

Gurugram University Gurugram
Curriculum for UG Degree
Course
in
ROBOTICS AND AUTOMATION
(Engineering & Technology)

Gurugram University - Gurugram

GENERAL COURSE STRUCTURE & CREDIT DISTRIBUTION

STRUCTURE OF UNDERGRADUATE ENGINEERING PROGRAM

S. No.	Category	Breakup of Credits
1	Humanities and Social Sciences including Management courses	11
2	Basic Science courses	22
3	Engineering Science courses including workshop, drawing, basics of electrical/mechanical/computer etc.	33
4	Professional core courses	59
5	Professional Elective courses relevant to chosen specialization/branch	12
6	Open subjects – Electives from other technical and /or emerging subjects	12
7	Project work, seminar and internship in industry or elsewhere	16
8	Mandatory Courses [Induction training, Sports, Indian Constitution, Scientific & Technical writing Skills, Practical Training-I, Economics	Non-credit
Total		165

SEMESTER WISE SUMMARY OF THE PROGRAM

S. No.	Semester	No. of Contact Hours	Marks	Credits
1.	I	24+2*	900	19.5
2.	II	27	800	22.5
3.	III	28	1000	22
4.	IV	26	900	21
5.	V	27	1000	25
6.	VI	21	900	21
7.	VII	25	800	20
8.	VIII	22	500	14
	Total	200	6800	165

Semester VII

S. No	Course Code	Course Title	Hours per week			Credits	Marks for Sessional	Marks for End Term Examination	Total
			L	T	P				
1		Field and Service Robotics	3	1	0	3	30	70	100
2		Organizational Behavior	3	1	0	3	30	70	100
3		Open Elective II	3	1	0	3	30	70	100
4		Open Elective -III	3	1	0	3	30	70	100
5		Professional Elective IV	3	1	0	3	30	70	100
6		Practical Training _II	0	0	2	1	50	50	100
7		Project II	0	0	8	4	100	100	200
Total						20			800

NOTE:

3. Choose any one from Professional Elective Course-IV
4. Choose any one from each of the Open Elective Course-III & IV

PROFESSIONAL ELECTIVE- IV (Semester-VII)

Sr. No	Code	Subject	Credit
1		Neural Network and Deep Learning	3
2		Intelligent Instrumentation	3
3		Machine Vision System	3
4		Totally Integrated Automation	3

FIELD AND SERVICE ROBOTICS

Course code					
Category	Professional Core Course				
Course title	FIELD AND SERVICE ROBOTICS				
Semester and Credits	L	T	P	Credits	Semester VII
	3	0	0	3	
Classwork	30 Marks				
Exam	70 Marks				
Total	100 Marks				
Duration of Exam	03 Hours				

Note: The examiner will set nine questions in total. Question one will be compulsory. Question one will have seven parts of 2 marks each from all units, and the remaining eight questions of 14 marks each to be set by taking two questions from each unit. The students have to attempt five questions in total, the first being compulsory and selecting one from each unit.

COURSE OBJECTIVE

- To study the various parts of robots and fields of robotics.
- To study the various kinematics and inverse kinematics of robots.
- To study about the localization, planning and navigation.
- To study the control of robots for some specific applications.

UNIT I

INTRODUCTION: History of service robotics, Present status and future trends, Need for service robots-applications examples and Specifications of service and field Robots. Non conventional Industrial robots.

UNIT II

LOCALIZATION: Introduction- Challenges of Localization-Map Representation-Probabilistic Map based Localization Monte carlo localization-Landmark based navigation-Globally unique localization-Positioning beacon systems-Route based localization.

UNIT III

PLANNING AND NAVIGATION Introduction-Path planning overview-Road map path planning-Cell decomposition path planning Potential field path planning-Obstacle avoidance-

UNIT IV

FIELD ROBOTS Ariel robots-Collision avoidance-Robots for agriculture, mining, exploration, underwater, civilian and military applications, nuclear applications, Space applications.

Course Outcome : Upon completion of the course, the student should be able to:

CO1: Explain the basic concepts of working of robot

CO2: Analyze the function of sensors in the robot

CO3: Write program to use a robot for a typical application

CO4: Use Robots in different applications

CO5: Know about the Non conventional Industrial robots.

CO6: Understand the Path Trajectory

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TEXT BOOKS: 1. Roland Siegwart, Illah Reza Nourbakhsh, Davide Scaramuzza, „Introduction to Autonomous Mobile Robots”, Bradford Company Scituate, USA, 2004

2. Riadh Siaer, „The future of Humanoid Robots-Research and applications”, Intech Publications, 2012.

REFERENCES: 1. Richard D Klafter, Thomas A Chmielewski, Michael Negin, "Robotics Engineering—An Integrated Approach", Eastern Economy Edition, Prentice Hall of India P Ltd., 2006. 2. Kelly, Alonzo; Iagnemma, Karl; Howard, And
FIELD AND SERVICE ROBOTICS

Organizational Behavior

Course code					
Course title	Organizational Behaviour				
Category	Humanities and Social Science				
Semester and Credits	L	T	P	Credits	Semester VII
	3	0	0	3	
Classwork	30 Marks				
Exam	70 Marks				
Total	100 Marks				
Duration of Exam	03 Hours				

Note: The examiner will set nine questions in total. Question one will be compulsory. Question one will have seven parts of 2 marks each from all units, and the remaining eight questions of 14 marks each to be set by taking two questions from each unit. The students have to attempt five questions in total, the first being compulsory and selecting one from each unit.

Course Objectives:

The objective of this course is to expose the students to basic concepts of management and provide insights necessary to understand behavioral processes at individual, team and organizational level.

UNIT-I

Introduction of Management- Meaning, definitions, nature of management; Managerial levels, skills and roles in an organization; Functions of Management: Planning, Organizing, staffing, Directing & Controlling, Interrelationship of managerial functions, scope of management & Importance of management. Management and social responsibility, difference between management and administration.

UNIT-II

Introduction of organization:-Meaning and process of Organization, Management v/s Organization; Fundamentals of Organizational Behavior: Concepts, evolution, importance and relationship with other Fields; Contemporary challenges and opportunities of OB. Individual Processes and Behavior-Personality- Concept, determinants and applications; Perception Concept, process and applications, Learning- Concept, theories ; Motivation- Concept, techniques and importance.

UNIT-III

Interpersonal Processes- Teams and Groups- Definition of Group, Stages of group development, Types of groups, meaning of team, merits and demerits of team; difference between team and group, Conflict- Concept, sources, types, management of conflict; Leadership: Concept, function, styles & qualities of leadership. Communication – Meaning, process, channels of communication, importance, barriers and overcome of communication.

UNIT-IV

Organizational Processes: Organizational structure - Meaning and types of organizational structure and their effect on human behavior; Organizational culture - Elements, types and factors affecting organizational culture. Organizational change: Concept, types & factors affecting organizational change, Resistance to Change.

Course Outcomes : On completion of this course, the students will be able

CO1: Students will be able to apply the managerial concepts in practical life.

CO2: The students will be able to understand the concept of organizational behavior at individual level and interpersonal level.

CO3: Students will be able to understand the behavioral dynamics in organizations.

CO4: Students will be able to understand the organizational culture and change.

CO5: Familiarize oneself with various leadership styles and qualities, and their impact on group performance.

CO6: Learn strategies and techniques for managing and resolving conflicts within groups and teams.

Textbooks:

1. Robbins, S.P. and Decenzo, D.A. Fundamentals of Management, Pearson Education Asia, New Delhi.
2. Stoner, J et. al, Management, New Delhi, PHI, New Delhi.
3. Satya Raju, Management – Text & Cases, PHI, New Delhi.
4. Kavita Singh, Organisational Behaviour: Text and cases. New Delhi: Pearson Education.

References:

1. Pareek, Udai, Understanding Organisational Behaviour, Oxford University Press, New Delhi.
2. Robbins, S.P. & Judge, T.A., Organisational Behaviour, Prentice Hall of India, New Delhi.
3. Ghuman Karminder, Aswathappa K., Management concept practice and cases, Mc Graw Hill education.
4. Chhabra T. N., Fundamental of Management, Sun India Publications-New Delhi.

PRACTICAL TRAINING - II

Course code					
Category	Practical Training				
Course title	Practical Training - II				
Scheme and Credits	L	T	P	Credits	Semester
	0	0	2	1	VII
Classwork	-				
Exam	-				
Total	-				
Duration of Exam	-				

The evaluation of Practical Training - I will be based on the seminar, viva voice, and report submitted by the students. According to performance, the students are awarded grades A, B, C, F. A student who is awarded an 'F' grade is required to repeat Practical Training.

A	Excellent
B	Good
C	Satisfactory
F	Not Satisfactory

PROJECT - II

Course code					
Category	Project				
Course title	Project - II				
Scheme and Credits	L	T	P	Credits	Semester
	0	0	8	4	VII
Classwork	100 Marks				
Exam	100 Marks				
Total	200 Marks				
Duration of Exam	03 Hours				

COURSE OBJECTIVE

1. To allow students to demonstrate a wide range of the skills by working on PROJECT-I that has passed through the design, analysis, testing and evaluation.
2. To encourage problem solving skills.
3. To allow students to develop problem solving, synthesis and evaluation skills.
4. To encourage teamwork and leadership.
5. To improve students' communication skills by asking them to produce both a professional report and a professional poster and to give an oral presentation.

Students will be assigned projects individually or in a group of not more than 3 students depending on the efforts required for completion of project.

The project will have 4 stages:

(*Marks for internal evaluation are given in brackets)

1. Synopsis submission (10 marks)
2. 1st mid-term progress evaluation (10 marks)
3. 2nd mid-term progress evaluation (10 marks)
4. Final submission evaluation (20 marks)

The external examiner will evaluate the project on the basis of idea/quality of project, implementation of the project, project report and/or publication and viva.

COURSE OUTCOMES:

At the end of this course, students will demonstrate the ability to

- CO1: Demonstrate a sound technical knowledge of their selected project solution.
- CO2: Undertake problem solution.
- CO3: Design engineering solutions to complex problems utilising a systems approach.
- CO4: Conduct the remaining engineering project.
- CO5: Communicate with team members at large in written and oral form.
- CO6: Demonstrate the knowledge, skills and attitudes of a professional engineer.

Professional Elective IV

Course code					
Category	Elective IV				
Course title	Neural Network and Deep Learning				
Semester and Credits	L	T	P	Credits	Semester VII
	3	0	0	3	
Classwork	30 Marks				
Exam	70 Marks				
Total	100 Marks				
Duration of Exam	03 Hours				

Note: The examiner will set nine questions in total. Question one will be compulsory. Question one will have seven parts of 2 marks each from all units, and the remaining eight questions of 14 marks each to be set by taking two questions from each unit. The students have to attempt five questions in total, the first being compulsory and selecting one from each unit.

COURSE OBJECTIVE:

1. Introduce major deep learning algorithms, the problem settings, and their applications to solve real-world problems.
2. To introduce the idea of artificial neural networks and their architecture
3. To introduce techniques used for training artificial neural networks
4. To enable design of an artificial neural network for classification
5. To enable design and deployment of deep learning models for machine learning problems
6. To apply the algorithms to a real-world problem, optimize the models learned and report on the expected accuracy that can be achieved by applying the models.

UNIT - I

Introduction: Definition, History of Deep Learning, Deep Learning Applications: Image Processing, Natural Language Processing, Speech recognition, Video Analytics;

UNIT - II

Neural Networks: McCulloch-Pitts unit and Thresholding logic, Linear Perceptron, Perceptron Learning Algorithm, Linear separability. Convergence theorem for Perceptron Learning Algorithm. Feed forward Networks: Multilayer Perceptron, Gradient Descent, Back propagation, Empirical Risk Minimization, regularization, autoencoders.

Convolutional Networks: The Convolution Operation - Variants of the Basic Convolution Function - Structured Outputs - Data Types - Efficient Convolution Algorithms - Random or Unsupervised Features- LeNet, AlexNet

UNIT - III

Recurrent Neural Networks: Bidirectional RNNs - Deep Recurrent Networks Recursive Neural Networks - The Long Short-Term Memory and Other Gated RNNs
Generative Adversarial Networks (GANs): Introduction, Discriminator, Generator, Activation, Common activation functions for GANs, BCE loss, Conditional GANs, Controllable generation, real life GANs

UNIT - IV

Deep Generative Models: Boltzmann Machines - Restricted Boltzmann Machines - Introduction to MCMC and Gibbs Sampling gradient computations in RBMs - Deep Belief Networks- Deep Boltzmann Machines

COURSE OUTCOMES:

At the end of this course, students will demonstrate the ability to

CO1: Understand the fundamentals of deep learning and the main research activities in this field.

CO2: Emphasizing knowledge on various deep learning algorithms.

CO3: Understanding of CNN and RNN to model for real-world applications.

CO4: Understanding the various challenges involved in designing deep learning algorithms for varied applications.

CO5: Implement deep learning algorithms and solve real-world problems.

CO6: Identify the deep learning algorithms which are more appropriate for various types of learning tasks in various domains.

TEXT AND REFERENCE BOOKS:

1. Nikhil Buduma, "Fundamentals of Deep Learning: Designing Next-Generation Machine Intelligence Algorithm", O'Reilly, 2017.
2. Ian Goodfellow, YoshuaBengio and Aaron Courville, "Deep Learning", MIT Press, 2016.
3. AurélienGéron, "Hands-On Machine Learning with Scikit- Learn and TensorFlow", O'Reilly, 2017.
4. Nikhil Ketkar, "Deep Learning with Python: A Hands-on Introduction", Apress, 2017.
5. Tariq Rashid, "Make your own neural network ", 2017.

INTELLIGENT INSTRUMENTATION

Course Code						
Category	Professional Elective Courses					
Course title	Intelligent Instrumentation					
Scheme	L	T	P	Credits	Semester: VII	
	3	0	0	3		
Class Work	30 Marks					
Exam	70 Marks					
Total	100 Marks					
Duration of Exam	3 Hrs					

Note: The examiner will set nine questions in total. Question one will be compulsory. Question one will have seven parts of 2 marks each from all units, and the remaining eight questions of 14 marks each to be set by taking two questions from each unit. The students have to attempt five questions in total, the first being compulsory and selecting one from each unit.

Course Objectives:

1. To learn various Intelligent instrumentation.
2. To gain understanding of Data acquisition system and signal processing.
3. To understand Intelligence sensor device for measurement and instrumentation.
4. To understand Interfacing instruments and computers.

Unit-I

Intelligence, features characterizing intelligence, intelligent instrumentation system: features of intelligent instrumentation, components of intelligent instrumentation, block diagram of intelligent instrumentation.

Unit-II

Signal amplification & attenuation (OP-AMP based), instrumentation amplifier (circuit diagram, high CMRR & other features), signal linearization (different types such as diode resistor combination, OPAMP based etc.), bias removal signal filtering (output from ideal filters, output from constant – k filters, matching of filter sections, active analog filters).

Unit-III

OP-AMP based voltage to current converter, current to voltage conversion, signal integration, voltage follower (pre amplifier), voltage comparator, phase locked loop, signal addition, signal multiplication, signal transmission, description of spike filter. Smart sensors: Primary sensors, excitation, compensation, information coding/processing, data compensation, standard for smart sensor interface.

Unit-IV

Interfacing instruments and computers: basic issues of interfacing, address decoding, data transfer control, A/D convertor, D/A convertors, sample & hold circuit, other interface considerations.

Course Outcomes:

At the end of this course, students will be able to

1. Understand the basic characteristic of intelligent instrumentation system Knowledge of new sensor technology
2. Understand the data acquisition system in intelligent instrumentation system
3. Understand the Signal amplification & attenuation.
4. Develop the design methodologies for measurement and instrumentation of real-world problems.
5. Study the concepts of intelligent sensor devices, their performance characteristics and signal and system dynamics.
6. Understand Interfacing instruments and computers.

Text / References

1. Principles of measurements and instrumentation by Alan S Morris, PHI
2. Intelligent instrumentation by Bamay, G.C. Prentice Hall
3. Sensors and transducers by Parranabis, PHI
4. Introduction to digital signal processing: MGH

Machine Vision System

Course code					
Category	Professional Elective IV				
Course title	MACHINE VISION SYSTEMS				
Semester and Credits	L	T	P	Credits	Semester VII
	3	0	0	3	
Classwork	30 Marks				
Exam	70 Marks				
Total	100 Marks				
Duration of Exam	03 Hours				

Note: The examiner will set nine questions in total. Question one will be compulsory. Question one will have seven parts of 2 marks each from all units, and the remaining eight questions of 14 marks each to be set by taking two questions from each unit. The students have to attempt five questions in total, the first being compulsory and selecting one from each unit.

COURSE OBJECTIVE

- To know about the principles and applications of vision system in modern manufacturing environment
- To learn about the algorithms in vision
- To know about the recognition of object
- To be familiar about the applications regarding vision
- To know about the components used for vision.

UNIT I

VISION SYSTEM

Basic Components–Elements of visual perception, Lenses: Pinhole cameras, Gaussian Optics Cameras–Camera-Computer interfaces

UNIT II

VISION ALGORITHMS

Fundamental Data Structures: Images, Regions, Sub-pixel Precise Contours–Image Enhancement Gray value transformations, image smoothing, Fourier Transform–Geometric Transformation–Image segmentation–Segmentation of contours, lines, circles and ellipses–Camera calibration–Stereo Reconstruction.

UNIT III

OBJECT RECOGNITION

Object recognition, Approaches to Object Recognition, Recognition by combination of views–objects with sharp edges, using two views only, using a single view, use of dept values.

UNIT IV

APPLICATIONS:

Transforming sensor reading, Mapping Sonar Data, Aligning laser scan measurements–Vision and Tracking: Following the road, Iconic image processing, Multiscale image processing, Video Tracking Learning landmarks: Landmark spatiograms, K-means Clustering, EM Clustering.

Course Outcome : Upon completion of the course, the student should be able to:

CO1: Knowledge or gadgets of vision systems

CO2: Ability to understand the image capturing and processing techniques

CO3: Ability to apply the vision system in other machines

CO4: Knowledge for recognizing the objects.

CO5: Knowledge in application of vision and image processing in robot operations.

CO6: Ability to understand Image Segmentation

TEXT BOOKS: 1. Roland Siegwart, Illah Reza Nourbakhsh, Davide Scaramuzza, „Introduction to Autonomous Mobile Robots”, Bradford Company Scituate, USA, 2004

2. Riadh Siaer, „The future of Humanoid Robots–Research and applications”, Intech Publications, 2012.

REFERENCES: 1. Richard D Klawter, Thomas A Chmielewski, Michael Negin, "Robotics Engineering–An Integrated Approach", Eastern Economy Edition, Prentice Hall of India P Ltd., 2006. 2. Kelly, Alonzo; Iagnemma, Karl; Howard,

Andrew, "Field and Service Robotics ", Springer, 2011.
ew, "Field and Service Robotics ", Springer, 2011

Totally Integrated Automation

Course code	Totally Integrated Automation				
Category	Professional Elective IV				
Course title	Totally Integrated Automation				
Semester and Credits	L	T	P	Credits	Semester VII
	3	0	0	3	
Classwork	30 Marks				
Exam	70 Marks				
Total	100 Marks				
Duration of Exam	03 Hours				

Note: The examiner will set nine questions in total. Question one will be compulsory. Question one will have seven parts of 2 marks each from all units, and the remaining eight questions of 14 marks each to be set by taking two questions from each unit. The students have to attempt five questions in total, the first being compulsory and selecting one from each unit.

Course Objectives:

- To gain knowledge in automation in industries.
- To gain knowledge in various electrical and electronic programmable automations and their applications
- . • To know about the basic in SCADA and DCS systems.
- To gain knowledge in communication protocols in an integrated system
- To know about the advanced in automation industries

UNIT I

TOTALLY INTEGRATED AUTOMATION:

Need, components of TIA systems, advantages, Programmable Automation Controllers (PAC), Vertical Integration structure.

UNIT II

HMI SYSTEMS:

Necessity and Role in Industrial Automation, Need for HMI systems. Types of HMI- Text display - operator panels - Touch panels - Panel PCs - Integrated displays (PLC & HMI). Check with PLC 502 and remove

UNIT III

SUPERVISORY CONTROL AND DATA ACQUISITION (SCADA)

Overview – Developer and runtime packages – architecture – Tools – Tag – Internal & External graphics, Alarm logging – Tag logging – structured tags– Trends – history– Report generation, VB & C Scripts for SCADA application.

UNIT IV

COMMUNICATION PROTOCOLS of SCADA

Proprietary and open Protocols – OLE/OPC – DDE – Server/Client Configuration – Messaging – Recipe – User administration – Interfacing of SCADA with PLC, drive, and other field device

COURSE OUTCOMES:

- Knowledge of PLC & PAC automation
- Knowledge in HMI systems and to integrate it with other systems.
- Ability to apply SCADA and usage of C programming for report generation
- Acquiring information's on communication protocols in automation systems

TEXT BOOKS:

1. John.W.Webb & Ronald A. Reis, “Programmable logic controllers: Principles and Applications”, Prentice Hall India, 2003.
2. Michael P. Lukas, “Distributed Control systems”, “Van Nostrand Reinhold Company”1995 .

REFERENCES:

1. Win C C Software Manual, Siemens, 2003
2. RS VIEW 32 Software Manual, Allen Bradley, 2005
3. CIMPLICITY SCADA Packages Manual, Fanuc India Ltd, 200

Bachelor of Technology Semester 8

S. No.	Category	Course Code	Course Title	Hours per week			Credits	Marks for Sessional	Marks for End Term Examination	Total
				L	T	P				
1	ESC		MOOC-1 (Essential)	3	0	0	3	25	75	100
	ESC		MOOC-2 (Essential)	3	0	0	3	25	75	100
	PROJ		Project-III/Internship	0	0	16	8	150	150	300
Total							14			500

MOOC-1 (ESSENTIAL)

Course Code						
Category	Engineering Science Course					
Course title	MOOC-1 (Essential)					
Scheme	L	T	P	Credits	Semester: VIII	
	3	0	0	3		
Class Work	25 Marks					
Exam	75 Marks					
Total	100 Marks					
Duration of Exam	3 Hrs					

A student has to complete NPTEL Courses of 12 Weeks respectively through MOOCs. For registration to MOOCs Courses, the students shall follow NPTEL Site <http://nptel.ac.in/> as per the NPTEL policy and norms. The students can register for these courses through NPTEL directly as per the course offering in Odd/Even Semesters at NPTEL. These NPTEL courses (recommended by the University) may be cleared during the B. Tech degree program (not necessary one course in each semester). After successful completion of these MOOCs courses the students, shall, provide their successful completion NPTEL status/certificates to the University (COE) through their college of study only.

MOOC-2 (ESSENTIAL)

Course Code						
Category	Engineering Science Course					
Course title	MOOC-2 (Essential)					
Scheme	L	T	P	Credits	Semester: VIII	
	3	0	0	3		
Class Work	25 Marks					
Exam	75 Marks					
Total	100 Marks					
Duration of Exam	3 Hrs					

A student has to complete NPTEL Courses of 12 Weeks respectively through MOOCs. For registration to MOOCs Courses, the students shall follow NPTEL Site <http://nptel.ac.in/> as per the NPTEL policy and norms. The students can register for these courses through NPTEL directly as per the course offering in Odd/Even Semesters at NPTEL. These NPTEL courses (recommended by the University) may be cleared during the B. Tech degree program (not necessary one course in each semester). After successful completion of these MOOCs courses the students, shall, provide their successful completion NPTEL status/certificates to the University (COE) through their college of study only.

PROJECT-III/INTERNSHIP

Course Code						
Category	Project					
Course title	Project-III/Internship					
Scheme	L	T	P	Credits	Semester: VIII	
	0	0	16	8		
Class Work	150 Marks					
Exam	150 Marks					
Total	300 Marks					
Duration of Exam	3 Hrs					

Course objectives:

1. To allow students to demonstrate a wide range of the skills learned during their course of study by asking them to deliver a product that has passed through the design, analysis, testing and evaluation
2. To encourage multidisciplinary research through the integration learned in a number of courses.
3. To allow students to develop problem solving, analysis, synthesis and evaluation skills.
4. To encourage teamwork.
5. To improve students' communication skills by asking them to produce both a professional report and a professional poster and to give an oral presentation

The students are required to undergo industrial training or institutional project work of duration not less than 4 months in a reputed organization or concerned institute. The students who wish to undergo industrial training, the industry chosen for undergoing the training should be at least a private limited company. The students shall submit and present the midterm progress report at the institute. the presentation will be attended by a committee. Alternately the teacher may visit the industry to get the feedback of the student.

The final Viva voice of the industrial training or institutional project work will be conducted by an external examiner and one external examiner appointed by the institute. External examiner will be from the panel of examiners submitted by the concerned institute approved by the board of studies in engineering and technology. Assessment of industrial training or institutional project work will be based on seminar, viva-voice, report and certificate of industrial training or institutional project work obtained by the student from the industry or institute.

The internal marks distribution for the students who have undergone industrial training consist of 150 marks internally and 150 marks by an external examiner.

Course outcomes

On successful completion of the course students will be able to:

1. Demonstrate a sound technical knowledge of their selected project topic.
2. Undertake problem identification, formulation and solution.
3. Design engineering solutions to complex problems utilising a systems approach.
4. Conduct an engineering project.
5. Communicate with engineers and the community at large in written and oral form.
6. Demonstrate the knowledge, skills and attitudes of a professional engineer.

