



**Bansilal Ramnath Agarwal Charitable Trust's**  
**Vishwakarma Institute of Technology**  
*(An Autonomous Institute affiliated to Savitribai Phule Pune University)*

**Structure & Syllabus of**

**Final Year B.Tech.**

**(Instrumentation and Control Engineering)**

**Pattern 'D23'**

**Effective from Academic Year 2023-24**

**Prepared by: - Board of Studies in Instrumentation & Control Engineering**  
**Approved by: - Academic Board, Vishwakarma Institute of Technology, Pune**

**Signed by**

**Chairman – BOS**

**Chairman – Academic Board**

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**Vision statement of Institute**

To be globally acclaimed Institute in Technical Education and Research for holistic Socio-economic development

**Mission statement of Institute**

- To endure that 100% students are employable in Industry, Higher studies, Become Entrepreneurs, Civil/Defense Services / Government Jobs and other areas like Sports and Theatre.
- To strengthen Academic Practices in terms of Curriculum, Pedagogy, Assessment and Faculty Competence.
- Promote Research Culture amongst Students and Faculty through Projects and Consultancy.
- To make students Socially Responsible Citizen.

**Core Values**

- Faculty Centric Initiatives
- Academic Practices
- Research Culture
- Use of Technology for Social and National Development

**Vision statement of Department**

To be recognized as a leading contributor in imparting technical education and research in Instrumentation & Control engineering for development of the society.

**Mission statement of Department**

- To deliver knowledge of Instrumentation and Control Engineering by strengthening involvement of Research institutions and industries in academics
- To build conducive environment for advanced learning through participation of faculty and students in collaborative research, consultancy projects, student exchange programs and internships
- To develop competent Engineers with entrepreneurial skills to address socio-economic needs.

## Program Educational Objectives (PEO)

### Programme: B. Tech. (Instrumentation and Control Engineering)

The Graduates would demonstrate

1. Core competency in Instrumentation and Control Engineering to cater to the industry and research needs.
2. Multi-disciplinary skills, team spirit and leadership qualities with professional ethics, to excel in professional career and/or higher studies.
3. Preparedness to learn and apply contemporary technologies for addressing impending challenges for the benefit of organization/society.
4. Knowledge of recommended standards and practices to design and implement automation solutions.

### Program Outcomes

#### Engineering Graduates will be able to:

1. **Engineering knowledge:** Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.
2. **Problem analysis:** Identify, formulate, review research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.
3. **Design/development of solutions:** Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.
4. **Conduct investigations of complex problems:** Use research –based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.
5. **Modern tool usage:** Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modeling to complex engineering activities with an understanding of the limitations.
6. **The engineer and society:** Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional engineering practice.

- 7. Environment and sustainability:** Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.
- 8. Ethics:** Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.
- 9. Individual and teamwork:** Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.
- 10. Communication:** Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.
- 11. Project management and finance:** Demonstrate knowledge and understanding of the engineering and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.
- 12. Life-long learning:** Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change.

### **Program Specific Outcomes (PSOs)**

Graduates shall have the ability to:

- 1.** Evaluate the performance of suitable sensors / Process components/ Electronic / Electrical components for building complete automation systems.
- 2.** Analyze real-world engineering problems in the area of Instrumentation and Control.
- 3.** Design or Develop measurement / electronic / embedded and control systems with computational algorithms to provide practical solutions to multidisciplinary engineering problems.

Wishwakarma Institute of Technology

Issue 01 : Rev No. 00 : Dt. 01/08/22

Title : Course Structure

FF No. 653

**Final Year B.Tech - Instrumentation and Control Engineering Structure for Pattern D-23, Module-7  
with effect from Semester-1 of Academic Year 2023-24**

Course Type	Course Code	Course Name	Teaching Learning Scheme (Hrs./Week)				Credits	Assessment Scheme (100 mark scale)													
			Th	Lab	Tut	Total		In Semester Assessment						End Semester Assessment						Total	
								Lab 10	CP 20	MSE-MCQ 30	MSE Review 30	Seminar / GD / HA 20			ESE 30			ESE Review 70	CVV 20		
									Seminar	GD	HA	Written	MCQ	Practical							
S1-OE1	MD4201	Engineering and Managerial Economics	2	0	0	2	2			30					10		30			30	100
S1-OE1	MD4202	Project Management																			
S1-OE1	IT4219	From Campus to Corporate																			
S1-OE1	MD4203	Business Proposal Writing																			
S1-OE1	MD4251	Linkedin Learning																			
S2-OE2	IC4201	Industrial Electronics	2	0	0	2	2			30					10		30			30	100
S2-OE2	CS4217	Human Computer Interaction																			
S2-OE2	CS4272	Neural Networks																			
S2-OE2	ET4230	Natural Language Processing																			
S2-OE2	IT4216	Data Management, Protection and Governance																			
S3-OE3	IC4242	Deep Learning ( NPTEL course)	1	0	0	2	3			30					10		30			30	100
S4	IC4243	Major Project	0	18	0	18	9				30									70	100
		<b>Total</b>	<b>5</b>	<b>18</b>	<b>0</b>	<b>24</b>	<b>16</b>			<b>90</b>	<b>30</b>			<b>30</b>		<b>90</b>			<b>70</b>	<b>90</b>	<b>400</b>
Sem-2																					
S4	IC4244	Major Project	0	20	0	20	10				30									70	100

Vishwakarma Institute of Technology  
Title : Course Structure

Issue 01 : Rev No. 00 : Dt. 01/08/22  
FF No. 653

**Final Year B.Tech - Instrumentation and Control Engineering Structure for Pattern D-23, Module-8  
with effect from Semester-2 of Academic Year 2023-24**

Course Type	Course Code	Course Name	Teaching Learning Scheme (Hrs./Week)				Credits	Assessment Scheme (100 mark scale)													
			Th	Lab	Tut	Total		In Semester Assessment						End Semester Assessment					Total		
								Lab 10	CP 20	MSE-MCQ 30	MSE Review 30	Seminar / GD / HA 20			ESE 30			ESE Review 70		CVV 20	
S1	IC4211	Industry Internship		30		30	15				30								70		100
S1	IC4224	Global Internship																			
S1	IC4226	Research Internship																			
S1	IC4240	Project Internship																			
		<b>Total</b>		<b>30</b>		<b>30</b>	<b>15</b>				<b>30</b>								<b>70</b>		<b>100</b>

1. Students can opt for any module in any semester.
2. Students can register for new courses of module-7 as module-8 courses instead of Internship module-8

# SEMESTER I

FF No.: 654

**IC4201:: INDUSTRIAL ELECTRONICS****Course Prerequisites:** Basic knowledge electrical and electronics engineering**Course Objectives:**

1. To understand the operation of various power devices
2. Knowledge of protection techniques for power devices
3. To understand power devices driving techniques and driver circuits
4. Study various power electronics circuits and their analysis
5. To Learn various power electronics circuits for industrial applications
6. To understand power electronics in Electric vehicles and solar photovoltaic systems

**Credits: 2****Teaching Scheme: Theory: 2 Hours/Week**

**Course Relevance:** This course gives knowledge of power electronics and its industrial applications. Almost in all industries power electronic systems are used for power supply, control, conversion and other applications. Power electronics is also employed in electric vehicles and renewable energy systems which have a great scope currently and in also future.

**SECTION-1**

**Unit-1: Power electronics devices:** Introduction to various power devices such as SCR, TRIAC, DIAC, IGBT, silicon and silicon carbide MOSFETs. Construction, characteristics, specifications and selection of the above devices.

**Unit-2: Power device drivers and heat sink design:** Driving requirement for power devices. Various driver ICs such as isolated, non-isolated, low side, high side etc. Interfacing power devices with digital logic circuits and microcontrollers-based systems. Static and dynamic switching losses in power devices. Power dissipation calculations, cooling requirement, heat sink design and selection.

**Unit-3: Protection techniques for power devices:** Protection devices such as semiconductor fuses, resettable fuses, PTC thermistors, MOV, TVS, snubber and overcurrent protection circuits for protection of power devices. Series and parallel operation of power devices. Over current and overvoltage protection of power devices.

## SECTION-2

**Unit-4: AC power control and controlled rectifiers:** Single phase controlled rectifiers, three phase half wave, full wave rectifiers, AC power control techniques. Calculations of RMS and average values. Power factor improvement. Static switches.

**Unit-5: DC to DC converters:** Non isolated dc-dc various converters such as buck, boost, buck boost etc. Transformer isolated dc-dc converters such as flyback, forward, push-pull, half bridge and full bridge. Bidirectional converters.

**Unit-6: Industrial applications:** SMPS, Inverters and UPS systems. Induction and dielectric heating. Temperature and light intensity control. Speed control of AC and DC motors. Variable frequency drives for AC induction motor. LED drivers. Application of power electronics in solar photovoltaic systems and electric vehicles.

### List of Home Assignments:

#### Design:

1. Snubber circuit design for a given application
2. Estimation of power losses and design of a heat sink
3. Design of a boost converter
4. Design of a buck converter
5. IOT and power electronics
6. Batteries bank for electric vehicles
7. Selection of fuses for over-current protection
8. Power electronic transformers for converters
9. Induction cooker

#### Case Study:

10. Power converters in electric vehicles
11. Power electronic in wind energy system
12. Power electronics in locomotives
13. High power UPS systems
14. Rooftop solar photovoltaic system
15. Power electronics in industrial process control
16. Super capacitor application
17. HVDC transmission
18. Power electronics in robotics

#### Blog:

19. GaN power devices and applications
20. Solar photovoltaic plants
21. SiC MOSFETs applications
22. Fuel cell
23. Electric vehicle battery charging

24. Electric vehicles
25. Renewable energy systems
26. Over-current sensing techniques
27. Silicon carbide power devices

**Surveys**

28. Ferrite cores types and applications
29. Energy storage systems
30. Solar microinverters
31. Snubber circuits
32. Wind generators types and applications
33. Renewable energy systems
34. Smart grids
35. TRIAC application

**Assessment Scheme:**

Course Assessment: Total: 100 marks

1. Mid Semester Examination: 30 marks (Total: 30 marks based on Section I)  
*30 marks converted to 30*
2. End Semester Examination: 30 marks (Total: 30 marks based on Section II)  
*30 marks converted to 30*
3. Home Assignment: 10 marks (Total: 100 marks: Case study, Design work, Survey, Blog)  
*100 marks converted to 10*
4. Viva: 30 marks (at the end of semester); *100 marks converted to 30*

**Text Books:**

1. Singh, Khanchandani; Power Electronics; Tata McGraw-Hill Education, 2008.
2. Robert W. Erickson, Dragan Maksimovic; Fundamentals of Power Electronics, Springer.

**Reference Books:**

1. Ned Mohan; Power Electronics: A First Course; Wiley International.
2. Kambiz Ebrahimi, Yimin Gao, Stefano Longo; Modern Electric, Hybrid Electric, and Fuel Cell Vehicles, 3<sup>rd</sup> Edition; CRC Press

**MOOCs Links and additional reading material:**

1. [www.nptelvideos.in](http://www.nptelvideos.in)
2. <http://www.nptelvideos.in/2012/11/power-electronics.html>
3. <http://www.nptelvideos.in/2012/11/industrial-drives-power-electronics.html>

**Course Outcomes:** After completing the course the students will be able to

1. Select a suitable power device for the given applications.
2. Calculate power losses, design heat sinks and select suitable driver ICs.
3. Protect power devices using protection devices and circuits.
4. Will be able demonstrate the operation of power electronic circuits.
5. Analyze the power electronic circuits.
6. Contribute in the design and development of power electronic systems.

### CO-PO Map

CO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PS O1	PS O2	PS O3
1	2	2	3	2	1	1	0	0	0	0	0	1	1	1	2
2	2	2	3	2	1	1	0	0	0	0	0	1	1	1	2
3	3	2	2	2	0	0	0	0	0	0	0	0	1	1	1
4	1	2	2	1	1	0	0	0	1	2	0	1	0	1	1
5	2	3	1	1	2	0	0	0	0	0	0	0	0	1	1
6	3	2	2	2	2	1	1	1	1	1	1	1	1	1	3

### CO attainment levels

CO No.	IC4201 CO1	IC4201 CO2	IC4201 CO3	IC4201 CO4	IC4201 CO5	IC4201 CO6
Attainment Level	3	4	4	3	5	5

**Future Courses Mapping:** *Advanced Power Electronics*

### Job Mapping:

Job opportunities in UPS and Inverter manufacturing industries. Industries manufacturing AC and DC drives or motor controllers. In instrumentation industries where power electronics components are involved. Industries related to electric vehicles, solar photovoltaic systems. Power plants.

FF No. : 654

**CS4217:: HUMAN-COMPUTER INTERACTION****Prerequisites:** Mathematics**Course Objectives:**

1. To differentiate IT applications into categories based on measurable human factors
2. To study user categorization and ethnographic observations in user community
3. To generate the awareness about usability guidelines, principles and standards
4. To design user-friendly user interface with due consideration of interface theory and principles
5. To apply usability evaluation methods to identify the usability issues with IT applications
6. To integrate web, CSCW and mobile app design approaches

**Credits:** 2**Teaching Scheme Theory:** 2 Hours/Week

**Course Relevance:** Human-Computer Interaction (HCI) is a socio-technical course, with a goal of bringing the power of computers and communication systems to users, customers or people. It aims to make all computing and communications systems more accessible, maintainable and useful in working, learning and recreational lives of users or people. It helps every computing, web or mobile application to become really user-centric, increasing its users as well as related sales.

**SECTION-I**

**Unit-I Fundamentals of Human Computer Interaction (HCI):** Definition of HCI, Interdisciplinary Nature, Related Disciplines, Goals of System Engineering, Usability, Types of Usability, User Interface (UI), Measurable Human Factors, Accessibility, Differently-abled Users. [5 hours] [CO 1] [PO1][ PO4 ]

**Unit-II Interaction Concepts and Models:** User Persona, User Categorization, Golden Rules of Interface Design, Miller's Principle, Task Analysis - GOMS, Contextual Inquiry, Work Models, Interaction Styles, Ethnography, Empathy Maps. [5 hours] [ CO2 ] [ PSO2 ][ PO5 ]

**Unit-III Design Process:** Design Concept, Three Pillars of Design, Process of Design, Participatory Design, Internationalization, Interaction Design Patterns. [4 hours] [ CO4 ] [ PO3 ] [ PO8 ]

**SECTION-II**

**Unit-IV Usability Evaluation:** Expert-based Evaluation, User-based Evaluation, Formative Evaluation, Summative Evaluation, Heuristic Evaluation, Cognitive Walkthrough, Semiotic Analysis, Icon Categorization, User Surveys, Interviews, Usability Testing, Data Analysis, Statistical Methods. [6 hours] [ CO5 ][ PO4 ] [ PO10 ]

**Unit-V Documentation and Groupware:** Classification of Documents, Reading from Displays, Online Help, Tutorials, Error / Warning Messages, Groupware, Computer Supported Cooperative Work (CSCW), Dimensions of Cooperation, Asynchronous Interactions, Synchronous Interactions, Online Communities, Challenges with Online Communications, Accessibility Guidelines. [4 hours][ CO3 ] [ PO9 ][ PO11 ]

**Unit-VI Website and Mobile App Design:** Content Design, Interaction and Navigation Design, Presentation Design, Differences in design approaches, Design and Evaluation Tools. [4 hours] [ CO6 ] [ PO3 ] [ PO11 ]

**List of Home Assignments:**

**Design :**

- HA\_D 01 Design of Effective Search-----
- HA\_D 02 Pocket Clouds - One App, One World, One Touch-
- HA\_D 03 Design of Online Voting System -----
- HA\_D 04 App Design: Health &Fitness Tracking-----
- HA\_D 05 Online Art Gallery-----
- HA\_D 06 Design of Currency Detection App for Visually Impaired Users -
- HA\_D 07 Design of Dashboard -----
- HA\_D 08 Design of Android Application for Medicine Reminder-
- HA\_D 09 Design of City Tourism App -----
- HA\_D10 Design of Mood-Based Song Recommendation System -

**Case Study:**

- HA\_CS 01 Accessibility in Video Games-----
- HA\_CS 02Amazon UX -----
- HA\_CS 03Facebook for Business -----
- HA\_CS 04Blood Donation Apps -----
- HA\_CS 05WhatsappVs Telegram -----
- HA\_CS 06Google Maps Features -----
- HA\_CS 07Cryptocurrencies -----
- HA\_CS 08Car Rental Applications in INDIA -----
- HA\_CS 09Tesla Motors -----
- HA\_CS 10 Human Computer Interaction in Movies -----

**Blog :**

- HA\_Blog 01 Learning ON / OFF -----
- HA\_Blog 02Rise of India's Online Fantasy Game Industry -
- HA\_Blog 03Is Online Doctor Consultation goingto Replace Traditional Doctor Visit?–
- HA\_Blog 04Social Media and Politics -----
- HA\_Blog 05Future of HCI -----
- HA\_Blog 06Challenges in Food Delivery Services -----
- HA\_Blog 07Human Robot Interaction: SCARA -----
- HA\_Blog 08Attention Span as an Important Factor in UI / UX ofeCommerceApps -----
- HA\_Blog 09Humanizing Fintech -----
- HA\_Blog10 User Centered Design Approach for Wearables -

**Survey :**

- HA\_Survey 01 Survey on OTT Platforms -----
- HA\_Survey 02Survey on e-Learning Platforms-----
- HA\_Survey03 Survey on Stock Trading Platforms-----
- HA\_Survey 04Survey on ZomatovsSwiggy -----
- HA\_Survey 05Survey on OlavsUber -----
- HA\_Survey 06Survey onJob Application Platforms -----

**HA\_Survey 07** Survey on Online Payment Apps-----

**HA\_Survey 08** Survey on Exposure of Hate Speech among Instagram Users-

**HA\_Survey 09** Survey on Travel Booking Apps -----

**HA\_Survey 10** Survey on Music Streaming Apps -----

**Suggest an assessment Scheme:**

MSE - 30, HA – 100, ESE – 30 & CVV - 100

**Text Books: (As per IEEE format)**

1. Ben Shneiderman, “Designing the User Interface”, Third Edition, Pearson Education, ISBN 81-7808-262-4.
2. Alan Dix, Janet Finlay, Gregory Abowd, Russell Beale, “Human-Computer Interaction”, Third Edition, Pearson Education, ISBN 81- 297-0409-9.

**Reference Books: (As per IEEE format)**

1. Donald Norman, “The Design of Everyday Things”, 2002 Edition, Basic Books, ISBN 100-465-06710-7.
2. Wilbert Galitz, “The Essential Guide to User Interface Design”, Second Edition, Wiley-Dreamtech India (P) Ltd., ISBN 81-265-0280-0.
3. John Carroll, “Human-Computer Interaction in the New Millennium”, Pearson Education, ISBN 81-7808-549-6.

**MOOCs Links and additional reading material:**

1. <https://nptel.ac.in/courses/106103115>
2. <https://www.coursera.org/learn/human-computer-interaction>
3. <https://classroom.udacity.com/courses/ud400>

**Course Outcomes:**

**On the completion of course, student will able to**

1. To appreciate the differences among IT applications and their categories based on measurable human factors.
2. To identify user categories and capture related ethnographic observations in user community
3. To follow usability guidelines, principles and standards
4. To design user interfaces as per interface theory and user requirements
5. To apply a suitable usability evaluation method to identify the usability issues with IT applications
6. To enhance UI designs as per desired web, CSCW or mobile app design approach

**CO-PO Map:**

CO1		CO2		CO3		CO4		CO5		CO6	
PO1	PO4	PSO2	PO5	PO9	PO11	PO3	PO8	PO4	PO10	PO3	PO11
3		3		2		2		3		1	

**CO attainment levels:**

CO1 ----- 3

CO4 ----- 2

CO2 ----- 3

CO5 ----- 3

CO3 ----- 2

CO6 ----- 1

**Future Course Mapping:****Mention other courses that can be taken after completion of this course**

User Interface Design, Usable Security, Intelligent User Interfaces

**Job Mapping:****What are the Job opportunities that one can get after learning this course**

UI Designer, Product Designer, Software Engineer, Mobile App Developer

**ET4230 :: NATURAL LANGUAGE PROCESSING****Course Prerequisites:**

1. Probability and statistics.
2. Linear Algebra
3. Python programming language

**Course Objectives:**

1. Learn fundamentals of Text processing
2. Understand the different Language Models
3. Implement POS tagging
4. Implement Text classification
5. Implement sentiment analysis
6. Implement Machine translation

**Credits: 2****Teaching Scheme Theory: 2 Hours/Week****Course Relevance:**

Natural Language Processing is a branch of artificial intelligence that deals with the interaction between computers and humans using the natural language. The common applications of NLP involves, Google translator, Word Processors such as Microsoft, Interactive Voice Response, Personal assistant applications.

**SECTION-1**

Text Processing: Basics, Empirical Laws, Spelling Correction: Edit Distance, N-Gram Language Models, Basic Smoothing, POS Tagging, Hidden Markov Models for POS Tagging, Viterbi Decoding for HMM and Parameter Learning, Maximum Entropy Models.

**SECTION-2**

Maximum Entropy Models, Name entity recognition, Syntax, Dependency Grammars and Parsing, Semantic, text classification, sentiment analysis, Machine Translation, Question Answering

**List of Course Seminar Topics:**

1. SemEval-2016 task 4: Sentiment analysis in Twitter
2. Modelling user attitudes using hierarchical sentiment-topic model
3. Multilingual dynamic topic model
4. Document-Level Text -classification Using Single-Layer Multisize Filters Convolutional Neural Network
5. Twitter Storytelling Generator Using Latent Dirichlet Allocation and Hidden Markov Model POS-TAG (Part-of-Speech Tagging)
7. Part-of-speech Tagging and Named Entity Recognition Using Improved Hidden Markov Model and Bloom Filter
8. Part of speech tagging for Twitter conversations using Conditional Random Fields model
9. A system for named entity recognition based on local grammars
10. A Maximum-Entropy Segmentation Model for Statistical Machine Translation
11. Mobile embodied conversational agent for task specific applications

**List of Course Group Discussion Topics:**

1. Smoothing Technique
2. N-gram models
3. POS tagging
4. Ambiguities in NLP
5. Challenges in NLP
6. Challenges in designing Language Translators
7. Challenges in designing text classification
8. Challenges in designing sentiment analysis
9. Challenges in designing Question and Answering system
10. Challenges in designing text summarization

**Suggest an assessment Scheme:**

Course Assessment: Total : 100 mks

1. Mid Semester Examination : 30 marks (Total : 30 marks based on Section I)  
*30 marks converted to 30*
2. End Semester Examination: 30 marks (Total : 30 marks based on Section II)  
*30 marks converted to 30*
3. Home Assignment : 10 mks (Total : 100 marks: Case study, Design work, Survey, Blog)  
*100 marks converted to 10*
4. Viva : 30 mks (at the end of semester); *100 marks converted to 30*

**List of Home Assignments:****Design:**

1. POS tagging using HMM
2. Build Chatbot
3. Summarization of customers reviews
4. Social media Information extraction
5. SMS spam classification

**Case Study:**

1. Hiring and recruitment
2. Advertising
3. Healthcare
4. Market intelligence
5. Sentiment analysis

**Blog**

1. Social media Information extraction
2. Name Prediction in Multiple Languages using Recurrent Neural Networks
3. Text Classification using Sentiment Analysis
4. Image Caption Generator
5. gender identification in marathi names

**Surveys**

1. POS tagging techniques
2. SMS and email spam classification
3. Categorization of sport articles
4. machine translation Techniques
5. Name entity recognition methods

**Text Books:**

1. Jurafsky & Martin "[Speech and Language Processing](#)" Prentice Hall, 2000
2. Akshar Bharati, Rajeev Sangal and Vineet Chaitanya: "Natural Language Processing: A Paninian Perspective", Prentice-Hall of India, New Delhi, 1995

**Reference Books:**

1. Steven Bird, Ewan Klein, and Edward Loper "Natural Language Processing with Python", O'Reilly Media 2009

**Moocs Links and additional reading material:**

1. <https://nptel.ac.in/courses/106/105/106105158/>
2. <https://nptel.ac.in/courses/106/106/106106211/>

**Course Outcomes:**

The student will be able to –

1. Have broad understanding of the field of natural language processing [3]
2. Get acquainted with the algorithmic description of the main language levels: morphology, syntax, semantics, and pragmatics [3]
3. Apply mathematical models and algorithms in applications of NLP [4]
4. Design and implementation issues in various NLP applications such as information retrieval and information extraction [4]
5. Demonstrate crucial ideas in linguistics (e.g., syntax, semantics, pragmatics), artificial intelligence (e.g., knowledge representation), and machine learning (e.g., deep learning) to natural language processing. [4]
6. Identify one of the contemporary (sub) problems of natural language processing and implement, in the form of a complete computer program as a possible solutions to it. [5]

**CO PO Map**

PO	CO 1	CO 2	CO 3	CO 4	CO 5	CO 6	CO 7	CO 8	CO 9	CO 10	CO 11	CO 12	PS O1	PS O2
1	3	3	3	2	4	1		1	1	1		2	1	1
2	3	3	3	2	4	1		1	1	1		2	3	3
3	4	3	3	3	4	2		1	1	1		2	3	3
4	4	3	3	3	4	2		1	1	1		2	3	3
5	4	3	3	2	4	2		1	1	1		2	3	3
6	4	3	3	3	4	2		1	1	1		2	3	3

**CO attainment levels**

1. CO1 - Level 3
2. CO2 - Level 3
3. CO3 - Level 4
4. CO4 - Level 4
5. CO5 - Level 4
6. CO6 - Level 5

**Job Mapping:**

Natural Language engineers, Data Scientist and Algorithm Architect with industries in domains Media & Entertainment, Healthcare and Finance.

FF No. : 654

**CS4272 :: NEURAL NETWORK****Course Prerequisites:** Operating Systems, Fundamentals of Computer Networks**Course Objectives:**

1. To become familiar with Cloud Computing and its ecosystem
2. To learn basics of virtualization and its importance
3. To evaluate in-depth analysis of Cloud Computing capabilities
4. To give a technical overview of Cloud Programming and Services.
5. To understand security issues in cloud computing

**Credits: 2****Teaching Scheme Theory: 2 Hours/Week****Course Relevance:** Cloud computing to enable transformation, business development and agility in an organization.**SECTION-I**

Introduction to Cloud Computing: Recent trends in Computing, Grid Computing, Cluster Computing, Distributed Computing, Utility Computing, Evolution of cloud computing

Cloud Computing Architecture: Cloud versus traditional architecture, Infrastructure as a Service(IaaS), Platform as a Service(PaaS), Software as a Service(SaaS), , Public cloud, Private cloud, Hybrid cloud, Community cloud, Google Cloud architecture, The GCP Console, Understanding projects, Billing in GCP, Install and configure Cloud SDK, Use Cloud Shell, GCP APIs

Infrastructure as a Service (IaaS): Introduction to IaaS, Introduction to virtualization, Different approaches to virtualization, Hypervisors, Machine Image, Virtual Machine(VM), Compute options in the cloud, Exploring IaaS with Compute Engine, Configuring elastic apps with autoscaling, Storage options in the cloud, Structured and unstructured storage in the cloud, unstructured storage using Cloud Storage, SQL managed services, Exploring Cloud SQL, Cloud Spanner as a managed service, NoSQL managed service options, Cloud Datastore, a NoSQL document store, Cloud Bigtable as a NoSQL option

**SECTION-II**

Platform as a Service (PaaS): Introduction to PaaS, Service Oriented Architecture (SOA). Cloud Platform and Management, Exploring PaaS with App Engine, Event driven programs with Cloud Functions, Containerizing and orchestrating apps with Google Kubernetes Engine

Software as a Service (SaaS): Introduction to SaaS, Web services, Web 2.0, Web OS,

Service Management in Cloud Computing: Service Level Agreements(SLAs), Billing and accounting, Billing in GCP

Cloud Security: Introduction to security in the cloud, the shared security model, Encryption options, Authentication and authorization with Cloud IAM, Identify Best Practices for Authorization using Cloud IAM.

Cloud Network : Introduction to networking in the cloud, Defining a Virtual Private Cloud, Public and private IP address basics, Google's network architecture, Routes and firewall rules in the cloud, Multiple VPC networks, Building hybrid clouds using VPNs, interconnecting, and direct peering, Different options for load balancing.

**List of Course Seminar Topics:**

1. Storage Cost Optimization On Cloud
2. Cloud Security And Cryptography
3. Infrastructure As A Code (IAC)
4. Cloud Computing In Healthcare
5. Serverless Architecture
6. Deployment Of Microservices In Kubernetes Engine
7. RPA Using AWS Cloud
8. Cloud Trends In Supporting Ubiquitous Computing
9. Mobile Cloud Computing
10. Modern Data Center Architecture

**List of Course Group Discussion Topics:**

1. Data Storage Security in Cloud
2. Cloud Services for SMB's
3. Monitoring Services Provided by GCP and AWS
4. Docker and Kubernetes
5. SaaS vs FaaS (Function as a service )
6. Hybrid Cloud
7. GCP Vs AWS Web Service Architecture
8. Cloud based security issues and threats
9. Authentication and identity
10. Future of Cloud-Based Smart Devices

**List of Home Assignments:**

**Design:**

1. Serverless Web App to order taxi rides using AWS lambda.
2. Deploying App on Kubernetes
3. Serverless web Application ( GCP Cloud Functions)

4. Demonstration of EBS, Snapshot, Volumes
5. Single Node Cluster Implementation (Hadoop)

**Case Study:**

1. PayU Migration to AWS
2. Cloud object storage
3. Deployment and Configuration options in AWS
4. Deployment and Configuration options in Microsoft Azure
5. Deployment and Configuration options in GCP

**Blog**

1. Comparing design of various cloud computing platforms
2. AWS EKS and Google Cloud Functions
3. App Engine
4. Cloud Endpoints
5. Cloud Pub/Sub

**Surveys**

1. Disaster Recovery in Cloud Computing
2. Cloud Economics
3. Data archiving solutions
4. Salesforce
5. Dropbox

**Assessment Scheme :**

Course Assessment: Total : 100 mks

1. Mid Semester Examination : 30 marks (Total : 30 marks based on Section I)  
*30 marks converted to 30*
2. End Semester Examination: 30 marks (Total : 30 marks based on Section II)  
*30 marks converted to 30*
3. Home Assignment : 10 mks (Total : 100 marks: Case study, Design work, Survey, Blog)  
*100 marks converted to 10*
4. Viva : 30 mks (at the end of semester); *100 marks converted to 30*

**Text Books:**

1. Judith Hurwitz, R.Bloor, M.Kanfman, F.Halper, "Cloud Computing for Dummies", Wiley,India.
2. Ronald Krutz and Russell Dean Vines, "Cloud Security", Wiley-India
3. Gautam Shroff. "Enterprise Cloud Computing", Cambridge

**Reference Books:**

1. Barrie Sosinsky, "Cloud Computing Bible", Wiley India
2. Antohy T Velte, et.al, "Cloud Computing : A Practical Approach", McGraw Hill.
3. Michael Miller, "Cloud Computing", Que Publishing.
4. Tim Malhar, S.Kumaraswamy, S.Latif, "Cloud Security & Privacy", SPD,O'REILLY
5. Scott Granneman, "Google Apps", Pearson

**Moocs Links and additional reading material:**

<https://nptel.ac.in/courses/106/105/106105167/>

[https://swayam.gov.in/nd1\\_noc20\\_cs55/preview](https://swayam.gov.in/nd1_noc20_cs55/preview)

<https://www.coursera.org/specializations/cloud-computing>

<https://azure.microsoft.com/en-in/overview/what-is-cloud-computing/>

<https://aws.amazon.com/what-is-cloud-computing/>

<https://www.ibm.com/in-en/cloud/learn/cloud-computing>

**Course Outcomes:**

- 1) Describe the main concepts, key technologies, strengths, and limitations of cloud computing and the possible applications for state-of-the-art cloud computing
- 2) Explain the architecture and infrastructure of cloud computing, including SaaS, PaaS, IaaS, public cloud, private cloud, hybrid cloud, etc.
- 3) Identify problems, and explain, analyze, and evaluate various cloud computing solutions.
- 4) Choose the appropriate technologies, algorithms, and approaches for the related issues.
- 5) Display new ideas and innovations in cloud computing.
- 6) Collaboratively research and write a paper on the state of the art (and open problems) in cloud computing.

**CO PO Map**

CO1	CO2	CO3	CO4	CO5	CO6
PO2	PO3	PO7	PO10	PO11	PSO4
3	3	2	2	1	3

**CO attainment levels**

CO1-1 CO2-2 CO3-3 CO4-5 CO5-4 CO6-3

**Future Courses Mapping:**

After completing this course different certifications courses in cloud be taken such as AWS, Azure, Google cloud certifications. One can go for higher studies in specialization of cloud computing and allied subjects.

**Job Mapping:**

Cloud Architect, Cloud Engineer, Cloud Administrator, Solutions Architect - Cloud Computing - AWS / Kubernetes, Cloud Computing Technical Consultant, Associate Cloud Computing Engineer, Cloud Computing Trainer

FF NO. : 654

**IT4216:: DATA MANAGEMENT, PROTECTION AND GOVERNANCE**

**Course Prerequisites:** Knowledge of Linear Algebra & Different types of Signals, Image Processing

**Course Objectives:**

1. To introduce the major ideas, methods, and techniques of computer vision
2. To acquaint with Image segmentation and shape representation.
3. To learn pattern recognition.
4. To explore object recognition and its application

**Credits: 2****Teaching Scheme Theory: 2** Hours/Week

**Course Relevance:** Computer vision is an interdisciplinary scientific field that deals with how computers can gain high-level understanding from digital images or videos. From the perspective of engineering, it seeks to understand and automate tasks that the human visual system can do.

**SECTION-1**

Image Formation Models : Fundamentals of Image Processing, Monocular imaging system, Radiosity: The ‘Physics’ of Image Formation, Color Model etc, Camera model and Camera Calibration, Construction of 3D Model from images.

Image Processing and Feature Extraction-Image preprocessing-Image Enhancement techniques, Image representations (continuous and discrete), Histogram Processing, Statistical & Geometric Transformation.

Shape Representation and Segmentation : Edge detection, Image segmentation techniques: Edge Based approaches to segmentation, Gradient using Masks, LOG, DOG, Canny, Edge Linking, Line detectors (Hough Transform), Corners – Harris, Region Growing, Region Splitting.

**SECTION-2**

Motion Estimation: Regularization theory, Optical computation, Stereo Vision, Motion estimation, Structure from motion.

Object Recognition: Object Recognition, Feature Detectors, Classifications-Supervised and Unsupervised Machine Learning for Image Classification, Principal Component Analysis, Singular Value Decomposition Shape priors for recognition.

Applications: Photo album – Face detection – Face recognition, Object tracking, Surveillance etc.

**List of Projects:**

1. Image and Video Enhancement models
2. Human Motion Detection
3. Object Detection Model
4. Face Recognition Model
5. Dynamic Texture Synthesis
6. Image and Video Editing
7. Develop an application for a vision-based security system during day/night time. The system should trigger an audio- visual alarm upon unauthorized entry.
8. Develop motion estimation/ tracking system to recognize object of interest related to one of the following applications. (Automobile tracking/ face tracking/ human tracking)

**List of Course Seminar Topics:**

1. Various Image Segmentation techniques
2. New trends in Face recognitions
3. Applications of Computer Vision for Traffic management
4. Facial Expression recognitions
5. Gesture recognitions using Computer Vision
6. Autonomous Car
7. Usage of Computer Vision in Robotics
8. AR VR using Computer Vision

**List of Course Group Discussion Topics:**

1. Object Recognitions,
2. 3-D models and its applications,
3. Image Understanding-Pattern Recognition Models,
4. Face detection models,
5. Image Understanding-Pattern Recognition Models,
6. Image Segmentation

**List of Home Assignments:****Design:**

1. Design 3-D models
2. Face Detection Models
3. Develop an application for a vision-based security system during day/night time. The system should trigger an audio- visual alarm upon unauthorized entry.
4. Develop motion estimation/ tracking system to recognize object of interest related to one of the following applications. (Automobile tracking/ face tracking/ human tracking).
5. Develop motion estimation/ tracking system to recognize object of interest related to one of the following applications. (Space vehicle tracking/ solar energy tracking/ crowd pattern tracking).

**Case Study:**

1. Computer Vision for Smart City
2. Computer Vision for AR AVR
3. Research Areas in Computer Vision
4. Computer Vision for Swastha Bharat
5. Computer Vision in IoT
6. Computer Vision in Health Analytics
7. Computer Vision in wearable computing

**Blog:**

1. Computer Vision for Data Science
2. Computer Vision for Smart Agriculture
3. Computer Vision in Medical Field
4. Usage of AI for Computer Vision
5. Job Opportunities in Computer Vision
6. Usage of Image Processing in Computer Vision, Machine Learning, Deep Learning, and AI

**Surveys:**

1. Computer Vision for Educations
2. Classifications and Recognitions
3. Drone based Surveillance
4. Video Editing
5. Human Motion/Object tracking and detections
6. Computer Vision using High-Performance Computing-Computational
7. Complexity/Time Complexity and Execution time
8. Recent Trends in Computer Vision

**Assessment Scheme:**

Course Assessment: Total : 100 mks

1. Mid Semester Examination : 30 marks (Total : 30 marks based on Section I)  
*30 marks converted to 30*
2. End Semester Examination: 30 marks (Total : 30 marks based on Section II)  
*30 marks converted to 30*
3. Home Assignment : 10 mks (Total : 100 marks: Case study, Design work, Survey, Blog)  
*100 marks converted to 10*
4. Viva : 30 mks (at the end of semester); *100 marks converted to 30*

**Text Books:**

1. Richard Szeliski, "Computer Vision: Algorithms and Applications (CVAA)", Springer, 2010.
2. E. R. Davies, "Computer & Machine Vision," Fourth Edition, Academic Press, 2012.
3. Simon J. D. Prince, "Computer Vision: Models, Learning, and Inference", Cambridge University Press, 2012.

- Rafael Gonzalez & Richard Woods, "Digital Image Processing," 3<sup>rd</sup> Edition, Pearson publications, ISBN 0132345633.

#### Reference Books:

- D. Forsyth and J. Ponce, "Computer Vision - A modern approach," Prentice Hall.
- E. Trucco and A. Verri, "Introductory Techniques for 3D Computer Vision,"- Publisher: Prentice Hall.
- D. H. Ballard, C. M. Brown, " Computer Vision", Prentice-Hall, Englewood Cliffs, 1982.

**Moocs Links and additional reading material:** [www.nptelvideos.in](http://www.nptelvideos.in)

#### Course Outcomes:

The student will be able –

- Extract features from Images and do analysis of Images
- Generate 3D model from images
- Understand video processing, motion computation and 3D vision and geometry
- Apply pre-processing algorithms to acquired images
- Develop feature descriptor for object detection purpose.
- Make use of Computer Vision algorithms to solve real-world problems

#### CO PO Map:

CO1	CO2	CO3	CO4	CO5	CO6
PO1	PO5	PO6	PO7	PO9	PSO3
3	2	3	3	2	3

#### CO attainment levels:

CO	CO1	CO2	CO3	CO4	CO5	CO6
Level	2	3	4	2	4	5

**Future Courses Mapping:** AR VR, NLP, AI, ML, DL, Video Analytics using GPU etc

**Job Mapping:** Machine Vision Engineer, Associate Data Scientist Computer Vision, Data Scientist-Computer Vision, tensor RT, Keras, Lead Scientist - Image Analytics & Signal Processing - Deep Learning, Software Development Engineer - Image Processing, Image Processing & Computer Vision Engineer, Architect - Video and Image Processing, Lead - Medical Image Analysis Developer, Research Engineer - Computer Vision, , Image Analysis Scientist - Image Processing/Pattern Recognition.

FF No. : 654

**IC4242: DEEP LEARNING****Credits: 3****Teaching Scheme Theory: 2 Hours/Week****Course Objectives:**

1. On completion of this course, a student will be familiar with traditional Machine Learning approaches, e.g. Bayesian Classification, Multilayer Perceptron etc.
2. Understand modern Deep Learning architectures like Convolutional Neural Networks, Autoencoders etc
3. Acquire the knowledge of applying Deep Learning techniques to solve various real life problems

**Course Relevance:** Machine learning, Computer Vision, Machine Vision, Natural language processing

**SECTION-1:****Unit -01(5 Hrs)**

Introduction to Deep Learning, Bayesian Learning, Decision Surfaces, Linear Classifiers, Linear Machines with Hinge Loss

**Unit:02: (5 Hrs)**

Optimization Techniques, Gradient Descent, Batch Optimization, Introduction to Neural Network, Multilayer Perceptron, Back Propagation Learning

**Unit:03:(5 Hrs)**

Unsupervised Learning with Deep Network, Autoencoders , Convolutional Neural Network, Building blocks of CNN, Transfer Learning

**SECTION-2:****Unit:01: (5Hrs)**

Revisiting Gradient Descent, Momentum Optimizer, RMSProp, Adam, Effective training in Deep Net- early stopping, Dropout, Batch Normalization, Instance Normalization, Group Normalization

**Unit :02:(5 Hrs)**

Recent Trends in Deep Learning Architectures, Residual Network, Skip Connection Network, Fully Connected CNN etc., Classical Supervised Tasks with Deep Learning, Image Denoising, Semantic Segmentation, Object Detection etc.

**Unit :03(5 Hrs)**

LSTM Networks, Generative Modeling with DL, Variational Autoencoder, Generative Adversarial Network Revisiting Gradient Descent, Momentum Optimizer, RMSProp, Adam

**List of Home Assignments:**

Students can choose the following topics for Design, Blog writing, Case study and Survey

1. Applications of NLP
2. Applications of Health Care
3. Applications of Computer vision
4. Applications of Machine Vision

**Assessment Scheme:**

Online ESE: 30 Marks

Online ESE: 30 Marks

Comprehensive Viva Voce: 100 Marks converted to 30 equivalent Marks

Home Assignment Assessment: 100 Marks converted to 10 Marks

**Text and Reference Books:**

1. Deep Learning- Ian Goodfellow, Yoshua Benjio, Aaron Courville, The MIT Press  
 2. Pattern Classification- Richard O. Duda, Peter E. Hart, David G. Stork, John Wiley & Sons Inc.

**Moocs Links and additional reading material:**

1. Deep Learning NPTEL Course by Prof. Prabir Kumar Biswas, IIT Kharagpur.  
[https://onlinecourses.nptel.ac.in/noc23\\_ee131/preview](https://onlinecourses.nptel.ac.in/noc23_ee131/preview)

**Course Outcomes:** The student will be able to –

1. Comprehend concepts of Machine learning and classification
2. Apply neural networks and back propagation
3. Understand building blocks of CNN and Autoencoders for different real time applications
4. Identify different types of optimizers and types of Normalization
5. Analyze recent Deep Learning Architectures for various real time applications
6. Explore LSTM networks, Generative Adversarial Network etc.. for various real time applications

**CO PO Map:**

CO	PO-1	PO-2	PO-3	PO-4	PO-5	PO-6	PO-7	PO-8	PO-9	PO-10	PO-11	PO-12	PSO-1	PSO-2	PSO-3
1	2	1	3	2	2	1	1	0	0	0	0	3	0	1	3
2	3	2	3	1	1	0	0	0	0	0	0	3	0	1	3
3	3	3	3	3	3	1	0	0	0	0	0	3	0	1	3
4	1	1	1	1	1	1	0	0	0	0	0	1	0	1	3
5	3	3	3	3	3	1	0	0	0	0	0	3	0	1	3
6	3	3	3	3	3	1	0	0	0	0	0	3	0	1	3

**CO attainment levels**

CO No.	IC4242_CO1	IC4242_CO2	IC4242_CO3	IC4242_CO4	IC4242_CO5	IC4242_CO6
Attainment Level	3	3	4	4	3	3

**Job Mapping:** Machine Learning engineer, Computer vision expert

FF No. : 654

**IC4243 :: MAJOR PROJECT****Credits:** 9**Teaching Scheme:** Lab: 18 Hours/Week

- Major project should be real time and research based problems based on the courses studied.
- Project to be completed with detailed design, implementation, test case preparations, testing and demonstration
- It is having Group formation, discussion with faculty advisor, formation of the project statement, resource requirement, identification and implementation and Time scheduling of the project.
- continuous assessment for the activities mentioned has been carried out throughout the semester
- The student should prepare a consolidated report in LaTeX /word and submit it before term end.
- Project consists of presentation and oral examination based upon the project work demonstration of the fabricated/designed equipment or software developed for simulation. The said examination will be conducted by a panel of examiners, consisting of preferably guide working as internal examiners and another external examiner preferably from an industry or university.

**List of Project areas:**

1. Control
2. Sensor
3. Embedded
4. Automotive
5. Automation (PLC, SCADA)
6. Process Instrumentation
7. Healthcare
8. Signal Processing
9. Image processing
10. Artificial Intelligence
11. IOT
12. Software

**Course Outcomes:**

Students will be able to

1. IC4243\_CO1: Design solutions for given engineering problem [4] (PO-1,2,3,4,5,6,7 PSO- 1,2,3)
2. IC4243\_CO2: Demonstrate practical knowledge by constructing models/algorithms for real time applications [4] (PO-1,2,3,4,5,6,7 PSO- 1,2,3)
3. IC4243\_CO3: Express effectively in written and oral communication. [3] (PO- 8,10,12 PSO- 1)
4. IC4243\_CO4: Exhibit the skills to work in a team [2] (PO- 8,9,12 PSO-2)
5. IC4243\_CO5: Prepare a time chart and financial record for execution of the project[1] ( PO-8,11,12 PSO-3)

# SEMESTER II

**IC4211:: INDUSTRY INTERNSHIP****Credits:** 15**Teaching Scheme:** Working in Industry 30 Hours / Week

- Gain practical experience within the industry environment.
- Acquire knowledge of the industry in which the internship is done.
- Apply knowledge and skills learned in the classroom in a work setting.
- Develop a greater understanding about career options while more clearly defining personal career goals.
- Experience the activities and functions of business professionals.
- Develop and refine oral and written communication skills.
- Identify areas for future knowledge and skill development.

**Course Outcomes:**

<b>IC4211_CO1 : Technical and Analytical Competencies : Ability to</b>		
a)	Seek knowledge, select appropriate technologies, and apply it to different areas	[5] PO-1, PO-3, PO-4, PO-6 PSO-1, PSO-2 PSO-3
b)	Develop a technical artifact requiring new technical skills.	
c)	Improve problem-solving and critical thinking skills.	
d)	Acquire and evaluate information	
e)	Analyze or visualize data to create information	
<b>IC4211_CO2: Skill Development / Modern Tool Usage : Ability to</b>		
a)	learn modern engineering tools	[4] PO-5 PSO-1, PSO-2
b)	Effectively utilize appropriate software tool to complete a task	
c)	Effectively utilize modern engineering tools necessary for engineering practices	
<b>IC4211_CO3: Communication &amp; Presentation Skills: Ability to</b>		
a)	Communicate ideas orally and in written form	[3] PO-9, PO-10
b)	Report effectively the status of task completion	
c)	Effectively Participate as a team member	
d)	Listen effectively	
e)	Present effectively	
<b>IC4211_CO4: Professionalism: Ability to</b>		
a)	Demonstrate understanding of professional customs and practices.	[2] PO-8, PO-12
b)	Organize and maintain information	
c)	Identify, understand and work with professional standards	
d)	Behave professionally and ethically	
<b>IC4211_CO5: Technical Writing: Ability to</b>		
a)	Write requirements documentation	[2] PO-10, PO-12
b)	Write Maintenance and troubleshoot report	
c)	Prepare documentation of task completed	

FF No. : 654

**IC4224:: GLOBAL INTERNSHIP****Credits:** 15**Teaching Scheme:** Working in Industry 30 Hours / Week

- Gain practical experience within the industry/ Institute environment.
- Acquire knowledge of the industry/ Institute in which the internship is done.
- Apply knowledge and skills learned in the classroom in a work setting.
- Develop a greater understanding about career options while more clearly defining personal career goals.
- Experience the activities and functions of business professionals.
- Develop and refine oral and written communication skills.
- Identify areas for future knowledge and skill development.
- If applicable the students should complete the following & document as applicable: Literature Review, Problem scope, Problem Definition, Requirement Analysis, Methodology to solve problem, Implementation, Preliminary results, Implementation, Observations, Results, Conclusion.

**Course Outcomes**

<b>IC4224_CO1 : Technical and Analytical Competencies : Ability to</b>		
a)	Seek knowledge, select appropriate technologies, and apply it to different areas	[5] PO-1, PO-3, PO-4, PO-6 PSO-1, PSO-2 PSO-3
b)	Develop a technical artifact requiring new technical skills.	
c)	Improve problem-solving and critical thinking skills.	
d)	Acquire and evaluate information	
e)	Analyze or visualize data to create information	
<b>IC4224_CO2: Skill Development / Modern Tool Usage : Ability to</b>		
a)	learn modern engineering tools	[4] PO-5 PSO-1, PSO-2
b)	Effectively utilize appropriate software tool to complete a task	
c)	Effectively utilize modern engineering tools necessary for engineering practices	
<b>IC4224_CO3: Communication &amp; Presentation Skills: Ability to</b>		
a)	Communicate ideas orally and in written form	[3] PO-9, PO-10
b)	Report effectively the status of task completion	
c)	Effectively Participate as a team member	
d)	Listen effectively	
e)	Present effectively	
<b>IC4224_CO4: Professionalism: Ability to</b>		
a)	Demonstrate understanding of professional customs and practices.	[2] PO-8, PO-12
b)	Organize and maintain information	
c)	Identify, understand and work with professional standards	
d)	Behave professionally and ethically	
<b>IC4224_CO5: Technical Writing: Ability to</b>		
a)	Write requirements documentation	[2] PO-10, PO-12
b)	Write Maintenance and troubleshoot report	
c)	Prepare documentation of task completed	

FF No. : 654

**IC4226:: RESEARCH INTERNSHIP**

Credits: 15

Teaching Scheme: Working in Industry 30 Hours / Week

**Section 1**

- Should complete the following
- Literature Review
- Problem scope
- Problem Definition
- Requirement Analysis
- Methodology to solve problem

**Section 2**

- Implementation
- Preliminary results
- Implementation
- Observations
- Results
- Conclusion

**Course Outcomes**

<b>IC4226_CO1 : Technical and Analytical Competencies : Ability to</b>		
a)	Seek knowledge, select appropriate technologies, and apply it to different areas	[5] PO-1, PO-3, PO-4, PO-6 PSO-1, PSO-2 PSO-3
b)	Develop a technical artifact requiring new technical skills.	
c)	Improve problem-solving and critical thinking skills.	
d)	Acquire and evaluate information	
e)	Analyze or visualize data to create information	
<b>IC4226_CO2: Skill Development / Modern Tool Usage : Ability to</b>		
a)	learn modern engineering tools	[4] PO-5 PSO-1, PSO-2
b)	Effectively utilize appropriate software tool to complete a task	
c)	Effectively utilize modern engineering tools necessary for engineering practices	
<b>IC4226_CO3: Communication &amp; Presentation Skills: Ability to</b>		
a)	Communicate ideas orally and in written form	[3] PO-9, PO-10
b)	Report effectively the status of task completion	
c)	Effectively Participate as a team member	
d)	Listen effectively	
e)	Present effectively	
<b>IC4226_CO4: Professionalism: Ability to</b>		
a)	Demonstrate understanding of professional customs and practices.	[2] PO-8, PO-12
b)	Organize and maintain information	
c)	Identify, understand and work with professional standards	
d)	Behave professionally and ethically	
<b>IC4226_CO5: Technical Writing: Ability to</b>		
a)	Write requirements documentation	[2] PO-10, PO-12
b)	Write Maintenance and troubleshoot report	
c)	Prepare documentation of task completed	

**IC4240:: PROJECT INTERNSHIP****Credits:** 15**Teaching Scheme:** Working in Industry 30 Hours / Week**Section 1**

- Should complete the following
- Literature Review
- Problem scope
- Problem Definition
- Requirement Analysis
- Methodology to solve problem

**Section 2**

- Implementation
- Preliminary results
- Implementation
- Observations
- Results
- Conclusion

**Course Outcomes**

<b>IC4240_CO1 : Technical and Analytical Competencies : Ability to</b>		
a)	Seek knowledge, select appropriate technologies, and apply it to different areas	[5] PO-1, PO-3, PO-4, PO-6 PSO-1, PSO-2 PSO-3
b)	Develop a technical artifact requiring new technical skills.	
c)	Improve problem-solving and critical thinking skills.	
d)	Acquire and evaluate information	
e)	Analyze or visualize data to create information	
<b>IC4240_CO2: Skill Development / Modern Tool Usage : Ability to</b>		
a)	learn modern engineering tools	[4] PO-5 PSO-1, PSO-2
b)	Effectively utilize appropriate software tool to complete a task	
c)	Effectively utilize modern engineering tools necessary for engineering practices	
<b>IC4240_CO3: Communication &amp; Presentation Skills: Ability to</b>		
a)	Communicate ideas orally and in written form	[3] PO-9, PO-10
b)	Report effectively the status of task completion	
c)	Effectively Participate as a team member	
d)	Listen effectively	
e)	Present effectively	
<b>IC4240_CO4: Professionalism: Ability to</b>		
a)	Demonstrate understanding of professional customs and practices.	[2] PO-8, PO-12
b)	Organize and maintain information	
c)	Identify, understand and work with professional standards	
d)	Behave professionally and ethically	
<b>IC4240_CO5: Technical Writing: Ability to</b>		
a)	Write requirements documentation	[2] PO-10, PO-12
b)	Write Maintenance and troubleshoot report	
c)	Prepare documentation of task completed	

**IC4244:: MAJOR PROJECT****Credits:** 9**Teaching Scheme:** Lab: 18 Hours/Week

- Major project should be real time and research based problems based on the courses studied.
- Project to be completed with detailed design, implementation, test case preparations, testing and demonstration
- It is having Group formation, discussion with faculty advisor, formation of the project statement, resource requirement, identification and implementation and Time scheduling of the project.
- continuous assessment for the activities mentioned has been carried out throughout the semester
- The student should prepare a consolidated report in LaTeX /word and submit it before term end.
- Project consists of presentation and oral examination based upon the project work demonstration of the fabricated/designed equipment or software developed for simulation. The said examination will be conducted by a panel of examiners, consisting of preferably guide working as internal examiners and another external examiner preferably from an industry or university.

**List of Project areas:**

1. Control
2. Sensor
3. Embedded
4. Automotive
5. Automation (PLC, SCADA)
6. Process Instrumentation
7. Healthcare
8. Signal Processing
9. Image processing
10. Artificial Intelligence
11. IOT
12. Software

**Course Outcomes:**

Students will be able to

1. IC4244\_CO1: Design solutions for given engineering problem [4] (PO-1,2,3,4,5,6,7 PSO- 1,2,3)
2. IC4244\_CO2: Demonstrate practical knowledge by constructing models/algorithms for real time applications [4] (PO-1,2,3,4,5,6,7 PSO- 1,2,3)
3. IC4244\_CO3: Express effectively in written and oral communication. [3] (PO- 8,10,12 PSO- 1)
4. IC4244\_CO4: Exhibit the skills to work in a team [2] (PO- 8,9,12 PSO-2)
5. IC4244\_CO5: Prepare a time chart and financial record for execution of the project[1] ( PO-8,11,12 PSO-3)