SEMESTER S4

MICROCONTROLLERS & EMBEDDED SYSTEMS

Course Code	PBECT404	CIE Marks	60
Teaching Hours/Week (L: T:P: R)	3:0:0:1	ESE Marks	40
Credits	4	Exam Hours	2 Hrs. 30 Min.
Prerequisites (if any)	PBECT304-Logic Circuit Design	Course Type	Theory

Course Objectives:

1. To learn Microcontroller architecture and its programming
2. To learn Embedded system design to develop a product.

SYLLABUS

Module No.	Syllabus Description	Contact Hours
1	Microcontroller Architecture – General internal architecture, Address bus, Data bus, control bus. The Microcontroller 8051: Features of 8051 microcontroller, Block diagram of 8051- program status word (PSW), accumulator, program counter. Memory organization – RAM & ROM, register banks and stack, Special Function Registers (SFRs), I/O port organization, Interrupts.	9
2	Instruction Set of 8051 & Addressing modes: Classification of instruction set - Data transfer group, arithmetic group, logical group, branching group. Addressing modes - Types. Accessing the data from internal and external memory.	9
3	Programming 8051 Using Assembly Language: Introduction to 8051 assembly language programming. Data types & directives, Concept of subroutine. Software delay programming. Programming 8051 Using Embedded C Language: Introduction to embedded C – advantages.	9
4	Timer / Counter in 8051: Timer registers - Timer0, Timer1. Configuration of timer registers. Timer mode programming. Counter	9

	mode. Serial Communication in 8051: Serial communication – modes and protocols, RS-232 pin configuration and connection. Serial port programming – transmitting and receiving. Programming the interrupts: Use external, timer and serial port interrupts. Interrupt priority settings.	

Suggestion on Project Topics

1. Interface any known ADC chip to 8051 uC. Read the variation in voltage from a potentiometer and display it on an LCD module.
2. Interface any known DAC chip to 8051 uC. Generate a Sine waveform of 1KHz at any port pin.
3. DC motor interface for speed and direction control.
4. Stepper motor interface - Unit step control, Rotation angle control, Speed control, Direction control
5. Read the Temperature sensor and display it on LCD.

Course Assessment Method
(CIE: 60 marks, ESE: 40 marks)

Continuous Internal Evaluation Marks (CIE):

Attendance	Project	Internal Ex-1	Internal Ex-2	Total
5	30	12.5	12.5	60

End Semester Examination Marks (ESE)

In Part A, all questions need to be answered and in Part B, each student can choose any one full question out of two questions

Part A	Part B	Total
• 2 Questions from each module. • Total of 8 Questions, each carrying 2 marks **(8x2 =16 marks)**	• 2 questions will be given from each module, out of which 1 question should be answered. • Each question can have a maximum of 2 sub divisions. • Each question carries 6 marks. **(4x6 = 24 marks)**	**40**

Course Outcomes (COs)

At the end of the course students should be able to:

Course Outcome		Bloom's Knowledge Level (KL)
CO1	Outline Architecture of Microcontroller	**K2**
CO2	Develop Microcontroller programs	**K5**
CO3	Design various interfaces to Microcontroller	**K5**
CO4	Design and implement an Embedded System	**K6**

Note*: K1- Remember, K2- Understand, K3- Apply, K4- Analyse, K5- Evaluate, K6- Create*

CO-PO Mapping Table:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3											
CO2	3	3	3	2	3			2				2
CO3	3	3	3	3	3			2				2
CO4	3	3	3	3	3	3	3	3	3	3	3	3

Text Books				
Sl. No	**Title of the Book**	**Name of the Author/s**	**Name of the Publisher**	**Edition and Year**
1	The 8051 Microcontroller and Embedded Systems Using Assembly and C	Muhammad Ali Mazidi Janice Gillispie Mazidi Rolin D. McKinlay	Prentice Hall -Inc	Second, 2007
2	The 8051 Microcontroller Architecture, Programming and Applications	Kenneth J Ayala Dhananjay V Gadre	Cengage Learning	2010

Reference Books				
Sl. No	**Title of the Book**	**Name of the Author/s**	**Name of the Publisher**	**Edition and Year**
1	8051 hardware Description	Datasheet	Intel Corporation	1992
2	Microprocessors and Microcontrollers	Lyla B. Das	Pearson Education	2011

Video Links (NPTEL, SWAYAM…)	
Module No.	**Link ID**
1	Microprocessors and Microcontrollers - https://nptel.ac.in/courses/106108100
2	Microcontrollers and Applications - https://nptel.ac.in/courses/117104072

PBL Course Elements

L: Lecture (3 Hrs.)	**R: Project (1 Hr.), 2 Faculty Members**		
	Tutorial	**Practical**	**Presentation**
Lecture delivery	Project identification	Simulation/ Laboratory Work/ Workshops	Presentation (Progress and Final Presentations)
Group discussion	Project Analysis	Data Collection	Evaluation
Question answer Sessions/ Brainstorming Sessions	Analytical thinking and self-learning	Testing	Project Milestone Reviews, Feedback, Project reformation (If required)
Guest Speakers (Industry Experts)	Case Study/ Field Survey Report	Prototyping	Poster Presentation/ Video Presentation: Students present their results in a 2 to 5 minutes video

Assessment and Evaluation for Project Activity

Sl. No	**Evaluation for**	**Allotted Marks**
1	Project Planning and Proposal	5
2	Contribution in Progress Presentations and Question Answer Sessions	4
3	Involvement in the project work and Team Work	3
4	Execution and Implementation	10
5	Final Presentations	5
6	Project Quality, Innovation and Creativity	3
Total		**30**

1. **Project Planning and Proposal (5 Marks)**

- Clarity and feasibility of the project plan
- Research and background understanding
- Defined objectives and methodology

2. Contribution in Progress Presentation and Question Answer Sessions (4 Marks)

- Individual contribution to the presentation
- Effectiveness in answering questions and handling feedback

3. **Involvement in the Project Work and Team Work (3 Marks)**

- Active participation and individual contribution
- Teamwork and collaboration

4. **Execution and Implementation (10 Marks)**

- Adherence to the project timeline and milestones
- Application of theoretical knowledge and problem-solving
- Final Result

5. **Final Presentation (5 Marks)**

- Quality and clarity of the overall presentation
- Individual contribution to the presentation
- Effectiveness in answering questions

6. **Project Quality, Innovation, and Creativity (3 Marks)**

- Overall quality and technical excellence of the project
- Innovation and originality in the project
- Creativity in solutions and approaches

SEMESTER S 3/S4

COURSE NAME: Electromagnetic Waves

Course Code	**PEEVT411**	**CIE Marks**	**40**
Teaching Hours/Week (L: T:P: R)	**3-0-0-0**	**ESE Marks**	**60**
Credits	**3**	**Exam Hours**	**2.30**
Prerequisites (if any)	**Vector Calculus**	**Course Type**	**Theory**

Course Objectives:

1. **This course aims to impart knowledge on the basic concepts of electric and magnetic fields and its applications**

SYLLABUS

Module No.	Syllabus Description	Contact Hours
1	Review of vector calculus- curl, divergence, gradient. Rectangular, cylindrical and spherical coordinate systems. Expression of curl, divergence and Laplacian in cartesian, cylindrical and spherical coordinate system. Electric field and magnetic field - Review of Coulomb's law, Gauss's law and Ampere's current law. Poisson and Laplace equations, Determination of E and V using Laplace equation.	**9 hrs**
2	Derivation of capacitance and inductance of two-wire transmission line and coaxial cable. Energy stored in Electric and Magnetic field. Displacement current density, continuity equation. Magnetic vector potential. Relation between scalar potential and vector potential. Maxwell's equation from fundamental laws. Boundary condition of electric field and magnetic field from Maxwell's equations.Solution of wave equation.	**9 hrs**
3	Propagation of plane EM wave in perfect dielectric, lossy medium, good conductor, media attenuation,phase velocity, group velocity, skin depth. Reflection and refraction of plane electromagnetic waves at boundaries for normal & oblique incidence (parallel and perpendicular	**8 hrs**

	polarization), Snell's law of refraction, Brewster angle.	
4	Power density of EM wave, Poynting vector theorem. Polarization of electromagnetic wave- linear,circular and elliptical polarisation. Uniform lossless transmission line - line parameters.Transmission line equations, Voltage andCurrent distribution of a line terminated with load .Reflection coefficient and VSWR. Derivation of input impedance of transmission line.Transmission line as circuit elements (L and C). Development of Smith chart - calculation of line impedance and VSWR using smith chart.	**10 hrs**

Course Assessment Method
(CIE: 40 marks , ESE: 60 marks)

Continuous Internal Evaluation Marks (CIE):

Attendance	Assignment/ Microproject	Internal Examination-1 (Written)	Internal Examination- 2 (Written)	Total
5	**15**	**10**	**10**	**40**

End Semester Examination Marks (ESE)

In Part A, all questions need to be answered and in Part B, each student can choose any one full question out of two questions

Part A	Part B	Total
• 2 Questions from each module. • Total of 8 Questions, each carrying 3 marks **(8x3 =24marks)**	• Each question carries 9 marks. • Two questions will be given from each module, out of which 1 question should be answered. • Each question can have a maximum of 3 sub divisions. **(4x9 = 36 marks)**	**60**

Course Outcomes (COs)

At the end of the course students should be able to:

Course Outcome		Bloom's Knowledge Level (KL)
CO1	To summarize the basic mathematical concepts related to electromagnetic vector fields.	**K2**
CO2	Analyse Maxwell's equation in different forms and apply them to diverse engineering problems.	**K3**
CO3	To analyse electromagnetic wave propagation and wave polarization	**K3**
CO4	To analyse the characteristics of transmission lines and solve the transmission line problems using Smith chart.	**K3**

Note*: K1- Remember, K2- Understand, K3- Apply, K4- Analyse, K5- Evaluate, K6- Create*

CO-PO Mapping Table:

	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**
CO1	3	3	1	1								2
CO2	3	3	1	1								2
CO3	3	3	1	1								2
CO4	3	3	1	1								2

Text Books				
Sl. No	**Title of the Book**	**Name of the Author/s**	**Name of the Publisher**	**Edition and Year**
1	Principles of Electromagnetics	Matthew N O Sadiku	Oxford international student edition	Sixth Edition 2014
2	Elements of Electromagnetic Fields	S P Seth	Dhanpath Rai & Co.	Second Edition 2003

3	Electromagnetic Fields	TVS Arun Murthy	S. Chand	First Edition 2008
4	Electromagnetic Theory	Uday Bakshi & Ajay Bhakshi	Technical Publications, Pune	First Edition 2004

Reference Books				
Sl. No	**Title of the Book**	**Name of the Author/s**	**Name of the Publisher**	**Edition and Year**
1	Electromagnetics	John D. Kraus	TMH	Fifth Edition 2010
2	Engineering Electromagnetics	Willian H. Hayt & John A. Buck	Mc Graw Hill	Eighth Edition 2014
3	Schaum's Outline of Electromagnetics	Edminister	Mc Graw Hill	Fourth Edition 2014
4	Engineering Electromagnetics	Umran S. Inam & Aziz S. Inam	Pearson	2010
5	Applied Electromagnetics	Martin A. Plonus	Mc Graw Hill	Second Edition 1978
6	Electromagnetic waves and Radiating systems	Jordan & Balmain	PHI	Second Edition 2013
7	Elements of Engineering Electromagnetics	Nannapaneni Narayana Rao	Pearson	Sixth Edition 2006

Video Links (NPTEL, SWAYAM…)	
Module No.	**Link ID**
1	https://nptel.ac.in/courses/117103065
2	https://nptel.ac.in/courses/108106073