LAKIREDDY BALI REDDY COLLEGE OF ENGINEERING
(AUTONOMOUS)
L.B.Reddy Nagar, Mylavaram – 521 230.Andhra Pradesh, INDIA
Affiliated to JNTUK, Kakinada & Approved by AICTE New Delhi
NAAC Accredited with 'A' Grade , An ISO 9001:2015 Certified Institution
DEPARTMENT OF AEROSPACE ENGINEERING
Website: http://lbrce.ac.in **Email:** hodaero@lbrce.ac.in **Phone:08659-222933 Ext:623**

COURSE HANDOUT

PART-A

Name of Course Instructor : Nazumuddin Shaik
Course Name & Code : **Aero Engine Repair & Maintenance- 17AE42**
L-T-P Structure : 3-0-0 Credits : 3
Program/Sem/Sec : B.Tech., VIII-Sem. A.Y: 2022-23

PRE-REQUISITE: Thermodynamics, Propulsion

COURSE EDUCATIONAL OBJECTIVES (CEOs): To learn the function of various components of piston engine and inspection, maintenance, troubleshooting of piston engine and overhauling procedures of piston engines, the function of jet engine components and overhauling procedures of Gas turbine components.

COURSE OUTCOMES (COs): At the end of the course, students are able to

CO 1	Classify the piston engine components (Underastand-L2)
CO 2	Inspect and troubleshoot the piston engines components (Underastand-L2)
CO 3	Illustrate the piston engine testing procedures (Underastand-L2)
CO 4	Describe the inspection procedure of jet engine components (Underastand-L2)
CO 5	Prepare overhaul procedures for jet engine components (Understand-L2)

COURSE ARTICULATION MATRIX (Correlation between COs, POs & PSOs):

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	2	2	1	-	-	-	-	-	-	-	3	3	3
CO2	3	2	2	1	-	-	-	-	-	-	-	2	3	3
CO3	3	3	2	1	-	-	-	-	-	-	-	2	3	3
CO4	3	3	3	1	-	-	-	-	-	-	-	3	3	3
CO5	3	2	2	1	-	-	-	-	-	-	-	3	3	3

Note: Enter Correlation Levels **1** or **2** or **3.** If there is no correlation, **put '-'**
1- Slight (Low), **2 –** Moderate (Medium), **3 -** Substantial (High).

REFERENCE BOOKS:

R1 Kroes & Wild, Aircraft Power plants, 7th Edition – McGraw Hill, New York, 1994.
R2 Gas Turbine Engines, TURBOMECA, The English Book Store, New Delhi, 1993.
R3 Pratt & Whitney, The Aircraft Gas Turbine Engine and its Operation, (latest edition), The English Book Store, New Delhi, 1974.

PART-B

COURSE DELIVERY PLAN (LESSON PLAN):

UNIT-I: CLASSIFICATION OF PISTON ENGINE COMPONENTS

S.No.	Topics to be covered	No. of Classes Required	Tentative Date of Completion	Actual Date of Completion	Teaching Learning Methods	HOD Sign Weekly
1.	Introduction to Course and COs and Unit-I	1	19-12-2022		**TLM1&2**	
2.	Types of Piston Engines	1	20-12-2022		**TLM1&2**	
3.	Piston Engines Principles of Operation	1	21-12-2022		**TLM1&2**	
4.	Piston Engines Function of Components	1	22-12-2022		**TLM1&2**	
5.	Piston Engines Materials Used	1	26-12-2022		**TLM1&2**	
6.	Details of Starting the Engines	1	27-12-2022		**TLM1&2**	
7.	Details of Carburetion and Injection Systems for	1	28-12-2022		**TLM1&2**	
8.	Details of Injection Systems	1	29-12-2022		**TLM1&2**	
9.	Details of Small and Large Engines	1	02-01-2023		**TLM1&2**	
10.	Ignition System Components	1	03-01-2023		**TLM1&2**	
11.	Spark Plug Details	1	04-01-2023		**TLM1&2**	
12.	Engine Operating Conditions at Various Altitudes	1	05-01-2023		**TLM1&2**	
13.	Maintenance and Inspection Check to be Carried Out.	1	09-01-2023		**TLM1&2**	
No. of classes required to complete UNIT-I: 13				No. of classes taken:		

UNIT-II: INSPECTIONS OF PISTON ENGINES

S.No.	Topics to be covered	No. of Classes Required	Tentative Date of Completion	Actual Date of Completion	Teaching Learning Methods	HOD Sign Weekly
1.	Introduction to Unit-II	1	10-01-2023		**TLM1&2**	
2.	**Piston engines** inspection	1	11-01-2023		**TLM1&2**	
3.	**Piston engines** Maintenance	1	12-01-2023		**TLM1&2**	
4.	Trouble Shooting	1	18-01-2023		**TLM1&2**	
5.	Inspection of All Engine Components	1	19-01-2023		**TLM1&2**	
6.	Inspection of All Engine Components	1	23-01-2023		**TLM1&2**	
7.	Daily and Routine Checks	1	24-01-2023		**TLM1&2**	
8.	Overhaul Procedures	1	25-01-2023		**TLM1&2**	
9.	Compression Testing of Cylinders	1	30-01-2023		**TLM1&2**	
10.	Special Inspection Schedules	1	31-01-2023		**TLM1&2**	
11.	Engine Fuel, Control and Exhaust Systems	1	01-02-2023		**TLM1&2**	
12.	Control and Exhaust Systems	1	02-02-2023		**TLM1&2**	
13.	Engine Mount and Super Charger	1	06-02-2023		**TLM1&2**	
14.	Checks and Inspection Procedures.	1	07-02-2023		**TLM1&2**	
No. of classes required to complete UNIT-II:14				No. of classes taken:		

UNIT-III: OVERHAULING OF PISTON ENGINES

S.No.	Topics to be covered	No. of Classes Required	Tentative Date of Completion	Actual Date of Completion	Teaching Learning Methods	HOD Sign Weekly
1.	Introduction to Unit-III	1	08-02-2023		**TLM1&2**	
2.	Symptoms of Failure	1	09-02-2023		**TLM1&2**	
3.	Fault Diagnostics	1	13-02-2023		**TLM1&2**	
4.	Case Studies of Different Engine Systems	1	14-02-2023		**TLM1&2**	
5.	Tools and Equipment Requirements for Various Checks and Alignment During Overhauling	1	20-02-2023		**TLM1&2**	
6.	Tools for Inspection and Tools for Safety and for Visual Inspection –	1	21-02-2023		**TLM1&2**	
7.	Methods and Instruments for Non-Destructive Testing Techniques	1	22-02-2023		**TLM1&2**	
8.	Non-Destructive Testing Techniques	1	23-02-2023		**TLM1&2**	
9.	Equipment for Replacement of Part and Their Repair. Engine Testing	1	27-02-2023		**TLM1&2**	
10.	Engine Testing Procedures and Schedule Preparation, Online Maintenance	1	28-02-2023		**TLM1&2**	
No. of classes required to complete UNIT-III:12				No. of classes taken:		

UNIT-IV : CLASSIFICATION OF JET ENGINE COMPONENTS

S.No.	Topics to be covered	No. of Classes Required	Tentative Date of Completion	Actual Date of Completion	Teaching Learning Methods	HOD Sign Weekly
1.	Introduction to Unit-IV	1	01-03-2023		**TLM1&2**	
2.	Types of Jet Engines – Principles of Operation – Functions of Components – Materials Used	1	02-03-2023		**TLM1&2**	
3.	Details of Starting and Operating Procedures	1	06-03-2023		**TLM1&2**	
4.	Gas Turbine Engine Inspection & Checks – Use of Instruments for Online Maintenance –	1	07-03-2023		**TLM1&2**	
5.	Special Inspection Procedures: Foreign Object Damage – Blade Damage – Etc.	1	08-03-2023		**TLM1&2**	
6.	Maintenance Procedures of Gas Turbine Engines	1	09-03-2023		**TLM1&2**	
7.	Trouble Shooting and Rectification Procedures	1	13-03-2023		**TLM1&2**	
8.	Component Maintenance Procedures	1	14-03-2023		**TLM1&2**	
9.	Systems Maintenance Procedures. Gas Turbine Testing Procedures –Test Schedule Preparation	1	15-03-2023		**TLM1&2**	
10.	Storage of Engines –Preservation and De-Preservation Procedures	1	16-03-2023		**TLM1&2**	
No. of classes required to complete UNIT-IV:10				No. of classes taken:		

UNIT-V : OVERHAUL PROCEDURES

S.No.	Topics to be covered	No. of Classes Required	Tentative Date of Completion	Actual Date of Completion	Teaching Learning Methods	HOD Sign Weekly
1.	Introduction to Unit-V	1	20-03-2023		**TLM1&2**	
2.	Engine Overhaul Procedures	1	21-03-2023		**TLM1&2**	
3.	Inspections and Cleaning of Components	1	22-03-2023		**TLM1&2**	
4.	Repairs Schedules for Overhaul	1	23-03-2023		**TLM1&2**	
5.	Balancing of Gas Turbine Components	1	27-03-2023		**TLM1&2**	
6.	Gas Turbine Trouble Shooting	1	28-03-2023		**TLM1&2**	
7.	Procedures for Rectification	1	29-03-2023		**TLM1&2**	
8.	Condition Monitoring of the Engine On Ground	1	30-03-2023		**TLM1&2**	
9.	Condition Monitoring of the Engine On at Altitude	1	03-04-2023		**TLM1&2**	
10.	Engine Health Monitoring and Corrective Methods.	1	04-04-2023		**TLM1&2**	
11.	Revision	1	05-04-2023		**TLM1&2**	
No. of classes required to complete UNIT-V:10				No. of classes taken:		

Teaching Learning Methods			
TLM1	Chalk and Talk	**TLM4**	Demonstration (Lab/Field Visit)
TLM2	PPT	**TLM5**	ICT (NPTEL/Swayam Prabha/MOOCS)
TLM3	Tutorial	**TLM6**	Group Discussion/Project

PART-C

EVALUATION PROCESS (R17 Regulations):

Evaluation Task	Marks
Assignment-I (Unit-I)	A1=5
Assignment-II (Unit-II)	A2=5
I-Mid Examination (Units-I & II)	M1=20
I-Quiz Examination (Units-I & II)	Q1=10
Assignment-III (Unit-III)	A3=5
Assignment-IV (Unit-IV)	A4=5
Assignment-V (Unit-V)	A5=5
II-Mid Examination (Units-III, IV & V)	M2=20
II-Quiz Examination (Units-III, IV & V)	Q2=10
Attendance	B=5
Assignment Marks = Best Four Average of A1, A2, A3, A4, A5	A=5
Mid Marks =75% of Max(M1,M2)+25% of Min(M1,M2)	M=20
Quiz Marks =75% of Max(Q1,Q2)+25% of Min(Q1,Q2)	B=10
Cumulative Internal Examination (CIE) : A+B+M+Q	40
Semester End Examination (SEE)	60
Total Marks = CIE + SEE	100

PART-D

PROGRAMME OUTCOMES (POs):

PO 1	**Engineering knowledge**: Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.
PO 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.
PO 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.
PO 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.
PO 5	**Modern tool usage**: Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modelling to complex engineering activities with an understanding of the limitations
PO 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
PO 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.
PO 8	**Ethic**s: Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.
PO 9	**Individual and team work**: Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.
PO 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.
PO 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.
PO 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.

PROGRAMME SPECIFIC OUTCOMES (PSOs):

PSO 1	To apply the knowledge of Aerodynamics, Propulsion, Aircraft structures and Flight Dynamics in the Aerospace vehicle design
PSO 2	To prepare the students to work effectively in Aerospace and Allied Engineering organizations

Course Instructor	Module Coordinator	HOD
Mr. Nazumuddin Shaik	Dr. P. Lovaraju	Dr. P. Lovaraju

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L B Reddy Nagar, Mylavaram-521 230, Krishna District, Andhra Pradesh.

COURSE HANDOUT

Part-A

PROGRAM : B.Tech., VIII-Sem., Aerospace Engineering

ACADEMIC YEAR : 2022-23

COURSE NAME & CODE : Helicopter Engineering-17AE35

L-T-P STRUCTURE : 3-1-0

COURSE CREDITS 3

COURSE INSTRUCTOR : **Ashutosh shukla**

COURSE COORDINATOR : **Ashutosh shukla**

PRE-REQUISITES : **Aerodynamics-I and Aerodynamics-II**

COURSE EDUCATIONAL OBJECTIVES (CEOs): The main objectives of this course are to learn about wind tunnels, different flow visualization methods, instrumentation for measuring fluid velocity, temperature and pressure. Also to learn about data acquisition and uncertainty analysis.

COURSE OUTCOMES(COs): At the end of the course, the student will be able to:

CO1 : To analyze the performance various components of helicopter

CO2 : To apply momentum theory in the design of propeller

CO3 : To analyze the performance of helicopter in various operating conditions

CO4 : To analyze the stability modes of helicopter

COURSE ARTICULATION MATRIX(Correlation between COs&POs,PSOs):

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3						3		1			3	3	3
CO2	3	3	2				3		1			3	3	3
CO3	3	3	3				3					3	3	3
CO4	3	3	3				3		1			3	3	3

Note: Enter Correlation Levels **1** or **2** or **3.** If there is no correlation, **put '-'1-** Slight(Low), **2 –** Moderate(Medium), **3 -** Substantial (High).

BOS APPROVED REFERENCE BOOKS:

1. E. Rathakrishnan., Helicopter Aerodynamics, PHI, 2018.
2. Gessow, A., Myers, Aerodynamics of Helicopter, G.C MacMillan & Co., N.Y. 1987.
3. B. W. McCormick, Aerodynamics of V/STOL Flight, Academic Press, 1987.
4. W. Johnson, Helicopter Theory, Princeton university Press, 1980.
5. B. W. McCormick, Aerodynamics, Aeronautics & Flight Mechanics, John Wiley, 1995.

Part-B

COURSE DELIVERY PLAN (LESSON PLAN): Section-A

UNIT-I: BASICS OF HELICOPTER CONFIGURATION

S.No.	Topics to be covered	No. of Classes Required	Tentative Date of Completion	Actual Date of Completion	Teaching Learning Methods	Learning Outcome COs	Text Book followed	HOD Sign Weekly
1.	Introduction	1	19-12-2022		**TLM1**	CO1	T1	
2.	Configurations of Helicopter	1	20-12-2022		**TLM1**	CO1	T1	
3.	Specifics of Helicopters	1	21-12-2022		**TLM1**	CO1	T1	
4.	Articulated Rotor Systems	1	22-12-2022		**TLM2**	CO1	T1	
5.	Effect of Cyclic Pitch Change	1	26-12-2022		**TLM1**	CO1	T1	
6.	Swash Plate	2	28-12-2022 29-12-2022		**TLM1**	CO1	T1	
7.	Fully Articulated Rotor	1	02-01-2023		**TLM1**	CO1	R1 to R5	
8.	TUTORIAL-I	1	03-01-2023		**TLM3**	CO1	T1	
9.	Semi-Rigid rotor	1	04-01-2023		**TLM1**	CO1	T1	
10.	Rigid Rotor, Coriolis effect	2	05-01-2023 09-01-2023		**TLM1**	CO1	R1 to R5	
11.	Objective-1 ,assignment1	1	10-01-2023		**TLM3**	CO1	T1	
No. of classes required to complete UNIT-I: 11					No. of classes taken:			

UNIT-II: MOMENTUM THEORY

S.No.	Topics to be covered	No. of Classes Required	Tentative Date of Completion	Actual Date of Completion	Teaching Learning Methods	Learning Outcome COs	Text Book followed	HOD Sign Weekly
1.	Thrust Generation	1	18-01-2023		**TLM1**	CO2	T1,R1 to R5	
2.	Hovering	1	19-01-2023		**TLM1**	CO2	T1	
3.	Figure of Merit	2	23-01-2023 24-01-2023		**TLM2**	CO2	T1	
4.	**Blade element**	1	25-01-2023		**TLM1**	CO2	R1 to R5	

5.	TUTORIAL-II	1	30-01-2023		**TLM3**	CO2	T1	
6.	Local Solidity, Top Loss	1	31-01-2023		**TLM1**	CO2	R1 to R5	
7.	Performance of ideally twisted Constant Chord B	1	01-02-2023		**TLM1**	CO2	T1	
8.	Rapid performance in Hover	1	02-02-2023		**TLM1**	CO2	R1 to R5	
9.	Equivalent Chord	1	06-02-2023		**TLM1**	CO2	T1	
10.	Assignment2,objective 2	1	07-02-2023		**TLM3**	CO2	R1 to R5	
No. of classes required to complete UNIT-II: 11					No. of classes taken:			

UNIT-III: PERFORMANCE IN HOVERING AND CLIMBING

S.No.	Topics to be covered	No. of Classes Required	Tentative Date of Completion	Actual Date of Completion	Teaching Learning Methods	Learning Outcome COs	Text Book followed	HOD Sign Weekly
1.	Introduction	1	08-02-2023		**TLM1**	CO3	T1,R1 to R5	
2.	Optimum Hovering	1	09-02-2023		**TLM1**	CO3	T1	
3.	Induced Torque	1	13-02-2023		**TLM3**	CO3	R1 to R5	
4.	Profile Drag Torque	1	14-02-2023		**TLM2**	CO3	T1	
5.	TUTORIAL-III	1	20-02-2023		**TLM3**	CO3	T1	
6.	Performance Equation	2	21-02-2023 22-02-2023		**TLM1**	CO3	T1	
7.	Optimum Rotor Design	1	23-02-2023,		**TLM1**	CO3	T1	
8.	Ground effect	1	28-02-2023		**TLM1**	CO3	T1	
9.	Objective-3 Assignment3	1	01-03-2023		**TLM3**	CO3	T1	
No. of classes required to complete UNIT-III: 12					No. of classes taken: 11			

UNIT-IV: PERFORMANCE IN HORIZONTAL FLIGHT

S.No.	Topics to be covered	No. of Classes Required	Tentative Date of Completion	Actual Date of Completion	Teaching Learning Methods	Learning Outcome COs	Text Book followed	HOD Sign Weekly
1.	Introduction	1	02-03-2023		**TLM1**	CO3	T1, R1 to R5	
2.	Flapping and lag Hinge	1	06-03-2023		**TLM2**	CO3	T1	
3.	Steady Hover, Equilibrium in Horizontal Blade	1	07-03-2023		**TLM3**	CO3	R1 to R5	
4.	Blade Hinge Motion	1	09-03-2023		**TLM1**	CO3	T1	
5.	TUTORIAL-IV	1	13-03-2023		**TLM3**	CO3	T1	
6.	Blade Element Angle of Attack - Flapping Coefficient	1	14-03-2023		**TLM1**	CO3	R1 to R5	
7.	Performance equation, Drag-Lift Ratio	1	15-03-2023		**TLM1**	CO3	T1	
8.	Profile Drag-Lift Ratio Charts	1	16-03-2023		**TLM1**	CO3	R1 to R5	
9.	Profile Power, Parasite Power	1	20-03-2023		**TLM1**	CO3	T1, T2	
10.	Blade Stall	1	21-03-2023		**TLM1**	CO3	T1	
11.	Objective-IV Assignment-IV	1	23-03-2023		**TLM3**	CO3	R1 to R5	
No. of classes required to complete UNIT-IV: 11					No. of classes taken:			

UNIT-V: STABILITY AND CONTROL

S.No.	Topics to be covered	No. of Classes Required	Tentative Date of Completion	Actual Date of Completion	Teaching Learning Methods	Learning Outcome COs	Text Book followed	HOD Sign Weekly
1.	introduction	1	27-03-2023		**TLM1**	CO4	T1, R1 to R5	
2.	Trim - Static Stability	1	28-03-2023		**TLM1**	CO4	T1	
3.	Dynamic Stability	1	29-03-2023		**TLM3**	CO4	R1 to R5	

4.	Rotor Static Stability	1	03-04-2023		**TLM1**	CO4	T1	
5.	Stability in hover	1	04-04-2023		**TLM1**	CO4	T1	
6.	TUTORIAL-IV	1	05-04-2023		**TLM3**	CO4	R1 to R5	
7.	Dynamic Stability Reduction	1	06-04-2023		**TLM1**	CO4	T1	
8.	Stability in Forward Flight	1	07-04-2023		**TLM1**	CO4	R1 to R5	
9.	Objective-V Assignment-V	1	08-04-2023		**TLM2**	CO4	T1	
10.	**II Mid Examinations**	**3 days**						
No. of classes required to complete			UNIT-V: 12		No. of classes taken:			
Total number of classes			63					

CONTENTS BEYOND THE SYLLABUS:

S.No.	Topics to be covered	No. of Classes Required	Tentative Date of Completion	Actual Date of Completion	Teaching Learning Methods	Learning Outcome COs	Text Book followed	HOD Sign
1.	Advanced Topics in Unit I	1	16-07-2018		**TLM1**	CO1	T1, R1 to R5	
2.	Advanced Topics in Unit II	1	10-08-2018		**TLM1**	CO2		
3.	Advanced Topics in Unit III	1	07-09-2018		**TLM1**	CO3		
4.	Advanced Topics in Unit IV	1	28-09-2018		**TLM1**	CO4		
5.	Advanced Topics in Unit V	1	26-10-2018		**TLM1**	CO5		

Teaching Learning Methods			
TLM1	Chalk and Talk	**TLM4**	Demonstration (Lab/Field Visit)
TLM2	PPT	**TLM5**	ICT (NPTEL/SwayamPrabha/MOOCS)
TLM3	Tutorial	**TLM6**	Group Discussion/Project

ACADEMIC CALENDAR:

Description	From	To	Weeks
Commencement of Class Work: 11-06-2018			
I Phase of Instructions	**11-06-2018**	**11-08-2018**	9
I Mid Examinations	**13-08-2018**	**18-08-2018**	1
II Phase of Instructions	**20-08-2018**	**27-10-2018**	10
II Mid Examinations	**29-10-2018**	**03-11-2018**	1
Preparation and Practicals	**05-11-2018**	**17-11-2018**	2
Semester End Examinations	**19-11-2018**	**01-12-2018**	2

Part - C

EVALUATION PROCESS:

Evaluation Task	COs	Marks
Assignment/Quiz – 1	1	A1=05
Assignment/Quiz – 2	2	A2=05
I-Mid Examination	1,2	B1=20
I-Online Mid Examination	1,2	C1=10
Assignment/Quiz – 3	3	A3=05
Assignment/Quiz – 4	4	A4=05
Assignment/Quiz – 5	5	A5=05
II-Mid Examination	3,4,5	B2=20
II-Online Mid Examination	3,4,5	C2=10
Evaluation of Assignment/Quiz Marks: A=(A1+A2+A3+A4+A5)/5	1,2,3,4,5	**A=05**
Evaluation of Mid Marks: B=75% of Max(B1,B2)+25% of Min(B1,B2)	1,2,3,4,5	**B=20**
Evaluation of Online Mid Marks: C=75% of Max(C1,C2)+25% of Min(C1,	1,2,3,4,5	**C=10**
Attendance: D (≥95% =**5M**; 90%≤A<95%=**4M;** 85%≤A<90%=**3M;** 80%≤A<85%=**2M;** 75%≤A<80%=**1M; <75%=0M)**	-	**D=05**
Cumulative Internal Examination: A+B+C+D	**1,2,3,4,5**	**A+B+C+D=40**

Semester End Examinations: E	**1,2,3,4,5**	**E=60**
Total Marks: A+B+C+D+E	**1,2,3,4,5**	**100**

PROGRAMME OUTCOMES (POs):

Engineering Graduates will be able to:

PO1: To apply the knowledge of mathematics, science, engineering fundamentals and an engineering specialization to the solution of complex engineering problems.

PO2: To identify, formulate, review research literature and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences and engineering sciences.

PO3: To 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.

PO4: To 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.

PO5: To create, select and apply appropriate techniques, resources, and modern engineering and IT tools including predictions and modeling to complex engineering activities with an understanding of limitations.

PO6: To 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

PO7: To understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development

PO8: To apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice

PO9: To function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.

PO10: To communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and effective reports and design documentation, make effective presentations, and give and receive clear instructions.

PO11: To 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.

PO12: To 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

PROGRAMME SPECIFIC OUTCOMES (PSOs):

PSO1: To apply the knowledge of Aerodynamics, Propulsion, Aircraft structures and Flight Dynamics in the Aerospace vehicledesign

PSO2: To prepare the students to work effectively in the Aerospace and Allied Engineering organizations

Position	***Course Instructor***	***Module Coordinator***	***HOD***
Name			
Signature			

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L.B.Reddy Nagar, Mylavaram-521230, Krishna Dist, Andhra Pradesh, India

DEPARTMENT OF MECHANICAL ENGINEERING

COURSE HANDOUT

PART-A

Name of Course Instructor : Mr. A. NAGESWARA RAO
Course Name & Code : Robotic & Automation-17ME82
L-T-P Structure : 4-0-0 Credits : 3
Program/Sem/Sec : B.Tech., ASE., VIII-Sem., Sections- A A.Y : 2022-23

Pre-requisite Course: None
Course Educational Objectives (CEOs): To impart knowledge on
1. The basic concepts of automation and material handling.
2. Robot configurations and components.
3. The various types of end effectors.
4. Programming techniques for industrial robots.
5. Sensors and actuators used in robotics.
6. Applications of robot.

Course Outcomes (COs):
At the end the student will be able to learn
1. Learn fundamentals in Automation.
2. Identify various robot configurations and components
3. Select and design of various end effectors.
4. Study various Methods of robot programming.
5. Select appropriate actuators and sensors for a robot based on specific application.

COURSE ARTICULATION MATRIX (Correlation between COs and POs and PSOs):

Mapping of Course Outcomes (COs) with Programme Outcomes (POs) & PSOs – ROBOTICS AND AUTOMATION (17ME82)															
		POs											PSOs		
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
COs	CO1			1					1					3		
	CO2		2	2	2				2						3	
	CO3	3	2	3					2				2		3	
	CO4				3									3		
	CO5			2											3	

3. Highly correlated 2. Moderate correlated 1. Lightly correlated
PO: Program Outcome (Defined by AICTE), PSO: Program Specific Outcomes
Programme Specific Outcomes (PSOs):
1. To apply the principles of thermal sciences to design and develop various thermal systems.
2. To apply the principles of manufacturing technology in the design, analysis and manufacturability of products.
3. To apply the basic principles of mechanical engineering design for evaluation of performance of various systems relating to transmission of motion and power, conservation of energy and other process equipment.

TEXT BOOK

1. Mikell P.Groover,"Automation, Production systems and computer Integrated Manufacturing", Prentice Hall of India Private Limited,New Delhi, 2008.
2. MikellP.Groover, MITCHELL WEISS, ROGER N. Nagel& NICHOLAS G. Odrey; Industrial Robotics, McGraw- HILL International Editions, 1986.

REFERENCES

1. R.K.Mittal and IJ Nagrath, Robotics and Control ,Tata Mc Graw – Hill publishing company Limited, New Delhi,2003.
2. Robert J.Schilling, Fundamentals of robotics analysis & control, PHI learning private limited, New Delhi, 2009.
3. Saeed B.Niku, Introduction to robotics analysis systems Application, PHI learning private limited, New Delhi, 2004.
4. K.S.Fu, R.C Gonzalez and C.S.G.Lee, Robotics control, Sensing, vision, and intelligence; Mc Graw HILL International Editions,1987.
5. Richard D.Klafter, Thomus A. Chmielewski, Michael Negin, "Robotic Engineering – An integrated approach", Prentice Hall India Private ltd, New Delhi, 2010.

PART-B

COURSE DELIVERY PLAN (LESSON PLAN):

UNIT-I: AUTOMATION

S.No.	Topics to be covered	No. of Classes Required	Tentative Date of Completion	Actual Date of Completion	Teaching Learning Methods	HOD Sign Weekly
1.	Introduction to Subject	1	19.12.2022		TML1	
2.	Course Outcomes	1	20.12.2022		TML1	
3.	Introduction	1	21.12.2022		TML1	
4.	Types and strategies of automation	1	22.12.2022		TML1	
5.	Pneumatic component circuits	1	26.12.2022		TML2	
6.	Hydraulic component circuits	1	27.12.2022		TML2	
7.	Introduction to material handling systems	1	28.12.2022		TML1	
8.	Types of equipment, functions	1	29.12.2022		TML2	
9.	functions		02.01.2023		TML2	
10.	Design of material handling system	1	03.01.2023		TML1	
11.	Conveyor systems	1	04.01.2023		TML1	
12.	Automated guided vehicle system	1	05.01.2023		TML1	
No. of classes required to complete UNIT-I:12				No. of classes taken:		

UNIT-II: ROBOTICS

S.No.	Topics to be covered	No. of Classes Required	Tentative Date of Completion	Actual Date of Completion	Teaching Learning Methods	HOD Sign Weekly
1.	Introduction to Robotics	1	09.01.2023		TML1	
2.	Basic concepts of robotics	1	10.01.2023		TML1	

3.	Robot anatomy-manipulator, link, DOF	1	11.01.2023		TML1	
4.	Components of robot	1	12.01.2023		TML1	
5.	Robot motions and No of DOF	1	18.01.2023		TML1	
6.	Work volume	1	19.01.2023		TML2	
7.	Classification of robot by control method	1	23.01.2023		TML1	
8.	Configurations of Robots	1	24.01.2023		TML2	
9.	Specification of robot	1	25.01.2023		TML2	
10.	Precision of movement	1	30.01.2023		TML1	
No. of classes required to complete UNIT-II:10				No. of classes taken:		

UNIT-III: ACTUATORS & END EFFECTORS

S.No.	Topics to be covered	No. of Classes Required	Tentative Date of Completion	Actual Date of Completion	Teaching Learning Methods	HOD Sign Weekly
1.	Introduction to Actuators and End effectors	1	06.02.2023		TML1	
2.	Types of Actuators-Pneumatic and hydraulic actuators	1	07.02.2023		TML1	
3.	Stepper motors control units	2	08.02.2023		TML2	
4.	Types of end effectors-Mechanical end effectors	1	09.02.2023		TML1	
5.	Mechanical end effectors	1	13.02.2023		TML1	
6.	Vacuum end effectors and magnetic end effectors	1	14.02.2023		TML1	
7.	Adhesive end effectors and other Robot end effectors	1	15.02.2023		TML1	
8.	Interface	1	16.02.2023		TML1	
9.	Consideration in gripper selection and design	1	20.02.2023		TML2	
10.	Gripper design	1	21.02.2023		TML2	
No. of classes required to complete UNIT-III:14				No. of classes taken:		

UNIT-IV : ROBOT PROGRAMMING

S.No.	Topics to be covered	No. of Classes Required	Tentative Date of Completion	Actual Date of Completion	Teaching Learning Methods	HOD Sign Weekly
1.	Introduction to Robot programming-Methods of robot programming	1	22.02.2023		TML1	
2.	Lead through method	1	23.02.2023		TML1	
3.	Textual robot languages-Generation of programming languages	1	27.02.2023		TML1	
4.	Robot language structure-Motion commands	1	28.02.2023		TML1	
5.	End effector and sensor commands	1	01.03.2023		TML1	
6.	VAL II programming languages	1	02.03.2023		TML2	

7.	PROGRAMME-1	1	06.03.2023		TML1	
8.	PROGRAMME-2	1	07.03.2023		TML1	
9.	RAIL	1	09.03.2023		TML2	
10.	AML	1	13.03.2023		TML3	
No. of classes required to complete UNIT-IV:12				No. of classes taken:		

UNIT-V : SENSORS &ROBOT APPLICATION

S.No.	Topics to be covered	No. of Classes Required	Tentative Date of Completion	Actual Date of Completion	Teaching Learning Methods	HOD Sign Weekly
1.	Introduction to sensors-types of sensors	1	14.03.2023		TML2	
2.	Acoustic sensors	1	15.03.2023		TML2	
3.	Optic, pneumatic sensors	1	16.03.2023		TML2	
4.	Force/torque sensor	2	20.03.2023		TML1	
5.	optical encoders-Machine vision	1	21.03.2023		TML2	
6.	Robotics applications-Robots in manufacturing	1	23.03.2023		TML2	
7.	Robots in manufacturing	1	27.03.2023		TML2	
8.	Non-manufacturing applications	2	28.03.2023		TML2	
9.	Future applications	1	29.03.2023		TML2	
10.	Future applications	1	03.04.2023		TML3	
No. of classes required to complete UNIT-V:12				No. of classes taken:		

Teaching Learning Methods			
TLM1	Chalk and Talk	**TLM4**	Demonstration (Lab/Field Visit)
TLM2	PPT	**TLM5**	ICT (NPTEL/Swayam Prabha/MOOCS)
TLM3	Tutorial	**TLM6**	Group Discussion/Project

PART-C

EVALUATION PROCESS (R17 Regulations):

Evaluation Task	**Marks**
Assignment-I (Unit-I)	A1=5
Assignment-II (Unit-II)	A2=5
I-Mid Examination (Units-I & II)	M1=20
Assignment-III (Unit-III)	A3=5
Assignment-IV (Unit-IV)	A4=5

Assignment-V (Unit-V)	A5=5
II-Mid Examination (Units-III, IV & V)	M2=20
Assignment Marks = Best Four Average of A1, A2, A3, A4, A5	A=5
Mid Marks =75% of Max(M1,M2)+25% of Min(M1,M2)	M=20
Cumulative Internal Examination (CIE) : A+M	40
Semester End Examination (SEE)	60
Total Marks = CIE + SEE	100

PART-D

PROGRAMME OUTCOMES (POs):

PO 1	**Engineering knowledge**: Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.
PO 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.
PO 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.
PO 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.
PO 5	**Modern tool usage**: Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modelling to complex engineering activities with an understanding of the limitations
PO 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
PO 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.
PO 8	**Ethic**s: Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.
PO 9	**Individual and team work**: Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.
PO 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.
PO 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.
PO 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.

PROGRAMME SPECIFIC OUTCOMES (PSOs):

PSO a	Specify, design and analyze systems that efficiently generate, transmit and distr electrical power.
PSO b	Design and analyze electrical machines, modern drive and lighting systems
PSO c	Specify, design, implement and test analog and embedded signal processing electronic systems.
PSO d	Design controllers for electrical and electronic systems to improve their perform

Course Instructor	Course Coordinator	Module Coordinator	HOD
Mr.A.Nageswara Rao	Mr.A.Nageswara Rao	Mr.J.Subba Reddy	Dr.S.Pichi Reddy

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Department of Aerospace Engineering
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A.Y:22-23

Comprehensive Viva-Voce - Schedule

S.No.	Roll Numbers	Schedule Date	Actual Date
1	18761A2145	26-12-22	
2	19761A2101	26-12-22	
3	19761A2102	27-12-22	
4	19761A2103	27-12-22	
5	19761A2104	28-12-22	
6	19761A2105	28-12-22	
7	19761A2106	02-01-23	
8	19761A2108	02-01-23	
9	19761A2109	03-01-23	
10	19761A2110	03-01-23	
11	19761A2111	04-01-23	
12	19761A2113	04-01-23	
13	19761A2114	09-01-23	
14	19761A2115	09-01-23	
15	19761A2116	10-01-23	
16	19761A2117	10-01-23	
17	19761A2118	23-01-23	
18	19761A2119	23-01-23	
19	19761A2120	24-01-23	
20	19761A2121	24-01-23	
21	19761A2122	25-01-23	
22	19761A2123	25-01-23	
23	19761A2124	30-01-23	
24	19761A2125	30-01-23	
25	19761A2126	31-01-23	
26	19761A2127	31-01-23	
27	19761A2128	01-02-23	
28	19761A2129	01-02-23	
29	19761A2130	20-02-23	
30	19761A2131	20-02-23	
31	19761A2132	21-02-23	

S.No	Roll Numbers	Schedule Date	Actual Date
32	19761A2133	21-02-23	
33	19761A2134	22-02-23	
34	19761A2135	27-02-23	
35	19761A2136	27-02-23	
36	19761A2137	28-02-23	
37	19761A2138	28-02-23	
38	19761A2139	01-03-23	
39	19761A2140	01-03-23	
40	19761A2141	06-03-23	
41	19761A2143	06-03-23	
42	19761A2144	07-03-23	
43	19761A2146	07-03-23	
44	19761A2147	13-03-23	
45	19761A2148	13-03-23	
46	19761A2149	14-03-23	
47	20765A2101	14-03-23	
48	20765A2102	15-03-23	
49	20765A2103	15-03-23	
50	20765A2104	20-03-23	
51	20765A2105	20-03-23	
52	20765A2106	21-03-23	
53	20765A2107	21-03-23	
54	20765A2108	27-03-23	

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DEPARTMENT OF AEROSPACE ENGINEERING

COURSE HANDOUT

Part-A

PROGRAM : B.Tech., VIII-Sem., ASE
ACADEMIC YEAR : 2022-23
COURSE NAME & CODE : Project Work & 17PD11
L-T-P STRUCTURE : 0-0-24
COURSE CREDITS : 12
COURSE EDUCATIONAL OBJECTIVES (CEOs):
COURSE OUTCOMES (COs)

After completion of the course, the student will be able to

17PD11:1	Apply domain specific concepts to solve real time problems
17PD11:2	Prepare a technical report with required analysis
17PD11:3	To work in teams with professional and ethical values.

COURSE ARTICULATION MATRIX (Correlation between COs&POs,PSOs):

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	1	1	----	2	----	3	---	----	----	3	3	2	3	3
CO2	1	1		2	----	2	---	----	----	2	3	1	3	3
CO3	----	----	-	3	----	----	----	2	----	3	3	3	3	3

Note: Enter Correlation Levels **1** or **2** or **3.** If there is no correlation, **put '-'**
1- Slight (Low), **2** – Moderate (Medium), **3** - Substantial (High).

Part-B

COURSE DELIVERY PLAN (LESSON PLAN):

S.No	Review No	Tentative Date of Review	Particulars	Actual Date of Review
1	Literature Survey	VII Sem (19-11-2022)	Literature Survey and Abstract Submission	
2	Review-1	03-03-2023	Design Methodology & Implementation	
3	Review-2	01-04-2023	Results & Discussion with Future Scope	
4	External Viva-voce	12-04-2023	External Viva-voce	

Note: All the Project Guides are informed to supervise their allotted batches for the smooth execution of Project.

Project Coordinator	Module Coordinator	HOD