

School of Computer Science, Engineering & Technology



Academic
Brochure
2020-21



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- Department of Computer Science & Engineering
- Department of Cyber Security & Networking
- Department of Information Technology
- Department of Blockchain Technology

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- Diploma in Information Technology
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- B.Tech. in Information Technology
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Departments

- Department of Artificial Intelligence
- Department of Computer Science & Engineering
- Department of Cyber Security & Networking
- Department of Information Technology
- Department of Blockchain Technology

Academic Programmes offered

- Diploma in Computer Science and Engineering....(120 seats)
- Diploma in Information Technology.....(60 seats)
- B.Tech. in Computer Science and Engineering.....(180 seats)
- B.Tech. in Information Technology.....(60 seats)
- B.Tech. in Computer Science and Engineering
(with specialization in Artificial Intelligence).....(90 seats)
- B.Tech. in Computer Science and Engineering (with
specialization in Cyber Security & Networking)....(30 seats)

School of Computer Science,
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*"Think Big...
Think Beyond"*

Programme Outcomes

Programme Outcomes for B. Tech (CSE) Programme

Designers and developers of tomorrow's computer systems are confronted with two major challenges:

- Computer systems that are increasingly complex
- Areas of application that are increasingly varied

To meet these challenges, the future degree holder in computer science must:

- Master current computer science technologies but also manage and ascertain their progress,
- Innovate by integrating elements linked to artificial intelligence, software engineering and security networks into computer systems,
- Work as a member of a multidisciplinary team and act as an interface between the development team and other participants involved in the scientific or technical issues of the project.

The future computer science engineer will acquire the skills and knowledge necessary to become a professional engineer, such as:

- Ability to select appropriate data structure(s) and algorithm(s) followed by development and testing of software for a given problem.
- Ability to develop Mobile Apps for Android and for iOS, and develop websites
- Ability to develop simple games.
- Ability to develop and implement software for IoT-based systems.
- Ability to setup Big Data lab and carry out Big Data Analytics projects
- Ability to apply Machine Learning algorithms for classification and clustering problems
- Ability to create Data Visualization and develop Dashboards
- Ability to develop projects using transaction data
- Ability to diagnose simple faults in computer systems.
- Ability to set up a campus-wide LAN and wireless network.
- Ability to prepare project plan followed by monitoring of projects
- Ability to understand and design parallel processing programs
- Ability to understand the design of general purpose computing systems using standard VLSI chips and associated hardware like power supplies and common peripheral interfaces.

Programme Outcomes:

Technical

- P01. An ability to apply mathematical foundations, algorithmic principles, and computer science theory in the modeling and design of computational systems.
- P02. An ability to identify, formulate, and develop solutions to computational problems.
- P03. An ability to design, implement, and evaluate a computational system to meet desired needs within realistic constraints.
- P04. An ability to use appropriate techniques, skills, and tools necessary for computing practice.
- P05. An ability to apply design and development principles in the construction of software systems of varying complexity.
- P06. Recognition of interplay between theory and practice.
- P07. An individual with field experience, capable of putting his/her knowledge into practice and use ever evolving high performance tools (both in research and technology)
- P08. A skilled professional having acquired cutting edge knowledge in his/her field of study, for example artificial intelligence, security networks, software engineering and programming systems

Behavioural

- P01. An ability to function effectively on teams to accomplish a common goal.
- P02. An understanding of professional, ethical, and social responsibilities.
- P03. An ability to communicate effectively.
- P04. An ability to analyze the impact of computing on individuals, organizations, and society, especially environment.
- P05. Recognition of the need for and an ability to engage in continuing professional development.
- P06. Effective problem solving and critical thinking skills.
- P07. Commitment to life-long learning, and professional and ethical responsibility.
- P08. **Ability of assessment from a system-level perspective:** Thinking ability at multiple levels of detail and abstraction. This understanding transcends the implementation details of the various components to encompass an appreciation for the structure of computer systems and the processes involved in their construction and analysis. They recognize the context in which a computer system may function, including its interactions with people and the physical world.

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Academic Regulations

Academic Regulations

Admission

Admission to this programme will be governed by ACPC norms for seats, which are filled through ACPC. The remaining seats will be filled by the process approved by the Academic Council of ITM(SLS) Baroda University, Vadodara.

The Eligibility Criteria

As per AICTE / Government of Gujarat (ACPC Norms). for the Management quota, the eligibility criteria will be decided by the Academic Council of ITM (SLS) Baroda University, Vadodara.

Duration

The duration of the programme is minimum 4 years (8 semesters); and maximum 6 years (12 Semesters).

Attendance

A candidate must have at least 75% attendance to write tests/examinations in a semester.

Choice Based Credit System (CBCS)

The CBCS provides an opportunity for the students to choose courses from the prescribed courses comprising core, elective, open and skill - based courses. The courses will be evaluated following the grading system. This will benefit the students to move across institutions within India to begin with and across countries.

Category of courses based on their outcome and flexibility:

- (i) **Core Course:** A course, which should compulsorily be studied by a candidate as a core requirement is termed as a core course.
- (ii) **Elective Course :** Generally, a course which can be chosen from a pool of courses and which may be very specific or specialized or advanced or supportive to the discipline / subject of study or which provides an extended scope or which enables an exposure to one or more of other disciplines / programmes / domains and / or nurtures the candidate's proficiency / skill is called an Elective Course.
 - (a) **Discipline Specific Elective (DSE) Course :** Elective courses may be offered by the main discipline / programme of study is referred to as Discipline Specific Elective. It may include Elective courses of inter disciplinary nature.

- (b) Generic Elective (GE) Course :** An elective course chosen generally from an unrelated discipline / subject, with an intention to seek exposure is called a Generic Elective.
- (c) Dissertation / Project:** An elective course is designed to acquire special / advanced knowledge, such as supplement study / support study to a project work, a candidate studies such a course on his own with an advisory support by a teacher / faculty member will be a part of dissertation / project.
- (iii) Ability Enhancement Courses (AEC):** The Ability Enhancement (AE) Courses may be of two kinds: Ability Enhancement Compulsory Courses (AECC) and Skill Enhancement Courses (SEC).
 - (a) "AECC" courses are the courses based upon the content that leads to Knowledge enhancement. These are mandatory for all disciplines.
 - (b) SEC courses are value-based and/or skill-based and are aimed at providing hands-on-training, competencies, skills, etc.

Category of courses based on their role in calculation of SGPA/CGPA:

Broadly there will be two types of courses that will be offered based on whether they are counted towards calculation of SGPA / CGPA:

(a) Credit Courses: In general these courses are designed for students who are interested in earning college credits towards a degree. These courses are usually a full semester long. Students who take credit courses receive a letter grade (O, A, B, C, D, E, P or F) at the end of the semester.

(b) Non credit courses: (All round Development)

These courses include a range of activities for over all development of students. A student will be required to earn Activity Points on prorata basis at the rate of 25 points per annum on an average. Thus, a student registered in a four years programme is required to earn at least 100 activity points. If the programme is of two, three, four, or five years duration, the minimum points required will be 50, 75, or 125, respectively.

The activity points are expected to be completed by one semester before the completion of the programme along with the necessary documents, which are to be submitted to Head of the Department. Earning of prescribed number of activity points is mandatory for each student to become eligible for award of degree for the programme.

Swapping of Courses :

Students will have the choice to swap any of the courses being offered with courses being offered through SWAYAM / NPTEL. A student can also opt for MOOCs being offered by other platforms. The swapping of courses will be subject to:

- (i) Fee of such courses shall be born by students;
- (ii) Such courses should be recommended by Head of the Department and approved by the Board of Studies of the concerned department which also has to look into equivalence of credits between the swapped courses and approve them as equivalent;
- (iii) The students will also have the freedom to go for different electives offered by SWAYAM / NPTEL or any other platform subject to its approval by the Board of Studies of the concerned department.

Structure of courses :

The courses / papers wherever possible will be structured such as to include a section to be taught through classroom lectures (L), a tutorial component for participatory discussion / problem solving / brief seminar on a topic/assignments /self-study or through other appropriate method that may potentiate the extent of assimilation by the student (T), followed by practical / practice session consists of hands on experience / laboratory experiments / field work / case studies etc (P). The total credit earned by a student at the end of semester upon successfully completing the course is L + T + P. The credit pattern of the course shall be indicated in L : T : P Format. For a 4-credit course, format shall be:

4:0:0 3:1:0 3:0:1 2:0:2 2:1:1 1:0:3 0:0:4

- (i) 1 Lecture period of one hour per week over a semester shall have 1 Credit
- (ii) 1 tutorial period of one hour per week over a semester shall have 1 Credit
- (iii) 1 Practical period of two hours per week over a semester shall have 1 Credit
- (iv) Lab / workshop / seminar periods of 2 hours per week shall have 1 Credit

Evaluation

Ratio of Internal Vs External Evaluation

The ratio of internal and external evaluation may be decided by the Board of Studies concerned in the range of 60:40 keeping in view the norms of the respective regulatory body i.e. UGC, AICTE, NCTE, BCI, COA, ICAR, PCI, etc.

Conversion of credit(s) into grade(s)

The following illustrations could be taken as an example for computing SGPA and CGPA from credits:

Sr. No.	% of Marks	Grade	Grade Point	Description
1	90 to 100	O	10	Outstanding
2	80 to 89.99	A	9	Excellent
3	70 to 79.99	B	8	Very Good
4	60 to 69.99	C	7	Good
5	50 to 59.99	D	6	Fair
6	40.01 to 49.99	E	5	Average
7	= 40	P	4	Pass
8	Less than 40	F	0	Fail
9	-	Ab	0	Absent

- (I) For non-credit courses "Satisfactory" or "Unsatisfactory" shall be indicated instead of the letter grade and this will not be counted for the computation of SGPA / CGPA.

Grade Card

The grade card issued at the end of the semester to each student will contain the following:

- (I) The course number, name of the course and the credits for each course registered in that semester.
- (ii) The letter grade obtained in each course
- (iii) The total number of credits earned by the student up to the end of that semester in each of the course categories
- (iv) The Semester Grade Point Average (SGPA) and Cumulative Grade Point Average (CGPA) of all the courses taken from the first semester.

Calculation of SGPA and CGPA :

The SGPA will be calculated according to the formula : $\Sigma(C_i \times GP_i) / \Sigma C_i$

where:

C_i = credit for the *i*-th course,

GP_i = it suggests grade point obtained for the *i*-th course and

C_i = the sum of credits of all courses taken in that semester, including those in which the student has secured 0 (fail or Absent) grades.

For the cumulative grade point average (CGPA), a similar formula is used where the summations are across credits of all courses taken in all semesters completed up to the point in time. For conversion of CGPA into percentage, the following conversion formula will be used: (CGPA minus 0.5) x10.

Minimum credit requirement :

Minimum credit requirement for a programme shall be minimum 40 credits per year. If a programme is less than a year in duration, proportionate minimum credits will be applicable.

Eligibility for Promotion

- (i) There shall not be any restriction for promotion from an odd semester to the next even semester.
- (ii) The result of the semester shall be declared pass only on securing P or above grades in all courses.
Provided that, candidate has to pass both internal and external examination individually.
- (iii) Provided further that the student should have successfully completed the courses of (n minus 4)-th semester to register for courses in n-th semester. For Example: To register for course in 5th, 6th, 7th or 8th semester of UG programme, the students should have successfully completed all the course of 1st, 2nd, 3rd or 4th semester respectively, as prescribed in the curriculum of the concerned Programme (branch of study).
- (iv) If a student has to register to clear only the backlogs under "n minus 4" rule, he/she will not be permitted to register for courses of a higher semester in any category.

Re-appear Examination

- (i) Students failing to score minimum grade required to qualify a course maybe allowed to reappear in those examinations where they couldn't score 'P' or higher grade, subject to not exceeding the maximum duration of the programme.
- (ii) If a student secures "F" Grade in a project work / project report / dissertation / field work report / training report etc, he / she shall be required to resubmit the revised project work / project report / dissertation / field work report / training report, etc. as required by the evaluator(s).
- (iii) When the Board of Management on the recommendation of the relevant authorities decide to incorporate radical or routine changes in the existing courses of studies, two more examinations in succeeding years will be held according to the old rules and syllabus for the benefit of the failed students of that course, Non-appearance at the examination shall be considered as an attempt. Such students, as they do not pass the examination held according to old rules and syllabus, maybe permitted to appear at the examinations under new rules and syllabus subsequently.
Provided that further, when a course is dropped, each of the failure students is permitted to reappear in that course, till they clear within the maximum duration of programme applicable to him /her.

Declaration of Class

The class shall be awarded when a candidate shall have to clear all courses prescribed in their programme and on the basis of CGPA as follow:

For Diploma and UG programmes (except B.Arch)

First Class with Distinction	=	CGPA of 8.5 and above
First class	=	CGPA of 6.5 to 8.49
Second class	=	CGPA of 5.5 to 6.4.
Pass	=	CGPA of 4.5

Award of Degree

A student shall be declared to be eligible for award of the B. Tech degree if he/she has:

- (i) Registered and successfully completed all the core courses and projects;
- (ii) Successfully acquired the minimum required credits as specified by CBCS Ordinance and the Board of Studies corresponding to the branch of his/her study within the stipulated time;
- (iii) Earned the specified credits in all the categories of subjects; secured a CGPA of 4.5 and above;
- (iv) No dues are pending concerning the University, Hostels, Libraries, NCC / NSS etc. and
- (v) No disciplinary action is pending against him/her.

Mobility Options and Credit Transfers:

- (i) Students are open to avail vertical and horizontal mobility and can take courses of their choice, learn at their pace, undergo additional courses, acquire more than the required credits, and adopt an interdisciplinary approach to learning.
- (ii) A student can even take the courses of other universities subject to equivalence of the core / elective courses and availability of seats, adopting due administrative process and formal consent of the university / universities. University shall constitute an Equivalence Committee for the purpose. Equivalence committee composition is (i) Dean of the school, (ii) Head of the concerned department; (iii) two professors of the concerned department.
- (iii) Student availing inter-university mobility shall remain the bonafide student of the University where he/she initially got admission and in case the candidate earns credit from a different university, the credits earned will be transferred to his / her parent university.
- (iv) In case of transfer of student from another university where he/she has completed some part of the programme, he/ she may be permitted subject to equivalence of the core/ elective courses and availability of seats, adopting due administrative process and formal consent of the university / universities. University shall constitute an Equivalence Committee for the purpose, which will make a recommendation based on rules framed in this respect.
- (v) Provided further, the Provost will issue necessary order.

Change of Branch

The change of branch (Discipline) may be considered, for students who have successfully completed the first year of the course. They will be eligible for consideration, subject to the availability of vacancies, and the performance based on merit during the first year. Vacancy means seats vacant due to drop-outs and created by students not eligible for that semester.

Discipline

When a student has been guilty of breach of discipline within or outside the premises of the University or an Institution, or persistent idleness or has been guilty of misconduct, the Head of the Institution at which such student is studying, the Provost /Registrar/Dean Student Affairs(DSA) may according to the nature and gravity of the offence:

- (a) Suspend such a student from attending classes for not more than a week at a time; or
- (b) Expel such a student from his/her institution;
- (c) Disqualify such a student from appearing at the next ensuing examination; or
- (d) Rusticate such a student.

**School of Computer Science,
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Curriculum

Curriculum - B.Tech. CSE / AI / Cyber Sec / IT 2020-21

Semester	C, C++	Python	OOP Java	Web, IT	Data Analy.	Virtual and Augmented Reality These streams may be pursued via electives mode.	Embedded Systems & IoT	Core	General	L-Tu-P	Hrs	Credits
SEMESTER - I												
Programming in Python - I										3-0-4	7	5
Discrete Mathematics with Python										4-0-2	6	5
R programming for Data										3-0-2	5	4
Web Technologies: HTML, CSS, JavaScript, PHP										2-0-4	6	4
Total										12-0-12	24	18
Project-1.1: Prepare your Website (18 Hours)												1
Project-1.2: Python Project (18 Hours)												1
Project-1.3: R Project (18 Hours)												1
W-1.1: Intel 8085 Assembly Language (18 Hours)												1
W-1.2: Workshop on Development of Mobile Apps using MIT Inventor (18 Hours)												1
Total												23
SEMESTER - II												
Programming in C										3-0-4	7	5
Data Structures and Algorithms -1										3-0-2	5	4
Computer Graphics										4-0-2	6	5
Programming in Python - II										2-0-4	6	4
Total										12-0-12	24	18
Project-2.1: Draw Geometrical Shapes, Conic Sections, Projections, Textures, Layers, etc ... (20 Hours)												1
W-2.1: Disassembling, Assembling Desktop System; Setup Network; Install Software (18 Hours)												1
W-2.2: Basic Electrical Engineering (18 hrs): transformers, motors, MCB, fuses, wires and insulation, relays, basic components - resistors, capacitors, inductors, batteries, switches. (18 Hrs.)												1
Total												21

CSE :
Computer Science & Engineering

AI :
Artificial Intelligence

Cyber. Sec. :
Cyber Security & Network

IT :
Information Technology

For All

Curriculum - B.Tech. CSE / AI / Cyber Sec / IT 2020-21

Semester	C, C++	Python	OOP Java	Web, IT	Data Analy.	Virtual and Augmented Reality These streams may be pursued via electives mode.	Embedded Systems & IoT	Core	General	L-Tu-P	Hrs	Credits
SEMESTER - III												
Object-oriented Programming using Java										3-0-4	7	5
Computer Architecture										3-0-2	5	4
Systems Software										3-0-2	5	4
Database Management System										3-0-4	7	5
Total										12-0-12	24	18
Project-3.1: Based on Python / Java & SQL (20 Hours)												1
W-3.1: Basic Mechanical Engineering (Heat, Motion, Fasteners, Torque) (18 hours)												1
W-3.2: Robotics Level-1 (18 Hours)												1
Total										416 Hrs.		21

SEMESTER - IV												
Data Structures and Algorithms -2										4-0-2	6	5
Mobile Computing (Android, iOS, Flutter)										2-0-4	6	4
Operating Systems										4-0-2	6	5
Computer Networking										4-0-2	6	5
Total										14-0-10	24	19
Project-4.1: Based on Python / Java & Networking (20 Hours)												1
W-4.1: Socket Programming using Python / Java (18 Hours)												1
W-4.2: Automated Software Testing Tools including Debugging & Profiling (18 Hours):												1
Total										416 Hrs		22

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Curriculum - B.Tech. CSE / AI / Cyber Sec / IT 2020-21

Semester	C, C++	Python	OOP Java	Web, IT	Data Analy.	Virtual and Augmented Reality These streams may be pursued via electives mode.	Embedded Systems & IoT	Core	General	L-Tu-P	Hrs	Credits
SEMESTER - V												
Machine Learning										3-0-4	7	5
Data Visualization										3-0-2	5	4
Elective - 1										4-0-2	6	5
Elective - 2										4-0-2	6	5
Total										14-0-10	24	19
Project-5.1: Based on Elective Subjects (36 Hours)												2
W-5.1: Regular Expressions & Applications (18 Hours)												1
W-5.2: Parallel Computing based Algorithms for Matrix Operations (18 Hours)												1
Total										432 Hrs		23
SEMESTER - VI												
Image Processing with Open CV & Python										3-0-4	7	5
Software Engineering & Agile Methodology										4-1-0	5	5
Elective - 1										4-0-2	6	5
Elective - 2										4-0-2	6	5
Total										15-1-8	24	20
Project-6.1: Based on Elective Subjects (36 Hours)												2
W-6.1: Text Editor with Limited Functionality using Python / Java (18 Hours)												1
W-6.2: Adaptability, Team Player Attitude, Openness to Feedback[1][2] (15 Hours)												1
Total										432 Hrs		24

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For All

Curriculum - B.Tech. CSE / AI / Cyber Sec / IT 2020-21

Semester	C, C++	Python	OOP Java	Web, IT	Data Analy.	Virtual and Augmented Reality These streams may be pursued via electives mode.	Embedded Systems & IoT	Core	General	L-Tu-P	Hrs	Credits
SEMESTER - VII												
Theory of Computations										4-0-2	5	5
Big Data Tools: Hadoop, Spark, NoSQL, etc										4-0-2	6	5
Elective - 1										4-0-2	6	5
Elective - 2										4-0-2	6	5
Total										16-0-8	23	20
Project-7.1: Based on Elective Subjects (36 Hours)												2
W-7.1: NS-3 Simulator (18 Hours)												1
W-7.2: Emotional Intelligence, Empathy, and Active Listening [1][2] (15 Hours)												1
Total										417 Hrs		24
SEMESTER - VIII												
Environmental Science										2-1-0	3	3
Capstone Project										0-9-16	25	17
Total										2-10-16	28	20
W-8.1: Project Management (24 Hours)												1
W-8.2: Professional Ethics; Growth Mindset; Economics[1][2] (15 Hours)												1
Total												22

Streams for Electives

Artificial Intelligence / Data Science	Artificial Intelligence Data Analytics Text Processing & Text Mining Image Processing Artificial Neural Networks (ANN) Data Preparation & Feature Engineering Language Processing ***Speech Processing Deep Learning (ANN included)	(Sem-5) (Sem-5) (Sem-5) (Sem-6) (Sem-6) (Sem-6) (Sem-7) (Sem-7) (Sem-7)
Data & Network Security	Number Theory Cryptography & Cryptanalysis *** Networking, Networking Devices, Tools of Kali Unix (W/S mode OK) Packet analysis tools like Wireshark (W/S mode OK) Steganography & Steganalysis Network Security Database Security Cyber Security *** Linguistic Forensic *** Security Audit, Cyber Laws & Ethics Deep Packet Analysis	(Sem-5) (Sem-5) (Sem-5) (Sem-6) (Sem-6) (Sem-6) (Sem-6) (Sem-7) (Sem-7) (Sem-7) (Sem-7)

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Streams for Electives

Information Technology	Data Warehousing & ETL Business Analytics and Business Intelligence Digital Transformation of Business	(Sem-5) (Sem-6) (Sem-7)
Virtual & Augmented Reality	*** Human-Computer Interface (HCI) including UI / UX for AR / VR Haptics & Sonification *** Virtual Reality VR Platforms & VR Devices, Unity, Unreal Engine, Blueprints Visual Scripting Augmented Reality Gaming Software	(Sem-5) (Sem-5) (Sem-6) (Sem-6) (Sem-7) (Sem-7)
Self-Learning Basket	Data Structures and Algorithms-1 with C Data Structures and Algorithms-2 with C .Net Technology Object Oriented Programming with C++	A student can opt for these courses in any semester provided she/he has completed the relevant pre-requisite.

Streams for Electives

Embedded Systems & Internet of Things	Embedded Systems	(Sem-5)
	Embedded-C / C++	(Sem-5)
	Sensors, A-D Converter, D-A Converter, Actuators, Processor & ASICs	(Sem-5)
	Micro-controllers	(Sem-5)
	Real Time Operating System	(Sem-6)
	Internet of Things	
	*** Network Standards, Protocols & Technologies	(Sem-6)
	Wi-Fi, Low Energy Bluetooth, Zigbee, Cellular, RFID technologies	(Sem-6)
	Low Power Wide-Area Network (LPWAN) technologies like LoRa	(Sem-6)
	Java, Swift, and Node.js among the top languages for IoT app development	(Sem-6)
	GPS programming skills	(Sem-7)
	Industrial Internet of Things	
	Industry 4.0	(Sem-7)
*** M2M Wireless protocols for IoT- WiFi, LoPan, BLE, Ethernet, Ethercat, PLC	(Sem-7)	
*** IoT-Raspberry Pi, Arduino , ArmMbedLPC	(Sem-7)	
*** AWS-IoT apps, Azure -IOT, Watson-IOT, Mindsphere IIoT cloud	(Sem-7)	
IIoT platform like Siemens MindSphere and Azure IoT	(Sem-7)	

Notes :

1. *** marked can be taken by IT stream.
2. In all, students can take maximum 06 electives. Students from AI and Cyber Security stream will be permitted to take minimum 04 papers from their respective specialization basket and the remaining 02, they may take from another available elective basket/s.
3. From self-learning basket, students can pick up a course (one maximum) in a semester provided he fulfills the condition of pre-requisite and pursue it in self-learning mode with the permission of HoD. HoD will arrange evaluation of the same during the semester. Teachers' guidance will be available.