Third-Year of Bachelor of Science
Vocational Skill Course - Physics
Revised Syllabus according to CBCS NEP - 2020

COURSE TITLE: Embedded Systems - I

SEMESTER-V

W.E.F. 2025-2026

RECOMMENDED BY THE BOARD OF STUDIES IN PHYSICS
AND
APPROVED BY THE ACADEMIC COUNCIL
Devrukh Shikshan flrasarak Mandal's
Nya. Tatyasaheb Athalye Arts, Ved. S. R. Sapre Commerce, and Vid. Dadasaheb flitre Science College (Autonomous), Devrukh. Tal.Sangmeshwar, Dist. Ratnagiri-415804, Maharashtra, India

Academic Council Item No: 02/2025

Name of the Implementing Institute	:	Nya. Tatyasaheb Athalye Arts, Ved. S. R. Sapre Commerce, and Vid. Dadasaheb Pitre Science College (Autonomous), Devrukh. Tal. Sangmeshwar, Dist. Ratnagiri-415804,
Name of the Parent University	:	University of Mumbai
Name of the Programme	:	Bachelor of Science
Name of the Department	:	Physics
Name of the Class	:	Third Year
Semester	:	Five
Paper	:	VSC - III
No. of Credits	:	02
Title of the Course	:	**Embedded System - I**
Course Code	:	**PHVS301**
Name of the Vertical in adherence to NEP 2020	:	Vocational Skill Course
Eligibility for Admission	:	
Passing Marks	:	40%
Mode of Assessment	:	Formative and Summative
Level	:	**5.5**
Pattern of Marks Distribution for SEE and CIA	:	60:40
Status	:	NEP-CBCS
To be implemented from Academic Year	:	2025-2026
Ordinances /Regulations (if any)		

Syllabus for Third Year of Bachelor of Science in Physics

(With effect from the academic year 2025-2026)

SEMESTER – V **Paper - Physics VSC – III**

Course Title: Embedded Systems - I **No. of Credits – 02**

Type of Vertical: Vocational Skill Course **COURSE CODE: PHVS301**

Course Learning Outcomes:

After completing the course, the learner will be able to…

Course Learning Outcome No.	Course Learning Outcome
CLO-01	Appreciate the importance of and career opportunities in the field of IoT/ embedded system in general
CLO-02	Elaborate the operation and use of various sensors and actuators
CLO-03	Use datasheets and literature of a device for designing circuits
CLO-04	Elaborate the necessity of digitization and its methods
CLO-05	Design and demonstrate the analog circuits
CLO-06	Design and demonstrate simple digital circuits
CLO-07	Design and manufacture a single sided PCB for simple circuits

Syllabus for Third Year of Bachelor of Science in Physics
(With effect from the academic year 2025-2026)

SEMESTER - V **Paper – Physics VSC - III**

Course Title: Embedded Systems - I **Credits – 02**

Type of Vertical: Vocational Skill Course **COURSE CODE: PHVS301**

COURSE CONTENT

Module	Practicals	Lectures
1	Introduction, Concepts – IoT and Current developments, uP, uC, SoC, SBC. Applications – case studies e.g.– washing machine, environmental data collection, drone, smartwatch • Students will watch A/V material related to embedded systems & IoT • Students will be briefed regarding the opportunities in the field • Presentations of case studies related to embedded/IoT devices **Ref – Webresources**	**04**
	Sensors & Actuators Temperature sensors – thermocouples, thermistor (NTC/PTC), IR sensors, Resistance temperature detectors (RTDs) - PT100. Pressure – piezo, pirani, strain gauge, capacitive. Light – LDR, photodiode, phototransistor. Proximity, Position, Level, Humidity, Flow, Light, Colour, Force, Motion, Sound, Microphones. Signal Preconditioning. Actuators – mechanical/solid state relays, reed switches, thermostats, stepper/ servo motors, hydraulic, pneumatic, electrical, thermal, magnetic, mechanical • Students will be briefed regarding meaning necessity and applications of sensors/transducers and actuators • Demo of some sensors like LDR, Thermistor, microphone, relays, reed switches, photodiode, various sensors from phone will be given • Basics of other sensors/actuators will be explained • Need and examples of signal conditioning circuits **Ref – CH**	**04**
	Concept of digitization – ADC, storage of signal, nyquist/sampling theorem Concept DAC, Concept of DSP & Analog vs digital signal processing • Demo of digitization & recoding signal using Arduino – LM35, LDR • Demo of signal recoding using Expeyes / DSO • Demo of DAC – LED dimming • Need and methods of digitization and its advantages • Demo of DSP using sound signal data • Brief regarding DSP and digital signal processing **Ref – ML Ch 12**	**06**
	Reading Datasheets /timing diagrams, testing devices • Using datasheets of discrete components/ICs, students will understand pinouts, min and max ratings etc • Students will study Timing diagram with various min and max time difference specifications for a device from its datasheet – DHT22 • Students will learn testing of discrete components **Ref – Various datasheets**	**04**

	Analog circuits -- Transistor as a switch, Amplifiers, Square wave generation, wave-shaping, building projects from circuits, Basics of calibration and troubleshooting • Six practical sessions comprising of designing, connection and testing of relevant circuits	**12**
	Revision of number systems (Binary, Hex, Octal) – problem solving approach • Students will revise number system concept from videos • During practical, students will solve problems related to number systems **Ref – ML – Ch 5**	**02**
	Digital circuits – basic concepts – combinational vs sequential ckts, pull-up/down, current sinking/sourcing, Tristate buffers, latches, FFs, Registers, Counters, shift registers, mux/demux/encoder/decoder, clock based circuits, ALU, Basics of Digital computing device, digital computer memory and a bus oriented system • Briefing regarding concept and importance of tristate devices • Students will connect circuits and verify operation of buffers, latches, counters etc **Ref – ML - , RPJ -**	**14**
	Use of DSO, Logic probe, logic analyser • Students will use various facilities of DSO • Students will use a multichannel logic analyser with a clock based system **Ref – DSO Manual, Sigrok software documentation**	**02**
2	PCB design and manufacture – librecad, kicad • Creating circuit schematic in CAD software • Editing PCB layout and printing • Etching the PCB, preparing for soldering • Soldering and testing **Ref – Librecad / Kicad documentation**	**12**
	Total	**60**

References:

- **CD:** Operational Amplifiers and Linear Integrated Circuits by Robert F. *Coughlin* & Frederick F. *Driscoll*.
- **CH:** Modern electronic Instrumentation and Measurement Techniques by Cooper and Helfrick
- **RG:** OPAMPs and linear integrated circuits by Ramakant Gayakwad
- **ML:** Digital Principals and applications by Malvino and Leach
- **RPJ:** Digital Electronics by R. P. Jain
- Online help wiki/video tutorials/YT channels
- Datasheets of various devices

Access to the Course

The course is available for students admitted for Bachelor of Science.

Methods of Assessment

The assessment pattern would be 60:40, 60% for Semester End Examination (SEE) and 40% for Continuous Internal Assessment (CIA). The structure of the SEE and CIA would be as recommended by the Board of Studies and approved by the Board of Examination and the Academic Council of the college.

Pattern of Evaluation

The Examination/Evaluation pattern shall be framed by the Board of Examination with its final approval from the Academic Council of the College.