PAAVAI ENGINEERING COLLEGE (Autonomous)

B.E. - ROBOTICS AND AUTOMATION

REGULATIONS – 2019 (CBCS)

CURRICULUM

SEMESTER I

S. No	Category	Course Code	Course Title	L	T	P	C
Theory							
1	BS	MA20101	Matrices and Calculus	3	1	0	4
2	HS	EN20101	English Communication Skills- I	3	0	0	3
3	BS	PH20101	Engineering Physics	3	0	0	3
4	BS	CH20101	Engineering Chemistry	3	0	0	3
5	ES	CS20201	Programming in Python	3	0	0	3
6	ES	ME20101	Engineering Graphics	2	1	0	3
Practical							
7	BS	CH20102	Chemistry Laboratory	0	0	2	1
8	ES	CS20103	Programming in Python Laboratory	0	0	2	1
Total				**17**	**2**	**4**	**21**

SEMESTER II

S. No	Category	Course Code	Course Title	L	T	P	C
Theory							
1	HS	GE20202	தமிழர்மரபு / Heritage of Tamils	1	0	0	1
2	BS	MA20201	Complex Variables and Differential Equations	3	1	0	4
3	HS	EN20201	English Communication Skills- II	3	0	0	3
4	BS	PH20203	Material Science	3	0	0	3
5	MC	MC20201	Environmental Science and Engineering	3	0	0	0
6	PC	ME20202	Engineering Mechanics	3	1	0	4
7	ES	EE20101	Basic Electrical Engineering	3	0	0	3
Practical							
8	BS	PH20205	Physics Laboratory	0	0	2	1
9	ES	GE20201	Engineering Practices Laboratory	0	0	4	2
Total				**19**	**2**	**6**	**21**

PAAVAI ENGINEERING COLLEGE, NAMAKKAL
Approved
BOARD OF STUDIES
Robotics and Automation
4/7/23
AUTONOMOUS

SEMESTER III

S. No	Category	Course Code	Course Title	L	T	P	C
Theory							
1	HS	GE20301	தமிழரும் தொழில்நுட்பமும் / Tamils and Technology	1	0	0	1
2	BS	MA20301	Transforms and Boundary Value Problems	3	1	0	4
3	PC	RA20301	Fluid Mechanics and Thermal Systems	3	1	0	4
4	PC	RA20302	Robot Kinematics	3	0	0	3
5	ES	EE20310	Electrical Drives and Actuators	3	0	0	3
6	ES	EE20311	Digital Electronics	3	0	0	3
7	MC	MC20301	Value Education	2	0	0	0
Practical							
8	PC	RA20303	Robot Modelling and Simulation Laboratory	0	0	2	1
9	EE	EE20312	Electrical Drives and Actuators Laboratory	0	0	2	1
10	EE	EN20301	English Proficiency Course Laboratory	0	0	2	1
Total				**18**	**2**	**6**	**21**

SEMESTER IV

S. No	Category	Course Code	Course Title	L	T	P	C
Theory							
1	BS	MA20401	Statistics and Numerical Methods	3	1	0	4
2	PC	RA20401	Manufacturing Technology	3	0	0	3
3	PC	RA20402	Mechanics of Materials	3	0	0	3
4	PC	EE20412	Control Systems Engineering	3	0	0	3
5	PC	EE20413	Microprocessors and Microcontrollers	3	0	0	3
6	PC	EE20414	Sensors and Instrumentation	3	0	0	3
Practical							
7	PC	RA20403	Manufacturing Technology Laboratory	0	0	2	1
8	ES	EE20415	Microprocessors and Microcontrollers Laboratory	0	0	2	1
9	PC	EE20416	Sensors and Instrumentation Laboratory	0	0	2	1
Total				**18**	**1**	**6**	**22**

GE20202 **தமிழர் மரபு** L P T C
1 0 0 1

அலகு I மொழி மற்றும் இலக்கியம் 3

இந்திய மொழிக் குடும்பங்கள் – திராவிட மொழிகள் – தமிழ் ஒரு செம்மொழி- தமிழ் செவ்விலக்கியங்கள் – சங்க இலக்கியத்தின் சமயச் சார்பற்ற தன்மை – சங்க இலக்கியத்தில் பகிர்தல் அறம் – திருக்குறளில் மேலாண்மைக் கருத்துக்கள் – தமிழ்க் காப்பியங்கள் தமிழகத்தில் சமண பௌத்த சமயங்களின் தாக்கம் – பக்தி இலக்கியம், ஆழ்வார்கள் மற்றும் நாயன்மார்கள் – சிற்றிலக்கியங்கள் – தமிழில் நவீன இலக்கியத்தின் வளர்ச்சி – தமிழ் இலக்கிய வளர்ச்சியில் பாரதியார் மற்றும் பாரதிதாசன் ஆகியோரின் பங்களிப்பு.

அலகு II மரபு – பாறை ஓவியங்கள் முதல் நவீன ஓவியங்கள் வரை 3

நடுகல் முதல் நவீன சிற்பங்கள் வரை – ஐம்பொன் சிலைகள் – பழங்குடியினர் மற்றும் அவர்கள் தயாரிக்கும் கைவினைப் பொருட்கள், பொம்மைகள் – தேர் செய்யும் கலை – சுடுமண் சிற்பங்கள் – நாட்டுப்புறத் தெய்வங்கள் – குமரிமுனையில் திருவள்ளுவர் சிலை – இசைக் கருவிகள் – மிருதங்கம், பறை, வீணை, யாழ், நாதஸ்வரம், - தமிழர்களின் சமூக பொருளாதார வாழ்வில் கோவில்களின் பங்கு.

அலகு III நாட்டுப்புறக் கலைகள் மற்றும் வீர விளையாட்டுகள் 3

தெருக்கூத்து, கரகாட்டம், வில்லுப்பாட்டு, கணியன் கூத்து, ஒயிலாட்டம், தோல்பாவைக் கூத்து, சிலம்பாட்டம், வளரி, புலியாட்டம், தமிழர்களின் விளையாட்டுகள்.

அலகு IV தமிழர்களின் திணைக் கோட்பாடுகள் 3

தமிழகத்தின் தாவரங்களும், விலங்குகளும் – தொல்காப்பியம் மற்றும் சங்க இலக்கியத்தில் அறம் மற்றும் புறக் கோட்பாடுகள் – தமிழர்கள் போற்றிய அறக்கோட்பாடு – சங்ககாலத்தில் தமிழகத்தில் எழுத்தறிவும், கல்வியும் – சங்ககால நகரங்களும் துறைமுகங்களும் – சங்க காலத்தில் ஏற்றுமதி மற்றும் இறக்குமதி – கடல்கடந்த நாடுகளில் சோழர்களின் வெற்றி.

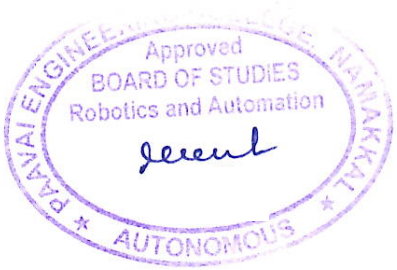
அலகு V இந்திய தேசிய இயக்கம் மற்றும் இந்திய பண்பாட்டிற்குத் தமிழர்களின் பங்களிப்பு 3

இந்திய விடுதலைப் போரில் தமிழர்களின் பங்கு – இந்தியாவின் பிறப்பகுதிகளில் தமிழ்ப் பண்பாட்டின் தாக்கம் – சுயமரியாதை இயக்கம் – இந்திய மருத்துவத்தில் சித்த மருத்துவத்தின் பங்கு – கல்வெட்டுகள், கையெழுத்துப்படிகள் – தமிழ்ப் புத்தகங்கள் அச்சு வரலாறு.

TOTAL PERIODS: 15

TEXT CUM REFERENCE BOOKS:

1. தமிழக வரலாறு – மக்களும் பண்பாடும் – கே.கே.பிள்ளை. (வெளியீடு தமிழ்நாடு பாடநூல் மற்றும் கல்வியியல் பணிகள் கழகம்).
2. கணினித் தமிழ் – முனைவர் இல. சுந்தரம் (விகடன் பிரசுரம்).
3. கீழடி – வைகை நதிக்கரையில் சங்ககால நகர நாகரிகம் (தொல்லியல் துறை வெளியீடு).
4. பொருநை – ஆற்றங்கரை நாகரிகம் (தொல்லியல் துறை வெளியீடு).
5. Social Life of Tamils (Dr.K.K.Pillay) A Joint publication of TNTB & ESC and RMRL – (in print).
6. Social Life of the Tamils – The Classical Period (Dr.S.Singaravelu) (Published by International institute of Tamil Studies.
7. Historical Heritage of the Tamils (Dr.S.V.Subramanian, Dr.K.D.Thirunavukkarasu)
8. The Contributions of the Tamils to Indian Culture (Dr.M.Valarmathi) (Published by International institute of Tamil Studies)
9. Keeladi – 'Sangam City Civilzation on the vanks of river vaigai' (Jointly Published by Department of Archaeology & Tamil Nadu Text Book and Educational Services Corporation, Tamil Nadu)
10. Studies in the History of India with Special Reference to Tamil Nadu (Dr.K.K.Pillay) (Published by the author)
11. Porunai Civilization (Jointly Published by Department of Arcaeology & Tamil Nadu Text Book and Educational Services Corporation, Tamilnadu).
12. Journey of Civilization Indus to vaigai (R.Balakrishnan) (Published by RMRL) – Reference Book



GE20202	HERITAGE OF TAMILS	L	P	T	C
		1	0	0	1

UNIT I LANGUAGE AND LITERATURE 3

Language Families in India - Dravidian Languages – Tamil as aClassical Language - Classical Literature in Tamil – Secular Nature of Sangam Literature – Distributive Justice in Sangam Literature - Management Principles in Thirukural - Tamil Epics and Impact of Buddhism & Jainism in Tamil Land - Bakthi Literature Azhwars and Nayanmars - Forms of minor Poetry - Development of Modern literature in Tamil - Contribution of Bharathiyar and Bharathidhasan.

UNIT II HERITAGE - ROCK ART PAINTINGS TO MODERN ART – SCULPTURE 3

Hero stone to modern sculpture - Bronze icons - Tribes and their handicrafts - Art of temple car making - - Massive Terracotta sculptures, Village deities, Thiruvalluvar Statue at Kanyakumari, Making of musical instruments - Mridhangam, Parai, Veenai, Yazh and Nadhaswaram - Role of Temples in Social and Economic Life of Tamils.

UNIT III FOLK AND MARTIAL ARTS 3

Therukoothu, Karagattam, Villu Pattu, Kaniyan Koothu, Oyillattam, Leatherpuppetry, Silambattam, Valari, Tiger dance - Sports and Games of Tamils.

UNIT IV THINAI CONCEPT OF TAMILS 3

Flora and Fauna of Tamils & Aham and Puram Concept from Tholkappiyam and Sangam Literature - Aram Concept of Tamils - Education and Literacy during Sangam Age - Ancient Cities and Ports of Sangam Age - Export and Import during Sangam Age - Overseas Conquest of Cholas.

UNIT V CONTRIBUTION OF TAMILS TO INDIAN NATIONAL MOVEMENT AND INDIAN CULTURE 3

Contribution of Tamils to Indian Freedom Struggle - The Cultural Influence of Tamils over the other parts of India – Self-Respect Movement - Role of Siddha Medicine in Indigenous Systems of Medicine – Inscriptions & Manuscripts – Print History of Tamil Books.

TOTAL PERIODS: 15

TEXT CUM REFERENCE BOOKS:

1. தமிழக வரலாறு – மக்களும் பண்பாடும் – கே.கே.பிள்ளை. (வெளியீடு தமிழ்நாடு பாடநூல் மற்றும் கல்வியியல் பணிகள் கழகம்).
2. கணினித் தமிழ் – முனைவர் இல. சுந்தரம் (விகடன் பிரசுரம்).
3. கீழடி – வைகை நதிக்கரையில் சங்ககால நகர நாகரிகம் (தொல்லியல் துறை வெளியீடு).

4. பொருநை – ஆற்றங்கரை நாகரிகம் (தொல்லியல் துறை வெளியீடு).
5. Social Life of Tamils (Dr.K.K.Pillay) A Joint publication of TNTB & ESC and RMRL – (in print).
6. Social Life of the Tamils – The Classical Period (Dr.S.Singaravelu) (Published by International institute of Tamil Studies.
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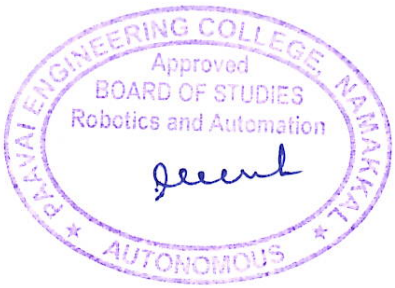
8. The Contributions of the Tamils to Indian Culture (Dr.M.Valarmathi) (Published by International institute of Tamil Studies)
9. Keeladi – 'Sangam City Civilzation on the vanks of river vaigai' (Jointly Published by Department of Archaeology & Tamil Nadu Text Book and Educational Services Corporation, Tamil Nadu)
10. Studies in the History of India with Special Reference to Tamil Nadu (Dr.K.K.Pillay) (Published by the author)
11. Porunai Civilization (Jointly Published by Department of Arcaeology & Tamil Nadu Text Book and Educational Services Corporation, Tamilnadu).
12. Journey of Civilization Indus to vaigai (R.Balakrishnan) (Published by RMRL) – Reference Book



MA20301 **TRANSFORMS AND BOUNDARY VALUE PROBLEMS** **3 1 0 4**

(Common to Aero, Agri, Chemical, EEE, Civil, Food, IT, Mech, MCT, Pharma, Robotics, Safety & Fire, Bio-Tech)

OBJECTIVES

To enable the students to

- introduce Fourier series analysis which is central to many applications in engineering apart from its use in solving boundary value problems
- acquaint the students with Fourier transform techniques used in wide variety of situations in which the functions used are not periodic
- formulate Partial Differential Equations and use Mathematical tools for the solution of PDE that model several physical processes
- develop the modeling of one dimensional equation of heat conduction, wave equation and two dimensional Laplace equation
- develop Z- transform techniques which will perform the same task for discrete time systems as Laplace Transform does for continuous systems, a valuable aid in analysis of continuous time systems

UNIT I **FOURIER SERIES** **12**

Dirichlet's conditions; General Fourier series; Odd and even functions; Half range series; Complex form of Fourier Series; Parseval's identity; Harmonic Analysis.

UNIT II **FOURIER TRANSFORMS** **12**

Fourier integral theorem (without proof); Fourier transform pair; Convolution theorem; Parseval's identity; Sine and Cosine transforms - Properties; Transforms of elementary functions.

UNIT III **PARTIAL DIFFERENTIAL EQUATIONS** **12**

Formation of partial differential equations; Lagrange's linear equation; Solutions of four standard types of first order partial differential equations; Linear partial differential equations of second order with constant coefficients.

UNIT IV **FOURIER SERIES SOLUTION TO PARTIAL DIFFERENTIAL EQUATIONS** **12**

Solutions of One-dimensional wave and heat equation; Steady state two-dimensional heat equation.

UNIT V **Z -TRANSFORMS AND DIFFERENCE EQUATIONS** **12**

Z-transforms - Elementary properties; Inverse Z-transform; Convolution theorem; Formation of difference equations; Solution of difference equations using Z-transform.

TOTAL PERIODS: 60

OUTCOMES

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

- derive Fourier series, their possible forms of representations of periodic functions
- identify and formulate a function in frequency domain whenever the function is defined in time domain
- formulate and solve partial differential equations that occur in many engineering applications
- model wave and heat equations, solve certain boundary value problems and use the solution methods in engineering applications.
- demonstrate the use of Z-transform to convert discrete functions into complex frequency domain representation

TEXT BOOKS

1. Veerarajan T., "Transforms and Partial Differential Equations", Tata McGraw Hill Education Pvt. Ltd., New Delhi, Second reprint, 2012.
2. Grewal. B.S, "Higher Engineering Mathematics", 41st Edition, Khanna Publications, Delhi,(2011).

REFERENCE BOOKS

1. Narayanan S., Manickavasagam Pillai.T.K and Ramanaiah.G "Advanced Mathematics for Engineering Students" ,Vol. II & III, S.Viswanathan Publishers Pvt Ltd. 1998.
2. Larry C. Andrews, Bhimsen K. Shivamoggi, "Integral Transforms for Engineers", SPIE Optical Engineering press, Washington USA (1999).
3. Ramana. B.V., "Higher Engineering Mathematics", Tata Mc-GrawHill Publishing Company limited, New Delhi (2010).
4. Glyn James, "Advanced Modern Engineering Mathematics", 3rd Edition, Pearson Education (2007).
5. Erwin Kreyszig., "Advanced Engineering Mathematics" 10th Edition, Wiley Publications.

CO/PO Mapping

Mapping of Course Outcomes with Programme Outcomes (3/2/1 indicates strength of correlation) 3- Strong, 2-Medium, 1-Weak														
CO	Programmes Outcomes(POs)													
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	3	2	2	-	-	-	-	-	-	-	1	-	-
CO2	3	3	2	1	-	-	-	-	-	-	-	1	-	-
CO3	3	2	3	2	-	-	-	-	-	-	-	1	-	-
CO4	3	2	2	2	-	-	-	-	-	-	-	1	-	-
CO5	3	3	2	2	-	-	-	-	-	-	-	1	-	-

RA20301 **FLUID MECHANICS AND THERMAL SYSTEMS** **3 1 0 4**

COURSE OBJECTIVES

To enable the students to

- become familiar in Fluid Properties and Statics.
- acquire knowledge of fluid kinematics and dynamics.
- comprehend the simple functioning of flows in fluid, Viscous flows and flow through pipes
- gain knowledge basics laws of thermodynamics.
- understand the second law of thermodynamics and entropy.

UNIT I FLUID PROPERTIES AND FLUID STATICS **12**

Fluid Definition and Classification - Properties of fluids: Density, Specific Weight, Specific Volume, Specific Gravity, Viscosity, Compressibility, Bulk Modulus, Capillary and Surface Tension-Fluid statics: Concept of fluid static pressure-Pascal's law-Absolute and Gauge pressures- Manometers: Types and Pressure measurement.

UNIT II FLUID KINEMATICS AND FLUID DYNAMICS **12**

Fluid Kinematics: Types of fluid flow, Continuity equation in two and three dimensions, Velocity and Acceleration of fluid particle - Velocity potential function and Stream function. Fluid dynamics: Euler's equation along a streamline - Bernoulli's equation and applications - Venturimeter, Orificemeter and Pitot tube.

UNIT III VISCOUS FLOW, FLOW THROUGH PIPES AND DIMENSIONAL ANALYSIS **12**

Viscous flow: Shear stress, pressure gradient relationship, Flow of viscous circular pipe - Flow through pipes: Loss of head due to friction - Minor head losses - Hydraulic fluid through gradient and total energy lines - Flow through pipes in series and in parallel – Power transmission through pipes. Dimensional analysis: Buckingham's π theorem.

UNIT IV BASICS OF THERMODYNAMICS AND FIRST LAW OF THERMODYNAMICS **12**

Thermodynamics Microscopic and macroscopic point of view Systems, properties, process, path, cycle. Thermodynamic equilibrium - Zeroth law of Thermodynamics-internal energy, enthalpy and specific heat capacities CV and CP, Relationship between CV and CP. First law of Thermodynamics - Application to closed and open systems - Steady Flow Energy Equation (SFEE) - Simple problems.

UNIT V SECOND LAW OF THERMODYNAMICS AND ENTROPY **12**

Second Law of thermodynamics - Kelvin Planck and Clausius Statements - Equivalents of Kelvin Planck and Clausius statements. Reversibility - Irreversibility, reversible cycle - Heat engine, heat pump and refrigerator. Carnot cycle and Clausius theorem, property of entropy - Entropy principle - General expression for entropy - Simple problems in entropy.

TOTAL PERIODS: 60

COURSE OUTCOMES

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

- recognize the fluid properties, fluid statics and laws of thermodynamics

- interpret the problems related to kinematics and dynamics of fluids and thermal systems.
- review the energy losses in flow through pipes and steady flow equation in thermal systems.
- analyse the fluid flow and thermal process.
- solve the problems related to fluid and thermal systems

TEXT BOOKS

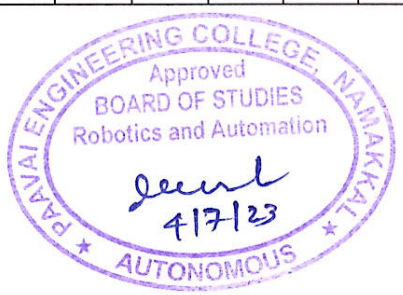
1. Bansal R.K, Fluid Mechanics New Delhi, 2015. Machines, 9th Edition, Laxmi Publications New Delhi.
2. P.K.Nag, Basic and Applied Thermodynamics, C 2002, Tata McGraw-Hill Publishing Company Limited.

REFERENCES

1. R.K. Rajput ,Engineering Thermodynamics, Third edition,Laxmi Publications,2011
2. R. S. Khurmi, A Text Book of Hydraulics, Fluid Mechanics and Hydraulic Machines, 15th edition,S. Chand Limited,2010
3. Cengel Yunus A. and Boles Michael A. Thermodynamics. An Engineering Approach. 7th Edition, McGraw-Hill, New York, 2011.
4. Frank M. White., -Fluid Mechanics, 7th Edition, Tata McGraw Hill Publishing Company, New Delhi, 2009.

CO - PO Mapping

Mapping of Course Outcomes with Programme Outcomes: **(1/2/3 indicates strength of correlation) 3-Strong, 2-Medium , 1-Weak**														
COs	**Programme Outcomes(POs)**													
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO 10**	**PO11**	**PO12**	**PSO1**	**PSO2**
CO1	3	-	2	-	3	-	-	-	-	-	-	2	2	3
CO2	3	-	2	-	3	-	-	-	-	-	-	2	2	3
CO3	3	-	2	-	3	-	-	-	-	-	-	2	2	3
CO4	3	-	2	-	3	-	-	-	-	-	-	2	2	3
CO5	3	-	2	-	3	-	-	-	-	-	-	2	2	3



RA20302 **ROBOT KINEMATICS** **3 0 0 3**

COURSE OBJECTIVES

To enable the students to

- get a brief exposure to Robots history, terminologies, classification and configurations.
- learn the concepts of basic Geometrical and Algebraic approach to solve forward kinematics of serial manipulator.
- know about advanced forward kinematics of serial manipulator.
- understand the inverse kinematics of various serial manipulator.
- acquire knowledge in the fundamentals of Jacobian aspects and infinitesimal motion of robot mechanisms.

UNIT I OVERVIEW OF ROBOTICS **9**

Introduction to Robotics - History - Definitions - Law of Robotics – Terminologies - Classifications Overview – Links & Joints - Degrees of Freedoms - Coordinate Systems - Work Volume - Precision, Repeatability & Accuracy - Position and Orientation of Objects - Roll, Pitch and Yaw Angles - Joint Configuration of Five Types of Serial Manipulators - Wrist Configuration- Overview of end effector - Selection and Application of Serial Manipulators.

UNIT II FORWARD KINEMATICS - GEOMETRICAL AND ALGEBRAIC APPROACH **9**

Need for forward and Inverse Kinematics Equation – Parameters in Design and Control – Methods of forward and inverse kinematics- Geometrical and Algebraic Approach in Forward Kinematics Solution, 1 DOF - 2 DOF Planar Robot (2P and 2R); 3DOF 2RP Spatial Robot.

UNIT III FORWARD KINEMATIC MODELING – DENAVIT-HARTEBERG APPROACH **9**

Unit Circle Trigonometry - Translation Matrix - Rotation matrix, Euler Angles - Quaternion Fundamental - Dot and Cross Products - Frames and Joint Coordinates - Homogeneous Transformation - D-H and Modified D-H Convention and Procedures – Forward kinematics Solution using D-H Convention: 3 DOF wrist , RR Planar, 3 DOF RRP, Cartesian, Cylindrical, Spherical , SCARA and Articulated 3 DOF robots - 3 DOF robot with wrist.

UNIT IV INVERSE KINEMATICS MODELING **9**

Introduction to inverse kinematics -Issues in inverse kinematics - Inverse kinematics of 2 DOF Planar robot - 2 and 3DOF planar and Spatial robot - Tool configuration - Inverse kinematics of 3 axis robot and 6 axis Robot - Inverse kinematics Computation- Closed loop solution.

UNIT V KINEMATIC MODELING OF DIFFERENTIAL DRIVE ROBOT **9**

Degree of Mobility, Steerability and Maneuverability- Mobile Robot kinematics - Kinematic model and constraints, Mobile robot workspace – Representation of robot position – Kinematic models of differential wheel drive - Fixed wheel and steered wheel - Mobile manipulators and its applications – swarm robots.

TOTAL PERIODS: 45

COURSE OUTCOMES

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

- describe the importance of the history, classifications, and basic terminologies of robotics and various configuration of robots.

- evaluate forward kinematic model for planar and spatial robot manipulator.
- apply the working principle of forward kinematic model for multi-DOF robot manipulators.
- assess the inverse kinematic model for multi-DOF robot manipulators.
- apply the knowledge forward kinematic model for differential drive mobile robot.

TEXT BOOKS

1. Mikell P. Groover, "Industrial Robotics", McGraw Hill, 2nd edition, 2012.
2. John J. Craig, "Introduction to Robotics", 3rd Edition, Addison Wesley, ISE 2008.

REFERENCES

1. Lynch, Kevin M., and Frank C. Park. Modern Robotics: Mechanics, Planning, and Control 1st ed. Cambridge University Press, 2017.
2. S K Saha, Introduction to Robotics, Tata McGraw-Hill, Second Edition, 2017
3. Yore Koran, "Robotics for Engineers", McGraw-Hill Book Co.,2001
4. Richard. K. Miller, "Industrial Robot Handbook", Springer, 2013.

CO - PO Mapping

Mapping of Course Outcomes with Programme Outcomes: **(1/2/3 indicates strength of correlation) 3-Strong, 2-Medium , 1-Weak**														
COs	**Programme Outcomes(POs)**													
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO 10**	**PO11**	**PO12**	**PSO1**	**PSO2**
CO1	3	2	1	1	-	-	-	-	-	-	-	1	1	3
CO2	3	2	1	1	-	-	-	-	-	-	-	1	1	3
CO3	3	2	1	1	-	-	-	-	-	-	-	1	1	3
CO4	3	3	1	2	-	-	-	-	-	-	-	1	1	3
CO5	3	1	1	2	-	-	-	-	-	-	-	1	1	3

EE20310 **ELECTRICAL DRIVES AND ACTUATORS** **3 0 0 3**

COURSE OBJECTIVES

To enable the students to

- familiarize the different power semiconductor devices and drivers circuits.
- get a knowledge on electric drive and their characteristics.
- obtain the knowledge on DC motors drives by using power electronics converter.
- study about AC motors controlling technique.
- know about the stepper and switched reluctance motor construction and operation.

UNIT I POWER SEMI-CONDUCTOR DEVICES **9**

Switching devices and V-I characteristics - BJT, SCR, TRIAC, GTO, MOSFET, IGBT; Triggering circuit - Introduction to driver and snubber circuits.

UNIT II DRIVE CHARACTERISTICS **9**

Electric drive - Equations governing motor load dynamics, steady state stability; Multi quadrant dynamics - Acceleration, deceleration, torque, and direction starting and stopping; Selection of motor.

UNIT III DC MOTORS AND DRIVES **9**

DC motors and their performance - Separately excited motor, shunt motor, series motor, compound motor, universal motor, permanent magnet motor, DC servo motor; Starting - Braking; Speed control – Single phase fully controlled rectifier fed DC drives, step down chopper controlled DC drives.

UNIT IV AC MOTORS AND DRIVES **9**

Three phase induction motor construction, operation and their characteristic; Speed control of three phase induction motor – Stator voltage control , stator frequency control, stator voltage and frequency control, static rotor resistance control, slip power recovery control; Starting-direct online starter, auto transformer starter.

UNIT V STEPPER AND SWITCHED RELUCTANCE MOTOR DRIVES **9**

Stepper motors - Variable reluctance stepper motor, permanent magnet stepper motor, drive circuits for stepper motors; Switched reluctance motor – construction and modes of operation, torque equation, drive circuits.

TOTAL PERIODS: 45

COURSE OUTCOMES

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

- recognize the construction and working power electronics components.
- explain the working and characteristics of various drives.
- apply the solid state switching circuits to operate various types of DC motors and drivers

- interpret the performance of AC motors and drives.
- describe the concept stepper and switched reluctance motors and drivers for applications.

TEXT BOOKS

1. Rashid M.H., "Power Electronics Circuits, Devices and Applications ", Pearson, Fourth Edition,2021.
2. Bimbhra B.S., "Power Electronics", Kanna Publishers, New Delhi, Fifth Edition, 2012.

REFERENCES

1. Gobal K. Dubey, "Fundamentals of Electrical Drives", Narosal Publishing House, New Delhi, Second Edition, Reprint 2017.
2. Theraja B.L. and Theraja A.K., "A Text Book of Electrical Technology", S.Chand& Co. Ltd., New Delhi, Second Edition, Reprint 2018.
3. Singh M.D. and Kanchandhani K.B., "Power Electronics", McGraw Hill, New Delhi, Second Edition, Reprint 2018.
4. Mehta V.K. and Rohit Mehta, "Principles of Electrical Machines", S.Chand & Co. Ltd., New Delhi, Reprint Edition, 2016.

CO-PO MAPPING

Mapping of Course Outcome (CO's) with Programme Outcomes (PO's) and Programme Specific Outcomes PSO's
(1/2/3 indicates strength of correlation) 3-Strong, 2-Medium, 1-Weak

CO's	Programme Outcomes PO's												PSO's	
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2
CO1	3	2	2	-	-	1	-	-	-	-	1	2	-	-
CO2	3	-	2	-	-	1	-	-	-	-	1	2	-	-
CO3	3	1	2	-	-	1	-	-	-	-	1	2	-	-
CO4	3	1	1	-	-	1	-	-	-	-	1	2	-	-
CO5	3	2	1	-	-	1	-	-	-	-	1	2	-	-

EE20311 **DIGITAL ELECTRONICS** **3 0 0 3**

COURSE OBJECTIVES

To enable the students to

- acquire the knowledge of digital logic and minimization technique.
- understand the combinational circuits.
- know the various sequential circuits.
- study the basics of asynchronous circuits.
- learn the concept of memories and programmable logic devices.

UNIT I LOGIC GATES AND MINIMIZATION CIRCUITS **9**

Basic digital circuits AND - OR - NAND - NOR - EX-OR - EX-NOR operations; Boolean Algebra-Simplification of Boolean functions - special forms of Boolean functions - minterm (SOP) - maxterm (POS); K Map representation of functions - simplification of logic functions using K Map - Don't care conditions, Quine - McCluskey method of minimization.

UNIT II COMBINATIONAL CIRCUITS **9**

Half and Full Adders - Half and Full Subtractors; Encoder – Decoder - Multiplexer- Demultiplexer - Binary/ BCD adders, Magnitude Comparator; Code Converters.

UNIT III SEQUENTIAL CIRCUITS **9**

General model of sequential circuits - flip-flops - level triggering, edge triggering - master slave configuration; Mealy/Moore models - state diagram - state table - State minimization - State assignment - Excitation table and maps - shift registers - Ring counter.

UNIT IV ASYNCHRONOUS SEQUENTIAL CIRCUITS **9**

Asynchronous sequential logic - Primitive flow table, minimization of Primitive flow table, State assignment, excitation table; Cycles- Race free state assignment; Hazards in combinational circuits, Hazards elimination.

UNIT V MEMORY DEVICES **9**

Memories – ROM, ROM organization , PROM, EPROM, EEPROM; RAM - RAM organization, static RAM cell, Bipolar RAM cell, dynamic RAM cell; Programmable logic devices (PLD); Programmable logic array (PLA); Programmable array logic (PAL); Field programmable gate arrays (FPGA).

TOTAL PERIODS: 45

COURSE OUTCOMES

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

- apply Boolean algebra principles and explain various digital logic families.
- design combinational circuits using logic gates.

- construct synchronous sequential circuits using basic flip flops.
- design the asynchronous logic families and its hazards.
- analyze the various memory devices, programmable logic devices and logic families.

TEXT BOOKS

1. M. Morris Mano, Michel D. Ciletti,"Digital Design", Pearson Education, New Delhi, 6th edition,2018.
2. Ronald J. Tocci Neal S. Widmer and Gregory L. Moss, "Digital Systems: Principles and Applications", Prentice Hall of India, New Delhi, 12th Edition, 2018.

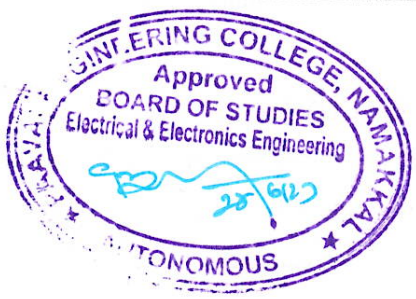
REFERENCES

1. W.H. Gothmann, "Digital Electronics – Introduction Theory and Practice", PHI, Reprint 5th edition 2016.
2. S. Salivahanan and S. Arivazhagan, "Digital Circuits and Design", 2nd Edition, Vikas Publishing House Pvt. Ltd, New Delhi, reprint 2015.
3. R.R. Jain, "Modern digital electronics", Third edition, Tata McGraw – Hill, 3rd edition Reprint 2017.
4. Charles H.Roth, Jr, Lizy Lizy Kurian John, 'Digital System Design using VHDL, Cengage, 2013.

CO-PO MAPPING

Mapping of Course Outcome (CO's) with Programme Outcomes (PO's) and Programme Specific Outcomes PSO's
(1/2/3 indicates strength of correlation) 3-Strong, 2-Medium, 1-Weak

CO's	Programme Outcomes PO's												PSO's	
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2
CO1	3	1	2	2	-	1	-	-	-	-	-	2	1	-
CO2	3	2	3	2	-	2	-	-	-	-	-	1	2	-
CO3	3	2	3	-	-	1	-	-	-	-	-	2	1	-
CO4	3	2	2	2	-	2	-	-	-	-	-	1	2	-
CO5	3	2	3	-	-	-	-	-	-	-	-	2	2	-



MC20301 **VALUE EDUCATION** **2 0 0 0**

COURSE OBJECTIVES

To enable the students to

- develop the individual multi-dimensionally in physical, intellectual, emotional and spiritual dimensions.
- facilitate individuals think about and reflect on different values.
- understand their responsibility in making choices and the practical implications of expressing them.
- instigate to choose their personal, social, moral and spiritual values.
- design and chisel the overall personality of an individual.

UNIT I PERSONAL VALUES **6**

Value Education – Definition, Types of values; Human values - Respect, Acceptance, Consideration, Appreciation, Listening, Openness, Affection, Patience, Honesty, Forgiveness, Sacrifice, Authenticity, Self Control, Altruism, Tolerance and Understanding, Wisdom, Decision making, Self –actualization, Character formation towards positive Personality, Contentment; -Religious Values -Humility, Sympathy and Compassion, Gratitude. Peace, Justice, Freedom, Equality.

UNIT II SOCIAL VALUES **6**

Social Values - Pity and probity - Self control - Respect to - Age, Experience, Maturity, Family members, Neighbours- Universal Brotherhood - Flexibility -Peer pressure - Sensitization towards Gender Equality, Physically challenged, Intellectually challenged - Reliability - Unity - Modern Challenges of Adolescent Emotions and behaviour - Comparison and Competition- Positive and Negative thoughts- Arrogance, Anger and Selfishness.

UNIT III ENGINEERING ETHICS **6**

Professional Values -.Knowledge thirst - Sincerity in profession- Regularity, Responsibility, Punctuality and Faith - Perseverance - Courage - Competence - Co-operation- Curbing unethical practices - Integrity, Social Consciousness and Responsibility. Global Values - Computer Ethics – Moral Leadership - Code of Conduct - Corporate Social Responsibility.

UNIT IV SPIRITUAL VALUES **6**

Developing Spirituality - Thinking process, Moralization of Desires - Health benefits- Physical exercises - Mental peace - Meditation - Objectives, Types, Effects on body, mind and soul- Yoga - Objectives, Types, Asanas. Family values -family's structure, function, roles, beliefs, attitudes and ideals, Family Work Ethic, Family Time, Family Traditions.

UNIT V HUMAN RIGHTS **6**

Classification of Human Rights - Right to Life, Liberty and Dignity- Right to Equality - Right against Exploitation - Cultural and Educational Rights- Physical assault and Sexual harassment - Domestic violence.

TOTAL PERIODS 30

COURSE OUTCOMES

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

- cultivate the values needed for peaceful living in the existing society.
- comprehend humanistic values to develop peace in the world.
- foster ethics in profession and usage of Technology.
- orient with the importance of value education towards personal, group and spiritual attributes.
- nurture physical, mental, spiritual growth to face the competitive world.

TEXT BOOKS

1. Little William, An Introduction of Ethics. Allied Publisher, Indian Reprint 1955.
2. Sharma S.P. Moral and value education; Principles and practices, Kanishka publishers, 2013.

REFERENCES

1. "Values (Collection of Essays)". Sri Ramakrishna Math. Chennai. 1996.

CO - PO Mapping

Mapping of Course Outcomes with Programme Outcomes: (1/2/3 indicates strength of correlation) 3-Strong, 2-Medium , 1-Weak														
COs	**Programme Outcomes(POs)**													
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO 10**	**PO11**	**PO12**	**PSO1**	**PSO2**
CO1	-	-	-	-	-	-	-	2	2	-	-	2	-	2
CO2	-	-	-	2	-	2	-	1	3	2	1	3	-	2
CO3	-	-	3	2	2	3	2	3	3	1	3	3	2	3
CO4	-	-	3	1	-	2	-	-	1	-	-	3	2	-
CO5	-	-	-	-	-	1	-	-	-	-	-	3	-	-

RA20303 ROBOT MODELLING AND SIMULATION LABORATORY 0 0 2 1

COURSE OBJECTIVES

To enable the students to

- give practice in the modelling of basic components of a robot
- work on their own in the exercise of modeling some common joints, links and transmission assembly for a robot.
- provide practice in the modelling of a robot and its end effector.
- design the 3D modelling of steering Mobile Robot.

LIST OF EXPERIMENTS

1. 2D Sketch of a Gear.
2. 2D Sketch and 3D modelling of Sheet Metal Components
3. 3D Modelling Mounting clamp for motor.
4. 3D Modelling of GT2 pulley and belt drive system
5. 3D Modelling Ball Screw and Nut assembly.
6. 3D Modelling and motion simulation of Rotational Joint assembly.
7. 3D Modelling and motion simulation of Prismatic Joint assembly.
8. 3D modelling and simulation of Cartesian Robot
9. 3D modelling and simulation of Articulated / Spherical / Cylindrical Robot.
10. 3D modelling and motion simulation of 2 fingered gripper assembly.
11. 3D modelling of 2 Wheeled skid steering Mobile Robot.
12. 3D modelling of 4 Wheeled 2 steering Mobile Robot.
13. 3D modelling of 4 Wheeled 4 steering Mobile Robot.
14. Study on Harmonic Gear drive.

TOTAL PERIODS : 30

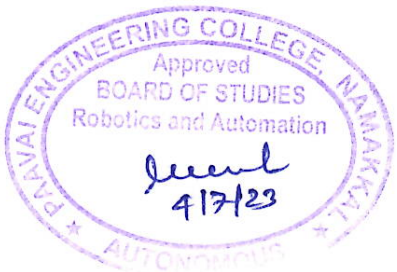
COURSE OUTCOMES

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

- identify and sketch components and physical features of various parts for a robot system and sub systems.
- model components and physical features of various parts for a robot system and sub systems with proper dimensions.
- create a CAD and simulation model for a robot system and end effector.
- apply design procedures for 3D modelling of steering Mobile Robot

CO - PO Mapping

Mapping of Course Outcomes with Programme Outcomes: **(1/2/3 indicates strength of correlation) 3-Strong, 2-Medium , 1-Weak**														
COs	**Programme Outcomes(POs)**													
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO 10**	**PO11**	**PO12**	**PSO1**	**PSO2**
CO1	3	2	1	1	-	-	-	-	-	-	-	1	2	3
CO2	3	2	1	1	-	-	-	-	-	-	-	1	2	3
CO3	3	2	1	1	-	-	-	-	-	-	-	1	2	3
CO4	3	2	1	1	-	-	-	-	-	-	-	1	2	3



EE20312 **ELECTRICAL DRIVES AND ACTUATORS LABORATORY** **0 0 2 1**

COURSE OBJECTIVES

To enable the students to

- impart knowledge on performance of the shunt DC motor and induction motor.
- acquire knowledge on characteristics of power semiconductors.
- know the performance DC and AC motors using power electronics controller.
- learn the performance of stepper motor using driver circuits .

LIST OF EXPERIMENTS

1. Load test on shunt DC motor
2. Load test on three phase induction motor
3. Static characteristics of SCR and MOSFET.
4. UJT triggering circuits.
5. Speed control of DC motor using chopper.
6. Speed control of AC motor using PWM inverter.
7. Speed control of stepper motor.

TOTAL PERIODS: 30

COURSE OUTCOMES

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

- analyse the DC and induction motor by using load test.
- test the characteristics of power semiconductor devices.
- measure the performance parameters of motor using power electronics drives.
- implement the concept of stepper motor.

CO-PO MAPPING

Mapping of Course Outcome (CO's) with Programme Outcomes (PO's) and Programme Specific Outcomes PSO's
(1/2/3 indicates strength of correlation) 3-Strong, 2-Medium, 1-Weak

CO's	Programme Outcomes PO's												PSO's	
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2
CO1	3	2	-	2	-	-	-	-	-	-	1	2	-	-
CO2	3	2	-	2	-	-	-	-	-	-	2	2	-	-
CO3	3	2	-	1	-	-	-	-	-	-	1	2	-	-
CO4	3	2	-	1	-	-	-	-	-	-	2	2	-	-

EN20301 ENGLISH PROFICIENCY COURSE LABORATORY 0 0 2 1

COURSE OBJECTIVES

To enable the students to

- familiarize with the reading skills such as skimming and scanning.
- practise writing tasks to the level expected.
- develop listening strategies such as listening for key words, making inferences and identifying main ideas.
- speak well without inhibition and to assist the students in improving their vocabulary, pronunciation and comprehension of grammar.
- enrich their LSRW skills so as to crack on-line proficiency tests and to bring their career aspirations true.

EXERCISES FOR PRACTICE

1. Listening Exercises from TOEFL
    a. Conversations, Lectures
2. Listening Exercises from IELTS
    a. Places and directions
    b. Actions and processes
3. Reading Exercises from PTE
    a. Re-order paragraphs
4. Reading Exercises from IELTS
    a. Opinions and attitudes
    b. Locating and matching information
5. Reading Exercises from BEC Vantage
    a. Single informational text with lexical gaps
    b. Error identification
6. Writing Exercises from PTE
    a. Summarize written text
7. Writing Exercises from IELTS
    a. Describing maps
    b. Describing diagrams

8. Speaking IELTS format
    a. Talking about familiar topics
    b. Giving a talk
    c. Discussion on aTopic

TOTAL PERIODS : 30

COURSE OUTCOMES

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

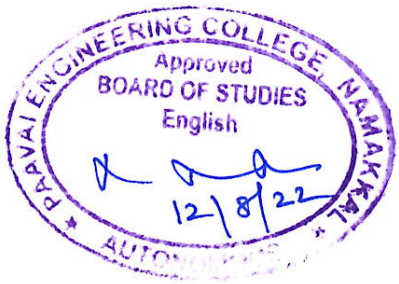
- skim, scan and infer the given texts and attend the tasks successfully.
- write coherently using appropriate vocabulary and grammar.
- listen to speeches and conversations and answer the questions.
- communicate fluently and effectively on any given topics.
- appear with confidence for on-line tests.

REFERENCES

1. Cambridge University Press India Pvt. Ltd, New Delhi.2016.
2. PTE Academic Test builder. Macmillan Education. London. 2012.
3. Cambridge IELTS 12 Academic Student's Book with Answers: Authentic Examination Papers (IELTS… by Cambridge University Press . New Delhi.2016
4. TOEFL iBT Prep Plus 2018-2019 4 Practice Tests) Kaplan Publishing. Newyork.2017.

CO - PO Mapping

Mapping of Course Outcomes with Programme Outcomes (1/2/3 indicates strength of correlation) 3-Strong, 2-Medium, 1-Weak														
COs	**Programme Outcomes (POs)**													
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**
CO1	-	-	-	2	3	-	-	-	3	2	-	-	-	2
CO2	-	-	2	2	-	-	1	1	3	2	-	2	-	2
CO3	-	-	-	-	-	3	1	2	3	2	2	3	2	-
CO4	-	-	-	-	-	2	2	3	3	2	2	-	2	-
CO5	-	-	2	-	-	1	2	-	3	3	-	1	2	3



GE20301 **தமிழரும் தொழில்நுட்பமும்** L T P C
1 0 0 1

அலகு I நெசவு மற்றும் பானைத் தொழில்நுட்பம் 3

சங்க காலத்தில் நெசவுத் தொழில் - பானைத் தொழில்நுட்பம் - கருப்பு சிவப்பு பாண்டங்கள் - பாண்டங்களில் கீறல் குறியீடுகள்.

அலகு II வடுவமைப்பு மற்றும் கட்டிடத் தொழில்நுட்பம் 3

சங்க காலத்தில் வடிவமைப்பு மற்றும் கட்டுமானங்கள் &சங்க காலத்தில் வீட்டுப் பொருட்களில் வடிவமைப்பு - சங்க காலத்தில் கட்டுமான பொருட்களும் நடுகல்லும் - சிலப்பதிகாரத்தில் மேடை வடிவமைப்பு பற்றிய விவரங்கள் - மாமல்லபுரச் சிற்பங்களும் கோவில்களும் - சோழர் காலத்துப் பெருங்கோயில்கள் மற்றும் பிற வழிபாட்டுத் தலங்கள் - நாயக்கர் காலக் கோயில்கள் - மாதிரி கட்டமைப்புகள் பற்றி அறிதல், மீனாட்சி அம்மன் ஆலயம் மற்றும் திருமலை நாயக்கர் மஹால் - செட்டி நாட்டு வீடுகள் - பிரிட்டிஷ் காலத்தில் சென்னையில் இந்தோ - சாரோசெனிக் கட்டிடக்கலை

அலகு III உற்பத்தி தொழில் நுட்பம் 3

கப்பல் கட்டும் கலை - உலோகவியல் - இரும்புத் தொழிற்சாலை - இரும்பு உருக்குதல், எஃகு - வரலாற்றுச் சின்னங்களாக செம்பு மற்றும் தங்க நாணயங்கள் - நாணயங்கள் அச்சடித்தல் - மணி உருவாக்கும் தொழிற்சாலைகள் - கல்மணிகள், கண்ணாடி மணிகள் - சுடுமண் மணிகள் - சங்கு மணிகள் -எலும்புத் துண்டுகள் - தொல்லியல் சான்றுகள் - சிலப்பதிகாரத்தில் மணிகளின் வகைகள்.

அலகு IV வேளாண்மை மற்றும் நீர்பாசனத் தொழில்நுட்பம் 3

அணை - ஏரிகுளங்கள், மதகு - சோழர்காலக் குமிழித் தூம்பின் முக்கியத்துவம் - கால்நடை பராமரிப்பு - கால்நடைகளுக்காக வடிவமைக்கப்பட்ட கிணறுகள் - வேளாண்மை மற்றும் வேளாண்மை சார்ந்த செயல்பாடுகள் கடல்சார் அறிவு - மீன்வளம் - முத்து மற்றும் முத்துக்குளித்தல் - பெருங்கடல் குறித்த பண்டைய அறிவு -அறிவுசார் சமூகம்

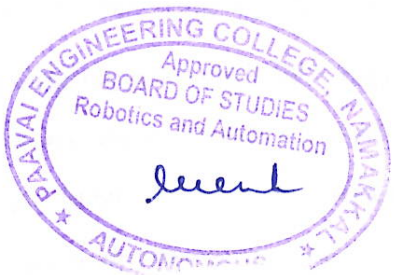
அலகு V *அறிவியல் தமிழ் மற்றும் கணித்தமிழ்* 3

அறிவியல் தமிழின் வளர்ச்சி -கணித்தமிழ் வளர்ச்சி - தமிழ் நூல்களை மின்பதிப்பு செய்தல் - தமிழ் மென்பொருட்கள் உருவாக்கம் - தமிழ் இணையக் கல்விக்கழகம் - தமிழ் மின் நூலகம் - இணையத்தில் தமிழ் அகராதிகள் சொற்குவைத் திட்டம்

TOTAL PERIODS: 15

TEXT CUM REFERENCE BOOKS:

1. தமிழக வரலாறு – மக்களும் பண்பாடும் – கே.கே.பிள்ளை. (வெளியீடு தமிழ்நாடு பாடநூல் மற்றும் கல்வியியல் பணிகள் கழகம்).
2. கணினித் தமிழ் – முனைவர் இல. சுந்தரம் (விகடன் பிரசுரம்).
3. கீழடி – வைகை நதிக்கரையில் சங்ககால நகர நாகரிகம் (தொல்லியல் துறை வெளியீடு).
4. பொருநை – ஆற்றங்கரை நாகரிகம் (தொல்லியல் துறை வெளியீடு).
5. Social Life of Tamils (Dr.K.K.Pillay) A Joint publication of TNTB & ESC and RMRL – (in print).
6. Social Life of the Tamils – The Classical Period (Dr.S.Singaravelu) (Published by International institute of Tamil Studies.
7. Historical Heritage of the Tamils (Dr.S.V.Subramanian, Dr.K.D.Thirunavukkarasu)
8. The Contributions of the Tamils to Indian Culture (Dr.M.Valarmathi) (Published by International institute of Tamil Studies)
9. Keeladi – 'Sangam City Civilzation on the vanks of river vaigai' (Jointly Published by Department of Archaeology & Tamil Nadu Text Book and Educational Services Corporation, Tamil Nadu)
10. Studies in the History of India with Special Reference to Tamil Nadu (Dr.K.K.Pillay) (Published by the author)
11. Porunai Civilization (Jointly Published by Department of Arcaeology & Tamil Nadu Text Book and Educational Services Corporation, Tamilnadu).
12. Journey of Civilization Indus to vaigai (R.Balakrishnan) (Published by RMRL) – Reference Book



GE20301	TAMILS AND TECHNOLOGY	L	T	P	C
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UNIT I WEAVING AND CERAMIC TECHNOLOGY **3**

Weaving Industry during Sangam Age – Ceramic technology – Black and Red Ware Potteries (BRW) – Graffiti on Potteries.

UNIT II DESIGN AND CONSTRUCTION TECHNOLOGY **3**

Designing and Structural construction House & Designs in household materials during Sangam Age - Building materials and Hero stones of Sangam age – Details of Stage Constructions in Silappathikaram - Sculptures and Temples of Mamallapuram - Great Temples of Cholas and other worship places - Temples of Nayaka Period - Type study (Madurai Meenakshi Temple)- Thirumalai Nayakar Mahal - Chetti Nadu Houses, Indo - Saracenic architecture at Madras during British Period.

UNIT III MANUFACTURING TECHNOLOGY **3**

Art of Ship Building - Metallurgical studies - Iron industry - Iron smelting,steel -Copper and goldCoins as source of history - Minting of Coins – Beads making-industries Stone beads -Glass beads - Terracotta beads -Shell beads/ bone beats - Archeological evidences - Gem stone types described in Silappathikaram.

UNIT IV AGRICULTURE AND IRRIGATION TECHNOLOGY **3**

Dam, Tank, ponds, Sluice, Significance of Kumizhi Thoompu of Chola Period, Animal Husbandry - Wells designed for cattle use - Agriculture and Agro Processing - Knowledge of Sea - Fisheries – Pearl - Conche diving - Ancient Knowledge of Ocean - Knowledge Specific Society.

UNIT V SCIENTIFIC TAMIL & TAMIL COMPUTING **3**

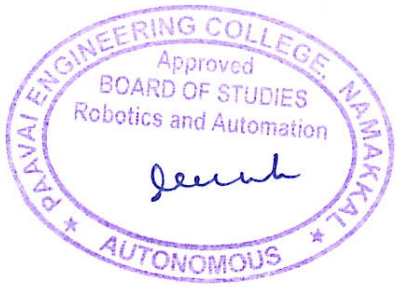
Development of Scientific Tamil - Tamil computing – Digitalization of Tamil Books – Development of Tamil Software – Tamil Virtual Academy – Tamil Digital Library – Online Tamil Dictionaries – Sorkuvai Project

TOTAL PERIODS: 15

TEXT CUM REFERENCE BOOKS:

1. தமிழக வரலாறு – மக்களும் பண்பாடும் – கே.கே.பிள்ளை. (வெளியீடு தமிழ்நாடு பாடநூல் மற்றும் கல்வியியல் பணிகள் கழகம்).
2. கணினித் தமிழ் – முனைவர் இல. சுந்தரம் (விகடன் பிரசுரம்).
3. கீழடி – வைகை நதிக்கரையில் சங்ககால நகர நாகரிகம் (தொல்லியல் துறை வெளியீடு).
4. பொருநை – ஆற்றங்கரை நாகரிகம் (தொல்லியல் துறை வெளியீடு).

5. Social Life of Tamils (Dr.K.K.Pillay) A Joint publication of TNTB & ESC and RMRL – (in print).
6. Social Life of the Tamils – The Classical Period (Dr.S.Singaravelu) (Published by International institute of Tamil Studies.
7. Historical Heritage of the Tamils (Dr.S.V.Subramanian, Dr.K.D.Thirunavukkarasu)
8. The Contributions of the Tamils to Indian Culture (Dr.M.Valarmathi) (Published by International institute of Tamil Studies)
9. Keeladi – 'Sangam City Civilzation on the vanks of river vaigai' (Jointly Published by Department of Archaeology & Tamil Nadu Text Book and Educational Services Corporation, Tamil Nadu)
10. Studies in the History of India with Special Reference to Tamil Nadu (Dr.K.K.Pillay) (Published by the author)
11. Porunai Civilization (Jointly Published by Department of Arcaeology & Tamil Nadu Text Book and Educational Services Corporation, Tamilnadu).
12. Journey of Civilization Indus to vaigai (R.Balakrishnan) (Published by RMRL) – Reference Book



MA20401 **STATISTICS AND NUMERICAL METHODS** 3 1 0 4

(Common to Robotics, Safety & Fire Engineering)

OBJECTIVES

To enable the students to

- this course aims at providing the necessary basic concepts of a few statistical and numerical methods and give procedures for solving numerically different kinds of problems occurring in engineering and technology.
- to acquaint the knowledge of testing of hypothesis for small and large samples which plays an important role in real life problems
- to introduce the basic concepts of solving algebraic and transcendental equations.
- to introduce the numerical techniques of interpolation in various intervals and numerical techniques of differentiation and integration this plays an important role in engineering and technology disciplines.
- to acquaint the knowledge of various techniques and methods of solving ordinary differential equations.

UNIT I TESTING OF HYPOTHESIS **12**

Sampling distributions - Tests for single mean, proportion and difference of means (Large and small samples) – Tests for single variance and equality of variances – Chi square test for goodness of fit – Independence of attributes.

UNIT II DESIGN OF EXPERIMENTS **12**

One way and two way classifications - Completely randomized design – Randomized block design – Latin square design – 2^2 factorial design.

UNIT III SOLUTION OF EQUATIONS AND EIGENVALUE PROBLEMS **12**

Solution of algebraic and transcendental equations - Newton Raphson method - Solution of linear system of equations - Gauss elimination method – Pivoting - Gauss Jordan method – Iterative methods -Secant method and Gauss Seidel method- Eigenvalues of a matrix by Power method.

UNIT IV INTERPOLATION, NUMERICAL DIFFERENTIATION AND NUMERICAL INTEGRATION **12**

Lagrange's and Newton's divided difference interpolations – Newton's forward and backward difference interpolation – Approximation of derivates using interpolation polynomials – Numerical Single Integration-Trapezoidal rule , Simpson's 1/3 rule and 3/8 rule.

UNIT V NUMERICAL SOLUTION OF ORDINARY DIFFERENTIAL EQUATIONS **12**

Single step methods: Taylor's series method –Runge-Kutta method for solving first order differential equations - Multi step methods: Milne's and Adams - Bash forth predictor corrector methods for solving first order differential equations

TOTAL PERIODS: 60

OUTCOMES

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

- apply the concept of testing of hypothesis for small and large samples in real life problems
- apply the basic concepts of classifications of design of experiments in the field of agriculture
- appreciate the numerical techniques of interpolation in various intervals and apply the numerical techniques of differentiation and integration for engineering problems
- understand the knowledge of various techniques and methods for solving first and second order ordinary differential equations.
- solve the partial and ordinary differential equations with initial and boundary conditions by using certain techniques with engineering applications

TEXT BOOKS

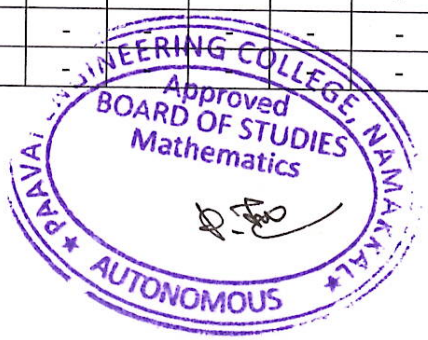
1. Milton. J. S. and Arnold. J.C., "Introduction to Probability and Statistics", Tata McGraw Hill, 4thEdition, 2007.
2. Sankar Rao K " Numerical Methods for Scientists And Engineers –3rd Edition Princtice Hall of India Private, New Delhi, 2007.

REFERENCE BOOKS

1. Grewal, B.S., and Grewal, J.S., "Numerical Methods in Engineering and Science", Khanna Publishers, 10th Edition, New Delhi, 2015.
2. Gerald. C.F. and Wheatley. P.O. "Applied Numerical Analysis" Pearson Education, Asia, New Delhi, 7th Edition, 2007.
3. Spiegel. M.R., Schiller. J. and Srinivasan. R.A., "Schaum's Outlines on Probability and Statistics", Tata McGraw Hill Edition, 4th Edition, 2012.
4. Johnson, R.A., Miller, I and Freund J., "Miller and Freund's Probability and Statistics for Engineers", Pearson Education, Asia, 8th Edition, 2015

CO/PO Mapping

Mapping of Course Outcomes with Programme Outcomes (3/2/1 indicates strength of correlation) 3- Strong, 2-Medium, 1-Weak														
COs	**Programmes Outcomes(POs)**													
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**
CO1	3	3	-	1	1	-	-	-	-	-	-	3	-	-
CO2	3	3	-	1	1	-	-	-	-	-	-	3	-	-
CO3	3	3	-	1	1	-	-	-	-	-	-	3	-	-
CO4	3	3	-	1	1	-	-	-	-	-	-	3	-	-
CO5	3	3	-	1	1	-	-	-	-	-	-	3	-	-



RA20401 **MANUFACTURING TECHNOLOGY** **3 0 0 3**

COURSE OBJECTIVES

To enable the students to

- study the concepts and basic mechanics of metal cutting and the factors affecting machinability
- learn working of basic and advanced turning machines.
- teach the basics of machine tools with reciprocating and rotating motions and abrasive finishing processes.
- study the basic concepts of CNC of machine tools and constructional features of CNC.
- learn the basics of CNC programming concepts to develop the part programme for Machine centre and turning centre.

UNIT I MECHANICS OF METAL CUTTING **9**

Mechanics of chip formation, forces in machining, Types of chip, cutting tools single point cutting tool nomenclature, orthogonal and oblique metal cutting, thermal aspects, cutting tool materials, tool wear, tool life, surface finish, cutting fluids and Machinability.

UNIT II TURNING MACHINES **9**

Centre lathe, constructional features, specification, operations taper turning methods, thread cutting methods, special attachments, surface roughness in turning, machining time and power estimation. Special lathes - Capstan and turret lathes- tool layout automatic lathes: semi-automatic single spindle: Swiss type, automatic screw type multi spindle.

UNIT III RECIPROCATING MACHINE TOOLS **9**

Reciprocating machine tools: shaper, planer, slotter: Types and operations- Hole making: Drilling, reaming, boring, tapping, type of milling operations-attachments- types of milling cutters machining time calculation - Gear cutting, gear hobbing and gear shaping gear finishing methods Abrasive processes: grinding wheel specifications and selection, types of grinding process cylindrical grinding, surface grinding, centreless grinding, internal grinding - micro finishing methods.

UNIT IV CNC MACHINES **9**

Computer Numerical Control (CNC) machine tools, constructional details, special features Drives, Recirculating ball screws, tool changers; CNC Control systems Open/closed, point-topoint/continuous - Turning and machining centres Work holding methods in Turning and machining centres, Coolant systems, Safety features.

UNIT V PROGRAMMING OF CNC MACHINE TOOLS **9**

Coordinates, axis and motion, Absolute vs Incremental, Interpolators, Polar coordinates, Program planning, G and M codes, Manual part programming for CNC machining centers and Turning centers Fixed cycles, Loops and subroutines, Setting up a CNC machine for machining.

TOTAL PERIODS: 45

COURSE OUTCOMES

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

- apply the mechanism of metal removal process and to identify the factors involved in improving machinability.
- describe the constructional and operational features of centre lathe and other special purpose lathes.
- describe the constructional and operational features of reciprocating machine tools.
- apply the constructional features and working principles of CNC machine tools.
- demonstrate the Program CNC machine tools through planning, writing codes and setting up CNC machine tools to manufacture a given component.

TEXT BOOKS

1. Kalpakjain.S, 'Manufacturing Engineering and Technology', Pearson Education India Edition, 2009.
2. Michael Fitzpatrick, Machining and CNC Technology, McGraw-Hill Education; 3rd edition, 2013.

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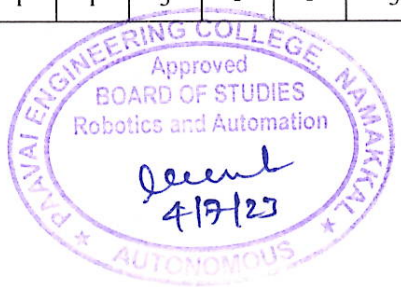
1. Roy. A. Lindberg, Processes and materials of manufacture, PHI / Pearson education, 2006.
2. GeofreyBoothroyd, 'Fundamentals of Metal Machining and Machine Tools, McGraw Hill, 1984.
3. Rao. PN "Manufacturing Tecnology", Metal Cutting and Machine Tools, Tata McGraw- Hill, New Delhi, 2003.
4. A.B. Chattopadhyay, Machining and Machine Tools, Wiley, 2nd edition, 2017.
5. Peter Smid, CNC Programming Handbook, Industrial Press Inc.,; Third edition, 2007.

CO - PO Mapping

Mapping of Course Outcomes with Programme Outcomes:

(1/2/3 indicates strength of correlation) 3-Strong, 2-Medium , 1-Weak

COs	Programme Outcomes(POs)													
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO11	PO12	PSO1	PSO2
CO1	3	3	3	1	1	1	3	-	-	3	-	2	3	3
CO2	3	3	3	1	1	1	3	-	-	3	-	2	3	3
CO3	3	3	3	1	1	1	3	-	-	3	-	2	3	3
CO4	3	3	2	1	1	1	3	-	-	3	-	2	3	3
CO5	3	3	3	1	1	1	3	-	-	3	-	2	3	3



RA20402 **MECHANICS OF MATERIALS** **3 0 0 3**

COURSE OBJECTIVES

To enable the students to

- know about how a solid (materials, structures) behaves when it is exposed to forces and deformations.
- apply the fundamental concepts of principle of superposition, equilibrium, compatibility, force deformation, and stress-strain relationships to the solid and structural mechanics problems
- analyze determinate and indeterminate bars, beams, to determine axial forces, torques, shear forces, and bending moments
- have physical insight into distribution of stresses and strains in structural members
- identify the biaxial stresses in acting in a body or an element.

UNIT I STRESS - STRAIN, AXIAL LOADING **9**

Stress and strain, elastic limit, Hooke's law, factor of safety, shear stress, shear strain, relationship between elastic constants. Stresses in stepped bars, uniformly varying sections, composite bars due to axial force. Lateral strain, Poisson's ratio, volumetric strain, changes in dimensions and volume. Thermal stresses and impact loading.

UNIT II STRESSES IN BEAMS **9**

Beam – Definition, types of end supports, types of beam, types of loading. Shear force diagram and bending moment diagram for cantilever, simply supported and overhanging beams under point load, UDL, UVL and moments. Euler beam theory - Bending equation, section modulus, Bending stress in beams – Shear stress in beams.

UNIT III DEFLECTION OF BEAMS AND COLUMNS **9**

Governing differential equation - Problems on Double integration method - Macaulay's Method – Moment area method. Concepts of Conjugate Beam method and Method of superposition. Columns – different end conditions – buckling load – Euler's theory – Rankine's formula.

UNIT IV TORSION AND SPRINGS **9**

Theory of torsion and assumptions - torsion equation, polar modulus, stresses in solid and hollow circular shafts, power transmitted by a shaft, shafts in series and parallel, deflection in shafts fixed at the both ends. Springs – types, Deflection expression for closed coiled helical spring – Stress in springs - design of springs.

UNIT V BIAXIAL STRESS **9**

Principal stresses, normal and tangential stresses, maximum shear stress - analytical and graphical method. Stresses in combined loading. Thin walled cylinder under internal pressure – changes in dimensions – volume. Spherical shells subjected to internal pressure – deformation in spherical shells – Lame's theory.

TOTAL PERIODS: 45

COURSE OUTCOMES

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

- know about how a solid (materials, structures) behaves when it is exposed to forces and deformations.

- apply the fundamental concepts of principle of superposition, equilibrium, compatibility, force-deformation, and stress-strain relationships to the solid and structural mechanics problems.
- analyze, determinate and indeterminate bars, beams, to determine axial forces, torques, shear forces, and bending moments.
- have physical insight into distribution of stresses and strains in structural members.
- identify the biaxial stresses in acting in a body or an element.

TEXT BOOKS

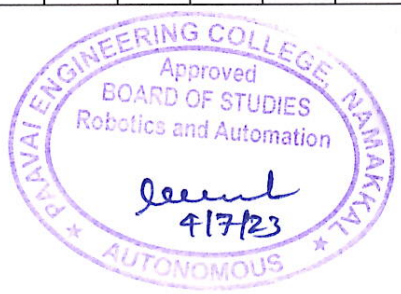
1. James M Gere, Barry J Goodno, "Mechanics of Materials, SI Edition", Ninth Edition, Cengage Learning, 2018.
2. Russell C. Hibbeler, "Mechanics of Materials", Tenth Edition, Pearson education, 2017.

REFERENCES

1. Clive L. Dym , Irving H. Shames, "Solid Mechanics : A Variational Approach, Augmented Edition", Springer publishers, 2013.
2. Roy R Craig, "Mechanics of Materials", Third Edition, John Wiley & Sons, 2011.
3. R.K.Rajput, 'Strength of Materials', S Chand; 4th Rev. Edition 2007.
4. Timothy A. Philpot, "Mechanics of Materials: An Integrated Learning System," 3rd Edition, Wiley, 2012.
5. William A. Nash, Merle C. Potter, "Schaum's Outline of Strength of Materials", 6th Edition, McGraw Hill Education, 2014.

CO - PO Mapping

Mapping of Course Outcomes with Programme Outcomes: **(1/2/3 indicates strength of correlation) 3-Strong, 2-Medium , 1-Weak**														
COs	**Programme Outcomes(POs)**													
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO 10**	**PO11**	**PO12**	**PSO1**	**PSO2**
CO1	3	3	-	1	-	-	-	-	-	-	-	3	2	3
CO2	3	3	-	1	-	-	-	-	-	-	-	3	2	3
CO3	3	3	-	1	-	-	-	-	-	-	-	3	2	3
CO4	3	3	-	1	-	-	-	-	-	-	-	3	2	3
CO5	3	3	-	1	-	-	-	-	-	-	-	3	2	3



EE20412 **CONTROL SYSTEMS ENGINEERING** **3 0 0 3**

COURSE OBJECTIVES

To enable the students to

- understand the methods of representation of systems and to obtain system transfer function models.
- provide knowledge on time response of systems and steady state error analysis.
- acquaint basic knowledge in obtaining the closed–loop frequency responses of systems.
- impart the concept of stability of control system and methods of stability analysis.
- learn the various approach for the state variable analysis.

UNIT I SYSTEMS REPRESENTATION **9**

Basic elements in control systems - open loop and closed loop with applications; Transfer functions of mechanical, electrical and analogous systems; Block diagram reduction; Signal flow graphs.

UNIT II TIME RESPONSE ANALYSIS **9**

Time response - Types of test input, time domain specifications, I and II order system response; Error coefficients - Steady state error, error constants, generalized error series; PID control - Analytical design for PD, PI, PID control systems.

UNIT III FREQUENCY RESPONSE AND SYSTEM ANALYSIS **9**

Closed loop frequency response - performance specification in frequency domain, frequency response of standard second order system; Bode Plot; Polar Plot.

UNIT IV STABILITY OF SYSTEMS **9**

Characteristics equation; Routh Hurwitz criterion; Root locus construction - Effect of pole, zero addition; Nyquist stability criterion.

UNIT V SYSTEM ANALYSIS USING STATE VARIABLE METHODS **9**

State variable representation - Conversion of state variable models to transfer functions, conversion of transfer functions to state variable models, solution of state equations; Concepts of controllability and observability.

TOTAL PERIODS: 45

COURSE OUTCOMES

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

- develop a mathematical model of a physical system and compute the transfer function using block diagram reduction technique and signal flow graph..
- analyze the transient response of control systems in using time domain.
- evaluate and analyze control systems using frequency domain methods.
- check the stability of systems and the effect of pole zero addition.

- design various transfer functions of digital control system using state variable models.

TEXT BOOKS

1. I.J. Nagrath and M. Gopal, "Control Systems Engineering", New Age International Publishers, Seventh Edition, 2021.
2. K. Ogata, "Modern Control Engineering", Pearson Education, Fifth Edition, 2015.

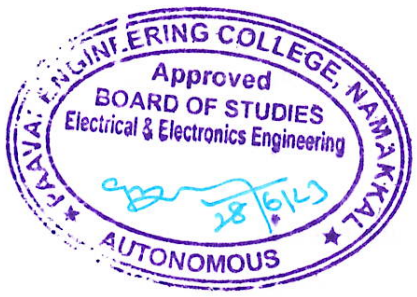
REFERENCES

1. B.C. Kuo, "Automatic Control Systems", Prentice Hall of India Ltd., Seventh Edition, 2017.
2. M. Gopal, "Control Systems, Principles & Design", Tata McGraw Hill, Third Edition, 2017.
3. A.Nagoorkani, "Control Systems", RBA Publications, Second Edition, 2018.
4. S.K.Bhattacharya, "Control System Engineering", PearsonEducation India, Third Edition, 2018.

CO-PO MAPPING

Mapping of Course Outcome (CO's) with Programme Outcomes (PO's) and Programme Specific Outcomes PSO's
(1/2/3 indicates strength of correlation) 3-Strong, 2-Medium, 1-Weak

CO's	Programme Outcomes PO's												PSO's	
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2
CO1	3	3	1	2	-	1	-	-	-	-	-	2	-	-
CO2	3	3	1	2	-	2	-	-	-	-	-	2	-	-
CO3	3	3	3	2	-	1	-	-	-	-	-	2	-	-
CO4	3	3	2	2	-	1	-	-	-	-	-	2	-	-
CO5	3	3	3	2	-	2	-	-	-	-	-	2	-	-



EE20413 MICROPROCESSORS AND MICROCONTROLLERS 3 0 0 3

COURSE OBJECTIVES

To enable the students to

- acquire knowledge on the architecture of 8085 microprocessor.
- analyze the memory and I/O devices of 8085 microprocessor.
- acquire knowledge about various interfacing devices.
- gain information about the architecture of 8051 microcontrollers.
- know about the application of microprocessor microcontroller.

UNIT I 8085 PROCESSOR **9**

Hardware architecture - Pinouts, functional building blocks of processor; Memory organization - I/O ports and data transfer concept; Timing diagram; Interrupts.

UNIT II MEMORY AND I/O DEVICES **9**

Need for Interfacing - Memory Interfacing, address space partitioning, address map; Address decoding; Bus contention; I/O Interfacing - Data transfer schemes; Programmed synchronous and asynchronous; Interrupt driven transfer; Multiple devices and multiple interrupt levels; Enabling disabling and masking of interrupts

UNIT III INTERFACING DEVICES **9**

Programmable peripheral device (8255); Programmable interval timer (8253); Programmable communication interface (USART); Programmable interrupt controller (8259); Programmable DMA controller (8257).

UNIT IV 8051 MICRO CONTROLLER **9**

Hardware architecture - Pinouts, functional building blocks of processor; Memory organization - I/O ports and data transfer concepts; Data transfer - manipulation, control algorithms and I/O instructions; Interrupts.

UNIT V MICROPROCESSOR AND MICROCONTROLLER APPLICATIONS **9**

Temperature monitoring system; Automotive applications; Stepper motor control; Washing machine control; Keyboard and display interface.

TOTAL PERIODS: 45

COURSE OUTCOMES

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

- explain the architecture of 8085 microprocessor.
- describe about memory and I/O devices in microprocessor.
- devise interfacing concepts of various devices.

- describe the architecture of 8051 microcontrollers.
- elaborate the real time applications of microprocessor and microcontroller.

TEXT BOOKS

1. R.S. Gaonkar, "Microprocessor Architecture Programming and Application with 8085", Wiley Eastern Ltd., New Delhi, Sixth Edition, 2013.
2. Sunil Mathur, Jeebananda Panda, "Microprocessor and Microcontrollers", PHI Learning Pvt. Ltd., 2016.
3. R.Theagarajan, S.Dhanasekaran, S.Dhanapal, "Microprocessors and its applications", New Age International, Reprint 2014.

REFERENCES

1. V. Douglas Hall, "Microprocessors and Interfacing Programming and Hardware", Tata McGraw - Hill Publishing Company Ltd., Reprint 2012.
2. K. Ray and K. M.Bhurchandi, "Advanced Microprocessor and Peripherals – Architecture, Programming and Interfacing", Tata McGraw - Hill Publishing Company Ltd., Reprint 2016.
3. Rafiquzzaman M., "Microprocessors Theory and Applications: Intel and Motorola", Prentice Hall, Reprint 2013.
4. Hrishna Kant, " Microprocessor & Microcontrollers", Prentice Hall of India, New Delhi, Eastern company Edition, 2017.

CO-PO MAPPING

Mapping of Course Outcome (CO's) with Programme Outcomes (PO's) and Programme Specific Outcomes PSO's
(1/2/3 indicates strength of correlation) 3-Strong, 2-Medium, 1-Weak

CO's	Programme Outcomes PO's												PSO's	
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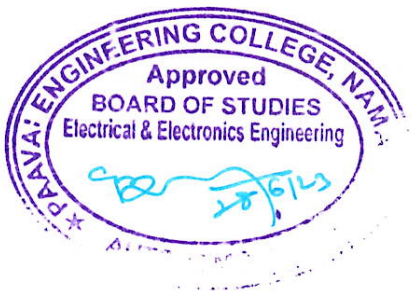
CO1	3	2	1	-	-	2	-	-	-	-	2	2	-	-
CO2	3	1	2	-	-	1	-	-	-	-	1	2	-	-
CO3	3	2	1	-	-	2	-	-	-	-	2	2	-	-
CO4	3	2	1	-	-	1	-	-	-	-	2	2	-	-
CO5	3	2	1	-	-	1	-	-	-	-	1	2	-	-



EE20414 **SENSORS AND INSTRUMENTATION** **3 0 0 3**

COURSE OBJECTIVES

To enable the students to

- understand the concepts of measurement technology
- identify the various sensors used to measure various physical parameters.
- acquaint the fundamentals of signal conditioning, data acquisition and communication systems used in mechatronics system development.
- learn about the optical, pressure and temperature sensor.
- study the signal conditioning and DAQ systems.

UNIT I INTRODUCTION **9**

Functional elements of an instrument - Classification of errors; Error analysis; Static and dynamic characteristics of transducers; Performance measures of sensors – Sensor calibration techniques, sensor output signal types.

UNIT II MOTION, PROXIMITY AND RANGE SENSORS **9**

Motion Sensors - PIR sensor, ultrasonic sensor, microwave sensor, tomographic sensor; Potentiometers - Resolver; Optical encoders; Capacitive transducers; Inductive transducers – LVDT, RVDT; GPS; Bluetooth; Range sensors; Ultrasonic ranging; Laser range sensor (LIDAR).

UNIT III FORCE, MAGNETIC AND HEADING SENSORS **9**

Force sensor; Strain gage - Strain gauge load cell; Magnetic sensors – principle, requirement and advantages; Magneto resistive; Hall effect ; Current sensor; Heading sensors; Gyroscope sensors - Types.

UNIT IV OPTICAL, PRESSURE AND TEMPERATURE SENSORS **9**

Light Sensor - Photo conductive cell. photo voltaic cell; LDR; Fiber optic sensors; Pressure sensor; Piezoelectric sensor; Tactile sensors; Temperature sensor - Temperature sensor IC, thermometer, RTD; Thermocouple; Thermistor; Radiation sensors; Smart sensors; Film sensor; MEMS and Nano sensors; LASER sensors.

UNIT V SIGNAL CONDITIONING AND DAQ SYSTEMS **9**

Signal Conditioning – Amplification, filtering, sample and hold circuits; Data acquisition - Single channel, multichannel data acquisition; Data loggers; Automobile sensor; Home appliances sensor; Manufacturing sensor; Environmental monitoring sensor.

TOTAL PERIODS 45

COURSE OUTCOMES

At the end this course, students will be able to

- recognize with various calibration techniques and signal types for sensors.
- describe the working principle and characteristics of force, magnetic, heading, pressure and temperature, smart and other sensors and transducers.
- apply the various sensors and transducers in various applications
- select the appropriate sensor for different applications.
- acquire the signals from different sensors using data acquisition systems.

TEXT BOOKS

1. Sawney A K and Puneet Sawney, "A Course in Mechanical Measurements and Instrumentation and Control", Dhanpat Rai & Co, 12th edition New Delhi, 2013
2. Ernest O Doebelin, "Measurement Systems – Applications and Design", Tata McGraw-Hill, 2019.

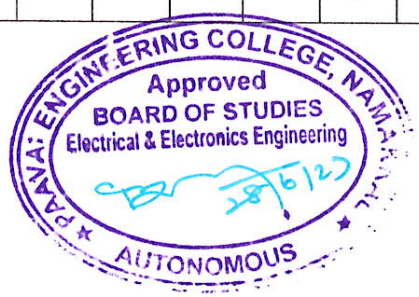
REFERENCES

1. C. Sujatha, Dyer, S.A., Survey of Instrumentation and Measurement, John Wiley & Sons, Canada, 2020.
2. Hans Kurt Tönshoff (Editor), Ichiro, "Sensors in Manufacturing" Volume 1, Wiley-VCH April 2021.
3. John Turner and Martyn Hill, "Instrumentation for Engineers and Scientists", Oxford Science Publications, Reprint 2018.
4. Patranabis D, "Sensors and Transducers", 2nd Edition, PHI, New Delhi, Reprint 2016.

CO-PO MAPPING

Mapping of Course Outcome (CO's) with Programme Outcomes (PO's) and Programme Specific Outcomes PSO's
***(1/2/3 indicates strength of correlation)* 3-Strong, 2-Medium, 1-Weak**

CO's	Programme Outcomes PO's												PSO's	
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2
CO1	3	1	1	-	-	2	-	-	-	-	-	2	-	-
CO2	3	1	2	-	-	2	-	-	-	-	-	1	-	-
CO3	3	1	2	-	-	2	-	-	-	-	-	3	-	-
CO4	3	2	1	-	-	2	-	-	-	-	-	2	-	-
CO5	3	1	3	-	-	2	-	-	-	-	-	1	-	-



RA20403 **MANUFACTURING TECHNOLOGY LABORATORY** **0 0 2 1**

COURSE OBJECTIVES

To enable the students to

- select appropriate tools, equipment and machines to complete a given job.
- do exercises on various welding processes using arc welding and fabrication of gears using gear making machines.
- learn various machining process such as rolling, drawing, turning, shaping, drilling, milling and analyzing the defects in the cast and machined components.
- get practice on grinding and lathe machine operations.

LIST OF EXPERIMENTS

1. Fabricating simple structural shapes using Arc Welding machine.
2. Preparing green sand moulds with cast patterns.
3. Taper Turning and Eccentric Turning on circular parts using lathe machine.
4. Knurling, external and internal thread cutting on circular parts using lathe machine.
5. Shaping Square and Hexagonal Heads on circular parts using shaper machine.
6. Drilling and Reaming using vertical drilling machine.
7. Milling contours on plates using vertical milling machine.
8. Cutting spur and helical gear using milling machine.
9. Grinding components using cylindrical and center less grinding machine.
10. Grinding components using surface grinding machine.
11. Cutting force calculation using dynamometer in lathe machine

TOTAL PERIODS : 30

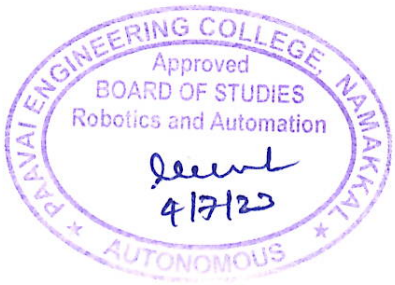
COURSE OUTCOMES

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

- apply safety precautions exercised in the mechanical workshop and select appropriate tools, equipment and machines to complete a given job
- work individually on various welding processes using arc welding and fabrication of gears using gear making machines
- perform various machining process such as rolling, drawing, turning, shaping, drilling, milling and analyzing the defects in the cast and machined components.
- carryout work on grinding and lathe machine operations for given dimensions on a job.

CO - PO Mapping

Mapping of Course Outcomes with Programme Outcomes: **(1/2/3 indicates strength of correlation) 3-Strong, 2-Medium , 1-Weak**														
COs	**Programme Outcomes(POs)**													
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO 10**	**PO11**	**PO12**	**PSO1**	**PSO2**
CO1	3	-	-	-	-	-	1	-	2	-	-	1	1	2
CO2	3	-	-	-	-	-	1	-	2	-	-	1	1	2
CO3	3	-	-	-	-	-	1	-	2	-	-	1	1	2
CO4	3	-	-	-	-	-	1	-	2	-	-	1	1	2



EE20415 **MICROPROCESSORS AND MICROCONTROLLERS LABORATORY** **0 0 2 1**

COURSE OBJECTIVES

To enable the students to

- learn the program using arithmetic operations of microprocessors.
- know about the sorting of number series and code conversion.
- understand various IC interfacing with 8085.
- learn the arithmetic operations of 8051 microcontrollers.

LIST OF EXPERIMENTS

Program using 8085

1. Addition of two 8-bit numbers.
2. Subtraction of two 8-bit numbers.
3. Arrange a series of numbers in ascending order.
4. Arrange a series of numbers in descending order
5. Decimal to hexadecimal conversion and hexadecimal number to decimal number conversion.
6. Interfacing with analog to digital conversion.
7. Interfacing with digital to analog conversion.
8. Interfacing with stepper motor controller.

Program using 8051

1. 16-bit addition.
2. 16-bit subtraction.

TOTAL PERIODS: 30

COURSE OUTCOMES

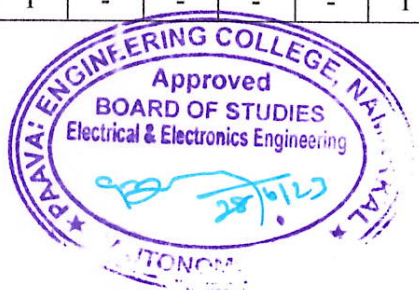
At the end of this course, students will be able to

- write the assembly level of programming in 8085 microprocessors.
- implement number sorting and code conversion.
- interface stepper motor, ADC, DAC with 8085 microprocessors.
- write the assembly level of programming in 8051 microcontroller.

CO-PO MAPPING

Mapping of Course Outcome (CO's) with Programme Outcomes (PO's) and Programme Specific Outcomes PSO's
(1/2/3 indicates strength of correlation) 3-Strong, 2-Medium, 1-Weak

CO's	Programme Outcomes PO's												PSO's	
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2
CO1	3	2	2	-	1	2	-	-	-	-	1	2	-	-
CO2	2	2	1	-	1	2	-	-	-	-	1	2	-	-
CO3	3	1	1	-	1	1	-	-	-	-	1	1	-	-
CO4	3	2	1	-	1	1	-	-	-	-	1	1	-	-



EE20416 SENSORS AND INSTRUMENTATION LABORATORY 0 0 2 1

COURSE OBJECTIVES

To enable the students to

- understand the various pressure sensors.
- obtain the characteristics of various temperature sensors.
- analyse the various displacement measuring sensors.
- acquire the knowledge about various light sensors.

LIST OF EXPERIMENTS

1. Characteristics of strain gauge.
2. Displacement measurement using LVDT.
3. Characteristics of temperature sensor - thermistor.
4. Characteristics of temperature sensor – RTD.
5. Characteristics of thermocouple.
6. Characteristics of LDR.
7. Characteristics of photo diode and photo transistor.
8. Flow measurement.

TOTAL PERIODS 30

COURSE OUTCOMES

At the end this course, students will be able to

- analyze circuit characteristics of strain gauge and LVDT.
- measure the characteristics of LDR ,thermocouple and thermistor.
- determine the characteristics of photo diode and photo transistor.
- demonstrate various sensors.

CO-PO MAPPING

Mapping of Course Outcome (CO's) with Programme Outcomes (PO's) and Programme Specific Outcomes PSO's (1/2/3 indicates strength of correlation) 3-Strong, 2-Medium, 1-Weak														
CO's	**Programme Outcomes PO's**												**PSO's**	
	PO 1	**PO 2**	**PO 3**	**PO 4**	**PO 5**	**PO 6**	**PO 7**	**PO 8**	**PO 9**	**PO 10**	**PO 11**	**PO 12**	**PSO 1**	**PSO 2**
CO1	3	1	2	-	-	1	-	-	-	-	2	1	-	-
CO2	3	1	2	-	-	1	-	-	-	-	1	2	-	-
CO3	3	1	1	-	-	2	-	-	-	-	1	2	-	-
CO4	3	1	2	-	-	`1	-	-	-	-	1	1	-	-