB offered under Thematic Pathway category (list 2). Thus, it will fulfill the requirement of a 3 credit hour course under Thematic Pathway (Environment Track) out of the total required 9 credits required under the Thematic Pathway category.
㉙	This would be the 2nd Humanities Elective (HUEL) out of total required 3 HUELs for BITS. The course will also fulfill the requirement of a course at UB offered under Thematic category. This course will satisfy the Diversity in the United States requirement. This course will be offered by UB through online mode.

㉚	Course CSE 331: Algorithms and Complexity is the required course offered at UB. Also, this course will be considered as the 3rd Open Elective for the BITS Requirement.
㉛	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.
㉜	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.
㉝	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.
㉞	Course PHY 158: General Physics II Lab is the required course offered at UB. It will be offered to meet graduation requirements of UB only.
㉟	The course CSE 305: 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. This course will satisfy the CSE 300/400-Level Technical Elective requirement at UB.
㊱	A 300 or 400 level CSE elective course offered at UB. Also, this course will be considered as the 5th Open Elective for BITS Requirement.
㊲	CSE 379: Introduction to Microprocessor is a hardware areas course. This course will be equivalent to CS F241: Microprocessors and Interfacing, a required core course offered at BITS.
㊳	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. This course will satisfy a CSE 400-Level Technical Elective requirement at UB.
㊴	CSE Security Areas Course satisfies the security area requirement. Also, this will be considered as the 3rd Discipline Elective course out of 4 required at BITS.
㊵	CSE AI Areas Course satisfies the security area requirement. Also, this course will be considered as the 4th Discipline Elective out of 4 required at BITS.
㊶	Course CSE 450: Hardware software integrated design is a required course offered at UB that satisfies the UB capstone experience. This course satisfies the 4th UB pathways requirement – global reflections list 3. 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.
㊷	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 5th

	course under Thematic or Global Pathway category out of the total required 6 courses required under this category.
㊸	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. This course will satisfy a CSE 400-Level Technical Elective requirement at UB.
㊹	Course CSE 442: Software engineering is a required course offered at UB that satisfies the UB capstone experience 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.
㊺	The course CSE 489: Modern Networking Concepts required to be offered at UB. BITS-UB Students shall take the course and this course will be considered as equivalent to a required core course CS F303: Computer Networks offered at BITS Pilani in 3rd Year. This course will not satisfy a degree requirement at UB.
㊻	Course CSE 490: Computer Architecture is a hardware area 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.
㊼	This course will be considered as an additional Open Elective for the 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 6th course under Thematic or Global Pathway category out of the total required 6 courses required under this category.
㊽	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.
㊾	Course UBC 399: UB Curriculum Capstone is the required course offered at UB. It will be offered to meet graduation requirements of UB only.