Vidyalankar Institute of Technology

An Autonomous Institute affiliated to University of Mumbai

Honours/Minor Degree Programme
for
Bachelor of Technology

in

Electronics and
Telecommunication Engineering

(As per AICTE guidelines, with effect from the Academic Year 2024-25)

Preamble

To meet the challenge of ensuring excellence in engineering education, the issue of quality needs to be addressed, debated, and taken forward in a systematic manner. Therefore, autonomy for Vidyalankar Institute of Technology is not merely a transition from pre-cooked syllabi to self-designed curriculum. The autonomous curriculum of the Institute offers required academic flexibility with emphasis on industry requirements and market trends, employability and problem-solving approach which leads to improving competency level of learners with diverse strengths. In line with this, the curriculum framework designed is **Choice-Based Credit and Grading System (CBCGS)**. The number of credits for each category of courses learnt by learners, internships and projects is finalized considering the scope of study and the ability that a learner should gain through the programme. The overall credits and approach of curriculum proposed are in line with AICTE model curriculum.

The curriculum comprises courses from various categories like basic sciences, humanities and social sciences, engineering sciences, general education and branch specific courses including professional electives and open electives. The curriculum has core courses of branch of engineering positioned and sequenced to achieve sequential and integral learning of the entire breadth of the specific branch. These courses are completed by the third year of the engineering programme that enables learners to prepare for higher education during their final year. Professional elective courses, that begins from third year of programme, offer flexibility and diversity to learners to choose specialization from a basket of recent developments in their field of technology. The selection of unique professional elective courses based on industrial requirements and organizing them into tracks is a salient feature of this curricula ensuring employability. Open Elective courses cover multi-disciplinary, special skill development, project management and similar knowledge that make learners capable of working in industrial environment.

For holistic development of learners, apart from technical courses, Humanities and Social Science courses develop the required soft-skills and attitude amongst learners. Our curriculum also introduces Social Service Internship and Internship with institutes abroad along with courses like Design Thinking, Wellness - Body, Mind & Spirit, Indian Traditional Knowledge System under General Education category. These general education courses aim to create balance in brain hemispheres and hence improve learners' clarity in thoughts and responses.

Additionally, curriculum provides add-on Honours/Minor degree that involves field/ domain study. Learner can avail themselves of this degree by completing requirement of additional 18 credits.

Thus, the academic plan of VIT envisages a shift from summative to formative and competency-based learning system which will enhance learner's ability towards higher education, employability and entrepreneurship.

Chairman, Board of Studies
Department of Electronics & Telecommunication Engineering
Vidyalankar Institute of Technology

Chairman, Academic Council
Vidyalankar Institute of Technology

[A] Guidelines for Award of Honours/ Minor Degree Programme

Honours and Minor Degree programme is introduced to facilitate learners to enhance the depth of knowledge, diversity, breadth and skills in emerging fields. An Honours or Minor Degree typically refers to a higher level of academic achievement either for research orientation or for improving employability. Learners can select any Honours or Minor Degree programme as per his/her choice.

In our curriculum, learners can choose to avail Honours/ Minor Degree programme by completing requirements of 18 credits, which will be over and above the minimum credits required for B.Tech. degree i.e. credit requirement for the award of degree programme and Honours/ Minor degree programme are required to be explicitly carried out. Learners shall opt for Honours or Minor specialisations during the break of Semester 5 and Semester 6. **Learners may complete the B.Tech. Degree programme without opting for Honours or Minor Degree programme** i.e. opting for Honours/ Minor Degree programme is not mandatory as a part of B.Tech. degree programme

For Honours/Minor Degree, learner shall select Honours/Minor programme offered by his/her own home department.

Eligibility Criteria

- Basic eligibility for opting for Honours/Minor shall be minimum CGPA of 6.75 at the end of 4th semester and no pending failure at the time of admission to semester 5.
- If student has already completed any course(s) that is listed in the chosen Honours/ Minor degree programme, as additional learning course(s), then the transfer credits for such course(s) can be carried out towards Honours/ Minor degree programme.
- For a student to get Honours/ Minor degree, it is mandatory that the student completes the relevant courses before graduating.

Syllabus Scheme Template

Sr. No.	Course		Head of Learning	Preferred Semester	Credits	Assessment Guidelines (Marks)			Total marks (Passing@40% of total marks)
	Code	Name				ISA	MSE	ESE	
1	HM01	Industry Interaction	Theory	Break of Sem5 and Sem6	1	25	-	-	025
2	HMXX	Honours / Minor Degree Course 1	Theory	6	2	15	20	40	075

	HMXX	Honours / Minor Degree Course 1 Lab	Practical	6	1	25	-	25	050
3	HM02	Survey Report/ Paper	Theory	Break of Sem6 and Sem7	2	50	-	25	075
4	HMXX	Honours / Minor Degree Course 2	Theory	7	2	15	20	40	075
	HMXX	Honours / Minor Degree Course 2 Lab	Practical	7	1	25	-	25	050
5	HM03	Seminar	Theory	Break of Sem7 and Sem8	2	25	-	25	50
6	HMXX	Honours / Minor Degree Course 3	Theory	8	2	15	20	40	075
	HMXX	Honours / Minor Degree Course 3 Lab	Practical	8	1	25	-	25	050
7	HM04	Capstone Project	Practical	8	4	75	-	50	125
Total Credits					**18**				

Detailed list of courses under each Honours/ Minor Degree Programme:

- Learners of the department of Electronics and Telecommunication can refer to the list of Honours/Minor Degree Programme and their corresponding courses in the Appendix-C.

[B] Honours/ Minor Degree Programmes offered to B.Tech. Electronics and Telecommunication Engineering students

The Institute offers the listed Honours Degree Programme for learners of B.Tech. Electronics and Telecommunication Engineering.

Honours Degree Programmes Offered.

Sr.No.	Honours/Minor Degree Programme	Department offering Honours	Honours applicable for	Minors applicable for
1	Next-Gen Data Analytics and Machine Learning	Electronics and Telecommunication	B.Tech. Electronics and Telecommunication students who have opted for Data Analytics and Machine Learning specialization track	None
2	Next-Gen Internet of Things	Electronics and Telecommunication Engineering	B.Tech. Electronics and Telecommunication, Electronics and Computer Science, Computer Engineering, Information Technology students who have opted for IoT specialization track	B.Tech. Biomedical Engineering students who have opted for IoT specialization track
3	User Interface (UI) and User Experience (UX)	Information Technology	All B.Tech. Electronics and Telecommunication Engineering students	As stated in Honours/ Minor document of Information Technology
4	Blockchain	Information Technology	All B.Tech. Electronics and Telecommunication Engineering students	As stated in Honours/ Minor document of Information Technology

Courses to be successfully completed as a part of Honours/Minor Degree Programme

1. Next-Gen Data Analytics and Machine Learning

Semester	Course Code	Course Name
VI	HMET04T	Advanced Database Management System
VI	HMET04P	Advanced Database Management System Lab
VII	HMET05T	Cloud Computing for Data Analytics
VII	HMET05P	Cloud Computing for Data Analytics Lab
VIII	HMET06T	Business Analytics
VIII	HMET06P	Business Analytics Lab

2. Next-Gen Internet of Thing

Semester	Course Code	Course Name
VI	HMET01T	Embedded Linux System
VI	HMET01P	Embedded Linux System Lab
VII	HMET02T	IoT and Data Analytic
VII	HMET02P	IoT and Data Analytic Lab
VIII	HMET03T	IoT Applications and Web Development
VIII	HMET03P	IoT Applications and Web Development Lab

3. User Interface (UI)/User Experience(UX)

Semester	Course Code *	Course Name
VI	HMIT01T	Foundations of UI/UX
VI	HMIT01P	Foundations of UI/UX Lab
VII	HMIT02T	UX Design, Evaluation & ARVR
VII	HMIT02P	UX Design, Evaluation & ARVR Lab
VIII	HMIT03T	USECASE in UI/UX
VIII	HMIT03P	USECASE in UI/UX Lab

*Detailed syllabus of these courses can be obtained from the Honours/Minor Degree document of Information Technology Department applicable for R-2022.

4. Blockchain

Semester	Course Code *	Course Name
VI	HMIT04T	Blockchain Technology
VI	HMIT04P	Blockchain Technology Lab
VII	HMIT05T	Smart Contract & Crypto Currencies
VII	HMIT05P	Smart Contract & Crypto Currencies Lab
VIII	HMIT06T	Decentralize & Blockchain Technologies
VIII	HMIT06P	Decentralize & Blockchain Technologies Lab

*Detailed syllabus of these courses can be obtained from the Honours/Minor Degree document of Information Technology Department applicable for R-2022.

[C] Detailed Syllabus for Honours/ Minor Degree Programmes

Course Name: Advanced Database Management System

Course Code: HMET04T

Category: Honours Next-Gen Data Analytics and Machine Learning

Preamble:

Mastering on mastering advanced database systems demands a structured approach. Our comprehensive roadmap covers query processing, advanced data management, distributed databases, enhanced data models, and information retrieval. Each module delves into its domain, blending theory with hands-on tasks. This systematic curriculum ensures learners gain a holistic understanding of modern database systems, ready to navigate complex data landscapes.

Pre-requisites: Data Base Management System (ET26T)

Objective:

1. To impart knowledge related to query processing and query optimization phases of adatabase management system.
2. To sensitize the learners about the importance of access control and data security
3. To introduce advanced database models like distributed databases.
4. To learn advanced techniques for data management and to overview emerging data modelslike Temporal, Mobile, and Spatial database.
5. To learn different IR models and queries in IR Systems

Course Outcomes:

Learner will be able to:

CO1: Measure query costs and design alternate efficient paths for query execution.

CO2: Apply sophisticated access protocols to control access to the database.

CO3: Design distributed databases for improving resource utilization, availability and performance.

CO4: To apply the traits of temporal and spatial data models as per the need

CO5: Perform efficient and effective retrieval of information to facilitate the decision-making

Course Scheme:

Contact Hours		Credits Assigned	
Theory	Practical	Theory	Practical
2	-	2	-

Assessment guidelines:

Head of Learning	ISA	MSE	ESE	Total
Theory	15	20	40	075

Detailed Syllabus:

Module No.	Module Name	Content	No of Hours
1	**Review of concepts in DBMS**	Data models, SQL, Concept of concurrency, transaction management & recovery	2
2	**Query Processing and Optimization**	Overview: Introduction, Query processing in DBMS, Steps of Query Processing, Measures of Query Cost Selection Operation, Sorting, Join Operation, Evaluation of Expressions. Query Optimization Overview, Goals of Query Optimization, Approaches of Query Optimization, Transformations of Relational Expression Estimating Statistics of Expression Results Choice of Evaluation Plans. Self-learning Topics: Solve problems on query Optimization.	**5**
3	**Data access control mechanisms**	Discretionary Access Control Based on Granting and Revoking Privileges. Mandatory Access Control and Role Based Access Control, Remote Database access protocol. Self-learning Topics: Learn Data Security concepts like Authentication, Authorization and encryption	**6**
4	**Distributed Databases**	Introduction: Distributed Data Processing, Distributed Database System: Architecture, Types, Design Issues. Data Fragmentation, Allocation in distributed databases. Self-learning Topics: Query Optimization in Distributed Databases	**6**
5	**Enhanced Data Models**	Active Database Concepts and Triggers, Temporal Database, Spatial Database, Introduction to Deductive Databases Self-learning Topics: Case Study like: "Temporal Dynamics in Information Retrieval: Modelling Temporal Relevance and Query Intent Shifts Over Time", Vector Data base.	**6**
6	**Introduction to Information Retrieval**	Retrieval Models, Types of Queries in IR Systems, Text Preprocessing Self-learning Topics: Case Study like "Enhancing Search Relevance Using Deep Learning: A Comparative Analysis of Neural Ranking Models"	**5**
		Total	**30**

Textbooks:

[1]. Korth, Silberschatz and Sudarshan," Database System Concepts", 6th Edition, McGraw – Hill

[2]. Elmasri and Navathe, "Fundamentals of Database Systems", 6th Edition, PEARSON Education.

[3]. M. Tamer Ozsu, "Principals of Distributed Systems", 3rd Edition, Springer.

[4]. Raghu Ramakrishnan and Johannes Gehrke, "Database Management Systems" 3rd Edition -McGraw Hill

References:

[1] Manning Christopher and Raghavan Prabhakar, "Introduction to Information Retrieval", Cambridge University Press

[2] Peter Rob and Carlos Coronel, "Database Systems Design, Implementation and Management", Thomson Learning, 9th Edition

Course Name: Advanced Database Management System Lab

Course Code: HMET04P

Category: Honours Next-Gen Data Analytics and Machine Learning

Preamble:

Mastering on mastering advanced database systems demands a structured approach. Our comprehensive roadmap covers query processing, advanced data management, distributed databases, enhanced data models, and information retrieval. Each module delves into its domain, blending theory with hands-on tasks. This systematic curriculum ensures learners gain a holistic understanding of modern database systems, ready to navigate complex data landscapes.

Pre-requisites: Data Base Management System (ET26T)

Objective:

1. To impart knowledge related to query processing and query optimization phases of adatabase management system.
2. To sensitize the learners about the importance of access control and data security
3. To introduce advanced database models like distributed databases.
4. To learn advanced techniques for data management and to overview emerging data modelslike Temporal, Mobile, and Spatial database.
5. To learn different IR models and queries in IR Systems

Course Outcomes:

Learner will be able to:

CO1: Measure query costs and design alternate efficient paths for query execution.

CO2: Apply sophisticated access protocols to control access to the database.

CO3: Design distributed databases for improving resource utilization, availability and performance.

CO4: To apply the traits of temporal and spatial data models as per the need

CO5: Perform efficient and effective retrieval of information to facilitate the decision-making

Course Scheme:

Contact Hours		Credits Assigned	
Theory	Practical	Theory	Practical
-	2	-	1

Assessment guidelines:

Head of Learning	ISA	MSE	ESE	Total
Theory	25	-	25	050

Suggested List of Practical:

Learners are expected to perform practical based on the following suggested topics.

Sr No	Suggested Topic(s)
1.	Design an Entity-Relationship (ER) / Extended Entity- Relationship (EER) Model.
2.	Perform Authorization of user.
3.	Implement complex SQL queries.
4.	Implementation of Views and Triggers.
5.	Database connectivity using JDBC.
6.	Execute TCL commands.
7.	Implement procedures in SQL
8.	Implementation of cursor.
9.	Case study/Mini Project

Textbooks:

1. SQL & PL / SQL for Oracle 11g Black Book, Dreamtech Press

Reference Books:

1. G. K. Gupta: "Database Management Systems", McGraw – Hill

Course Name: Embedded Linux System

Course Code: HMET01T

Category: Honours Next-Gen IoT

Preamble:

The rapid growth of Linux as an embedded operating system in many products is due to the ease of using embedded Linux to replace home-grown operating systems. Linux-based embedded systems are widely used in smartphones, in-vehicle infotainment systems, in countless consumer electronics and for numerous industrial applications. It may be the need for TCP/IP networking, USB support, Secure Digital support, or some other standard that causes a company to dump their current operating system and switch to Linux. But it is the joy of developing with Linux that keeps the engineers promoting it for future products. The objective of the course is to give students solid introductory knowledge on Linux OS and internals of Linux for embedded system design.

Pre-requisites:
- C Programming
- Object Oriented Programming
- Microprocessor and microcontroller

Course Objectives:
- To understand role of operating system in embedded system development.
- To understand architecture of operating systems for embedded system applications.
- To understand different types of kernels.
- To understand kernel module of Linux.
- To understand communication between user and operating system.
- Use Linux operating system in embedded system application.

Course Outcomes:
Student will be able to:
CO1: Understand fundamental concepts of operating System.
CO2: Understand architecture of Linux operating system for embedded system applications.
CO3: Understand concept of kernel.
CO4: Use Linux kernel module.
CO5: Do communication between user space and kernel space.
CO6: Develop applications.

Course Scheme:

Contact Hours		Credits Assigned	
Theory	Practical	Theory	Practical
2	2	2	1

Assessment Guidelines:

Head	ISA	MSE	ESE	Total
Theory	15	20	40	75

The assessment guidelines for the courses of different credits are mentioned in the above table. Notwithstanding the above, each course faculty shall have the choice to propose her/his assessment

methodology based on the nature of the course. However, the proposed assessment methodology shall be approved by a panel constituted at Institute level and published to the learners before the commencement of the semester.

Detailed Syllabus:

Module no	Module name	Content	No of Hours
1	RTOS and Linux based Embedded Systems: An Introduction	Introduction to Real Time Operating Systems: Characteristics of RTOS, Tasks Specifications and types, Real-Time Scheduling Algorithms, Concurrency, Inter-process Communication and Synchronization mechanisms, Priority Inversion, Inheritance and Ceiling. Operating systems for embedded systems, Why Linux-based embedded systems? Linux evolution Embedded Linux Vs Desktop Linux, Embedded Linux Distributions, System calls, Static and dynamic libraries, Cross tool chains. Linux-based embedded system: example	05
2	Embedded Linux Architecture and Kernel Architecture	Architecture of Embedded Linux- Real Time Executive, Monolithic kernels, Microkernel. Linux Kernel Architecture- Hardware Abstraction Layer (HAL), Memory manager, Scheduler, File System, I/O and Networking subsystem, IPC. User space, Linux Start-up sequence.	05
3	Building and Debugging	Building the Kernel, Building Applications, Building the Root File System, Integrated Development Environment, Debugging Virtual Memory Problems, Kernel Debuggers, Profiling	05
4	Introduction to Linux kernel modules	Introduction, CPU – I/O interface, I/O interface with polling, I/O interface with interrupt, I/O interface, I/O interface latency, Direct memory access (DMA) architecture - transfer modes, I/O taxonomy, Typical operations, Linux devices, The Virtual File System (VFS) abstraction. Linux kernel modules – the initialization function, the cdev data structure, the initialization function, the clean-up function, custom VFS functions.	06
5	Communication Between Kernel and User Space	Introduction, The reference use case, The CPU/Device interface, The module level – file operations, ioctl() implementation, open()/release() implementation, read() implementation, Passing data to/from the kernel, write() implementation, communication with the device, Memory mapped I/O – initialization, clean-up, read, write, GPIO-based I/O – initialization, clean-up, read, write, Interrupts, Requesting the interrupt line, Freeing the interrupt line, The interrupt handler, Interrupt handling, Top-half and bottom-half, needed support, Work queue, The user level, The user level – the application	06

6	Porting Applications	Architectural Comparison, Application Porting Roadmap, Programming with Pthreads, Operating System Porting Layer (OSPL), Kernel API Driver.	03
Total			**30**

Textbooks:

1. "Embedded Linux System Design and Development", P Raghvan, Amol Lad, Sriram Neelakandan, Auerbach Publications.
2. "Mastering Embedded Linux Programming", Chris Simmonds Second Edition, PACKT Publications Limited.
3. "Embedded Linux Primer: A Practical Real World Approach", Christopher Hallinan, Prentice Hall, 2nd Edition, 2010

Reference Books:

1. "Building Imbedded Linux Systems", Karim Yaghmour, O'Reilly & Associates.
2. Embedded Linux Systems with the Yocto Project, Rudolf K. Sterif

Course Name: Embedded Linux System Lab

Course Code: HMET01P

Category: Honours Next-Gen IoT

Preamble:

The rapid growth of Linux as an embedded operating system in many products is due to the ease of using embedded Linux to replace home-grown operating systems. Linux-based embedded systems are widely used in smartphones, in-vehicle infotainment systems, in countless consumer electronics and for numerous industrial applications. It may be the need for TCP/IP networking, USB support, Secure Digital support, or some other standard that causes a company to dump their current operating system and switch to Linux. But it is the joy of developing with Linux that keeps the engineers promoting it for future products. The objective of the course is to give students solid introductory knowledge on Linux OS and internals of Linux for embedded system design.

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Pre-requisites:

- C Programming
- Object Oriented Programming
- Microprocessor and microcontroller

Course Objectives:

- To understand role of operating system in embedded system development.
- To understand architecture of operating systems for embedded system applications.
- To understand different types of kernels.
- To understand kernel module of Linux.
- To understand communication between user and operating system.
- Use Linux operating system in embedded system application.

Course Outcomes:

Student will be able to:

CO1: Demonstrate fundamental concepts of operating System.
CO2: Demonstrate architecture of Linux operating system for embedded system applications.
CO3: Demonstrate concept of kernel.
CO4: Use Linux kernel module with standard commands.
CO5: Establish communication from user space to kernel space.
CO6: Develop embedded system applications based on Linux operating system.

Course Scheme:

Contact Hours		Credits Assigned	
Theory	Practical	Theory	Practical
-	2	-	1

Assessment Scheme:

Head	ISA	MSE	ESE	Total
Practical	25	-	25	25

Suggested List of Practical:

1. Introduction to the Board and Workspace Set-Up.
2. Custom Embedded Linux Build Using the Manual Approach.
3. Introduction to Linux Kernel Modules under Yocto.
4. Handling General Purpose I/O Using Linux Kernel Modules.
5. Handling Hc-Sr04 Ranging Sensor Using Linux Kernel Modules.
6. Introduction to Code Development and Debugging Using Yocto.
7. Introduction to Linux Kernel and Application Profiling.
8. Installing Linux kernel and configuration of Rasp-berry Pi computer (SBC)
9. Installation of Free RTOS and integration with Keil IDE for multithreaded application.

Practical can be designed using project-based approach.

Textbooks:

1. "Embedded Linux System Design and Development", P Raghvan, Amol Lad, Sriram Neelakandan, Auerbach Publications.
2. "Mastering Embedded Linux Programming", Chris Simmonds Second Edition, PACKT Publications Limited.
3. "Embedded Linux Primer: A Practical Real-World Approach", Christopher Hallinan, Prentice Hall, 2nd Edition, 2010

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1. "Building Imbedded Linux Systems", Karim Yaghmour, O'Reilly & Associates.
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