Faculty of Engineering and Technology, BGS Institute of Technology, Department of Robotics & Artificial Intelligence

Scheme for Third Semester (Robotics & Artificial Intelligence)

Sl. No	Course Code	Title of the Course	Teaching Department	Teaching Hours/Semester						Examination		
				Classroom Instructions(CI) (in Hrs. per Semester)		Lab Instructions(LI) (in Hrs. per Semester)	Term Work(TW)+ Self Learning (in Hrs. per Semester)	Total No of Hrs. per Semester	Total Credits (C) * (Total Hrs./30)	Continuous Internal Examination	Semester End Examination	Marks
				L	T	P	SL	Hrs.	Credits	CIE Marks	SEE Marks	Total Marks
1	26BRAICC3A	Engineering Mathematics-V	Mathematics	28	14	25	23	90	90/30=3	50	50	100
2	26BRAICC3B	Basics of Robotics and Programming	RAI/ME	28	14	25	23	90	90/30=3	50	50	100
3	26BRAICC3C	Solid and Fluid Mechanics	RAI/ME	28	14	25	23	90	90/30=3	50	50	100
4	26BRAICC3D	Robot Operating System	RAI/CSE	28	14	25	23	90	90/30=3	50	50	100
5	26BRAIIC3E	Sensors and Actuators for Robotics	RAI/ME/ECE	42	14	42	22	120	120/30=4	50	50	100
6	26BRAIPL3F	Robot Programming Lab	RAI			30		30	30/30=1	50	50	100
7	26BRAIPL3G	MAT Lab	RA/ME			30		30	30/30=1	50	50	100
8	26BENGAE3H	Soft Skill Development-I	RAI	14			16	30	30/30=1	50	50	100
	26BENGIK3I	Indian Health Science	RAI	14			16	30	30/30=1	50	50	100
10	26BENGNC3J	Sports	PED			30		30		50	--	50
11	26BRAIIN3K	Internship-I	RAI			20	10	30	30/30=1	50	50	100
				182	70	252	156	660	21	550	500	1050
For Lateral Entry Students Only												
12	26BRAICC3L	Python Programming	RAI	28	14	25	23	90	90/30=3	50	50	100
13	26BENGLE3M	Applied Mathematics-I	Mathematics	14			16	30	---	50	--	50
For 2025 Admitted Students Only												
14	26BRAICC3L	Python Programming	RAI/CSE	28	14	25	23	90	90/30=3	50	50	100

#AICTE Activity points (20 X 05=100)

Faculty of Engineering and Technology, BGS Institute of Technology, Department of Robotics & Artificial Intelligence

Scheme for Fourth Semester (Robotics & Artificial Intelligence)

Sl. No	Course Code	Title of the Course	Teaching Department	Teaching Hours/Semester						Examination		
				Classroom Instructions (CI) (in Hrs. per Semester)		Lab Instructions(LI) (in Hrs. per Semester)	Term Work(TW)+ Self Learning (in Hrs. per Semester)	Total No of Hrs. per Semester	Total Credits (C) * (Total Hrs./30)	Continuous Internal Examination	Semester End Examination	Marks
				L	T	P	SL	Hrs.	Credits	CIE Marks	SEE Marks	Total Marks
1	26BRAICC4A	Engineering Mathematics-VI	Mathematics	28	14	25	23	90	90/30=3	50	50	100
2	26BRAICC4B	Robot Kinematics and Dynamics	RAI/ME	28	14	25	23	90	90/30=3	50	50	100
3	26BRAICC4C	Data Acquisition and Robotic Vision	RAI/ME/CSE	28	14	25	23	90	90/30=3	50	50	100
4	26BRAICC4D	Introduction to AI and ML	RAI/CSE/AIML	28	14	25	23	90	90/30=3	50	50	100
5	26BRAIIC4E	Design of Robotic Components	RAI/ME	42	14	42	22	120	120/30=4	50	50	100
6	26BRAIPL4F	Data Acquisition and Robotic Vision Lab	RAI/EC			30		30	30/30=1	50	50	100
7	26BRAIPL4G	Simulation Lab	RAI/ME/ECE			30		30	30/30=1	50	50	100
8	26BENGAE4H	Soft Skill Development-II	RAI	14			16	30	30/30=1	50	50	100
9	26BENGIK4I	Indian Agriculture	RAI	30				30	30/30=1	50	50	100
10	26BENGNG4J	Yoga	PED			30		30	---	50	--	50
				198	70	232	130	630	20	500	450	950
For Lateral Entry Students Only												
11	26BRAICC4K	Fundamentals of Robotics & Applications	RAI	28	14	25	23	90	90/30=3	50	50	100
12	26BENGLE4L	Applied Mathematics-II	Mathematics	14			16	30	---	50	--	50
For 2025 Admitted Students Only												
13	26BRAICC4K	Fundamentals of Robotics & Applications	RAI	28	14	25	23	90	90/30=3	50	50	100

#AICTE Activity points (20 X 05=100)

Faculty of Engineering and Technology, BGS Institute of Technology, Department of Robotics & Artificial Intelligence

Scheme for Fifth Semester (Robotics & Artificial Intelligence)

Sl. No	Course Code	Title of the Course	Teaching Department	Teaching Hours/Semester						Examination		
				Classroom Instructions(CI) (in Hrs. per Semester)		Lab Instructions(LI) (in Hrs. per Semester)	Term Work(TW)+ Self Learning (in Hrs. per Semester)	Total No of Hrs. per Semester	Total Credits (C) * (Total Hrs./30)	Continuous Internal Examination	Semester End Examination	Marks
				L	T	P	SL	Hrs.	Credits	CIE Marks	SEE Marks	Total Marks
1	26BENGHS5A	Management & Entrepreneurship	RAI	28	14	25	23	90	90/30=3	50	50	100
2	26BRAICC5B	Data Structures and Algorithms	RAI/CSE	28	14	25	23	90	90/30=3	50	50	100
3	26BRAIIC5C	Advanced AI and ML	RAI/CSE	42	14	42	22	120	120/30=4	50	50	100
4	26BRAIPE5D 26BRAIPE5E 26BRAIPE5F 26BRAIPE5G 26BRAIPE5H	Professional Elective-I	RAI	28	14	25	23	90	90/30=3	50	50	100
5	26BRAIOE5I 26BRAIOE5J 26BRAIOE5K 26BRAIOE5L 26BRAIOE5M	Open Elective-I	RAI	28	14	25	23	90	90/30=3	50	50	100
6	26BRAIPL5N	AI & ML Lab	RAI/AIML			30		30	30/30=1	50	50	100
7	26BRAIPL5O	Data Structures and Algorithms Lab	RAI/CSE			30		30	30/30=1	50	50	100
8	26BENGAE5P	Soft Skill Development-III	RAI	14			16	30	30/30=1	50	50	100
9	26BENGIK5Q	Vedic Mathematics	Mathematics	14			16	30	30/30=1	50	50	100
10	26BENGNG5R	Constitution of India & Professional Ethics	RAI/ME	14			16	30	---	50	--	50
11	26BRAIIN5S	Internship-II	RAI			20	10	30	30/30=1	50	50	100
				196	70	222	172	660	21	550	500	1050

Faculty of Engineering and Technology, BGS Institute of Technology, Department of Robotics & Artificial Intelligence

Scheme for Sixth Semester (Robotics & Artificial Intelligence)

Sl. No	Course Code	Title of the Course	Teaching Department	Teaching Hours/Semester						Examination		
				Classroom Instructions(CI) (in Hrs. per Semester)		Lab Instructions(LI) (in Hrs. per Semester)	Term Work(TW)+ Self Learning (in Hrs. per Semester)	Total No of Hrs. per Semester	Total Credits (C) * (Total Hrs./30)	Continuous Internal Examination	Semester End Examination	Marks
				L	T	P	SL	Hrs.	Credits	CIE Marks	SEE Marks	Total Marks
1	26BRAICC6A	Micro Aerial Robots	RAI	28	14	25	23	90	90/30=3	50	50	100
2	26BRAICC6B	Control Engineering	RAI/ECE	28	14	25	23	90	90/30=3	50	50	100
3	26BRAIIC6C	Mechatronics	RAI/ECE	42	14	42	22	120	120/30=4	50	50	100
4	26BRAIPE6D 26BRAIPE6E 26BRAIPE6F 26BRAIPE6G 26BRAIPE6H	Professional Elective-II	RAI	28	14	25	23	90	90/30=3	50	50	100
5	26BRAIOE6I 26BRAIOE6J 26BRAIOE6K 26BRAIOE6L 26BRAIOE6M	Open Elective –II	RAI	28	14	25	23	90	90/30=3	50	50	100
6	26BRAIPL6N	Computer Integrated Manufacturing Laboratory	RAI/ME			30		30	30/30=1	50	50	100
7	26BRAIPL6O	Microcontroller Lab	RAI/ECE			30		30	30/30=1	50	50	100
8	26BENGAE6P	Soft Skill Development-IV	RAI	14			16	30	30/30=1	50	50	100
9	26BENGIK6Q	Art & Culture	Humanities	14			16	30	30/30=1	50	50	100
10	26BENGNG6R	Environmental Studies	RAI	14			16	30	---	50	--	50
				196	70	202	162	630	20	500	450	950

Faculty of Engineering and Technology, BGS Institute of Technology, Department of Robotics & Artificial Intelligence

Scheme for Seventh Semester (Robotics & Artificial Intelligence)

Sl. No	Course Code	Title of the Course	Teaching Department	Teaching Hours/Semester						Examination		
				Classroom Instructions(CI) (in Hrs. per Semester)		Lab Instructions (LI) (in Hrs. per Semester)	Term Work (TW)+ Self Learning (in Hrs. per Semester)	Total No of Hrs. per Semester	Total Credits (C) * (Total Hrs./30)	Continuous Internal Examination	Semester End Examination	Marks
				L	T	P	SL	Hrs.	Credits	CIE Marks	SEE Marks	Total Marks
1	26BRAICC7A	Smart Mobile Robots	RAI	28	14	25	23	90	90/30=3	50	50	100
2	26BRAICC7B	Drive System for Robots	RAI	28	14	25	23	90	90/30=3	50	50	100
3	26BRAIIC7C	IoT and Communication Systems	RAI/ECE	42	14	42	22	120	120/30=4	50	50	100
4	26BRAIPE7D 26BRAIPE7E 26BRAIPE7F 26BRAIPE7G 26BRAIPE7H	Professional Elective-III	RAI	28	14	25	23	90	90/30=3	50	50	100
5	26BRAIOE7I 26BRAIOE7J 26BRAIOE7K 26BRAIOE7L 26BRAIOE7M	Open Elective- III	RAI	28	14	25	23	90	90/30=3	50	50	100
6	26BRAIPL7N	Robot Programming and Simulation Lab	RAI			30		30	30/30=1	50	50	100
7	26BRAIPL7O	IoT Lab	RAI			30		30	30/30=1	50	50	100
8	26BRAIPW7P	Project Work Phase-I	RAI			70	20	90	90/30=3	50	50	100
				154	70	272	134	630	21	400	400	800

Faculty of Engineering and Technology, BGS Institute of Technology, Department of Robotics & Artificial Intelligence

Scheme for Eight Semester (Robotics & Artificial Intelligence)

Sl. No	Course Code	Title of the Course	Teaching Department	Teaching Hours/Semester						Examination		
				Classroom Instructions(CI) (in Hrs. per Semester)		Lab Instructions(LI) (in Hrs. per Semester)	Term Work(TW)+ Self Learning (in Hrs. per Semester)	Total No of Hrs. per Semester	Total Credits (C) * (Total Hrs./30)	Continuous Internal Examination	Semester End Examination	Marks
				L	T	P	SL	Hrs.	Credits	CIE Marks	SEE Marks	Total Marks
1	26BRAIPW8A	Project Work Phase-II	RAI			150	30	180	180/30=06	50	50	100
2	26BRAIIN8B	Internship-III	RAI			80	10	90	90/30=03	50	50	100
3	26BRAITS8C	Technical Seminar	RAI			20	40	60	60/30=02	50	50	100
						250	80	3	11	150	150	300

Sem	1	2	3	4	5	6	7	8
Credits	23	23	21	20	21	20	21	11

Electives

	5th semester		6th semester		7th semester	
	Course code	**Course Name**	**Course code**	**Course Name**	**Course code**	**Course Name**
	Professional Elective -I		**Professional Elective -II**		**Professional Elective -III**	
Professional Elective	26BRAIPE5D	Medical Robots	26BRAIPE6D	Underwater Robotics	26BRAIPE7D	Digital Manufacturing
	26BRAIPE5E	Data Visualization	26BRAIPE6E	Hydraulic & Pneumatic Drives for Robots	26BRAIPE7E	Robot Gripper Design
	26BRAIPE5F	Cloud Computing	26BRAIPE6F	Micro-Electro- Mechanical Systems	26BRAIPE7F	Object Oriented Programming and Its Applications
	26BRAIPE5G	Robot Safety and Maintenance	26BRAIPE6G	Augmented Reality and Virtual Reality	26BRAIPE7G	Digital Signal Processing
	26BRAIPE5H	Collaborative Robots	26BRAIPE6H	Digital Twin and Industry 5.0	26BRAIPE7H	Industrial Automation Systems

	5th semester		6th semester		7th semester	
	Course code	**Course Name**	**Course code**	**Course Name**	**Course code**	**Course Name**
	Open Elective -I		**Open Elective -II**		**Open Elective -III**	
Open Elective	26BRAIOE5I	Mechatronics	26BRAIOE6I	Automation in Manufacturing Systems	26BRAIOE7I	Micro-Electro-Mechanical Systems
	26BRAIOE5J	Fundamentals of Robotics & Applications	26BRAIOE6J	Smart Mobile Robots	26BRAIOE7J	Industrial Automation Systems
	26BRAIOE5K	Hydraulic & Pneumatic Drives for Robots	26BRAIOE6K	IOT Concepts and Applications	26BRAIOE7K	Data Visualization
	26BRAIOE5L	Collaborative Robots	26BRAIOE6L	Robot Safety and Maintenance	26BRAIOE7L	Augmented Reality and Virtual Reality
	26BRAIOE5M	Data Acquisition and Robotic Vision	26BRAIOE6M	Autonomous Vehicles	26BRAIOE7M	Digital Twin and Industry 5.0

1. Course Information

Section	Details
Course Title	Engineering Mathematics-V
Course Code	26BRAICC3A
Program	ECE & RAI
Academic Year/Semester	2026-2027 / 3rd Semester
Course Type	✓ **Core** ☐ Elective ☐ Lab
Pre-Requisite	Matrix Algebra and Linear Systems, Differentiation and Integration, Differential Equations & Complex Numbers and Functions.
Contact Hours per Semester	Lecture: 28 Tutorial: 14 Practical: 25 Self-Learning: 23 Total: 90
Credits	03
W.e.f	2026-2027
Approved in AC on	June. 2026
Course Description	This course introduces statistical methods, transform techniques and matrix decomposition tools used in Engineering problems. It covers curve fitting, correlation and regression analysis, Laplace transforms, Fourier series, Eigenvalue problems, LU decomposition and Z-transforms. The course emphasizes analytical techniques for solving differential and difference equations.

2. Course Objectives

- Apply statistical methods, transform techniques and regression analysis to analyse and solve Engineering problems.
- Develop problem-solving skills using matrix decomposition techniques, Eigenvalue analysis and transform methods to solve systems of equations in Engineering applications.

3. Course Outcomes (COs)

COs	Course Outcome Statement	BTL	POs Mapped
CO1	Apply curve fitting, correlation and regression techniques to analyze Engineering data and solve statistical problems using least squares methods and regression models.	3	PO1, PO2, PO5
CO2	Apply Laplace and inverse Laplace transforms to solve differential equations and Engineering problems.	3	PO1, PO2, PO5
CO3	Use the Fourier series and harmonic analysis to represent periodic functions and solve Engineering problems.	3	PO1, PO2, PO5

CO4	Understand and apply matrix decomposition techniques, Eigenvalues and quadratic forms in solving Engineering problems.	3	PO1, PO2, PO5
CO5	Apply Z-transforms and inverse Z-transforms to solve difference equations.	3	PO1, PO2, PO5

4. Course Content (Module-Wise)

Module	Topics	L-T-P-SL= TOTAL Hours	COs	BTL	SDG
I	**Applied Statistical Methods:** Curve fitting by the method of at least squares- fitting the curves of the form: $y = ax + b$ *and* $y = ax^2 + bx + c$. Correlation and Regression-Karl Pearson's coefficient of correlation, Regression analysis- lines of regression and problems. **Self-Learning: Fitting the curves of the form: $y = ax^b$ and $y = ab^x$.**	06-03-05-05=19	CO1	3	4
II	**Laplace Transforms:** Introduction, Definition and Laplace transform of elementary functions, Properties of Laplace transforms (without proof). Laplace transforms of $(e^{at}f(t), t^n f(t), \frac{f(t)}{t})$, Unit step function (Heaviside functions) –problems. **Inverse Laplace Transform:** Definition and general properties, Solution of linear differential equation. **Self-Learning: Convolution theorem- Problems.**	06-03-05-05=19	CO2	3	4
III	**Fourier Series:** Introduction to infinite series, convergence and divergence. Periodic functions, Dirichlet's condition. Fourier series of periodic functions with period 2l and Practical harmonic analysis - Simple problems **Self-Learning: Half range Fourier series- Simple problems.**	06-03-05-05=19	CO3	3	4
IV	**Matrix Decomposition**: Eigen values and Eigen Vectors-Introduction, Solution of system of linear equations by LU Decomposition method of order two and Diagonalization of a square matrix of order two. **Self-Learning: Constrained optimization.**	05-03-05-04=17	CO4	3	4
V	**Z-Transform:** Introduction, Definition, Standard Z-transforms, damping rule, shifting rule, Inverse Z-Transforms, Application of Z-transforms to solve difference equations **Self-Learning: Application of Z-Transforms in Digital Signal Processing (DSP) and Discrete-Time System Analysis.**	05-02-05-04=16	CO5	3	4

Total Hours	28-14-25-23=90
Credits = Total Hrs/30	90/30=03

5. CO–PO Mapping Matrix

CO \ PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
CO1	3	3	-	-	2	-	-	-	-	-	-
CO2	3	3	-	-	2	-	-	-	-	-	-
CO3	3	3	-	-	2	-	-	-	-	-	-
CO4	3	3	-	-	2	-	-	-	-	-	-
CO5	3	3	-	-	2	-	-	-	-	-	-

(*Mapping: 1 – Low, 2 – Medium, 3 – High*)

6. CO–SDG Mapping Matrix

CO \ SDG	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17
CO1	-	-	-	3	-	-	-	-	-	-	-	-	-	-	-	-	-
CO2	-	-	-	3	-	-	-	-	-	-	-	-	-	-	-	-	-
CO3	-	-	-	3	-	-	-	-	-	-	-	-	-	-	-	-	-
CO4	-	-	-	3	-	-	-	-	-	-	-	-	-	-	-	-	-
CO5	-	-	-	3	-	-	-	-	-	-	-	-	-	-	-	-	-

(*Mapping: 1 – Low, 2 – Medium, 3 – High*)

7. Details of Practical's Sessions (if applicable)

Practical	Title of Experiment / Activity
1	Curve fitting using least square method for $y = ax + b$ & $y = ax^2 + bx + c$.
2	Solve the Ordinary Differential Equations Using Laplace and Inverse Laplace Transforms.
3	Find Fourier series for a function with period 2l.
4	Solve system of linear equations using LU decomposition method.
5	Program for Computing Z-Transforms and Inverse Z-Transforms of Discrete-Time Sequences.

8. Textbooks

S. No.	Author(s)	Title	Publisher & Year
1	B. S. Grewal	Higher Engineering Mathematics	Khanna Publishers, 44th Edition, 2024
2	Erwin Kreyszig	Advanced Engineering Mathematics	John Wiley & Sons, 10th Edition, 2017.

9. Reference Books

S. No.	Author(s)	Title	Publisher & Year
1	Michael D. Greenberg	Advanced Engineering Mathematics	Pearson, 2nd Edition, 2013.
2	Dennis G. Zill	A First Course in Differential Equations with Modelling Applications	Cengage Learning, 11th Edition, 2017.
3	Martin Braun	Laplace Transforms and their applications	Springer Publishers, 3rd Edition, 2017.

10. Assessment Scheme

Component	Weightage (%)
Internal Assessment Test I	10
Internal Assessment Test II	10
Internal Assessment Test III	10
Other Assessments	10
Assignment/Presentation	10
End Semester Examination	50

11. Course Outcome Attainment

Type	Method
Direct	Internal Tests, Other Assessments, Assignments & End Semester Examination.
Indirect	Course Exit Survey & Student Feedback.

Prepared by	Vetted by		Confirmed by
Faculty	**HOD**	**IQAC, ACU**	**Principal**
Name: **Mrs. Dakshayini G**	**Name:** **Dr. Yuvaraja B K**	**Name:** **Dr. M Shankar**	**Name:** **Dr. B N Shobha**
Designation: **Assistant Professor**	**Designation:** **Professor & Head**	**Designation:** **Director, IQAC**	**Designation:** **Dean & Principal**
Signature:	**Signature:**	**Signature:**	**Signature:**

1. Course Information

Section	Details
Course Title	Basics of Robotics and Programming
Course Code	26BRAICC3B
Program	Robotics and Artificial Intelligence
Academic Year/Semester	2026-2027/III
Course Type	☐✔ **Core** ☐Elective ☐ Lab
Prerequisite (If any)	Basic Mathematics, Engineering Mechanics, and Programming Fundamentals.
Contact Hours per Semester	Lecture:28 Tutorial:14 Practical:25 SL:23 Total: 90
Credits	3
W.e.f	2026
Approved in AC on	June 2026
Course Description	Basics of Robotics and Programming introduces the fundamental principles, design, and applications of robotics in modern engineering and industry. The course introduces robotic structures, sensors, actuators, control systems, kinematics, dynamics, and programming. The course emphasizes both theoretical understanding and practical applications, covering industrial automation, mobile robotics, and emerging fields such as service and medical robotics. Hands-on exposure to robotic programming, simulation tools, and real-world case studies prepare students to design and analyze robotic systems for diverse applications.

2. Course Objectives

1. Understand and discuss the fundamental elementary concepts of Robotics.
2. Provide insight into different types of robots.
3. Explain intelligent modules for robotic motion control.
4. Illustrate the applications of robots in industries

3. Course Outcomes (COs)

COs	Course Outcome Statement	BTL	Pos Mapped
CO1	Identify and describe the components and anatomy of robotic system	2	PO1, PO2, PO11
CO2	Know about various path planning techniques and analyze different motions of robotics system	3	PO1, PO2, PO3, PO4, PO11
CO3	Use suitable drives and end-effectors for a given robotics application and robotics sensors	2	PO1, PO2, PO3, PO6, PO11
CO4	Formulate different types of robot cell layouts and use modern tools to write robot programs for different tasks	3	PO1, PO2, PO3, PO5, PO8, PO9, PO10, PO11

4. Course Content (Module-Wise)

Module	Topics	L-T-P-SL=TOTAL	COs/BTL/SDG
I	**Introduction to robotics**: Introduction to Robotics, laws of robot, brief history of robotics, basic components of robot, robot specifications, classification of robots, human system and robotics, social impact, Robotics market, and the prospects, advantages, disadvantages and applications.	06-03-05-05=19	**1/2/4,9**
II	**Robot motion analysis**: Anatomy of a Robot, Robot configurations: polar, cylindrical, Cartesian, and jointed arm configurations, Robot links and joints, Degrees of freedom: types of movements, vertical, radial and rotational traverse, roll, pitch and yaw, Wok volume/envelope, Robot kinematics: Introduction to direct and inverse kinematics, transformations and rotation matrix.	06-03-05-05=19	**2/3/4,9,11**
III	**Drives and Grippers:** Drives – Basic types of drives. Advantages and Disadvantages of each type. Selection / suitability of drives for Robotic application. Controllers, Types of Controllers and introduction to close loop controller Grippers, Mechanical Gripper-Grasping force, mechanisms for actuation, Magnetic gripper vacuum cup gripper considerations in gripper selection & design.	06-03-05-05=19	**3/2/4,7,9**
IV	**Robot Applications:** Material transfer and machine loading/unloading, processing operations assembly and inspection. Programming and Languages: Methods of robot programming, Introduction to various languages, Features of each type and development of languages for recent robot systems.	05-03-05-04=17	**3/2/4,7,9**
V	**Introduction to robot programming:** Robot cell layout, work cell control and interlocks, manual programming, lead through and walk through programming, off-line programming, robot programming languages, examples.	05-02-05-04=16	**4/3/4,9,11**
	Total Hrs	**28-14-25-23=90**	
	Credits=Total Hrs/30	**90/30=03**	

5. CO–PO Mapping Matrix

CO \PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
CO1	3	1									1
CO2	3	3	2	2							2
CO3	3	2	3			1					1
CO4	2	2	3		3			2	1	1	2

(*Mapping:1 –Low, 2– Medium,3 – High*)

6. CO–SDG Mapping Matrix

CO/ SDG	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17
CO1				3					2								
CO2				3					3		2						
CO3				3			2		3								
CO4				3					3		2						

7. Details of Practical's Sessions (if applicable)

Practical	Title of Experiment/Activity
1	
2	
3	

8. Textbooks

S. No.	Author(s)	Title	Publisher & Year
1	R. K. Mittal and I. J. Nagrath	Robotics and Control	Tata- McGraw-Hill Publications, 2017
2	Fu K. S, Gonzelez R. C, Lee C. S. G	Robotics: Control, Sensing, Vision, Intelligence	McGraw Hill Book Co., 2008.

9. Reference Books

S. No.	Author(s)	Title	Publisher & Year
1	Raig, J. J	Introduction to Robotics: Mechanics and Control	Pearson Prentice Hall Publications, 3rd Edition, 2005
2	Chilling R. J	Fundamentals of Robotics, Analysis and Control	Prentice Hall Publications, Eastern Economy edition, 2007

10. Assessment Scheme

Component	Weightage (%)
Internal Assessment Test-I	10
Internal Assessment Test-II	10
Internal Assessment Test-III	10
Other Assessment	10
Assignments/ Presentation	10
Semester End Examination	50

11. Course Outcome Attainment

Type	Method
Direct	Internal Tests, Assignments, Semester End Exams.
Indirect	Course Exit Survey, Student Feedback

Prepared by	Vetted by		Confirmed by
Faculty	**HOD**	**IQAC, ACU**	**Principal**
Name: Keerthi B L	**Name: Dr. Girisha K B**	**Name:**	**Name: Dr. B N Shobha**
Designation: Assistant Professor	**Designation: Professor**	**Designation:**	**Designation: Dean & Principal**
Signature:	**Signature:**	**Signature:**	**Signature:**

1. Course Information

Section	Details
Course Title	Solid and Fluid Mechanics
Course Code	26BRAICC3C
Program	Robotics and Artificial Intelligence
Academic Year/Semester	2026-2027
Course Type	☐✔ Core ☐ Elective ☐ Lab
Prerequisite (If any)	Engineering Mechanics, Mathematics, Fundamentals of Robotics and Automation
Contact Hours per Semester	Lecture: 28 Tutorial: 14 Practical: 25 SL: 23 Total: 90
Credits	3
W.e.f	2026-27
Approved in AC on	June 2026
Course Description	Robotics integrates principles of Solid Mechanics and Fluid Mechanics to design, analyze, and optimize robotic systems and automated machines. This course provides students with a foundational understanding of how forces, stresses, deformation, and fluid behavior influence the performance, stability, and motion of robotic components and systems.

2. Course Objectives

1. Basics of Engineering elements like springs and beams must have been made clear so that they will be able to design them.
2. Able to appreciate the basic principles and understand the function of various type of pumps and machineries and flow of liquid through pipes.

3. Course Outcomes (COs)

COs	Course Outcome Statement	BTL	Pos Mapped
CO1	Describe the fundamental concepts of equilibrium, stress, strain and deformation of solids.	2	PO1, PO2, PO3
CO2	Discusses the bending of beams and torsion.	2	PO1, PO2, PO3, PO4
CO3	Defines the fluid concepts, properties, statics and kinematics.	2	PO1, PO2, PO3
CO4	Calculate the fluid dynamics and in-compressible fluid flow.	3	PO1, PO2, PO3, PO4
CO5	Defines and discusses the hydraulic turbines and pumps.	2	PO1, PO2, PO3, PO4, PO6, PO7

4. Course Content (Module-Wise)

Module	Topics	L-T-P-SL=TOTAL	COs/BTL/SDG
I	**Equilibrium, Stress, Strain and Deformation of Solids:** Deformation in Solids, stress, strain, Hooke's law, Elastic constants, Stress Strain curve for ductile and brittle materials, Principle of super position, Shear stresses Compound Stresses and Strains - Two-dimensional system, stress at a point on a plane, principal stresses and principal planes, Mohr's circle of stress	06-03-05-05=19	**1/2/4,9**
II	**Bending of Beams:** Beams – Types and transverse loading on beams – shear force and bending moment in beams – Cantilevers – Simply supported beams and over-hanging beams. Theory of simple bending – Analysis of stresses – load carrying capacity. Bending and shear stress for I and T section.	06-03-05-05=19	**2/2/4,9**
III	**Fluid Concepts, Properties, Statics and Kinematics:** Fluid – definition, real and ideal fluids - Distinction between solid and fluid - Units and dimensions - Properties of fluids - density, specific weight, specific volume, specific gravity, viscosity, capillary and surface tension, compressibility and vapour pressure – Temperature influence on fluid properties - Fluid statics – hydrostatic pressure concept and distribution on plane surfaces – Absolute and gauge pressures – pressure measurements by manometers and pressure gauges.	06-03-05-05=19	**3/2/4,9,11**
IV	**Fluid Kinematics and Dynamics:** Fluid Kinematics - Flow visualization - types of flow – lines of flow - velocity field and acceleration. Fluid dynamics – Euler's equation of motion – Euler's equation of motion along a streamline – Bernoulli equation and its application – Venturi, orifice and flow nozzle meters – pitot tube – notches and weirs.	05-02-05-04=16	**4/3/4,7,9,11**

V	**Hydraulic Turbines and Pumps:** Introduction to types of hydraulics turbine, Pelton wheel, Francis Hydro turbines - definition, types and classifications – Pelton, Francis and Kaplan turbines. Introduction to pumps and blowers reciprocating type, centrifugal and axial type. Positive displacement pumps and blower.	05-03-05-04=17	**5/3/4,7,9,11**
	Total Hrs	**28-14-25-23=90**	
	Credits=Total Hrs/30	**90/30=03**	

5. CO–PO Mapping Matrix

CO \PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
CO1	3	2	1								
CO2	3	3	2	1							
CO3	3	2	1								
CO4	3	3	2	2							
CO5	2	2	2	1		1	1				

(*Mapping:1 –Low, 2– Medium,3 – High*)

6. CO–SDG Mapping Matrix

CO/ SDG	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17
CO1				3					2								
CO2				3					3								
CO3				3					2		1						
CO4				3			2		3		1						
CO5				3			3		3		2						

7. Details of Practical's Sessions (if applicable)

Practical	Title of Experiment/Activity (Demonstration Only)
1	Tensile, shear and compression tests of metallic and non-metallic specimens using Universal Testing Machine.
2	Torsion Test and Bending Test on metallic and nonmetallic specimens.
3	Determination of coefficient of friction of flow in a pipe, Determination of coefficient of discharge of a Venturimeter and orifice meter.
4	Performance Parameters of Hydraulic Turbines like Kaplan, Francis, and Pelton.

8. Textbooks

S. No.	Author(s)	Title	Publisher & Year
1	Dr. R K Bansal	Fluid Mechanics and Hydraulics Machines	Laxmi publications, 2005
2	S B Junnarkar, Dr H J Shah	Mechanics of Structures, Vol. 1	Charotar Publishing house Pvt. Ltd, 2012

9. Reference Books

S. No.	Author(s)	Title	Publisher & Year
1	Bhavikatti S S, Kothandaraman C P	Solid And Fluid Mechanics	New Age International Private Limited, 2021

10. Assessment Scheme

Component	Weightage (%)
Internal Assessment Test-I	10
Internal Assessment Test-II	10
Internal Assessment Test-III	10
Other Assessment	10
Assignments/ Presentation	10
Semester End Examination	50

11. Course Outcome Attainment

Type	Method
Direct	Internal Tests, Assignments, Semester End Exams.
Indirect	Course Exit Survey, Student Feedback

Prepared by	Vetted by		Confirmed by
Faculty	**HOD**	**IQAC, ACU**	**Principal**
Name: Keerthi B L	**Name: Dr. Girisha K B**	**Name:**	**Name: Dr. B N Shobha**
Designation: Assistant Professor	**Designation: Professor & Head**	**Designation:**	**Designation: Dean & Principal**
Signature:	**Signature:**	**Signature:**	**Signature:**

1. Course Information

Section	Details
Course Title	Robot Operating System
Course Code	26BRAICC3D
Program	Robotics and Artificial Intelligence
Academic Year/Semester	2026-2027/III
Course Type	☐✔ **Core** ☐Elective ☐ Lab
Prerequisite (If any)	Fundamentals of Computer Programming, Basic Operating System Concepts, Engineering Mathematics
Contact Hours per Semester	Lecture: 28 Tutorial: 14 Practical: 25 SL: 23 Total: 90
Credits	3
W.e.f	2026
Approved in AC on	June 2026
Course Description	This course introduces the fundamentals of Robot Operating System (ROS), UNIX/Linux environment, and robot programming techniques used in modern robotic and automation systems. The course provides students with foundational knowledge of ROS architecture, history, distributions, services, framework, and its role as a middleware platform for robotic applications.

2. Course Objectives

1. To familiarize the students with the basic understanding of robot operating system and their architecture.
2. To visualize and simulate the robot environment with simulators.

3. Course Outcomes (COs)

COs	Course Outcome Statement	BTL	Pos Mapped
CO1	Explain the basic architecture and purpose of ROS in robotics.	2	PO1, PO2, PO5, PO11
CO2	Develop simple publishers, subscribers, and service programs.	3	PO1, PO2, PO3, PO5, PO11
CO3	Visualize a basic robot model using URDF and RViz.	3	PO1, PO2, PO3, PO5, PO11
CO4	Interface simple sensor data and perform basic robot movement in simulation.	3	PO1, PO2, PO3, PO4, PO5, PO11
CO5	Implement a small ROS-based application integrating multiple nodes.	3	PO1, PO2, PO3, PO4, PO5, PO6, P8, PO9, PO10, PO11

4. Course Content (Module-Wise)

Module	Topics	L-T-P-SL=TOTAL	COs/BTL/SDG
I	**Introduction** – Introduction to the concept of middleware in robotics and the need for ROS. Students learn the basic architecture of ROS including nodes, topics, messages, services, and parameters. The unit covers ROS installation, workspace creation, package creation, and simple command-line tools.	06-03-05-05=19	**1/2/4,9**
II	**ROS Communication and Programming Basics:** ROS communication methods such as topics, services, and simple actions at an introductory level. Students learn about message types, creating custom messages (basic level), and using launch files.	06-03-05-05=19	**2/3/4,9**
III	**Robot Modeling and Visualization:** simple robot modeling concepts using URDF. Students learn how to define links and joints for a basic mobile robot or manipulator. Basic coordinate frames and TF concepts are introduced in a simplified manner.	06-03-05-05=19	**3/3/4,9,11**
IV	**Sensor Integration and Basic Navigation:** Sensors such as ultrasonic sensors, IMU, encoders, and LiDAR (conceptual understanding). Students learn how sensor data is published and visualized in ROS. Introduction to mapping and localization concepts at a beginner level is included.	05-03-05-04=17	**4/3/4,9,11**
V	**File system** - packages – stacks – messages – services – catkin workspace – working with catkin workspace – working with ROS navigation and listing commands. Navigation through file system - Understanding of Nodes – topics – services – messages – bags – master – parameter server**.**	05-02-05-04=16	**5/3/4,9,11**
	Total Hrs	**28-14-25-23=90**	
	Credits=Total Hrs/30	**90/30=03**	

5. CO–PO Mapping Matrix

CO \PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
CO1	3	2			1						1
CO2	2	2	2		3						1
CO3	2	2	2		3						1
CO4	3	2	2	1	3						1
CO5	3	3	3	2	3	1		2	1	1	1

(*Mapping:1 –Low, 2– Medium,3 – High*)

6. CO–SDG Mapping Matrix

CO/ SDG	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17
CO1				3					2								
CO2				3					3								
CO3				3					3		1						
CO4				3					3		2						
CO5				3					3		2						

7. Details of Practical's Sessions (if applicable)

Practical	Title of Experiment/Activity
1	
2	
3	

8. Textbooks

S. No.	Author(s)	Title	Publisher & Year
1	Morgan Quigley, Brian Gerkey and William D. Smart,	Programming Robots with ROS: A Practical Introduction to the Robot Operating System	O'Reilly Media, 2015
2	Sabrie Soloman	Advanced Robotics (Design & Applications)	Khanna Book Publishing, 2023.

9. Reference Books

S. No.	Author(s)	Title	Publisher & Year
1	Carol Fairchild and Thomas L. Harman,	ROS Robotics By Example (Vol. 1 & 2),	Packt Publishing, 2016–2017.

10. Assessment Scheme

Component	Weightage (%)
Internal Assessment Test-I	10
Internal Assessment Test-II	10
Internal Assessment Test-III	10
Other Assessment	10
Assignments/ Presentation	10
Semester End Examination	50

11. Course Outcome Attainment

Type	Method
Direct	Internal Tests, Assignments, Semester End Exams.
Indirect	Course Exit Survey, Student Feedback

Prepared by	Vetted by		Confirmed by
Faculty	**HOD**	**IQAC, ACU**	**Principal**
Name: Dr. Girisha K B	**Name: Dr. Girisha K B**	**Name:**	**Name: Dr. B N Shobha**
Designation: Professor	**Designation: Professor**	**Designation:**	**Designation: Dean & Principal**
Signature:	**Signature:**	**Signature:**	**Signature:**

1. Course Information

Section	Details
Course Title	Sensors and Actuators for Robotics
Course Code	26BRAIIC3E
Program	Robotics & Artificial Intelligence
Academic Year/Semester	2026-2027/ III
Course Type	☑ **Core** ☐ Elective ☐ Lab
Prerequisite (If any)	Mechanical Measurements, Material Science
Contact Hours per Semester	Lecture: 42 Tutorial: 14 Practical: 42 SL: 22 Total: 120
Credits	4
W.e.f	2026
Approved in AC on	June 2026
Course Description	This course provides a comprehensive study of sensors and actuators that form the foundation of robotic perception and motion. Students learn how robots acquire information from their surroundings through sensors and how they perform physical actions using actuators. The course emphasizes sensor selection, signal conditioning, data acquisition, actuator control, and integration into robotic systems. Practical laboratory exercises and projects enable students to interface sensors and actuators with microcontrollers and robotic platforms

2. Course Objectives

1. Analyze sensory systems in robotics.
2. Select the sensor for robotic application and design the systems.
3. Analyze actuators and configuring the parameters of Actuators.

3. Course Outcomes (COs)

COs	Course Outcome Statement	BTL	Pos Mapped
CO1	Explain the anatomy of robotic systems including links, joints, degrees of freedom (DOF), end-effectors, and different robotic configurations.	2	PO1, PO2, PO5, PO11
CO2	Classify and explain different types of sensors used in robotics and identify suitable sensors for specific applications.	3	PO1, PO2, PO3, PO4, PO5, PO11
CO3	Apply robotic vision systems, MEMS devices, smart sensors, and basic image processing techniques for robotic perception tasks.	3	PO1, PO2, PO3, PO4, PO5, PO10, PO11
CO4	Compare and apply the characteristics of electric actuators to select appropriate actuators for robotic applications.	3	PO1, PO2, PO3, PO4, PO5, PO10, PO11
CO5	Apply the principles of hydraulic, pneumatic, and advanced actuators to select suitable actuation systems for robotic applications.	3	PO1, PO2, PO3, PO4, PO5, PO10, PO11

4. Course Content (Unit-Wise)

Module	Topics	L-T-P-SL=Total	COS/BTL/SDG
I	**Anatomy of the Robotic System:** Links and joints in robots, types of joints, end effectors, concept of degrees of Freedom and its calculations	10-02-08-05=25	**1/2/4,9**
II	**Sensors:** Pressure/contact. Resistive position. Infrared. Light. Position Sensors, optical encoders, proximity sensors, Range sensors, Ultrasonic sensors, Touch and Slip sensors. sensors for motion and position, Force, torque and tactile sensors, Flow sensors, and temperature sensing devices	08-03-08-05=24	**2/3/4,9**
III	**Vision Sensors and Advanced Sensor Technology:** Vision System Devices, Image acquisition, Masking, Sampling and quantization, Image Processing Techniques, Noise reduction methods, Edge detection, Segmentation. Smart sensors, MEMS-based sensors, Innovations in sensor technology Actuators and its selection while designing a robot system. Types of transmission systems.	08-03-08-04=23	**3/3/4,9,11**
IV	**Electric Actuators:** Direct current motor, Permanent magnet stepper motor, Servo Control DC motors, Linear and latching linear actuators, Rotary actuators, Piezoelectric actuators, Actuator parameters and characteristics, Stepper motors, Specifications and characteristics of Stepper Motors Servo Motors.	08-03-08-04=23	**4/3/4,7,9**
V	**Pneumatic & Hydraulic actuators:** Hydraulic Actuators, selection of linear actuating cylinders, Hydraulic Motors, Pneumatic actuators, design considerations and selection, pneumatic cylinders, pneumatic drive system, Linear & rotary actuators. Advanced actuators – Piezoelectric actuators, elastomer actuators, soft actuators, shape memory alloy-based actuators, under actuated robotic hand.	08-03-10-04=25	**5/3/4,7,9,11**
	Total Hours	**42-14-42-22=120**	
	Credits=Total Hrs/30	**120/30=04**	

5. CO–PO Mapping Matrix

CO \PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
CO1	3	3	1		1						1
CO2	3	3	2	2	3						1
CO3	3	3	2	2	2					1	1
CO4	3	3	2	2	2					1	1
CO5	3	3	2	2	2					1	1

(*Mapping:1 –Low, 2– Medium,3 – High*)

6. CO–SDG Mapping Matrix

CO/ SDG	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17
CO1				3					2								
CO2				3					3		1						
CO3				3					3		2						
CO4				3			2		3								
CO5				3			3		3		1						

7. Details of Practical's Sessions (if applicable)

Practical	Title of Experiment/Activity
1	To study the architecture of SOC Broadcom-2835 application board of Raspberry Pi.
2	Interfacing Push Button with Raspberry Pi.
3	Touch Sensors interfacing and feedback system.
4	Capturing Image using Raspberry Pi Camera Module.
5	Use of object detection and Image processing using Vision sensors in Robot system.
6	Temperature Sensor Reading using Raspberry Pi.
7	Controlling LED using Mobile/Bluetooth.
8	Controlling DC Motor using Raspberry Pi.
9	Creating the sensor project.
10	Creating the actuator project.

8. Textbooks

S. No.	Author(s)	Title	Publisher & Year
1	S. R. Ruocco	Robot Sensors & Transducers	Springer, 2013
2	Thomas Bräunl	Embedded robotics: mobile robot design and applications with embedded systems	Berlin; Heidelberg, 3rd Edition, Springer, 2008

9. Reference Books

S. No.	Author(s)	Title	Publisher & Year
1	Gerard C., M. Meijer	Gerard C., M. Meijer	Wiley, 2008
2	Andrzej M. Pawlak	Sensors and Actuators in mechatronics	Taylor & Francis Group, 2007

10. Assessment Scheme

Component	Weightage (%)
Internal Assessment Test-I	10
Internal Assessment Test-II	10
Internal Assessment Test-III	10
Other Assessment	10
Assignments/ Presentation	10
Semester End Examination	50

11. Course Outcome Attainment

Type	Method
Direct	Internal Tests, Assignments, Semester End Exams.
Indirect	Course Exit Survey, Student Feedback

Prepared by	Vetted by		Confirmed by
Faculty	**HOD**	**IQAC, ACU**	**Principal**
Name: Dr. Girisha K B	**Name: Dr. Girisha K B**	**Name:**	**Name: Dr. B N Shobha**
Designation: Professor	**Designation: Professor & Head**	**Designation:**	**Designation: Dean & Principal**
Signature:	**Signature:**	**Signature:**	**Signature:**

1. Course Information

Section	Details
Course Title	Robot Programming Lab
Course Code	26BRAIPL3F
Program	Robotics and Artificial Intelligence
Academic Year/Semester	2026-2027
Course Type	☐ Core ☐Elective ☐✔ Lab
Prerequisite(If any)	C Programming, Artificial intelligence
Contact Hours per Semester	Lecture: 00 Tutorial: 0 Practical: 30 SL: 0 Total: 30
Credits	1
W.e.f	2026
Approved in AC on	June 2026
Course Description	Robotics Lab teaches the practical and theoretical aspects of designing, building, and programming robots, covering topics such as kinematics, dynamics, control systems, path planning, and sensors.

2. Course Objectives

1. Understand the fundamentals of hydraulic and pneumatic systems.
2. Design robotic systems, including arms, joints, and end effectors, considering task-specific requirements and degrees of freedom.
3. Evaluate the performance and functionality of different types of hydraulic and pneumatic valves.

3. Course Outcomes (COs)

COs	Course Outcome Statement	BTL	Pos Mapped
CO1	Design and assemble basic hydraulic and pneumatic circuits for industrial and automation applications.	3	PO1, PO2, PO3, PO4, PO5, PO9, PO11
CO2	Demonstrate the operation of double-acting cylinders using pneumatic direction control valves for linear motion applications.	3	PO1, PO2, PO3, PO5, PO9
CO3	Design and configure robotic arms to meet specific industrial tasks requirements.	3	PO1, PO2, PO3, PO4, PO5, PO9,PO10, PO11
CO4	Select and apply appropriate robotic end effectors for material handling and assembly operations.	3	PO1, PO2, PO3, PO4, PO5, PO9, PO11

4. Course Content (List of Experiments)

List	Topics	L-T-P-SL=TOTAL	COs/BTL/SDG
I	Design and assembly of hydraulic / pneumatic circuits	00-00-03-0=03	**1/3/4,7,9,11**
II	Study of power steering mechanism using cut piece model	00-00-03-0=03	**1/3/4,7,9,11**
III	Study of reciprocating movement of double acting cylinder using pneumatic direction control valve	00-00-04-0=04	**2/3/4,7,9**
IV	Use of direction control and pressure control valves clamping devices for jigs and fixtures	00-00-04-0=04	**2/3/4,7,9**
V	Design of robotic arms and configuration	00-00-04-0=04	**3/3/4,9,11**
VI	Design and implementation of robotic end effectors	00-00-04-0=04	**4/3/4,9,11**
VII	Design of robotic joints	00-00-04-0=04	**4/4,9,11**
VIII	Study of different types of hydraulic and pneumatic valves	00-00-04-00=04	**4/4,9,11**
	Total Hrs	**00-00-30-00=30**	
	Credits=Total Hrs/30	**30/30=01**	

5. CO–PO Mapping Matrix

CO \PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
CO1	3	2	3	2	2				1		1
CO2	3	2	2	1	2				1		
CO3	3	3	3	2	3				1	1	1
CO4	3	3	3	2	3				1		1

(*Mapping:1 –Low, 2– Medium,3 – High*)

6. CO–SDG Mapping Matrix

CO/ SDG	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17
CO1				3			2		3		1						
CO2				3			2		3								
CO3				3					3		2						
CO4				3					3		2						

7. Details of Practical's Sessions (if applicable)

Practical	Title of Experiment/Activity
1	
2	
3	

8. Textbooks

S. No.	Author(s)	Title	Publisher & Year
1	N D Bhatt	Engineering Drawing	Charotar Publishing House, 2012
2	P S Gill	Textbook of Machine Drawing	S K Kataria & Sons-New Delhi, 2023

9. Reference Books

S. No.	Author(s)	Title	Publisher & Year
1	Dr. K. C. John	Textbook of Machine Drawing	PHI, 2009

10. Assessment Scheme

Component	Weightage (%)
CIE	50
End Semester Examination	50

11. Course Outcome Attainment

Type	Method
Direct	Internal Tests, Assignments, Semester End Exams.
Indirect	Course Exit Survey, Student Feedback

Prepared by	Vetted by		Confirmed by
Faculty	**HOD**	**IQAC, ACU**	**Principal**
Name: Dr. Girisha K B	**Name: Dr. Girisha K B**	**Name:**	**Name: Dr. B N Shobha**
Designation: Professor	**Designation: Professor & Head**	**Designation:**	**Designation: Dean & Principal**
Signature:	**Signature:**	**Signature:**	**Signature:**

1. Course Information

Section	Details
Course Title	MAT LAB
Course Code	26BRAIPL3G
Program	Robotics and Artificial Intelligence
Academic Year/Semester	2026-2027
Course Type	☐ **Core** ☐Elective ☐✔ Lab
Prerequisite (If any)	Basic mathematics, Programming fundamentals
Contact Hours per Semester	Lecture: 00 Tutorial: 0 Practical: 30 SL: 0 Total: 30
Credits	1
W.e.f	2026
Approved in AC on	June 2026
Course Description	MATLAB provides data analysis, visualization, modeling, and programming within the MATLAB environment. These courses are designed for beginners or those with some programming knowledge to learn MATLAB's interactive interface, work with data types, write scripts and functions, and use toolboxes for engineering and scientific applications.

2. Course Objectives

1. Understand the basic structure of MATLAB, including its command window, workspace, and editor.
2. Understand how to use MATLAB's plotting tools for analyzing and presenting data.
3. Apply MATLAB to solve linear algebra problems
4. Apply MATLAB for simulating physical, electrical, or mechanical systems.

3. Course Outcomes (COs)

COs	Course Outcome Statement	BTL	Pos Mapped
CO1	Apply basic concepts of Linear Algebra for vector and matrix operations Perform 2D and 3D plotting	3	PO1, PO2, PO3, PO4, PO5, PO11
CO2	Formulate and solve systems of linear equations by Gaussian elimination, and matrix inversion	3	PO1, PO2, PO3, PO4, PO5, PO11
CO3	Write conditional statements and loops, Scripts and functions	2	PO1, PO2, PO3, PO4, PO5, PO9
CO4	Solving some engineering problems using MATLAB	3	PO1, PO2, PO3, PO4, PO5, PO6, PO9, PO10,PO11

4. Course Content (List of Experiments)

List	Topics	L-T-P-SL=TOTAL	COs/BTL/SDG
I	MATLAB environment and important commands, Linear Algebra and matrix operations	00-00-03-00=03	**1/3/4,9**
II	Plotting and visualizing curves and surfaces in MATLAB – Symbolic computations using MATLAB	00-00-03-00=03	**1/3/4,9**
III	Evaluating the Extremum of a single variable function	00-00-03-00=03	**1/3/4,9**
IV	Evaluating maxima and minima of functions of several variables	00-00-03-00=03	**1/3/4,9**
V	2D (normal, logarithmic and subplots) and 3D plotting	00-00-03-00=03	**2/3/4,9**
VI	Solutions to systems of linear equations	00-00-03-00=03	**2/3/4,9**
VII	Conditional statements (if statements, also any, all, find and other commands), Loops (for and while loops)	00-00-03-00=03	**3/2/4,9**
VIII	MATLAB scripts and functions	00-00-03-00=03	**4/3/4,7,9,11**
IX	Polynomials, including numerical and symbolic differentiation and integration (trapz, quadl, integral, int, diff and other commands)	00-00-03-00=03	**4/3/4,7,9,11**
X	Using MATLAB for simple and complicated engineering problems (applying MATLAB to solve problems related to mechanical engineering problems; thermal/fluid and solid mechanics)	00-00-03-00=03	**4/3/4,7,9,11**
	Total Hrs	**00-00-30-00=30**	
	Credits=Total Hrs/30	**30/30=01**	

5. CO–PO Mapping Matrix

CO \PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
CO1	3	3	1	1	2						
CO2	3	3	1	2	3						
CO3	2	2	2	1	3					1	
CO4	3	3	2	3	3	1			1	1	1

(*Mapping:1 –Low, 2– Medium,3 – High*)

6. CO–SDG Mapping Matrix

CO/ SDG	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17
CO1				3					2								
CO2				3					3								
CO3				3					3								
CO4				3			1		3		1						

7. Details of Practical's Sessions (if applicable)

Practical	Title of Experiment/Activity
1	
2	
3	

8. Textbooks

S. No.	Author(s)	Title	Publisher & Year
1	Peter Issa, Kattan Peter Issa Kattan	MATLAB for Beginners	Petra Books, 2025
2	Amos Gilat	MATLAB: An Introduction with Applications	Wiley, 5th edition 2014

9. Reference Books

S. No.	Author(s)	Title	Publisher & Year
1	Amos Gilat	An Introduction with Applications	Wiley, 2023

10. Assessment Scheme

Component	Weightage (%)
CIE	50
End Semester Examination	50

11. Course Outcome Attainment

Type	Method
Direct	Internal Tests, Assignments, Semester End Exams.
Indirect	Course Exit Survey, Student Feedback

Prepared by	Vetted by		Confirmed by
Faculty	**HOD**	**IQAC, ACU**	**Principal**
Name: Dr. Girisha K B	**Name: Dr. Girisha K B**	**Name:**	**Name: Dr. B N Shobha**
Designation: Professor	**Designation: Professor & Head**	**Designation:**	**Designation: Dean & Principal**
Signature:	**Signature:**	**Signature:**	**Signature:**

Course Information

Section	Details
Course Title	Indian Health Science (Indian Knowledge System - IKS)
Course Code	26BENGIK3I
Program	Common to all
Academic Year/Semester	2026-2027 / III
Course Type	✔Core (Applicable to all UG programs) ☐Elective ☐ Lab
Prerequisite (If any)	Basic understanding of general science and wellness concepts
Contact Hours per Semester	Lecture:14 Tutorial: 0 Practical:0 SL: 16 Total: 30
Credits	1
W.e.f	2026
Approved in AC on	June 2026
Course Description	Indian Health Science (IKS) introduces foundational concepts of ancient Indian medical and wellness systems, primarily Ayurveda and Yoga. It covers holistic health principles, Tridosha theory, Panchamahabhuta, body-mind constitution (Deha & Manasa Prakriti), preventive health practices, Yogic techniques for stress management, and their relevance in modern life. The course promotes understanding of Indian philosophical frameworks for wellbeing, lifestyle balance, and self-awareness through traditional knowledge.

1. Course Objectives: Students will be able to

1. Understand the foundational concepts of Ayurveda and Yoga, including holistic Tridosha, Panchamahabhuta, Dhatus, and their interrelationship in maintaining health.
2. Recognize the philosophical and practical frameworks of ancient Indian medical systems and apply Yogic principles for stress management, lifestyle balance, and self-awareness.

2. Course Outcomes (COs): Students will be able to

COs	Course Outcome Statement	BTL	Pos Mapped
CO1	Explain the historical evolution, principles, and preventive health approaches of Ayurveda, including concepts of body and mental constitution (Deha and Manasa Prakriti) and their relevance in modern wellness practices.	2	PO1, PO2, PO6, PO7, PO8, PO10, PO11
CO2	Demonstrate an understanding of Yogic science, its origins, theoretical background (Samkhya & Yoga Darshanas), stress-relieving techniques, chakra healing, and the role of Pranava (Om) in enhancing mental and emotional health.	3	PO1, PO2, PO6, PO7, PO8, PO10, PO11

2. Course Content (Unit-Wise)

Unit	Topics	L-T-P-SL=TOTAL	COs/BTL/SDG
I	Overview of Ancient Indian Medical Systems Conceptual understanding and history of Ayurveda. Introduction to basic principles of Ayurveda. Overview of different schools of Indian Philosophy. Brief knowledge of all Dhatus (tissues) in the body. Origin and Philosophy of Yoga in Ancient India. Ayurveda-Yoga role in maintenance of good health and treatment of diseases.	14-0-0-16=30	**1/2/3,4**
II	Health, Yoga & Wellness Yogic concept of health. Five element theory (Panchamahabhuta) and Tridosha. Tridosha in Deha Prakriti (Body constitution) and Manasa Prakriti (Mental Constitution). Concept of Tridosha and its role in body and mind. Triguṇa (Three Qualities) in life and its significance.		**2/3/3,4**
	Total Hrs	14-0-0-16=30	
	Credits=Total Hrs/30	**30/30=01**	

3. CO–PO Mapping Matrix

CO \PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
CO1	1	2				2	2	2		1	3
CO2	1	2				2	2	2		1	3

(*Mapping:1 –Low, 2– Medium,3 – High*)

4. CO–SDG Mapping Matrix

CO/ SDG	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17
CO1			**3**	**3**													
CO2			**3**	**3**													

5. Details of Practical's Sessions

Practical	Title of Experiment/Activity
1	Yoga Practice Session: Perform basic asanas, pranayama, and meditation; record personal wellness benefits.
2	Ayurveda Lifestyle Study: Analyze daily routine (Dinacharya) and seasonal regimen (Ritucharya) from texts; prepare a personal wellness plan.
3	Chakra & Pranava Exploration: Study and practice basic chakra meditation with Om chanting; discuss stress relief effects.

6. Textbooks

S. No.	Author(s)	Title of the Book	Publisher & Year
1	Swami Svatmarama (Edited by Swami Digambarji and Raghunathshastri Kokaje)	Hatha Pradipika	Kaivalyadhama, Lonavala, 1998 (Reprint/Ed.)
2	Sharma P.V.	History of Medicine in India	Chowkhamba Orientalia, Varanasi, (Edition varies; classic reference)
3	Vagbhata (Translated by Prof. K.R. Srikantha Murthy)	Astanga Hridayam (English Translation, Prathama Khanda)	Chowkhamba Krishnadas Academy, Varanasi, 2018 (or 2000 multi-vol set)

7. Reference Books

S. No.	Author(s)	Title	Publisher & Year
1	Ved D.K., S. Noorunnisa Begum and K. Ravikumar	Trade in Indian Medicinal Plants	Ministry of AYUSH, Government of India (National Medicinal Plants Board), (2017–2018 context)

8. AssessmentScheme

Component	Weightage (%)
Internal Assessment Test-I	10
Internal Assessment Test-II	10
Internal Assessment Test-III	10
Other Assessment	10
Assignments/ Presentation	10
Semester End Examination	50

9. Course Outcome Attainment

Type	Method
Direct	Internal Tests, Assignments, Semester End Exams.
Indirect	Course Exit Survey, Student Feedback

Prepared by	Vetted by		Confirmed by
Faculty	**HOD**	**IQAC, ACU**	
Name: Mr. Naveen S S	**Name:** Dr. Girisha K B	**Name:**	**Name:** Dr.B N Shobha
Designation: Assistant Professor	**Designation:** Professor & Head	**Designation:**	**Designation:** Dean & Principal
Signature:	**Signature:**	**Signature:**	**Signature:**

1. Course Information

Section	Details
Course Title	Sports
Course Code	26BENGNC3J
Program	Common to all
Academic Year/Semester	2026-2027/III
Course Type	☐ Core ☐ Elective ☐ **Lab✓**
Prerequisite (If any)	
Contact Hours per Semester	Lecture: 0 Tutorial: 0 Practical: 30 SL: 0 Total: 30
Credits	1
W.e.f	2026
Approved in AC on	June 2026
Course Description	This course is designed to promote physical fitness, teamwork, strategic thinking, and ethical sportsmanship among engineering students through structured training in selected sports disciplines. Students will engage in hands-on practice sessions, competitive simulations, and officiating exercises to build core competencies in movement, coordination, and game strategy. The course also emphasizes leadership, communication, and stress management through active participation in team sports.

2. Course Objectives

1. To develop physical talents to their maximum potential.
2. To engage in competitive activities, while promoting sound health, safety,and physical fitness.
3. To exemplify good conduct as a means for learning good citizenship.
4. To learn to appropriately experience both success and failure in an educational environment.

3. Course Outcomes (COs) After completion of the course students are able to

COs	Course Outcome Statement	BTL	POs Mapped
CO1	Demonstrate fundamental skills and techniques in Volleyball, Basketball, Cricket, Kabaddi, and Kho-Kho through structured practice and gameplay.	3	PO5, PO6, PO7
CO2	Apply sport-specific strategies and decision-making skills in competitive and simulated match scenarios across multiple disciplines.	3	PO2, PO5, PO7
CO3	Exhibit teamwork, leadership, and interpersonal communication through participation in team-based sports and collaborative drills.	3	PO9

CO4	Interpret and implement rules, measurements, and officiating duties to ensure fair play, ethical conduct, and regulatory compliance in sports activities.	3	PO8
CO5	Develop physical fitness, mental resilience, and stress management techniques through regular engagement in sports and physical training routines.	3	PO5, PO6, PO7

4. Course Content (Unit-Wise)

Unit	Topics	L-T-P-SL= Total	COs/BTL/SDG
I	**Volley ball** Player stance, Receiving and passing, The Volley (Overhead pass), The Dig(Underhand pass), Service Reception, Service-Under Arm Service, Tennis Service, Side Arm Spin Service, Round Arm Service. High spin service, Asian serve American serve (floating),Setting the ball- Set for attack, Back set, Jump set Smash Spike- Straight smash, Body turns smash. Wrist outwardsmash. Wrist inward smash.	00-00-06-00=06	1,2,5/3/3,4,17
II	**Basketball** **Grip:** Player stance- Triple threat stance and Ball handling exercises Passing(Two hand/one hand)- Chest pass, Bounce Pass, Overhead pass, Underhandpass, Hook Pass, Behind the back pass, Baseball pass, Side arm pass and passing in running. **Receiving-**Two Hand receiving, One hand receiving, Receiving in stationary position, Receiving While jumping, Receiving while running, Dribbling- How to start dribble, How to stop dribble, High / Low dribble with variationsShooting-Layup shot and its variations, one hand set shot, one hand jump shot, Free throw, Hook shot, Tip-in shot.	00-00-06-00=06	1,2,3,5/3/3,4,17
III	**Cricket** Batting-Forward (front foot) and backward (back foot) defensive stroke, Drives Bowling- Simple bowling techniques, Fast bowling, Spin bowling Fielding-Orthodox fielding and Long Barrier (defensive). Pick up and throwand Chase and Return/ Throwing techniques (offensive) Catching-High catch and Low catch Wicket keeping techniques- Stance. Position, Collection of Ball, Ground measurements, Rule and their interpretations and Duties of officials.	00-00-06-00=06	1,2,4,5/3/3,4,16,17

IV	**Kabaddi** Raiding Skills: - Can't, Entry, Footwork, Attack, Retreat; Hand touches; Legtouches: -Toe touch, Foot touch, Squat leg thrust: Various kicks: - Back kick,Side kick, Running kick, Curve kick. Crossing of baulk line, Crossing of Bonus line, Learning the opponent to catch, Pursuing. Additional skills in raiding: - Bringing the antis in to particular position, escaping from various holds, Techniques of escaping from chain formation. Defensive Skills: - Holding Skills: Wrist hold. Ankle hold, Dive and Ankle Hold, Knee hold, thigh hold, Waist hold, Blocking- Chest block; Chain Hold.	00-00-06-00=06	1,2,4,5/3/3,4,16,17
V	**Kho-Kho:** Sitting in the square- Parallel toe / Shuffling or bullet toe method Giving "Kho':- Proximal and Distal foot, Advance Kho, Giving Kho' with a fake. General skills of the game - Running, Chasing Dodging, Faking etc. Skills inchasing- Moving on the cross lane, Pursuing the runner, Direct Indirect and Surprise attack, Tapping- Heel, Shoulder and on the pole, Diving, JudgmentKho Rectification of Foal, Skills in Running- Single and double chain, Variations in ring games, dodging while facing on the back, Pole turning, Polediving, Pole Avoiding, Attack after pole turning, Fakes Body, Arm, Legs etc., Counter action for ring game, Combination of different skills Court marking Rules and their interpretations and Duties of officials.	00-00-06-00=06	1,2,4,5/3/3,4,16,17
Total Hrs		**00-00-30-00=30**	
Credits=Total Hrs/30		**30/30=01**	

5. CO–PO Mapping Matrix

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
CO1					3	2	3				
CO2		2			2		2				
CO3									3		
CO4								3			
CO5					2	3	3				

(*Mapping: 1 – Low, 2 – Medium, 3 – High*)

6. CO–SDG Mapping Matrix

CO/ SDG	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17
CO1			**3**	**2**													**1**
CO2			**3**	**2**													**2**
CO3			**2**	**2**													**3**
CO4			**3**	**2**												**3**	
CO5			**3**	**2**													

7. Textbooks

Sl. No.	Author(s)	Title	Publisher
1	Bob Miller	The Volleyball Handbook	Human Kinetics Publishers, 1st Edition, 2005
2	Bill Simmon	The Book of Basketball	ESPN, Updated Reprint Edition, 2010
3	Jon Hotten.	Bat, Ball and Field: The Elements of Cricket: A Guide to the History, Miscellany and Magic of the Sport of Cricket	William Collins & Sons Ltd, 2023
4	Muniraju	A Text Book on Kabaddi	LAP Lambert Academic Publishing, 2015
5	Dr Kavita Verma	A Text Book of Kho-Kho	International E Publication, 2015

8. Assessment Scheme

Component	Weightage (%)
Internal Assessment Test-I	10
Internal Assessment Test-II	10
Internal Assessment Test-III	10
Other Assessment	10
Assignments/ Presentation	10

9. Course Outcome Attainment

Type	Method
Direct	Internal Tests, End Semester Exams.
Indirect	Course Exit Survey, Student Feedback.

Prepared by	Vetted by		Confirmed by
Faculty	**HOD**	**IQAC, ACU**	**Principal**
Name: Dr. Ranganatha Swamy L	**Name: Dr. Girisha K B**	**Name:**	**Name: Dr. B N Shobha**
Designation: Associate Professor	**Designation: Professor & Head**	**Designation:**	**Designation: Dean & Principal**
Signature:	**Signature:**	**Signature:**	**Signature:**

1. Course Information

Section	Details
Course Title	Internship-I
Course Code	26BRAIIN3K
Program	Robotics & Artificial Intelligence
Academic Year/Semester	2025-2026/ III
Course Type	☐✔ **Core** ☐Elective ☐ Lab
Prerequisite(If any)	
Contact Hours per Semester	Lecture: 0 Tutorial: 0 Practical: 20 SL: 10 Total: 30
Credits	1
W.e.f	2026
Approved in AC on	June 2026
Course Description	Internship provides practical exposure to industrial/research environments. To bridge the gap between academic knowledge and real-world applications. Enable students to apply theoretical concepts to solve practical problems. Development of teamwork, communication, and professional ethics.

2. Course Objectives

1. To provide students with practical exposure to industrial and professional work environments.
2. To develop technical, analytical, and problem-solving skills related to the field of study.
3. To enhance communication, teamwork, and professional ethics among students.

3. Course Outcomes (COs)

COs	Course Outcome Statement	BTL	Pos Mapped
1	Apply theoretical knowledge and technical skills in real industrial or professional environments	L3	PO1, PO2, PO3, PO4, PO5, PO6, PO7, PO8, PO9, PO10, PO11
2	Analyze practical problems and develop appropriate engineering or technical solutions	L4	PO1, PO2, PO3, PO4, PO5, PO6, PO7, PO9, PO10, PO11
3	Demonstrate effective communication, teamwork, and interpersonal skills in the workplace	L3	PO3, PO6, PO8, PO9, PO10, PO11

4. Course Content (Module-Wise)

Unit	Topics	Hours	COs

5. CO–PO Mapping Matrix

CO \PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
CO1	3	2	2	1	2	2	1	1	2	1	2
CO2	2	3	3	2	2	1	1		1	1	2
CO3			1			1		1	3	3	2

(*Mapping:1 –Low, 2– Medium,3 – High*)

6. Details of Practical's Sessions (if applicable)

Practical	Title of Experiment/Activity
1	
2	
3	

7. Textbooks

S. No.	Author(s)	Title	Publisher & Year

8. Reference Books

S. No.	Author(s)	Title	Publisher & Year

9. Assessment Scheme

Component	Weightage (%)
Conduction+ Write Up+ Viva	50
Internal Assessment	50
End Semester examination	100

10. Course Outcome Attainment

Type	Method
Direct	Internal Tests, Semester End Exams.
Indirect	Course Exit Survey, Student Feedback

Prepared by	Vetted by		Confirmed by
Faculty	**HOD**	**IQAC, ACU**	**Principal**
Name: Keerthi B L	**Name: Dr. Girisha K B**	**Name:**	**Name: Dr. B N Shobha**
Designation: Assistant Professor	**Designation: Professor**	**Designation:**	**Designation: Dean and Principal**
Signature:	**Signature:**	**Signature:**	**Signature:**

1. Course Information

Section	Details
Course Title	Python Programming
Course Code	26BRAICC3L
Program	Robotics and Artificial Intelligence
Academic Year/Semester	2026-27/ III
Course Type	✓ **Core** ☐ Elective ☐ Lab
Prerequisite (If any)	Basic Computer Knowledge, Basic Mathematical Skills.
Contact Hours per Semester	Lecture: 28 Tutorial: 14 Practical: 25 SL: 23 Total: 90
Credits	03
W.e.f	2026-27
Approved in AC on	June 2026
Course Description	Python is a high-level, general-purpose programming language renowned for its simple, readable syntax, which emphasizes code clarity and allows programmers to express concepts in fewer lines of code compared to many other languages.

2. Course Objectives

- Describe the core syntax and semantics of Python programming language.
- Discover the need for working with the strings and functions.
- Illustrate the process of structuring the data using lists, dictionaries, tuples and sets.
- Indicate the use of regular expressions and built-in functions to navigate the file system.
- Infer the Object-oriented Programming concepts in Python.

3. Course Outcomes (COs)

COs	Course Outcome Statement	BTL	POs Mapped
CO1	Understand the fundamentals of programming by explaining computer hardware architecture, interpreters and compilers and the basic building blocks of Python programs including variables, expressions, statements, and conditional execution.	2	PO1, PO2, PO5, PO11
CO2	Apply control structures and logical reasoning to develop Python programs using conditional statements, logical operators, exception handling, and short-circuit evaluation to solve simple computational problems.	3	PO1, PO2, PO3, PO5, PO11

CO3	Apply the modular Python programs using functions, iteration constructs (while and for loops), and string operations, including parsing and formatting of textual data.	3	PO1, PO2, PO3, PO5, PO11
CO4	Analyze and manipulate structured data by developing Python programs using files, lists, dictionaries and tuples for data storage, retrieval, searching, and text processing applications.	4	PO1, PO2, PO3, PO4, PO5, PO11
CO5	Develop object-oriented Python programs by creating classes and objects, implementing methods, constructors, operator overloading and demonstrating concepts such as mutability, polymorphism and type-based dispatch.	5	PO1, PO2, PO3, PO4, PO5, PO11

4. Course Content (Module -Wise)

Module	Topics	L-T-P-SL=Total Hours	COs/BTL/SDG
I	**Why should you learn to write programs?** Creativity and motivation, Computer hardware architecture, Understanding Words and sentences, Conversing with Python, Interpreter and compiler, The building blocks of program Compiler**, expressions and statements:** Statements, Operators and operands, Expressions, Order of operations, Modulus operator, String operations, **Conditional execution: Boolean expressions, Logical operators, Conditional execution, Alternative execution, Chained conditionals, Nested conditionals, catching exceptions using try and except.** **Self-learning:** Short-circuit evaluation of logical expressions. Textbook 1: Chapters 1-3	06-03-04-06=19	1/2/4,9
II	**Functions: Function calls, Built-in functions, Math functions, Random numbers, Adding new functions, Flow of execution, Parameters and arguments, Fruitful functions and void functions** **Iteration:** Updating variables, the while statement, Infinite loops, finishing iterations with continue, Definite loops using for, Loop patterns, Counting and summing loops, Maximum and minimum loops. **Strings:** A string is a sequence, Getting the length of a string using length, Traversal through a string with a loop, String slices, Strings are immutable, Looping and counting, the in operator and String comparison.	06-02-05-05=18	2/3/4,9

	Self-learning: - String methods, Parsing strings, Format operator **Textbook 1: Chapters 4 - 6**		
III	**Files:** Persistence, Opening files, Text files and lines, reading files, searching through a file, Letting the user choose the file name, using try, except and open, Writing files. **Lists: A list is a sequence, Lists are mutable, traversing a list, List operations, List slices, List methods, deleting elements, Lists and functions, Lists and strings, Parsing lines, Objects and values, Aliasing, List arguments.** **Dictionaries:** Dictionary as a set of counters, Dictionaries and files, Looping and dictionaries. **Self-learning: -** Advanced text parsing. **Textbook 1: Chapters 7 – 9**	06-02-08-02=18	3/3/4,9
IV	**Tuples:** Tuples are immutable, comparing tuples, Tuple assignment, Dictionaries and tuples, Multiple assignment with dictionaries, The most common words, Using tuples as keys in dictionaries. **Regular Expressions:** Character matching in regular expressions, extracting data using regular expressions, combining searching and extracting, **Self-learning: -** Extracting data using regular expression Escape character. **Textbook 1: Chapters 10 - 11**	05-04-04-05=18	4/4/4,9,11
V	**Classes and objects:** Programmer-defined types, Attributes, Rectangles, Instances as return values, Objects are mutable, Copying. **Classes and functions:** Time, Pure functions, Modifiers, Prototyping versus planning. **Classes and methods:** Object-oriented features, Printing objects, the init method, The __str__ method, Operator overloading **Self-learning: -** Type-based dispatch, Polymorphism. **Textbook 2: Chapters 15 – 17**	05-03-04-05=17	5/5,4,9,11
Total		**28-14-25-23=90**	
Credits = Total Hrs. / 30		**90/30=3**	

5. CO–PO Mapping Matrix

CO \ PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
CO1	3	2	-	-	1	-	-	-	-	-	1
CO2	2	3	2	-	2	-	-	-	-	-	1
CO3	2	3	3	-	2	-	-	-	-	-	2
CO4	2	3	3	2	2	-	-	-	-	-	2
CO5	2	3	3	2	3	-	-	-	-	-	2

(*Mapping: 1 – Low, 2 – Medium, 3 – High*)

6. CO–SDG Mapping Matrix

CO/ SDG	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17
CO1				**3**					**2**								
CO2				**3**					**3**								
CO3				**3**					**3**								
CO4				**3**					**3**		**1**						
CO5				**3**					**3**		**1**						

7. Details of Practical's Sessions (if applicable)

Practical	Title of Experiment / Activity
1	Write a Python program to perform basic arithmetic operations on two numbers.
2	Write a Python program to implement a simple calculator using if-elseif statements.
3	Write a Python function to find the factorial of a number.
4	Write a Python program to generate Fibonacci series using functions.
5	Write a Python program to find the frequency of characters in a string.

8. Textbooks

S. No.	Author(s)	Title	Publisher & Year
1	Charles R. Severance	Python for Everybody: Exploring Data Using Python 3	Create Space Independent Publication. 1st Edition, 2016.
2	Allen B. Downey,	Think Python: How to Think Like a Computer Scientist	Green Tea Press, 3rd Edition, 2024.

9. Reference Books

S. No.	Author(s)	Title	Publisher & Year
1	Charles Dierbach	Introduction to Computer Science Using Python	Wiley India Pvt Ltd, 1st Edition, 2022.
2	Gowrishankar S. Veena A.	Introduction to Python Programming	CRC Press/Taylor& Francis, 1st Edition, 2018.
3	Mark Lutz, O	Programming Python	'O' Reilly Media, 4th Edition, 2011.

10. Assessment Scheme

Component	Weightage (%)
Internal Assessment Test-I	10
Internal Assessment Test-II	10
Internal Assessment Test-III	10
Other Assessment	10
Assignments/ Presentation	10
Semester End Examination	50

11. Course Outcome Attainment

Type	Method
Direct	Internal Tests, Assignments, End Semester Exams.
Indirect	Course Exit Survey, Student Feedback.

Prepared by	Vetted by		Confirmed by
Faculty	**HOD**	**IQAC, ACU**	**Principal**
Name: **Mr. Prasanna Kumar M J**	**Name:** **Dr. Girisha K B**	**Name:**	**Name:** **Dr. B N Shobha**
Designation: **Assistant Professor**	**Designation:** **Professor and Head**	**Designation:** **Director, IQAC**	**Designation:** **Dean and Principal**
Signature:	**Signature:**	**Signature:**	**Signature:**

1. Course Information

Section	Details
Course Title	Engineering Mathematics-VI
Course Code	26BRAICC4A
Program	ECE & RAI
Academic Year/Semester	2026-2027 / 4th Semester
Course Type	✓ **Core** ☐ Elective ☐ Lab
Pre-Requisite	Calculus fundamentals, Coordinate geometry, Probability and Complex numbers.
Contact Hours per Semester	Lecture: 28 Tutorial: 14 Practical: 25 Self-Learning: 23 Total: 90
Credits	03
W.e.f	2026-2027
Approved in AC on	June. 2026
Course Description	This course covers numerical solutions of differential equations, probability distributions, stochastic processes complex analysis and Fourier transform for Engineering applications. It develops analytical and problem-solving skills for mathematical modelling and data interpretation.

2. Course Objectives

- To develop skills in numerical techniques, probability theory, stochastic processes, Fourier transforms and complex analysis for solving Engineering and scientific problems.
- To apply the methods of ODE solutions, probability distributions, Fourier transform techniques and complex function theory for data analysis.

3. Course Outcomes (COs)

COs	Course Outcome Statement	BTL	POs Mapped
CO1	Solve first-order ordinary differential equations using numerical methods.	3	PO1, PO2, PO5
CO2	Apply concepts of complex functions and analytic functions to solve Engineering and mathematical problems involving complex variables.	3	PO1, PO2, PO5
CO3	Understand & apply probability distributions to solve Engineering and real-world problems.	3	PO1, PO2, PO5
CO4	Apply probability distributions and stochastic processes to solve problems involving random variables and Markov chains.	3	PO1, PO2, PO5

CO5	Apply Fourier transform techniques for signal analysis and Engineering applications.	3	PO1, PO2, PO5

4. Course Content (Module-Wise)

Module	Topics	L-T-P-SL= TOTAL Hours	COs	BTL	SDG
I	**Numerical Solutions of Ordinary Differential Equations (ODE's):** Numerical solution of ODEs of the first order and first degree- Taylor's method, Modified Euler's method, Runge - Kutta method of fourth order, Milne's predictor and corrector method (Without proof)-Problems. **Self-Learning: Adam's-Bashforth predictor and corrector method.**	05-02-05-04=16	CO1	3	4
II	**Calculus of complex functions:** Review of function of a complex variable, Limits, Continuity and Differentiability. Analytic functions: Cauchy-Riemann equations in Cartesian and Polar form (Statement only). Construction of analytic functions (Milne Thomson method problems). Cauchy's theorem and Cauchy's Integral formula. **Self-Learning: Cauchy's residue theorem.**	05-03-05-04=17	CO2	3	4
III	**Probability- I:** Basic concepts of probability theory, Random variables (discrete and continuous), probability mass/density functions. Binomial, Exponential & Normal distributions (Derivation)-Problems. **Self-Learning: Poisson Distribution- Problems.**	06-03-05-05=19	CO3	3	4
IV	**Probability- II:** Joint Probability distribution for two discrete random variables, Expectation of X, Y & XY, Standard deviation, covariance and correlation coefficient. **Stochastic process:** Stochastic processes, probability vector, stochastic matrices, fixed probability vectors, regular stochastic matrices. **Self-Learning: Markov chains, Higher transition probabilities– simple problems.**	06-03-05-05=19	CO4	3	4
V	**Fourier Transforms:** Fourier transforms definition, Fourier sine and cosine transforms- Problems. Inverse Fourier transforms definition, Inverse Fourier cosine and sine transforms, Fourier Fast Transform (FFT) -Problems. **Self-Learning: Discrete Fourier Transform (DFT)**	06-03-05-05=19	CO5	3	4
Total Hrs		**28-14-25-23=90**			

Credits = Total Hrs/30	90/30=03

5. CO–PO Mapping Matrix

CO \ PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
CO1	3	3	-	-	2	-	-	-	-	-	-
CO2	3	3	-	-	2	-	-	-	-	-	-
CO3	3	3	-	-	2	-	-	-	-	-	-
CO4	3	3	-	-	2	-	-	-	-	-	-
CO5	3	3	-	-	2	-	-	-	-	-	-

(*Mapping: 1 – Low, 2 – Medium, 3 – High*)

6. CO–SDG Mapping Matrix

CO \ SDG	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17
CO1	-	-	-	3	-	-	-	-	-	-	-	-	-	-	-	-	-
CO2	-	-	-	3	-	-	-	-	-	-	-	-	-	-	-	-	-
CO3	-	-	-	3	-	-	-	-	-	-	-	-	-	-	-	-	-
CO4	-	-	-	3	-	-	-	-	-	-	-	-	-	-	-	-	-
CO5	-	-	-	3	-	-	-	-	-	-	-	-	-	-	-	-	-

(*Mapping: 1 – Low, 2 – Medium, 3 – High*)

7. Details of Practical's Sessions (if applicable)

Practical	Title of Experiment / Activity
1	Solution of ODE by Runge–Kutta Method & Milne's Predictor–Corrector Method.
2	Check whether a given complex function is analytic by applying the Cauchy–Riemann equations.
3	Find probabilities using Binomial, Poisson and Normal distributions.
4	Solve problems on Joint probability, covariance and correlation coefficient.
5	Program to Computing Fourier Transform of a given function.

8. Textbooks

S. No.	Author(s)	Title	Publisher & Year
1	B. S. Grewal	Higher Engineering Mathematics	Khanna Publishers, 44th Edition, 2024.
2	Erwin Kreyszig	Advanced Engineering Mathematics	John Wiley & Sons, 10th Edition, 2017.

9. Reference Books

S. No.	Author(s)	Title	Publisher & Year
1	S. S. Sastry	Introductory Methods of Numerical Analysis.	PHI Publishing 5th Edition, 2012.
2	James Ward Brown and Ruel V. Churchill,	Complex Variables and Applications.	McGraw-Hill, 9th Edition, 2014.
3	Murray R. Spiegel, Larry J. Stephens,	Schaum's Outline of Advanced Mathematics for Engineers and Scientists,	McGraw-Hill, 4th Edition, 2017.

10. Assessment Scheme

Component	Weightage (%)
Internal Assessment Test I	10
Internal Assessment Test II	10
Internal Assessment Test III	10
Other Assessments	10
Assignment/Presentation	10
End Semester Examination	50

11. Course Outcome Attainment

Type	Method
Direct	Internal Tests, Other Assessments, Assignments & End Semester Examination.
Indirect	Course Exit Survey & Student Feedback.

Prepared by	Vetted by		Confirmed by
Faculty	**HOD**	**IQAC, ACU**	**Principal**
Name: **Mrs. Dakshayini G**	**Name:** **Dr. Yuvaraja B K**	**Name:** **Dr. M Shankara**	**Name:** **Dr. B N Shobha**
Designation: **Assistant Professor**	**Designation:** **Professor & Head**	**Designation:** **Director, IQAC**	**Designation:** **Dean & Principal**
Signature:	**Signature:**	**Signature:**	**Signature:**

1. Course Information

Section	Details
Course Title	Robot Kinematics and Dynamics
Course Code	26BRAICC4B
Program	Robotics and Artificial Intelligence
Academic Year/Semester	2026-2027/IV
Course Type	☐✔ Core ☐ Elective ☐ Lab
Prerequisite (If any)	Engineering Mechanics, Mathematics, and Fundamentals of Robotics
Contact Hours per Semester	Lecture: 28 Tutorial: 14 Practical: 25 SL: 23 Total: 90
Credits	3
W.e.f	2026-27
Approved in AC on	June 2026
Course Description	Robot Kinematics and Dynamics provide fundamental principles and methodologies used in analyzing and controlling robotic systems. It covers forward and inverse kinematics for serial and parallel manipulators, velocity and acceleration analysis, and workspace determination. Students will study dynamics formulations using Newton-Euler and Lagrangian methods to model robot motion under forces and torques.

2. Course Objectives

1. To study the link mechanisms for the different robot configurations.
2. To study the Inverse kinematics solutions for the different robot configurations
3. To study the dynamic equation of motion of a robot.
4. To implement the trajectory planning for a robot manipulator.

3. Course Outcomes (COs)

COs	Course Outcome Statement	BTL	Pos Mapped
CO1	Identify and enumerate different link-based mechanisms with basic understanding of motion	2	PO1, PO2, PO3, PO11
CO2	Identify and enumerate the inverse kinematic solution for given robot configuration	2	PO1, PO2, PO3, PO4, PO5, PO11
CO3	Illustrate the dynamic equation of motion for the Robot arm.	3	PO1, PO2, PO3, PO4, PO5, PO11
CO4	Implement the trajectory planning for the given robot configuration	3	PO1, PO2, PO3, PO4, PO5, PO6, PO11

4. Course Content (Module-Wise)

Module	Topics	L-T-P-SL=TOTAL	Cos/BTL/SDG
I	**Links and Mechanisms:** Introduction: Definitions: Link, kinematic pairs, kinematic chain, mechanism, structure, degrees of freedom, Classification links, 3D homogeneous transformations, applications of 3D homogeneous transformation to robot kinematics, Link joints and their parameters, kinematic modeling of manipulator, Denavit- Hartenberg notation, kinematic relationship between adjacent links, direct kinematic solution for 3R planar manipulator, 3R robot, cylindrical robot, SCARA Robot	06-03-05-05=18	**1/2/4,9**
II	**Inverse Kinematics:** Manipulator workspace, Solvability of inverse kinematic model, Existence of solution, Multiple solutions, Solution technique, Closed form solution, Inverse kinematic solution for 2R Planar Manipulator, 3-DOF Articulated arm robot, cylindrical robot, RPY Wrist	08-03-05-04=15	**2/2/4,9**
III	**Manipulator Differential Motion and Statics:** Linear velocity and Angular velocity of a link, Linear velocity due to angular motion, Combined linear and angular motion, Relationship between transformation matrix and angular velocity, Mapping velocity vector, Velocity propagation of a link, Angular velocity of a link, Manipulator Jacobian, prismatic joint Jacobian, rotary joint Jacobian, Jacobian inverse, Jacobian singularity, Computation of singularities, Wrist singularities.	08-03-05-08=19	**2/2/4,9**

IV	**Robot Dynamics:** Lagrangian mechanics, Two degree of freedom manipulator – dynamic model, Lagrange – Euler formulation, Velocity of a point on the manipulator, The inertia tensor, the kinetic energy, The potential energy, Equation of motion, The LE dynamic model algorithm, Derivation of Dynamic equation of motion for 2 DOF robot configuration	08-04-05-08=20	**3/3/4,7,9**
V	**Robot Trajectory Planning:** Definitions and planning tasks, Terminology, joint space techniques, Use of a p-Degree polynomial as interpolation function, Cubical polynomial trajectories, Linear function with parabolic blends, Cartesian space techniques, A straight –line path, A circular path, Position planning, Orientation planning, Joint-space versus Cartesian space trajectory planning, 4-3-4 Joint Trajectory planning, problems	10-04-05-10=24	**4/3/4,9,11**
	Total Hrs	**28-14-25-23=90**	
	Credits=Total Hrs/30	**90/30=03**	

5. CO–PO Mapping Matrix

CO \PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
CO1	3	2	1								1
CO2	3	3	2	1	2						1
CO3	3	3	2	2	1						1
CO4	2	3	3	2	2	1					2

(*Mapping:1 –Low, 2– Medium,3 – High*)

6. CO–SDG Mapping Matrix

CO/ SDG	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17
CO1				**3**					**2**								
CO2				**3**					**3**								
CO3				**3**			**2**		**3**								
CO4				**3**					**3**		**2**						

7. Details of Practical's Sessions (if applicable)

Practical	Title of Experiment/Activity
1	
2	
3	

8. Textbooks

S. No.	Author(s)	Title	Publisher & Year
1	Rattan S. S	Theory of Machines	Tata McGraw-Hill Publishing Company Ltd., New Delhi, Ed 2009
2	Sadhu Singh	Theory of Machines	Pearson Education (Singapore) Pvt. Ltd, Indian Branch New Delhi, 2nd edition 2006

9. Reference Books

S. No.	Author(s)	Title	Publisher & Year
1	Robert L. Norton	Design of Machinery	McGraw Hill,2001

10. Assessment Scheme

Component	Weightage (%)
Internal Assessment Test - I	10
Internal Assessment Test - II	10
Internal Assessment Test - III	10
Other Assessment	10
Assignments/Presentations	10
End Semester Examination	50

11. Course Outcome Attainment

Type	Method
Direct	Internal Tests, Assignments, Semester End Exams.
Indirect	Course Exit Survey, Student Feedback

Prepared by	Vetted by		Confirmed by
Faculty	**HOD**	**IQAC, ACU**	**Principal**
Name: Dr. Girisha K B	**Name: Dr. Girisha K B**	**Name:**	**Name: Dr. B N Shobha**
Designation: Professor	**Designation: Professor & Head**	**Designation:**	**Designation: Dean & Principal**
Signature:	**Signature:**	**Signature:**	**Signature:**

1. Course Information

Section	Details
Course Title	Data Acquisition and Robotic Vision
Course Code	26BRAICC4C
Program	Robotics and Artificial Intelligence
Academic Year/Semester	2026-2027/ IV
Course Type	☐✔ Core ☐ Elective ☐ Lab
Prerequisite (If any)	Computer Programming, Basic Electrical and Electronic Engineering
Contact Hours per Semester	Lecture: 28 Tutorial: 14 Practical:25 SL: 23 Total: 90
Credits	3
W.e.f	2026-27
Approved in AC on	June 2026
Course Description	The course also introduces the fundamentals of machine and robotic vision, including image acquisition, image processing, feature extraction, object detection, and vision-based automation. Through laboratory experiments and mini-projects, students gain hands-on experience in integrating sensors, data acquisition hardware, and vision systems for industrial, robotic, and intelligent automation applications.

2. Course Objectives

1. Understand and implement data acquisition systems for collecting, monitoring, and processing data.
2. To learn about the selection of output drivers and devices
3. To learn about the machine vision systems and its application

3. Course Outcomes (COs)

COs	Course Outcome Statement	BTL	Pos Mapped
CO1	Represent the equivalent circuit of sensors and describe their significant properties.	2	PO1, PO2, PO11
CO2	Choose the type of signal conditioning circuits to be used for a specific sensor.	3	PO1, PO2, PO3, PO11
CO3	Examine the requirements for interfacing circuit design.	4	PO1, PO2, PO3, PO4, PO5, PO11
CO4	Explain the basics of machine vision and their operation.	2	PO1, PO2, PO5, PO6, PO11

4. Course Content (Module-Wise)

Module	Topics	L-T-P-SL=TOTAL	COs/BTL/SDG
I	**Introduction to Data Acquisition**: Overview of data acquisition systems, Types of sensors used in data acquisition Signal conditioning and amplification, Sampling theorem and analog-to-digital conversion	06-03-05-05=18	**1/2/4,9**
II	**Sensors for Robotic Vision**: Signal conditioning: Amplification, Impedance Matching, Instrumentation Amplifiers, Charge Amplifiers, Filtering, attenuation, Noise Reduction and Isolation, Grounding Conflict, Ground Loops, Cross Talk, Shielded Wiring, Isolation, Linearization, Circuit protection.	08-03-05-04=15	**2/3/4,7,9**
III	**Data Acquisition Techniques:** Wired and wireless communication protocols, Synchronization and data fusion, Calibration techniques for sensor alignment and accuracy, Real-time data acquisition considerations	08-03-05-08=19	**2/3/4,7,9**
IV	**Image Processing Fundamentals:** Image representation and formats, Image enhancement techniques, Image segmentation and feature extraction, Object detection and recognition, Introduction to machine learning for vision tasks	08-04-05-08=20	**3/4/4,7,9**
V	**Integration of Data Acquisition and Robotic Vision:** Sensor integration with robotic platforms, Sensor fusion for multi-modal perception Closed-loop control using sensor feedback. Case studies: Automated Navigation guidance by vision system vision based de palletizing- line tracking-. Automatic part Recognition., Autonomous Navigation with Digital Twin	10-04-05-10=24	**4/2/4,9,11**
	Total Hrs	**28-14-25-23=90**	
	Credits=Total Hrs/30	**90/30=03**	

5. CO–PO Mapping Matrix

CO \PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
CO1	3	2									1
CO2	3	3	2								1
CO3	3	3	3	2	2						1
CO4	2	1			2	1					2

(*Mapping:1 –Low, 2– Medium,3 – High*)

6. CO–SDG Mapping Matrix

CO/ SDG	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17
CO1				**3**					**2**								
CO2				**3**			**1**		**3**								
CO3				**3**			**1**		**3**								
CO4				**3**					**3**		**2**						

7. Details of Practical's Sessions (if applicable)

Practical	Title of Experiment/Activity
1	
2	
3	

8. Textbooks

S. No.	Author(s)	Title	Publisher & Year
1	Bentley, John P	Principles of Measurement Systems	Pearson/Prentice Hall, 2005
2	Jacob Fraden	Handbook of Modern Sensors Physics, Design and Applications	Springer, 4th edition, 2010

9. Reference Books

S. No.	Author(s)	Title	Publisher & Year
1	Conor Suarez	Data Acquisition Handbook	Clanrye International,2015

10. Assessment Scheme

Component	Weightage (%)
Internal Assessment Test - I	10
Internal Assessment Test - II	10
Internal Assessment Test - III	10
Other Assessment	10
Assignments/Seminars	10
Semester End Examination	50

11. Course Outcome Attainment

Type	Method
Direct	Internal Tests, Assignments, Semester End Exams.
Indirect	Course Exit Survey, Student Feedback

Prepared by	Vetted by		Confirmed by
Faculty	**HOD**	**IQAC, ACU**	**Principal**
Name: **Dr. Chethana G C**	**Name: Dr. Girisha K B**	**Name:**	**Name: Dr. B N Shobha**
Designation: Assistant Professor	**Designation: Professor & Head**	**Designation:**	**Designation:** **Dean & Principal**
Signature:	**Signature:**	**Signature:**	**Signature:**

1. Course Information

Section	Details
Course Title	Introduction to AI & ML
Course Code	26BRAICC4D
Program	Robotics and Artificial Intelligence
Academic Year/Semester	2026-2027
Course Type	☐✔ **Core** ☐ Elective ☐ Lab
Prerequisite (If any)	Programming skills, Data Structures
Contact Hours per Semester	Lecture: 28 Tutorial: 14 Practical: 25 SL: 23 Total: 90
Credits	3
W.e.f	2026
Approved in AC on	June 2026
Course Description	Introduction to AI & ML provides a comprehensive introduction to the fundamental concepts, techniques, and applications of Artificial Intelligence (AI) and Machine Learning (ML). Students will learn the principles of intelligent systems, problem-solving methods, and data-driven approaches for building predictive and adaptive models.

2. Course Objectives

1. To impart artificial intelligence principles, techniques, and history.
2. To assess the applicability, strengths, and weaknesses of the basic knowledge representation, problem- solving and learning methods in solving engineering problems.
3. To develop intelligent systems by assembling solutions to concrete computational problems.

3. Course Outcomes (COs)

COs	Course Outcome Statement	BTL	Pos Mapped
CO1	Apply Artificial Intelligence (AI) methods and describe their foundational principles	3	PO1, PO2, PO3, PO5, PO11
CO2	Apply basic principles of AI in solutions that require problem- solving, inference, perception, knowledge representation, and learning.	3	PO1, PO2, PO3, PO4, PO5, PO11
CO3	Demonstrate knowledge of reasoning and knowledge representation for solving real-world problems.	2	PO1, PO2, PO3, PO6, PO11
CO4	Analyze and illustrate how search algorithms play vital role in problem solving.	4	PO1, PO2, PO3, PO4, PO5, PO11
CO5	Illustrate the construction of learning and expert system.	2	PO1, PO2, PO3, PO4, PO5, PO6, PO11

4. Course Content (Unit-Wise)

Unit	Topics	L-T-P-SL=TOTAL	COs/BTL/SDG
I	**Artificial Intelligence and its Issues**: Definitions-Importance of AI, Evolution of AI-Applications of AI, Classification of AI systems concerning the environment, Knowledge Inferring systems and planning, Uncertainty and towards Learning Systems	06-03-05-05=18	**1/3/4,9**
II	**Overview of Problem Solving**: Problem-solving by Search, Problem space- State space, Blind Search-Types, and Performance measurement.	08-03-05-04=15	**2/3/4,9,11**
III	**Heuristic Search, Knowledge Representation, and Reasoning**: Types, Gameplay in Gemini-max algorithm, Alpha-Beta Pruning. Logical Systems Knowledge-Based Systems, Proposition Logic Constraints, Predicate Logic First Order Logic, Inference in First-Order Logic, on to logical Representations and Applications.	08-03-05-08=19	**3/2/4,9,11**
IV	**Uncertainty and knowledge Reasoning**: Overview Definition of uncertainty, Bayes Rule Inference, Belief Network, Utility-Based System, Decision Network.	08-04-05-08=20	**4/4/4,9,11**
V	**Learning Systems**: Forms of Learning Types-Supervised, Unsupervised, Reinforcement Learning, Learning decision trees.	10-04-05-10=24	**5/2/4,9,11**
	Total Hrs	**28-14-25-23=90**	
	Credits=Total Hrs/30	**90/30=03**	

5. CO–PO Mapping Matrix

CO \PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
CO1	3	2	2								2
CO2	3	3	2	2	2						1
CO3	3	2	3			1					2
CO4	3	3	2	1	2						1
CO5	2	2	3	2	2	1					2

(*Mapping:1 –Low, 2– Medium,3 – High*)

6. CO–SDG Mapping Matrix

CO/ SDG	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17
CO1				3					3								
CO2				3					3		1						
CO3				3					3		1						
CO4				3					3		2						
CO5				3					3		2						

7. Details of Practical's Sessions (if applicable)

Practical	Title of Experiment/Activity
1	
2	
3	

8. Textbooks

S. No.	Author(s)	Title	Publisher & Year
1	Russell, S and Norvig	Artificial Intelligence-A Modern Approach	Prentice Hall, 3rd Edition, 2009
2	Poole, D and Mackworth	Artificial Intelligence: Foundations of Computational Agents	Cambridge University Press, 2010

9. Reference Books

S. No.	Author(s)	Title	Publisher & Year
1	Ric, E., Knight, Kand Shankar	Artificial Intelligence	3rd edition, Tata Mc Graw Hill, 2009

10. Assessment Scheme

Component	Weightage (%)
Internal Assessment Test - I	10
Internal Assessment Test – II	10
Internal Assessment Test – III	10
Other Assessment	10
Assignments/ Presentations	10
Semester End Examination	50

11. Course Outcome Attainment

Type	Method
Direct	Internal Tests, Assignments, Semester End Exams.
Indirect	Course Exit Survey, Student Feedback

Prepared by	Vetted by		Confirmed by
Faculty	**HOD**	**IQAC, ACU**	**Principal**
Name: Dr. Girisha K B	**Name: Dr. Girisha K B**	**Name:**	**Name: Dr. B N Shobha**
Designation: Professor	**Designation: Professor & Head**	**Designation:**	**Designation: Dean & Principal**
Signature:	**Signature:**	**Signature:**	**Signature:**

1. Course Information

Section	Details
Course Title	Design of Robotic Components
Course Code	26BRAIIC4E
Program	Robotics and Artificial Intelligence
Academic Year/Semester	2026-2027/IV
Course Type	☑ **Core** ☐Elective ☐ Lab
Prerequisite(If any)	Material science, Computer Aided Tools, Manufacturing process
Contact Hours per Semester	Lecture:42 Tutorial: 14 Practical: 42 SL: 22 Total: 120
Credits	4
W.e.f	2026-27
Approved in AC on	June 2026
Course Description	This course provides a comprehensive foundation in designing, selecting, and fabricating essential robotic components, including mechanical structures, joints, and power transmission systems and gears.

2. Course Objectives

1. To understand the fundamentals of Robotics Components.
2. To develop machine components subjected to static and complex loading conditions, using theories of failure, stress concentration concepts.
3. To provide analytical skills and practical knowledge for designing and evaluating belt drives and rolling contact bearings used in mechanical systems.
4. To understand the mechanics of torsion and apply standard design practices in the analysis and design of shafts and keys for mechanical power transmission systems.

3. Course Outcomes (COs)

COs	Course Outcome Statement	BTL	Pos Mapped
CO1	Analyze mechanical behavior of materials under different loading conditions, apply fundamental concepts of stress and strain.	4	PO1, PO2, PO3, PO4, PO11
CO2	Apply failure theories to design components under static loading, evaluate the strength of threaded fasteners, and design bolted joints considering various loading scenarios including fatigue and eccentric loading.	3	PO1, PO2, PO3, PO4.PO5, PO11
CO3	Analyze belt drive systems for power transmission and centrifugal effects and select suitable rolling contact bearings based on load-life calculations, operating conditions, and manufacturer data.	4	PO1, PO2, PO3, PO4.PO5, PO11
CO4	Apply standard design practices in the analysis and design of shafts and keys for mechanical power transmission systems.	3	PO1, PO2, PO3, PO4, PO5, PO11
CO5	Apply the law of gearing, and design a selected gear type (spur, helical, bevel, or worm) considering force analysis, interference, material selection, and standard specifications.	4	PO1, PO2, PO3, PO4.PO5, PO11

4. Course Content (Module-Wise)

Module	Topics	L-T-P-SL=TOTAL	Cos/BTL/SDG
I	**Introduction**: Mechanical properties of materials, Stress, Strain and Hooke's law, Stress strain diagram for brittle and ductile materials, Factor of safety, True stress and strain, Calculation of stresses in straight, Stepped and tapered sections, Stresses due to temperature change, Shear stress and strain, Lateral strain and Poisson's ratio, Elastic constants and relations between them. **Lab Component: Simple Mechanical Material Tests in MT Lab(Tensile, Compression & Wear)**	10-03-09-06=28	**1/4/4,9**
II	**Introduction to Machine Design**: Meaning of design with special reference to machine design - Definition and understanding of several types of designs. Concept of design. Design for Static Strength: Static Strength, Static loads, Theories of elastic failure – Maximum normal stress theory, Maximum shear stress theory, Distortion energy theory; Failure of brittle materials, Failure of ductile materials, Stress concentration factor. **Lab Component: Principal stress and strain calculations in Design lab**	08-03-09-04=24	**2/3/4,9**
III	**Belt Drives**: Ratio of tensions, Centrifugal stress in a belt, Power transmitted, effect of centrifugal tension on power transmitted, Simple numerical problems Rolling contact bearings: Types, static and dynamic load capacities, equivalent bearing load, load-life relationship, bearing life, load factor, selection of bearing from manufacturer's catalogue; ball and roller bearings.	08-03-08-05=24	**3/4/4,7,9,11**

	Lab Component: Pressure Distribution Curve in Journal Bearing Setup (Design lab)		
IV	**Shafts and Keys**: Pure torsion, assumptions, derivation of torsional equations, polar modulus, torsional rigidity / stiffness of shafts, Derivation of power transmitted by solid and hollow circular shafts, design for strength and rigidity with steady loading, ASME & BIS codes for design of transmission shafting. Keys: Types of keys, Design of keys. **Lab Component: Simple Beam analysis for Shafts using Ansys (CAMA lab)**	08-03-08-04=23	**4/3/4,7,9,11**
V	**Design of Gears**: Classification of Gears, Selection of type of gears, Law of Gearing, Gear terminology, Standard system of gear tooth, force analysis, Interference and undercutting, number of teeth, gear tooth failures, selection of material. Specifications of spur gear, helical gear, bevel gear, worm gears (Numerical on any one gear design). **Lab Component: Simple Gear Tooth Analysis using Ansys (CAMA lab)**	08-02-08-03=21	**5/4/4,7,9,11**
	Total Hrs	**42-14-42-22=120**	
	Credits=Total Hrs/30	**120/30=04**	

5. CO–PO Mapping Matrix

CO \PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
CO1	3	3	1	1							1
CO2	3	3	3	1	1						1
CO3	3	3	2	1	2						1
CO4	3	3	3	1	2						1
CO5	3	3	3	2	2						2

(*Mapping:1 –Low, 2– Medium,3 – High*)

6. CO–SDG Mapping Matrix

CO/ SDG	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17
CO1				**3**					**3**								
CO2				**3**					**3**								
CO3				**3**			**2**		**3**		**1**						
CO4				**3**			**2**		**3**								
CO5				**3**			**2**		**3**		**1**						

7. Details of Practical's Sessions (if applicable)

Practical	Title of Experiment/Activity
1	
2	
3	

8. Textbooks

S. No.	Author(s)	Title	Publisher & Year
1	Joseph E Shigley and Charles R. Mischke	Mechanical Engineering Design	McGraw Hill International edition, 2003
2	V.B. Bhandar	Design of Machine Elements	Tata McGraw Hill Publishing Company Ltd., 2010

9. Reference Books

S. No.	Author(s)	Title	Publisher & Year
1	Robert L	Machine Design	Norton, Pearson Education Asia, 5th Edition, 2013
2	Hall, Holowenko, Laughlin,	Machine Design	Tata McGraw Hill Publishing Company Ltd., 2007

10. Assessment Scheme

Component	Weightage (%)
Internal Assessment Test - I	10
Internal Assessment Test - II	10
Internal Assessment Test - III	10
Other Assessment	10
Assignments/ Presentations	10
Semester End Examination	50

11. Course Outcome Attainment

Type	Method
Direct	Internal Tests, Assignments, Semester End Exams.
Indirect	Course Exit Survey, Student Feedback

Prepared by	Vetted by		Confirmed by
Faculty	**HOD**	**IQAC, ACU**	**Principal**
Name: Keerthi B L	**Name:** **Dr. Girisha K B**	**Name:**	**Name: Dr. B N Shobha**
Designation: **Assistant Professor**	**Designation: Professor & Head**	**Designation:**	**Designation:** **Dean & Principal**
Signature:	**Signature:**	**Signature:**	**Signature:**

1. Course Information

Section	Details
Course Title	Data Acquisition and Robotic Vision Lab
Course Code	26BRAIPL4F
Program	Robotics and Artificial Intelligence
Academic Year/Semester	2026-2027
Course Type	☐ Core ☐Elective ☐✔ Lab
Prerequisite (If any)	Computer Programming and Fundamentals of Digital Image Processing.
Contact Hours per Semester	Lecture:0 Tutorial: 0 Practical:30 SL: 0 Total: 30
Credits	1
W.e.f	2026-27
Approved in AC on	
Course Description	This laboratory course provides hands-on experience in the acquisition, conditioning, processing, and analysis of data obtained from various sensors and transducers used in engineering applications. Students learn to design and implement sensor interfacing circuits, signal conditioning systems, and data acquisition modules using modern instrumentation and embedded platforms.

2. Course Objectives

1. To understand various lighting techniques, design and image acquisition of machine vision system.
2. To practice Feature Extraction, Image pre-processing and pattern recognition.
3. To apply machine learning technique to classification and object detection.

3. Course Outcomes (COs)

COs	Course Outcome Statement	BTL	Pos Mapped
CO1	Select appropriate lighting techniques and image acquisition device for robot vision system.	3	PO1, PO2, PO3, PO5, PO11
CO2	Apply Feature Extraction, Image pre-processing and pattern recognition algorithm in real time robot.	3	PO1, PO2, PO3, PO4, PO5, PO6, PO11
CO3	Apply machine learning techniques for classification and object detection.	3	PO1, PO2, PO3, PO4, PO5, PO11

4. Course Content (List of Experiments)

List	Experiments	L-T-P-SL=TOTAL	COs/BTL/SDG
I	Study on different kinds of vision sensors and lighting techniques for machine vision	00-00-03-00=03	**1/3/4,9,11**
II	Experimentation on image acquisition towards the computation platform.	00-00-03-00=03	**1/3/4,9,11**
III	Experimentation with image processing algorithm for feature extraction.	00-00-03-00=03	**2/3/4,9,11**
IV	Experimentation with pattern recognition	00-00-03-00=03	**2/3/4,9,11**
V	Pre-processing techniques in image processing	00-00-03-00=03	**2/3/4,9,11**
VI	Experimentation for Stereo vision.	00-00-03-00=03	**3/3/4,9,11**
VII	Robot assisted image acquisition.	00-00-03-00=03	**3/3/4,9,11**
VIII	Vision based defect identification	00-00-03-00=03	**3/3/4,9,11**
IX	Experimentation for Stereo vision.	00-00-03-00=03	**3/3/4,9,11**
X	Vision based Object detection using Machine Learning Techniques.	00-00-03-00=03	**3/3/4,9,11**
	Total Hrs	**00-00-30-00=30**	
	Credits=Total Hrs/30	**30/30=01**	

5. CO–PO Mapping Matrix

CO \PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
CO1	3	2	2		1						1
CO2	3	3	3	2	3	1					2
CO3	3	3	3	2	3						2

(*Mapping:1 –Low, 2– Medium,3 – High*)

6. CO–SDG Mapping Matrix

CO/ SDG	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17
CO1				3					3		1						
CO2				3					3		2						
CO3				3					3		2						

7. Details of Practical's Sessions (if applicable)

Practical	Title of Experiment/Activity
1	
2	
3	

8. Textbooks

S. No.	Author(s)	Title	Publisher & Year
1	Bentley, John P	Principles of Measurement Systems	Pearson/Prentice Hall, 2005
2	Jacob Fraden	Handbook of Modern Sensors Physics, Design and Applications	Springer, 4th edition, 2010

9. Reference Books

S. No.	Author(s)	Title	Publisher & Year
1	Conor Suarez	Data Acquisition Handbook	Clanrye International,2015

10. Assessment Scheme

Component	Weightage (%)
CIE	50
Semester End Examination	50

11. Course Outcome Attainment

Type	Method
Direct	Internal Tests, Assignments, Semester End Exams.
Indirect	Course Exit Survey, Student Feedback

Prepared by	Vetted by		Confirmed by
Faculty	**HOD**	**IQAC, ACU**	**Principal**
Name: Dr. Girisha K B	**Name: Dr. Girisha K B**	**Name:**	**Name: Dr. B N Shobha**
Designation: Professor	**Designation: Professor & Head**	**Designation:**	**Designation: Dean & Principal**
Signature:	**Signature:**	**Signature:**	**Signature:**

1. Course Information

Section	Details
Course Title	Simulation Lab
Course Code	26BRAIPL4G
Program	Robotics and Artificial Intelligence
Academic Year/Semester	2026-2027/ IV
Course Type	☐ Core ☐Elective ☐✔ Lab
Prerequisite (If any)	Fundamentals of Robotics, Programming skills
Contact Hours per Semester	Lecture: 0 Tutorial: 0 Practical:30 SL: 0 Total: 30
Credits	1
W.e.f	2026-27
Approved in AC on	June 2026
Course Description	Simulation Lab provides practical training in programming, simulating, and controlling robotic systems using modern software tools and programming environments. The course emphasizes kinematic modeling, trajectory planning, sensor integration, and the use of simulation platforms to analyze and optimize robot performance before real-world implementation.

2. Course Objectives

1. To introduce different types of robotics and demonstrate them to identify different parts and components.
2. To Implement functional routines such as pick-and-place tasks, material handling, or assembly simulations.

3. Course Outcomes (COs)

COs	Course Outcome Statement	BTL	Pos Mapped
CO1	Use of any robotic simulation software to model the different types of robots and calculate work volume for different robots	2	PO1, PO2, PO5,
CO2	Understand the basic structure and components of industrial robots and their applications in automation	2	PO1, PO6
CO3	Simulate robotic operations using standard robotic simulation Software	3	PO3, PO4, PO5
CO4	Execute robot programming logic using online teach pendants and offline simulation environment	3	PO3, PO5, PO8, PO11

4. Course Content (List of Experiments)

List	Topics	L-T-P-SL=TOTAL	COs/BTL/SDG
I	Determination of maximum and minimum position of links	00-00-04-00=04	**1/2/4,9,11**
II	Verification of transformation (Position and orientation) with respect to gripper and world Coordinate system	00-00-04-00=04	**1/2/4,9,11**
III	Estimation of accuracy, Repeatability and resolution	00-00-04-00=04	**2/2/4,9,11**
IV	Robot programming and simulation for pick and place	00-00-04-00=04	**2/2/4,9,11**
V	Robot programming and simulation for colour identification	00-00-04-00=04	**3/3/4,9,11**
VI	Robot programming and simulation for Shape identification	00-00-04-00=04	**3/3/4,9,11**
VII	Robot programming and simulation for machining (cutting, welding)	00-00-03-00=03	**3/3/4,9,11**
VIII	Robot programming and simulation for any industrial process. (Packing, Assembly)	00-00-03-00=03	**4/3/4,9,11**
	Total Hrs	**00-00-30-00=30**	
	Credits=Total Hrs/30	**30/30=01**	

5. CO–PO Mapping Matrix

CO \PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
CO1	3	2			3						
CO2	3					2					
CO3			2	2	3						
CO4			3		3			2			2

(*Mapping:1 –Low, 2– Medium,3 – High*)

6. CO–SDG Mapping Matrix

CO/ SDG	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17
CO1				3					3		1						
CO2				3					3		1						
CO3				3					3		2						
CO4				3					3		2						

7. Details of Practical's Sessions (if applicable)

Practical	Title of Experiment/Activity
1	
2	
3	

8. Textbooks

S. No.	Author(s)	Title	Publisher & Year
1	Robin R. Murphy	Introduction to AI and Robotics	MIT Press, 2nd Edition, 2019.
2	Stephen J. Chapman	MATLAB Programming for Engineers	Cengage Publisher,6th edition,2019

9. Reference Books

S. No.	Author(s)	Title	Publisher & Year
1	Danny Staple	Learn Robotics Programming: Build and control AI-enabled autonomous robots using the Raspberry Pi and Python	Packt Publishing Limited, 2021
2			

10. Assessment Scheme

Component	Weightage (%)
CIE	50
End Semester Examination	50

11. Course Outcome Attainment

Type	Method
Direct	Internal Tests, Assignments, Semester End Exams.
Indirect	Course Exit Survey, Student Feedback

Prepared by	Vetted by		Confirmed by
Faculty	**HOD**	**IQAC, ACU**	**Principal**
Name: Keerthi B L	**Name: Dr. Girisha K B**	**Name:**	**Name: Dr. B N Shobha**
Designation: Assistant Professor	**Designation: Professor & Head**	**Designation:**	**Designation: Dean & Principal**
Signature:	**Signature:**	**Signature:**	**Signature:**