



# DEPARTMENT OF PRODUCTION TECHNOLOGY

## MIT CAMPUS - CHROME PET

ANNA UNIVERSITY :: CHENNAI – 600 044.

### COURSE PLAN

#### COURSE DETAILS:

Degree	B.E.		
Programme Name	Robotics and Automation Engineering		
Course Code & Title	RO 5403 : Materials for Robots		
Credits	3	Session	February – June 2024
Course Type	PCC	Section	MIT - Campus
Name of the Faculty	<b>Dr.G.Kumaresan</b> Assistant Professor Department of Production Technology, MIT Campus, Anna University, Chennai – 600044.		

#### COURSE CONTENT:

RO5403

### MATERIALS FOR ROBOTS

L	T	P	C
3	0	0	3

#### COURSE OBJECTIVES:

1. To impart knowledge on the various structural features of metallic materials.
2. To describe the various ferrous and nonferrous alloys and their applications.
3. To illustrate the role of heat treatment and surface modification of materials.
4. To review nonmetallic materials and composites with their applications.
5. To enable student to select material for applications including the modern materials.

#### UNIT-I ALLOYS AND PHASE DIAGRAM

9

Atomic structure and inter atomic bonding the structure of crystalline and non-crystalline materials. Constitution of alloys- Solid solution, substitutional and interstitial- phase diagrams, Isomorphous, eutectic, eutectoid, peritectic and peritectoid reactions, iron –carbon equilibrium diagram.

#### UNIT-II FERROUS AND NON FERROUS METALS

9

Classification of the steels—effect of alloying addition of steel-stainless and tool steel-HSLA. Cast iron-Gray, White, Malleable and Spheroidal—alloy cast iron, Copper and Copper alloys, Brass, Bronze and Cupronickel—Aluminium alloys and Al-Cu—precipitation strengthening treatment—Alloys of Aluminium, Titanium and Magnesium.

#### UNIT-III HEAT TREATMENT AND SURFACE MODIFICATION

7

Isothermal transformation diagrams—cooling curves superimposed on I.T. diagram CCR – Types and stages of annealing, stress relief, recrystallization and spheroidizing—normalizing, hardening and tempering of steel—Introduction to case hardening, Thermal spraying, CVD, PVD and nonmetallic coatings.

#### UNIT-IV NON METALLIC MATERIALS AND COMPOSITES

11

Polymers-Thermo, Thermoset Polymers, PE, PS, PVSPMMA, PC, PET, ABS-Engineering Polymers, PA, PPS, PI, PFE- Natural and Synthetic rubbers, Elastomers - Adhesives—Ceramics - Natural and Synthetic Ceramic - Composites – classification - structural composites and applications of composites

#### UNIT-V FUNCTIONAL MATERIALS

9



Introduction to smart materials, principles of piezoelectricity, piezoelectric polymers. Magnetostrictive materials - Magneto resistance effect, Introduction to Electro active polymers, Ionic polymer matrix composite. Shape memory alloys-Bulk Metallic glasses and nano Crystalline materials.

**TOTAL:45PERIODS**

### COURSE OUTCOMES

Upon successful completion of the course, students should be able to:

CO1: Identify the various structural features of metallic materials.

CO2: Recognize the various ferrous and nonferrous alloys with their applications. CO3:

Relate the heat treatment, Coating, microstructure and properties.

CO4: Explain the various nonmetallic materials and composites with their applications. CO5:

Suggest suitable materials for a given application.

Mapping of COs with POs and PSOs												
COs/POs & PSOs	POs											
	1	2	3	4	5	6	7	8	9	10	11	12
CO1	3	2	1	1								1
CO2	3	2	1	1								1
CO3	3	2	1	1								1
CO4	3	2	1	1								1
CO5	3	2	1	1								1
CO/PO&PS O												
Average												

1—Slight, 2—Moderate, 3—Substantial

### TEXTBOOKS:

1. David G. Rethwisch, Callister's 'Materials Science and Engineering', Wiley India Pvt. Limited, 2021.
2. Kenneth G. Budinski and Michael K. Budinski, "Engineering Materials", 9th Indian Reprint, Prentice-Hall of India Private Limited, 2016.

### REFERENCES:

1. Callister's Jr. W.D, Rethwisch, D.G, Materials Science and Engineering, 9th Edition, Wiley, 2014.
2. Donald R. Askeland, Pradeep P. Fulay and Wendelin J. Wright, "The Science and Engineering of Materials", 7th Edition, Cengage Learning, Inc. 2017.
3. Sidney H. Avner, "Introduction to Physical Metallurgy", McGraw Hill Book Company, 2017.
4. Ashby M.F., Material Selection in Mechanical Design, 5th Edition, Butterworth 2017.

### COURSE ALIGNED PROGRAMME OUTCOMES (PO) & PROGRAMME SPECIFIC OUTCOMES (PSO)

PO	Graduate Attribute	Programme Outcome
1	Engineering knowledge	Apply knowledge of mathematics, basic science and engineering science.
2	Problem analysis	Identify, formulate and solve engineering problems.
3	Design/development of solutions	Design a system or process to improve its performance, satisfying its constraints.
4	Conduct investigations of complex problems	Conduct experiments & collect, analyze and interpret the data.
5	Modern tool usage	Apply various tools and techniques to improve the



		efficiency of the system.
6	The Engineer and society	Conduct selves to uphold the professional and social obligations.
7	Environment and sustainability	Design the system with environment consciousness and sustainable development.
8	Ethics	Interacting industry, business and society in a professional and ethical manner.
9	Individual and team work	Function in a multidisciplinary team.
10	Communication	Proficiency in oral and written Communication.
11	Project management and finance	Implement cost effective and improved system.
12	Life-long learning	Continue professional development and learning as a life-long activity.

PSO	Graduates demonstrate
1	Apply the knowledge gained in Mechanical Engineering for design and development and manufacture of engineering systems.
2	Apply the knowledge acquired to investigate research oriented problems in mechanical engineering with due consideration for environmental and social impacts.
3	Use the engineering analysis and data management tools for effective management of multidisciplinary projects.

### COURSE TENTATIVE SCHEDULE / PLAN

S.No	Date	Hrs	Unit	Topics	Text / Ref.
1	7-2-24	4	1	Atomic structure and bonding	T1
2	8-2-24	1,2	1	Alloys and defects	T1
3	14-2-24	4	1	Introduction to Phase diagrams	T1
4	15-2-24	1,2	1	Nil solid solubility phase diagram	T1
5	21-2-14	4	1	Partially solid solubility phase diagram	T1
6	22-2-14	1,2	1	Iron – carbon phase diagram	T1
7	28-2-24	4	2	Classification of steels	T1
8	29-2-24	1,2	2	Classification of cast iron	T1
9	6-3-24	4	2	Copper alloys	T1
10	7-3-24	1,2	2	Aluminium alloys	T1
11	13-3-24	4	2	Titanium alloys	T1
1	14-3-24	1,2	2	Strengthening mechanism	T1
2	20-3-24	4	3	TTT diagram	T1
13	21-3-24	1,2	3	Heat treatment	T1
14	27-3-24	4	3	Hardening and tem[pering	T1
15	28-3-24	1,2	3	PVD and CVD	T1
16	3-4-24	4	4	Introduction to polymers	T2
17	4-4-24	1,2	4	PE , PS, PVS, PMMA	T2
18	10-4-24	4	4	PET, ABS, PA	T2
19	11-4-24	1,2	4	PPS, PI,PTFE	T2
20	17-4-24	4	4	Rubbers	T2
21	18-4-24	1,2	4	Ceramics	T2
22	24-4-24	4	4	Composites	T2
23	25-4-24	1,2	5	Smart materials	R2
24	2-5-24	1,2	5	Shape memory alloys	R2
25	8-5-24	4	5	Bulk metallic glasses	R2
26	9-5-24	1,2	5	Nano materials	R2

### COURSE DELIVERY/INSTRUCTIONAL METHODOLOGIES:

✓ Chalk & Talk	✓ Stud. Assignments	✓ Web Resources
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<input checked="" type="checkbox"/> LCD/Smart boards	<input checked="" type="checkbox"/> Stud. Seminars	<input type="checkbox"/> Add-On Courses
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#### **COURSE ASSESSMENT METHODOLOGIES-DIRECT**

✓ University (End Semester) Examination		✓ Internal Assessment Tests	
✓ Assignments	<input type="checkbox"/> Laboratory Practices	<input type="checkbox"/> Mini/Major Projects	✓ Stud. Seminars
<input type="checkbox"/> Viva Voce	<input type="checkbox"/> Certifications	<input type="checkbox"/> Add-On Courses	<input type="checkbox"/> Others

#### **COURSE ASSESSMENT METHODS**

S.N.	Mode of Assessment	Date	Duration	% Weight
1	Internal Assessment Tests 1		1½ hr	25 %
2	Internal Assessment Tests 2		1½ hr	25 %
3.	University Examination		3 hr	50 %
Additional marks may be given for Assignments / Group / Team Seminar Presentation)				

#### **COURSE ASSESSMENT METHODOLOGIES-INDIRECT**

<input checked="" type="checkbox"/> Assessment of CO (By Feedback, Once)	<input checked="" type="checkbox"/> Student Feedback On Faculty (Once)
<input type="checkbox"/> Assessment of Mini/Major projects by Ext. Experts	<input type="checkbox"/> Others

#### **COURSE (EXTRA) ESSENTIAL READINGS:**

1. NPTEL – LINK
2. **COURSE EXIT SURVEY** (will be collected at end of the course)

The purpose of this survey is to find out from students about their learning experiences and their thoughts about the course.

Rating:	1: Slight (Low)	2: Moderate (Medium)	3: Substantial (High)
CO1:			
CO2:			
CO3:			
CO4:			
CO5:			

#### **COURSE POLICY (Compensation Assessment)**

1. Attending all the assessment is mandatory for every student
2. Course policy will be followed as per the academic course regulation

#### **COURSE ACADEMIC DISHONESTY AND PLAGIARISM**

1. All rules and regulation prescribed by the ACOE, University Departments, are applicable in the Internal Assessment Tests and University (End Semester) Examinations. ([https://acoe.annauniv.edu/download\\_forms/student\\_forms/Guidelines.pdf](https://acoe.annauniv.edu/download_forms/student_forms/Guidelines.pdf))
2. In general, possessing a mobile phone, carrying bits of paper with materials, talking to other students, copying from other students during Internal Assessment Tests and University (End Semester) Examinations will be treated as Malpractice and punishable as per the rules and regulations. The misuse of Assignment / Project / Seminar works from others is considered as academic dishonesty and will be treated with the rules and regulations of the University.

#### **COURSE ADDITIONAL INFORMATION**

Queries / clarifications / discussion (if required) may be e-mailed to / contact the course instructors during their Office Hours.

For Approval		
 Course Faculty	 Course Coordinator	HOD

## DOCUMENTS TO BE MAINTAINED IN COURSE FILE FOR QUALITY IMPROVEMENT (NBA)

May be followed as per regulation

### A.THEORY COURSES

1. Syllabus with 5 course objectives and 5 course outcomes (5COs) for all theory subjects with CO- PO-PSO mapping.
2. Course plan for the total LTPC
3. Question papers to be modified according to blooms taxonomy (latest format may be used), Cos has to be matched according to the mark entry.
4. SEMS marks statement
5. Internal-1, Internal -2, end semester mark entry sheet dully signed by faculty
6. 2 answer sheets/ category copy to be available in course file for the following category students (poor, average and good). A total of 6 sheets to be available.
7. End semester answer sheets if possible from DCOE
8. Assignment/ quiz answer sheets copy to be available in course file for the following category students (poor, average and good).
9. **Result analysis of student's performance for the grades.**  
Example: A-10 students, B-20 students etc.