



DIPLOMA WING

## RAJIV GANDHI PROUDYOGIKI VISHWAVIDYALAYA, BHOPAL

SCHEME OF STUDIES & EXAMINATIONS ( IMPLEMENTED FROM SESSION : JULY 2023)

SCHEME
OCBC JULY 2022/2023

NAME OF BRANCH
OPTO ELECTRONICS ENGINEERING

BRANCH CODE
O01

SEMESTER
SIXTH (VI)

S.N.	PAPER CODE	SUBJECT CODE	SUBJECT NAME	THEORY COMPONENT							PRACTICAL COMPONENT					TOTAL CREDITS	TOTAL MARKS	
				HRS PER WEEK	CREDITS	TERM WORK			THEORY PAPER		HRS PER WEEK	CREDITS	LAB WORK	PRACTICAL EXAM/VIVA				
						QUIZ/ASSIGNMENT	MID TERM TEST*		TOTAL	MARKS				DURATION	MARKS			DURATION
							I	II										
1	7386	601	ENTREPRENEURSHIP AND START -UPS	4	4	10	10	10	30	70	03 Hrs.	0	0	0	0	0	4	100
2	7478	602	OPTICAL AND DIGITAL COMMUNICATION	7	7	10	10	10	30	70	03 Hrs.	6	3	20	30	3 Hrs.	10	150
3	7605	611	ARTIFICIAL INTELLIGENCE OR	3	3	10	10	10	30	70	03 Hrs.	0	0	0	0	0	3	100
	7607	612	PRODUCT DESIGN															
4	7609	621	MECHATRONICS OR	3	3	10	10	10	30	70	03 Hrs.	0	0	0	0	0	3	100
	7611	622	INDUSTRIAL ROBOTS															
5			INDIAN CONSTITUTION	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0
6			MAJOR PROJECT **	0	0	0	0	0	0	0	0	6	4	100	50	03 Hrs.	4	150
7			SEMINAR ***	3	1	50	0	0	50	0	0	0	0	0	0	0	1	50
8			LIBRARY/VISITS etc.	0	0	0	0	0	0	0	0	2	0	0	0	0	0	0
TOTAL				22	18				170	280		14	7	120	80		25	650

- NOTE -**
- (1)\* Two Best, out of Three Mid Term Tests (Progressive Tests) Marks should be entered here.
  - (2)\*\* One Credit is carried forward from the Vth semester major project evaluation.
  - (3)\*\*\* One Hour Time duration for each student.

GRAND TOTAL OF CREDITS
25

GRAND TOTAL OF MARKS
650



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**DIPLOMA IN OPTO ELECTRONICS ENGINEERING (001)**

*SEMESTER VI*

COURSE TITLE	:	ENTREPRENEURSHIP AND START-UPS
PAPER CODE	:	7386
SUBJECT CODE	:	601
THEORY CREDITS	:	04
PRACTICAL CREDITS	:	00

**Course Learning Objectives:**

1. Acquiring Entrepreneurial spirit and resourcefulness.
2. Familiarization with various uses of human resource for earning dignified means of living.
3. Understanding the concept and process of entrepreneurship - its contribution and role in the growth and development of individual and the nation.
4. Acquiring entrepreneurial quality, competency, and motivation.
5. Learning the process and skills of creation and management of entrepreneurial venture.

**Course Content:**

**Unit 1** - Introduction to Entrepreneurship and Start – Ups

- Definitions, Traits of an entrepreneur, Intrapreneurship, Motivation
- Types of Business Structures, Similarities/differences between entrepreneurs and managers.

**Unit 2** – Business Ideas and their implementation

- Discovering ideas and visualizing the business
- Activity map
- Business Plan

**Unit 3** – Idea to Start-up

- Market Analysis – Identifying the target market,
- Competition evaluation and Strategy Development,
- Marketing and accounting,
- Risk analysis

**Unit 4** – Management

- Company’s Organization Structure,
- Recruitment and management of talent.
- Financial organization and management

**Unit 5** - Financing and Protection of Ideas

- Financing methods available for start-ups in India
- Communication of Ideas to potential investors – Investor Pitch
- Patenting and Licenses

**Unit 6:** Exit strategies for entrepreneurs, bankruptcy, and succession and harvesting strategy

**Learning Outcome:**

Upon completion of the course, the student will be able to demonstrate knowledge of the following topics:

1. Understanding the dynamic role of entrepreneurship and small businesses
2. Organizing and Managing a Small Business
3. Financial Planning and Control
4. Forms of Ownership for Small Business
5. Strategic Marketing Planning
6. New Product or Service Development
7. Business Plan Creation

**SUGGESTED LEARNING RESOURCES:**

<b>S. No.</b>	<b>Title of Book</b>	<b>Author</b>	<b>Publication</b>
1.	The Startup Owner's Manual: The Step-by-Step Guide for Building a Great Company	Steve Blank and Bob Dorf	K & S Ranch ISBN – 978-0984999392
2.	The Lean Startup: How Today's Entrepreneurs Use Continuous Innovation to Create Radically Successful Businesses	Eric Ries	Penguin UK ISBN – 978-0670921607
3.	Demand: Creating What People Love Before They Know They Want It	Adrian J. Slywotzky with Karl Weber	Headline Book Publishing ISBN – 978-0755388974
4.	The Innovator's Dilemma: The Revolutionary Book That Will Change the Way You Do Business	Clayton M. Christensen	Harvard business ISBN: 978-142219602

**SUGGESTED SOFTWARE/LEARNING WEBSITES:**

- a. <https://www.fundable.com/learn/resources/guides/startup>
- b. <https://corporatefinanceinstitute.com/resources/knowledge/finance/corporate-structure/>
- c. <https://www.finder.com/small-business-finance-tips>
- d. <https://www.profitbooks.net/funding-options-to-raise-startup-capital-for-your-business/>

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**DIPLOMA IN OPTO ELECTRONICS ENGINEERING (001)**

*SEMESTER VI*

COURSE TITLE	:	OPTICAL AND DIGITAL COMMUNICATION
PAPER CODE	:	7478
SUBJECT CODE	:	602
THEORY CREDITS	:	07
PRACTICAL CREDITS	:	03

**Course Objectives:**

Transmission of electrical energy through metallic conductors is full of losses and signal deteriorated due to atmospheric interference.

Optical fibers are proving themselves are better replacement of metallic cables because of non atmospheric interference and low transmission losses with this advent, large number of channels are possible to be sent through a thin non metallic fiber.

This subject has been prescribed in the curriculum so that student should understand the constructional features, working of the optical fibers to understand propagation of light signal through it and specification parameters determining state of art applications specially high speed telecommunication.

**Course Content:**

**Unit I: Fundamentals**

Introduction to optical communication: Advantages of Optical Fiber Communication over coaxial cable, microwave link and other conventional communication systems optical fiber communication windows, generation of optical fibers.

**Unit II: Sources And Detectors**

Optical Sources: light emitting diode, laser diode, Laser diode, direct and indirect band gap type semiconductors , homostructure and heterostructures, properties of ideal and practical optoelectronic sources - efficiency spectral width, beam width (directivity)volt current and power current characteristics, bandwidth, stabilisation.

Optica Detectors: Ideal detectors and its characteristics, laser diodes, basic principle of operation, vacuum photodiode, photomultiplier tube, photodiode, phototransistor, photoconductor( LDR) PIN detector, avalanche photodiode,properties of opto electronic detectors like- spectral response responsivity, efficiency, internal gain, speed of response, noise.

**Unit III: Optical Communication**

Optical fiber link design for analog and digital link: Power budgeting, Rise time budgeting, Optical and electrical bandwidth. Intensity modulated systems for analog and digital systems, Modulations: IM, FM/IM, AM/IM, PCM, ADPCM, DM, ADM. Biasing techniques for photoelectronic sources and detectors, Eye pattern Analysis, BER, Intersymbole interference (ISI), Jitter.

#### **Unit IV: Digital Communication**

Introduction to Data Communication: Introduction, Data Transmission mode: simplex, half duplex, full duplex, Difference between Digital and Data Communication, Serial and parallel data transmission, Character codes: Baudot code, ASCII code, LAN, WAN, MAN, FDDI, and OTN.

#### **Unit V: Advance Optical Communication Technologies**

FTTH (Fiber To The Home): ODN, FTTH terminologies, PON and its types, PON network architecture.

WDM (Wavelength division multiplexing): WDM technology, DWDM technology, Advantages of WDM, Erbium Doped Fiber Amplifier (EDFA).

#### Reference Books/Web Portals

S. N.	Title	Author/Publisher
1.	Optical Fiber Communication	By John M Senior
2.	Optical Fiber Communication	By Gerd Keiser
4.	<a href="https://www.thefoa.org">https://www.thefoa.org</a>	
5.	<a href="https://www.tutorialspoint.com/ftth">https://www.tutorialspoint.com/ftth</a>	
6.	Youtube video on Optical Power metre, OTDR and Splicing machine	

#### **Course Outcomes:**

Upon completion of this course, the student will be able to:

- Understand propagation of light in the optical fiber
- Explain various types of optical fiber
- Describe specifications of fiber and related components
- Describe state of the art fiber manufacturing process
- Demonstrate fiber cable structure and its element

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# OPTICAL AND DIGITAL COMMUNICATION LAB

## Suggested List of Experiments

<b>S.N.</b>	<b>Experiment</b>
1.	Audio communication through optical fiber.
2.	Video communication through optical fiber
3.	Digital communication through optical fiber.
4.	Study of computer interfacing through optical fiber.
5.	Study of telephone interfacing through optical fiber
6.	Study of Eye Pattern Analysis
7.	Optical Power Measurement
8.	Measurements using OTDR
9.	Demonstration of Fusion splicing.
10.	Demonstration of Connector assembling
11.	Demonstrate GPON distribution Network Component

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*SEMESTER VI*

COURSE TITLE	:	ARTIFICIAL INTELLIGENCE
PAPER CODE	:	7605
SUBJECT CODE	:	611
THEORY CREDITS	:	03
PRACTICAL CREDITS	:	00

**Course Content:**

**Unit 1 – Introduction to Artificial Intelligence**

- Artificial Intelligence (AI) definition
- Goals of AI
- History of AI
- Applications of AI

**Unit 2 – Agents and Environments**

- Agent Terminology, Types of Agents – Simple Reflex Agents, Model Based Reflex Agents, Goal Based Agents
- Nature of Environments, Properties of Environments

**Unit 3 – Search**

Algorithms

Terminology

- Brute Force Search Strategies – Breadth First Search, Depth First Search.
- Heuristic Search Strategies, Local Search Algorithms.

**Unit 4 – Fuzzy Logic Systems**

Introduction to Fuzzy Logic and Fuzzy systems,

- Membership functions,
- Fuzzification/Defuzzification

**Unit 5 – Neural Networks**

Basic structure of Neural Networks

- Perceptron
- Back-propagation

**Suggested Learning Resources:**

S. No.	Title of Book	Author	Publication
1	Artificial Intelligence By Example: Develop machine intelligence from scratch using real artificial intelligence use cases	Denis Rothman	Packt Publishing ISBN – 978-1788990547

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**SEMESTER VI**

COURSE TITLE	:	PRODUCT DESIGN
PAPER CODE	:	7607
SUBJECT CODE	:	612
THEORY CREDITS	:	03
PRACTICAL CREDITS	:	00

**Course Learning Objectives:**

- To acquire the basic concepts of product design and development process
- To understand the engineering and scientific process in executing a design from concept to finished product
- To study the key reasons for design or redesign.

**Course Content:**

**UNIT-I:** Definition of a product; Types of product; Levels of product; Product-market mix; New product development (NPD) process; Idea generation methods; Creativity; Creative attitude; Creative design process; Morphological analysis; Analysis of interconnected decision areas; Brain storming.

**Unit-II:** Product life cycle; The challenges of Product development; Product analysis; Product characteristics; Economic considerations; Production and Marketing aspects; Characteristics of successful Product development; Phases of a generic product development process; Customer need identification; Product development practices and industry-product strategies.

**Unit-III:** Product design; Design by evolution; Design by innovation; Design by imitation; Factors affecting product design; Standards of performance and environmental factors; Decision making and iteration; Morphology of design (different phases); Role of aesthetics in design.

**Unit-IV:** Introduction to optimization in design; Economic factors in design; Design for safety and reliability; Role of computers in design; Modeling and Simulation; The role of models in engineering design; Mathematical modeling; Similitude and scale models; Concurrent design; Six sigma and design for six sigma; Introduction to optimization in design; Economic factors and financial feasibility in design; Design for manufacturing; Rapid Prototyping (RP); Application of RP in product design; Product Development versus Design.

**Unit-V:** Design of simple products dealing with various aspects of product development; Design starting from need till the manufacture of the product



**Reference Books:**

1. Product Design and Development, Karl T. Ulrich and Steven D. Eppinger, Tata McGraw–Hill edition.
2. Engineering Design –George E. Dieter.
3. An Introduction to Engineering Design methods Vijay Gupta.
4. Merie Crawford : New Product management, McGraw-Hill Irwin.
5. Chitale A K and Gupta R C, “Product Design and Manufacturing”, Prentice Hall of India, 2005.
6. Kevin Otto and Kristin Wood, Product Design, Techniques in Reverse Engineering and New Product Development, Pearson education.

**Course outcomes:**

At the end of the course, the student will be able to:

CO1	Understand the basic concepts of product design and development process.
CO2	Illustrate the methods to define the customer needs.
CO3	Describe an engineering design and development process.
CO4	Understand the intuitive and advanced methods used to develop and evaluate a concept.
CO5	Apply modelling and embodiment principles in product design and development process.

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*SEMESTER VI*

COURSE TITLE	:	MECHATRONICS
PAPER CODE	:	7609
SUBJECT CODE	:	621
THEORY CREDITS	:	03
PRACTICAL CREDITS	:	00

**Course Content:**

**Unit 1**– Introduction to Mechatronics

- Introduction to System Concepts, Analysis and Design
- Mechatronics basic definitions; systems and components;
- Systems with mixed disciplines
- Electronics Fundamentals Review

**Unit 2**– Elements in Mechatronics

- Data conversion devices, sensors, micro-sensors, transducers, signal processing devices, timers
- Microprocessors, Microcontrollers
- PID Controllers and PLCs

**Unit 3**– Drives

- Stepper Motors, Servo Drives
- Linear Motion bearings, cams
- Systems controlled by camshafts, electronic cams
- Tool magazines and indexing mechanisms.

**Unit 4**– Hydraulic Systems

- Flow, Pressure and Direction Control Valves
- Actuators, Supporting Elements, Hydraulic Power Packs, Pumps
- Design of Hydraulic circuits

**Unit 5**– Pneumatic System

- Production, Distribution and conditioning of compressed air
- System Components and Graphic representations
- Design of Systems

**SUGGESTED LEARNING RESOURCES:**

<b>S.No.</b>	<b>Title of Book</b>	<b>Author</b>	<b>Publication</b>
1.	Analysis and design of Dynamic Systems	Cochin, Era and Cadwallender	AddisonWesley, 1997
2.	Mechatronics Engineering	Tomkinson, D. And Horne, J. Longman	McGraw Hill, 1996
3.	Mechatronics	Bolton, W	Pearson
4.	Fundamental of mecha- tronic	M. Jouaneh	Cengage Learning ISBN – 978-1111569020
5.	Mechatronics – An Inte- grated Approach	Clarence W. de Silva	CRC Press ISBN – 978-0849312748

**SUGGESTED SOFTWARE/LEARNING WEBSITES:**

1. [https://youtu.be/Ro\\_tFv1iH6g](https://youtu.be/Ro_tFv1iH6g)
2. <https://www.motioncontroltips.com/faq-what-are-stepper-drives-and-how-do-they-work/>
3. <https://science.howstuffworks.com/robot.htm>
4. <https://howtomechatronics.com/>

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**SEMESTER VI**

COURSE TITLE	:	INDUSTRIAL ROBOTS
PAPER CODE	:	7611
SUBJECT CODE	:	622
THEORY CREDITS	:	03
PRACTICAL CREDITS	:	00

**Course Objectives:**

The goal of the course is to familiarize the students with the concepts and techniques in robotic engineering, manipulator kinematics, dynamics and control, chose, and incorporate robotic technology in engineering systems.

Make the students acquainted with the theoretical aspects of Robotics  
Enable the students to acquire practical experience in the field of Robotics through design projects and case studies.

Make the students to understand the importance of robots in various fields of engineering.  
Expose the students to various robots and their operational details.

**Course Contents:**

**UNIT – I**

Introduction: Automation and Robotics – An over view of Robotics – present and future applications. Components of the Industrial Robotics: common types of arms. Components, Architecture, number of degrees of freedom – Requirements and challenges of end effectors, Design of end effectors, Precision of Movement: Resolution, Accuracy and Repeatability, Speed of Response and Load Carrying Capacity.

**UNIT – II**

Motion Analysis: Basic Rotation Matrices, Equivalent Axis and Angle, Euler Angles, Composite Rotation Matrices. Homogeneous transformations as applicable to rotation and translation – problems. Manipulator Kinematics-H notation-H method of Assignment of frames-H Transformation Matrix, joint coordinates and world coordinates, Forward and inverse kinematics – problems on Industrial Robotic Manipulators.

**UNIT – III**

Differential transformation of manipulators, Jacobians – problems. Dynamics: Lagrange – Euler and Newton – Euler formations – Problems.  
Trajectory planning and avoidance of obstacles, path planning, Slew motion, joint interpolated motion straight line motion.

## **UNIT – IV**

Robot actuators and Feedback components: Actuators: Pneumatic, Hydraulic actuators, electric & stepper motors, comparison of Actuators, Feedback components: position sensors – potentiometers, resolvers, encoders – Velocity sensors, Tactile and Range sensors, Force and Torque sensors – End Effectors and Tools

## **UNIT-V**

Robot Application in Manufacturing: Material Transfer – Material handling, loading and unloading- Processing – spot and continuous arc welding & spray painting – Assembly and Inspection. Robotic Programming Methods – Languages: Lead Through Programming, Textual Robotic Languages such as APT, MCL.

### **Text Books/ Reference Books:**

1. Robot Dynamics and Controls / Spony and Vidyasagar / John Wiley
2. Robot Analysis and control / Asada, Slotine / Wiley Inter-Science
3. Robotics – Fu et al / TMH Publications.
4. Industrial Robotics / Groover M P /Mc Graw Hill
5. Introduction to Industrial Robotics / Ramachandran Nagarajan / Pearson

### **Course Outcomes**

At the end of the course, the student will be able to:

1. Understand the basic components of robots.
2. Differentiate types of robots and robot grippers.
3. Model forward and inverse kinematics of robot manipulators.
4. Analyze forces in links and joints of a robot.
5. Programme a robot to perform tasks in industrial applications.
6. Design intelligent robots using sensors.

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*SEMESTER VI*

COURSE TITLE	:	INDIAN CONSTITUTION
PAPER CODE	:	--
SUBJECT CODE	:	--
THEORY CREDITS	:	00
PRACTICAL CREDITS	:	00

**Course Content**

**Unit 1** – The Constitution - Introduction

- The History of the Making of the Indian Constitution
- Preamble and the Basic Structure, and its interpretation
- Fundamental Rights and Duties and their interpretation
- State Policy Principles

**Unit 2** – Union Government

- Structure of the Indian Union
- President – Role and Power
- Prime Minister and Council of Ministers
- Lok Sabha and Rajya Sabha

**Unit 3** – State Government

- Governor – Role and Power
- Chief Minister and Council of Ministers
- State Secretariat

**Unit 4** – Local Administration

- District Administration
- Municipal Corporation
- Zila Panchayat

**Unit 5** – Election Commission

- Role and Functioning
- Chief Election Commissioner
- State Election Commission

**Suggested Learning Resources:**

<b>S. No.</b>	<b>Title of Book</b>	<b>Author</b>	<b>Publication</b>
1.	Ethics and Politics of the Indian Constitution	Rajeev Bhargava	Oxford University Press, New Delhi, 2008
2.	The Constitution of India	B.L. Fadia	Sahitya Bhawan; New edition (2017)
3.	Introduction to the Constitution of India	DD Basu	Lexis Nexis; Twenty-Third 2018 edition

**Suggested Software/Learning Websites:**

- a. <https://www.constitution.org/cons/india/const.html>
- b. <http://www.legislative.gov.in/constitution-of-india>
- c. <https://www.sci.gov.in/constitution>
- d. <https://www.toppr.com/guides/civics/the-indian-constitution/the-constitution-of-india/>

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**SEMESTER - VI**

COURSE TITLE	:	MAJOR PROJECT
PAPER CODE	:	--
COURSE CODE	:	--
THEORY CREDITS	:	00
PRACTICAL CREDITS	:	04 (03+01 Credit of the V Sem.)

**MAJOR PROJECT**

It should be based on real/live problems of the Industry/Govt./NGO/MSME/Rural Sector or an innovative idea having the potential of a Startup.

Evaluation is based on work done, quality of report, performance in vivavoce, presentation etc

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*SEMESTER VI*

COURSE TITLE	:	SEMINAR
PAPER CODE	:	--
COURSE CODE	:	--
THEORY CREDITS	:	01
PRACTICAL CREDITS	:	00

SEMINAR

Evaluation is based on work done, quality of report, performance in Viva-voce, presentation etc .

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