YEARLY STATUS REPORT - 2020-2021

Part A	
Data of the Institution	
1.Name of the Institution	BIRLA INSTITUTE OF TECHNOLOGY AND SCIENCE
• Name of the Head of the institution	SOUVIK BHATTACHARYYA
• Designation	Vice Chancellor
• Does the institution function from its own campus?	Yes
• Phone no./Alternate phone no.	911596255247
• Mobile no	9836833100
• Registered e-mail	iqac_bits@pilani.bits-pilani.ac.in
• Alternate e-mail address	gsc@pilani.bits-pilani.ac.in, Vidya Vihar Jhunjhunu Dist

• City/Town	Pilani
• State/UT	Rajasthan
• Pin Code	333031
2.Institutional status	
• University	Private
• Type of Institution	Co-education
• Location	Rural
• Name of the IQAC Co-ordinator/Director	GAJENDRA SINGH CHAUHAN
• Phone no./Alternate phone no	01596255626
• Mobile	9413150096
• IQAC e-mail address	iqac_bits@pilani.bits-pilani.ac.in
• Alternate Email address	gsc@pilani.bits-pilani.ac.in
3.Website address (Web link of the AQAR (Previous Academic Year)	http://www.bits-pilani.ac.in/AwardsandAccreditations
4.Whether Academic Calendar prepared during the year?	Yes
5.Accreditation Details	

Cycle	Grade	CGPA	Year of Accreditation	Validity from	Validity to
Cycle 1	Five Star	Nil	2000	07/02/2000	06/02/2005

Cycle 2	A	3.71	2009	29/01/2009	28/01/2014
Cycle 3	A	3.45	2016	16/12/2016	15/12/2021

6.Date of Establishment of IQAC	25/05/2024

7.Provide the list of Special Status conferred by Central/ State Government-UGC/CSIR/DST/DBT/ICMR/TEQIP/World Bank/CPE of UGC etc.

Institution/ Department/Faculty	Scheme	Funding agency	Year of award with duration	Amount
Dr. Kaushar Vaidya	RESPOND	ISRO	2019, 3 Year	17.72
Dr. P N Jha	NASF	ICAR	2019, 3 Year	23.95
Dr. Navneet Gupta	International (INDO-BULGARIA)	DST	2019, 2 year	11.82
Dr. Leela Rani	Research Grant (ERIC-Educational Research and Innovations Committee)	NCERT	2019, 2 year	5.15
Dr. Rajiv Gupta	TMD (Consortium Project)	DST	2019, 5 year	329.89
Dr. Gaikwad Anil Bhanudas	EEQ	SERB	2019, 3 year	50.33
Dr. Aakash Chand Rai	TDP	DST	2020, 2 year	35.96
Dr. Meetha V. Shenoy	SYST	DST	2020, 3 year	39.78
Dr. Anshuman Dalvi	MAJOR PROJECT	UGC- DAE	2017, 4 year	4.45
Dr. Gaikwad Anil	EEQ	SERB	2017, 4	47.19

Bhanudas			year	
Dr. Kiran Bajaj	WoS	DST	2017, 4 year	29.70
Dr. Monika Sandhu	WoS	DST	2017, 3 year	20.80
Dr.Deepak Chitkara	Nanobiotechnology	DBT	2018, 3 year	50.55
Dr. S Murugesan	International (INDO-SPAIN)	DBT	2018, 2 year	60.00
Dr. Anil Jindal	Nanobiotechnology	DBT	2018, 3 year	29.05
Dr. Souvik Bhattacharya	International (INDO-NORWAY)	DBT	2018, 3 year	65.45
Dr. Anupama Mittal	Nanomission	DBT	2018, 3 year	40.57
Dr. H D Mathur	ICPS	DST	2019, 3 year	47.53
Dr. Yash Sharma	ICPS	DST	2019, 3 year	35.58
Dr. Srikanta Routroy	R&D Scheme	DST	2018, 3 year	30.49
Dr. Hitesh Datt Mathur	International-SPARC(INDO-FRANCE)	MHRD	2019, 2 year	42.56
Dr. Srinivas Appari	International-SPARC(INDO-JAPAN)	MHRD	2019, 2 year	28.80
Dr. Arnab Hazra	International-SPARC(INDO-ISRAEL)	MHRD	2019, 2 year	46.12
Dr. H D Mathur	RSOP	CPRI	2019, 3 year	21.09
Dr. Rajeev Taliyan	Nanomission	DST	2017, 3	32.14

			year	
Dr. M M Pandey	Foldscope Scheme	DBT	2018, 2 year	8.00
Dr. D. M. Kulkrani	RESPOND Programme	ISRO	2019, 3 Year	36.29
Dr. Shibu clement	Grant in Aid scheme of Aeronautics R & D Board	DRDO	2019, 2 year	23.01
Dr. Srinivas Krishnaswamy	Mission Innovation call	DST	2020, 3 year	78.61
Dr. Jiss Maria Louis	WOS-A	DST	2019, 3 year	20.68
Dr. M. Srikanth	SHRI	DST	2019, 2 year	32.80
Dr. Sumit Biswas	Rapid Action Project	Wildlife Trust of India	2019, 1 year	1.70
Dr. Vinayak Naik	International (IC-IMPACT, Indo- Canadian)	DST	2019, 2 year	38.31
Dr. Radhika Vathsan	QUest (Quantum Technologies)	DST	2020, 3 year	48.40
Dr. Srikanth Mutnuri	Grand Challenges India	DBT-BIRAC	2020, 2 year	151.92
Dr. Halan Prakash	Multilateral Indo-EU (Horizon H2020 (EU))	DST- EU	2019, 4 year	209.31
Dr. Sunil Bhand	Multilateral (Indo-Swidish SPARC)	SPARC- MHRD	2019, 2 year	51.05
Development Grant	Bio-NEST	BIRAC	2017, 4 year	296.64
Dr. S D Manjare	Local Product Development	DSTE- Goa	2017, 5 year	10.00
Dr. Amrita Chatterjee	Consortium for Scientific	UGC- DAE	2017, 3	11.19

	Research Proposal		year	
Lalit M Bharadwaj, Amity University, CCPIs Prof. Sunil Bhand	Multiinstitute- NASF	ICAR	2016, 4 year	43.08
Prof. Sanket Goel	Technology Development Programme	DST	2019, 3 Year	43.75
Dr. Amrita Priyadarshini	Armament Research Board-Grant-in-aid	DRDO	2019, 3 Year	16.87
Dr. Sridhar Raju	Govt., of Telangana	R & D Project	2019, 2 Year	9.90
Dr. Suchismita Satpathy	Urban water system	DST	2019, 5 Year	57.26
Dr. Santanu Prasad Datta	SEED Division	DST	2019, 3 year	38.40
Dr. Naga Mohan K	Cognitive science research Initiative	DST	2020, 3 year	60.42
Ms Priya latha under Dr. Runa Kumari	Women Scientist Scheme	DST	2020, 3 year	25.34
Dr. Sajeli Begum	FIST	DST	2019, 5 year	134.00
Dr.Anasua Guharay	International Bilteral Cooperation Division	DST	2019, 2 year	6.39
Dr. Prashant Garg	Medical Research Council (UK)	DBT	2015, 6 year	35.00
Dr. Sajeli Begum	FIST	DST	2019, 5 year	134.00
Dr. C. Hota	Ministry of Electronics & Information Technology	Department of Electronics and Information Technology	2015, 5 year	38.30

Dr. K V G Chandra Sekhar	MINISTRY OF SCIENCE & TECHNOLOGY	DBT	2018, 3 year	13.00
Dr. Sabareesh G R	Inter University center for Astronomy and Astrophysics	LIGO India	2018, 3 year	44.81
Dr. Rajitha	L&S Band Airborne SAR Research	ISRO	2017, 4 year	13.58
Dr. Prasanta Kumar Sahu	Ministry of Human Resource Development	SPARC	2019, 2 year	29.39
Dr. Bahurudeen A	Ministry of Human Resource Development	SPARC	2019, 2 year	28.79
Dr. Amit Kumar Gupta	Armament Research Board-Grant-in-aid	DRDO	2016, 4 year	48.74

8.Whether composition of IQAC as per latest NAAC guidelines	Yes
• Upload latest notification of formation of IQAC	View File
9.No. of IQAC meetings held during the year	8
• The minutes of IQAC meeting and compliance to the decisions have been uploaded on the institutional website. (Please upload, minutes of meetings and action taken report)	Yes
10.Whether IQAC received funding from any of the funding agency to support its activities during the year?	No
• If yes, mention the amount	

11.Significant contributions made by IQAC during the current year (maximum five bullets)

1. Institute enabled all teachers with necessary software and hardware infrastructure for online lecture delivery and virtual lab sessions through remote labs

2. Institute organised training workshops / sessions for faculty members and laboratory demonstrators for online learning and evaluation

3. Leadership of the institute ensured smooth transition from physical to virtual classroom to mitigate the lock-down effects

4. Institute has set-up an effective mechanism by way of collaborating with external experts to deal with mental stress and anxiety for stakeholders

12.Plan of action chalked out by the IQAC in the beginning of the Academic year towards Quality Enhancement and the outcome achieved by the end of the Academic year

Plan of Action	Achievements/Outcomes
In view of the circumstances developed due to pandemic, more emphasis was laid on providing online platforms and tools to teachers and students for virtual sessions	Institute Senate constituted a Committee to define guidelines for systematic completion of II Semester AY2019-20 (Jan-July, 2020). BITS leveraged on its vast experience of conducting online programs for industry professionals. Teaching and evaluation components (projects, seminars, assignments) for the leftover curriculum, internship program, and remaining Laboratory experiments were conducted virtually (e.g. Google Meet/Microsoft Teams, Impartus). Pending experiments were demonstrated through novel in-house Remote Labs, videos of experiments from instructors own labs and existing online (YouTube, JoVE, etc.) resources. Appropriate novel and advanced online platform and other logistics for the conduct of daily online teachings for class strengths of 250+ students and Mid/ End -Semester Examinations for class-size of 500+ students were conducted smoothly. The balancing of the number of instruction hours/day in a week was executed in all the Campuses. Semester-end Examinations were also conducted online using proctored modes. The transition to and execution of teaching-learning virtually was extremely smooth while ensuring full academic rigor. Semester II (AY 2019-20) was completed exactly following normal schedule while delivering instructions virtually. This has been a remarkable achievement at scale. In terms of unique pedagogic innovation, the Remote Labs developed at BITS, IoT enabled physical Labs operated over internet, is absolutely novel in India.
Special plan was made to administer online examination and	Implementation and review of decisions for online curriculum delivery and examination was duly monitored by the Academic Undergraduate and Graduate Studies Divisions to ensure Semester completion in stipulated time. For Semester-end Examinations, students were given the choice to select from (a) normalization scheme where the mid-semester marks were extrapolated against 100% OR (b) appearing in online examinations conducted through proctored online assessment modes (Google Forms/Classrooms). For graduating students,

evaluation system	examinations and result declaration were completed by July 25, 2020 and recruiters were informed accordingly. As BITS Pilani was already using the Moodle platform, these tasks were accomplished smoothly on-time. Based on feedback from students and faculty, the evaluation scheme was revised appropriately within government guidelines.
Departments were encouraged to participate and conduct online symposium, workshops and webinars for continuous learning during crisis times.	Faculty members have conducted 70 academic events, delivered 414 invited talks and attended 540 various online events.

13.Whether the AQAR was placed before statutory body?	Yes

- Name of the statutory body

Name	Date of meeting(s)
Management	15/12/2021

14.Whether NAAC/or any other accredited body(s) visited IQAC or interacted with it to Assess the functioning?	Yes

15.Whether institutional data submitted to AISHE

Year	Date of Submission
2020	07/07/2020

Extended Profile

1.Programme	
1.1 Number of programmes offered during the year:	53
1.2 Number of departments offering academic programmes	13
2.Student	
2.1 Number of students during the year	14031
2.2 Number of outgoing / final year students during the year:	3601
2.3 Number of students appeared in the University examination during the year	14031
2.4 Number of revaluation applications during the year	79
3.Academic	
3.1 Number of courses in all Programmes during the year	2378
3.2 Number of full time teachers during the year	821
3.3 Number of sanctioned posts during the year	821
4.Institution	

4.1 Number of eligible applications received for admissions to all the Programmes during the year	135356
4.2 Number of seats earmarked for reserved category as per GOI/ State Govt. rule during the year	00
4.3 Total number of classrooms and seminar halls	166
4.4 Total number of computers in the campus for academic purpose	5161
4.5 Total expenditure excluding salary during the year (INR in lakhs)	30061

Part B

CURRICULAR ASPECTS

1.1 - Curriculum Design and Development

1.1.1 - Curricula developed and implemented have relevance to the local, national, regional and global developmental needs which is reflected in Programme outcomes (POs), Programme Specific Outcomes(PSOs) and Course Outcomes(COs) of the Programmes offered by the University

The mission of BITS Pilani is to prepare young men and women to act as leaders for the promotion of the economic and industrial development of the country and to play a creative role in society. It has the reputation of a highly purposive and innovative university often setting the pace for workable reforms in higher education, suitable and relevant for the Indian cultural milieu. The Institute operates educational programmes at three tiers of education, namely, the Integrated First Degree programmes, Higher Degree programmes and the Doctoral programmes. All programmes in the Institute are designed to allow as many components of science and applied science as are necessary for the graduates of the programmes to function effectively and efficiently in the technological society. BITS is strongly committed to the view that university education must be oriented so as to (i) meet the rapidly changing needs and challenges of the environment, (ii) help people use their

intelligence and become capable of facing unfamiliar, open-ended real-life situations, and (iii) bear an economic relevance to the society.

"Minor programs" are offered as options for first degree students with the intent of encouraging them to add focus to their supplemental learning (outside a major area) as well as recognizing and certifying the knowledge obtained in an area that is outside of their major area. At present twelve minor programs viz. Minor in Aeronautics, Data Science, English Studies, Entrepreneurship, Film and Media, Finance, Materials Science and Engineering, Philosophy, Economics and Politics (PEP), Physics, Public Policy, Robotics and Automation and Water and Sanitation have been designed.

Sustainable Development Goal 6 (SDG 6) focusses on Water and Sanitation and the tasks mentioned in SDG 6. Sanitation is also high on agenda of the Indian Government. Trained Postgraduate and working professionals are of high demand. Bill and Melinda Gates foundation had significantly invested in Water, Sanitation and Hygiene programme and they had funded UNESCO IHE and its 8 partners in developing e learning alliance. The foundation's investment strategy in sanitation requires qualified and trained professionals. International Water Association (IWA) is an association of water professionals around the world and they too predicted the requirement of professional capacity needs in Water and Sanitation. According to IWA "The gap in 2014 was 700,000 individuals, but that gap has widened with the adoption of the Sustainable Development Goals." In partnership with the Bill & Melinda Gates Foundation, IHE Delft has launched a new Master of Science Program in Sanitation.Gates foundation through IHE, Delft would like to transfer this programme to other universities in other countries with partial funding through IHE Delft. Their target is to generate 1000 professionals through their partnership with various Institutes across the world.

File Description	Documents
Upload relevant supporting document	No File Uploaded

1.1.2 - Number of Programmes where syllabus revision was carried out during the year

24

File Description	Documents
Upload the data template	View File
Upload relevant supporting document	No File Uploaded

1.1.3 - Total number of courses having focus on employability/ entrepreneurship/ skill development offered by the

University during the year

1.1.3.1 - Number of courses having focus on employability/ entrepreneurship/ skill development during the year

2334

File Description	Documents
Upload the data template	View File
Upload relevant supporting document	No File Uploaded

1.2 - Academic Flexibility

1.2.1 - Number of new courses introduced of the total number of courses across all programs offered during the year

93

File Description	Documents
Upload the data template	View File
Upload relevant supporting document	No File Uploaded

1.2.2 - Number of Programmes in which Choice Based Credit System (CBCS)/elective course system has been implemented during the year

43

File Description	Documents
Upload the data template	View File
Upload relevant supporting document	No File Uploaded

1.3 - Curriculum Enrichment

1.3.1 - Institution integrates crosscutting issues relevant to Professional Ethics, Gender, Human Values, Environment and Sustainability into the Curriculum

Students admitted at BITS Pilani have to complete the requirements a list of Discipline Core Courses and Discipline Electives. Additionally, students have to also take humanities courses as well as certain science and technology courses. Students should also complete the minimum number of courses and units required in different category including Principles of

Economics, or Principles of Management and Environmental Studies under the head of General Awareness / Professional courses. All the Integrated First Degree programmes described above have a Practice School option which consists of two courses, Practice School I and Practice School II. A student goes to Practice School I of two months' duration during the summer following second year and to Practice School II of five and a half months' duration during the final year. The curriculum, through Practice School, finds a formal method of bringing the reality of professional environment into the educational process. A student is required to complete at least 12 elective courses under the categories of Humanities electives, Discipline electives and Open electives. By judicious choice of these courses a student can obtain depth in his/her discipline and/or expand his/her horizon to gain exposure to one or more other areas of study.

File Description	Documents
Upload relevant supporting document	View File

1.3.2 - Number of value-added courses for imparting transferable and life skills offered during the year

12

File Description	Documents
Upload the data template	View File
Upload relevant supporting document	View File

1.3.3 - Total number of students enrolled in the courses under 1.3.2 above

1.3.3.1 - Number of students enrolled in value-added courses imparting transferable and life skills offered during the year

600

File Description	Documents
Upload the data template	View File
Upload relevant supporting document	No File Uploaded

1.3.4 - Number of students undertaking field projects / research projects / internships during the year

6241

File Description	Documents
Upload the data template	View File
Upload relevant supporting document	No File Uploaded

1.4 - Feedback System

1.4.1 - Structured feedback for design and review of syllabus - semester wise / is received from Students Teachers Employers Alumni	• All 4 of the above

File Description	Documents
Upload relevant supporting document	View File

1.4.2 - Feedback processes of the institution may be classified as follows	• Feedback collected, analysed and action has been taken

File Description	Documents
Upload relevant supporting document	View File

TEACHING-LEARNING AND EVALUATION

2.1 - Student Enrollment and Profile

2.1.1 - Demand Ratio

2.1.1.1 - Number of seats available during the year

4189

File Description	Documents
Upload the data template	View File
Upload relevant supporting document	No File Uploaded

2.1.2 - Total number of seats filled against reserved categories (SC, ST, OBC, Divyangjan, etc.) as per applicable reservation policy during the year (Excluding Supernumerary Seats)

2.1.2.1 - Number of actual students admitted from the reserved categories during the year

00

File Description	Documents
Upload the data template	No File Uploaded
Upload relevant supporting document	View File

2.2 - Catering to Student Diversity

2.2.1 - The institution assesses the learning levels of the studentsand organises special Programmes for advanced learners and slow learners

EVALUATION

All courses are conducted and evaluated in a continuous & internal manner by the faculty who teach these courses. The student registers for a certain number of courses each semester; the year being divided into two semesters, and a summer term, whenever offered. A faculty member, as registration advisor, helps a student to draw up his programme, suitable to his pace and needs, which is made possible by the coursewise time-table of the Institute. Every student gets, incidentally, a training in decision-making through (i) choice of load, i.e. number of courses per semester to suit his/her pace, (ii) selection of his/her own time-table to suit his/her convenience, and (iii) picking up courses as electives to meet his/her own aspirations. It is the responsibility of the student to attend classes regularly and to maintain a required level of scholastic standing.

The performance of a student in each course is assessed by the teacher by means of continuous evaluation throughout the semester in classwork, periodical quizzes (sometimes unannounced), tests (both open and closed book), tutorials, laboratory work, home work, seminars, group discussions, project, etc., and a comprehensive examination at the end of the semester. The student is thereby given a large number of opportunities to carryout various academic assignments and be evaluated. Besides encouraging and rewarding continuous and systematic study, the system provides a constant feedback to the student as to where he/she stands, thus enabling him/her to cultivate regular habits of studying and preparing himself/herself for the future.

The system discards the conventional emphasis on a single final examination and numerical marks as the only absolute indication of the quality of student's performance. Thus, at the end of the semester the teacher of the course awards letter grades A, A–, B, B–, C, C–, D, E to the student based on the total performance of the student and it is relative to the performance of others taking the same course. These letter grades stand for quality of

performance: A (Excellent), A- (Very Good), B (Good), B- (Above Average), C (Average), C- (Below Average), D (Poor) and E (Exposed). Further, these letter grades have points associated with them in a quantified hierarchy: a maximum of 10 (for an A) to a minimum of 2 (for an E). There are also courses in which the teacher awards non-letter grades which have only a qualitative hierarchy. The teacher may also pronounce the performance of a student in a course in terms of certain reports which should not be misconstrued as grades.

Although BITS Pilani does not stipulate a minimum percentage of attendance before a student is permitted to appear in any test/examination, the Institute, being a fully residential university with internal and continuous evaluation system, expects every student to be responsible for regularity of his/her attendance in classrooms and laboratories, to appear in scheduled tests and examinations and to fulfill all other tasks assigned to him/her in every course. The system has adequate resilience to accommodate unforeseen situations through withdrawal from a course, make-up test, feedback from examinations and interaction with teachers. In spite of all these facilities when a student fails to cooperate with the teacher in the discharge of his/her part of the contract to such an extent that the teacher is unable to award any grade, the teacher is authorized to give a "Not Cleared" (NC) report.

A student is deemed to have cleared a course if he/she obtains a grade in the course. However, the educational philosophy of the Institute interlinks and at the same time distinguishes between the performance of a student in a single course and his/her overall cumulative performance. The overall performance of a student is indicated by an index known as the "Cumulative Grade Point Average" (CGPA). It is the weighted average of the grade points of all the letter grades received by the student since his/her entry into the Institute and is expressed on a 10-point scale. In the case of Integrated First Degree programmes the final division for the degree is decided on the basis of CGPA and there are three classifications, namely Distinction, First Division and Second Division. However, in the case of Higher Degree and the Doctoral programmes no division is awarded.

During the student's stay in the Institute, the Institute expects him/her to show a certain minimum performance and progress. The minimum academic requirements regarding the performance and progress for the Integrated First Degrees and Higher Degrees are:

1. A CGPA of at least 4.5 at the end of every semester for integrated First Degree students and 5.5 for Higher Degree/Ph.D. students.
2. Not more than one E grade in a semester for integrated First Degree programmes and no E grade in the Higher Degree programmes.
3. The pace of progress of a student should be such that at any stage of reckoning he/she should not have spent more than 50% extra time than what is prescribed for him/her upto

that stage in his/her programme.

The Institute's Academic Regulations must be consulted regarding the minimum academic requirements for the pursuit of the Ph.D. programme and also for off-campus programmes.

Students who fail to meet the minimum academic requirements stipulated above are put under an appropriate committee which monitors their programmes and give guidance so that they are properly rehabilitated at the earliest. In case of Ph.D., this is done by the Departmental Research Committee (DRC) and Doctoral Counselling Committee and in the case of Higher Degrees and integrated First Degrees this is done by Academic Counselling Board (ACB). These Committees are appointed by the Senate and are given authority to take appropriate action including discontinuance of the student or transfer to other programme.

File Description	Documents
Upload relevant supporting document	View File
Link For Additional Information	Nil

2.2.2 - Student - Full time teacher ratio during the year

Number of Students	Number of Teachers
14031	821

File Description	Documents
Upload relevant supporting document	View File

2.3 - Teaching- Learning Process

2.3.1 - Student centric methods, such as experiential learning, participative learning and problem-solving methodologies are used for enhancing learning experiences

EDUCATIONAL PROCESS

The mission of BITS Pilani is to prepare young men and women to act as leaders for the promotion of the economic and industrial development of the country and to play a creative role in society. It has the reputation of a highly purposive and innovative university often setting the pace for workable reforms in higher education, suitable and relevant for the Indian cultural milieu.

BITS Pilani has been following semester system with continuous and internal evaluation since its inception. The educational programmes are modular and flexible. Through its Practice School programme, BITS Pilani has established purposeful linkages with industries. The Institute has evolved a direction for Research which makes research relevant to the national development and social needs. It has developed and adopted a unique academic administrative structure which makes all its innovations possible and workable.

The Institute operates educational programmes at three tiers of education, namely, the Integrated First Degree programmes, Higher Degree programmes and the Doctoral programmes. All programmes in the Institute are designed to allow as many components of science and applied science as are necessary for the graduates of the programmes to function effectively and efficiently in the technological society. All programmes contain certain structural commonality and the common courses are invariably operated together irrespective of the clientele who are required to take the courses. Similarly, irrespective of the ultimate degree for which a student qualifies, the large factor of this commonality between all students creates an educational basis which provides easy professional linkage, communication and group activity among students graduating in different degrees. This similarity among different students graduating with different degrees is further welded in a stronger professional bond when they work as internees in the Practice School stations or as members in a team working on mission-oriented time-bound research and development projects.

The various structural flexibilities provide not only scope for multiple point entries but also enable the system to accommodate many legitimate educational and operational needs of students.

PROGRAMMES OF STUDIES

All programmes of studies are based on the principle that a series of courses make up the hierarchy of the structure where each course is self-contained but nevertheless acts as a bridge between what precedes and what comes after. A formal contact hour is such that a student is invariably required to spend several times of these hours towards self-study. Attempt here is to awaken curiosity in the mind of the student and train him to think rationally and scientifically and enable him to face the unfamiliar. Through the Practice School option, the flavour of the professional world is sought to be imbibed by the student as well as the teacher. Even many co-curricular activities are converted into a learning situation whereby the growth of a student becomes a continuing operation.

TEACHING-LEARNING PROCESS

The objective of class room education is to awaken the curiosity of the student, generate habits of rational thinking in him/her, gear his/her mind to face the unfamiliar and train him/her to be able to stand on his/her own. With its team of committed and dedicated faculty, BITS Pilani aims at maximizing the learning process through teaching. Through their innovative teaching, the teachers enable the student search for knowledge on his/her own and motivate him/her to use the facilities like the library, laboratory and the environment to optimize his/her learning process. Self-study by the student is therefore an important factor in the planning of teaching and evaluation and in this environment; the student exhibits interest and responds to this challenge. Teaching and evaluation form a unity of function and operate in a climate of mutual understanding and trust.

Every course whether single section or multi-section is conducted by a member of the faculty called instructor-in-charge, with the assistance, where necessary, of the required number of instructors – who will be partners with him in meeting the full academic perceptions and organizational needs of teaching the course and evaluating the students.

Within one week of the beginning of class work, the instructor-in-charge/ instructor announces to his class/section through a hand-out, the necessary information in respect of (i) the operations of the course (its pace, coverage and level of treatment, textbooks and other reading assignments, home tasks etc.); (ii) various components of evaluation, such as tutorials, laboratory exercises, home assignment, project, several quizzes/ tests/ examinations (announced or unannounced, open book or closed book), regularity of attendance, etc., (iii) the frequency, duration, tentative schedule, relative weightage etc. of these various components; (iv) the broad policy which governs decisions about make-up; (v) mid-semester grading; (vi) grading procedure (overall basis, review of border line cases, effect of class average, etc.) and (vii) other matters found desirable and relevant.

PRACTICE SCHOOL

All Integrated First Degree and Higher Degree Programmes of the Institute provide a Practice School option. A student who exercises this option receives, on successful completion of the requirements of the programme, a degree which carries the tag, "With Practice School".

Theme

BITS is strongly committed to the view that university education must be oriented so as to (i) meet the rapidly changing needs and challenges of the environment, (ii) help people use their intelligence and become capable of facing unfamiliar, open-ended real-life situations, and (iii) bear an economic relevance to the society.

The Practice School (PS) method of education links the university with the professional world, by infusing the reality of the world of work into the educational process. The classroom is shifted for a period of 7½ months to a professional location where the students, under the supervision of the faculty, are involved in applying the knowledge acquired in the classroom to finding solutions to real life problems. The PS experiment began with a small group of 12 students in 1973 and has been extended to accommodate all students from all disciplines. The distinguishing features of the PS method of education - (i) the work of the students is supervised and evaluated by faculty, (ii) the credits earned by the student count towards the total credit requirement of the degree, and (iii) the PS option is available to students of all disciplines - make it a bold and radical educational reform with no parallel.

File Description	Documents
Upload relevant supporting document	View File

2.3.2 - Teachers use ICT enabled tools including online resources for effective teaching and learning processes during the year

As per NEP 2019, BITS Pilani ensures an optimal teaching learning environment for using ICT tools in all its academic activities across the campuses.Realizing the importance of Information and Communication Technology (ICT)Professors do regularly combine technology with traditional mode of instruction to engage students for effective learning. In addition to the chalk and talk method of teaching, the faculty members are using the IT enabled learning tools such as PPT,Video clippings, Simulations, Live labs, Audio system, online sources, and Impartus (virtual classroom)platforms to expose the students for advanced knowledge and practical learning.

All classrooms are fully furnished with LCD/OHP/Computers.Most of the faculty use interactive methods for teaching. The major emphasis is on classroom interaction in terms of research paper presentations, seminars, debates, group discussions, assignments, quiz/tests/viva and laboratory work.

Specialized computer labs with an internet connection have been provided to promote independent learning. Wi-Fi facility for access of internet is available on individual laptop and mobile devices.

File Description	Documents
Upload relevant supporting document	View File

2.3.3 - Ratio of students to mentor for academic and other related issues during the year

2.3.3.1 - Number of mentors

210

File Description	Documents
Upload relevant supporting document	View File

2.4 - Teacher Profile and Quality

2.4.1 - Total Number of full time teachers against sanctioned posts during the year

821

File Description	Documents
Upload the data template	View File
Upload relevant supporting document	No File Uploaded

2.4.2 - Total Number of full time teachers withPh.D./D.M/M.Ch./D.N.B Superspeciality/D.Sc./D'Lit. during the year

756

File Description	Documents
Upload the data template	View File
Upload relevant supporting document	No File Uploaded

2.4.3 - Total teaching experience of full time teachers in the same institution during the year

2.4.3.1 - Total experience of full-time teachers

7236

File Description	Documents
Upload the data template	View File
Upload relevant supporting document	No File Uploaded

2.4.4 - Total number of full time teachers who received awards, recognition, fellowships at State, National,

International level from Government/Govt. recognised bodies during the year

8

File Description	Documents
Upload the data template	View File
Upload relevant supporting document	No File Uploaded

2.5 - Evaluation Process and Reforms

2.5.1 - Number of days from the date of last semester-end/ year- end examination till the declaration of results during the year

2.5.1.1 - Number of days from the date of last semester-end/ year- end examination till the declaration of results year wise during the year

45

File Description	Documents
Upload the data template	View File
Upload relevant supporting document	View File

2.5.2 - Total number of student complaints/grievances about evaluation against total number appeared in the examinations during the year

79

File Description	Documents
Upload relevant supporting document	No File Uploaded

2.5.3 - IT integration and reforms in the examination procedures and processes (continuous internal assessment and end-semester assessment) have brought in considerable improvement in examination management system of the institution

Birla Institute of Technology and Science, Pilani (BITS Pilani) is a completely ICT enabled university and everything related to the student registration, class timetable, examination system are run through ERP.

The institute has been continuously carrying out of reforms in its examination procedure through integration of IT in all the procedures and processes of the examination system. The reforms have also been implemented in the continuous internal assessments modes and components. Examination procedure has been completely automated using ERP & Proctored Based software.

The central computing facility of BITS Pilani referred to as the IPC (Information Processing Centre) hosts and manages the computing/ networking infrastructure for the campus. The infrastructure includes local and external connectivity including email as well as computer services. IPC operates early morning to midnight on 365 days a year. Some specialized labs/centers offer round the clock computing facility.

The SDET Unit incorporates the Centre for Software Development (CSD) as well as Centre for Educational Technology (CET). The unit has a mandate to include in its scope of work to include identification, establishment, deployment and evolution of appropriate educational technology in order to support effective resource utilization of expertise (teaching / mentoring / collaboration) available at various campuses as well as enable students and faculty involved in various off-campus work-integrated learning programmes of the institute.

The centre for Educational Technology is the second major centre run by the Software Development and Educational Technology Unit at BITS-Pilani. It comprises of modern digital video studio and is equipped with the satellite (EDUSAT) - based as well as leased line based high-quality video-conferencing facilities. Its main objective is to facilitate Online Lectures, interactions, on-demand services and web-based seminars for the Off-campus Work-Integrated learning programme of the Institute, delivery of live interactive lectures to university's various campuses.

Birla Institute of Technology & Science, Pilani (BITS Pilani) has been signed an agreement with Induslynk Training Services Pvt. Ltd. (Mercer Mettl), for providing software support for conducting Proctored Based Online Examination operating on three levels to register suspicious events: recording actions, analyzing behavior, and live supervision. The BITS Pilani has conducted tests, mid-semester test and comprehensive (end semester) examination using proctored based online tool. With regards to candidates' educational experience, remote proctoring was met with mixed feelings.

File Description	Documents
Upload relevant supporting document	View File

A. 100% automation of entire division &

2.5.4 - Status of automation of Examination division along with approved Examination Manual	implementation of Examination Management System (EMS)

File Description	Documents
Upload the data template	View File
Upload relevant supporting document	View File

2.6 - Student Performance and Learning Outcomes

2.6.1 - The institution has stated learning outcomes (generic and programme specific)/graduate attributes which are integrated into the assessment process and widely publicized through the website and other documents

BITS Pilani has been following semester system with continuous and internal evaluation since its inception. The educational programmes are modular and flexible. Through its Practice School programme, BITS Pilani has established purposeful linkages with industries. The Institute has evolved a direction for Research which makes research relevant to the national development and social needs. It has developed and adopted a unique academic administrative structure which makes all its innovations possible and workable.

All programmes contain certain structural commonality and the common courses are invariably operated together irrespective of the clientele who are required to take the courses. Similarly, irrespective of the ultimate degree for which a student qualifies, the large factor of this commonality between all students creates an educational basis which provides easy professional linkage, communication and group activity among students graduating in different degrees. This similarity among different students graduating with different degrees is further welded in a stronger professional bond when they work as internees in the Practice School stations or as members in a team working on mission-oriented time-bound research and development projects. The various structural flexibilities provide not only scope for multiple point entries but also enable the system to accommodate many legitimate educational and operational needs of students.

All programmes of studies are based on the principle that a series of courses make up the hierarchy of the structure where each course is self-contained but nevertheless acts as a bridge between what precedes and what comes after. A formal contact hour is such that a student is invariably required to spend several times of these hours towards self-study. Attempt here is to awaken curiosity in the mind of the student and train him to think rationally and scientifically and enable him to face the unfamiliar. Through the Practice School option, the flavour of the professional world is sought to be imbibed by the student

as well as the teacher. Even many cocurricular activities are converted into a learning situation whereby the growth of a student becomes a continuing operation.

The Institute also conducts Off-campus Work Integrated degree programmes as a means of continuing education for employed professionals as part of the human resource development programmes of specific organizations at the various off-campus centres. In all these programmes, emphasis is on self-learning and the pedagogy attempts to incorporate as many modern technologies as desirable. While each one of these programmes requires collaboration of an organization, some programmes have a highly structured collaboration with planned classroom activities and some programmes may have less structured planning. While a number of degrees are offered through structured collaboration with many collaborating organizations, there are also degrees, which are available in an open manner for a large number of organizations, each of which may sponsor only few students. For all these programmes, faculty/resource persons are drawn from the Institute and the participating organizations as well as other Institutions.

File Description	Documents
Upload relevant supporting document	View File

2.6.2 - Attainment of Programme outcomes, Programme specific outcomes and course outcomes are evaluated by the institution during the year

BITS Pilani has a system in place for measuring the levels of attainment of course outcomes, programme specific outcomes and programme outcomes by collecting feedback from various means.

Attainment of the Course Outcomes

The course outcomes are measured by adopting best practices of teaching, learning, and evaluation processes at BITS Pilani. These processes at BITS Pilani is considered to be indivisible entity. While the teacher has the freedom to adopt his/her own teaching style, it is his/her responsibility to carry out student evaluation in a continuous manner, culminating in the award of a set of qualitative letters (or non-letter) grades for each course. For the successful operation of the internal assessment scheme, teachers share their teaching plan and assessment scheme with their students at the beginning of the semester. This is done through a 'Course Handout'. Clause 4 of the Academic Regulations spells out the instructor's responsibilities in this respect. As soon as a course has been assigned to a teacher or a team of teachers, the instructor-in-charge, in consultation with his/her team will take the necessary steps to prepare the details of the 'Course Handout' which has been

distributed to the students within the first week of the start of the classwork by the respective instructor. The instructor or the team of instructors make a comprehensive plan in respect of conducting the course even before the semester begins and in a multi-section course remain in continuous interaction in order to ensure a smooth operation of the course. While recognizing variations due to personal attitudes and styles, it is important that these are smoothened out so that the operation and grading in the different sections in a course, indeed between courses across the Institute, are free from any seeming arbitrariness.

The instructor-in-charge/instructor announces to his/her class/section through a course handout the necessary information in respect of (i) the operations of the course (its pace, coverage, and level of treatment, textbooks and other reading assignments, home tasks, etc.); (ii) various components of evaluation, such as tutorials, laboratory exercises, home assignment, several quizzes/tests/examinations (announced or unannounced, open book or closed book), regularity of attendance, etc., (iii) the frequency, duration, tentative schedule, relative weightage, etc. of these various components; (iv) the broad policy which governs decisions about make-up; (v) mid-semester grading; (vi) grading procedure (overall basis, review of borderline cases, the effect of class average, etc.) and (vii) other matters found desirable and relevant. The different components of evaluation used to be evenly spread out in the semester and aim to draw out a response from the student in regard to various attributes like spontaneous recall, ability to apply known concepts, capacity to work on his/her own, competence in conceptualized arguments, ability to face unknown situations, etc. At least one of the components (examination) is required to be comprehensive enough to include the whole course and being held at the end of the semester. Also, at least 20% of the evaluation component are kept as the open book for first degree courses and 40% for the higher degree courses.

Just as evaluation is done in a continuous manner, it is also ensured that the feedback is given in a continuous manner. Thus the answerscripts are promptly evaluated, shown to the students for them to obtain any clarification on their own performance, and returned to the students whenever practicable. The performance of the students in the examination should be discussed in the class giving as much detail as possible like the highest, lowest and average performances.

At the conclusion of the semester, a student is awarded a grade in each of the courses they have taken during this period. The grade awarded to a student in a course will depend on their total performance in all the evaluation components as designed by the instructor-in-charge. The instructor-in-charge of a course maintains the full records of each student's

attendance, performance in different evaluation components, section/ class average, mid-semester grading, copies of question papers, etc.

Attainment of the Programme Specific Outcomes

The programme specific outcomes is measured by taking the aggregate result of all courses in a given programme of an individual student. Firstly, a student's performance is assessed in a given course, and qualitative letter grades from A to E are awarded to the students in that course at the end of the semester. Finally, the Cumulative Grade Point Average (CGPA) is evaluated to describe the overall performance of a student in all courses (required for a given programme) in which he/she is awarded letter grades, since his/her entry into the Institute up to and including the latest semester/term as per the procedure given in this clause. It is also used to declare division when the program is completed. It is the weighted average of the grade points of all the letter grades received by the student from his/her entry into the Institute. A student's grades, CGPA, etc. are recorded on a grade sheet at the end of every semester/term, a copy of which is issued to all the students registered in a given programme.

Attainment of the Programme Outcomes

The general programme outcomes for First Degree, Higher Degree, and Ph.D. programmes all across the disciplines of study in the Institute are that the students contribute to the existing body of knowledge by discovery, innovation, problem-solving, establishing of the new perspective, etc. The number of students who completed FD/HD/PhD during the assessment period is evidence of the attainment of the programme outcomes. Program outcomes at the First Degree and Higher degree levels are measured through students' going for higher studies in world-class higher education institutions of repute and students' remarkable/excellent placement record in companies and institutions.

Weblink of Placement :https://www.bits-pilani.ac.in/placements

Weblink of Academic: https://academic.bits-pilani.ac.in/

File Description	Documents
Upload relevant supporting document	No File Uploaded

2.6.3 - Number of students passed during the year

2.6.3.1 - Total number of final year students who passed the university examination during the year

3489

File Description	Documents
Upload the data template	View File
Upload relevant supporting document	No File Uploaded

2.7 - Student Satisfaction Survey

2.7.1 - Student Satisfaction Survey (SSS) on overall institutional performance (Institution may design its own questionnaire) (results and details need to be provided as a web link)

https://www.igauge.in/rating/birla-institute-of-technology-and-science-pilani-bits-pilani

RESEARCH, INNOVATIONS AND EXTENSION

3.1 - Promotion of Research and Facilities

3.1.1 - The institution Research facilities are frequently updated and there is well defined policy for promotion of research which is uploaded on the institutional website and implemented

Research is an integral and important part of any higher education system. BITS Pilani, actively promotes research among its staff and students. In addition to basic research, which is the backbone of any applied research, the Institute also gives adequate importance and support to applied research.

Research at BITS relies on the motivated intellectual manpower pool available among its staff and students. Students undertake research projects as a component of their education programme itself. Teachers conduct research as an integral part of their responsibilities since this enables them to assimilate and disseminate the knowledge as well as generate new knowledge. In addition to this, BITS has devised innovative schemes to enable professionals-at-large to conduct research at their place of work and simultaneously work for the Ph.D. degree of the Institute.

At BITS Pilani, the faculty are encouraged to publish their findings in reputed journals and present papers at conferences. Support is given to participate in national and international conferences and thereby network with experts from India and abroad. Recently, the Institute has taken steps to provide support to faculty to file for patents if the research is likely to fructify in a commercially viable products or processes. During the last 5 years, BITS has seen a healthy growth in the amount of funding received from different agencies. While most of these are from the government sector, the Institute through its existing

collaboration with industries is trying to involve the corporate sector in funding of research projects.

Promotional Efforts for Research at Doctoral Level

We take special efforts to interest our students in research. Through various schemes, scholarships and grants, we try and develop students into junior faculty members. Some of these schemes are:

- Faculty Development Scheme
- Various research scholarships given by agencies like CSIR, UGC, DST, DRDO and ICMR
- Seed Grant Scheme of the Institute
- The Aditya Birla Group scheme for research funding
- Arrangements for research at centers outside the university likeCDRI, Lucknow; ITRC, Lucknow; Uniformed Services University of the Health Sciences (USUHS), Bethesda, Maryland, USA
- Ph.D. Aspirants' Scheme

Infrastructural Support for R&D

The Institute through its faculty recruitment drive has been constantly adding manpower at the senior level to provide leadership for R&D and at junior levels to provide research work force. As a result of this effort, during this year, a number of faculty members and students at both these levels have joined.

Research facilities exist to support our existing efforts in almost all areas of research.. For example, the Institute has an Animal House (Central Animal Facility), which is a CPCSEA approved facility and a Green House along with a new Tissue Culture laboratory. The areas of energy and environmental studies, fibre optics, computer aided analysis and design, flexible manufacturing systems, digital systems, VLSI and embedded systems, communications, robotics and intelligent systems, biotechnology, drug design and delivery systems, image processing, power electronics, materials science and technology, etc. have been strengthened. A number of PC-Based systems and instruments have been added in various laboratories. Research facilities in areas of CAD, Robotics, Fibre Optics, Microelectronics, Materials Science and Technology, Biotechnology, Drug Design and Delivery and FMS areas have been augmented. Some experimental set-ups for process control and materials research have also been acquired. Various Groups and Centres, under UGC X Plan Fund, UGC SAP and DST FIST Fund have purchased several equipments/instruments. Internet facility has been augmented for providing global information access. Furthermore, Motorola (India) has established an Embedded Controllers

Applications Centre at BITS. Tata IBM has established IBM Java Competency Centre and it is aimed at high quality people repository in software technologies. A state of the art VLSI design Laboratory called as Oyster Lab. has been set up. A Centre for Women Studies for gender related research and extension activities, a Radio- Isotope Laboratory, having atomic absorption spectro-photometer, −ραψ source & various radio-isotopes, a Biotechnology Laboratory having modern research tools such as Multi-channel Analyzer, Refrigerated Centrifuge etc., have also been set up to strengthen the research infrastructure. Also a number of machines and equipments have been added to the existing labs. For example, Industrial CNC Industrial Vertical Machining Centre (LMW KODI-40 Klein), CNC Turning Centre (XLTURN), CNC Train Master T-70 (HMT) Lathe have been added to FMS Lab. and facility has been created for CNC training and research. Similarly, acoustic emission equipment, acousto-ultrasonic equipment, microprocessor controlled servo- hydraulic UTM etc. have been added to the Centre for Materials Science and Technology for advanced research in materials area. Also a campus wide computer network – NEURON (Next Generation Enabled University-wide Redundant Optical Network) gives a big boost to research activities at the Institute. A new National MEMS Design Centre has also been established.

In the BITS Pilani, K.K. Birla Goa Campus, new laboratories such as micro-electronics, optics, & environmental and applied biotechnology have been added. New equipments such as a Sapphire Laser System, second harmonic generator, optical table with pneumatic support and ultracentrifuge have been procured.

https://www.bits-pilani.ac.in/university/fad/FacilitiesAndBenefits

File Description	Documents
Upload relevant supporting document	View File

3.1.2 - The institution provides seed money to its teachers for research (amount INR in Lakhs)

17.27

File Description	Documents
Upload the data template	View File
Upload relevant supporting document	No File Uploaded

3.1.3 - Number of teachers receiving national/ international fellowship/financial support by various agencies for advanced studies/ research during the year

9

File Description	Documents
Upload the data template	View File
Upload relevant supporting document	No File Uploaded

3.1.4 - Number of JRFs, SRFs, Post-Doctoral Fellows, Research Associates and other research fellows enrolled in the institution during the year

1696

File Description	Documents
Upload the data template	View File
Upload relevant supporting document	No File Uploaded

3.1.5 - Institution has the following facilities to support research Central Instrumentation Centre Animal House/Green House Museum Media laboratory/Studios Business Lab Research/Statistical Databases Moot court Theatre Art Gallery	A. Any 4 or more of the above

File Description	Documents
Upload relevant supporting document	View File

3.1.6 - Number of departments with UGC-SAP, CAS, DST-FIST, DBT, ICSSR and other recognitions by national and international agencies during the year

19

File Description	Documents
Upload the data template	View File
Upload relevant supporting document	No File Uploaded

3.2 - Resource Mobilization for Research

3.2.1 - Extramural funding for Research (Grants sponsored by the non-government sources such as industry, corporate

houses, international bodies for research projects) endowments, Chairs in the University during the year (INR in Lakhs)

638.63

File Description	Documents
Upload the data template	View File
Upload relevant supporting document	No File Uploaded

3.2.2 - Grants for research projects sponsored by the government agencies during the year (INR in Lakhs)

22458

File Description	Documents
Upload the data template	View File
Upload relevant supporting document	No File Uploaded

3.2.3 - Number of research projects per teacher funded by government and non-government agencies during the year

159

File Description	Documents
Upload the data template	View File
Upload relevant supporting document	No File Uploaded

3.3 - Innovation Ecosystem

3.3.1 - Institution has created an eco-system for innovations including Incubation centre and other initiatives for creation and transfer of knowledge

Centre for Innovation, Incubation & Entrepreneurship (CIIE)

Centre for Innovation, Incubation and Entrepreneurship (CIIE) at BITS Pilani across its 4 campuses continuously work in an integrated manner to strengthen the on-campus ecosystem to promote innovation, entrepreneurship and incubation taking care of all related academic and non-academic activities. The mandate of the CIIE includes facilitating technology transfer &

commercialization, executing filing of patents, custodian of intellectual property of BITS, supporting entrepreneurial activities, interfacing with Technology business incubators of all campuses and fostering collaboration with alumni and industry for several entrepreneurial activities.

Pilani Innovation and Entrepreneurship Development Society

Pilani Innovation and Entrepreneurship Development Society (PIEDS) at BITS Pilani – Pilani Campus established in 2013 gives a distinct emphasis on creation of technology/innovation based new enterprises. The society takes up various activities to promote and encourage technology based innovation, incubation & entrepreneurship development. The main objectives of the society are to aid and help startup teams in the creation of technologies/innovations addressing market/societal needs; to foster the entrepreneurial spirit among students, faculty and community; and to provide mentoring, consulting, networking & funding services to aspiring innovators and entrepreneurs.

File Description	Documents
Upload relevant supporting document	View File

3.3.2 - Number of workshops/seminars conducted on Research Methodology, Intellectual Property Rights (IPR), Entrepreneurship and Skill Development during the year

3.3.2.1 - Total number of workshops/seminars conducted on Research methodology, Intellectual Property Rights (IPR), entrepreneurship, skill development year wise during the year

32

File Description	Documents
Upload the data template	View File
Upload relevant supporting document	View File

3.3.3 - Number of awards / recognitions received for research/innovations by the institution/teachers/research scholars/students during the year

3.3.3.1 - Total number of awards / recognitions received for research/innovations won by institution/teachers/research scholars/students year wise during the year

104

File Description	Documents
Upload the data template	View File
Upload relevant supporting document	No File Uploaded

3.4 - Research Publications and Awards

3.4.1 - The institution ensures implementation of its stated Code of Ethics for research

3.4.1.1 - The institution has a stated Code of Ethics for research and the implementation of which is ensured through the following • **Inclusion of research ethics in the research methodology course work** • **Presence of institutional Ethics committees (Animal, chemical, bio-ethics etc)** • **Plagiarism check** • **Research Advisory Committee**	A. All of the above

File Description	Documents
Upload relevant supporting document	View File

3.4.2 - The institution provides incentives to teachers who receive state, national and international recognitions/awards Commendation and monetary incentive at a University function Commendation and medal at a University function Certificate of honor Announcement in the Newsletter / website	D. Any 1 of the above

File Description	Documents
Upload the data template	View File
Upload relevant supporting document	No File Uploaded

3.4.3 - Number of Patents published/awarded during the year

3.4.3.1 - Total number of Patents published/awarded year wise during the year

31

File Description	Documents
Upload the data template	View File
Upload relevant supporting document	No File Uploaded

3.4.4 - Number of Ph.D's awarded per teacher during the year

3.4.4.1 - How many Ph.D's are awarded during the year

118

File Description	Documents
Upload the data template	View File
Upload relevant supporting document	View File

3.4.5 - Number of research papers per teacher in the Journals notified on UGC website during the year

2916

File Description	Documents
Upload the data template	View File
Upload relevant supporting document	No File Uploaded

3.4.6 - Number of books and chapters in edited volumes published per teacher during the year

3.4.6.1 - Total number of books and chapters in edited volumes / books published, and papers in national/international conference-proceedings during the year

1132

File Description	Documents
Upload the data template	View File
Upload relevant supporting document	No File Uploaded

3.4.7 - E-content is developed by teachers For e-PG-Pathshala For CEC (Under Graduate) For SWAYAM For other	C. Any 3 of the above

MOOCs platform For NPTEL/NMEICT/any other Government Initiatives For Institutional LMS	

File Description	Documents
Upload the data template	View File
Upload relevant supporting document	No File Uploaded

3.5 - Consultancy

3.5.1 - Institution has a policy on consultancy including revenue sharing between the institution and the individual and encourages its faculty to undertake consultancy

Institution has a well-defined policy on consultancy and the details are attached in relevant supporting document.

File Description	Documents
Upload relevant supporting document	View File

3.5.2 - Revenue generated from consultancy and corporate training during the year (INR in Lakhs)

3.5.2.1 - Total amount generated from consultancy and corporate training during the year (INR in lakhs)

62993053

File Description	Documents
Upload the data template	View File
Upload relevant supporting document	No File Uploaded

3.6 - Extension Activities

3.6.1 - Extension activities in the neighbourhood community in terms of impact and sensitising students to social issues and holistic development during the year

Pilani

As part of government's Atmanirbhar Bharat initiative, Nirmaan volunteers helped the women beneficiaries in the Bhaas village to prepare masks during the spread of covid. Through, this they earned their livelihood as well as people in villages got awareness about benefits

of using masks to prevent themselves from being infected. Besides this, Nirmaan in association with PARC established a stitching center to train the women from nearby villages in stitching and become self-reliant. Currently, more than 25 women are getting trained there.

To promote the government's Swasth Bharat program, several online sessions have been conducted to create awareness related to various diseases and myths related to them. NSS organized a session on Breast cancer awareness to make women aware of the symptoms and do not feel shy to share their health issues with health workers. To create awareness about the covid vaccination, the NSS volunteers organized an online session on Vacc-in-Pilani in which the expert was a senior official from Serum Institute Pune. The awareness drive was successful as most of the campus residents came forward and got themselves vaccinated in a short span of time. To help people during the second wave, the anti-covid force of NSS volunteers helped people in getting vital information regarding availability of bed etc. in a timely manner. Under the Swachh Bharat initiative, NSS Program Officers planted saplings in the campus to promote green campus.

Goog education is path to future developments and hence, the NSS and Nirmaan volunteers support the education of many underprivileged kids through project Umang and project Utkarsh respectively. Through these projects, the education of more than 70 kids have been supported in the last year.

To sensitize the volunteers towards the social issues, several sessions have organized. One such session was focused on mobilization of people towards implementing social welfare schemes in villages. The students learnt a lot through interactions with Mr. Sanjay Sharma of Manjari Foundation about the type of problems arise while implementing any scheme in the villages and suggested a systematic approach to address the same. Another session was conducted with the help of Sakshi NGO to sensitize students towards child abuse. The student were briefed about the legal definition of child abuse, POCSO act and how to report such cases or to provide legal help to sufferers in nearby areas.

GOA

BITS Pilani, K K Birla Goa Campus, with the help of financial support from BITSAA International, distributed 67 schoolkits consisting of a school bag, note-books and other stationery material to the students of two government primary schools in Zari and Zuarinagar - located in the vicinity of the campus. These underprivileged students, who were directly affected due to the spread of COVID-19 pandemic, were very happy to receive the kits. The distribution function was organized by the respective school at their premises in presence

of the teachers and students' parents. Heads of both schools appreciated BITS Pilani's efforts in reaching out to the underprivileged students and supporting them with such necessary items.

The various student run NGOs, namely Nirmaan, Udaan and Abhigyaan proactively work in order to instill a sense of social fulfillment among students.

Nirmaan Organization is a registered NGO, started by students of BITS Pilani in 2005. They work in the areas of Education, Skill Development & Entrepreneurship and Social Leadership.

Abhigyaan is a volunteer organisation operating from BITS Pilani, Goa campus to help the not so privileged. with the aim to achieve the goal of "education for all" Members of Abhigyaan regularly visit the neighbouring slum of Lamani to teach and to play with the children. There are also programmes to teach children in the evenings and the the unfortunate, like the mess workers, at night on the campus. Various occasions like the Children's Day, the Republic Day and the Independence Day are celebrated with the underprivileged children.

Udaan is a group of motivated students who want to strike a change in the lives of underprivileged women on BITS, Pilani Goa Campus. They work for the overall development of these women.

File Description	Documents
Upload relevant supporting document	View File

3.6.2 - Number of awards received by the Institution, its teachers and students from Government /Government recognised bodies in recognition of the extension activities carried out during the year

3.6.2.1 - Total number of awards and recognition received for extension activities from Government / Government recognised bodies during the year

1

File Description	Documents
Upload the data template	View File
Upload relevant supporting document	View File

3.6.3 - Number of extension and outreach programs conducted by the institution including those through NSS/NCC/Red cross/YRC during the year(including Government initiated programs such as Swachh Bharat, Aids

Awareness, Gender Issue, etc. and those organised in collaboration with industry, community and NGOs)

32

File Description	Documents
Upload the data template	View File
Upload relevant supporting document	No File Uploaded

3.6.4 - Total number of students participating in extension activities listed at 3.6.3 above during the year

5471

File Description	Documents
Upload the data template	View File
Upload relevant supporting document	No File Uploaded

3.7 - Collaboration

3.7.1 - Number of collaborative activities with other institutions/ research establishment/industry for research and academic development of faculty and students during the year

3.7.1.1 - Total number of Collaborative activities with other institutions/ research establishment/industry for research and academic development of faculty and students during the year

6241

File Description	Documents
Upload the data template	View File
Upload relevant supporting document	No File Uploaded

3.7.2 - Number of functional MoUs with institutions/ industries in India and abroad for internship, on-the-job training, project work, student / faculty exchange and collaborative research during the year

14

File Description	Documents
Upload the data template	View File

Upload relevant supporting document	No File Uploaded

INFRASTRUCTURE AND LEARNING RESOURCES

4.1 - Physical Facilities

4.1.1 - The institution has adequate facilities for teaching - learning. viz., classrooms, laboratories, computing equipment, etc.

Pilani Campus

Software Development and Educational Technology Unit

The Software Development & Educational Technology Unit (SDET Unit) incorporates the Centre for Software Development (CSD) as well as the Centre for Educational Technology (CET). The Unit has a mandate to include identification, establishment, deployment and evolution of appropriate educational technology in order to support effective resource utilization of expertise (teaching / mentoring / collaboration) available at various campuses (both existing and upcoming) as well as enable students and faculty involved in various off-campus work-integrated learning programs of the Institute. Research, development and consultancy in those areas of computing where it has expertise and interest amongst its nucleus members remain the other important areas of the work for the SDET Unit.

The SDET Unit has four specific sets of activities handled by its two wings: CSD and CET. These wings focus on multimedia, E-learning, web-services, live and stored video streaming as current thrust areas. Its CET wing has its mandate to identify suitable educational technology solutions for on as well as off-campus operations of the Institute and helping in their deployment.

The SDET Unit is involved in the Open-source Moodle LMS based deployment for requirements of the Institute in the form of the Nalanda portal. Recently, this portal has been upgraded and deployed over cloud for better scalability and performance. For quite some time now, it has added the live interactive (bi-directional audio/video/text-based) classroom feature to value add its on-campus student population.

The SDET Unit has played the leading role in designing and establishing a University-wide, Integrated immersive Telepresence Infrastructure with seamless support for very high-quality eye-to-eye contact based meetings between people present in four telepresence rooms across all four campuses of the Institute along with integrated multi-campus interactive lecture delivery and recording support for four class rooms spread over all four campuses of the

Institute. Apart from this, SDET is facilitating the video /audio conferencing requirement of the Institute for academic and non-academic purposes.

In addition, the SDET Unit is the official enabler for the BITS-BITSAA joint venture known as Project Embryo (http://www.embryo.org) that is aimed at joint efforts by current students, alumni and faculty for delivery of live lectures by specialist alums as well as joint collaborative research guidance by alums and faculty to on-campus students.

Centre for Software Development (CSD)

Software Development and Educational Technology Unit (SDET Unit) at BITS-Pilani is primarily responsible for in-house development of applications, web site development & maintenance, development of mobile applications, and conduct of short term certification programs pertaining to new and upcoming software development technologies.

Information Processing Center

Information Processing Centre (IPC) provides computing facility for students and staff of the Institute. The Centre is responsible for planning, need forecasting and maintenance of computing resources across the Institute. The Centre has signed campus agreement with Microsoft and MATLAB for licensing their product & tools.

With a view to upgrade the computing resources, across the Institute, 30 desktop machines, 30 Laptops, servers, network equipment and a few printers & peripherals were purchased. During the year, Centre has been involved in setting up of Wi-Fi based 600 node network in girls and boys hostel, implementation of identity based access control, Deployment of Biometric attendance systems, and implementation of first phase of campus wide surveillance system using more than 100 CCTV cameras. The Centre has also successfully completed the deployment of 250 port Giga bit network for faculty housing.

The Centre is responsible for maintaining and upgrading the campus wide 5000 data port wired and Wi-Fi network. With the augmentation of existing facilities, the Centre has been able to support conduct of online examinations, structured and unstructured labs for more than 30 courses offered by Computer Science and other departments. The Centre has also been involved in supporting the number of workshops and training programmes conducted in the Institute. The IPC is open on all days throughout the academic session from 08:00 A.M. to midnight and it is closed only for 3 days in every semester. The details of existing facilities in the IPC are given below.

The Center also offers number of high-end computer servers to its users currently it has 16 node HPC cluster, 5 GPU servers with Nvidia tesla cards, and 15 numbers of Intel based SMP servers. These servers offer, variety of operating systems and development tools to the faculty and students. In addition to the servers, the center has 7 labs equipped with 350 latest desktop machines. These systems operate under Linux and Windows environment and support variety of compilers database and software tools such as C, C++, Java, and Microsoft Visual tools, MATLAB, and Rational Rose etc. The central computing facility specifically takes care of the bulk computing needs of under graduate, masters and Ph.D students.

Apart from the above-mentioned centralized computing facility, the various departments have their own specialized computing facility.

The BITS Intranet

IntraBITS is a collaboration-category intranet portal deployed and supported by the Software Development and Educational Technology Unit (through its Centre for Software Development) since 1999. Its principal objective has been to enable the faculty and students to leverage appropriate software technologies in the On-Campus educational (teaching, learning, sharing) process. The followings are some of the highlights of the BITS Intranet. This portal has gradually expanded to multiple independent sites linked to it.

- An On-line Learning Management System (Nalanda) built in 2010, atop LAMP and Moodle platforms provides a complementary globally accessible service that aims to serve the entire community, both students and faculty members.
- An online IPC Complaint Management System that provides facility for registering network connectivity related queries of the campus community.
- The BITS Intranet is serving as a vibrant medium for exchange of academic and other ideas among students and faculty.

Centre for Software Development (CSD)

The Centre for Software Development (CSD) is responsible for the development and maintenance of University website, multimedia based content creation, maintenance of immersive Telepresence systems across all campuses, development of web based applications for providing various services to the user community (i.e. room booking, complaint management etc.) and maintenance of Open-source Moodle based learning management system. A team of students work on various research and development projects using latest technologies in the centre.

Centre for Education Technology (CET)

The Centre for Education Technology (CET) is responsible for identifying and deploying the new and upcoming technology to support instruction delivery. The centre manages the Telepresence facility based classroom which is used for running inter campus courses. It is involved in the Open-source Moodle LMS based deployment for requirements of the Institute in the form of the Nalanda portal on a regular basis. The centre also provides technical support for managing class room lecture recording system, deployed in four classrooms of Lecture Theater Complex (LTC). It is involved in the research, development and deployment specific to the next-generation Education Technology solutions.

Central Analytical Laboratory Facility (Pharmacy)

Central Analytical Laboratory (CAL) at BITS Pilani, Pilani campus houses many sophisticated instruments, catering to the needs of the various research Departments like Pharmacy, Biological Sciences, Physics, Chemistry and Chemical Engineering etc. The facility is used for training and teaching of the students as well doctoral research. CAL has a spacious area of 2600 sq.ft and is equipped with latest instruments that includes - Stability Cabinets (For stability testing of drugs and organic molecules), UV-Visible Spectrophotometers, UV-Visible-NIR Scanning Spectrophotometer, IR Spectrophotometer, FTIR Spectrophotometer, Scanning Spectroflourimeter, High Voltage Electrophoresis, Digital Polarimeters, Ultra and Refrigerated Centrifuges, Differential Scanning Calorimeter, Gas Chromatography, High Performance, Liquid Chromatography (with auto-sampler and various detectors), Thermogravimetric Analyzer (Shimadzu), Impedance analyzer, Particle Size analyzer, Rheometer, Ellipsometer and Elemental Analyser (vario MICRO cube). High end equipment's such as 400 MHz NMR spectrophotometer (Bruker AVANCE III), Atomic Force Microscope-Surface Enhance Raman Spectroscopy, Gas Chromatography-Mass spectrometry, Field Emission Scanning Electron Microscope have also been installed. Recently the laboratory has been upgraded with Confocal Microscope. Currently the facility is capable of carrying out research work at all levels including the industrial projects. Apart from using the Central Analytical Laboratory facilities for teaching and training of the First Degree and Higher Degree students, it is extensively used for dissertation and doctoral research, faculty research and consultancy work. It is also used by scientists/faculty from other nearby organizations.

Central Animal Facility (Pharmacy)

Central Animal Facility at BITS Pilani, Pilani campus is a CPCSEA approved facility with total floor area of 5330 sq. ft. The facility is also approved for in-house breeding of small animals. The facility maintains the animal species like Rats, Mice, Guinea Pigs,

Rabbits and Hamsters. It was build up in accordance with guidelines issued by CPCSEA and other regulatory bodies. It is also equipped with incinerator (electrically operated) facility for disposal of the biological and other biomedical waste. The air conditioned facility is maintained by well trained personnel, with a full time veterinarian to take care of the various requirements of the animals. Central Animal Facility caters to the needs of the various research departments like Pharmacy, Biological Sciences and Chemistry, etc. The facility also incorporates Pharmacokinetics, Pharmacodynamics and Pharmacology research laboratory for carrying out advanced research in the areas of pre-clinical pharmacokinetics, bioavailability studies, pharmacological screening of various synthetic/natural origin drugs. The laboratory has sophisticated instruments such as two chamber automated organ bath, laser doppler, noninvasive blood pressure recorder, semi dry transfer apparatus, microtome, RT-PCR, electroconvulsiometer, actophotometer, analgesiometer, light dark apparatus, rotarod etc. Equipments such as surgical anesthesia machine, electrical cautery, deep freezers (-20 and -80°C) and spare air-conditioners are also utilized. The laboratory is upgraded with video documentation system for various animal behavioral studies. Facility is geared to take up various industrial or governmental funded projects in various pre-clinical areas. Recently Air Handling Units and Large Scale Autoclave have been installed.

Technology Innovation Centre

Engineers/Scientists from industry bring their research and developmental projects for investigation in the campus. Such investigations are carried out in collaboration with Institute faculty associated with students registered in assigned research or project courses. Several industries have been participating in this programme. While in the campus, these engineers and scientists from industry are given a de-facto status of faculty members, so that they are encouraged to extend their professional interest much beyond the original scope of operation. Students also undertake identified projects by the industry wherein professional guidance is extended by professionals from industry virtually.

Centre for Innovation, Incubation & Entrepreneurship (CIIE)

Centre for Innovation, Incubation and Entrepreneurship (CIIE) at BITS Pilani across its 4 campuses continuously work in an integrated manner to strengthen the on-campus ecosystem to promote innovation, entrepreneurship and incubation taking care of all related academic and non-academic activities. The mandate of the CIIE includes facilitating technology transfer & commercialization, executing filing of patents, custodian of intellectual property of BITS, supporting entrepreneurial activities, interfacing with Technology business incubators of all campuses and fostering collaboration with alumni and industry for several entrepreneurial activities.

Pilani Innovation and Entrepreneurship Development Society

Pilani Innovation and Entrepreneurship Development Society (PIEDS) at BITS Pilani – Pilani Campus established in 2013 gives a distinct emphasis on creation of technology/innovation based new enterprises. The society takes up various activities to promote and encourage technology based innovation, incubation & entrepreneurship development. The main objectives of the society are to aid and help startup teams in the creation of technologies/innovations addressing market/societal needs; to foster the entrepreneurial spirit among students, faculty and community; and to provide mentoring, consulting, networking & funding services to aspiring innovators and entrepreneurs.

Embedded Controller Application Centre

This Centre was set up in Collaboration with Motorola India Ltd. The objective of the Centre is to impart detailed understanding of important features of embedded controller architectures and familiarization of advanced concepts in the field of embedded controllers through students projects/Industrial projects, Imparting training to the industry professionals and running short term courses in the field of Embedded System design, developing course modules.The infrastructure of the Centre includes High quality computing facilities, Microcontroller Modular Evaluation Systems, Microcontroller Development Systems, Emulators, Assemblers and Cross compilers for various microcontroller families (ARM, ATMEL, Microchip, Cypress, ST Microelectronics, etc.) DSP processors, logic analyzer and other bench equipments. We have received hardware and software license support under the ARM University program and Texas Instruments University Collaboration.

Centre for Renewable Energy and Environment Development (CREED)

CREED is an interdisciplinary Centre that co-ordinates educational and research activities in the active areas of renewable energy and environment. The objectives of the Centre are (i) to conceive, develop and implement renewable energy applications and environment protection projects, (ii) to develop courses and organize awareness programmes, and (iii) to collaborate with external organizations in the areas of renewable energy education, training and technology development. Some of the existing facilities at CREED include an experimental set up for solar water heating, solar air-heating system, solar stills, and solar photovoltaic power pack with storage battery bank, SPV lighting systems, fluidized bed combustor with gasifier and various instruments related to energy audit and solar resource assessment.

Currently, active research areas of CREED include concentrated solar power and photovoltaic power based policy analysis, emissions and environmental impact of thermal power plants, planning and economics of renewable energy systems, real time operation and control of renewable systems, industrial cogeneration, integrated renewable systems, demand side management, clean development management integrated resource planning, CO2 based refrigeration, biomass based fluidized bed combustion, biomass pyrolysis etc. The faculty members and research scholars of the center have also visited University of South Florida, USA and TU Braunschweig, Germany for the research purpose under institute's schemes.

The Renewable Energy Club is an exclusively a student managed body that operates under CREED. The Club has undertaken active work in organizing competitions, quizzes, carbon footprint analysis and carbon credits. Commercial organizations in these areas have evolved out of this club, and are currently owned and operated by BITS alumni.

Centre for Biotechnology

The Centre has in-house facilities of Genetic Engineering and Recombinant-DNA Technology. The objectives of the Centre are to take up research and development projects from various sponsoring organizations, establishments of University-Industry linkage through various R&D contract projects and conduct periodic Workshops and hands on training for faculty members, industry personnel and students in the area of advanced molecular biology/biotechnology and bioinformatics. The facilities available are Gel Documentation System, PCR Machines, Real Time PCR, Hybridization oven, Gel electrophoresis equipments, UV-Cross linker, FPLC, Nanodrop, Vacuum concentrator, Temperature Controlled Water Bath Shaker, Refrigerated Centrifuge, Ultracentrifuge, Cell counter, Plant growth chamber, Fluorescent microscopes, Apotome Microscope, Gene Gun, ICP-OES, Cold Room, Tissue Culture Room, Plant Biotechnology facility, Semi-automated Green House, Radioisotope handling facilities, Victor-3 Multichannel counter, Inverted microscope with camera attachment, −80°C Deep Freezer, etc. We developed Insectory to facilitate research on mosquito borne diseases. A Drosophila lab is being developed for studying human genetic disorders.

Centre for Materials Science and Technology (Mechanical Engineering)

The objective of the Centre for Materials Science and Technology is to develop and implement projects related to modern materials such as smart materials, biomaterials, fibre-reinforced plastic composites and also related to conventional materials such as metals, ceramics and polymers. The Centre undertakes mechanical and non-destructive testing of various engineering materials and products for evaluating their mechanical properties and for evaluating defects such as cracks, voids, delamination, inclusions etc. Other activities

include providing consultancy related to materials aspects and testing/development and analysis in the field of materials science and technology in general. The testing facilities available at the Centre include a conventional Universal Testing Machine of 50 Tons capacity, as well as, a fully computerized microprocessor based Electronic Universal Testing Machine of 100 kN capacity, Heating Chamber for UTM for High Temperature Testing, Hounsfield Tenso-meter, various hardness testing machines such as Brinell, Rockwell, and Vickers Hardness Testers, Rotating Bending Fatigue Testing Machine, Combined Bending and Torsion Fatigue Testing Machine, Strain-gauge testing facility, Izod Impact Testing Machines, Digital impact testing machine, Double disk polisher, Inverted Metallurgy Microscope, Erichsen cupping tester, Circular and plane Polari-scope for photoelastic stress measurement, Single Screw Extruder with Calendering and Pelleti-zation Facilities, Ultrasonic Flaw Detectors, Liquid Penetrant Test kit, Magnetic Crack Detector, Eddy Current Tester, Acoustic Emission Testing equipment, Acoustoultrasonic pocket hand-held AU scanner etc.Wet-lab facility and fume hood for polymer fabrication section. Basic Mechanical fault simulator, Data acquisition system for vibration measurement, Tribometer.

Centre for Desert Development Technologies (C-DDT)

Established with the financial support from BITS Alumni, C-DDT functions with the primary objective of developing world-class desert development technologies for making the desert bloom. It has joined hands with the Jacob Blustein Institute for Desert Research (BIDR) of Ben Gurion University, Negev, Israel to work in the area of desert development. The activities of the centre revolve around developing affordable and technically less esoteric technologies and integrating them with the existing practices of the desert areas of Rajasthan for economic upliftment, employment generation and poverty alleviation of the people of Rajasthan. Last four years research has been focused on the energy efficient houses. For the purpose four rooms were constructed with different architectural elements. Last two years three International papers are published in International reputed journals and two reputed International conferences and one Ph.D. scholar has completed her doctorate along with some first-degree projects at centre this year. Last year the solar house was integrated with rain water harvesting scheme and tank was covered, extended roof is fabricated to harness more rainwater and some roof tops were connected. This year ground is cleaned and leveled to apply contour irrigation system. Downward slope is made to flow the water in one direction.

Astonomical Observatory Facility (Physics)

BITS Pilani houses an astronomical observatory that is equipped with two telescopes, a 6″ refracting telescope, and an 11" Celestron's Schmidt-Cassegrain telescope which is

completely computerized. The observatory has recently procured a CCD camera which can be used with the 11" telescope to obtain long-exposure, high quality images, of nebulae and star-clusters. The observatory is maintained by the Physics Department of the institute. A group of 20 students, known as, Astro Club,makes a regular use of the telescopes to observe celestial objects on a fortnightly basis. In addition, the club conducts regular astronomical observation sessions as well as workshops for general public, i.e. entire BITS community of students and staff, several times during a semester. Moreover, students registered in the elective course on Introduction to Astronomy and Astrophysics, offered by the physics department faculty, also make use of the observatory on a regular basis to augment their understanding of celestial objects.

Pilani Meteorological Observatory (Physics)

The Institute runs and maintains Pilani Meteorological Observatory on behalf of the Meteorological Department of the Government of India. Daily meteorological data regarding the weather at Pilani are recorded and transmitted by the observer, under the supervision of a professor in-charge, appointed by the Institute. The observatory has an automated weather station.

SPECIALISED LABORATORIES

Apart from the Centers described above, the following specialized laboratories have been established with a view to strengthen research and development in the respective areas:

Process Dynamics and Control Laboratory (Chemical Engineering)

Infrastructure includes Universal Process Control Trainer, Multiprocessor Trainer and Computer Control of process variables such as temperature, pressure, level, flow and pH in Chemical Engineering Processes

Environmental Engineering Laboratory (Chemical Engineering)

Infrastructure of this laboratory includes BOD Incubator Shaker, several gas and water pollutant sampling and analysis equipment such as air and water analysis kits, underground water sampling kit, pH meter , conductivity meter, Total Dissolved Solid, Salinity, Dissolved Oxygen meter, BOD incubator, Digital BOD analyzer, Digital COD apparatus, Temperature Controlled Shaker Bath, Laminar Hood Chamber, Orsat Apparatus, Refractometer, AutoClave, Fermenter, Distilled Water Setup, Peristaltic Pump, Compressor, Muffle Furnace, Calony Counter, Electronic Balance, Ion Meter, Fluoride Electrode, Hot Plate, Vertex

Mixture, Deep Freezer, Oven, Hot Air Oven, Vacuum Oven, Remi Centrifuge, High Speed Centrifuge, Refrigerator. Data Logging Thermometer, 4-Channel Thermometer, etc.

Petroleum Engineering Laboratory (Chemical Engineering)

Infrastructure of this laboratory includes setups for ASTM Distillation, Flash point and fire point, Cloud point and pour point, Reid vapor pressure, Saybolt viscometer, Copper-strip corrosion, Conradson carbon residue, Redwood viscometer-1 & 2, Engler viscometer, Penetrometer, Bomb calorimeter, Drop point of grease, Melting point apparatus, Smoke point apparatus, Gum content testing apparatus, Oxidation stability tester, Sulfur analyzer etc.

Research (Setup) Laboratory (Chemical Engineering)

Continuous Adsorption Set-up, Biofiltration Column Set-up, Downdraft Biomass Gasifier, PyrolysisUnit, Reactive Distillation Setup, Air-LiftBioreactor, CSTR Unit, FluidizedBed Reactor, Fixed Bed Catalytic Reactor, Re-circulating Fluidized Bed Bench-scale Riser, Loop reactor, Particle Imaging Velocimetry, Flow Sense Camera, Isokinetic Tar sampling Setup, Digital Steam Rotameter, Ventury Scrubber, Sand Bed Filter, Glass Fiber Candle Filter, Fixed Bed Pyrolysis Unit, Fluidized bed Pyrolysis unit, Biomass Coke Stove, etc.

Analytical Laboratory (Chemical Engineering)

UV-VIS Spectrophotometer, pH/Ion Meter, Thermal Gravimetric analyser (TGA), High Performance Liquid Chromatograph (HPLC), Digital Scanning Calorimeter (DSC), Automatic Potentiometric Titrator with KF Attachment, Atomic Absorption Spectrophotometer (AAS), Gas Chromatograph (GC), Fourier Transform Infrared Spectrometer (FTIR), Flue Gas Analyser, Surface Area Analyser, Dynamic Foam Analyser, Multi Syringe Pump,Volumetric Analyser (VA), Cooling Micro Centrifuge, Rota Vapour, Digital Viscometer, Ultrasonic Cleaner, Auto Vacuum Desiccators, Ultrasonic Liquid Processor, HPLC Pump, Freeze Dryer (Lifolizer), Nan-contact Infrared Thermometer, Spin Coating Machine, DTG, Contact Angle Meter, Continuous Gas Chromatograph, Weighing Balance,CO2 Analyser, etc.

Flexible Manufacturing Systems Laboratory (Central Workshop)

The Flexible Manufacturing Systems (FMS) Laboratory conducts hands on training to first degree & higher degree students and cutting edge research in manufacturing science. This laboratory is a center for carrying out practical experiments for various on campus courses such as Flexible Manufacturing Systems (EA C412/BITS F431), Computer Aided Manufacturing (ME F432), Production Techniques-II (ME F313), Metal Forming and Machining (MF 313), etc. This

laboratory has been designed and configured to assist the Indian industry to become globally competitive in CNC manufacturing, CAD/CAM and machine tool sectors. The aim of the laboratory is to conduct fundamental as well as integrated research in order to achieve appropriate skill in CNC machining, in-depth knowledge in metal cutting, designing of manufacturing systems, developing manufacturing management techniques/strategies/practices for revitalization of Indian industries. The FMS lab aims to be foremost research center in CNC manufacturing, design of manufacturing systems and manufacturing excellence practices.

The following facilities are available in the FMS Lab.

- Hardware:

  - KODI-40 KLIEN Vertical Machining Center (Industrial)
  - Renishaw Probing System attached to KODI 40 VMC
  - Taylor Hobson Talysurf
  - FLIR Thermal Image System T250
  - MTAB STARRTURN CNC Lathe and Milling Trainer
  - MTAB FMS Cell
  - ROBOT
  - Rapid Prototyping Machines

- Dimension Elite 3D Printer
- FMD 200mc

  - IBM Intelli Workstations and High Computing Facility

- Software Tools

  - Umberto Life Cycle Assessment Tool
  - CATIA-PLM Tool
  - QUEST-3D Simulation Tool
  - ARENA-2D Simulation Tool
  - SIMUFACT Software
  - MINITAB-Quality Control Tool
  - DFMA-Product Design Tool
  - LINDO/LINGO-Optimization Tool
  - Multi-Attribute Decision Models

Oysters Lab-VLSI DESIGN Laboratory (EEE) This laboratory has been established to support the Micro-electronics program and to carry out projects in the field of VLSI design. The facilities in the Lab, with a seating capacity of forty students, include the centralized IBM x3650 M4 servers, Sun Fire X2200, Ultra 20 with RHEL operating system and DELL Optiplex desktops as clients. The servers operate on High Availability platform with parallel computing and cluster configuration. The lab is equipped with the complete set of front-end and back-end EDA (Electronic Design Automation) tools from the top vendors including Cadence, Synopsys and Mentor Graphics for ASIC design, Symica custom IC design Tool kit, Altera for FPGA design, and Silvaco for device & process simulation.

The lab has collaboration with Europractice to obtain design kits for ASIC design including UMC 90 nm, 130nm, and 180nm, TSMC 180nm and 250nm and the Altera FPGA kits include 40 UP3 kits, 10 DSP development kits and 10 NIOS-II development kits. The lab also has a Mixed Signal Oscilloscope and a Function generator, from Tektronix, to test the fabricated chips

Instrumentation Technology and Virtual Instrumentation Laboratory (EEE): The facility in the laboratory includes general purpose and specialized bench equipment, transducers and signal conditioning kits, PC based data acquisition and control cards, Virtual Instrumentation software (LabView) and data acquisition & signal conditioning modules, ELVIS boards, Green Engineering, bioengineering kits, wireless sensor network kits, Programmable Logic Controllers with I/O modules and interfaces.

Optical Communication Laboratory (EEE)

The infrastructure in the laboratory includes facilities for study and characterization of optical waveguides, fibers, Optoelectronic sources and detectors. Facilities are available for fabrication and calibration of fiber optic sensors. Training kits to study, design and simulate fiber optic communication & network systems with additional computational facilities to characterize them.

IoT laboratory (EEE)

The Internet of Things (IoT) lab provides various equipment and facilities to conduct research and develop prototypes for IoT and several allied areas such as Security, Drones, Brain Computer Interface (BCI), 5G, Blockchain and Vehicular Ad Hoc Networks (VANETS). It also hosts laboratory activities for the related courses. Humanoid robots, BCI and FPGA kits, Quadcopters, FPGAs, and a variety of microcontrollers, sensors and actuators are available in this laboratory for research and development activities.

Advanced Structural Engineering Lab (Civil Engineering)

This lab has well-equipped testing facilities for structures and materials. The lab supports various equipment such as Loading frame with Servo-Hydraulic Actuator of 400 kN capacity,100 kN Dynamic Universal Testing Machine, 1000 kN Static Universal Testing Machine, 1000 N Shake Table, Beam Torsion Testing Machine, Acid Resistance chamber, Digital Hot Air oven. These facilities are available to students, academicians, and researchers for their class and project work, and to outside agencies.

Structural Engineering Lab (Civil Engineering)

Portal Frame Apparatus, Redundant Joint Apparatus, Elastically Couple Beam Apparatus, Deflection of Truss Apparatus, Elastic Properties of Deflected Beam Apparatus, 3-Hinged Arch Apparatus, Column and Strut Apparatus, Unsymmetrical Bending Apparatus, Digital Switching Power Amplifier etc., etc. These facilities are available to students for their class and project work..

Highway/Transportation Engineering Laboratory (Civil Engineering)

The highway / transportation engineering laboratory is equipped with state-of-the-art devices that are used for the testing of pavement materials, conducting traffic engineering studies and to design safe flexible and rigid pavements. The equipment housed in the laboratory includes, among others, Los Angeles Abrasion Testing Machine, Light Weight Deflectometer (LWD), Dynamic Cone Penetrometer (DCP), MERLIN, Bump Integrator, Portable Skid Resistance Tester, Centrifuge Extractor, Viscosity Bath Test Apparatus, Digital Ductility Testing Machine, Speed Radar Gun, Auto Exhaust Multi- gas Analyzer, Global Positioning System (GPS) units, Digital California Bearing Ratio Test Machine, and Marshall Stability Test Apparatus, Buoyancy Balance equipment. In addition, the laboratory also hosts several software packages that include VISSIM, ArcGIS, AutoCAD, MX Road, Trazer, Asphalt Mixer Density Meter, Two Handycams - Sony Make with tripods, etc. These facilities are available to students, academicians, and researchers for their class and project work, and to outside agencies for consulting work.

Survey Lab (Civil Engineering)

The survey lab is equipped with both basic and advanced instruments such as Total station, Digital Theodolite, Tacheometer, Prismatic compass, Auto Level, Tilting Level, Digital Planimeter, GPS etc., These instruments are predominantly used for the undergraduate lab work for the surveying course and also for project work for post-graduate students.

Soil Mechanics and Foundation Engineering Lab (Civil Engineering):

This lab has state-of-the art facilities for both teaching and research purpose and has wide range on instruments such as Digital Direct Shear Test Apparatus, Manual Direct Shear Test Apparatus, Triaxial Test Apparatus, Relative Density Test Apparatus, Unconfined Compressive Test Apparatus, Hot Air Oven, Consolidation Test Apparatus, Permeability Test Apparatus, Field Density Test Apparatus, IS Sieves, Hydrometer, CBR Test Apparatus, SPT Apparatus, DCPT Apparatus and Casagrande Apparatus, 4-Channel Digital Vibration Meter. These facilities are available to students, academicians, and researchers for their class and project work, and to outside agencies

Hydraulics Lab (Civil Engineering)

This lab has state-of-the art facilities for both teaching and research purpose and has wide range on instruments such as Stoke's Apparatus, Discharge Measuring Apparatus (V-Notch), Osborne Reynolds Apparatus, Hydraulic Jump Measuring Apparatus. Jet Impact Measurement Apparatus, Centrifugal PumpFrancis TurbineKaplan Turbine, Heleshaw Apparatus, Metacentric Height Measurement Apparatus (Ship Model), Fixed Bed Flume, Multi-Purpose Flume, Tilting Flume Apparatus, Constant Head Apparatus, Varying Head Apparatus, Anemometer Viscometer.

Concrete Lab (Civil Engineering

The concrete lab has state-of-the art facilities for both teaching and research purpose and has wide range on instruments such as.Self Compacting Concrete Mixer, Slump Cone, Compression Testing Machine(2000kN), Compaction Factor Apparatus, Cement Tensile Testing Apparatus, Hobart Mixer, Cube Cutter, Flexural Strength Measuring Apparatus (Beam), 4-Point Loading Apparatus, Core Cutter, Vicat Apparatus, Vibrator Table, Vee Bee Test, Hot Air Oven, Muffle Furnace, Freeze-Thaw Chamber, Carbonation Chamber, Hydraulic Trolley (5000 kg capacity), Calorimeter, Motorized Sieve Shaker, Humidity Environmental Chamber, Concrete cube permeability apparatus, Cement autoclave, Automatic Blaine apparatus, Rebound hammer, concrete cube cutter apparatus These facilities are available to students, academicians, and researchers for their class and project work, and to outside agencies.

Environmental Engineering Lab (Civil Engineering):

The Environmental Engineering Lab has state-of-the art facilities for both teaching and research purpose and has wide range on instruments such as.Orbital Shaker, Hot Air Oven, Deep Refrigerator, Vertical Autoclave, UV Spectrophotometer, Jar Test Apparatus, Incubator, Oxy Top Bottles, Nephlometer, COD Digester, DR Spectrophotometer, Digital DO/pH Meter,

Centrifuge, Primary Clarifier/Setting tank apparatus, Rapid Sand Filtration Process Apparatus, Fume Hood with special blower.

Computer Center and GIS (Civil Engineering)

The computer center and GIS Lab has state-of-the art facilities for both teaching and research purpose such as VISSIM, ArcGIS, ANSYS 14.5, CivilFEM, Abaqus 6.13, ETABS 2013, SAP2000 16, GEO5 15, AUTOCAD 2014, Lahey-fujitsu Fortran 7.5, RAM Concept V8i, STAAD Foundation Advance V8i, Structural Synchronizer V8i, MX V8i, Bentley Maps V8i, Bentley PowerCivil V8i,Projectwise V8i, STAAD Beava Module, Bentley Products, Pipe flow expert, ROLTA Geomatica suite, STAAD Pro V8i, STAAD Foundation V8i, DigitiZeIT

Composite Lab (Civil Engineering)

This lab is dedicated for research purpose, especially in the area of composites. Many equipments such as, Vacuum system for composites equipment, AE Win, Waveform equipment, Probe Sonicater are available for research purpose. Composite plates are being manufactured and tested in this lab for the research purpose.

Language Laboratory (HSS)

A language laboratory with 40 booths is functioning to conduct practice sessions pertaining to the various courses offered by the department and to provide adequate practice to the students in different communication skills in English. The computer assisted lab facilitates the teacher to instruct and take responses from students through a computer network. Students and faculty across the institute also use these labs for the self-practice and self-assessment of their language and communication skills. The lab has a good collection of audio visual teaching materials in the form of Audio/Video CDs, Audio cassettes and Learning software which are used to enhance the linguistic competence and interpersonal skills of the students. The Department has procured an advanced language lab software system named Orell Digital Language Lab (ODLL) which offers cutting edge software solutions and delivers language teaching - learning solutions integrating two - way communication and incognito individual student monitoring. The Lab also houses a 2D Classical Animation Desk for students to practice and do assignment for the course Mass Media Content and Design.

Creative Media Lab (HSS): The Department is equipped with a studio-cum-lab for meeting the requirements of asset of courses in the area of Media and Communication. It is primarily designed to support the course Short Film and Video Production. The lab is equipped with DSLR and video cameras, colour video monitor, Microphones, basic lighting equipment and

other accessories. For editing films, the lab has acquired a Mac –Pro 2.4 GHz Quad –core Intel XEON.

Music Lab (HSS): The Music lab is used for offering the various courses, theoretical as well as practical, i.e.- Appreciation of Indian Music, Musicology-An Introduction, Indian Classical Music- (Instrumental-1) and Indian Classical Music (Instrumental-2), with different course plans of Indian and worldwide music, along with the musical practices and rehearsals for different institutional events taking place throughout the academic year. It houses various instruments like Tanpura, Tabla, Harmonium, Sitar, Guitar, Synthesizer, Violin, etc. for the class room practices for the practical courses and performances.

Central Workshop

The Central Workshop of the Institute has shifted to the 2600 sqm new building. The new workshop; in addition to imparting training to the students and catering to the maintenance and research needs of the Institute; is also designed for the 'design to test' concept. When fully functional, any student having an idea can design, prototype and test the part/product in the workshop. CNC machining, Reconfigurable Mini CNC machining, Foundry, Forming, Welding, Carpentry, Advanced Metrology, Learning Factory, Sustainable Manufacturing & Life Cycle Engineering are fully functional. Major equipment added during the year are: coordinate measuring machine (CMM), contour measuring system, vision measuring system, surface roundness tester, profile projector, microscope, micro hardness tester, 4 CNC turning and milling centres, 63 tonne power press, power tools, TIG & MIG welding and dynamometer. The workshop is equipped with state of the art metrology lab and dustless carpentry shop. Students' training consists of training all integrated first degree students through the course 'Workshop Practice' by imparting skills in various manufacturing processes. In addition, students are imparted training for other courses like 'Production Techniques', 'Metal Forming and Machining', 'Casting and Welding', 'Computer Aided Manufacturing', and 'Flexible Manufacturing Systems'.

Goa Campus

Network Facilities

The Campus LAN Project of BITS Pilani – K K BIRLA Goa Campus is a state of the art, completely switched, voice-enabled LAN infrastructure. LAN is able to provide 100 Mbps fibre channel network connectivity to all faculty cubicles, offices, library, Labs, lecture theatres, workshop, auditorium all hostel rooms, staff quarters, visitors' guest house, shopping complex, student activity centre & other public facility locations in the campus.

There are 5000+ nodes across the campus. The network is a three-layer network, namely core, distribution and access. The core &distribution layer is connected through gigabit fibre optic backbone, while the access layer is using enhanced CAT6 / CAT6A cabling. The network is designed to provide link level and device level redundancy.

Virtual Class Room (BITS Connect 2.0)

The virtual classroom is set up at K K BIRLA Goa campus. This facility will enable faculty to deliver lectures to all four BITS campuses simultaneously; alumni and experts to remotely deliver lectures and conduct workshops or panel discussions to multiple BITS campuses simultaneously, with recording and streaming of lectures. Telepresence classroom provided for delivering and receiving interactive lectures between all the BITS campuses. These facilities used for cross campus courses, guest lectures, administrative meetings and online meetings of research groups in India as well as across the world.

Telepresence Conferencing Room (BITS Connect 2.0)

An 18+16 seat CISCO Telepresence (CISCO Room 70 Dual) conference room allows impressive multipoint teleconferencing facility among all the BITS campuses. CISCO Telepresence will transform the meeting spaces into a video collaboration hub for connecting teams across the globe or local meetings. Room 70 Dual comprising a powerful codec, a quad-camera, and 70″ dual 4K display(s) with integrated speakers and microphones. It offers sophisticated camera technologies that bring speaker-tracking and auto-framing capabilities for a people-focused and people/content-focused experience. Telepresence at K K BIRLA Goa campus facilitate virtual meetings for academic and administrative decisions at University level. Licenses for WebEx (web conferencing software) have been provided to the entire faculty to facilitate discussions related to course work and research. This facility will also open up avenues of multimedia collaboration with anybody outside the campus activities, seminars, annual functions and other such activities.

Bring your own device (BYOD)

As a part of an effort to make Computer Centre Lab enhancement, collaborative learning with students own personal digital devices on campus, bring your own device (BYOD) area has been designed in the Computer Centre Lab. It is created with the purpose of encouraging students to use technology to support their academic learning and research. Students are permitted to bring devices that can connect to the campus Wired/Wi-Fi network for any accessible digital content.

CCTV Network

CCTV systems provide surveillance capabilities used in the protection of people, assets and systems through an Internet Protocol camera (IP camera) system). This system capable of a higher-resolution video recording and thus provide better, clearer images and perform in low-light recording situations. Presently, we have 110 IP cameras connected through the local area network to dedicated local storage media with 30 days of recording.

Computer Centre

Computer Centre (CC) has a central computing lab having 300 workstations (DELL & Lenovo) connected through LAN. These workstations operate under LINUX and Windows environments and support a variety of software tools such as C, C++, Java, Python, Microsoft visual studio, MySQL, Xilinx, ModelSim, Adobe Photoshop, Open CV, Pro-Engineer, ANSYS, COMSOL, Matlab, AutoDesk etc. CC supports all Departments for their software, hardware and storage requirements. CC provides computing and storage facilities for students, staffs and faculties of the Institute. Presently, with the existing facilities, the centre provides support for conducting online examinations in several courses including Computer Programming, Data Structure and Algorithms, Operating Systems, Computer Networks, Creative Multimedia, Computer Architecture, Database Systems, Engineering Graphics, Control Systems, etc. BITSAT, Admissions, students' elections and other online events are also conducted in the central computing lab. Apart from the computing facilities, CC supports a LAN of 4000 wired and 3000 Wi-Fi nodes. with intranet and internet facilities in the academic block, hostel rooms, staff quarters, guest house and other places. There are three internet lines: 500 Mbps from United telecom for hostel rooms, 1000 Mbps from Reliance Jio telecom for academic block and 500 Mbps from Ethernet Express for staff quarters. 100 Mbps dedicated internet bandwidth is provided for WILP classes. 45Mbps MPLS line is provided for video conferencing applications in Telepresence rooms. Secured Wireless connectivity is provided in the Institute building, student hostels, student activity centre, visitor's guest house and medical centre. Sophos XG 750 Next-gen XG Firewall ensures high-performance network security includes network protection (IPSec/SSL VPN, intrusion prevention), Web (URL filtering, application control, Email protection (anti-spam, encryption), wireless, webserver protection and unmatched defense against malware, exploits & ransomware. The centralized e-mail solution is supported by Google. This solution is an integrated solution covering e-mail with 30 GB space, online digital classroom tools, file storage with 5 GB space, collaboration tool, file sharing, personal web pages, calendaring system, etc.

Voice Communication

All faculty members have been provided with a laptop and IP phone facility in their chambers. The IP phone facilitates receiving of incoming calls directly on the individual's telephone.

Video Communication

Multi-point video conferencing facility is made available using the POLYCOM HDX machine. This facility is utilized for online meetings of research groups in India as well as across the world apart from the administrative meetings.

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to support their academic learning and research. Students are permitted to bring devices that can connect to the campus wired/Wi-Fi network for any accessible digital content.

Laboratories

The Institute provides labs equipped with sophisticated instruments and apparatus for students, faculty and research scholars. Some of these include: Nonlinear Optics Lab, Solid State Physics Lab; Physics Teaching Labs (Mechanics), Optics and Electricity and Magnetism, Modern Physics and Advanced Physics Lab), IMA Central Lab, Advanced Computing Lab, Materials Testing Lab, Measurement Techniques (Biology) Lab, Biotechnology Lab, Genetic Engineering Lab, Animal Cell & Tissue Culture Lab, Microbiology Lab, Applied & Environmental Biotechnology Lab, Advance Bio Lab, Cognitive Neuroscience Lab, Faecal Sludge Management Laboratory, Vector Biology Laboratory, Proteomics Lab, MT1 ChemistryLab, Chemistry ProjectLab [Also known as Nano Material Lab], Chemistry Special ProjectLab[Also known as Biosensor Lab], Chemistrylab -Research & Teaching Lab, ChemistryLabII -Teaching Lab,

Analog and Digital Lab, Embedded Systems Lab, Digital Signal Processing Lab, Electric Machines Lab, Digital Communications Lab, Instrumentation Lab, Microelectronics Lab, Power Electronics Lab, Reconfigurable Computing Lab, Renewable Energy Lab, Weather Observatory, Network Embedded Systems Lab, Remote Embedded Lab, Labs of the Department of EEE are equipped with the following Major Facilities for higher education and research work: Anechoic Chamber, Vector Network Analyzer - Keysight, USA, Logic Analyzer - Tektronix, USA, Arbitrary Waveform Generator – Tabor Electronics, Israel, USRP (Universal Software Radio Peripheral) - National Instruments, IRNSS + GPS Receiver, Cadence EDA Tools, Mentor Graphics (HEP) EDA Tools, Synopsys EDA Tools & TCAD Tools and Xilinx Vivado System Edition Measurement Techniques Lab,

Robotics & Automation Lab, MEMS Design Center, Thermal Science Lab, Fluid Mechanics and Machines Lab, IC Engines Lab with Low Speed Wind Tunnel Facility, Dynamics& Vibration Lab, Polymer & Composite Lab, Material Science Lab, Material Testing Lab, Mechanical Engineering. Process Engineering Technology lab, Process Control lab, Phase Equilibrium lab, Computer Aided Design Lab, Separation Processes Lab, Selected Chemical Engineering Operation Lab, Gas Hydrate Lab, Material Synthesis Lab, Engineering Chemistry Lab, Scientific Computing Lab and Language Lab.

In addition to computer centre facility the Computer Science department has an additional lab with following facilities, for higher degree and research work.

The lab has the 150 state of art computers with the necessary software. A DGX-1 station is with four NVIDIA® Tesla® V100 Tensor Core GPUs, integrated with a fully-connected four-way NVIDIA NVLinkTM architecture. It has 500 TFLOPS of supercomputing performance suited for the data science applications.

Senses 75-inch Interactive Intelligent Panel for Smart Presentations, Remote Teaching, and Teleconferencing, Cloud computing facility, Monosek Network Analyzer, Pervasive devices for applications in wireless sensor device, FPGA Kits for Hardware reconfiguration, Multimedia Equipment, Real Time Operating Systems like VxWorks, QnX., HiPC Server (For University-wide Computation Service) IBM x3650 (Intel Xeon 5, 2GHz, 32 GB, 2-Processor, 16-core, 4TB RAID 5) Head Node with RHEL6.2 and 5 IBM x3550 (Intel Xeon 5, 2GHz, 32 GB, 2-Processor, 16-core diskless) Compute Nodes; MPI on IB backbone and ethernet connectivity. 650 MFLOPS tested nominal 1TFLOPS.

Scientific Computing Lab of the Department of Mathematics equipped with 24 Laptops, multimedia equipment, interacting projector, and the following software facilities for higher education and research work: MATLAB (Institute wide user's license), MATHEMATICA (30 user's license), Scilab (Free Open Source Software), FreeFem++ (Free Open Source Software) ,FEniCS (Free Open Source Software),Tora and Statistical Software R, SAGE.

Incubator

BITS BIRAC BioNEST incubation facility is set up with the objective of 'Enabling innovation in health care and environment for a bettertomorrow.

The incubator has a state-of-the-art innovation lab for supporting experiments in Microbiology, Biotechnology and Environmental Engineering to develop technologies and startups that can provide solutions for societal challenges.

BITS BIRAC BioNEST was started as a part of BITS, Pilani K K Birla Goa Campus and is now under the aegis of an independent entity: BGIIES (BITS Goa Innovation, Incubation & Entrepreneurship Society). The Society was set up in February 2020 and will help to grow incubation and the overall startup ecosystem.

The incubator is spread over 3500 sq. ft. of office and lab spaces, surrounded by beautiful green landscape; it has the capacity to support more than 20 startups. Currently supporting about 8 incubates; Resident, Associated and pre-incubates in different areas like Medical devices, waste water management, agricultural waste management, grey water recycling, bioremediation, food tech and healthcare.

Networks and collaborations, legal, accounting and market research services, along with access to funding opportunities are provided to support the growth of incubated startups.

Workshop

The workshop is spread over 24,800 sq.ft. area and is well equipped with metal cutting machine tools like lathes, milling machines, shapers, pedestal grinders, tool and cutter grinders, cylindrical grinder, drilling machines, etc. It also has machines like pipe bending machine, plastics processing using rotational moulding machine, Compression Moulding Press, Iron Worker, Muffle Furnace, Multi-Component Piezo Electric Cutting force Dynamometer etc. The workshop is fully equipped with Conventional and Non-conventional machines which helps PHD student for project setup and Advanced CNC shop with 5 Axis machine and CMM.

There is a separate CNC machining section with production machines like CNC lathe, CNC Milling, Co-ordinate Measuring Machine and CNC Engraving Machine. These machines are based on FANUC controller. To introduce the concepts of layered manufacturing in product development, a 3-D printer or a Rapid Prototyping machine is also available. An Electric Discharge Machine is used to introduce the students for un-conventional machining. The carpentry section has the facilities of wood working lathes, planning machines and band saw machine. A welding shop with the welding machines to facilitate arc, gas, TIG and MIG welding exists separately in the workshop. The casting section includes an Aluminum melting furnace and casting testing laboratory to test the sand properties like strength, moisture, etc. A separate Metrology laboratory is also well equipped with measuring instruments like sine bar, dial gauge indicators, gauges, etc. There exists an electroplating section where Ni and Zn plating is carried out on the workpieces produced.

Apart from the above facilities Central Workshop houses a well-equipped polymer and composite lab with equipment’s like screw extruder, Density and Melt flow index tester, Dynamic Mechanical Analyzer (DMA), HDT& VSP tester, Universal testing machines for Polymeric materials (low capacity) as well as for metals and other materials (high capacity) Hydraulic Press for compression moulding, Izod Charpy impact tester, etc. An Injection Moulding Machine is being installed. To test the formability of the sheets for metal forming an Ericcson’s Cup testing equipment is housed.The Non-destructive testing (NDT) equipment’s like Ultrasonic Flaw Detector, Magnetic Particle Testing device is housed to introduce the concepts of NDT.The KD2 Pro, a fully portable field and lab thermal properties analyzer is available. It uses the transient line heat source method to measure thermal conductivity, resistivity, diffusivity, and specific heat. Pneumatic section with pneumatics and electro pneumatics set ups (Make Festo Controls) and a pick & place pneumatic manipulator is used to teach the concepts of Low Cost Automation using Pneumatics. Acoustic Emission System,

Cryogenic Treatment Equipment, Low Force Test System (UTM) (2KN), Refrigerator/Heating Circulator, Tensile - Creep testing of Polymer & Rubber.

Hyderabad Campus

Computer Centre (CC):

The Computer Centre provides IT facilities and services to support students, faculty and staff for teaching, research, learning and administration. It facilitates and maintain the state-of-art networking and computational environment for the institute. The Computer Centre function as three operational divisions (i) CCIT (ii) CC Lab and (iii) Website maintenance.

The CCIT maintains the server room, which houses an IBM Blade server-H with 14 Blade Chassis out of which 7 blades are populated and a 3 TB DS 3400 IBM SAN box is available on the network supporting Pentium based PCs and Workstations of Lenovo/HP/Dell make equipped with Windows and/or Linux environments supporting a variety of software tools.

The CCIT manages and maintains the campus-wide network which is built using Cisco three-tier architecture with wired and WiFi access to users. The campus LAN is connected 1.5 Gbps dedicated fiber leased line (taken from three different ISPs) for the Internet connectivity to the entire campus community, and one 2 Mbps PRI line for telephones at various offices within the campus. In July-2020, we plan to increase the total bandwidth to 2.0 Gbps.

The ISP WAN (from different vendors) links are load balanced through a Radware Alteon load-balancer for better monitoring of WAN links, bandwidth allocation to different VLANs, and to provide application level QoS to users. Two Sophos XG550 UTM devices sit on the periphery of the network for authenticating users, performing web and spam filtering etc.

The CCIT is also responsible for creating and managing official e-mail IDs for all students, staff, departments and divisions, using Google's centralized e-mail solutions.

The CCIT also maintains the Voice over IP (VoIP) infrastructure and the Telepresence(TP) infrastructure in the campus. In the FY 2019-20, the existing (which reached end-of-life) TP facilities in TP conference-room and TP classroom were replaced with new TP implementations consisting of latest equipment. Using the TP facility, BITS Hyderabad campus establishes connectivity with three other BITS campuses to conduct conferences, meetings and online live lecture sessions.

The CC Lab facilitates the computational requirements for teaching and research in BITS Pilani Hyderabad campus. It manages eight computational laboratories for teaching and research. The CC-Labs facility with approximately 500 PCs is accommodating integrated teaching with computational/ numerical tools. In the academic year 2019-20, CC Lab facilitated 50 courses from engineering and science departments, and the number may increase in the next academic year 2020-21. A dedicated research lab equipped with 50 desktops is catering to the research needs of the faculty and students working on funded projects, dissertations as well as on design-oriented-projects. It maintains 30 network-based software/numerical tools which include the course specific software and the general application software. The course specific licenses include Design Tools- Auto CAD, FLEXSIM and PTC Creo, Numerical Computing Tools- MATLAB, MATHEMATICA and MATHCAD, Computational Fluid Dynamics (CFD) Tools- ANSYS CFD, Open Foam and COMSOL, Finite Element Method (FEM) analysis Tools- ABAQUS and ANSYS Mechanical, Civil Engineering Design Software- Bentley, and several other Statistical and Geographical Information System (GIS) tools. The CC Lab is also involved in the procurement and maintenance of computer aided tools or software and the supporting hardware infrastructure for the academic use. The vision of the CC Lab is to facilitate advanced computing facilities to faculty and students to enhance teaching and research endeavors of the Institute. To achieve its aim, the CC lab is constantly conducting trainings to staff/students that impart knowledge on basics and advancements in software/numerical tools. Further, the CC Lab also help AUGSD and AGSRD divisions in online instruction, and Admissions Division in conducting the BITSAT online entrance examination. The CC Lab also supports various departments and student associations in conducting workshops, Conferences, and seminars.

The Website maintenance of the Computer Centre manages the website specific to Hyderabad Campus.

The Central Workshop imparts training to students and caters to the maintenance & fabrication needs of the Institute. Students' training involves training all first degree students through the course "Workshop Practice" by imparting skills in various manufacturing processes like machining, fitting, carpentry, smithy, foundry, sheet metal, electroplating, welding, etc. and two computer oriented exercises, CNC Programming using Pro-E and Master CAM software's and Manufacturing Simulation using FlexSim software. For B.E. (Mechanical Engineering) and B.E. (Manufacturing Engineering) degree courses, students are also imparted in-depth training in various other courses such as "Production Techniques-I and II", "Manufacturing Processes", "Casting and welding" and "Computer Aided Manufacturing". Apart from routine maintenance and training, the workshop also accepts fabrication jobs concerning the project works of students and also technical support for TBI works.

The workshop comprises the following sections: Machine shop, Welding, Electroplating, Fitting, Smithy, Sheet Metal, Carpentry, Foundry and Metrology. Major equipment's include Vertical Machining Center (Bridgeport VMC GX600), EDM Wire cut (Model: SPRINT CUT), CNC Lathe (Model PTC- 200), Hydraulic press with computer control(40T), nine Lathes, two Shapers, Radial Drilling Machine, Universal Milling Machine(Batlibai make) with indexing attachment, Cylindrical Grinding Machine with internal grinding attachment, Surface Grinding Machine, Tool and Cutter Grinder, Pedestal Grinder, Slotting Machine, Power Shearing Machine (Vivek Brand), Portable Drilling Machine, Injection Moulding Machine, TIG Welding Machine, MIG Welding Machine, Spot Welding Machine, Universal Milling Machine (BFW make), Shaper (Sagar make), Surface Roughness Tester (Mitutoyo make) and Hydraulic Bulge Test Rig, ECM setup (Electro Chemical Machining), Lathe Tool Dynamometer, and Rotational Moulding Machine, M TAB CNC Lathe Trainer, 3-D Coordinate Measuring Machine (CMM), HMT-PRAGA Universal Tool & Cutter Grinding Machine, FRITSCH Vibratory Sieve Shaker, Magnesium metal stir casting Furnace, Milling tool dynamometer, Drilling tool dynamometer, Lathe tool dynamometer, 200 TON capacity Compression testing machine, Mold Testing Equipment, Open-hearth furnace for smithy, Gas-fired furnace for foundry, Wood-working Lathes, Arc-welding equipment, Oxy-Acetylene gas welding equipment, Gauge planner for wood works, Electroplating equipment (zinc coating), Power Hacksaw, Sand Muller (Capacity-75kg), Panther make lathe machines, Model: 1350/1, HMT make High Speed Precision Machine, Model: NH26/1500, and two 3D Printers, Lenovo make desktops and CIMCO CNC Simulation software (20 Licenses), MASTER CAM (15 Licenses) and Micro Milling Machine

Laboratories

Advanced research laboratories for pharmacy, chemistry and biology have been setup. Research laboratories in Analytical, Organic, Inorganic and Physical Chemistryhave been set up.

The department of biological sciences at BITS-Pilani Hyderabad Campus, despite being just twelve year-old, has attained success in almost all spheres of academia, in line with the aims and objectives of BITS-Pilani University. We have established a strong research culture, replete with sponsored funding, publications and patents in the designated thrust areas. The faculty are constantly striving towards enhancing the departmental research programmes through individual and collaborative contributions. Since inception, the department has been successfully running M.Sc., M.E. and Ph.D. programmes, making the department a preferred destination for several graduate and undergraduate students across the country. The department has several national fellowship holders from agencies such as CSIR, UGC, DBT at both Junior and Senior Research Fellow levels. We have also established startup companies, strong industry linkages and are presently working towards strengthening these and establishing more. The department has nine faculty members of which all Ph.D

holders. The research thrust areas of the department are Medical biotechnology, Agriculture biotechnology, Food and Nutrition, Environment and bioenergy, Bio resources, Structural Biology and Bioinformatics, Technology development, Biophysics, Microbiology, Biochemistry and Molecular biology, Health Sciences and Public/ Global Health.

The department has several Inter-institutional collaborative projects both at the national and the international level. The national institutes that the department collaborates with Apollo hospitals, Bangalore; All India Institute of Medical Sciences, New Delhi, National Institute of Ayurveda, Jaipur; Ranbaxy Research Labs, New Delhi, India; SP College of Medicine, Bikaner, Rajasthan; Indian Institute of Science, Bangalore; LV Prasad Eye Institute, Hyderabad; Shankar Netralaya, Chennai, Tamil Nadu; Elite School of Optometry, Chennai, Tamil Nadu and Grasim Industries, Nagda. The International collaborations are with Baylor College of Medicine, USA; University of Pittsburgh, USA; University of Chicago at Illinois, USA; Mälardalens Högskola, Swedish Council of Higher Education, Sustainable Innovations Inc, Virginia, USA; Equate Health, Silicon Valley, California, USA.

There are seventeen laboratories, which four laboratories i.e. Biology laboratory, Microbiology, Biotechnology and genetic engineering serve undergraduate and post graduate teaching activity. In addition, Animal Cell Technology, and Bioinformatics labs serve both teaching and research related activities. Department developedresearch laboratories, namely, Genomics, Stem Cell, Plant Biotechnology, Structural Biology, Environmental Biotechnology. In addition, to these, four labs have been developed to support research in the areas of Immunology, Infectious Diseases, RNA Biology, Cancer Biology, and Neurology. A specialized laboratory has been set up with financial support from DST-FIST laboratory, funded by the Department of Science and Technology housing equipment flow-cytometer, RT-PCR machine and Phosphor imager.

The sophisticated and high-end equipment that caters to both research and teaching purposes includeBSL-2a and -2b laminar flow hoods,refrigerated orbital shakers, CO2incubators, FPLC, plant growth chambers,plant growth room,Inverted microscope, Nomarsky microscope, UV-vis spectrophotometers, multimode readers, advanced PCR machines, QRT-PCR machines, hybridization ovens, advanced table and floor top cooling centrifuges, ELISA reader, gel documentation system, Nanodrop spectrophotometer, fermenter, Lyophilizer, Millipore Unit, -80 Freezers,workstation and servers for computational work.

The Central Analytical Labs (Central Analytical Lab 1 and new Central Analytical Lab 2) of BITS Pilani - Hyderabad Campus, known as CALabs are equipped with modern state of the art instruments useful for advanced teaching and research. These instruments cover various modes of elemental analysis, spectroscopy, separation, thermal studies and material

characterization and imaging. The following list of equipment is established and functional for teaching and research purposes. List of important instruments is as follows: Powder XRD, single crystal XRD, FE-SEM, XPS, Laser scanning confocal microscope, 400 MHz NMR, AAS-7000, Flame photometry, XRF, BET surface area analyser, GC, HPLC (detectors: diode array UV, RI, fluorescence), LC-MS-MS, DSC-60, FPLC, TGA-DTA, spectrofluorometer FP-6300, UV-Vis-NIR spectrophotometer, FT-IR spectrometer, CD, Polarimeter, Karl-Fischer Titrator, Electrophoresis, Milli Q water, Impedance analyzer, Time-correlated single-photon counting spectrofluorometer, and Rheometer. In the FY 2019-20, three major equipment such as Cell Sorter, simultaneous TG-DSC and contact angle measurement have been procured. In the FY-2020-21, new equipments like SAXS and single quad mass spectrometry are planned. In addition to serving the internal teaching and research purposes, CAL also extends its service support to the external institutions, TBI incubates and industries.

The Department of Chemistry offers M.Sc. and Ph. D. (Chemistry) courses where the students are systematically trained in well-equipped laboratories as a part of their practical courses. Individual students are given the scope to run the experiments on their own with the guidance of faculty members. The laboratory facilities include organic, inorganic, physical, spectroscopy, material science and computational chemistry laboratories. Recently we established a new teaching lab and two research labs. Apart from that, they also take the courses on an instrumental method of analysis where all the students individually run various equipment such as IR, AAS, Fluorescence, GC-MS, X-ray, Raman spectroscopy, microwave oven and high-end UV-Vis spectrometer. The department has recently added current source, plasma cleaner, two ice machines and solvent purification system to its existing infrastructure. It is our pleasure to inform that SEM has been commissioned at our CAL (Central Analytical Laboratory) and NMR has reached to our campus. Both of this two equipment is the heart of the chemistry-based research and teaching. The faculty members for the department are involved in various projects such as organic synthesis, material science, and computational, physical, inorganic and analytical chemistry.

The department of Physics offers M.Sc and PhD programmes in Physics. The faculty members of the department research in Astrophysics, Quantum optics, gravitational physics and black holes, high energy physics, Theoretical Physics, Computational Physics; Materials Physics; Bio-sensing, Microfluidics, and Pedagogy. The current existing research facilities include Scanning Tunneling Microscope, Atomic force microscope, Fluorescence Microscope, AC Impedance Analyzer, Dynamic Mechanical Analyzer, Faraday rotation measurement unit, thin-film deposition unit, and four-probe resistivity measurement unit; Soft-lithography based micro fabrication unit, Dell server for computation,COMSOL with microfluidics module for simulations, Igor Pro and Microcal Origin software for data analysis. M.Sc students are also familiarized with some of the research equipment through the “Advanced Physics Lab” course.

Apart from this, the undergraduate lab has been bolstered with apparatus to measure the Zeeman Effect, Velocity of light, Frank-Hertz equipment etc. A computer interfaced telescope has been procured to provide hands-on experience to students on acquisition and analysis of astronomical data. The department hosts an IUCAAcentrefor Astronomy Research and Development (ICARD). Workshops and skywatch sessions are conducted for students under the aegis of this centre.

The department of Pharmacy offers B. Pharm, M. Pharm and Ph.D. courses where the students are trained in well-equipped laboratories for their practical exposure. The laboratory facilities include analytical instruments, equipment for pharmaceutical dosage form preparations, computer aided drug design lab, medicinal chemistry lab, pharmacology, molecular biology, BSL-3 and animal facilities. The department has recently added clean room facility for making formulations to its existing infrastructure. The faculty for the department are involved in various projects including development new lead molecules for TB, cancer, neuropathic pain; formulation development, Nano-delivery systems, transdermal delivery systems, natural product chemistry and pharmacological systems.

The civil engineering department has established following state-of-art laboratories and facilities, which can provide opportunities at various levels to students, academicians, researchers and to outside agencies for consulting works:

Structural Engineering Laboratory: The major test equipment/facilities are loading frame with 200 tons' capacity static compression testing facility, compression testing machine of 3000 KN capacity, Servo-hydraulic actuator (250 KN) for Dynamic Testing, Advanced dynamic testing shake table of size 2m×3m with 12 tons payload capacity (maximum displacement ± 75 mm, velocity 1 m/s, acceleration 3g, frequency 0 to 50 Hz), NI-9234 data acquisition system with LabView, Piezoelectric uniaxial accelerometers model PCB-393B04 (acceleration 5g, sensitivity 1000 mV/g, frequency 0.06 - 450 Hz), Impact hammer 5800B4 (500 LbF range, 10 mV/LbF, head weight 100 grams), Dytran Uni-Axial Accelerometer (500g range, 10 mV/g), Force Sensor 1053V4 (500 LbF range, 10 mV/LbF), APS 113 Long Stroke Shaker with m+p software based DAQ system, APS0112 Reaction mass assembly with vertical and horizontal table kit. Other equipment includes Structural analysis lab models, Wind tunnel, Weighing balance of 300 kg capacity, and Hydraulic floor crane 2 tons' capacity

Concrete Technology Laboratory: The major equipment/facilities available in the lab are Servo Hydraulic Compression Testing Machine (2000 KN), Vibrating table, Vibrating machine, Sieve shaker, Cement/Mortar/Concrete Permeability Apparatus, Autoclave, Torsion testing Machine, Air Permeability Apparatus, Flexural Testing, Machine, Rebound Hammer Test-NDT,

Ultrasonic Pulse Velocity Tester, Dynamic Pull-Off Tester, Stereo Microscope and Strain Gauges of 120 ohms and 350 ohms capacity attached with Lab View Tester.

Advanced Characterisation and Analysis of Materials Laboratory: The lab has Hamburg Stereomicroscope, Laminar Air Flow chamber, Vibratory strain gage setup, digital length comparator, muffler furnace, height gauge, colorimeter, Rapid Chloride Ion Penetration Test setup.

Highway Material Testing Laboratory: Highway Material Testing Laboratory is equipped with equipment namely universal penetrometer, ring and ball softening point apparatus, advanced ductility and elastic recovery apparatus with both heating and cooling arrangements, pycnometers for specific gravity, closed cup pensky martin apparatus for flash and fire points of bitumen, Rolling thin film oven test, Brookfield Rotational Viscometer, Cannon Manning Vacuum Viscometer for absolute viscosity of bitumen (indigenous), Silverson High shear laboratory mixer, Ika Magnetic stirrer and heating plate, Hobert N50 Mixer, Ika Low shear Mixer, Jaw Crusher, Abrasion Testing Machine, Aggregate Impact Test setup, Aggregate Crushing Value test setup, Pycnometers and immersion basket methods of aggregate specific gravity test, Length gauge and thickness gauge for finding the shape of the aggregates, Modified Marshall apparatus with automatic compacting equipment and Indirect Tensile Strength test setup, Asphalt density Meter, Field CBR test setup, Modified Proctors density apparatus, Fifth Wheel Bump Integrator for measuring the roughness of pavement surface, Benkelman Beam for measuring the pavement rebound deflection, Merlene, Dynamic Cone Penetrometer, Soxhlet bitumen extractor, Hamburg Wheel Tracking Device (indigenous), Humidity Chamber, Straight edge, Camber Board, Cold plate hot plate thermal conductivity test setup, Cement autoclave, TRL Pendulum type pavement friction tester, Permeability test apparatus (indigenous), Ovens of various sizes and capacities

Geotechnical Engineering Laboratory: The Geotechnical Engineering Laboratory has all basic and a majority of advanced instruments and set-ups to test properties of soil and rock. These include Universal Permeability Test set-up, CBR, Manual and Electronic Direct Shear apparatus, Large Shear Box apparatus, electronic Tri-axial set-up, Unconfined Compressive Strength test set-up, electronic Consolidometer, Linear and Volumetric Shrinkage measurement device, Swelling Pressure measurement apparatus, Model Plate Load Test set-up, Model Retaining Wall Test set-up, Rock Permeability Apparatus, Automatic Liquid limit Apparatus, Cone Penetrometer, Core drilling Machine, Soil Trimmer – CBR, Automatic Soil Compaction Machine and Relative density Apparatus. The lab also has finite element software Plaxis 2D for modelling soil.

Environmental Engineering Laboratory: The lab has facilities to test most of the water quality parameters. The facilities include, Spectrophotometers, Portable water testing kits, Digital PH meter, Fluoride meters, Double Distillation Unit, Turbidity meter, Portable DO meters, Fume Hood, Rain Gauge Equipment, BOD Incubator, BOD Analyzer , PM 2.5 and PM 10 dual dust sampler, Colony Counter and Auto clave.

Geomatics Laboratory: The Geomatics lab has a majority of advanced instruments available for executing modern surveying techniques. The major instruments available are Total stations, DGPS, Handheld GPS, Auto level, Electronic Digital Theodolite and Planimeter along with conventional surveying instruments. The lab also has ArcGIS software for mapping and spatial analysis.

Traffic and Transportation Engineering Laboratory: This laboratory has a majority of advanced instruments and software related to traffic engineering and transportation planning. The major instruments available added to this laboratory are Speed Radar Gun, V-Box with Video camera, Noise-meter, Alcohol-meter, Lux meter, Safety manuals and Traffic sign boards. The lab has the software such as N-Gene, M-Plus, NLogit software and has also a traffic simulation software VISSIM.

The Civil Engineering Department also has a Centre for Excellence in Water Resources Management (CEWRM), which is initiated for innovation in sustainable research, education and training in water resources management and allied fields..

The Department of Chemical Engineering has six undergraduate labs namely Selected Chemical Engineering Operations, Transport Phenomena, Chemical Reaction Engineering, Environmental engineering, Petroleum Engineering lab and Process Control labs. The department also houses Multiphase Systems lab, Advanced Separation processes lab, Materials Science and Engineering lab and polymer engineering lab for the Master's program. The department houses apparatus such as Supermass colloider MKCA6-2J (Ultrafine friction grinding machine), Micro Gaschromatography (Agilent G3581A-490, Moisture Analyzer (50 to 200 OC, Shimadzu MOC63U), Karl Fisher Titrator (Moisture measurement in solids and liquids using chemical agents), Electrospinning Machine (Super-ES-2, nanoscale fibres and core-shell fibres), Fluidized bed Granulator, BET Surface area analyser (0.1-1500 m2 /g), Gas Liquid Chromatography (Agilent 7820 A, suitable for liquids having boiling points below 300 OC, FID detector), Muffle furnace (1000 OC), Fixed bed reactor (Chemito, up to 1200 OC), Brookfield Rheometer (coaxial cylinder 0.026 to 8830 Pas) Potentiostat & Galvanostat (Metroohm, used to measure the Electrochemcial energy conversion and storage), Temperature controller bath (PP07R-20 refrigerating/ heating, -20 to 200 OC), High pressure Autoclave (PARR reactor, 350 OC, 140 Kg/cm2), Reid Vapor Pressure Bath (Koehler Instrument Company, K11459), Rotary Microtome

(Leica, sections of 500 nm using tungsten carbide and diamond knife, automated), Humidity Chamber (40 to 80% RH, 10 OC - 60 OC), Granulator, Tray Fermenter (Biomate India, BI-FERM-8D), Rotary Pulp Digester (160 OC, 10 Kg/cm2), UV-Visible double beam Spectrophotometer (Hitachi, U-2900, 190-1100nm), Optical Microscope (transmission mode, 10X, 40X including software to measure parameters), Injection moulding (200 degC), Compression moulding (250 degC), Ultrasonic processor (VCX 130 Sonic Vibra cell.), Autoclave (Ambient to 140 degC), Thermax Boiler (REVOMAX, 200 Kg/hr), Bubble cap distillation column, Filtration equipment, Rotary evaporator, Holmarc Contact Angle Meter with Temperature Control, Novascan UV / Ozone System, Probe Sonicator Heavyduty, Software tools such as ANSYS-CFD, COMSOL, MATLAB, MATHCAD, ASPEN, etc are also available for computational work in the Central Computer Aided Design laboratory.

The CS&IS department has access to around 360 DELL/Lenovo machines (made available by CCIT) as workstations and desktop PCs catering to the needs of Computer Science & Information Systems students for running their labs related to the lab oriented courses.

Apart from these facilities, CSIS Department has two labs namely; Data Science Lab and Systems Lab consisting of a total of 140 computers centrally connected to two servers. Each of these 140 machines have Intel Core i7 2.8GHz 6C processor with 8GB RAM, Nvidia Quadro K420 2GB GPU. The servers are HPE DL 380 Gen 10 Servers with Intel Xeon Silver 4114 (Deca core) processor and 256 GB RAM. These two computing facilities are used by First Degree and Higher degree students for their curriculum based project courses, course assignments, and any other out of regular lab hour practice sessions or self-learning.

There is a separate lab facility for Ph.D. students consisting of twenty HP Mini Towers with Intel Xeon E3-1225 V5 processor, 16 GB RAM, and Nvidia Quadro K420 2GB GPU. There are three higher end GPU enabled machines with Nvidia Quadro K1200 4GB for GPU intensive computing research activities. All these machines are also connected to the above mentioned two servers There are other research machines in this research lab which are bought through different grants obtained by faculties.

In addition to these, the department has IBM e-Server Blade Center running Linux Redhat Enterprise Compute server, and FTP servers for use in the courses. It also runs a virtual Infrastructure which comprises Academic vSphere/vCloud Suite 5 (4 CPU license), 2 Servers with Dual processor 6 cores (E2620) with Total 48 logical cores and 512 GB RAM.

The development tools and software available in all these labs include Compilers (gcc /g++ & JDK), Script Interpreters (Tcl/Tk, Perl 5.0, and gawk), Python libraries like Python3-pip and machine learning packages like tensorflow, Cuda, git, Nodejs, Matplotlib, ffmpeg, vend,

OpenGL, glfw3, QT, Anaconda, Wireshark, Nmap, Virtualbox6, GNU Assemblers, flex, flex++, X-development tools, NetSim, Oracle, etc.

The department has Atom processor kits, Gen1 Galileo Boards, Gen 2 Galileo Boards, and embedded software (sponsored by Intel) for developing embedded systems. The lab also includes Raspberry PI, Arduino Boards, NetFPGA, Hack-RF cards. The lab is used by the students of Software for embedded systems, Pervasive Computing, and IoT related projects.

Department of Humanities and Social Sciences has a computer based English language labto strengthen communication skills of students. It has software that offers language teaching-learning solutions through interactive practice sessions.

The Mechanical Engineering Department has nine laboratories, catering to the undergraduate and postgraduate teaching and research activities of the department: Robotics and Mechatronics and Automation Laboratory, Materials Testing Laboratory, Product Design and Realization (PDR), Dynamics & Vibration Laboratory, Tribology Laboratory, Refrigeration Air-Conditioning & Energy (RACE) Laboratory, Heat Transfer Laboratory, Hydraulic Machines Laboratory and IC Engines Laboratory.

Robotics, Mechatronics and Automation (RAM) laboratory is presently equipped with facilities such as 5-axis industrial robot, NI-Myrio Kit, Multiple sets of Docile X mobile robot, Omni wheel robot loaded with sonars, ABB Articulated arm Robot with finger and vacuum gripper, Smart camera evaluation kit, Mechatronic workbenches, Industrial AC servo motor kit, PLC, Hydraulic and Pneumatic training kit, etc.

Material Testing Laboratory has the following important facilities: Universal testing machine (Zwick / Roell) consist of tension, compression, bending test facility from cryogenic temperatures to elevated temperatures (-1800C to 12000C) for metal, composite and polymers. Rotating fatigue testing machine for metallic specimens. Creep and rapture testing machine for constant load condition. Torsion testing machine for circular metallic specimens. Material characterization facility such as polishing machine, hot mounting machine, Digital density meter, stereo and inverted metallurgical microscopes (up to 500X magnification). Pultrusion machine. Hardness testing: Micro-Vickers and Brinell hardness testing. Impact testing: Charpy and Izod impact testing. Furnace: Muffle furnace (12000C). Polariscope.

PDR (Product Design & Realization) laboratory is equipped with Rank-Taylor-Hobson computerized profilometer, additive manufacturing machine (rapid prototyping), David SL2 &

3D scanner, milling dynamometer and etching machines along with the softwares like ABAQUS, DEFORM-3D, LS-DYNA, and Design-Expert.

Dynamics and Vibration laboratory has miniature shakers, uniaxial and triaxial accelerometers, universal vibration apparatus, whirling of shaft apparatus, gyroscopes, static and dynamic balancing machines, wireless strain remote monitoring WSDA link, stroboscope, gearbox with spur gear arrangement to perform condition monitoring studies, planetary gearbox for wind turbine fault diagnosis, NI DAQ system for data acquisition, sensors for lubricating oil monitoring and microphones for acquiring acoustic signals.

Tribology laboratory is equipped with a number of sophisticated equipment to study the friction and wear characteristics of bulk materials, coatings and lubricants. The available facilities include pin-on-disc tribometer, four ball tester, scratch tester with humidity controller, journal bearing equipment, electrostatic spray coating system, tool maker's microscope , infrared thermometer and ABAQUS simulation software

RACE (Refrigeration, Air-conditioning and Energy) laboratory is equipped with the refrigeration and air conditioning test rigs, Solar dryer test rig, energy storage test rig, Brix meter, DYNEO DD-600F refrigerated/heating circulator, cool thermal energy storage (CTES) test system, wind emulator, wind energy training system, indoor air quality testing instrument with air quality probe having digital multimeter, cooling tower, heat pump test rig, evaporators, steam power plant test rig, PCM test setup, solar PV training & research systems, solar concentrator training system and solar thermal training systems and data loggers and data acquisition system.

Heat Transfer laboratory is equipped with heat transfer and heat exchanger modules, convection, conduction and radiation equipment setups, convection drier, thermal constant analyser, flame propagation unit, and computerized fluidized bed. Apart from these, a high speed camera (model no: Phantom VEO440L) is also added in its feather.

Hydraulic Machines laboratory has the following equipments: centrifugal pumps, submersible pumps, hydraulic turbines, Wind Tunnel Test Rig, steam power plant test rig, a nozzle performance test module, modular air flow bench, Laser flow visualization, hotwire anemometer and rheometer.

IC Engines laboratory is equipped with computerized SI and CI engine, AVL Ditest MDS 650 system with features such as smoke meter and gas analyzer, pressure sensor adapter & tooling device, computerized dual fuel VCR system, a test rig for evaluating alternate fuels, LPG & CNG sequential kits.

Also Mechanical Engineering Department is supported by a Central Workshop and a Centralized CAD laboratory. Central Workshop is an autonomous unit, equipped with numerous manual, semi-automatic and automatic machine tools and machines and providing services to all other departments and divisions. Centralized CAD laboratory has a variety of computer aided design and engineering software like Pro/Engineer, ANSYS, COMSOL, MATLAB, etc. In addition, the Mechanical Engineering Department has collaboration with Hemair Systems Ltd. Hyderabad, for establishing an ISO-6 (Class-1000) Clean Room in the institute for micro-electro-mechanical systems (MEMS) fabrication, which is part of the Institute's Technology Business Incubation (TBI) programme funded by the Department of Science and Technology (DST), Government of India.

Since its inception, the EEE department at Hyderabad campus has established laboratories with Equipment and Software worth more than ₹ 18 Crores. Currently, the 17 lab rooms are spanned in more than 31,000 square feet area. These labs include, Analog Electronics Lab, Communication Systems Lab, RF & Microwave Engineering Lab, Microelectronic Circuits Lab, Digital Design Lab, Microprocessor and Interfacing Lab, Digital Signal Processing Lab, Electrical Machines Lab, Control System Lab, Power Electronics Lab, Power systems lab, Instrumentation and Transducers lab, MEMS, Microfluidics and Nanoelectronics (MMNE) Lab, Optical Communications Lab, Advanced Communication Lab, Embedded Systems lab, Data processing Lab, Machine Learning Lab, Advanced Digital Communication Lab, FPGA design Lab, Mobile and personal communication, Computer Architecture, VLSI CAD Lab, Advanced Computing Lab, High Voltage Lab, IoT Lab, Electronic Materials and Devices Lab (EMDL), VLSI Architecture Lab, Analog VLSI Design Lab, Software for Embedded System Lab. These labs cater the teaching and learning requirement of the undergraduate programs in EEE, ECE & EEI and the higher degree programs in Communication Engineering, Embedded System Design and Microelectronics. Further, the students' projects, thesis, PhD research work and several sponsored projects are also implemented in these labs. A summary about a few labs are given here alphabetically:

Advanced Computing Lab is the best-in-class and one of the core labs catering the computational needs of many labs in the Department. The lab consists of several High-Performance Computing server nodes, Red Hat Enterprise Linux and Community Enterprise OS, High-Performance Computing Software and 150 High-Performance Workstations. The lab has several general computing resources also.

Communication Systems Lab covers the basic understanding of functionalities of various block-sets involved in communication system. It involves system design and simulation exercises using MATLAB and Simulink and experiments based on HW boards. In this Lab, the students study in detail about the various types of modulators and demodulators,

transceivers and spectrum analyzer and also different types of Pulse Code Modulation (PCM) formats both using hardware and software.

Electronic Materials and Devices Lab holds the cutting edge Nanoelectronic and optoelectronic devices fabrication, characterization, and simulation facilities such as thermal evaporator, rapid thermal processor, spin-coater, chemical synthesis equipment, different furnaces (with ambiances), Automated Agilent B2912A SMU, Probe station, Four probe unit, Solar simulator, RF amplifier, optical exposure unit, DFT, etc.

Instrumentation Lab focused on designing and developing various instrument layout including sensing unit, data processing unit and signal processing unit. Various data acquisition hardware, sensors, mini-microprocessors, LCD interfacing and governing software are covered in this lab.

Internet of Things Lab provides concepts of IoT, its eco-system, wide spread application, and its design challenges. The experiments include interaction options with real world objects though cyber infrastructure, a systematic development of IoT based solutions, approached to handle data from IoT, introduction to Python programming and Raspberry Pi kit, introduction to Arduino programming and develop controllers, basic machine learning to process data from IoT on the fly, understanding the security implications while deploying IoT applications, and basics of developing mobile applications to command and control IoT.

High Voltage Lab has recently been set up and it consists of all state-of the art equipment such as 100 KV AC/DC Source and control panel, 3 stage 300 KV 3 KJ Impulse Generator, C and Tan-delta Test Kit (Schering Bridge), Vacuum and Pressure Vessel, Rod Gap Apparatus – Horizontal Sphere Gap Apparatus, Rain Making Equipment, Salt Fog Chamber, and Electrolytic Tank. On the other side, some sophisticated instruments also added up which include Solar simulator, Laser engraver, contact angle measurement, UV laser writer, and dry film photoresist.

MEMS, Microfluidics and Nanoelectronics (MMNE) Lab comprises of state-of-the-art fabrication facilities such as photolithography, 3D printing, soft-lithography, direct-laser writing, paper-based device facilities, Chemical Vapor Deposition (CVD) and Electrospinning etc. The lab has also modern testing, device characterization, and simulation facilities such as Fluorescence Microscope, Tensiometer, Ink-jet printer, CO2 Laser writer, Electrochemical Workstation, Digital Viscometer, Photomultiplier tube, advanced data acquisition system, High-seed cameras, Raman Confocal Microscope, Spectroradiometer, COMSOL, AutoCAD, etc.

Power Electronics Lab covers modelling, simulation and experimental verification different power electronics devices/converter applications. Students are also provided with power electronic drives for performing minor projects as part of the power electronic course. Lab Consists hardware: 3-Ø Power Module, SCR – Diode Power Module, IGBT – Diode Power Module and Software: MATLAB - 2015a, P-Sim Software.

RF & Microwave Engineering Lab consists of various microwave equipment and components, to determine and plot the characteristics of Gunn Oscillator, Reflex klystron and other passive microwave components. It also included how to use various simulation software to design various microwave devices with desired characteristics, scattering parameters and field patterns. Using ANSYS HFSS to Design Waveguides, Microstrip Antenna, Microstrip Quadrature Hybrid & Design of Ring Hybrid.

Software for Embedded Systems Design lab supports implementation of projects by interfacing a variety of advanced sensors with microcontroller boards such as Arduino and Rasberry Pi. The Lab is also equipped with Robot Operating System (ROS), Simulator, such as Gazebo, to create a 3D scenario on a computer with robots, obstacles, and many other objects.

VLSI Lab has Industry-standard licensed tools for Computational VLSI & VLSI Design, such as Cadence EDA tools, Synopsys TCAD tools, Synopsys Front-End and Back-end tools, Synopsys Quantum-Wise Atomistic Modeling tools, Mentor Graphics HEP-I and HEP-II tools etc.

Apart from this, EEE Department is leveraging the facilities provided by a Central Workshop, Centralized CAD lab, Center Computing Facility, Central Analytical Lab and Clean Room.

Sandboxx

Sandboxx is a multi-disciplinary platform to develop technologies in the domains of Internet of Things, Wearable Technologies and Consumer Electronics. The lab is envisioned as a platform that enables students in the creation of technologies that solve real world problems at the interface of engineering (Mech, EEE, CS, etc) sciences (biology, pharmacy, physics, etc) and design. This lab is for facilitating student ideas and implementation with easy access to equipment and tools such as sensors, microprocessors, power tools etc

Tinkerers' Lab

The Tinkerers' Lab is a new addition to Sandboxx and both collectively function under I-Cell. A Tinkerer is someone who enjoys experimenting. At Tinkerers' Lab, we promote and motivate such tinkerers with the objective of growing the community of innovators. We

provide them the platform to convert their creative and innovative ideas into actual engineering products. The Lab is one of its kind advanced technical facility where innovators get an opportunity to apply the theoretical knowledge learned in classes. The lab is spread over total floor area of more than 2500 sq.ft and the facility is currently being utilized by 80 innovators.

Some of the projects that are being innovated at the Tinkerers' Lab include but are not limited to Hybrid Aerial Vehicles, Sub scaled Rockets, Autonomous Underwater Rover.

Technology Business Incubator (TBI)

The role of technology business incubator is to proliferate overall entrepreneurial process and thus increasing the competiveness and bring about sustain development to an innovative idea till formation of a successful venture. A Technology Business Incubator (TBI) can ably support such an environment by nurturing technical bents of mind and innovations. TBIs are, a desirable link, in the present context between manifesting the potential of technical innovations and New Enterprise Creation & Growth. The essence of economic development lies in the pace of entrepreneurship development.

Against this backdrop BITS-Pilani, Hyderabad has promoted a Technology Business Incubator, The Incubator is supported by National Science and Technology Entrepreneurship Development Board, DST, Govt. of India.

The Technology Business Incubator at BITS-Pilani, Hyderabad aimed at fostering technology/knowledge based entrepreneurial start-ups by:

- Nurturing them at an early-stage and helping them overcome limitation trough low cost services
- Offer value added services viz. legal, financial, technical, IPR, mentoring, business networking (National and international) etc. to incubatee's
- Providing business environment for operation with well-equipped infrastructure support
- Commercialization of technologies and nurturing any such business collaboration for profitable business
- Strengthening business skills/knowledge startups and making them more enterprising
- Skill development in the region in terms of innovation and Entrepreneurship and creating job opportunities.
- Creating a sustainable ecosystem with multiple stakeholders for enterprise creation.

Sectors of Intervention:

TBI will offer services in diverse sectors. To begin with, TBI@BITS Hyderabad aims to provide a low cost and resource intensive sandbox for Health-Tech, Bio-Tech and Devices where entrepreneurs can develop their product, services or process ideas towards commercialization.

Current Infrastructural support and facility

Working Area

Office space and co-working for startups

Bio-Tech/Pharma Lab

Lab space around 2000SFT is available for startups

3D printing

MEMS clean room (Micro-Electro-Mechanical Systems)

Clean room (Micro and Nano Fabrication Facility)

https://universe.bits-pilani.ac.in/hyderabad/ cleanroom/cleanroom

BITS Pilani Hyderabad campus has established state of the art facilities for Micro and Nano semiconductor device fabrication and characterization. The size of the clean room is 581 sq. ft and 80% of it is maintained as (ISO 6) class 1000 and the rest is class 100 (ISO 5). Complete class 100 area covered with yellow light and dedicated for Lithography process. This facility consists of the following equipments: Wet chemical work station for semiconductor and other clean applications, Two-inch tubular furnace capabilities, Spin coater system, Probe station with source measure unit, UV exposure system, Electron beam evaporator system andMaskaligner with accuracy up to 3 micrometer., Makers space: 3D printer's, CNC machine, machining tools, Lathe etc.

Central Workshop

The Central Workshop provides training to students and caters the maintenance & fabrication needs of the Institute. Through the course "Workshop Practice", all first degree students are trained to acquire the necessary skills related to various manufacturing processes like machining, fitting, carpentry, smithy, foundry, sheet metal, electroplating, welding, etc. and two computer oriented exercises, a CNC Simulation software (by CIMCO) and MASTER CAM,

and a Manufacturing Simulation software called FlexSim. Further, students of B.E. (Mechanical Engineering) and B.E. (Manufacturing Engineering) are given in-depth training in various courses such as "Production Techniques – I" and "Production Techniques - II", "Manufacturing Processes" and "Computer Aided Manufacturing". Apart from routine maintenance and training, the workshop also provides fabrication services pertaining to the project works of students and also offers technical support for TBI works.

The workshop comprises of various sections namely Machine shop, Welding, Electroplating, Fitting, Smithy, Sheet Metal, Carpentry, Foundry and Metrology. Major equipment include 1 Vertical Machining Center (Bridgeport VMC GX600), 1 EDM Wire cut facility (Model: SPRINT CUT), 1 CNC Lathe (Model PTC- 200), 1 Hydraulic press with computer control (40T), 9 Lathes, 2 Shapers, 1 Radial Drilling Machine, 1 Universal Milling Machine (Batlibai make) with indexing attachment, 1 Cylindrical Grinding Machine with internal grinding attachment, 1 Surface Grinding Machine, 1 Tool and Cutter Grinder, 1 Pedestal Grinder, 1 Slotting Machine, 1 Power Shearing Machine (Vivek Brand), 1 Portable Drilling Machine, 1 Injection Moulding Machine, 1 TIG Welding Machine, 1 MIG Welding Machine, 1 Spot Welding Machine, 1 Universal Milling Machine (BFW make), 1 Shaper (Sagar make), 1 Surface Roughness Tester (Mitutoyo make) and 1 Hydraulic Bulge Test Rig, 1 Electro Chemical Machining (ECM) setup, 1 Lathe Tool Dynamometer, and 1 Rotational Moulding Machine, 1 M TAB CNC Lathe Trainer, 1 3-D Coordinate Measuring Machine (CMM) "Spectra", 1 HMT PRAGA Universal Tool & Cutter Grinding Machine, 1 FRITSCH Vibratory Sieve Shaker, Magnesium metal stir casting Furnace, 1 Milling tool dynamometer, 1 Drilling tool dynamometer, 1 Lathe tool dynamometer, 1 200TON capacity Compression testing machine, Mold Testing Equipment, 1 Open-hearth furnace for smithy, 1 Gas-fired furnace for foundry, 5 Wood-working Lathes, 2 Arc-welding equipments, 1 Oxy-Acetylene gas welding equipment, 1 Gauge planner for wood works, Electroplating equipment (zinc coating), 1 Power Hacksaw and 1 Sand Muller (Capacity-75kg), 2 Panther make lathe machines, 1 HMT make High Speed Precision Machine, two 3D Printers, 1 Plasma arc cutting machine, 3 AC Welding Transformers, 1 Powder mixing unit, 13 Lenovo make desktops, a CNC Simulation software by CIMCO (20 Licenses), NC programming software called MASTER CAM (15 Licenses), 1 Planetary ball Mill and 1 Micro milling machine.

File Description	Documents
Upload relevant supporting document	View File

4.1.2 - The institution has adequate facilities for cultural activities, yoga, games (indoor, outdoor) and sports. (gymnasium, yoga centre, auditorium, etc.)

Pilani Campus

Student Housing

The Institute is fully residential and hostel accommodation is provided to all students. Permission to become day-scholar may be granted only under exceptional circumstances where student's parents or close relatives are residents of Pilani

There is a central kitchen from where food is served to all messes for every set of two boys' hostels. Each unit of the mess serves vegetarian and non-vegetarian food and the unit operates under the management of students' mess committee. The girls' hostel has a separate mess of its own, situated within the boundary of the hostel. Students staying in the hostel have to necessarily take their food in the hostel messes. Every inmate of the hostel is provided with necessary furniture and fixtures in the room. Each hostel is equipped with solar water heating systems. Common room facilities like TT table, carrom etc. are available in each hostel. Internet connectivity has been provided in all hostel rooms. There are 13 hostels for boys and one hostel complex for girls.

Sports Facility

Games and sports are organized through the Sports Club. The Institute has on its rolls Physical Director, Senior Coach, Life Saver (both male & female), Martial Art Instructor and other supporting staff. Facilities for the following games and sports are available: Football, Hockey, Cricket, Basketball, Volleyball, Tennis, Badminton, Table Tennis, Athletics, Gymnastics, Health Club, Swimming, Water Polo, Weight lifting etc. Besides organizing routine activities in above-mentioned sports, the Sports Club also conducts the BITS Open Sports Meet (BOSM) in the First Semester every year in which several outstation teams participate.

Health club is equipped with advanced exercising machines for weight training and aerobic exercise floor. A 25 x 12.5 m swimming pool provides facility for learning swimming, playing water polo and racing. Students can become members of Swimming Club/Health Club. Each hostel also has facility for volleyball, table tennis, badminton, chess, carom, etc.

Student Activities Centre

The Institute has a Student Activities Centre housed in a separate building where students have their union office and rooms for various activities. This building also has badminton courts, a squash court, a Table tennis room, a Health Club, an open air amphi theatre and three food outlets.

Cultural and Recreational Activities

The Institute has following clubs and societies: Music, Dance, Hindi Drama, English Drama, Hindi Press, English Press, Creative Activities, and Mime clubs; English Language Activity and Hindi Activity societies. These are entirely managed by the students and have been nurturing the creative and cultural talents of the students. In addition, the Institute runs Recreational Activity Forum, Photography Club, Swimming Club, and Health Club whose membership is open to students and staff. The Institute also organizes Theatre and Dance workshops. A classical music group called 'Ragamalika' aims at encouraging budding talent among the students in music and dance. It also arranges performances by leading artists in the field of classical music and dance. In addition, there is also a BITS Pilani Chapter of SPIC-MACAY which organizes programmes to promote Indian classical music and culture amongst youth.

Recreational Activity Forum (RAF) regularly organizes film shows for the BITS community. BITS being an all-India Institute, students have also established regional associations representing almost all Indian States conducting several special programmes on festive occasions.

While the actual management of student activities is the responsibility of the Union & other bodies, the Division provides necessary support. The Students' Union operates various clubs, including Music, Dance, Hindi Drama, English Drama, Hindi Press, English Press, Creative Activities, Mime, Photography, and Poetry Clubs, English Language Activities Society, and Hindi Activities Society. There are also several departments, which help organize various student events.

Traditionally students organize OASIS, a cultural festival sometime during the days adjoining Dussehra or Diwali. The students also organize A Professions-Oriented Gathering over Educational Experience (APOGEE), an Academic Week during the Second Semester, which may be aptly described as the academic get-together of the University Youth.

A classical music circle called 'Ragamalika' aims at encouraging budding talent among the students in music and dance. It also arranges performances by leading artists in the field of classical music and dance. In addition there is also a BITS Pilani Chapter of SPIC-MACAY, which organizes programmes to promote Indian classical music and culture amongst youth.

BITS being an all-India Institute, there are also regional associations like Maurya Vihar, Sangam, Andhra Samiti, Tamil Mandram, Maharashtra Mandal, Moru Chhaya etc. conducting several special programmes on festivals.

Recreational Activity Forum (RAF) that comes under the Student Welfare Division regularly organizes film shows for the BITS community. Currently, RAF organizes twelve, English and Hindi movies each, through the semester.

Physical Education

Physical Education of the Institute aims at providing a safe atmosphere to enable students and staff members to exercise to their potential whilst achieving their goals. It offers a variety of fitness, wellness, and recreation opportunities, and Fitness Programmes including Yoga and Martial Arts. The Physical Education has major facilities that include Health Club, Swimming Club and Sports Club. Health Club is equipped with single and multi-stationed machines and weight training facilities to provide students with an opportunity of doing exercise for physical fitness. Swimming Club has a swimming pool of 25 m length while Sports Club has various indoor and outdoor facilities for students to take part in sports and games. The indoor facilities are Badminton, Table Tennis and Squash with synthetic flooring while outdoor facilities are Basketball, Football, Hockey, Volleyball, Cricket, Tennis, Track & Field (400 m) etc. Sports and fitness activities are supervised by the qualified and experienced staff members of the Institute.

Festivals on Campus

Traditionally students organize three festivals during an academic year. BOSM (BITS Open Sports Meet) in September, a sports festival; OASIS, a cultural festival in October and APOGEE (A Professions-Oriented Gathering Over Educational Experience), an Academic Festival in February thus bringing about a beautiful blend of sports, cultural and academic milieu of the campus. All the three festivals are entirely managed by students in which a large number of students from all over India actively participate.

Students' Participation in Institute Activities

Students actively participate in various continuing and developmental activities of the Institute as follows:

There are four students as members of the Senate – one representing each campus, two students in the Senate-appointed Academic Counselling Board and two students in the Senate-appointed Standing Committee for Students’ Discipline in each campus. In addition, senior students act as mentors to junior students in the registration process. Some students are also associated with the course development activities. Students participate as associate

members in the activities of various Divisions of the Institute. Their contribution in projects and research activities of the Institute has always proved to be very useful

Goa Campus

Students Activity Centre (SAC)

"A sound mind in a sound body" It's the philosophy that was founded on and BITS Goa campus too swears by it. Sports play a pivotal role in shaping one's personality and maintaining good health. BITS Goa specially developed a sports environment that matches international standards and gives a truly global experience to all our students. All the sports activities at BITS Goa campus are conducted under the supervision of the SAC/SWD headed by the Physical Education Instructor. In addition to this, there is sports secretary from the student council. The main function of the SAC is to promote sports culture, provide world class sports facilitates for daily sporting activities, organize sports in various sports disciplines and build institute teams for the participation and Further select the best among them for the National and other level tournaments. SAC also organizes staff sports events annually.

BITS Goa has multiple sports facilities to its members with the opportunity to experience sport either for leisure and recreation or to an elite competitive level using state of the art equipment and a wide-range of sports facilities.

Indoor Sports facilities

The Student Activity Centre (SAC) of BITS Pilani Goa Campus is constructed in an area of 37,000 square feet with state of the art sports facilities. It is equipped with indoor sports facilities like wooden Badminton courts, Table Tennis hall, Billiards room, and wooden Squash court with viewing gallery, Carom room, and a Dance room. It also has a music room with both eastern and western musical instruments, and also a Prayer room. A modern air-conditioned gym, with all the latest gadgets has been set up, it provides a wide variety of fitness classes and fun activities throughout the year for the BITS community.

Outdoor sports facilities

The campus has a BCCI approved well maintained cricket ground, cricket practice net arena concrete and turf pitches, an AIFF approved football ground, standard volleyball courts, also international standard all weather synthetic tennis courts, synthetic and concrete Basketball courts, with LED flood lights. All our outdoor sports facilities are open to

students, staff & faculty members their kids and the BITS alumni. The Institute has left no stone unturned in encouraging students to participate in sports and recreational activities.

Games and Sports

The Student Activity Centre (SAC) of BITS Pilani Goa Campus is constructed in an area of 37,000 square feet with state of the art sports facilities. BITS Goa has multiple sports facilities to its members with the opportunity to experience sport either for leisure and recreation or to an elite competitive level using state of the art equipment and a wide-range of sports facilities. It is equipped with indoor sports facilities of International standard like Table Tennis hall, wooden badminton and squash courts. In outdoor sports the campus has a BCCI approved well maintained cricket ground, an AIFF approved football ground, standard volleyball courts, also international standard all weather synthetic tennis courts, synthetic Basketball courts, with LED flood lights.

All the sports activities at BITS Goa campus are conducted under the supervision of the SAC/SWD headed by the Physical Education Instructor. In addition to this, there is sports secretary from the student council. The main function of the SAC is to promote sports culture, provide world class sports facilitates for daily sporting activities, organize sports in various sports disciplines and build institute teams for the participation and Further select the best among them for the National and other level tournaments. SAC also organizes annual sports festival of institute "SPREE". It is the biggest All India Inter-Collegiate Sports and Entertainment festival of India, organized with the sole aim of promoting sports and social interaction amongst colleges from India and abroad.

Cultural and Recreational Activities

Students have cultural clubs to cater to interests such as photography, music, foreign languages, cinema, painting, arts, dance, literary, debate and drama to name a few. There are multiple technical clubs in the topics of Robotics, Aerodynamics, Block Chain, Astronomy, Auto-mobile building as well. Along with all the conventional sports club, BITS Goa also has one of the best Ultimate Frisbee Club in the country. All these clubs enrich the quality of campus life at Goa. Students organize various inter-institute national festivals: "Waves" is the Annual Cultural Festival and "Quark" the Annual Technical Festival. An inter-institutional sports festival "Spree" draws enthusiastic participation from young sportspersons. Along the national festivals, students also organize inter-hostel festival called "Zephyr" for all students on campus.

Students also organize TEDx under which talented individuals from across the country and the globe are invited to present their innovative ideas. Major Indian festivals such as Makar Sankranti, Lohri, Holi, Ganesh Chaturthi, Onam, Durga Puja, Diwali and Christmas are celebrated by the entire campus community.Classical Music, Dance and performing arts have a strong presence supported by classes held on campus for students, staff and children. The student group "Srutilaya" organizes concerts and workshops by eminent artists. The campus Film Screen Club organizes screenings of latest release movies, as well as educational films with interactive sessions with the directors.

The Staff Cultural Association brings the staff members and their families together and organizes annual events such as SANGAM which is a cultural function, "Spoorti a sports event, and FunFair which involves participation from staff and their families. It also organizes annual event Sandhya Milan for senior citizens of Campus.

Environmental Awareness

Campus maintains lush green gardens with a rich collection of flora and fauna.Every year during the monsoon, tree plantation drives are conducted with the help of the students. Solar water heaters are provided at all hostels which accommodate 3500+ students. Around 40 standalone solar powered street lights are installed in the campus. Around 85% of the street lights in the campus are connected to off-grid solar power plant of 19 kW per day.These street lights function on solar power for about six to eight hours every night. Groundwater recharge points are created across the campus.In this, the surface runoff water during monsoon is directed to a designated area which then percolates in the ground resulting in groundwater recharge. All overhead tanks and water coolers are fitted with floats, sensors and other mechanisms to shut the water supply and avoid overflow.Domestic waste generated in the campus at residences, hostels, messes, etc. is segregated at source into dry, wet, electrical and medical waste. Wet waste is treated in a bio-gas plant and composter machine, with the capacity to treat one ton of waste each on daily basis. Dry waste is further segregated as per norms and handed over to GHMS approved vendor for recycling. All garden waste is composted and converted into manure which is used to maintain the garden. The Sewage Treatment Plant (STP), with the capacity of 600 cusecs is working round the clock to treat sewage generated by residents of the campus. The treated water is also recycled by using it to maintain lush green garden. The sludge generated at STP is transferred to drying bed in the vicinity of STP which is used as manure after drying. Environment Protection and Awareness Club (EPAC) by students also carries out activities such as Beach cleanup drive, campus clean up drive, snake awareness program and visits to animal shelters.

Hyderabad Campus

Student Housing

BITS Pilani, Hyderabad Campus is a fully residential campus outside the bustle of the city, yet not far from the attractions of the city during weekends. BITS Hyderabad boasts 11 boys & 2 girls' hostels accommodating both UG & PG students. The campus provides spacious well ventilated double/single room Non AC accommodation to each student. Each room is provided with modern furniture, internet connectivity and round the clock security. Floor wise common room facilitates with cable TV, magazines, newspapers, Table Tennis, Chess and carom boards. Other recreational facility like volley ball is also available in each hostel QTs. Potable drinking water is available in each floor and telephones are provided in all the hostel offices.

The central dining facility is available for all the students. There are two independent large dining halls with modern and well equipped kitchens with RO plant for drinking water. A variety of food and beverage joints spread across the campus

Students Activity Centre (SAC)

To ensure overall development of every student, the institute provides multiple avenues for relaxation, health and fitness through sports and recreation facilities. Student Activity Centre (SAC) offers facilities for various Indoor Games & Sports like Chess, Carroms, Table Tennis, Pool Table, Snooker, Billiards Badminton and Squash. A Gymnasium (With separate sections for strength and weight training) with state-of-the-art equipment is available here.

A separate hall with wooden flooring is being provided for Dance. The Students Union and various clubs like Music (Indian and Western), VFX, Photography, Dramatics, Shades (Fine Arts) and English Language Activities Society (ELAS) are provided with rooms inside SAC to pursue their activities. Many more clubs share space in SAC for their activities.

A variety of musical instruments like synthesizers, drums, guitars, etc., have been made available for students of the Music Club to encourage them to practice and perform.

Games and Sports

In addition to indoor facilities, modern facilities for outdoor sports like Tennis, Basketball and Throw ball are available in SAC premises. Two indoor Badminton courts with wooden flooring, two Tennis and Volley Ball courts with synthetic surface have been provided with flood lights. The cricket ground having two pitches with grass playfields along with a

spectator gallery is located inside the institute premises. Three synthetic grass turf pitches are also provided besides the ground for practice. Football and hockey ground along with kabaddi courts are located centrally inside the institute. In addition to the common sports facilities, separate play areas for volley ball, table tennis, chess and carom are provided in each hostel.

File Description	Documents
Upload relevant supporting document	View File

4.1.3 - Availability of general campus facilities and overall ambience

Pilani Campus

Software Development and Educational Technology Unit

The Software Development & Educational Technology Unit (SDET Unit) incorporates the Centre for Software Development (CSD) as well as the Centre for Educational Technology (CET). The Unit has a mandate to include identification, establishment, deployment and evolution of appropriate educational technology in order to support effective resource utilization of expertise (teaching / mentoring / collaboration) available at various campuses (both existing and upcoming) as well as enable students and faculty involved in various off-campus work-integrated learning programs of the Institute. Research, development and consultancy in those areas of computing where it has expertise and interest amongst its nucleus members remain the other important areas of the work for the SDET Unit.

The SDET Unit has four specific sets of activities handled by its two wings: CSD and CET. These wings focus on multimedia, E-learning, web-services, live and stored video streaming as current thrust areas. Its CET wing has its mandate to identify suitable educational technology solutions for on as well as off-campus operations of the Institute and helping in their deployment.

The SDET Unit is involved in the Open-source Moodle LMS based deployment for requirements of the Institute in the form of the Nalanda portal. Recently, this portal has been upgraded and deployed over cloud for better scalability and performance. For quite some time now, it has added the live interactive (bi-directional audio/video/text-based) classroom feature to value add its on-campus student population.

The SDET Unit has played the leading role in designing and establishing a University-wide, Integrated immersive Telepresence Infrastructure with seamless support for very high-quality

eye-to-eye contact based meetings between people present in four telepresence rooms across all four campuses of the Institute along with integrated multi-campus interactive lecture delivery and recording support for four class rooms spread over all four campuses of the Institute. Apart from this, SDET is facilitating the video /audio conferencing requirement of the Institute for academic and non-academic purposes.

In addition, the SDET Unit is the official enabler for the BITS-BITSAA joint venture known as Project Embryo (http://www.embryo.org) that is aimed at joint efforts by current students, alumni and faculty for delivery of live lectures by specialist alums as well as joint collaborative research guidance by alums and faculty to on-campus students.

Centre for Software Development (CSD)

Software Development and Educational Technology Unit (SDET Unit) at BITS-Pilani is primarily responsible for in-house development of applications, web site development & maintenance, development of mobile applications, and conduct of short term certification programs pertaining to new and upcoming software development technologies.

Information Processing Center

Information Processing Centre (IPC) provides computing facility for students and staff of the Institute. The Centre is responsible for planning, need forecasting and maintenance of computing resources across the Institute. The Centre has signed campus agreement with Microsoft and MATLAB for licensing their product & tools.

With a view to upgrade the computing resources, across the Institute, 30 desktop machines, 30 Laptops, servers, network equipment and a few printers & peripherals were purchased. During the year, Centre has been involved in setting up of Wi-Fi based 600 node network in girls and boys hostel, implementation of identity based access control, Deployment of Biometric attendance systems, and implementation of first phase of campus wide surveillance system using more than 100 CCTV cameras. The Centre has also successfully completed the deployment of 250 port Giga bit network for faculty housing.

The Centre is responsible for maintaining and upgrading the campus wide 5000 data port wired and Wi-Fi network. With the augmentation of existing facilities, the Centre has been able to support conduct of online examinations, structured and unstructured labs for more than 30 courses offered by Computer Science and other departments. The Centre has also been involved in supporting the number of workshops and training programmes conducted in the Institute. The IPC is open on all days throughout the academic session from 08:00 A.M. to midnight and

it is closed only for 3 days in every semester. The details of existing facilities in the IPC are given below.

The Center also offers number of high-end computer servers to its users currently it has 16 node HPC cluster, 5 GPU servers with Nvidia tesla cards, and 15 numbers of Intel based SMP servers. These servers offer, variety of operating systems and development tools to the faculty and students. In addition to the servers, the center has 7 labs equipped with 350 latest desktop machines. These systems operate under Linux and Windows environment and support variety of compilers database and software tools such as C, C++, Java, and Microsoft Visual tools, MATLAB, and Rational Rose etc. The central computing facility specifically takes care of the bulk computing needs of under graduate, masters and Ph.D students.

Apart from the above-mentioned centralized computing facility, the various departments have their own specialized computing facility.

The BITS Intranet

IntraBITS is a collaboration-category intranet portal deployed and supported by the Software Development and Educational Technology Unit (through its Centre for Software Development) since 1999. Its principal objective has been to enable the faculty and students to leverage appropriate software technologies in the On-Campus educational (teaching, learning, sharing) process. The followings are some of the highlights of the BITS Intranet. This portal has gradually expanded to multiple independent sites linked to it.

- An On-line Learning Management System (Nalanda) built in 2010, atop LAMP and Moodle platforms provides a complementary globally accessible service that aims to serve the entire community, both students and faculty members.
- An online IPC Complaint Management System that provides facility for registering network connectivity related queries of the campus community.
- The BITS Intranet is serving as a vibrant medium for exchange of academic and other ideas among students and faculty.

Centre for Software Development (CSD)

The Centre for Software Development (CSD) is responsible for the development and maintenance of University website, multimedia based content creation, maintenance of immersive Telepresence systems across all campuses, development of web based applications for providing various services to the user community (i.e. room booking, complaint management etc.) and maintenance of Open-source Moodle based learning management system. A team of

students work on various research and development projects using latest technologies in the centre.

Centre for Education Technology (CET)

The Centre for Education Technology (CET) is responsible for identifying and deploying the new and upcoming technology to support instruction delivery. The centre manages the Telepresence facility based classroom which is used for running inter campus courses. It is involved in the Open-source Moodle LMS based deployment for requirements of the Institute in the form of the Nalanda portal on a regular basis. The centre also provides technical support for managing class room lecture recording system, deployed in four classrooms of Lecture Theater Complex (LTC). It is involved in the research, development and deployment specific to the next-generation Education Technology solutions.

Central Analytical Laboratory Facility (Pharmacy)

Central Analytical Laboratory (CAL) at BITS Pilani, Pilani campus houses many sophisticated instruments, catering to the needs of the various research Departments like Pharmacy, Biological Sciences, Physics, Chemistry and Chemical Engineering etc. The facility is used for training and teaching of the students as well doctoral research. CAL has a spacious area of 2600 sq.ft and is equipped with latest instruments that includes - Stability Cabinets (For stability testing of drugs and organic molecules), UV-Visible Spectrophotometers, UV-Visible-NIR Scanning Spectrophotometer, IR Spectrophotometer, FTIR Spectrophotometer, Scanning Spectroflourimeter, High Voltage Electrophoresis, Digital Polarimeters, Ultra and Refrigerated Centrifuges, Differential Scanning Calorimeter, Gas Chromatography, High Performance, Liquid Chromatography (with auto-sampler and various detectors), Thermogravimetric Analyzer (Shimadzu), Impedance analyzer, Particle Size analyzer, Rheometer, Ellipsometer and Elemental Analyser (vario MICRO cube). High end equipment's such as 400 MHz NMR spectrophotometer (Bruker AVANCE III), Atomic Force Microscope-Surface Enhance Raman Spectroscopy, Gas Chromatography-Mass spectrometry, Field Emission Scanning Electron Microscope have also been installed. Recently the laboratory has been upgraded with Confocal Microscope. Currently the facility is capable of carrying out research work at all levels including the industrial projects. Apart from using the Central Analytical Laboratory facilities for teaching and training of the First Degree and Higher Degree students, it is extensively used for dissertation and doctoral research, faculty research and consultancy work. It is also used by scientists/faculty from other nearby organizations.

Central Animal Facility (Pharmacy)

Central Animal Facility at BITS Pilani, Pilani campus is a CPCSEA approved facility with total floor area of 5330 sq. ft. The facility is also approved for in-house breeding of small animals. The facility maintains the animal species like Rats, Mice, Guinea Pigs, Rabbits and Hamsters. It was build up in accordance with guidelines issued by CPCSEA and other regulatory bodies. It is also equipped with incinerator (electrically operated) facility for disposal of the biological and other biomedical waste. The air conditioned facility is maintained by well trained personnel, with a full time veterinarian to take care of the various requirements of the animals. Central Animal Facility caters to the needs of the various research departments like Pharmacy, Biological Sciences and Chemistry, etc. The facility also incorporates Pharmacokinetics, Pharmacodynamics and Pharmacology research laboratory for carrying out advanced research in the areas of pre-clinical pharmacokinetics, bioavailability studies, pharmacological screening of various synthetic/natural origin drugs. The laboratory has sophisticated instruments such as two chamber automated organ bath, laser doppler, noninvasive blood pressure recorder, semi dry transfer apparatus, microtome, RT-PCR, electroconvulsiometer, actophotometer, analgesiometer, light dark apparatus, rotarod etc. Equipments such as surgical anesthesia machine, electrical cautery, deep freezers (-20 and -80°C) and spare air-conditioners are also utilized. The laboratory is upgraded with video documentation system for various animal behavioral studies. Facility is geared to take up various industrial or governmental funded projects in various pre-clinical areas. Recently Air Handling Units and Large Scale Autoclave have been installed.

Technology Innovation Centre

Engineers/Scientists from industry bring their research and developmental projects for investigation in the campus. Such investigations are carried out in collaboration with Institute faculty associated with students registered in assigned research or project courses. Several industries have been participating in this programme. While in the campus, these engineers and scientists from industry are given a de-facto status of faculty members, so that they are encouraged to extend their professional interest much beyond the original scope of operation. Students also undertake identified projects by the industry wherein professional guidance is extended by professionals from industry virtually.

Centre for Innovation, Incubation & Entrepreneurship (CIIE)

Centre for Innovation, Incubation and Entrepreneurship (CIIE) at BITS Pilani across its 4 campuses continuously work in an integrated manner to strengthen the on-campus ecosystem to promote innovation, entrepreneurship and incubation taking care of all related academic and non-academic activities. The mandate of the CIIE includes facilitating technology transfer & commercialization, executing filing of patents, custodian of intellectual property of BITS,

supporting entrepreneurial activities, interfacing with Technology business incubators of all campuses and fostering collaboration with alumni and industry for several entrepreneurial activities.

Pilani Innovation and Entrepreneurship Development Society

Pilani Innovation and Entrepreneurship Development Society (PIEDS) at BITS Pilani – Pilani Campus established in 2013 gives a distinct emphasis on creation of technology/innovation based new enterprises. The society takes up various activities to promote and encourage technology based innovation, incubation & entrepreneurship development. The main objectives of the society are to aid and help startup teams in the creation of technologies/innovations addressing market/societal needs; to foster the entrepreneurial spirit among students, faculty and community; and to provide mentoring, consulting, networking & funding services to aspiring innovators and entrepreneurs.

Embedded Controller Application Centre

This Centre was set up in Collaboration with Motorola India Ltd. The objective of the Centre is to impart detailed understanding of important features of embedded controller architectures and familiarization of advanced concepts in the field of embedded controllers through students projects/Industrial projects, Imparting training to the industry professionals and running short term courses in the field of Embedded System design, developing course modules.The infrastructure of the Centre includes High quality computing facilities, Microcontroller Modular Evaluation Systems, Microcontroller Development Systems, Emulators, Assemblers and Cross compilers for various microcontroller families (ARM, ATMEL, Microchip, Cypress, ST Microelectronics, etc.) DSP processors, logic analyzer and other bench equipments. We have received hardware and software license support under the ARM University program and Texas Instruments University Collaboration.

Centre for Renewable Energy and Environment Development (CREED)

CREED is an interdisciplinary Centre that co-ordinates educational and research activities in the active areas of renewable energy and environment. The objectives of the Centre are (i) to conceive, develop and implement renewable energy applications and environment protection projects, (ii) to develop courses and organize awareness programmes, and (iii) to collaborate with external organizations in the areas of renewable energy education, training and technology development. Some of the existing facilities at CREED include an experimental set up for solar water heating, solar air-heating system, solar stills, and solar photovoltaic power pack with storage battery bank, SPV lighting systems, fluidized bed

combustor with gasifier and various instruments related to energy audit and solar resource assessment.

Currently, active research areas of CREED include concentrated solar power and photovoltaic power based policy analysis, emissions and environmental impact of thermal power plants, planning and economics of renewable energy systems, real time operation and control of renewable systems, industrial cogeneration, integrated renewable systems, demand side management, clean development management integrated resource planning, CO2 based refrigeration, biomass based fluidized bed combustion, biomass pyrolysis etc. The faculty members and research scholars of the center have also visited University of South Florida, USA and TU Braunschweig, Germany for the research purpose under institute's schemes.

The Renewable Energy Club is an exclusively a student managed body that operates under CREED. The Club has undertaken active work in organizing competitions, quizzes, carbon footprint analysis and carbon credits. Commercial organizations in these areas have evolved out of this club, and are currently owned and operated by BITS alumni.

Centre for Biotechnology

The Centre has in-house facilities of Genetic Engineering and Recombinant-DNA Technology. The objectives of the Centre are to take up research and development projects from various sponsoring organizations, establishments of University-Industry linkage through various R&D contract projects and conduct periodic Workshops and hands on training for faculty members, industry personnel and students in the area of advanced molecular biology/biotechnology and bioinformatics. The facilities available are Gel Documentation System, PCR Machines, Real Time PCR, Hybridization oven, Gel electrophoresis equipments, UV-Cross linker, FPLC, Nanodrop, Vacuum concentrator, Temperature Controlled Water Bath Shaker, Refrigerated Centrifuge, Ultracentrifuge, Cell counter, Plant growth chamber, Fluorescent microscopes, Apotome Microscope, Gene Gun, ICP-OES, Cold Room, Tissue Culture Room, Plant Biotechnology facility, Semi-automated Green House, Radioisotope handling facilities, Victor-3 Multichannel counter, Inverted microscope with camera attachment, -80°C Deep Freezer, etc. We developed Insectory to facilitate research on mosquito borne diseases. A Drosophila lab is being developed for studying human genetic disorders.

Centre for Materials Science and Technology (Mechanical Engineering)

The objective of the Centre for Materials Science and Technology is to develop and implement projects related to modern materials such as smart materials, biomaterials, fibre-reinforced plastic composites and also related to conventional materials such as metals, ceramics and

polymers. The Centre undertakes mechanical and non-destructive testing of various engineering materials and products for evaluating their mechanical properties and for evaluating defects such as cracks, voids, delamination, inclusions etc. Other activities include providing consultancy related to materials aspects and testing/development and analysis in the field of materials science and technology in general. The testing facilities available at the Centre include a conventional Universal Testing Machine of 50 Tons capacity, as well as, a fully computerized microprocessor based Electronic Universal Testing Machine of 100 kN capacity, Heating Chamber for UTM for High Temperature Testing, Hounsfield Tenso-meter, various hardness testing machines such as Brinell, Rockwell, and Vickers Hardness Testers, Rotating Bending Fatigue Testing Machine, Combined Bending and Torsion Fatigue Testing Machine, Strain-gauge testing facility, Izod Impact Testing Machines, Digital impact testing machine, Double disk polisher, Inverted Metallurgy Microscope, Erichsen cupping tester, Circular and plane Polari-scope for photoelastic stress measurement, Single Screw Extruder with Calendering and Pelleti-zation Facilities, Ultrasonic Flaw Detectors, Liquid Penetrant Test kit, Magnetic Crack Detector, Eddy Current Tester, Acoustic Emission Testing equipment, Acoustoultrasonic pocket hand-held AU scanner etc.Wet-lab facility and fume hood for polymer fabrication section. Basic Mechanical fault simulator, Data acquisition system for vibration measurement, Tribometer.

Centre for Desert Development Technologies (C-DDT)

Established with the financial support from BITS Alumni, C-DDT functions with the primary objective of developing world-class desert development technologies for making the desert bloom. It has joined hands with the Jacob Blustein Institute for Desert Research (BIDR) of Ben Gurion University, Negev, Israel to work in the area of desert development. The activities of the centre revolve around developing affordable and technically less esoteric technologies and integrating them with the existing practices of the desert areas of Rajasthan for economic upliftment, employment generation and poverty alleviation of the people of Rajasthan. Last four years research has been focused on the energy efficient houses. For the purpose four rooms were constructed with different architectural elements. Last two years three International papers are published in International reputed journals and two reputed International conferences and one Ph.D. scholar has completed her doctorate along with some first-degree projects at centre this year. Last year the solar house was integrated with rain water harvesting scheme and tank was covered, extended roof is fabricated to harness more rainwater and some roof tops were connected. This year ground is cleaned and leveled to apply contour irrigation system. Downward slope is made to flow the water in one direction.

BITS Astronomical Observatory (Physics)

BITS Pilani houses an astronomical observatory that is equipped with two telescopes, a 6″ refracting telescope, and an 11" Celestron's Schmidt-Cassegrain telescope which is completely computerized. The observatory has recently procured a CCD camera which can be used with the 11" telescope to obtain long-exposure, high quality images, of nebulae and star-clusters. The observatory is maintained by the Physics Department of the institute. A group of 20 students, known as, Astro Club,makes a regular use of the telescopes to observe celestial objects on a fortnightly basis. In addition, the club conducts regular astronomical observation sessions as well as workshops for general public, i.e. entire BITS community of students and staff, several times during a semester. Moreover, students registered in the elective course on Introduction to Astronomy and Astrophysics, offered by the physics department faculty, also make use of the observatory on a regular basis to augment their understanding of celestial objects.

Pilani Meteorological Observatory (Physics)

The Institute runs and maintains Pilani Meteorological Observatory on behalf of the Meteorological Department of the Government of India. Daily meteorological data regarding the weather at Pilani are recorded and transmitted by the observer, under the supervision of a professor in-charge, appointed by the Institute. The observatory has an automated weather station.

SPECIALISED LABORATORIES

Apart from the Centers described above, the following specialized laboratories have been established with a view to strengthen research and development in the respective areas:

Process Dynamics and Control Laboratory (Chemical Engineering)

Infrastructure includes Universal Process Control Trainer, Multiprocessor Trainer and Computer Control of process variables such as temperature, pressure, level, flow and pH in Chemical Engineering Processes

Environmental Engineering Laboratory (Chemical Engineering)

Infrastructure of this laboratory includes BOD Incubator Shaker, several gas and water pollutant sampling and analysis equipment such as air and water analysis kits, underground water sampling kit, pH meter , conductivity meter, Total Dissolved Solid, Salinity, Dissolved Oxygen meter, BOD incubator, Digital BOD analyzer, Digital COD apparatus, Temperature Controlled Shaker Bath, Laminar Hood Chamber, Orsat Apparatus, Refractometer,

AutoClave, Fermenter, Distilled Water Setup, Peristaltic Pump, Compressor, Muffle Furnace, Calony Counter, Electronic Balance, Ion Meter, Fluoride Electrode, Hot Plate, Vertex Mixture, Deep Freezer, Oven, Hot Air Oven, Vacuum Oven, Remi Centrifuge, High Speed Centrifuge, Refrigerator. Data Logging Thermometer, 4-Channel Thermometer, etc.

Petroleum Engineering Laboratory (Chemical Engineering)

Infrastructure of this laboratory includes setups for ASTM Distillation, Flash point and fire point, Cloud point and pour point, Reid vapor pressure, Saybolt viscometer, Copper-strip corrosion, Conradson carbon residue, Redwood viscometer-1 & 2, Engler viscometer, Penetrometer, Bomb calorimeter, Drop point of grease, Melting point apparatus, Smoke point apparatus, Gum content testing apparatus, Oxidation stability tester, Sulfur analyzer etc.

Research (Setup) Laboratory (Chemical Engineering)

Continuous Adsorption Set-up, Biofiltration Column Set-up, Downdraft Biomass Gasifier, PyrolysisUnit, Reactive Distillation Setup, Air-LiftBioreactor, CSTR Unit, FluidizedBed Reactor, Fixed Bed Catalytic Reactor, Re-circulating Fluidized Bed Bench-scale Riser, Loop reactor, Particle Imaging Velocimetry, Flow Sense Camera, Isokinetic Tar sampling Setup, Digital Steam Rotameter, Ventury Scrubber, Sand Bed Filter, Glass Fiber Candle Filter, Fixed Bed Pyrolysis Unit, Fluidized bed Pyrolysis unit, Biomass Coke Stove, etc.

Analytical Laboratory (Chemical Engineering)

UV-VIS Spectrophotometer, pH/Ion Meter, Thermal Gravimetric analyser (TGA), High Performance Liquid Chromatograph (HPLC), Digital Scanning Calorimeter (DSC), Automatic Potentiometric Titrator with KF Attachment, Atomic Absorption Spectrophotometer (AAS), Gas Chromatograph (GC), Fourier Transform Infrared Spectrometer (FTIR), Flue Gas Analyser, Surface Area Analyser, Dynamic Foam Analyser, Multi Syringe Pump,Volumetric Analyser (VA), Cooling Micro Centrifuge, Rota Vapour, Digital Viscometer, Ultrasonic Cleaner, Auto Vacuum Desiccators, Ultrasonic Liquid Processor, HPLC Pump, Freeze Dryer (Lifolizer), Nan-contact Infrared Thermometer, Spin Coating Machine, DTG, Contact Angle Meter, Continuous Gas Chromatograph, Weighing Balance,CO2 Analyser, etc.

Flexible Manufacturing Systems Laboratory (Central Workshop)

The Flexible Manufacturing Systems (FMS) Laboratory conducts hands on training to first degree & higher degree students and cutting edge research in manufacturing science. This laboratory is a center for carrying out practical experiments for various on campus courses

such as Flexible Manufacturing Systems (EA C412/BITS F431), Computer Aided Manufacturing (ME F432), Production Techniques-II (ME F313), Metal Forming and Machining (MF 313), etc. This laboratory has been designed and configured to assist the Indian industry to become globally competitive in CNC manufacturing, CAD/CAM and machine tool sectors. The aim of the laboratory is to conduct fundamental as well as integrated research in order to achieve appropriate skill in CNC machining, in-depth knowledge in metal cutting, designing of manufacturing systems, developing manufacturing management techniques/strategies/practices for revitalization of Indian industries. The FMS lab aims to be foremost research center in CNC manufacturing, design of manufacturing systems and manufacturing excellence practices.

The following facilities are available in the FMS Lab.

- **Hardware:**

  - **KODI-40 KLIEN Vertical Machining Center (Industrial)**
  - **Renishaw Probing System attached to KODI 40 VMC**
  - **Taylor Hobson Talysurf**
  - **FLIR Thermal Image System T250**
  - **MTAB STARRTURN CNC Lathe and Milling Trainer**
  - **MTAB FMS Cell**
  - **ROBOT**
  - **Rapid Prototyping Machines**

- **Dimension Elite 3D Printer**
- **FMD 200mc**

  - **IBM Intelli Workstations and High Computing Facility**

- **Software Tools**

  - **Umberto Life Cycle Assessment Tool**
  - **CATIA-PLM Tool**
  - **QUEST-3D Simulation Tool**
  - **ARENA-2D Simulation Tool**
  - **SIMUFACT Software**
  - **MINITAB-Quality Control Tool**
  - **DFMA-Product Design Tool**
  - **LINDO/LINGO-Optimization Tool**
  - **Multi-Attribute Decision Models**

Oysters Lab-VLSI DESIGN Laboratory (EEE) This laboratory has been established to support the Micro-electronics program and to carry out projects in the field of VLSI design. The facilities in the Lab, with a seating capacity of forty students, include the centralized IBM x3650 M4 servers, Sun Fire X2200, Ultra 20 with RHEL operating system and DELL Optiplex desktops as clients. The servers operate on High Availability platform with parallel computing and cluster configuration. The lab is equipped with the complete set of front-end and back-end EDA (Electronic Design Automation) tools from the top vendors including Cadence, Synopsys and Mentor Graphics for ASIC design, Symica custom IC design Tool kit, Altera for FPGA design, and Silvaco for device & process simulation.

The lab has collaboration with Europractice to obtain design kits for ASIC design including UMC 90 nm, 130nm, and 180nm, TSMC 180nm and 250nm and the Altera FPGA kits include 40 UP3 kits, 10 DSP development kits and 10 NIOS-II development kits. The lab also has a Mixed Signal Oscilloscope and a Function generator, from Tektronix, to test the fabricated chips

Instrumentation Technology and Virtual Instrumentation Laboratory (EEE): The facility in the laboratory includes general purpose and specialized bench equipment, transducers and signal conditioning kits, PC based data acquisition and control cards, Virtual Instrumentation software (LabView) and data acquisition & signal conditioning modules, ELVIS boards, Green Engineering, bioengineering kits, wireless sensor network kits, Programmable Logic Controllers with I/O modules and interfaces.

Optical Communication Laboratory (EEE)

The infrastructure in the laboratory includes facilities for study and characterization of optical waveguides, fibers, Optoelectronic sources and detectors. Facilities are available for fabrication and calibration of fiber optic sensors. Training kits to study, design and simulate fiber optic communication & network systems with additional computational facilities to characterize them.

IoT laboratory (EEE)

The Internet of Things (IoT) lab provides various equipment and facilities to conduct research and develop prototypes for IoT and several allied areas such as Security, Drones, Brain Computer Interface (BCI), 5G, Blockchain and Vehicular Ad Hoc Networks (VANETS). It also hosts laboratory activities for the related courses. Humanoid robots, BCI and FPGA kits, Quadcopters, FPGAs, and a variety of microcontrollers, sensors and actuators are available in this laboratory for research and development activities.

Advanced Structural Engineering Lab (Civil Engineering)

This lab has well-equipped testing facilities for structures and materials. The lab supports various equipment such as Loading frame with Servo-Hydraulic Actuator of 400 kN capacity,100 kN Dynamic Universal Testing Machine, 1000 kN Static Universal Testing Machine, 1000 N Shake Table, Beam Torsion Testing Machine, Acid Resistance chamber, Digital Hot Air oven. These facilities are available to students, academicians, and researchers for their class and project work, and to outside agencies.

Structural Engineering Lab (Civil Engineering)

Portal Frame Apparatus, Redundant Joint Apparatus, Elastically Couple Beam Apparatus, Deflection of Truss Apparatus, Elastic Properties of Deflected Beam Apparatus, 3-Hinged Arch Apparatus, Column and Strut Apparatus, Unsymmetrical Bending Apparatus, Digital Switching Power Amplifier etc., etc. These facilities are available to students for their class and project work..

Highway/Transportation Engineering Laboratory (Civil Engineering)

The highway / transportation engineering laboratory is equipped with state-of-the-art devices that are used for the testing of pavement materials, conducting traffic engineering studies and to design safe flexible and rigid pavements. The equipment housed in the laboratory includes, among others, Los Angeles Abrasion Testing Machine, Light Weight Deflectometer (LWD), Dynamic Cone Penetrometer (DCP), MERLIN, Bump Integrator, Portable Skid Resistance Tester, Centrifuge Extractor, Viscosity Bath Test Apparatus, Digital Ductility Testing Machine, Speed Radar Gun, Auto Exhaust Multi- gas Analyzer, Global Positioning System (GPS) units, Digital California Bearing Ratio Test Machine, and Marshall Stability Test Apparatus, Buoyancy Balance equipment. In addition, the laboratory also hosts several software packages that include VISSIM, ArcGIS, AutoCAD, MX Road, Trazer, Asphalt Mixer Density Meter, Two Handycams - Sony Make with tripods, etc. These facilities are available to students, academicians, and researchers for their class and project work, and to outside agencies for consulting work.

Survey Lab (Civil Engineering)

The survey lab is equipped with both basic and advanced instruments such as Total station, Digital Theodolite, Tacheometer, Prismatic compass, Auto Level, Tilting Level, Digital Planimeter, GPS etc., These instruments are predominantly used for the undergraduate lab work for the surveying course and also for project work for post-graduate students.

Soil Mechanics and Foundation Engineering Lab (Civil Engineering):

This lab has state-of-the art facilities for both teaching and research purpose and has wide range on instruments such as Digital Direct Shear Test Apparatus, Manual Direct Shear Test Apparatus, Triaxial Test Apparatus, Relative Density Test Apparatus, Unconfined Compressive Test Apparatus, Hot Air Oven, Consolidation Test Apparatus, Permeability Test Apparatus, Field Density Test Apparatus, IS Sieves, Hydrometer, CBR Test Apparatus, SPT Apparatus, DCPT Apparatus and Casagrande Apparatus, 4-Channel Digital Vibration Meter. These facilities are available to students, academicians, and researchers for their class and project work, and to outside agencies

Hydraulics Lab (Civil Engineering)

This lab has state-of-the art facilities for both teaching and research purpose and has wide range on instruments such as Stoke's Apparatus, Discharge Measuring Apparatus (V-Notch), Osborne Reynolds Apparatus, Hydraulic Jump Measuring Apparatus. Jet Impact Measurement Apparatus, Centrifugal PumpFrancis TurbineKaplan Turbine, Heleshaw Apparatus, Metacentric Height Measurement Apparatus (Ship Model), Fixed Bed Flume, Multi-Purpose Flume, Tilting Flume Apparatus, Constant Head Apparatus, Varying Head Apparatus, Anemometer Viscometer.

Concrete Lab (Civil Engineering

The concrete lab has state-of-the art facilities for both teaching and research purpose and has wide range on instruments such as.Self Compacting Concrete Mixer, Slump Cone, Compression Testing Machine(2000kN), Compaction Factor Apparatus, Cement Tensile Testing Apparatus, Hobart Mixer, Cube Cutter, Flexural Strength Measuring Apparatus (Beam), 4-Point Loading Apparatus, Core Cutter, Vicat Apparatus, Vibrator Table, Vee Bee Test, Hot Air Oven, Muffle Furnace, Freeze-Thaw Chamber, Carbonation Chamber, Hydraulic Trolley (5000 kg capacity), Calorimeter, Motorized Sieve Shaker, Humidity Environmental Chamber, Concrete cube permeability apparatus, Cement autoclave, Automatic Blaine apparatus, Rebound hammer, concrete cube cutter apparatus These facilities are available to students, academicians, and researchers for their class and project work, and to outside agencies.

Environmental Engineering Lab (Civil Engineering):

The Environmental Engineering Lab has state-of-the art facilities for both teaching and research purpose and has wide range on instruments such as.Orbital Shaker, Hot Air Oven, Deep Refrigerator, Vertical Autoclave, UV Spectrophotometer, Jar Test Apparatus, Incubator, Oxy Top Bottles, Nephlometer, COD Digester, DR Spectrophotometer, Digital DO/pH Meter,

Centrifuge, Primary Clarifier/Setting tank apparatus, Rapid Sand Filtration Process Apparatus, Fume Hood with special blower. These facilities are available to students, academicians, and researchers for their class and project work, and to outside agencies

Computer Center and GIS (Civil Engineering)

The computer center and GIS Lab has state-of-the art facilities for both teaching and research purpose such as VISSIM, ArcGIS, ANSYS 14.5, CivilFEM, Abaqus 6.13, ETABS 2013, SAP2000 16, GEO5 15, AUTOCAD 2014, Lahey-fujitsu Fortran 7.5, RAM Concept V8i, STAAD Foundation Advance V8i, Structural Synchronizer V8i, MX V8i, Bentley Maps V8i, Bentley PowerCivil V8i,Projectwise V8i, STAAD Beava Module, Bentley Products, Pipe flow expert, ROLTA Geomatica suite, STAAD Pro V8i, STAAD Foundation V8i, DigitiZeIT

Composite Lab (Civil Engineering): This lab is dedicated for research purpose, especially in the area of composites. Many equipments such as, Vacuum system for composites equipment, AE Win, Waveform equipment, Probe Sonicater are available for research purpose. Composite plates are being manufactured and tested in this lab for the research purpose.

Language Laboratory (HSS)

A language laboratory with 40 booths is functioning to conduct practice sessions pertaining to the various courses offered by the department and to provide adequate practice to the students in different communication skills in English. The computer assisted lab facilitates the teacher to instruct and take responses from students through a computer network. Students and faculty across the institute also use these labs for the self-practice and self-assessment of their language and communication skills. The lab has a good collection of audio visual teaching materials in the form of Audio/Video CDs, Audio cassettes and Learning software which are used to enhance the linguistic competence and interpersonal skills of the students. The Department has procured an advanced language lab software system named Orell Digital Language Lab (ODLL) which offers cutting edge software solutions and delivers language teaching - learning solutions integrating two - way communication and incognito individual student monitoring. The Lab also houses a 2D Classical Animation Desk for students to practice and do assignment for the course Mass Media Content and Design.

Creative Media Lab (HSS): The Department is equipped with a studio-cum-lab for meeting the requirements of asset of courses in the area of Media and Communication. It is primarily designed to support the course Short Film and Video Production. The lab is equipped with DSLR and video cameras, colour video monitor, Microphones, basic lighting equipment and

other accessories. For editing films, the lab has acquired a Mac –Pro 2.4 GHz Quad –core Intel XEON.

Music Lab (HSS): The Music lab is used for offering the various courses, theoretical as well as practical, i.e.- Appreciation of Indian Music, Musicology-An Introduction, Indian Classical Music- (Instrumental-1) and Indian Classical Music (Instrumental-2), with different course plans of Indian and worldwide music, along with the musical practices and rehearsals for different institutional events taking place throughout the academic year. It houses various instruments like Tanpura, Tabla, Harmonium, Sitar, Guitar, Synthesizer, Violin, etc. for the class room practices for the practical courses and performances.

Central Workshop

The Central Workshop of the Institute has shifted to the 2600 sqm new building. The new workshop; in addition to imparting training to the students and catering to the maintenance and research needs of the Institute; is also designed for the 'design to test' concept. When fully functional, any student having an idea can design, prototype and test the part/product in the workshop. CNC machining, Reconfigurable Mini CNC machining, Foundry, Forming, Welding, Carpentry, Advanced Metrology, Learning Factory, Sustainable Manufacturing & Life Cycle Engineering are fully functional. Major equipment added during the year are: coordinate measuring machine (CMM), contour measuring system, vision measuring system, surface roundness tester, profile projector, microscope, micro hardness tester, 4 CNC turning and milling centres, 63 tonne power press, power tools, TIG & MIG welding and dynamometer. The workshop is equipped with state of the art metrology lab and dustless carpentry shop. Students' training consists of training all integrated first degree students through the course 'Workshop Practice' by imparting skills in various manufacturing processes. In addition, students are imparted training for other courses like 'Production Techniques', 'Metal Forming and Machining', 'Casting and Welding', 'Computer Aided Manufacturing', and 'Flexible Manufacturing Systems'. Apart from routine maintenance, fabrication and training, the workshop also accepts jobs on precision fabrication of project work of students, staff and research scholars.

Central Library

The BITS Pilani library is housed in a state-of-the-art building, covering about 65000 sq.ft area and is located close to all academic blocks of the Institute. The library indeed is an architectural marvel with an attractive palatial interiors, high ceiling, adequate natural lighting and ventilation with several series of courtyards, with each used for different activities. Inside the library, there is a layout of natural green plants that are soothing

for the eyes. The library has a seating capacity for 950 students in one go. This year the library created new spaces like Innovation and MakerSpace,BITS Heritage Gallery in addition to the last year's Brainstorm Room, Group Discussion Room and Research Zone, E-Zones, AC Reading Rooms with necessary IT infrastructure to serve the needs of the modern tech savvy users.

The library aims to support the teaching, learning and research activities of the institute with specially designed information services to meet the needs of its users. The library is fully automated with RFID technology integrated with KOHA library management software that provides quick and efficient circulation operations, enhanced security for Library print collection, seamless inventory management and provides latest technology experience to its patrons. The Online Public Access Catalogue with efficient searching facility can be accessed from anywhere within the campus through Wifi and LAN. The library includes well-lit reading halls, stacks, display areas, e-library zones, audio-visual cum brainstorm facility and study carrels.

The collection consists of over 2,49, 000, books including rare books, textbooks and bound volumes of journals since 1920s. Besides core subjects, the stock also covers a good blend of reference material in the form of Dictionaries, Encyclopedias, Handbooks, Yearbooks, Theses, Standards etc. The library also provides access to millions of E- Books.

The library has made a special efforts to preserve rare books by establishing a state of the art air conditioned G.D Birla Rare Books Section - in Hall No. 3. This newly set-up section has a remarkable stock of scholarly rare books, manuscripts, paintings and photographs which are timeless and invaluable. Many of these rare books are published almost about 150 and 200 years ago. The library staff has been trained to preserve rare books. by using German Tissue paper. So far more than 150 valuable and scholarly rare books have been preserved using this technique and the work is in progress.

Library subscribes to over 113 print National and International journals. It has access to over 50,000 full-text e-journals through 36 online databases such as ACM, IEEE, ASCE, ASME, Bentham Science, Springer, Science Direct, Wiley, IOP, Project Muse, ACS, PROQUEST, SciFinder, Scopus, Emerald, EBSCO,JSTOR, OUP, CUP, Indiastat, ProwessIQ etc.. covering all branches of Science, Technology, Engineering, Economics and Management, Humanities and Social Sciences. These can also be accessed from hostel rooms as well as from faculty residences. In addition to books and periodicals, the library has a good collection of non-book material namely Audio CDs, Videos, DVDs, CD ROMs, etc to cater to the educational/academic and research needs of students as well as faculty. These electronic resources are made available through an interactive and dynamic library portal called

infoBITS. The portal provides an integrated search engine called One Search which is an online discovery tool that "pulls together" BITS Pilani Library resources so that users can be explored using a single search box. In other words, instead of searching individually the different resources such as WebOPAC, databases, E-books, Institutional Repository etc, users can use One Search and get the most relevant results using advanced scholarly filtering techniques.

There are 45 public access terminals in the library. The library provides Internet connectivity even for the readers' laptops.. The renovated Text Book section in Hall 5 provides all latest text and reference books for study in the library. Photocopying facility on First Floor is also available in the library premises.

The Library has implemented two institutional repositories namely E-Print and D-Space which provide access to Institute's research and academic output. Currently repositories contain over 3257 faculty publications , digitized books and institutions events in audio visuals, etc.

BITS Pilani Heritage Gallery (BHG) is going to be established soon in the Library. BHG will be a modern, state of the art gallerywhich will showcase the historical, cultural, educational and rich legacy established by this great institute andhow it has evolved from Patashala to the current status ofInstitute of Eminencein the country.It will have a display of framed photographs and many other important documents and literature in a chronological order. It will also have a separate digital display of audio-visual content which can be retrieved through a search engine developed by the BITS Pilani library in collaboration with students.

Research Zone

To support the research activities in the campus a Research Zone has been established in the Hall No. 4 where all the latest books acquired using project funded books on research, last 5 years Ph.D theses, Research@BITS Publications and research tools are kept. Faculty Publications are also displayed in this room. The Research Zone has one LED screen with Internet connection where research scholars can book this room to make presentations and to conduct meetings, workshops, seminars etc.

Online Portal infoBITS

Through the interactive library portal infoBITS, all library services such as Daily News, Monthly infoBITS Bulletins, Book Finder, Periodical Finder, Books@MyDesk, Lost and Found

Items, Suggestions/Complaints, Book Reviews, Feedback, book of the week are made available. All library resources are also made available through the library portal

The library organizes many events throughout the year to inculcate reading habits among the students. Basant Book Festival, World Book and Copyright Day, Summer & Winter Reading Challenges are just a few to name.

Innovation Zone Cum MakerSpace

This room can be used for Innovative projects - Ideation, Product Design, Rapid prototyping, Brainstorming etc. The person booking this facility is responsible for the co-ordination of the event or activity happening in this room. It is important to read the Rules and Regulations for using Innovation zone on the library portal carefully prior to booking the space.

Maximum eight students are allowed inside the Innovation/Maker Space zone at a time. The use of Innovation Zone/MakerSpace is limited for two hours per day per student, unless prior approval is obtained from the Librarian. Any electronic gadgets such as Raspberry Pi4 etc must be returned in the same working condition as they were issued. Students who attempts to delete or modify either hardware or software will be held liable for all damages. Theft will be considered as a serious offence and will result in a hefty fine and also permanent ban from the Innovation Zone/MakerSpace area.

Students must save their work on their external memory device. Once the project is over, it is the student's responsibility to delete any of their personal files from library computers in the Innovation Zone / MakerSpace. Any issues or accidents are to be immediately reported to a library staff member at the Help Desk in the Central Zone.

Brainstorm and Group Discussion Rooms

The library has on its 1st floor an Air-conditioned, spacious Brainstorm Room with a seating capacity for about 20 persons. This room can be used for academic discussions, deliberations, small seminars, brainstorming, Video screenings, Webinars etc.

Group Discussion Room has a capacity for about 6 persons. This room can be used for academic discussions, deliberations, meetings, brainstorming, Video screenings etc. The person booking these facilities is responsible for co-ordination of the event or activity happening in this room.

Please go through the rules and regulations on the library portal prior to using these facilities.

Reprography Section

The Reprography Section takes care of all the in-house printing, binding, and photocopying work (e.g. printing of institute bulletin, annual report, various information brochures, timetable, academic regulation, answer booklets and project reports for submission to various Government and other funding agencies). The printing and binding sections have been fully equipped with facilities like offset B/W printing, heavy-duty photocopier machines, cutting, laminating, stitching, spiral binding, etc. Reprography has a separate question paper printing/copying facility where the scripts related to assignments, tutorials, quizzes, test and comprehensive examination for all courses offered in on-campus or off-campus programs are printed.

Apart from Institute work, the reprography section also caters to the printing and publishing needs of staff and students. Services like photocopying of journal articles, laser printing, binding and lamination of project reports are available. Reprography also supports printing requirements of various student activities like OASIS, APOGEE, BOSM and other activities undertaken by various clubs and associations. The printing and publication requirement of conferences and workshops organized in the Institute is also supported by the reprography.

The following facilities are available for the benefit of students and staff members.

1. Dispatch facility: All the Institute dispatch requirements are catered through reprography either through ordinary/ speed post facility available at the VidyaVihar Post Office, Pilani or through private courier and cargo carriers for both domestic and international destinations as per needs.
2. Photocopying and allied facilities: Photocopying, printing, word processing, binding and laminating facilities are available for students and staff on chargeable basis at the Reprography section. Photocopying service is also available at the BITS Library.
3. Photography facility: Nikon Camera and Flashlight (Set 1: D7000 & SPEEDLIGHT SB-910; Set 2: D7500 & SPEEDLIGHT SB-5000), Umbrella Light (Problitz 300D), Tripod (Manfrotto, 498RC2) and Photo editing
4. Document Designing: Notification poster and advertisements of BITSAT, ME & Ph.D. admissions, faculty recruitment; Cover page designing of Annual report, Bulletin, Research at BITS, BITScan, BITS in the News, News in Alumni, etc.; Greeting card

designing; Digital advertisement preparation, All the above-mentioned designing as per BITS Brand guidelines using Adobe creative cloud software.

Instrumentation

The instrumentation unit undertakes regular and annual maintenance of laboratory instruments across the Institute. Instrumentation provides an LCD projection facility for regular class-work in classrooms, workshops, conferences, symposiums, and other academic and cultural activities across the institute and also performs preventive maintenance for these projectors. The instrumentation unit facilitates all the institute programs with high-quality public address systems, digital mixers, loudspeakers, and Lighting equipment to make the events more effective and lively. The instrumentation unit also takes care of digital TV installation and recharges in all the hostel's common rooms.

All classes have been equipped with a projection and microphone facility supported by UPS. Unit has procured some state of art instruments like Kramer switch,multiplayer, Logitech presentation remote, 4 Unit x LED par 64 LED stage par cans light, 36x3W RGB DMX RGB Infinite color mixing with Control mode: Work Auto, Sound Active, Master/Slave, DMX512, LED control panel, Irradiant SRC-146 Lighting Controller, 24 Channel Lighting Controller and also providing Videography using Panasonic memory card camera-recorder.

The instrumentation unit also provides mobile and a cellular connection to faculty and staff members. The instrumentation unit also provides an announcement system in MB Hostel and periodic bell system for classrooms and offices in the institute.

Goa Campus

Network Facilities

Campus Local Area Network

The Campus LAN Project of BITS Pilani – K K BIRLA Goa Campus is a state of the art, completely switched, voice-enabled LAN infrastructure. LAN is able to provide 100 Mbps fibre channel network connectivity to all faculty cubicles, offices, library, Labs, lecture theatres, workshop, auditorium all hostel rooms, staff quarters, visitors’ guest house, shopping complex, student activity centre & other public facility locations in the campus. There are 5000+ nodes across the campus.

The network is a three-layer network, namely core, distribution and access. The core & distribution layer is connected through gigabit fibre optic backbone, while the access layer is using enhanced CAT6 / CAT6A cabling. The network is designed to provide link level and device level redundancy.

Virtual Class Room (BITS Connect 2.0)

The virtual classroom is set up at K K BIRLA Goa campus. This facility will enable faculty to deliver lectures to all four BITS campuses simultaneously; alumni and experts to remotely deliver lectures and conduct workshops or panel discussions to multiple BITS campuses simultaneously, with recording and streaming of lectures. Telepresence classroom provided for delivering and receiving interactive lectures between all the BITS campuses. These facilities used for cross campus courses, guest lectures, administrative meetings and online meetings of research groups in India as well as across the world.

Telepresence Conferencing Room (BITS Connect 2.0)

An 18+16 seat CISCO Telepresence (CISCO Room 70 Dual) conference room allows impressive multipoint teleconferencing facility among all the BITS campuses. CISCO Telepresence will transform the meeting spaces into a video collaboration hub for connecting teams across the globe or local meetings. Room 70 Dual comprising a powerful codec, a quad-camera, and 70″ dual 4K display(s) with integrated speakers and microphones. It offers sophisticated camera technologies that bring speaker-tracking and auto-framing capabilities for a people-focused and people/content-focused experience. Telepresence at K K BIRLA Goa campus facilitate virtual meetings for academic and administrative decisions at University level. Licenses for WebEx (web conferencing software) have been provided to all the faculty to facilitate discussions related to course work and research. This facility will also open up avenues of multimedia collaboration with anybody outside the campus activities, seminars, annual functions and other such activities.

Bring your own device (BYOD)

As a part of an effort to make Computer Centre Lab enhancement, collaborative learning with students own personal digital devices on campus, bring your own device (BYOD) area has been designed in the Computer Centre Lab. It is created with the purpose of encouraging students to use technology to support their academic learning and research. Students are permitted to bring devices that can connect to the campus Wired/Wi-Fi network for any accessible digital content.

CCTV Network

CCTV systems provide surveillance capabilities used in the protection of people, assets and systems through an Internet Protocol camera (IP camera) system). This system capable of a higher-resolution video recording and thus provide better, clearer images and perform in low-light recording situations. Presently, we have 110 IP cameras connected through the local area network to dedicated local storage media with 30 days of recording.

Computer Centre

Computer Centre (CC) has a central computing lab having 300 workstations (DELL & Lenovo) connected through LAN. These workstations operate under LINUX and Windows environments and support a variety of software tools such as C, C++, Java, Python, Microsoft visual studio, MySQL, Xilinx, ModelSim, Adobe Photoshop, Open CV, Pro-Engineer, ANSYS, COMSOL, Matlab, AutoDesk etc. CC supports all Departments for their software, hardware and storage requirements. CC provides computing and storage facilities for students, staffs and faculties of the Institute. Presently, with the existing facilities, the centre provides support for conducting online examinations in several courses including Computer Programming, Data Structure and Algorithms, Operating Systems, Computer Networks, Creative Multimedia, ComputerArchitecture, Database Systems, Engineering Graphics, Control Systems, etc. BITSAT, Admissions, students' elections and other online events are also conducted in the central computing lab. Apart from the computing facilities, CC supports a LAN of 4000 wired and 3000 Wi-Fi nodes. with intranet and internet facilities in the academic block, hostel rooms, staff quarters, guest house and other places. There are three internet lines: 500 Mbps from United telecom for hostel rooms, 1000 Mbps from Reliance Jio telecom for academic block and 500 Mbps from Ethernet Express for staff quarters. 100 Mbps dedicated internet bandwidth is provided for WILP classes. 45Mbps MPLS line is provided for video conferencing applications in Telepresence rooms. Secured Wireless connectivity is provided in the Institute building, student hostels, student activity centre, visitor's guest house and medical centre. Sophos XG 750 Next-gen XG Firewall ensures high-performance network security includes network protection (IPSec/SSL VPN, intrusion prevention), Web (URL filtering, application control, Email protection (anti-spam, encryption), wireless, webserver protection and unmatched defense against malware, exploits & ransomware. The centralized e-mail solution is supported by Google. This solution is an integrated solution covering e-mail with 30 GB space, online digital classroom tools, file storage with 5 GB space, collaboration tool, file sharing, personal web pages, calendaring system, etc.

Voice Communication

All faculty members have been provided with a laptop and IP phone facility in their chambers. The IP phone facilitates receiving of incoming calls directly on the individual's telephone.

Video Communication

Multi-point video conferencing facility is made available using the POLYCOM HDX machine. This facility is utilized for online meetings of research groups in India as well as across the world apart from the administrative meetings.

Virtual Class Room (BITS Connect 2.0)

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to support their academic learning and research. Students are permitted to bring devices that can connect to the campus wired/Wi-Fi network for any accessible digital content.

Laboratories

The Institute provides labs equipped with sophisticated instruments and apparatus for students, faculty and research scholars. Some of these include: Nonlinear Optics Lab, Solid State Physics Lab; Physics Teaching Labs (Mechanics), Optics and Electricity and Magnetism, Modern Physics and Advanced Physics Lab), IMA Central Lab, Advanced Computing Lab, Materials Testing Lab, Measurement Techniques (Biology) Lab, Biotechnology Lab, Genetic Engineering Lab, Animal Cell & Tissue Culture Lab, Microbiology Lab, Applied & Environmental Biotechnology Lab, Advance Bio Lab, Cognitive Neuroscience Lab, Faecal Sludge Management Laboratory, Vector Biology Laboratory, Proteomics Lab, MT1 ChemistryLab, Chemistry ProjectLab [Also known as Nano Material Lab], Chemistry Special ProjectLab[Also known as Biosensor Lab], Chemistrylab -Research & Teaching Lab, ChemistryLabII -Teaching Lab,

Analog and Digital Lab, Embedded Systems Lab, Digital Signal Processing Lab, Electric Machines Lab, Digital Communications Lab, Instrumentation Lab, Microelectronics Lab, Power Electronics Lab, Reconfigurable Computing Lab, Renewable Energy Lab, Weather Observatory, Network Embedded Systems Lab, Remote Embedded Lab, Labs of the Department of EEE are equipped with the following Major Facilities for higher education and research work: Anechoic Chamber, Vector Network Analyzer - Keysight, USA, Logic Analyzer - Tektronix, USA, Arbitrary Waveform Generator – Tabor Electronics, Israel, USRP (Universal Software Radio Peripheral) - National Instruments, IRNSS + GPS Receiver, Cadence EDA Tools, Mentor Graphics (HEP) EDA Tools, Synopsys EDA Tools & TCAD Tools and Xilinx Vivado System Edition Measurement Techniques Lab,

Robotics & Automation Lab, MEMS Design Center, Thermal Science Lab, Fluid Mechanics and Machines Lab, IC Engines Lab with Low Speed Wind Tunnel Facility, Dynamics& Vibration Lab, Polymer & Composite Lab, Material Science Lab, Material Testing Lab, Mechanical Engineering. Process Engineering Technology lab, Process Control lab, Phase Equilibrium lab, Computer Aided Design Lab, Separation Processes Lab, Selected Chemical Engineering Operation Lab, Gas Hydrate Lab, Material Synthesis Lab, Engineering Chemistry Lab, Scientific Computing Lab and Language Lab.

In addition to computer centre facility the Computer Science department has an additional lab with following facilities, for higher degree and research work.

The lab has the 150 state of art computers with the necessary software. A DGX-1 station is with four NVIDIA® Tesla® V100 Tensor Core GPUs, integrated with a fully-connected four-way NVIDIA NVLinkTM architecture. It has 500 TFLOPS of supercomputing performance suited for the data science applications.

Senses 75-inch Interactive Intelligent Panel for Smart Presentations, Remote Teaching, and Teleconferencing, Cloud computing facility, Monosek Network Analyzer, Pervasive devices for applications in wireless sensor device, FPGA Kits for Hardware reconfiguration, Multimedia Equipment, Real Time Operating Systems like VxWorks, QnX., HiPC Server (For University-wide Computation Service) IBM x3650 (Intel Xeon 5, 2GHz, 32 GB, 2-Processor, 16-core, 4TB RAID 5) Head Node with RHEL6.2 and 5 IBM x3550 (Intel Xeon 5, 2GHz, 32 GB, 2-Processor, 16-core diskless) Compute Nodes; MPI on IB backbone and ethernet connectivity. 650 MFLOPS tested nominal 1TFLOPS.

Scientific Computing Lab of the Department of Mathematics equipped with 24 Laptops, multimedia equipment, interacting projector, and the following software facilities for higher education and research work: MATLAB (Institute wide user's license), MATHEMATICA (30 user's license), Scilab (Free Open Source Software), FreeFem++ (Free Open Source Software) ,FEniCS (Free Open Source Software),Tora and Statistical Software R, SAGE.

Incubator

BITS BIRAC BioNEST incubation facility is set up with the objective of 'Enabling innovation in health care and environment for a bettertomorrow.

The incubator has a state-of-the-art innovation lab for supporting experiments in Microbiology, Biotechnology and Environmental Engineering to develop technologies and startups that can provide solutions for societal challenges.

BITS BIRAC BioNEST was started as a part of BITS, Pilani K K Birla Goa Campus and is now under the aegis of an independent entity: BGIIES (BITS Goa Innovation, Incubation & Entrepreneurship Society). The Society was set up in February 2020 and will help to grow incubation and the overall startup ecosystem.

The incubator is spread over 3500 sq. ft. of office and lab spaces, surrounded by beautiful green landscape; it has the capacity to support more than 20 startups. Currently supporting about 8 incubates; Resident, Associated and pre-incubates in different areas like Medical devices, waste water management, agricultural waste management, grey water recycling, bioremediation, food tech and healthcare.

Networks and collaborations, legal, accounting and market research services, along with access to funding opportunities are provided to support the growth of incubated startups.

Workshop

The workshop is spread over 24,800 sq.ft. area and is well equipped with metal cutting machine tools like lathes, milling machines, shapers, pedestal grinders, tool and cutter grinders, cylindrical grinder, drilling machines, etc. It also has machines like pipe bending machine, plastics processing using rotational moulding machine, Compression Moulding Press, Iron Worker, Muffle Furnace, Multi-Component Piezo Electric Cutting force Dynamometer etc.

The workshop is fully equipped with Conventional and Non-conventional machines which helps PHD student for project setup and Advanced CNC shop with 5 Axis machine and CMM.

There is a separate CNC machining section with production machines like CNC lathe, CNC Milling, Co-ordinate Measuring Machine and CNC Engraving Machine. These machines are based on FANUC controller. To introduce the concepts of layered manufacturing in product development, a 3-D printer or a Rapid Prototyping machine is also available.

An Electric Discharge Machine is used to introduce the students for un-conventional machining. The carpentry section has the facilities of wood working lathes, planning machines and band saw machine. A welding shop with the welding machines to facilitate arc, gas, TIG and MIG welding exists separately in the workshop.

The casting section includes an Aluminum melting furnace and casting testing laboratory to test the sand properties like strength, moisture, etc. A separate Metrology laboratory is also well equipped with measuring instruments like sine bar, dial gauge indicators, gauges, etc. There exists an electroplating section where Ni and Zn plating is carried out on the workpieces produced.

Apart from the above facilities Central Workshop houses a well-equipped polymer and composite lab with equipment’s like screw extruder, Density and Melt flow index tester, Dynamic Mechanical Analyzer (DMA), HDT& VSP tester, Universal testing machines for Polymeric materials (low capacity) as well as for metals and other materials (high capacity) Hydraulic Press for compression moulding, Izod Charpy impact tester, etc. An Injection Moulding Machine is being installed.

To test the formability of the sheets for metal forming an Ericcson's Cup testing equipment is housed.The Non-destructive testing (NDT) equipment's like Ultrasonic Flaw Detector, Magnetic Particle Testing device is housed to introduce the concepts of NDT.The KD2 Pro, a fully portable field and lab thermal properties analyzer is available. It uses the transient line heat source method to measure thermal conductivity, resistivity, diffusivity, and specific heat.

Pneumatic section with pneumatics and electro pneumatics set ups (Make Festo Controls) and a pick & place pneumatic manipulator is used to teach the concepts of Low Cost Automation using Pneumatics. Acoustic Emission System, Cryogenic Treatment Equipment, Low Force Test System (UTM) (2KN), Refrigerator/Heating Circulator, Tensile – Creep testing of Polymer & Rubber

Central Library

Spread over 3512 sq mts. area, the central library has a seating capacity of 550+ and includes several reading halls and a large area for book storage. It has a good collection of over 40,789 books on a wide range of subjects. The library subscribes to 52 print journals. Subscription to important digital libraries and databases like IEEE Xplore online, Science Direct, ASME, ProQuest and ACM DL etc. provide full access to thousands of online journals to faculty, students and researchers.

Educational CDs, audio/video cassettes and question bank are also available. The textbook section keeps copies of all prescribed text books and reference books. A digital repository of resources curated from these as well as from the publications and dissertations of the Campus' faculty members and students is being built up.

A new initiative for making the Library a "Happening Place", taking a cue from the NAAC recommendations, is evolving through the leadership of the Library Committee. New comfortable and aesthetically pleasing furniture has been procured; spaces like lounge area and exhibition area and peripheral utility infrastructure have been developed to make the 'reading space library' experience more comfortable and enjoyable for the users.

The library has been provided with a wireless network whereby users can access the internet using laptops. The library transactions and search are managed using the (FLOSS) KOHA Library Management Software to automate its entire housekeeping activities. In this, the Campus is among leading campuses in the country. The bibliographic and holdings databases of books and e-journals can be accessed from anywhere in the campus through a Local Area

Network. Indigenous projects are afoot to harness the same to a mobile phone-based social network.

Hyderabad Campus

Computer Centre (CC):

The Computer Centre provides IT facilities and services to support students, faculty and staff for teaching, research, learning and administration. It facilitates and maintain the state-of-art networking and computational environment for the institute. The Computer Centre function as three operational divisions (i) CCIT (ii) CC Lab and (iii) Website maintenance.

The CCIT maintains the server room, which houses an IBM Blade server-H with 14 Blade Chassis out of which 7 blades are populated and a 3 TB DS 3400 IBM SAN box is available on the network supporting Pentium based PCs and Workstations of Lenovo/HP/Dell make equipped with Windows and/or Linux environments supporting a variety of software tools.

The CCIT manages and maintains the campus-wide network which is built using Cisco three-tier architecture with wired and WiFi access to users. The campus LAN is connected 1.5 Gbps dedicated fiber leased line (taken from three different ISPs) for the Internet connectivity to the entire campus community, and one 2 Mbps PRI line for telephones at various offices within the campus. In July-2020, we plan to increase the total bandwidth to 2.0 Gbps.

The ISP WAN (from different vendors) links are load balanced through a Radware Alteon load-balancer for better monitoring of WAN links, bandwidth allocation to different VLANs, and to provide application level QoS to users. Two Sophos XG550 UTM devices sit on the periphery of the network for authenticating users, performing web and spam filtering etc.

The CCIT is also responsible for creating and managing official e-mail IDs for all students, staff, departments and divisions, using Google’s centralized e-mail solutions.

The CCIT also maintains the Voice over IP (VoIP) infrastructure and the Telepresence(TP) infrastructure in the campus. In the FY 2019-20, the existing (which reached end-of-life) TP facilities in TP conference-room and TP classroom were replaced with new TP implementations consisting of latest equipment. Using the TP facility, BITS Hyderabad campus establishes connectivity with three other BITS campuses to conduct conferences, meetings and online live lecture sessions.

The CC Lab facilitates the computational requirements for teaching and research in BITS Pilani Hyderabad campus. It manages eight computational laboratories for teaching and research. The CC-Labs facility with approximately 500 PCs is accommodating integrated teaching with computational/ numerical tools. In the academic year 2019-20, CC Lab facilitated 50 courses from engineering and science departments, and the number may increase in the next academic year 2020-21. A dedicated research lab equipped with 50 desktops is catering to the research needs of the faculty and students working on funded projects, dissertations as well as on design-oriented-projects. It maintains 30 network-based software/numerical tools which include the course specific software and the general application software. The course specific licenses include Design Tools- Auto CAD, FLEXSIM and PTC Creo, Numerical Computing Tools- MATLAB, MATHEMATICA and MATHCAD, Computational Fluid Dynamics (CFD) Tools- ANSYS CFD, Open Foam and COMSOL, Finite Element Method (FEM) analysis Tools- ABAQUS and ANSYS Mechanical, Civil Engineering Design Software- Bentley, and several other Statistical and Geographical Information System (GIS) tools. The CC Lab is also involved in the procurement and maintenance of computer aided tools or software and the supporting hardware infrastructure for the academic use. The vision of the CC Lab is to facilitate advanced computing facilities to faculty and students to enhance teaching and research endeavors of the Institute. To achieve its aim, the CC lab is constantly conducting trainings to staff/students that impart knowledge on basics and advancements in software/numerical tools. Further, the CC Lab also help AUGSD and AGSRD divisions in online instruction, and Admissions Division in conducting the BITSAT online entrance examination. The CC Lab also supports various departments and student associations in conducting workshops, Conferences, and seminars.

The Website maintenance of the Computer Centre manages the website specific to Hyderabad Campus.

The Central Workshop imparts training to students and caters to the maintenance & fabrication needs of the Institute. Students' training involves training all first degree students through the course "Workshop Practice" by imparting skills in various manufacturing processes like machining, fitting, carpentry, smithy, foundry, sheet metal, electroplating, welding, etc. and two computer oriented exercises, CNC Programming using Pro-E and Master CAM software's and Manufacturing Simulation using FlexSim software. For B.E. (Mechanical Engineering) and B.E. (Manufacturing Engineering) degree courses, students are also imparted in-depth training in various other courses such as "Production Techniques-I and II", "Manufacturing Processes", "Casting and welding" and "Computer Aided Manufacturing". Apart from routine maintenance and training, the workshop also accepts fabrication jobs concerning the project works of students and also technical support for TBI works.

The workshop comprises the following sections: Machine shop, Welding, Electroplating, Fitting, Smithy, Sheet Metal, Carpentry, Foundry and Metrology. Major equipment's include Vertical Machining Center (Bridgeport VMC GX600), EDM Wire cut (Model: SPRINT CUT), CNC Lathe (Model PTC- 200), Hydraulic press with computer control(40T), nine Lathes, two Shapers, Radial Drilling Machine, Universal Milling Machine(Batlibai make) with indexing attachment, Cylindrical Grinding Machine with internal grinding attachment, Surface Grinding Machine, Tool and Cutter Grinder, Pedestal Grinder, Slotting Machine, Power Shearing Machine (Vivek Brand), Portable Drilling Machine, Injection Moulding Machine, TIG Welding Machine, MIG Welding Machine, Spot Welding Machine, Universal Milling Machine (BFW make), Shaper (Sagar make), Surface Roughness Tester (Mitutoyo make) and Hydraulic Bulge Test Rig, ECM setup (Electro Chemical Machining), Lathe Tool Dynamometer, and Rotational Moulding Machine, M TAB CNC Lathe Trainer, 3-D Coordinate Measuring Machine (CMM), HMT-PRAGA Universal Tool & Cutter Grinding Machine, FRITSCH Vibratory Sieve Shaker, Magnesium metal stir casting Furnace, Milling tool dynamometer, Drilling tool dynamometer, Lathe tool dynamometer, 200 TON capacity Compression testing machine, Mold Testing Equipment, Open-hearth furnace for smithy, Gas-fired furnace for foundry, Wood-working Lathes, Arc-welding equipment, Oxy-Acetylene gas welding equipment, Gauge planner for wood works, Electroplating equipment (zinc coating), Power Hacksaw, Sand Muller (Capacity-75kg), Panther make lathe machines, Model: 1350/1, HMT make High Speed Precision Machine, Model: NH26/1500, and two 3D Printers, Lenovo make desktops and CIMCO CNC Simulation software (20 Licenses), MASTER CAM (15 Licenses) and Micro Milling Machine

Laboratories

Advanced research laboratories for pharmacy, chemistry and biology have been setup. Research laboratories in Analytical, Organic, Inorganic and Physical Chemistryhave been set up.

The department of biological sciences at BITS-Pilani Hyderabad Campus, despite being just twelve year-old, has attained success in almost all spheres of academia, in line with the aims and objectives of BITS-Pilani University. We have established a strong research culture, replete with sponsored funding, publications and patents in the designated thrust areas. The faculty are constantly striving towards enhancing the departmental research programmes through individual and collaborative contributions. Since inception, the department has been successfully running M.Sc., M.E. and Ph.D. programmes, making the department a preferred destination for several graduate and undergraduate students across the country. The department has several national fellowship holders from agencies such as CSIR, UGC, DBT at both Junior and Senior Research Fellow levels. We have also established startup companies, strong industry linkages and are presently working towards strengthening these and establishing more. The department has nine faculty members of which all Ph.D

holders. The research thrust areas of the department are Medical biotechnology, Agriculture biotechnology, Food and Nutrition, Environment and bioenergy, Bio resources, Structural Biology and Bioinformatics, Technology development, Biophysics, Microbiology, Biochemistry and Molecular biology, Health Sciences and Public/ Global Health.

The department has several Inter-institutional collaborative projects both at the national and the international level. The national institutes that the department collaborates with Apollo hospitals, Bangalore; All India Institute of Medical Sciences, New Delhi, National Institute of Ayurveda, Jaipur; Ranbaxy Research Labs, New Delhi, India; SP College of Medicine, Bikaner, Rajasthan; Indian Institute of Science, Bangalore; LV Prasad Eye Institute, Hyderabad; Shankar Netralaya, Chennai, Tamil Nadu; Elite School of Optometry, Chennai, Tamil Nadu and Grasim Industries, Nagda. The International collaborations are with Baylor College of Medicine, USA; University of Pittsburgh, USA; University of Chicago at Illinois, USA; Mälardalens Högskola, Swedish Council of Higher Education, Sustainable Innovations Inc, Virginia, USA; Equate Health, Silicon Valley, California, USA.

There are seventeen laboratories, which four laboratories i.e. Biology laboratory, Microbiology, Biotechnology and genetic engineering serve undergraduate and post graduate teaching activity. In addition, Animal Cell Technology, and Bioinformatics labs serve both teaching and research related activities. Department developedresearch laboratories, namely, Genomics, Stem Cell, Plant Biotechnology, Structural Biology, Environmental Biotechnology. In addition, to these, four labs have been developed to support research in the areas of Immunology, Infectious Diseases, RNA Biology, Cancer Biology, and Neurology. A specialized laboratory has been set up with financial support from DST-FIST laboratory, funded by the Department of Science and Technology housing equipment flow-cytometer, RT-PCR machine and Phosphor imager.

The sophisticated and high-end equipment that caters to both research and teaching purposes includeBSL-2a and -2b laminar flow hoods,refrigerated orbital shakers, CO2incubators, FPLC, plant growth chambers,plant growth room,Inverted microscope, Nomarsky microscope, UV-vis spectrophotometers, multimode readers, advanced PCR machines, QRT-PCR machines, hybridization ovens, advanced table and floor top cooling centrifuges, ELISA reader, gel documentation system, Nanodrop spectrophotometer, fermenter, Lyophilizer, Millipore Unit, -80 Freezers,workstation and servers for computational work.

The Central Analytical Labs (Central Analytical Lab 1 and new Central Analytical Lab 2) of BITS Pilani - Hyderabad Campus, known as CALabs are equipped with modern state of the art instruments useful for advanced teaching and research. These instruments cover various modes of elemental analysis, spectroscopy, separation, thermal studies and material

characterization and imaging. The following list of equipment is established and functional for teaching and research purposes. List of important instruments is as follows: Powder XRD, single crystal XRD, FE-SEM, XPS, Laser scanning confocal microscope, 400 MHz NMR, AAS-7000, Flame photometry, XRF, BET surface area analyser, GC, HPLC (detectors: diode array UV, RI, fluorescence), LC-MS-MS, DSC-60, FPLC, TGA-DTA, spectrofluorometer FP-6300, UV-Vis-NIR spectrophotometer, FT-IR spectrometer, CD, Polarimeter, Karl-Fischer Titrator, Electrophoresis, Milli Q water, Impedance analyzer, Time-correlated single-photon counting spectrofluorometer, and Rheometer. In the FY 2019-20, three major equipment such as Cell Sorter, simultaneous TG-DSC and contact angle measurement have been procured. In the FY-2020-21, new equipments like SAXS and single quad mass spectrometry are planned. In addition to serving the internal teaching and research purposes, CAL also extends its service support to the external institutions, TBI incubates and industries.

The Department of Chemistry offers M.Sc. and Ph. D. (Chemistry) courses where the students are systematically trained in well-equipped laboratories as a part of their practical courses. Individual students are given the scope to run the experiments on their own with the guidance of faculty members. The laboratory facilities include organic, inorganic, physical, spectroscopy, material science and computational chemistry laboratories. Recently we established a new teaching lab and two research labs. Apart from that, they also take the courses on an instrumental method of analysis where all the students individually run various equipment such as IR, AAS, Fluorescence, GC-MS, X-ray, Raman spectroscopy, microwave oven and high-end UV-Vis spectrometer. The department has recently added current source, plasma cleaner, two ice machines and solvent purification system to its existing infrastructure. It is our pleasure to inform that SEM has been commissioned at our CAL (Central Analytical Laboratory) and NMR has reached to our campus. Both of this two equipment is the heart of the chemistry-based research and teaching. The faculty members for the department are involved in various projects such as organic synthesis, material science, and computational, physical, inorganic and analytical chemistry.

The department of Physics offers M.Sc and PhD programmes in Physics. The faculty members of the department research in Astrophysics, Quantum optics, gravitational physics and black holes, high energy physics, Theoretical Physics, Computational Physics; Materials Physics; Bio-sensing, Microfluidics, and Pedagogy. The current existing research facilities include Scanning Tunneling Microscope, Atomic force microscope, Fluorescence Microscope, AC Impedance Analyzer, Dynamic Mechanical Analyzer, Faraday rotation measurement unit, thin-film deposition unit, and four-probe resistivity measurement unit; Soft-lithography based micro fabrication unit, Dell server for computation,COMSOL with microfluidics module for simulations, Igor Pro and Microcal Origin software for data analysis. M.Sc students are also familiarized with some of the research equipment through the “Advanced Physics Lab” course.

Apart from this, the undergraduate lab has been bolstered with apparatus to measure the Zeeman Effect, Velocity of light, Frank-Hertz equipment etc. A computer interfaced telescope has been procured to provide hands-on experience to students on acquisition and analysis of astronomical data. The department hosts an IUCAAcentrefor Astronomy Research and Development (ICARD). Workshops and skywatch sessions are conducted for students under the aegis of this centre.

The department of Pharmacy offers B. Pharm, M. Pharm and Ph.D. courses where the students are trained in well-equipped laboratories for their practical exposure. The laboratory facilities include analytical instruments, equipment for pharmaceutical dosage form preparations, computer aided drug design lab, medicinal chemistry lab, pharmacology, molecular biology, BSL-3 and animal facilities. The department has recently added clean room facility for making formulations to its existing infrastructure. The faculty for the department are involved in various projects including development new lead molecules for TB, cancer, neuropathic pain; formulation development, Nano-delivery systems, transdermal delivery systems, natural product chemistry and pharmacological systems.

The civil engineering department has established following state-of-art laboratories and facilities, which can provide opportunities at various levels to students, academicians, researchers and to outside agencies for consulting works:

Structural Engineering Laboratory: The major test equipment/facilities are loading frame with 200 tons' capacity static compression testing facility, compression testing machine of 3000 KN capacity, Servo-hydraulic actuator (250 KN) for Dynamic Testing, Advanced dynamic testing shake table of size 2m×3m with 12 tons payload capacity (maximum displacement ± 75 mm, velocity 1 m/s, acceleration 3g, frequency 0 to 50 Hz), NI-9234 data acquisition system with LabView, Piezoelectric uniaxial accelerometers model PCB-393B04 (acceleration 5g, sensitivity 1000 mV/g, frequency 0.06 - 450 Hz), Impact hammer 5800B4 (500 LbF range, 10 mV/LbF, head weight 100 grams), Dytran Uni-Axial Accelerometer (500g range, 10 mV/g), Force Sensor 1053V4 (500 LbF range, 10 mV/LbF), APS 113 Long Stroke Shaker with m+p software based DAQ system, APS0112 Reaction mass assembly with vertical and horizontal table kit. Other equipment includes Structural analysis lab models, Wind tunnel, Weighing balance of 300 kg capacity, and Hydraulic floor crane 2 tons' capacity

Concrete Technology Laboratory: The major equipment/facilities available in the lab are Servo Hydraulic Compression Testing Machine (2000 KN), Vibrating table, Vibrating machine, Sieve shaker, Cement/Mortar/Concrete Permeability Apparatus, Autoclave, Torsion testing Machine, Air Permeability Apparatus, Flexural Testing, Machine, Rebound Hammer Test-NDT,

Ultrasonic Pulse Velocity Tester, Dynamic Pull-Off Tester, Stereo Microscope and Strain Gauges of 120 ohms and 350 ohms capacity attached with Lab View Tester.

Advanced Characterisation and Analysis of Materials Laboratory: The lab has Hamburg Stereomicroscope, Laminar Air Flow chamber, Vibratory strain gage setup, digital length comparator, muffler furnace, height gauge, colorimeter, Rapid Chloride Ion Penetration Test setup.

Highway Material Testing Laboratory: Highway Material Testing Laboratory is equipped with equipment namely universal penetrometer, ring and ball softening point apparatus, advanced ductility and elastic recovery apparatus with both heating and cooling arrangements, pycnometers for specific gravity, closed cup pensky martin apparatus for flash and fire points of bitumen, Rolling thin film oven test, Brookfield Rotational Viscometer, Cannon Manning Vacuum Viscometer for absolute viscosity of bitumen (indigenous), Silverson High shear laboratory mixer, Ika Magnetic stirrer and heating plate, Hobert N50 Mixer, Ika Low shear Mixer, Jaw Crusher, Abrasion Testing Machine, Aggregate Impact Test setup, Aggregate Crushing Value test setup, Pycnometers and immersion basket methods of aggregate specific gravity test, Length gauge and thickness gauge for finding the shape of the aggregates, Modified Marshall apparatus with automatic compacting equipment and Indirect Tensile Strength test setup, Asphalt density Meter, Field CBR test setup, Modified Proctors density apparatus, Fifth Wheel Bump Integrator for measuring the roughness of pavement surface, Benkelman Beam for measuring the pavement rebound deflection, Merlene, Dynamic Cone Penetrometer, Soxhlet bitumen extractor, Hamburg Wheel Tracking Device (indigenous), Humidity Chamber, Straight edge, Camber Board, Cold plate hot plate thermal conductivity test setup, Cement autoclave, TRL Pendulum type pavement friction tester, Permeability test apparatus (indigenous), Ovens of various sizes and capacities

Geotechnical Engineering Laboratory: The Geotechnical Engineering Laboratory has all basic and a majority of advanced instruments and set-ups to test properties of soil and rock. These include Universal Permeability Test set-up, CBR, Manual and Electronic Direct Shear apparatus, Large Shear Box apparatus, electronic Tri-axial set-up, Unconfined Compressive Strength test set-up, electronic Consolidometer, Linear and Volumetric Shrinkage measurement device, Swelling Pressure measurement apparatus, Model Plate Load Test set-up, Model Retaining Wall Test set-up, Rock Permeability Apparatus, Automatic Liquid limit Apparatus, Cone Penetrometer, Core drilling Machine, Soil Trimmer – CBR, Automatic Soil Compaction Machine and Relative density Apparatus. The lab also has finite element software Plaxis 2D for modelling soil.

Environmental Engineering Laboratory: The lab has facilities to test most of the water quality parameters. The facilities include, Spectrophotometers, Portable water testing kits, Digital PH meter, Fluoride meters, Double Distillation Unit, Turbidity meter, Portable DO meters, Fume Hood, Rain Gauge Equipment, BOD Incubator, BOD Analyzer , PM 2.5 and PM 10 dual dust sampler, Colony Counter and Auto clave.

Geomatics Laboratory: The Geomatics lab has a majority of advanced instruments available for executing modern surveying techniques. The major instruments available are Total stations, DGPS, Handheld GPS, Auto level, Electronic Digital Theodolite and Planimeter along with conventional surveying instruments. The lab also has ArcGIS software for mapping and spatial analysis.

Traffic and Transportation Engineering Laboratory: This laboratory has a majority of advanced instruments and software related to traffic engineering and transportation planning. The major instruments available added to this laboratory are Speed Radar Gun, V-Box with Video camera, Noise-meter, Alcohol-meter, Lux meter, Safety manuals and Traffic sign boards. The lab has the software such as N-Gene, M-Plus, NLogit software and has also a traffic simulation software VISSIM.

The Civil Engineering Department also has a Centre for Excellence in Water Resources Management (CEWRM), which is initiated for innovation in sustainable research, education and training in water resources management and allied fields..

The Department of Chemical Engineering has six undergraduate labs namely Selected Chemical Engineering Operations, Transport Phenomena, Chemical Reaction Engineering, Environmental engineering, Petroleum Engineering lab and Process Control labs. The department also houses Multiphase Systems lab, Advanced Separation processes lab, Materials Science and Engineering lab and polymer engineering lab for the Master's program. The department houses apparatus such as Supermass colloider MKCA6-2J (Ultrafine friction grinding machine), Micro Gaschromatography (Agilent G3581A-490, Moisture Analyzer (50 to 200 OC, Shimadzu MOC63U), Karl Fisher Titrator (Moisture measurement in solids and liquids using chemical agents), Electrospinning Machine (Super-ES-2, nanoscale fibres and core-shell fibres), Fluidized bed Granulator, BET Surface area analyser (0.1-1500 m2 /g), Gas Liquid Chromatography (Agilent 7820 A, suitable for liquids having boiling points below 300 OC, FID detector), Muffle furnace (1000 OC), Fixed bed reactor (Chemito, up to 1200 OC), Brookfield Rheometer (coaxial cylinder 0.026 to 8830 Pas) Potentiostat & Galvanostat (Metroohm, used to measure the Electrochemcial energy conversion and storage), Temperature controller bath (PP07R-20 refrigerating/ heating, -20 to 200 OC), High pressure Autoclave (PARR reactor, 350 OC, 140 Kg/cm2), Reid Vapor Pressure Bath (Koehler Instrument Company, K11459), Rotary Microtome

(Leica, sections of 500 nm using tungsten carbide and diamond knife, automated), Humidity Chamber (40 to 80% RH, 10 OC - 60 OC), Granulator, Tray Fermenter (Biomate India, BI-FERM-8D), Rotary Pulp Digester (160 OC, 10 Kg/cm2), UV-Visible double beam Spectrophotometer (Hitachi, U-2900, 190-1100nm), Optical Microscope (transmission mode, 10X, 40X including software to measure parameters), Injection moulding (200 degC), Compression moulding (250 degC), Ultrasonic processor (VCX 130 Sonic Vibra cell.), Autoclave (Ambient to 140 degC), Thermax Boiler (REVOMAX, 200 Kg/hr), Bubble cap distillation column, Filtration equipment, Rotary evaporator, Holmarc Contact Angle Meter with Temperature Control, Novascan UV / Ozone System, Probe Sonicator Heavyduty, Software tools such as ANSYS-CFD, COMSOL, MATLAB, MATHCAD, ASPEN, etc are also available for computational work in the Central Computer Aided Design laboratory.

The CS&IS department has access to around 360 DELL/Lenovo machines (made available by CCIT) as workstations and desktop PCs catering to the needs of Computer Science & Information Systems students for running their labs related to the lab oriented courses.

Apart from these facilities, CSIS Department has two labs namely; Data Science Lab and Systems Lab consisting of a total of 140 computers centrally connected to two servers. Each of these 140 machines have Intel Core i7 2.8GHz 6C processor with 8GB RAM, Nvidia Quadro K420 2GB GPU. The servers are HPE DL 380 Gen 10 Servers with Intel Xeon Silver 4114 (Deca core) processor and 256 GB RAM. These two computing facilities are used by First Degree and Higher degree students for their curriculum based project courses, course assignments, and any other out of regular lab hour practice sessions or self-learning.

There is a separate lab facility for Ph.D. students consisting of twenty HP Mini Towers with Intel Xeon E3-1225 V5 processor, 16 GB RAM, and Nvidia Quadro K420 2GB GPU. There are three higher end GPU enabled machines with Nvidia Quadro K1200 4GB for GPU intensive computing research activities. All these machines are also connected to the above mentioned two servers There are other research machines in this research lab which are bought through different grants obtained by faculties.

In addition to these, the department has IBM e-Server Blade Center running Linux Redhat Enterprise Compute server, and FTP servers for use in the courses. It also runs a virtual Infrastructure which comprises Academic vSphere/vCloud Suite 5 (4 CPU license), 2 Servers with Dual processor 6 cores (E2620) with Total 48 logical cores and 512 GB RAM.

The development tools and software available in all these labs include Compilers (gcc /g++ & JDK), Script Interpreters (Tcl/Tk, Perl 5.0, and gawk), Python libraries like Python3-pip and machine learning packages like tensorflow, Cuda, git, Nodejs, Matplotlib, ffmpeg, vend,

OpenGL, glfw3, QT, Anaconda, Wireshark, Nmap, Virtualbox6, GNU Assemblers, flex, flex++, X-development tools, NetSim, Oracle, etc.

The department has Atom processor kits, Gen1 Galileo Boards, Gen 2 Galileo Boards, and embedded software (sponsored by Intel) for developing embedded systems. The lab also includes Raspberry PI, Arduino Boards, NetFPGA, Hack-RF cards. The lab is used by the students of Software for embedded systems, Pervasive Computing, and IoT related projects.

Department of Humanities and Social Sciences has a computer based English language labto strengthen communication skills of students. It has software that offers language teaching-learning solutions through interactive practice sessions.

The Mechanical Engineering Department has nine laboratories, catering to the undergraduate and postgraduate teaching and research activities of the department: Robotics and Mechatronics and Automation Laboratory, Materials Testing Laboratory, Product Design and Realization (PDR), Dynamics & Vibration Laboratory, Tribology Laboratory, Refrigeration Air-Conditioning & Energy (RACE) Laboratory, Heat Transfer Laboratory, Hydraulic Machines Laboratory and IC Engines Laboratory.

Robotics, Mechatronics and Automation (RAM) laboratory is presently equipped with facilities such as 5-axis industrial robot, NI-Myrio Kit, Multiple sets of Docile X mobile robot, Omni wheel robot loaded with sonars, ABB Articulated arm Robot with finger and vacuum gripper, Smart camera evaluation kit, Mechatronic workbenches, Industrial AC servo motor kit, PLC, Hydraulic and Pneumatic training kit, etc.

Material Testing Laboratory has the following important facilities: Universal testing machine (Zwick / Roell) consist of tension, compression, bending test facility from cryogenic temperatures to elevated temperatures (-1800C to 12000C) for metal, composite and polymers. Rotating fatigue testing machine for metallic specimens. Creep and rapture testing machine for constant load condition. Torsion testing machine for circular metallic specimens. Material characterization facility such as polishing machine, hot mounting machine, Digital density meter, stereo and inverted metallurgical microscopes (up to 500X magnification). Pultrusion machine. Hardness testing: Micro-Vickers and Brinell hardness testing. Impact testing: Charpy and Izod impact testing. Furnace: Muffle furnace (12000C). Polariscope.

PDR (Product Design & Realization) laboratory is equipped with Rank-Taylor-Hobson computerized profilometer, additive manufacturing machine (rapid prototyping), David SL2 &

3D scanner, milling dynamometer and etching machines along with the softwares like ABAQUS, DEFORM-3D, LS-DYNA, and Design-Expert.

Dynamics and Vibration laboratory has miniature shakers, uniaxial and triaxial accelerometers, universal vibration apparatus, whirling of shaft apparatus, gyroscopes, static and dynamic balancing machines, wireless strain remote monitoring WSDA link, stroboscope, gearbox with spur gear arrangement to perform condition monitoring studies, planetary gearbox for wind turbine fault diagnosis, NI DAQ system for data acquisition, sensors for lubricating oil monitoring and microphones for acquiring acoustic signals.

Tribology laboratory is equipped with a number of sophisticated equipment to study the friction and wear characteristics of bulk materials, coatings and lubricants. The available facilities include pin-on-disc tribometer, four ball tester, scratch tester with humidity controller, journal bearing equipment, electrostatic spray coating system, tool maker's microscope , infrared thermometer and ABAQUS simulation software

RACE (Refrigeration, Air-conditioning and Energy) laboratory is equipped with the refrigeration and air conditioning test rigs, Solar dryer test rig, energy storage test rig, Brix meter, DYNEO DD-600F refrigerated/heating circulator, cool thermal energy storage (CTES) test system, wind emulator, wind energy training system, indoor air quality testing instrument with air quality probe having digital multimeter, cooling tower, heat pump test rig, evaporators, steam power plant test rig, PCM test setup, solar PV training & research systems, solar concentrator training system and solar thermal training systems and data loggers and data acquisition system.

Heat Transfer laboratory is equipped with heat transfer and heat exchanger modules, convection, conduction and radiation equipment setups, convection drier, thermal constant analyser, flame propagation unit, and computerized fluidized bed. Apart from these, a high speed camera (model no: Phantom VEO440L) is also added in its feather.

Hydraulic Machines laboratory has the following equipments: centrifugal pumps, submersible pumps, hydraulic turbines, Wind Tunnel Test Rig, steam power plant test rig, a nozzle performance test module, modular air flow bench, Laser flow visualization, hotwire anemometer and rheometer.

IC Engines laboratory is equipped with computerized SI and CI engine, AVL Ditest MDS 650 system with features such as smoke meter and gas analyzer, pressure sensor adapter & tooling device, computerized dual fuel VCR system, a test rig for evaluating alternate fuels, LPG & CNG sequential kits.

Also Mechanical Engineering Department is supported by a Central Workshop and a Centralized CAD laboratory. Central Workshop is an autonomous unit, equipped with numerous manual, semi-automatic and automatic machine tools and machines and providing services to all other departments and divisions. Centralized CAD laboratory has a variety of computer aided design and engineering software like Pro/Engineer, ANSYS, COMSOL, MATLAB, etc. In addition, the Mechanical Engineering Department has collaboration with Hemair Systems Ltd. Hyderabad, for establishing an ISO-6 (Class-1000) Clean Room in the institute for micro-electro-mechanical systems (MEMS) fabrication, which is part of the Institute's Technology Business Incubation (TBI) programme funded by the Department of Science and Technology (DST), Government of India.

Since its inception, the EEE department at Hyderabad campus has established laboratories with Equipment and Software worth more than ₹ 18 Crores. Currently, the 17 lab rooms are spanned in more than 31,000 square feet area. These labs include, Analog Electronics Lab, Communication Systems Lab, RF & Microwave Engineering Lab, Microelectronic Circuits Lab, Digital Design Lab, Microprocessor and Interfacing Lab, Digital Signal Processing Lab, Electrical Machines Lab, Control System Lab, Power Electronics Lab, Power systems lab, Instrumentation and Transducers lab, MEMS, Microfluidics and Nanoelectronics (MMNE) Lab, Optical Communications Lab, Advanced Communication Lab, Embedded Systems lab, Data processing Lab, Machine Learning Lab, Advanced Digital Communication Lab, FPGA design Lab, Mobile and personal communication, Computer Architecture, VLSI CAD Lab, Advanced Computing Lab, High Voltage Lab, IoT Lab, Electronic Materials and Devices Lab (EMDL), VLSI Architecture Lab, Analog VLSI Design Lab, Software for Embedded System Lab. These labs cater the teaching and learning requirement of the undergraduate programs in EEE, ECE & EEI and the higher degree programs in Communication Engineering, Embedded System Design and Microelectronics. Further, the students' projects, thesis, PhD research work and several sponsored projects are also implemented in these labs. A summary about a few labs are given here alphabetically:

Advanced Computing Lab is the best-in-class and one of the core labs catering the computational needs of many labs in the Department. The lab consists of several High-Performance Computing server nodes, Red Hat Enterprise Linux and Community Enterprise OS, High-Performance Computing Software and 150 High-Performance Workstations. The lab has several general computing resources also.

Communication Systems Lab covers the basic understanding of functionalities of various block-sets involved in communication system. It involves system design and simulation exercises using MATLAB and Simulink and experiments based on HW boards. In this Lab, the students study in detail about the various types of modulators and demodulators,

transceivers and spectrum analyzer and also different types of Pulse Code Modulation (PCM) formats both using hardware and software.

Electronic Materials and Devices Lab holds the cutting edge Nanoelectronic and optoelectronic devices fabrication, characterization, and simulation facilities such as thermal evaporator, rapid thermal processor, spin-coater, chemical synthesis equipment, different furnaces (with ambiances), Automated Agilent B2912A SMU, Probe station, Four probe unit, Solar simulator, RF amplifier, optical exposure unit, DFT, etc.

Instrumentation Lab focused on designing and developing various instrument layout including sensing unit, data processing unit and signal processing unit. Various data acquisition hardware, sensors, mini-microprocessors, LCD interfacing and governing software are covered in this lab.

Internet of Things Lab provides concepts of IoT, its eco-system, wide spread application, and its design challenges. The experiments include interaction options with real world objects though cyber infrastructure, a systematic development of IoT based solutions, approached to handle data from IoT, introduction to Python programming and Raspberry Pi kit, introduction to Arduino programming and develop controllers, basic machine learning to process data from IoT on the fly, understanding the security implications while deploying IoT applications, and basics of developing mobile applications to command and control IoT.

High Voltage Lab has recently been set up and it consists of all state-of the art equipment such as 100 KV AC/DC Source and control panel, 3 stage 300 KV 3 KJ Impulse Generator, C and Tan-delta Test Kit (Schering Bridge), Vacuum and Pressure Vessel, Rod Gap Apparatus – Horizontal Sphere Gap Apparatus, Rain Making Equipment, Salt Fog Chamber, and Electrolytic Tank. On the other side, some sophisticated instruments also added up which include Solar simulator, Laser engraver, contact angle measurement, UV laser writer, and dry film photoresist.

MEMS, Microfluidics and Nanoelectronics (MMNE) Lab comprises of state-of-the-art fabrication facilities such as photolithography, 3D printing, soft-lithography, direct-laser writing, paper-based device facilities, Chemical Vapor Deposition (CVD) and Electrospinning etc. The lab has also modern testing, device characterization, and simulation facilities such as Fluorescence Microscope, Tensiometer, Ink-jet printer, CO2 Laser writer, Electrochemical Workstation, Digital Viscometer, Photomultiplier tube, advanced data acquisition system, High-seed cameras, Raman Confocal Microscope, Spectroradiometer, COMSOL, AutoCAD, etc.

Power Electronics Lab covers modelling, simulation and experimental verification different power electronics devices/converter applications. Students are also provided with power electronic drives for performing minor projects as part of the power electronic course. Lab Consists hardware: 3-Ø Power Module, SCR – Diode Power Module, IGBT – Diode Power Module and Software: MATLAB - 2015a, P-Sim Software.

RF & Microwave Engineering Lab consists of various microwave equipment and components, to determine and plot the characteristics of Gunn Oscillator, Reflex klystron and other passive microwave components. It also included how to use various simulation software to design various microwave devices with desired characteristics, scattering parameters and field patterns. Using ANSYS HFSS to Design Waveguides, Microstrip Antenna, Microstrip Quadrature Hybrid & Design of Ring Hybrid.

Software for Embedded Systems Design lab supports implementation of projects by interfacing a variety of advanced sensors with microcontroller boards such as Arduino and Rasberry Pi. The Lab is also equipped with Robot Operating System (ROS), Simulator, such as Gazebo, to create a 3D scenario on a computer with robots, obstacles, and many other objects.

VLSI Lab has Industry-standard licensed tools for Computational VLSI & VLSI Design, such as Cadence EDA tools, Synopsys TCAD tools, Synopsys Front-End and Back-end tools, Synopsys Quantum-Wise Atomistic Modeling tools, Mentor Graphics HEP-I and HEP-II tools etc.

Apart from this, EEE Department is leveraging the facilities provided by a Central Workshop, Centralized CAD lab, Center Computing Facility, Central Analytical Lab and Clean Room.

Sandboxx

Sandboxx is a multi-disciplinary platform to develop technologies in the domains of Internet of Things, Wearable Technologies and Consumer Electronics. The lab is envisioned as a platform that enables students in the creation of technologies that solve real world problems at the interface of engineering (Mech, EEE, CS, etc) sciences (biology, pharmacy, physics, etc) and design. This lab is for facilitating student ideas and implementation with easy access to equipment and tools such as sensors, microprocessors, power tools etc

Tinkerers' Lab

The Tinkerers' Lab is a new addition to Sandboxx and both collectively function under I-Cell. A Tinkerer is someone who enjoys experimenting. At Tinkerers' Lab, we promote and motivate such tinkerers with the objective of growing the community of innovators. We

provide them the platform to convert their creative and innovative ideas into actual engineering products. The Lab is one of its kind advanced technical facility where innovators get an opportunity to apply the theoretical knowledge learned in classes. The lab is spread over total floor area of more than 2500 sq.ft and the facility is currently being utilized by 80 innovators.

Some of the projects that are being innovated at the Tinkerers' Lab include but are not limited to Hybrid Aerial Vehicles, Sub scaled Rockets, Autonomous Underwater Rover.

Technology Business Incubator (TBI)

The role of technology business incubator is to proliferate overall entrepreneurial process and thus increasing the competiveness and bring about sustain development to an innovative idea till formation of a successful venture. A Technology Business Incubator (TBI) can ably support such an environment by nurturing technical bents of mind and innovations. TBIs are, a desirable link, in the present context between manifesting the potential of technical innovations and New Enterprise Creation & Growth. The essence of economic development lies in the pace of entrepreneurship development.

Against this backdrop BITS-Pilani, Hyderabad has promoted a Technology Business Incubator, The Incubator is supported by National Science and Technology Entrepreneurship Development Board, DST, Govt. of India.

The Technology Business Incubator at BITS-Pilani, Hyderabad aimed at fostering technology/knowledge based entrepreneurial start-ups by:

- Nurturing them at an early-stage and helping them overcome limitation trough low cost services
- Offer value added services viz. legal, financial, technical, IPR, mentoring, business networking (National and international) etc. to incubatee's
- Providing business environment for operation with well-equipped infrastructure support
- Commercialization of technologies and nurturing any such business collaboration for profitable business
- Strengthening business skills/knowledge startups and making them more enterprising
- Skill development in the region in terms of innovation and Entrepreneurship and creating job opportunities.
- Creating a sustainable ecosystem with multiple stakeholders for enterprise creation.

Sectors of Intervention:

TBI will offer services in diverse sectors. To begin with, TBI@BITS Hyderabad aims to provide a low cost and resource intensive sandbox for Health-Tech, Bio-Tech and Devices where entrepreneurs can develop their product, services or process ideas towards commercialization.

Current Infrastructural support and facility

Working Area

Office space and co-working for startups

Bio-Tech/Pharma Lab

Lab space around 2000SFT is available for startups

3D printing

MEMS clean room (Micro-Electro-Mechanical Systems)

Clean room (Micro and Nano Fabrication Facility)

https://universe.bits-pilani.ac.in/hyderabad/ cleanroom/cleanroom

BITS Pilani Hyderabad campus has established state of the art facilities for Micro and Nano semiconductor device fabrication and characterization. The size of the clean room is 581 sq. ft and 80% of it is maintained as (ISO 6) class 1000 and the rest is class 100 (ISO 5). Complete class 100 area covered with yellow light and dedicated for Lithography process. This facility consists of the following equipments: Wet chemical work station for semiconductor and other clean applications, Two-inch tubular furnace capabilities, Spin coater system, Probe station with source measure unit, UV exposure system, Electron beam evaporator system andMaskaligner with accuracy up to 3 micrometer..

Makers space: 3D printer's, CNC machine, machining tools, Lathe etc.

Library facility

The Library at BITSPilani- Hyderabad Campus is a gateway to knowledge resources. The Libraryis one of the central support services of BITSPilani- Hyderabad Campus. It provides information services and access to textual and bibliographic digital and print resources to the BITS Community—Institute's state-of-the-art Library with two floors spread over

45000sq.ft.Open seven days a week till 9 pm and during the tests and examinations till 1 am (midnight). It has a collection of over 42500 books, 920 educational CD-ROMsand subscribes to over 74 Indian and foreign journals. The Library also subscribes to 9600+ e-journals like American Society for Civil Engineers (ASCE), American Society of Mechanical Engineers (ASME), Association of Computing Machinery (ACM),JSTOR, SciFinder, SCOPUS, Royal Society of Chemistry, IOP, APS, Nature,IEEE, Science Direct, Wiley online, etc. The Library has a collection of over 11100 e-books on engineering, computer science, life sciences and Bio-Medical Engineering. In the Digital Library, the previous year's question papers are available. The library operations are fully computerized and students can have access to the Online Public Access Catalogue (OPAC) from their hostel rooms. Recently, RFID (Radio-Frequency Identification) technology and self-check-in and Check-out facility were introduced in the Library. With the introduction to RFID has enabled faculty and students to borrow and return materials whenever the Library is open. No time restrictions for books issues and returns. Self-service facilities also allow for a much faster and more efficient way of borrowing and returning books. Discussion rooms are available in the Library for the faculty and students to meet and discuss their project and other academic-related work. The Library is equipped with the most modern furniture. The Library has been designed, taking into consideration the future growth of the library collection and needs of the users in the coming years. The Library is fully air-conditioned with WI-FIfacility as well.

Shibboleth: Now, our campus is part of INFED (INFLIBNET(UGC) Access Management Federation. Shibbolethoffers a mechanism for users to access multiple resources within a federatedsingle sign-onframework. The goal of the INFED is to allow users to access internal and external resources seamlessly using a single, institutionally controlled identity. This would not only allow authorized users to access e-resourcesfrom anywhere, anytimebut would also circumvent the requirement of maintaining multiple passwords for multiple resources in various domains.During this COVID 19 period, Shibboleth was very useful to our students and faculty to remotely access all the library e-resources.

RFID Technology: The Radio Frequency Identification (RFID) Technology for the books and self-check-in / check-out facility is available. The key benefits of RFID Technology are:

- Quick & Efficient Circulation Operations
- Enhanced Security for Library Items
- Seamless Inventory Management
- Emerging Technology Experience for Library users

The Library renders standard services like issuing books; attending to reference queries, providing photocopies, interlibrary loans, etc. for the institute's faculty and students.

The following are the highlights.

Acquisition Section

The Library has a collection of 41790 volumes and 7279 Springer engineering ebooks. During this year 3240 new books were added to the existing book collection in different disciplines. These include emerging areas like Lean Technology, Leadership, Digital Libraries, Earthquake Engineering, Wireless Communication, Signal Processing, Robotics, Nano-technology, Micro-electromechanical Systems (MEMS), Bio-informatics, Biotechnology, Geographical Information Systems, Network Security,Embedded Systems, Grid Computing, Pervasive Computing, Software Testing, Data Warehousing/ Mining and the Library also added books related to the placement.

Other Services

1. **The Library keeps the readers informed every week through the regular display of all the books added to the Library. A list of weekly/monthly additions is also made available to readers on the library site and through e-mail to the entire faculty. Impressive topical displays are also organized periodically.**
2. **The Library had organized a Special Book Display in association with our campus book store in December 2020 for the library selection by the faculty members and research scholars.**
3. **Free wireless internet (WIFI) access is available in the Library**
4. **During the examinations, the Library working hours have been extended till 1 am (midnight)**
5. **Discussions rooms are available for the faculty and students.**

WORKSHOP

The Central Workshop provides training to students and caters the maintenance & fabrication needs of the Institute. Through the course "Workshop Practice", all first degree students are trained to acquire the necessary skills related to various manufacturing processes like machining, fitting, carpentry, smithy, foundry, sheet metal, electroplating, welding, etc. and two computer oriented exercises, a CNC Simulation software (by CIMCO) and MASTER CAM, and a Manufacturing Simulation software called FlexSim. Further, students of B.E. (Mechanical Engineering) and B.E. (Manufacturing Engineering) are given in-depth training in various courses such as "Production Techniques – I" and "Production Techniques - II", "Manufacturing Processes" and "Computer Aided Manufacturing". Apart from routine maintenance

and training, the workshop also provides fabrication services pertaining to the project works of students and also offers technical support for TBI works.

The workshop comprises of various sections namely Machine shop, Welding, Electroplating, Fitting, Smithy, Sheet Metal, Carpentry, Foundry and Metrology. Major equipment include 1 Vertical Machining Center (Bridgeport VMC GX600), 1 EDM Wire cut facility (Model: SPRINT CUT), 1 CNC Lathe (Model PTC- 200), 1 Hydraulic press with computer control (40T), 9 Lathes, 2 Shapers, 1 Radial Drilling Machine, 1 Universal Milling Machine (Batlibai make) with indexing attachment, 1 Cylindrical Grinding Machine with internal grinding attachment, 1 Surface Grinding Machine, 1 Tool and Cutter Grinder, 1 Pedestal Grinder, 1 Slotting Machine, 1 Power Shearing Machine (Vivek Brand), 1 Portable Drilling Machine, 1 Injection Moulding Machine, 1 TIG Welding Machine, 1 MIG Welding Machine, 1 Spot Welding Machine, 1 Universal Milling Machine (BFW make), 1 Shaper (Sagar make), 1 Surface Roughness Tester (Mitutoyo make) and 1 Hydraulic Bulge Test Rig, 1 Electro Chemical Machining (ECM) setup, 1 Lathe Tool Dynamometer, and 1 Rotational Moulding Machine, 1 M TAB CNC Lathe Trainer, 1 3-D Coordinate Measuring Machine (CMM) "Spectra", 1 HMT PRAGA Universal Tool & Cutter Grinding Machine, 1 FRITSCH Vibratory Sieve Shaker, Magnesium metal stir casting Furnace, 1 Milling tool dynamometer, 1 Drilling tool dynamometer, 1 Lathe tool dynamometer, 1 200TON capacity Compression testing machine, Mold Testing Equipment, 1 Open-hearth furnace for smithy, 1 Gas-fired furnace for foundry, 5 Wood-working Lathes, 2 Arc-welding equipments, 1 Oxy-Acetylene gas welding equipment, 1 Gauge planner for wood works, Electroplating equipment (zinc coating), 1 Power Hacksaw and 1 Sand Muller (Capacity-75kg), 2 Panther make lathe machines, 1 HMT make High Speed Precision Machine, two 3D Printers, 1 Plasma arc cutting machine, 3 AC Welding Transformers, 1 Powder mixing unit, 13 Lenovo make desktops, a CNC Simulation software by CIMCO (20 Licenses), NC programming software called MASTER CAM (15 Licenses), 1 Planetary ball Mill and 1 Micro milling machine.

File Description	Documents
Upload relevant supporting document	No File Uploaded

4.1.4 - Total expenditure excluding salary for infrastructure augmentation during the year (INR in Lakhs)

8700

File Description	Documents
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4.2 - Library as a Learning Resource

4.2.1 - Library is automated using Integrated Library Management System (ILMS) and has digitisation facility

Pilani

The library has started its automation of library function using LibSys ILMS since 2005 and in 2014, it was migrated to more robust widely used open source ILMS "KOHA". The library operations like acquisition, cataloguing, circulation, serial control services are fully automated since 2014. The software also integrates with Web enabled Online Public Access Catalogue (Web OPAC) which facilitates searching of complete library collection with the results, providing the location of a book in a particular library. Networking and sharing the resources for retrieval, uploading and downloading in any environment becomes possible using Z39.50 protocol. All the resources available in the library are cataloged using MARC21, the International Standard for machine readable catalogue world over. The database server is Z39.50 compliant to enable the internet users to access the database with ease.

Koha is a web-based ILMS, with a SQL database (MariaDB) back end with cataloguing data stored in MARC and accessible via Z39. 50 or SRU. The user interface is very configurable and adaptable and the software provides a distributed system of input for bibliographic details of the books and other documentary materials like periodicals consisting current issues and bound volumes, thesis and dissertations. The software has all core modules like acquisition, cataloguing, circulations, serials and reporting. It is unicode supported and thus facilitates bibliographic entries in many Indic languages like Hindi, Urdu, Punjabi, Bengali etc. In 2014, the automation system has been further strengthened by introducing RFID (Radio Frequency Identification) system with self-issue/return KIOSK.

1. **Acquisition system**
2. **Cataloguing system**
3. **Circulation system (Issue, Return and Renewals)**
4. **Serials Control system**
5. **OPAC (Online Public Access Catalogue.**

Goa

- **KOHA – Library Management Software – Multi user**
- **OPAC (Online Public Access Catalogue) – 1 computer.**
- **Help Desk – 1 computers**
- **Back office – 5 computers**
- **LMS Server – 1 No**

- Dspace Server – 1 No.
- CCTV Cameras with System – 4 nos.
- WIFI Access points – 07 Nos.
- Photocopier in Library – 02 No.
- Scanner in Library – 1 No.
- Library has sitting capacity of 550 nos.
- Library provided flexi sitting arrangements like (Sofa's-8 nos. and U shape chairs-16nos.)
- Library provided lounge room for reading - 01 nos
- Library provided Discussion/Conference room (Sound Proof) - 01 nos.

Hyderabad

- All the Library Services are automatedfrom 2008.
- Currently, the Library is using KOHA Library Management Software.
- In 2016, RFID technology with Self-check-in/check-out kiosk was introduced.
- As part of the automation, the Library is also maintaining the Digital library.

File Description	Documents
Upload relevant supporting document	View File

4.2.2 - Institution has subscription for e-Library resources Library has regular subscription for the following: e - journals e-books e-ShodhSindhu Shodhganga Databases	A. Any 4 or all of the above

File Description	Documents
Upload relevant supporting document	View File

4.2.3 - Annual expenditure for purchase of books/ e-books and subscription to journals/e-journals during the year (INR in Lakhs)

117264238

File Description	Documents
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Upload relevant supporting document	View File

4.2.4 - Number of usage of library by teachers and students per day (foot falls and login data for online access)

1958

File Description	Documents
Upload relevant supporting document	View File

4.3 - IT Infrastructure

4.3.1 - Number of classrooms and seminar halls with ICT - enabled facilities such as LCD, smart board, Wi-Fi/LAN, audio video recording facilities during the year

166

File Description	Documents
Upload the data template	View File
Upload relevant supporting document	No File Uploaded

4.3.2 - Institution has an IT policy, makes appropriate budgetary provision and updates its IT facilities including Wi-Fi facility

The central computing facility of BITS Pilani referred to as the IPC (Information Processing Centre) hosts and manages the computing/ networking infrastructure for the campus. The infrastructure includes local and external connectivity including email as well as computer services. IPC operates early morning to midnight on 360 days a year. Some specialized labs/centers offer round the clock computing facility.

The campus hosts about 1000 latest desktops/workstations (including 350 in a central location), about a dozen compute-servers (Intel-based SMP Systems, IBM Blade Center with several blades), multi-Tera-byte storage (including a SAN) a variety of peripherals (printers/scanners/ plotters). These systems support heterogeneous operating environments (Linux and Windows), compilers, development tools/packages for students and staff. The computing infrastructure issues are resolved through online portal.

IPC has setup a centralized Data backup solution. Departments can make use of this central facility to backup their data. Currently data from about 10-11 Servers, from different departments, are being uploaded daily.

IPC has designed and implemented Campus wide highspeed Wired as well as Wireless Network. Campus has 4 Gbps of Internet access through different vendors with a high availability configuration and a Firewall system which provides data Security system, secured remote access through VPN's. Each end user devices which needs connectivity to Institutes network first gets authenticated and then if allowed gets access to the resources. Institute has its own IP addresses, which has made it possible to maintain same IP's irrespective of change of Internet lease line vendors and also helped us to implement our own unique Autonomous System numbers.

High-speed Wireless connectivity has been implemented within the campus including Hostels. We have chosen latest technology in Wifi transmission and security while implementing the same across the campus. Currently IPC is implementing Outdoor Wifi solution, which will enable Student's to access the Internet outside their Hostels premises seamlessly and also help them make online payments at eateries in the campus through UPI. Students get access to Institutes Internet through their Mobile phones as well as their Laptops. Their download limits have been getting increased as their hunger to access online technical resources keeps increasing. While allowing free access to Students to resources for their skill development, we make sure that a red line is drawn regarding other contents students can access with strict IT Policy.

IPC has designed and implemented campus wide Security system using CCTV Cameras. These are IP based cameras with central storage system and cameras have been installed at the corridors, entry and exit points of the buildings in the campus. We are in the process of implementing the same for the Staff quarters also. This will enhance the monitoring capability of the security officers in the campus and provides well being for the Staff and Students alike.

Each year IPC studies requirement for new IT facilities and implements expansion of existing IT resources to meet the demand of IT resources by its Administration, Faculty and Students. Budgets are allocated for maintenance of existing IT resources and also to expand the same, looking out for any new technology which can enhance Network availability, Security and management.

File Description	Documents
Upload relevant supporting document	View File

4.3.3 - Student - Computer ratio during the year

Number of students	Number of Computers available to students for academic purposes
14031	5161

4.3.4 - Available bandwidth of internet connection in the Institution (Leased line)	• ≥1 GBPS

File Description	Documents
Upload relevant supporting document	View File

4.3.5 - Institution has the following Facilities for e-content development Media centre Audio visual centre Lecture Capturing System(LCS) Mixing equipment's and softwares for editing	A. All of the above

File Description	Documents
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4.4 - Maintenance of Campus Infrastructure

4.4.1 - Total expenditure incurred on maintenance of physical facilities and academic support facilities excluding salary component during the year

3169

File Description	Documents
Upload the data template	View File
Upload relevant supporting document	View File

4.4.2 - There are established systems and procedures for maintaining and utilizing physical, academic and support facilities - laboratory, library, sports complex, computers, classrooms etc.

BITS – Pilani (Pilani Campus) has a set of established procedures and policies for maintaining and utilizing physical, academic and support facilities - laboratory, library, sports complex, computers, classrooms etc.

Maintenance of library:

For maintenances of library infrastructure and facilities, the library committee and administration have been given the responsibility to purchase, procure books, manuscripts and other materials, as per the recommendations received from the departments of the colleges. The departments of the colleges have a good stock of texts and references in their departmental libraries. For enriching of the library, the committee procures some good publications from national and international publishers. The library committee organizes reading sessions and competitions among students and teachers, appeals to and organizes students, teachers, alumni, guardians to donate books.

Maintenance of the laboratory:

The laboratory equipment's, specimens, and other necessary chemicals are purchased by the office of the principal and purchase committee as per the requirements of the teaching departments of the college. The Science students of the college as well as those of five associate schools are taught and trained about the use and maintenance of laboratory items.

Maintenance of the sport facilities:

Containing all kind of standard grounds and Students' union sport secretary and his/her advisor takes the responsibilities of the maintenances of the sport facilities. The necessary goods and sports articles are purchased by the office of the principal as per the recommendations of the sport secretary and the advisor of the Student Union of the college. The college authority purchases them by calling quotations from the reputed sport outlets. Periodically necessary steps have taken by the authority to develop the sport activities of the students.

A national level tournament "BOSM" held every year for the students within the campus, so that the students can enjoy all the events of sports week, organized in the college. Some of the sports items are kept in boys'/girls' common rooms/ union room and given out for use of students under the monitoring of the Sports cum common room secretaries. Students with excellence and achievements are publicly felicitated and also supported financially to the extent possible.

Maintenance of Computers and IT facilities:

The office of the IT/Computer science department decides about purchasing necessary IT equipment's as per requirements of the colleges and the administrative office of the

college. Computer skilled personnel of the college maintain IT facilities and they also take the responsibilities of periodic up-gradations of the IT resources. The IT facilities are taken stock of by the administrations and they are modified or changed whenever necessary. There is an ICT cell in the college which looks after the maintenance of the computers and facilities. Few part-time employees are also entrusted with use and maintenance of these facilities.

Classroom facilities:

The maintenance of classrooms is a regular exercise. The cleanliness of classrooms is ensured by a group of Grade -IV workers and sweepers. After the admission process in every semester it is ensured that all the classrooms have adequate desks, benches. The fans and electrical appliances are checked wherever requirements are found the purchase committee are appraised of the requirements. The purchase committee makes the purchases after approval from the Principal. All the class room fulfills the requirement of a smart classrooms.

Student support and welfare:

In the college campus, there is a good environment for the benefit and welfare of the students. Various sub committees are in the college to support services, student welfare and to meet their needs. The principal is the chairperson of all sub committees besides the student's union. There is a Mess committee for maintenances of the messes to ensure the healthy and hygienic food for the students as well as the other members of the college.

Institute canteen is administered by the proper staff and manager recruited specifically for the purpose itself.

The hostel sub- committee looks after the hostel facilities for the borders in the college campus. The girls' hostel in the college campus with 45(forty-five) girls has a warden, one matron and a night chowkidar. The hostel management committee ascertains smooth

administrative functioning of the hostels as well as tries to maintain a homely environment for its borders.

The NSS unit maintains the social services within the campus and outside it.

There is a central announcement system (Public Address System) in the Principal office for any urgent notification to the students. The authority and the respective departments have made observations of National and State level occasions, so that the students of the college

can participate, directly or indirectly, in the process of peace and harmony, unity and development of the Nation.

Academic Support:

The BITS is a deemed University, affiliated to UGC. The college has an elaborate academic support mechanism. The examination system is very systematic and transparent. The mid semester examinations are conducted by a committee. The committee ensures setting of question papers, evaluation of answer scripts of each department.

An examination committee is appointed by the Director in each end semester examination and they are engaged in smooth conduction of examination, verification of the internal assessment and any other issues related to the examination.

The authority engaged many part time and guest lecturers in addition to the regular faculty for the benefit of the students.

Academic support of the students is also provided by the faculty exchange programme within and outside the college. The remedial classes are also engaged for the students as an academic support.

Distance Education facility is also provided to the P.G. levels.

In the admission process, the college has followed the Constitutional provisions of reservation as well as rule of the State Government regarding free admission to those students, who belong to below poverty line (BPL).

File Description	Documents
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STUDENT SUPPORT AND PROGRESSION

5.1 - Student Support

5.1.1 - Total number of students benefited by scholarships and free ships provided by the institution, Government and non-government agencies (NGOs) during the year (other than the students receiving scholarships under the government schemes for reserved categories)

7253

File Description	Documents
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5.1.2 - Total number of students benefited by career counselling and guidance for competitive examinations offered by the Institution during the year

15405

File Description	Documents
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5.1.3 - Following Capacity development and skills enhancement initiatives are taken by the institution Soft skills Language and communication skills Life skills (Yoga, physical fitness, health and hygiene) Awareness of trends in technology

A. All of the above

File Description	Documents
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5.1.4 - The Institution adopts the following for redressal of student grievances including sexual harassment and ragging cases Implementation of guidelines of statutory/regulatory bodies Organisation wide awareness and undertakings on policies with zero tolerance Mechanisms for submission of online/offline students' grievances Timely redressal of the grievances through appropriate committees

- All of the above

File Description	Documents
Upload relevant supporting document	View File

5.2 - Student Progression

5.2.1 - Number of students qualifying in state/ national/ international level examinations during the year (eg:NET/SLET/GATE/GMAT/CAT/ GRE/TOEFL/Civil Services/State government examinations)

5.2.1.1 - Number of students who qualified in state/ national/ international examinations (e.g.: IIT-JAM/NET/SET/JRF/ GATE /GMAT /CAT/ GRE/ TOEFL/Civil Services/State government examinations) during the year

137

File Description	Documents
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Upload relevant supporting document	No File Uploaded

5.2.2 - Total number of placement of outgoing students during the year

3018

File Description	Documents
Upload the data template	View File
Upload relevant supporting document	View File

5.2.3 - Number of recently graduated students who have progressed to higher education (previous graduating batch) during the year

137

File Description	Documents
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5.3 - Student Participation and Activities

5.3.1 - Number of awards/medals won by students for outstanding performance in sports/cultural activities at inter - university/state/national/international events (award for a team event should be counted as one) during the year

21

File Description	Documents
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5.3.2 - Presence of Student Council and its activities for institutional development and student welfare

Pilani Campus

The members of theActingStudent Council2020-21 are as follows:

Name BITS ID Category

Yash Anil Saboo 2020A4PS0465PBatch Rep - FD 2020

Suraj Phalod 2020B3PS1959PBatch Rep - FD 2020

Kirat Bir Singh Chawla 2019B1A80735P Batch Rep - FD 2019

Harsh Lamba 2019B3A40587P Batch Rep - FD 2019

Ujjwal Gupta 2018A2PS1015P Batch Rep - FD 2018

Harsh Shukla 2019B3A10430P Member of UC-2019-20

Saksham Agarwal 2018ABPS0848P Member of UC-2019-20

Goa Campus

Four positions namely: President, Vice President, Secretory, and Treasurer at Goa Campus, due to the pandemic situation as students are mostly away and do not have any specific position for student election this time; however, three student representatives to continue as an acting student's council:

Name Student ID Post

Kaluskar Dhruv Vikram 2017A4PS0590G President

Avi Chauhan 2017A7PS0056G Vice President

Sengupta Aanak Abhimanyu 2017A3PS0238G Treasurer

Rane Devashish Satyajit 2017A3PS0330G Sports Secretary

Aseem Juneja 2018A7PS0726G General Secretary

Hyderabad Campus

Nimish Gupta 2018A7PS0372H

Abhiraj Singh 2018A8PS0630H

VedantMishra 2018B2A40763H

File Description	Documents
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5.3.3 - Number of sports and cultural events / competitions organised by the institution during the year

13

File Description	Documents
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5.4 - Alumni Engagement

5.4.1 - The Alumni Association/Chapters (registered and functional)contributes significantly to the development of the institution through financial and other support services during the year

The Alumni of BITS Pilani has distinguished themselves at the national and international levels. BITS Pilani is proud to have as its alumni a group of over 1,60,000 engineers, technologists, scientists, managers, entrepreneurs and social reformers. Several of them have reached heights of excellence in their respective fields and are significantly contributing to the socio-economic development of the nation at large.

BITS Pilani Alumni Association is dedicated to bringing together the alumni community on a common platform to build another channel of personal and professional support to members through 'self-help' within the community. It is one of the most vibrant alumni associations in the world and operates through a network of national and international chapters. Alumni plays an important role in shaping the future of the institution.

1. More than 40 Chapters:BITS Pilani Alumni Association (BITSAA) is growing. There are now 40+ chapters around the world and 200+ initiatives running that serve BITSians around the world. It has now raised over $ 2 million for many causes and the network continues to have a major impact on BITSians lives across the globe.
2. Promoting educational activities:- BITSAA engages the educational activities by raising funds for setting up endowments, creating scholarships, rewarding teaching and research and generally promoting the development of resources at Birla Institute of Technology and Science at Pilani, Dubai, Goa & Hyderabad campuses.
3. Alumni Interaction:Alumni of BITS Pilani give inputs to aspiring graduates by mentoring them for future career prospects, higher education abroad, civil services and most important of all taking up entrepreneurship as a career option. . They are invited as resource persons at various events, guest lectures and panel discussions. They provide inputs and share their experiences regarding skills, recent technologies & trends in the corporate world, application of knowledge and corporate working culture.
4. Placement & Career Guidance Assistance:Alumni are serving in senior positions in organisations in India and abroad and extend all support in guiding students for their future careers and imparting knowledge from the world of work in emerging areas.
5. Campus Recruitment and Internships:Alumni come to campus as recruiters for their companies and also recommend and promote BITS Pilani to their employers/Companies for campus placements. They have been extending all-out support in the practice school programme (internships for 2 months and 6 months) for the students which is a part of the curriculum.
6. Social Responsibility:In the time of the Covid-19 crisis, Alumni from all across the globe came together to help the community to overcome this crisis.Members ofthe Alumni association are engaged in conducting social activities for the welfare of the society through Donations in the form of Books, rations, Blankets, Chairs, stationery etc.
7. Batch meets :Alumni associations host alumni reunions on campus that aim to help alums relive their memories of campus life, connect with batchmates, interact with faculty, and spend quality time with their families. These events present an opportunity to update alumni about the progress made by the institute in various areas, share the vision, plans, and invite ideas on alumni engagement.

File Description	Documents
Upload relevant supporting document	View File

5.4.2 - Alumni contribution during the year (INR in Lakhs)	A. ≥ 5Lakhs

File Description	Documents
Upload relevant supporting document	View File

GOVERNANCE, LEADERSHIP AND MANAGEMENT

6.1 - Institutional Vision and Leadership

6.1.1 - The institution has a clearly stated vision and mission which are reflected in its academic and administrative governance

BITS Vision

To be one of the leading universities in the world known for its excellence in teaching, research, industry engagement and quality of education.

To prepare young men and women to act as leaders for the promotion of the economic and industrial development of the country and to play a creative role in service to humanity.

BITS Mission

The qualities of innovation, enterprise, commitment to excellence, adherence to merit, and transparency, have characterized the Institute during its inexorable march to eminence

The Institute is committed to generating, disseminating, and preserving knowledge, and to working with others to bring this knowledge to bear on the world's great challenges.

BITS is dedicated to providing its students with an education that combines rigorous academic study and the excitement of discovery with the support and intellectual stimulation of a diverse campus community.

We seek to develop in each member of the BITS community the ability and passion to work wisely, creatively, and effectively for the betterment of humankind.

File Description	Documents
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6.1.2 - The effective leadership is reflected in various institutional practices such as decentralization and participative management

1. University Governance Framework

BITS Pilani has implemented a geographically distributed and empowered multi-campus governance structure through several divisions and units that include Academic - Undergraduate Studies Division (AUGSD), Academic - Graduate Studies & Research Division (AGSRD), Sponsored Research and Consultancy Division (SRCD), Faculty Affairs Division (FAD), Practice School Division (PSD), Work Integrated Learning Programmes Division (WILPD), International Programs and Collaborations Division (IPCD), and Alumni Relations. Each of these divisions is headed by an Institute-Wide Dean, and there is an Associate Dean at each campus for each division. There are several campus specific Faculty-in-Charges (FICs) responsible for activities at campus level such as Time Table, Centre for Innovation, Incubation & Entrepreneurship, Teaching Learning Center, Societal Development (NSS and Nirmaan), Registration & Counselling, Publications and Media Relations etc.

The decentralized structure characterized by participatory management was largely possible due to a pervasive Custom-built[Cisco Tele-Presence] HD video conferencing facility (launched in 2013). Not only we have solved the multi-campus governance problem elegantly, we also used this technology for instruction in specialized 250 capacity classrooms shared live across campuses with great success along with facilitating faculty selection and various committee meetings. This facility is also leveraged in offering a niche entrepreneurship course titled New Venture Creation taught exclusively by entrepreneurs, VCs, Startup mentors over the TP platform, which is otherwise not possible.

Corporate recruiters interview students of other campuses either from one campus location or from their own TP facility. While few corporates have it, BITS probably is the only institute in the country to have a full scale TP facility across all its campuses.

2. University Placement Function

BITS Pilani takes pride in having one of the best placement metrics in the country competing with the leading old IITs. The execution of this function is carried out at a nicely blended and balanced centralised team along with an empowered campus level decentralised teams. It is led by a full-time professional University-wide Chief Placement Officer accompanied by a dedicated Placement Manager (full time professionals) at each campus to take care of operations at campus level. They are assisted by a student team of Placement Committee volunteers who work to ensure the smooth functioning of the placement process. The team is headed by a Placement Coordinator, assisted by a Pitching Head, a Logistics Head and a team of around 50 volunteers in each semester.

Most of our students have their career paths charted much before graduation. Almost 100% succeed in securing a job. Two placement seasons in a year. Roughly half of the outgoing

batch avails placement in the first semester and the other half in the second semester.This well synchronized by the central team along with the campus teams. Contemporary HR practices accompanied by technology deployment enables us to monitor relevant metrics on a continuous basis and do course correction as we progress through the seasonal placement processes.

File Description	Documents
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6.2 - Strategy Development and Deployment

6.2.1 - The institutional Strategic plan is effectively deployed

Curriculum Development

BITS Pilani has established a three-tier system for curriculum and course review. Each department has a Departmental Committee on Academics (DCA) with 5 to 8 faculty members. There is a Cross Campus Committee on Academics (CCDCA) which is a University-wide and department-specific empowered team. CCDCA enables integration and collaboration among each department across all BITS campuses. Typically, CCDCA constitutes a representation of 2 to 3 faculty members from each campus for the specific department. Curriculum review, introduction of new courses, program design, etc., are initially discussed in detail at DCA; a detailed discussion at CCDCA follows this. The final recommendations are made by CCDCA and presented to Senate for its consideration and approval.

In addition to the above, once in maximum of 5 years, the institute carries out a comprehensive curriculum review involving external eminent domain experts and industry professionals, under the coordination of the two Academic Deans.

Teaching and Learning

To promote effective teaching and learning, 2 to 3 teaching workshops are conducted every year. Every department (at each campus) invites about 5 to 6 experts to provide expert talks. At the beginning of each semester, Departmental Committee on Academics (DCA) reviews the course handouts of all the courses offered in that semester. All the classrooms at BITS Pilani are Wi-Fi enabled and have LCD projectors. BITS Pilani has also established Cisco Tele-Presence Class Room, which connects all the BITS Campuses. In every semester, around four courses are offered through this facility, thus enabling peer learning across all campuses. To promote continuous improvements in teaching, BITS Pilani has a structured student feedback process (ensuring anonymity), which facilitates collecting information on

the courses taught for each semester. BITS Pilani also gathers feedback regularly from faculty, industry experts, practice school organizations, campus interview teams, alumni, and parents.

Examination and Evaluation

For each course, question paper standards and other parameters are reviewed by at least two faculty members of the respective department. Departmental Committee on Academics (DCA) shares the question paper review reports of all the courses (offered by the department) with Dean, Academics (UG), and Dean, Academics (PG) as applicable. Once the final evaluation is complete, the faculty member discusses the proposed grades in the Departmental Meeting and seeks the view of other faculty colleagues. This is followed by submitting grades with Dean, Academics (UG) and Dean, Academics (PG) as applicable. Grades submitted for all the courses across all departments (of a campus) are discussed in depth by the Examination Committee before being declared as valid grades.

Research and Development

A rigorous written test followed by an interview is conducted to ensure high-quality student admission to the PhD program. The quality of the students admitted to the PhD program is further refined by a meticulous PhD qualifying examination. To further strengthen the PhD program, each department has a Departmental Research Committee (DRC), which regularly supports and monitors the progress of each PhD student admitted in the specific department. To provide customized/personalized support, each PhD candidate (research scholar) is also provided with Doctoral Advisory Committee Members (2 faculty members who specialize in the area of research of the respective PhD candidate). Additionally, it is mandatory to publish at least two papers in Scopus- Indexed Journals before submitting the PhD thesis for final evaluation.The Dean and the Vice Chancellor personally looks into the two External Examiners chosen for each Thesis submitted, ensures that they are from the top research institutes (mostly old IITs, IISERs, NIPERs, NIRF top 15 Universities and Institutes) and Research Labs (CSIR, DRDO, DSt etc.) and that they are currently active individuals with eminent research profile.

Even though BITS Pilani does not receive any fellowship grants from Government of India, it provides fellowship support to all doctoral students. These fellowships are at par with those offered by DST and MoE.

Top leadership continuously monitors the research dashboard, studies the research trends, carry out data analytics and obtain actionable insights on the research gaps and utilizes

the opportunities effectively. Publication quality metrics such as C-index - Citations / paper, h-index, P-index - # of papers/faculty/year, % of papers published /year with at least one international co-author, trends and CAGR in the cumulative and annual of number of publications, number of citations, number of publications in Q1 and Q2 journals, etc.

Library, ICT and physical infrastructure / instrumentation

In spite of the pandemic, the Hyderabad campus library was operational with minimum staff while strictly following Covid protocols. Even though the opening hours were limited, book borrowing and returning services were offered. Services were maintained mainly to support research scholars on campus and faculty for their online classes. In January 2021, a mini Book Exhibition was organized in association with the campus bookstore. Faculty on campus visited and recommended titles for the library.

Due to the pandemic, the Dubai campus library was open with limited seating capacity as per the Knowledge and Human Development Authority (KHDA) guidelines. Working hours were reduced to 7.30 am – 7 pm. However, library working hours were extended until 10 pm during the comprehensive examinations. Library Committee Members and Library staff had visited the Sharjah International Book Fair and recommended books to the library. The library has procured nearly 46 course text and reference eBooks subscribed to Pressreader to access more than 7000+ e-magazines and e-newspaper. This was also integrated with the E-Library portal, thus facilitating access to these resources from any remote location.

During the pandemic to facilitate remote access to thelibrary, Shibbolethplatform (provided by UGC/INFLIBNET) was used by faculty members, research scholars, and students across all Indian campuses. They were also able to access subscribed scholarly electronic resources on a 24x7 basis from their home.

To adhere to the needs of students (who are digital natives), Pilani campus library developed an Android Mobile App which facilitates access (through mobile phones) of library’s online resources such as subscribes databases, journals, e-Textbooks, and e-Referencebooks. Several sessions (intended for users) was conducted viz. know your Library, training sessions on databases and research tools, etc.

Several events and competitions were organised by libraries across all campuses. To name a few,

- Academic Writing Competition for Chemistry, Chemical Engg and Pharmacy research scholars was organized with the help of the Royal Society of Chemistry (RSC), UK.

- Webinar on "The Chemical Science: A Touch of History and the future" was organized on Nov 7, 2020.
- Webinar onReinvigorating Libraries and Reinventing Librarianship was organized duringJanuary 5-6, 2021.
- A competition on Best Ideas for BITS Pilani Library was organized during 11-16 January 2021 for the students.
- A talk on "5 Best Things I learnt during Covid-19 Pandemic" was organized for school children on April 23, 2021, to commemorate World Book and Copyright Day.
- Basant Book Festival 2021 (VBBF-21) was organized on a virtual platform by the Library during 11-17 Feb 2021, where over 35,000 books were made available online for all the faculty, research scholars, and students. They could also recommend books for the library acquisition.
- Series of 'know your Library' webinars
- Sessions on how to access archived question papers.
- Organized virtual library orientation for students admitted in the year 2020.
- Seven user-specific information literacy programswere conducted for students.
- E-resource access training programs from various publishers like IEEE, EBSCO, Pressreader, and Knimbus (E-Library) were conducted for users to effectively access Library subscribed e-resources from within and outside the campus.
- Along with IEEE organized Webinar on "How to Publish a Quality Technical Paper" by Top Authors in IEEE Xplore on Oct 10, 2020.
- Organized Co-Author Talk on a book titled "Digital Nation: How the United Arab Emirates is Building a Future Based on Tech Innovation" on Sept 3, 2020.

Human Resource Management

BITS Pilani encourages its faculty members to present papers and attend conferences, seminars, workshops, conclaves, and training programs to promote peer interaction of faculty members with faculty members, researchers, and industry professionals. In this regard, the following policies are in practice.

- Reimbursable Professional Allowance for the Faculty: Allowance of Rs. 1 L/year for Assistant Professor at Academic Level L12 or above. Typically, 50% or more of such allowance should be used to present paper(s) at Tier 1 or Tier 2 Conferences identified by the Departments.
- Sabbatical Leave: A faculty member shall avail a one-year sabbatical Leave after completion of six years of continuous service at Assistant Professor Academic Level L12 or above. They can avail this once every six years of continuous employment. During the period of Sabbatical Leave, the faculty member is entitled to full salary (50% of the

compensation paid during the Sabbatical Leave, while the balance will be paid in 4 equal instalments over the next two years together with interest calculated @ 6%/Yr) and allowances admissible under the standard rules but will not be provided travelling allowance or any other allowance in India or abroad.

- Extra-ordinary Leave (EOL): To enrich the experience of the faculty members, which in turn help BITS Pilani in teaching, research, consulting, and administration, a faculty member is allowed to avail Extra-ordinary Leave (EOL) without pay for up to 2 years subject to conditions.
- Consultancy Assignments/Projects: Faculty members of BITS Pilani have expertise in various areas to provide intellectual inputs and significant contributions for solving problems faced by the industry and other organizations. The institute has a comprehensive policy and guidelines that encourages faculty members to engage in consultancy assignments.
- Testing Projects: Using the existing infrastructure at any of BITS Campuses, faculty members can engage in testing projects for the industry or for any other external stakeholder. Testing projects typically include testing a component or a product against a standard, testing the strength of concrete in construction, compaction strength of soil, calibration of pressure gauges, chemical identification, drugs identifications, estimation, and evaluation of unknown species, etc.

Faculty and Staff recruitment

Teaching Staff Recruitment : To ensure that top-quality faculty members are recruited across all levels (for tenured positions at on-campus and off-campus/WILP), BITS Pilani has a well-defined, structured and rigorous recruitment process. The recruitment process involves four levels.The lowest/starting level is the Department Level Application Short-listing Committee (DLSC) which is constituted for each department at every campus. Typically, at least three faculty members are part of this committee. This is followed by theCampus Level Short-listing Review Committee (CLSC), which is campus-specific and headed by the Director (of the specific campus), Chairperson (nominated by the campus Director), two or more Professors (appointed by the campus Director), Associate Dean - Faculty Affairs Division (of the respective campus), all other Professors and Associate Professors from the Department. The next level is theUniversity Level Short-listing Review Committee, which has the Vice-Chancellor or his nominee as Chairman, Dean of Faculty Affairs as Convener, and, Directors of all Campuses. The final level is the University Level Selection Committee, where Vice-Chancellor is the Chairman, Dean of Faculty Affairs as Convener, two eminent external experts in the concerned discipline/sub-area, Director of one of the four campuses (nominated by the Vice-Chancellor), Directors of the remaining BITS campuses (as Special

Invitees), Chairmen of the Department Level short-listing committee from one of the campuses in the concerned department/discipline.

BITS Pilani also recruits people for non-tenured positions. BITS encourage young researchers, professionals who are starting their careers, those who have superannuated, for an appointment at BITS for a fixed duration as "visiting" or on "contract." The positions available under "non-tenured faculty "appointments are Post-doctoral Research Associate (PDF) to work on research projects; Visiting Faculty, Visiting Professors, Honorary Visiting Professor to enrich teaching, research, and curriculum. Guest Faculty plays an important role in the WILP programs and the on-campus needs of a department (preferably for an academic semester). However, these appointments are not routine (i.e., continued year after year) but primarily meet immediate teaching and other requirements.To attract top eminent level academics from across the globe, BITS has introduced the Distinguished Visiting Professor position where a few murky individuals of eminence have already been engaged.

BITS Pilani uses theCisco TelePresence facility (Video conferencing) for faculty selection process across four campuses. The usage of the facility can be categorized in two sections, before and during COVID 19:

- August 2019 to March 2020: Video conferencing facility in the campus premises is equipped with a 70mm dual screen to display virtually the panel members and the candidates appearing from four campuses, respectively. Additionally, using 70mm touch-sense screen as a writing board for the candidates appearing from campus premises in-person for demo lecture/presentations. BITS Pilani uses an online Telepresence Integrated Platform (Cisco Meet) to accommodate overseas candidates. For uninterrupted connectivity, MPLS lines were utilized across campuses.
- Since March 2020: Shifted to Zoom platform for faculty selection process to accommodate respective panel members and the candidates across the globe.

Non-Teaching Staff Recruitment : All appointments to non0teaching posts may initially be made temporarily for a specific period. If confirmed, the appointee may be allowed to continue until the close of the academic session in which he/she attains the age of 60 years subject to Regulations.

Industry Interaction / Collaboration

Practice School (PS) is a unique feature at BITS Pilani. Full-time students enrolled with BITS Pilani are required to complete a unique 5.5 months (PS II) structured industry immersion program. Faculty members visit various organizations/companies to identify the

projects/assignments well in advance before starting the PS course each semester/summer term.This is followed by creatinga problem bank, which essentially captures the needs of the host organizations. Problem bank acts as asource of information for students to decide their choice of PS stations and facilitates the PS Division to allot the student with the right project (i.e., mapping the skill set of a student with thatof the project need vice-versa). For a few domains where there are skill gaps, it is overcome by offering specialized Skill gap courses to students before reporting for the PS station. PS orientation programs were further strengthened through activity mapping, process mapping, and process improvement mapping at the host organization. Domain-specific faculty members were assigned as PS instructors. These faculty members are responsible for preparing domain-specific course handout(s), identifying learning outcomes, and conducting various evaluation components as part of the PS program. At the host organization (PS station), domain-wise Gap Lectures, panel discussions, etc., by senior executives were organized for PS students. Mentors from the host organization are also involved in the evaluation process. Post PS I students learning and experience are collected and published domain-wise under PS-I chronicles.

To improve PS learning and experience for students and the host organization, a new cell, Quality Assurance and Assessment Cell, was created.

As the pandemic broke out in March 2020, the Practice School (PS) Division undertook several critical actions to effectively convert the ongoing PS programs into work-from-home mode using thesmart learning management system.

Admission of Students

BITS Pilani regularly analyses the scoring pattern of the BITSAT exam of previous years. These findings are used toupdate and strengthen the BITSAT question bank(UG and PG). Postgraduate admissions were opened for thestudents with GATE/GPAT scores(unlike in the past admissions were based on only BITSAT Scores) and the number of seats was also increased. This effort has increased the number of applications received in this Academic Year. To havecultural diversityon the campus, a greater focus has been given to the admission of Internationals candidates.

File Description	Documents
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6.2.2 - The functioning of the institutional bodies is effective and efficient as visible from policies, administrative setup, appointment and service rules, procedures, etc.

The Institute has a functional administrative structure. Vice-Chancellor is the executive head of the Institute, including all its campuses. Further, each Campus has a Director who takes care of the day-to-day academic and administrative operations of the Campus.

Various activities and requirements arising out of innovative educational programmes have been grouped into functions and each functional Division is headed by a Dean and each Unit by a Chief. Similarly the departments are headed by the Head of the Department. There are also faculty members designated as Incharge of various activities such as Instruction, Registration, Practice School, etc.

For each Division and Unit, there are cohesive teams of faculty known as the nucleus to support the activities of the Division/Unit.

File Description	Documents
Upload relevant supporting document	View File

6.2.3 - Institution Implements e-governance in its areas of operations

6.2.3.1 - e-governance is implemented covering following areas of operation **1. Administration** **2. Finance and Accounts** **3. Student Admission and Support** **4. Examination**	A. All of the above

File Description	Documents
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6.3 - Faculty Empowerment Strategies

6.3.1 - The institution has a performance appraisal system, promotional avenues and effective welfare measures for teaching and non-teaching staff

Pperformance appraisal system, promotional avenues and effective welfare measures for teaching and non-teaching staff:

The Performance Management System at BITS, is designed to encourage regular, constructive discussion between faculty and HoD regarding their performance and progress to enhance their professional growth and development. The Performance Management System helps the faculty to get regular feedback, set goals for themselves and motivate them to give their best. It's imperative that faculty members know that their contributions are recognized and acknowledged. Performance Management is integral to supporting faculty development and creating a superior performing institution. Institutional excellence can be achieved only when each member strives for excellence.

The performance management process cycle starts with goalsetting at the beginning of the academic year.

1. Goal Setting for the upcoming year based on Performance Expectation Grid
2. Self- Appraisal for the previous year(s)
3. Annual Performance Review with the HoD
4. Review by Campus Moderation/ Cross Campus Faculty Appraisal Committee
5. Review by Leadership and release of appraisals

In the same way, the Development Oriented Performance Management System (DOPMS) has been placed for Non-Teaching and Other Academic staff for their professional assessment and career growth.

BITS has several welfare measures in place for its teaching and non-teaching staff. Some major welfare schemes are as follows:

- Medical Allowance
- Child Educational Allowance
- Maternity benefits as per norms
- Leave Travel Concession
- on campus medical facilities
- Employees' Welfare Fund
- Regular opportunities for international exposure, as per norms

The following facilities are also provided to employees for efficient functioning:

- Medical leave
- Psychological counselling
- 24-hour power back-up
- Wi-Fi facility

- Workspace
- Computing facility Cafeterias
- Identity cards
- Shopping outlets
- Sports facilities

File Description	Documents
Upload relevant supporting document	View File

6.3.2 - Total number of teachers provided with financial support to attend conferences / workshops and towards membership fee of professional bodies during the year

821

File Description	Documents
Upload the data template	View File
Upload relevant supporting document	View File

6.3.3 - Number of professional development / administrative training Programmes organized by the institution for teaching and non-teaching staff during the year

16

File Description	Documents
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6.3.4 - Total number of teachers undergoing online/ face-to-face Faculty Development Programmes (FDP)during the year(Professional Development Programmes, Orientation / Induction Programmes Refresher Course, Short Term Course)

3

File Description	Documents
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6.4 - Financial Management and Resource Mobilization

6.4.1 - Institutional strategies for mobilisation of funds and the optimal utilisation of resources

The Institute has a strong annual planning and budgeting process. Institute maintains & follows a well-planned process for the mobilization of funds and resources with the help of strong Financial MIS system and a strong qualified finance team headed by CFO (Chief Finance Officer).

Source of Funds

- Fee from students
- Interest on Investments
- Interest on corpus
- Contribution from Alumni and Corporates
- Projects
- Consultancy charges
- Endowments
- Overhead charges from the research grants received from various government and non-government agencies
- Sale of application forms

Optimum Utilization of Resources:

- Funds generated from the above sources are principally used for effective teaching-learning practices, maintenance (Renovation of classrooms, Labs and Sports or student welfare related infrastructure) and for the overall development of the University.
- Finance department monitors the optimum utilization of funds for various projects.

• The central purchase unit seeks quotations from vendors for the purchase of equipment, computers, books, etc.

• The requirements of the various departments are submitted to the central purchase committee after getting approval from the competent authority.

• For the purpose of the purchase, competitive bidding and tendering process is followed to ensure optimum use of funds.

• Budget is utilized to meet day-to-day operational and administrative expenses and maintenance of fixed assets.

• The finance department and purchase unit along with the accounts department ensure that the expenditure lies within the allotted budget. The intervention of the management is sought in case the expenditure exceeds the budget.

Resource Mobilization Policy and Procedure

• Before the financial year begins, the finance department prepares the university budget.

• The institutional budget includes recurring expenses such as salary, electricity and internet charges, stationery & other maintenance costs.

• It includes planned expenses such as lab equipment purchases, furniture, and other development Expenses.

• The budget is scrutinized and approved by the leadership and Governing Council.

•The accounts department and Purchase department monitor whether expenses are exceeding the budget provision.

File Description	Documents
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6.4.2 - Funds / Grants received from government bodies during the year for development and maintenance of infrastructure (not covered under Criteria III and V) (INR in Lakhs)

00

File Description	Documents

Upload the data template	No File Uploaded
Upload relevant supporting document	No File Uploaded

6.4.3 - Funds / Grants received from non-government bodies, individuals,philanthropists during the year for development and maintenance of infrastructure (not covered under Criteria III and V)(INR in Lakhs)

62.90

File Description	Documents
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6.4.4 - Institution conducts internal and external financial audits regularly

Birla Institute of Technology and Science, Pilani regularly conducts statutory audit.

M/s. S R Batliboi, Chartered Accountants, are the statutory auditors of BITS Pilani.

BITS Pilani also conducts Internal audit on a regular basis and files form 10BB and audit report on the income tax portal.

M/s. Aneja and Associates, Mumbai are the internal auditors of BITS Pilani.

Due to the pandemic, the internal auditors were not able to travel for audit for FY 21.

BITS Pilani also has an internal auditor for perpetual audit of the books of accounts on behalf of M/s. Brij Kishore and Company, Chartered Accountants, Jhunjhunu in the Accounts and Finance Section.

File Description	Documents
Upload relevant supporting document	View File

6.5 - Internal Quality Assurance System

6.5.1 - Internal Quality Assurance Cell (IQAC) has contributed significantly for institutionalizing the quality assurance strategies and processes by constantly reviewing the teaching learning process, structures & methodologies of operations and learning outcomes at periodic intervals

The Teaching-Learning Centre

The Institute has set up Teaching Learning Centre (TLC). It will be involved in improving the overall teaching - learning environment at BITS Pilani and headed by a Professor-in-charge, who will be supported by Faculty-in-charges from all the four campuses of BITS Pilani. There will be a few nucleus members in each campus to support the Faculty-in-charge. The Centre will carry out research on innovative teaching pedagogy, collection of good practices of teaching learning from all over the world and disseminate among the faculty, conduct intensive teaching workshops and invite experts from India and abroad to deliver lectures on relevant topics.

According to the notification issued by the Office of the Registrar of the Birla Institute of Technology and Science, Pilani dated 10 June 2015 (Ref. No. N/3), the Teaching-Learning Centre (hereinafter referred to by the acronym TLC) "will be involved in improving the overall teaching-learning environment at BITS Pilani".

The TLC is mandated with the specific tasks of

- **collecting the best teaching-learning practices from around the world towards disseminating these amongst the teaching-learning community at BITS Pilani**
- **conducting teaching-learning workshops**
- **enhancing scholarship on the teaching-learning process**

The Teaching-Learning Centre at Pilani Campus is envisioned

- **as an entity that fosters the teaching-learning experience**
- **as an entity that enables the agency of both the learner and the teacher**
- **as being grounded on the learner-centered paradigm of education**
- **as a forum for discussing teaching pedagogy and evaluation techniques**
- **as an entity that encourages innovation in teaching-learning methodologies**
- **as an entity that promotes the use of the latest technologies in the teaching-learning process**
- **as a forum for resolving challenges in the teaching-learning process through a collegial rather than a prescriptive approach**

TLC at Pilani is envisioned merely as an enabling entity in matters related to teaching and learning. The Instruction Division is the principal authority empowered for the administration of instruction at BITS Pilani.

In a learner centered paradigm, it is imperative that the concerns of the learner are addressed through the activities of the TLC. Towards this end, TLC will consult with various sections of students on matters concerning teaching and learning through the Students' Welfare Division, Students' Union, Student Faculty Councils, Academic Counseling Board and Academic Counseling Cell.

TLC will establish links with peer entities in India and abroad with the purpose of exchanging expertise and sharing experience.

TLC will support individual programmes as well as departments in their endeavour towards evolving clearly defined/quantifiable learning outcomes corresponding to individual programmes/departments. These learning outcomes will concur with the founding vision of BITS Pilani, the Chancellor's vision, and the attributes and professional competencies expected of graduating students.

TLC will initiate and support different types of research pertaining to teaching and learning processes:

- Foundational research that contributes to a fundamental understanding of teaching and learning processes
- Design and development research that seeks strategies/solutions/ /interventions to specific problems in the teaching-learning processes
- Effectiveness research that examines the efficacy of an intervention/strategy/solution in specific target contexts
- Scale-up research that examines effectiveness in a wide range of populations, contexts, and circumstances.

File Description	Documents
Upload relevant supporting document	View File

6.5.2 - Institution has adopted the following for Quality assurance Academic Administrative Audit (AAA) and follow up action taken Confernces, Seminars, Workshops on quality conducted Collaborative quality initiatives with other institution(s) Orientation programme on quality issues for teachers and studens Participation in NIRF Any	A. Any 5 or all of the above

other quality audit recognized by state, national or international agencies (ISO Certification, NBA)	

File Description	Documents
Upload the data template	View File
Upload relevant supporting documnent	View File

6.5.3 - Incremental improvements made for the preceding during the year with regard to quality (in case of first cycle) Post accreditation quality initiatives(second and subsequent cycles)

There have been many incremental changes as part of planned exercise and towards the general goal of overall quality improvement and enabling the various stake holders and performers. ERP has been implemented at full scale, integrating student life cycle, finance, and HR processes. Learning Management Systems (LMS), synchronous teaching platforms (virtual classrooms), and Virtual and Remote Laboratories are used extensively, especially during the challenging time of pandemic related restrictions.

Thanks to a pervasive and Custom-built new Cisco Tele-Presence HD video conferencing facility upgraded recently (launched in 2013), not only we have solved the multi-campus administration and governance problem elegantly, but we also used this technology for instruction in specialized 250 capacity classrooms shared live across campuses with great success along with facilitating faculty selection and various committee meetings. While few corporates have it, BITS probably is the only institute with a full-scale TP facility across all its campuses. In addition, there are clear financial benefits - in the last 9 yrs, we have saved over Rs 20 Cr in travel costs and of course enormous travel time. We typically offer 20+ courses/Year (pre-Covid bubble stats) in this mode.

The option of enrolling in a minor program has been enriched with more state of the art minor programs offered, and so is the number of open electives offered across the disciplines.

A requirement of a minimum number of units of courses in the Humanities and Social Sciences (for students enrolled in science and engineering programs) as electives are followed. Students enjoy complete autonomy in managing co-curricular and extra-curricular activities. Students participate in various Institutional activities and are appointed as members of different bodies, including the Senate. Institute offers several opportunities to develop and hone their entrepreneurial capabilities including participation in several such novel

courses such as new venture creation which is taught by entrepreneurs and venture capitalists.

File Description	Documents
Upload relevant supporting document	No File Uploaded

INSTITUTIONAL VALUES AND BEST PRACTICES

7.1 - Institutional Values and Social Responsibilities

7.1.1 - Measures initiated by the Institution for the promotion of gender equity during the year

BITS Pilani is among 30 institutions selected to participate in GATI (Gender Advancement for Transforming Institutions) project of DST, towards the journey of creating an ecosystem to build competencies and adopting best practices and pathways for transformational changes with focus on gender equity and women empowerment.

1. BITS Pilani is committed to maintaining a working and learning environment free of intimidation, fear, bullying, revenge, retaliation in which students, faculty, and staff can develop intellectually, professionally, personally, and socially. Institute is committed to create a harassment free, friendly work environment to working or studying in the Institute along the guidelines of the Supreme Court. To ensure this, the institute has constituted Internal Complaint Committee
2. BITS Pilani follows the UGC guidelines for ensuring equitable environment for all students. For this, the institute has an active Gender Champions team consisting of students and faculty members.
3. BITS Pilani recognizes that all human beings are born free and are equal in dignity and rights. The Institute recognizes that all human beings of all sexual orientations and of all gender identities are entitled to the full enjoyment of all human rights. BITS Pilani is committed to l take all appropriate steps to ensure that persons of non-normative gender identity and/or sexual orientation do not face any form of discrimination or stigmatization.

File Description	Documents
Upload relevant supporting document	View File

Annual gender sensitization action plan(s)	Informing the community about ICC, its activities , by putting notices, and sending the mail to all students, faculty and staff , and work to create a campus free of any kind of harassment and intimidation like ICC(internal complaints committee), Gender Champions, Anchor. Regular updating of website, putting posters, notices on prominent places about gender issues. Updating the site: https://www.bits-pilani.ac.in/SexualHarassment To conduct talks/workshops by eminent speakers/activists from academia, law, NGOs in the areas of gender issues. Attending workshops/training programs being organized by other premier institutes.
Specific facilities provided for women in terms of: a. Safety and security b. Counseling c. Common rooms d. Daycare Centre e. Any other relevant information	Institute has well lighted roads, Security guards CCTVs at all prominent places. Clean, separate toilets & Common rooms with mirrors, dustbins, vending machines for sanitary napkins at institute and girls' hostel. Institute has ACC(Academic Counseling Cell) to address anxieties around performance, provide guidance to prepare for tests, and plan the career. Every student has been allotted a faculty mentor to whom the student can approach with any kind of issues of concern. A cell of Mpower has been established in the campus to provide support to mental wellness issues. Mpower has team of mental health professionals which can be approached through digital messaging/ skype call/ audio calling.

7.1.2 - The Institution has facilities for alternate sources of energy and energy conservation Solar energy Biogas plant Wheeling to the Grid Sensor-based energy conservation Use of LED bulbs/ power-efficient equipment	A. Any 4 or All of the above

File Description	Documents
Upload relevant supporting document	View File

7.1.3 - Describe the facilities in the Institution for the management of the following types of degradable and non-degradable waste (within 200 words) Solid waste management Liquid waste management Biomedical waste management E-waste management Waste recycling system Hazardous chemicals and radioactive waste management

Pilani Campus

Solid Waste Management: BITS Pilani Campus has a systematic waste collection & disposal system which includes In-house & outsourced resources. Domestic mixed waste is collected from door to door, stored in Pedal operated covered Garbage bins. Thereafter this waste is disposed-off to the municipal dump yard.

One organic waste processing plant of 2 Ton capacity is in process in our campus to recycle the organic/wet waste and convert it into the electricity & manure.

Liquid Waste:In BITS Campus a well designed sewer network is collecting liquid waste from entire campus to Treatment plants. Mixed liquid waste which includes sewage also is being recycled/ treated with extended Aeration Activated Sludge & MBBR Technology in treatment plants. The recycled water is further reusing for the gardening and flushing purposes in Institute.

At present two STPs are established & operating successfully in our campus having the capacity of 2.5 MLD which lead us to a zero discharge campus.

Goa Campus

Solid waste management

We use the "segregation at source" policy for waste disposal. For this different colored bins are provided to residents

1. Blue : For dry waste
2. Green: For wet waste
3. Black: for Electrical waste, and
4. Yellow: For diapers and sanitary napkins

This waste is then collected by the state pollution board approved agency, Goa Health Monitoring Services (GHMS) for further processing and recycling.

- All garden waste is composted and converted into manure which is used to maintain the garden.

Liquid waste management

- The Sewage Treatment Plant (STP), with the capacity of 600 cumec is working round the clock to treat sewage generated by residents of the campus.

- In the recently completed hostels and residential quarters, the STP treated water is supplied to flush tanks of EWC through dedicated supply network.
- The treated water is also recycled by using it to maintain lush green garden.
- The sludge generated at STP is transferred to drying bed in the vicinity of STP which is used as manure after drying.

Biomedical waste management

The biomedical waste is segregated as infectious plastic waste, infectious non plastic waste, infectious sharp waste and cytotoxic waste using bins as per the standard color codes

The segregated waste is further collected by GHMS for further processing.

E-waste management

Unique black colored bins are provided for the collection of E-waste such as old batteries, computer related waste, etc and is collected by GHMS for further processing and recycling.

Hazardous chemicals and radioactive waste management

The radioactive waste is not generated in campus. Hazardous chemical waste generation is very low which is further diluted and treated in common treatment plant. Waste oil from the diesel generators are sent to state pollution board approved vendor.

Hyderabad Campus

Solid waste management: Adequate Trash Bins were provided across the campus to control the littering of the waste material. A separate Waste management yard is in operation to segregate Domestic dry waste and wet waste. Dry waste sent outside Campus through the vendor for recycling and wet waste is vermicomposting and used for garden manure. All garden waste is composted and converted into manure, which is used to maintain the garden.

Liquid waste management: Two Sewage treatment plants of 450 KLD capacity & 600KLD capacity with MBBR technology are functioning to treat the wastewater generated on the Campus. Treated water is used for around 25000 sqm of landscape area and used for flushing purposes.

Biomedical waste management: Biomedical waste is segregated and dispatched through authorized vendors outside the campus.

Waste recycling system: Sewage water is being treated and the treated water is pumped back to maintain the avenues, horticulture, and flushing the toilets. The sludge generated at STP is transferred to a drying bed in the vicinity of STP which is used as manure after drying.

E-waste management: E-waste generated is collected and sent either to an e-waste dealer or to the collection point prescribed by the Pollution Control Board.

Hazardous waste management and Radioactive waste management: This factor has been taken care of in an adequate manner to provide an eco-friendly environment within the campus, and there is no radioactive waste generated at our Campus.

File Description	Documents
Upload relevant supporting document	View File

7.1.4 - Water conservation facilities available in the Institution: Rain water harvesting Bore well /Open well recharge Construction of tanks and bunds Waste water recycling Maintenance of water bodies and distribution system in the campus	A. Any 4 or all of the above

File Description	Documents
Upload relevant supporting document	View File

7.1.5 - Green campus initiatives include

7.1.5.1 - The institutional initiatives for greening the campus are as follows: 1. Restricted entry of automobiles 2. Use of bicycles/ Battery-powered vehicles 3. Pedestrian-friendly pathways 4. Ban on use of plastic 5. Landscaping	A. Any 4 or All of the above

File Description	Documents
Upload relevant supporting document	View File

7.1.6 - Quality audits on environment and energy are regularly undertaken by the institution

7.1.6.1 - The institution's initiatives to preserve and improve the environment and harness energy are confirmed through the following: 1. Green audit 2. Energy audit 3. Environment audit 4. Clean and green campus recognitions/awards 5. Beyond the campus environmental promotional activities	A. Any 4 or all of the above

File Description	Documents
Upload relevant supporting document	View File

7.1.7 - The Institution has a disabled-friendly and barrier-free environment Ramps/lifts for easy access to classrooms and centres. Disabled-friendly washrooms Signage including tactile path lights, display boards and signposts Assistive technology and facilities for persons with disabilities: accessible website, screen-reading software,mechanized equipment, etc. Provision for enquiry and information: Human assistance, reader, scribe, soft copies of reading materials, screen reading, etc.	A. Any 4 or all of the above

File Description	Documents
Upload relevant supporting document	View File

7.1.8 - Describe the Institutional efforts/initiatives in providing an inclusive environment i.e. tolerance and harmony towards cultural, regional, linguistic, communal, socio-economic and other diversities (within a maximum of 200 words)

BITS has students from every part of the country. Students get the opportunity to experience the different cultures in the campus through 16 regional cultural associations in the campus. These associations arrange various cultural festivals so that one never really feels away from home.Student Clubs are formed around academic and national themes to add to the

rich mosaics of student life. The aim of such clubs is to enrich the social and cultural life on the Institute campus.

BITS Pilani, actively promotes and participates in several regional and cultural activities every year. Our faculty and students have formed several social, cultural, economic, and art clubs and departments through which they actively conduct several campaigns and activities that contribute to the service of the society and help create awareness against national issues.

Contributing to the unique diversity of our nation through different cultural associations and also creating necessary awareness, rests with today's youth and our students fully realize this. BITS Pilani, actively encourages its students to participate in all these activities to buildan inclusive environment where they learn and share to be tolerant and harmonious towards cultural, regional, linguistic, communal, groups.

File Description	Documents
Upload relevant supporting document	View File

7.1.9 - Sensitization of students and employees of the institution to constitutional obligations: values, rights, duties and responsibilities of citizens:

To sensitize the students and employees to constitutional obligations, values, rights and their duties and responsibilities as an Indian citizen, national pledge is administered at occasions like Independence day and Republic Day. On Gandhi Jayanti also a pledge is being administered to make the students aware about their duties to maintain the integrity and sovereignty of the nation. On the same day, the kindergarten kids are introduced to the principles and teachings of Gandhiji (Father of our Nation) like Ahimsa, Non violence etc.

There are student associations having tie-ups with National NGOs like NIrmaan Organizations wherein students and employees of BITS Pilani actively participate for national causes like poor children education, donations for national calamities like flood relief in Prime Minister care funds, etc.

7.1.10 - The Institution has a prescribed code of conduct for students, teachers, administrators and other staff and conducts periodic programmes in this regard. The Code of Conduct is displayed on the website There is a committee to monitor adherence to the Code of Conduct Institution organizes professional ethics programmes for	Any 3 of the above

students, teachers, administrators and other staff Annual awareness programmes on Code of Conduct are organized	

File Description	Documents
Upload relevant supporting document	View File

7.1.11 - Institution celebrates / organizes national and international commemorative days, events and festivals

National Events celebrated by the Institute:

1. **Independence Day (15th August) every year is celebrated to mark the day India got Independent status as a nation. On this day, the tricolor flag is hoisted by the Honorable Vice Chancellor followed by various patriotic songs sung by the group of students. National Pledge is administered followed by national anthem that fill the hearts of all faculties and students with pride and spirit of nationalism.**
2. **Republic Day (26th January) is also celebrated every year in the Institute where the national flag is hoisted by the Honorable Vice Chancellor and patriotic songs are sung by the students.**
3. **Gandhi Jayanti (2nd October) is celebrated where the students, faculties and kids of infant care centre (Blossom Kids Zone) are made aware of the teachings and principles of Gandhiji through certain documentaries. The kids of Infant care centre (BKZ) pay tribute to Gandhiji by singing favourite bhajans of Gandhiji. A pledge to uphold the freedom, sovereignty and integrity of our nation is taken by all.**
4. **Basant Panchmi every year is celebrated as Founders Day to mark the inauguration of the BITS Vidya Vihar Campus by First President of India- Dr. Rajendra Prasad in the year 1951. On this auspicious day the non-teaching staff members who have successfully completed their service period are felicitated. To recognize the contribution of our non-teaching staff and appreciate individuals for their outstanding achievements in their field of work and significant contributions made to the functional administration of the institute, medals and certificates are awarded on this day.**
5. **In addition to the above national days, there is Staff Association and various regional associations in the Institute wherein various festivals like Ram Navami, Holi, Deepawali, Ganesh Chaturthi, Christmas, etc. are celebrated by students and faculties.**

There are various students' clubs and associations which are involved in organizing/ hosting various extra-curricular cultural inter-college events such as OASIS and academic events such as APOGEE at national level. The institute sports club also organizes inter-college sports event "BITS OPEN SPORTS MEET" at national level.

File Description	Documents
Upload relevant supporting document	View File

7.2 - Best Practices

7.2.1 - Describe one best practice successfully implemented by the Institution as per NAAC format provided in the Manual

Harnessing the power of emerging technologies

BITS has been a pioneer in deploying technology in all its activities – academics, governance, monitoring, data dashboards, ERP etc. To mention a few, in 2005, BITSAT, the first online entrance test one of its kind in the nation, was introduced. ERP has been implemented at full scale, integrating student life cycle, finance, and HR processes. Learning Management Systems (LMS), synchronous teaching platforms (virtual classrooms), and Virtual and Remote Laboratories are used extensively, especially in the programs offered for working professionals.

Thanks to a pervasive Custom-built[Cisco Tele-Presence] HD video conferencing facility launched in 2013, not only we have solved the multi-campus administration and governance problem elegantly, we also used this technology for instruction in specialized 250 capacity classrooms shared live across campuses with great success along with facilitating faculty selection and various committee meetings. While few corporates have it, BITS probably is the only institute in the country to have a full scale TP facility across all its campuses. There are clear financial benefits - in the last 9 yrs, we have saved over Rs 20 Cr in travel costs and of course enormous travel time. We offer typically 20+ courses/Year (pre-Covid bubble stats) in this mode.

Multiple additional benefits accrue from this novel facility - corporate recruiters interview students of other campuses either from one campus location or from their own TP facility, access to guest lecturers located around the globe, enabling collaborative research and interactive learning. Such a facility is also instrumental in offering a niche entrepreneurship course titled New Venture Creation taught exclusively by entrepreneurs, VCs, Startup mentors over the TP platform, which is otherwise not possible.

TP video conferencing worked for BITS because, thanks to the motion sensing cameras, we are able to maintain eye level with the person sitting on the other side of the screen, just by doing that – looking at that person's eyes! I don't even look at the camera atop my screen!

Compare that to the personal conferencing we use, we are using right now. Inadvertently, we do tend to shuttle between looking at ourselves and the people on the screen – this keeps reminding us of the artificial setting we are in, and alters our experience.

The future lies in more such camera innovations in handheld or computer devices, where we are looking straight at the person. Of course, it can't be the same as in-person experience, but once the medium cleverly hides itself or makes it even simpler and more natural to interact, the adoption will definitely increase.

In our hugely successful programs for working professionals who are located at their workplace, one of the major hurdles is usage of real labs – we solved it using the remote labs in all subject domains, operational for the last 6 years. You operate real test rigs from anywhere aided by multi camera live video feed. Imagine the best of labs in higher education or K-12 available to learners across the world. For a school child in a village, whose school doesn't have the infrastructure or resources to host a lab, this would definitely be path breaking. We extended access to this bouquet of test rigs for 20 courses of NIT Mizoram across 4 Depts absolutely free of cost during Jan 2021. Such initiatives will multiply in future is what we envisage.

Academic Flexibility

Preparation of professionals must centrally involve critical and interdisciplinary thinking, discussion, debate, research, and innovation. For this to be achieved, professional education should not take place in the isolation of one's specialty. Influence of technology on human endeavours is expected to erode the silos between technical education and other disciplines too. The once core disciplines such as mechanical, electrical, electronics etc. are significantly cross-disciplined now. This has gone one step further to include arts in engineering & technology discipline.

BITS Pilani offers various academic flexibility for its students to enable worthy educational goals to be met. For several decades, the institute provided a dual degree programme (horizontal) that permits a student to pursue two first degrees (UG degrees) concurrently, typically an engineering degree (BE) with a science degree (MSc). This kind of flexibility is emphasized in the NEP 2020. Other academic flexibilities include crafting of an individual timetable, the possibility of transfer from one programme to another, the option of enrolling in a minor programme, control over the pace of progress through the programme, open electives, registering in project courses that provide an opportunity for independent study and investigation, the choice of a thesis/dissertation as an alternate option to Practice School.

Technical education will require closer collaborations between industry and higher education institutions to drive innovation and research in these fields. With the technology design-adoption-obsolescence cycle shrinking, the workplace becomes the best place to learn technology. An extreme industry engagement that is not just limited to a few consultancy projects but goes beyond to include curriculum design, work integrated learning, joint labs and guided research projects are essential. BITS Pilani has been practicing this through the well-structured Practice School curricular framework.

All-round development of students

The curriculum at BITS Pilani is broad-based, with a common Institutional foundational requirement and a requirement of a minimum number of units of courses in the Humanities and Social Sciences (for students enrolled in science and engineering programs) as electives. Students enjoy complete autonomy in managing co-curricular and extra-curricular activities. Students participate in various Institutional activities and are appointed as members of different bodies, including the Senate. Institute offers several opportunities to develop and hone their entrepreneurial capabilities including participation in several such novel courses such as New venture Creation which is taught by entrepreneurs and venture capitalists.

7.3 - Institutional Distinctiveness

7.3.1 - Highlight the performance of the institution in an area distinct to its priority and thrust (within a maximum of 200 words)

BITS Pilani views education as a continual engagement and experience and ensures that the learning experience is integrated seamlessly across its classrooms and laboratories and in the industry, as exemplified by its Work Integrated Learning Programmes (WILP) and Practice School (PS). WILP enables working professionals to pursue programs at BITS while they continue to work, whereas Practice School (PS) link industry experience with university instruction for students studying at the different campuses of BITS.

WILP - Work Integrated Learning Programs

Our WILP Model entails a unique tri-partite collaboration among Employer, Employee and Educational institution (The 3 Es) to arguably deliver the most business and Industry relevant education experience.

It is a trusted ally of the Indian industry to win the war for future skills talent and a capability arsenal for working professionals to lead the 4th industrial revolution having

launched a slew of new programmes in digital domains like Data science, AI&ML, IoT, FullStack, Business Analytics, FinTech, Cloud, Digital Manufacturing, Automotive Electronics etc. Today it offers a wide portfolio of 45 Programmes comprising primarily of Degree Programmes (MTech, BTech, MSc, BSc and MBA Programmes) & also PG Diploma & Certificate programmes in niche & specialised domains.

WILP makes extensive use of virtual laboratories, remote laboratories, simulations, and case studies for effective experiential learning. A significant augmentation of WILP's experiential learning capacity was undertaken by adding several new remote labs in areas such as ADAS, Automotive Cyber systems, Industrial IoT, Vehicle dynamics, augmented reality, etc. It is serving key sectors such as IT & ITES, Automotive, Manufacturing, Pharmaceuticals, Metal & Mining, Energy, BFSI etc.

BITS Pilani has state-of-the-art recording studios on its campuses to record high-quality video content, implemented by rich animation and multimedia content.Engaging content for many new courses was developed that further augmented WILP's rich repository of digital content.

Practice School

Quality Assurance and Assessment Cell was formed to enhance the learning outcomes and capture feedback effectively. Additionally, increased faculty involvement with expertise in domains relevant to the PS projects also significantly improved the learning experience.

To ensure that the students are fully equipped to maximize their learning during PS, many specific customized preparatory modules were launched & delivered by BITS. The primary focus was to provide prerequisite knowledge or filling any priority skill gap before a student begins the PS.

The pandemic challenge was met by evolving a Unique Remote PS Model in close cooperation with the Industry Partners and adopting technology-enabled Learning Management Systems. Model ensured that both the students and the Industry partners could continue to participate seamlessly in the PS ecosystem without disrupting education continuity. All these have been achieved and implemented at an enviable scale. With over 500 industry partners, 6200+ students were placed in leading industry organizations for their internship stint through PS-I and PS-II programs. By far the highest in the country for an academic institution, this has led to over 1020 Pre-Placement Offers (PPOs) during AY 2020-21 which was severely hit by a raging pandemic.

7.3.2 - Plan of action for the next academic year

Overseas faculty recruitment

After being named as one of the Institute of Eminence, BITS Pilani's key mandate has been to recruit candidates from overseas for faculty positions. In the year 2020-21, faculty recruitment advertisements were placed in ACM (Association for Computing Machinery), SIAM (Society for Industrial and Applied Mathematics), ASME (The American Society of Mechanical Engineers), EPW (Economic & Political Weekly), and Nature Research. For the last three years, BITS Pilani has also been actively participating in faculty hiring events organized by SciROI [Science and Research Opportunities inIndia]. SciROI facilitates the return of STEM professionals in USA to India; they engage with leading academic institutes in India toward such initiatives. Several marquee faculty members were recruited through this route, and we continue to engage with them for this purpose.

Internationalization

BITS Pilani has introduced a semester abroad scheme and off-campus thesis to get international exposure for its students. BITS Pilani has widened its network by partnering/collaborating with international institutions (ranked above 400 in World QS ranking), helping students to spend a semester at foreign locations, an opportunity for admission to foreign institutions' postgraduate program after completion of a degree at BITS, enabling international placement opportunities, participating in global student projects and competitions, helping international collaborative research, offer short certificate courses, offering joint core/elective courses, enabling international students and faculty to spend up to a semester at BITS Pilani campuses. The institute has introduced a University immersion program that facilitates faulty members to spend reasonable time with top-ranked international universities.

Institutional Social Responsibility

BITS Pilani campuses have been participating in the following activities under the aegis of NSS, NIRMAAN and Green Initiatives.

Pilani Campus

As part of the government's Atmanirbhar Bharat initiative, Nirmaan volunteers helped the women beneficiaries in the Bhaas village to prepare masks during the spread of covid. Through, this they earned their livelihood as well as people in villages got awareness about benefits of using masks to prevent themselves from being infected. Besides this, Nirmaan in association with PARC established a stitching center to train the women from nearby villages

in stitching and become self-reliant. Currently, more than 25 women are getting trained there.

To promote the government's Swasth Bharat program, several online sessions were conducted to create awareness related to various diseases and myths related to them. NSS organized a session on breast cancer to make women aware of the symptoms and make sure that they do not feel shy to share their health issues with health workers. To spread awareness on Covid vaccination, the NSS volunteers organized an online session on Vacc-in-Pilani in which the expert was a senior official from the Serum Institute, Pune. The awareness drive was successful as most of the campus residents came forward and got themselves vaccinated in a short span of time which was organised on campus itself. To help people during the second wave, the anti-Covid force of NSS volunteers helped people get vital information regarding availability of bed etc. in a timely manner.

During spread of the second wave, NSS and Nirmaan volunteers approached the BITS Alumni and they provided several oxygen concentrators and nebulizers to the Primary Health Centre, Pilani under their initiative of MOFA (Medical oxygen for all). Besides this, the NSS and Nirmaan volunteers were actively involved in the institute's ration distribution drive over 18 months by providing the information of people requiring immediate help. NSS volunteers collaborated with Dhoondh.com to provide the list of donors on their portal and connecting the people in urgent need of blood with the donors in their localities. To promote the awareness among people about blood donation, a session was organized by NSS BITS Pilani with Blood connect organization in which people were briefed about the benefits of donating blood and its impact on the life of various people. Under the Swachh Bharat initiative, NSS Program Officers planted saplings in the campus to promote green campus.

Good education is a path to future developments and hence, the NSS and Nirmaan volunteers support the education of many underprivileged kids through project Umang and project Utkarsh respectively. Through these projects, the education of more than 70 kids have been supported in the last year. Besides this, the volunteers were actively involved in teaching the students in online mode to ensure that they don't suffer due to lockdown.

To sensitize the volunteers towards the social issues, several sessions have been organized. A session was conducted with the help of Sakshi NGO to sensitize students towards child abuse. The students were briefed about the legal definition of child abuse, POCSO act and how to report such cases or to provide legal help to sufferers in nearby areas. To sensitize people towards social issues, a two-day online youth conference (Conferencia-de-youth) was organized by NSS BITS Pilani in March 2021 in which participants from many institutions

registered. There were several competitions organized in the conference focusing the solutions to various social issues.

Hyderabad Campus

Volunteers from the Hyderabad campus visited Thumkunta High School and taught Basics in Computer, MS Word, and Excel for students to match the pace of the modern era. The tree plantation programme was organized at a nearby location under the Tree Adoption Programme. On the occasion of Gandhi Jayanti, NSS Volunteers visited a nearby government hospital and cleaned the premises as a part of Swach Bharat Abhiyaan. To respect and celebrate the heritage of India, conducted a session of SPIC MACAY event featuring Carnatic Sangeeth and Bharatanatyam.

SCIO is an NPO started by a team of motivated students from BITS Pilani Hyderabad Campus to form a support structure to the current education system by guiding students to make a well-informed decision about their careers. SCIO has more than 30 volunteers, and more than 800 people benefited.

NIRMAAN, BITS Hyderabad Chapter now undertakes three verticals: School Adoption Programme (SAP), Livelihood Initiatives, and Community Development Initiatives. Under the Educational initiatives, it has undertaken Project Parishkar and SAP, Joy of Giving Week (Daan Utsav) on campus. NIRMAAN believes that education is one of the most valuable virtues to be shared, and project Parishkar is our consistent effort towards educating people.

Enactus is an entrepreneurial NGO. Enactus BPHC chapter was started by a group of enthusiastic students who wanted to bring a difference in people’s lives.

The institution took several initiatives to make its campus eco-friendly. Some of the key initiatives include energy conservation, renewable energy, water harvesting, efforts for carbon neutrality, tree plantation, hazardous waste management, E-waste management etc.

Goa Campus

1200 scholarship tests conducted in Various Government and Private Schools in Goa under Protsahan scheme. COVID Relief Initiative done in collaboration with some faculties of the Institute to help the Workers and Labourers of Zari, Lamani, and Birla by providing Ration and Groceries to them and helped 80 labourers to reach their home state through Shramik Special Trains.

Nirmaan Goa, in collaboration with Enactus BITS Goa, provided face shields to all the essential workers currently working on our campus. Under this initiative, we distributed 500 face shields on our campus, thus ensuring the safety of in-campus essential workers. Distant Learning English Communication course for 25 kids residing in Zari, Lamani, and Birla was launched under the Unnati scheme.

A two-day workshop was conducted in collaboration with the Art of Living Foundation under Project Sahayam, a mental health initiative of Nirmaan. A fun filled evening was organized in which 40 children from Lamani were hosted as a part of the Republic Day Celebration. The event was done in collaboration with Abhigyaan. Prepared 18 students for the Jawahar Navodaya Vidyalaya (JNV) examination- a prestigious scholarship examination for fifth class students.Organized a Menstrual Awareness Session for over 50 teenagers and 30 women in Hindi and Kannada languages.

Alumni Relations

BITS Pilani Alumni Relations Cell is a vibrant Team working centrally as well as at empowered campus levels. It is fully manned by full time professionals in fundraising, managing donations, reporting and monitoring.

Several Alumni funded Awards are in place. Nominations were invited for several awards viz. SSR Memorial Teaching Excellence Award, Prof. C R Mitra Best Faculty Award, Distinguished Alumnus Award, Mantra Award, etc. Made efforts to mobilize funds from alumni for scholarships for undergraduate students, supporting contractual labour/small shopkeepers/drivers, and other support staff across Indian campuses. Revised the Naming Right Policy making it simpler and precise. Improved collaboration with BITSAA International with a focus on developing Vision for Innovation and Entrepreneurship and joint fundraising campaigns. Enhanced connections with alumni through a dedicated online community – BITS Pilani AlmaConnect by taking the total registration on the platform to more than 42000. Created several engagement opportunities for alumni to provide their expertise at BITS Pilani through invited talks (online and visit to the campus), Practice School, Placements, WILP, etc. Published BITS ECHO newsletter to share developments about Alumni and BITS Pilani. Alumni achievements information was shared through BITS Website and Social Media Channels.

Several results are visible out of the effective measures taken to operate the Alumni Relations Cell. A few are listed below:

- 100+ Startups Incubated / under Incubation in BITS TBIs in Pilani, Hyderabad and Goa

- BITS Pilani ranked #3 in Alumni startups with 800+ in 10 years
- 9 BITSian Unicorns today. #3 in India in number of unicorns currently from an institute.
- 7400+ Alumni are Startup Founders / Co-Founders
- Well-known BITSian startups of recent times: Bigbasket, Swiggy, Postman, Groww, Cambium Networks, Aakash, FalconX, Ofbusiness, Zivame, Akamai, RedBus, pepper, Kalam Labs, Sierra Atlantic, Grey Orange, Pixxel, BlueJeans, MapMyIndia, Goodera, and many more.
- 17 Alumni Startups Raised $730 M in the last 15 m
- Smart Database BITS AlmaConnect now has 51,000 full profile registrations
- BITS Pilani Incubation and Innovation Centre (BPIInC) fully funded by CSR and Alumni donations is under construction at an estimated cost of about Rs 20 Cr. It's a G+2 strcuture with a total floor area of over 30,000 sqft to house a 100 seater co-working space for incubates, 4-6 domain labs, corporate collaborations space etc.

BITS BioCyTiH Foundation

BITS Pilani has formed a Section 8 not-for-profit company (BITS BioCyTiH Foundation) to establish a Technology Innovation Hub (TIH) and to undertake interdisciplinary research, innovation, and technology development in the domain of Bio Cyber Physical Systems funded under NM-ICPS by DST to the extent of Rs 125 Cr. The TIH will be bringing together experts across the fields of biology, electronics, chemistry, computer science, etc. The hub shall be translating academic R&D into technologies for industries such as healthcare, diagnostics, medical devices, wearables, biosensor, clean water, food safety, quality & monitoring, and other allied areas. The TIH will be focusing mainly on Research and Development, Human Resource Development, Innovation, and Entrepreneurship alongside translational research and Industry engagement. Innovation and incubation is a central focus of the initiative.

Expansion Plan

BITS Pilani has undertaken a massive plan to upgrade (Project Parivartan) the physical infrastructure in the three Indian campuses. This envisages an investment of about Rs. 1450 Cr to build new buildings or renovate existing academic spaces and housing for students, faculty, and staff. Currently we are approaching the last phase of this initiative. The institute takes pride in offering the best-in-class infrastructure for student and faculty accommodation and academic and research space.

Following are the Campus wise progress for AY 2020-21 in terms of specific buildings and facilities:

Pilani: Renovation of two hostels (Meera Bhawan, block 3 and 4; Vyas Bhawan), Shankar Vyas Mess, and faculty housing (44 flats) has been completed.

Hyderabad: Expansion projects involving new construction were completed, which includes student hostel (700 beds), faculty housing (40 flats), staff housing (64 flats), sports complex, swimming pool, additional roads, hardscapes, and car parking.

Goa: Expansion projects involving new construction were complete, which includes two student hostels (204 Beds & 318beds), faculty housing (32 flats), and Married PhD housing (64 flats).