ANNAMACHARYA INSTITUTE OF TECHNOLOGY AND SCIENCES, TIRUPATI
(Autonomous)
Course structure for Four Year Regular B.Tech. Degree Program
(Effective for the batches admitted from 2019-20)
MECHANICAL ENGINEERING (ME)

II B. Tech – II Semester

S.No	Category	Course Code	Course Title	Contact Hours per week			Credits	Scheme of Examination (Max. Marks)		
				L	T	P		CIE	SEE	Total
THEORY										
1	BS	19ABS9915	Transform Techniques and Numerical Methods	3	0	0	3	30	70	100
2	PC	19APC0309	Kinematics of Machines	2	0	0	2	30	70	100
3	ES	19AES0505	Internet of Things (IoT)	2	0	0	2	30	70	100
4	PC	19APC0302	Mechanics of Materials	3	0	0	3	30	70	100
5	PC	19APC0312	Manufacturing Technology	3	0	0	3	30	70	100
6	PC	19APC0314	Fluid Mechanics & Hydraulic Machinery	3	0	0	3	30	70	100
7	MC	19AMC9901	Biology for Engineers	2	0	0	0	30	-	30
PRACTICAL										
8	PR	19APR0301	Socially Relevant Project (15 Hrs/Sem)	0	0	0	0.5	50	-	50
9	PC	19APC0315	Fluid Mechanics & Hydraulic Machinery Lab	0	0	2	1	30	70	100
10	ES	19AES0506	Internet of Things (IoT) Lab	0	0	2	1	30	70	100
11	PC	19APC0303	Mechanics of Materials Lab	0	0	3	1.5	30	70	100
12	PC	19APC0313	Manufacturing Technology Lab	0	0	3	1.5	30	70	100
			TOTAL	**16**	**0**	**10**	**21.5**	**380**	**700**	**1080**

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Year: II **Semester : II** **Branch of Study : ME**

Subject Code	Subject Name	L	T	P	Credits
19ABS9915	Transform Techniques and Numerical Methods	3	0	0	3

Course Outcomes:

CO: 1 Apply the Laplace transform for solving differential equations (continuous systems)
CO: 2 Find the Fourier series of periodic signals
CO: 3 Know and be able to apply integral expressions for the forwards and inverse Fourier transform to a range of non-periodic waveforms
CO: 4 Solve linear/nonlinear algebraic and transcendental equations using numerical methods
CO: 5 Solve ordinary differential equations by Euler's method, modified Euler's method, Runge Kutta method, Predictor Corrector method and Milne's method

UNIT I
Laplace transforms:
Definition of Laplace transform, existence conditions, properties of Laplace transforms, inverse Laplace transforms, transforms of derivatives, transforms of integrals, multiplication by t^n, division by t, convolution theorem, periodic functions, unit step function, unit impulse function, applications to ordinary differential equations. (Without proofs).

UNIT II
Fourier series:
Dirichlet's conditions, Fourier series, conditions for a Fourier expansion, functions of any period, odd and even functions - half range series.

UNIT III
Fourier transforms:
Fourier integrals, Fourier cosine and sine integrals, Fourier transform, sine and cosine transform, properties, convolution theorem.

UNIT IV
Solution to algebraic equations:
Solution of polynomial and transcendental equations: bisection method, Newton-Raphson method and Regula-Falsi method. finite differences, relation between operators, interpolation using Newton's forward and backward difference formulae. Interpolation with unequal intervals: Newton's divided difference and Lagrange's formulae.

UNIT V
Numerical differentiation and integration:
Numerical Differentiation, numerical integration- trapezoidal rule and Simpson's 1/3rd and 3/8 rules. Ordinary differential equations-Taylor's series, Euler and modified Euler's methods. Runge-Kutta method of fourth order for solving first and second order equations.

Textbooks:

1. B. S. Grewal, Higher Engineering Mathematics, 44/e, Khanna Publishers, 2017.

2. Erwin kreyszig, Advanced Engineering Mathematics, 9/e, John Wiley & Sons, 2006.

References

1. T.K.V.Iyengar, B.Krishna Gandhi and others, Engineering Mathematics-II, & Probability and Statistics, S.Chand Publishers
2. Veerarajan T., Engineering Mathematics, Tata McGraw-Hill, New Delhi, 2008.
3. Erwin kreyszig, Advanced Engineering Mathematics, 9/e, John Wiley & Sons, 2006.
4. N.P. Bali and Manish Goyal, A text book of Engineering Mathematics, Laxmi Publications, Reprint, 2010.

List of COs	PO no. and keyword	Competency	Performance Indicator
CO 1	PO1: Apply the knowledge of mathematics	1.1	1.1.2
CO 2	PO1:Apply the knowledge of mathematics	1.1	1.1.2
CO 3	PO 2: First principles of mathematics.	2.2	2.2.2
CO 4	PO1: Knowledge of mathematics	1.3	1.3.1
CO 5	PO1: Knowledge of mathematics	1.1	1.1.1

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Year: II **Semester : II** **Branch of Study : ME**

Subject Code	Subject Name	L	T	P	Credits
19APC0309	Kinematics of Machinery	3	0	0	3

Course Outcomes:

CO: 1 To enable the students in selection of appropriate mechanisms.
CO: 2 To impart the clear idea in constructing velocity & acceleration diagrams for the given mechanism.
CO: 3 To provide an overview of straight line motion mechanisms, steering mechanisms and Hooke's joint.
CO: 4 To understand the kinematic analysis of gears & gear trains.
CO: 5 To develop the knowledge of kinematic analysis of cams.

UNIT I

Mechanisms, Machine and Structure:

Element or Link – Classification – Rigid Link, flexible and fluid link – Kinematic pair – Types – sliding, turning, rolling, screw and spherical pairs, Lower and Higher pairs, closed and open pairs – Constrained motion – completely, partially or successfully constrained motion, and incompletely constrained motion.

Kinematic chain – Degrees of freedom of planar mechanisms – inversion of mechanism – inversion of quadric cycle chain, single and double slider crank chain.

UNIT II

Velocity and Acceleration analysis of mechanisms:

Velocity Analysis:

Relative velocity method: Motion of Link – construction of velocity diagrams – determination of angular velocity of points and links – four bar chain, single slider crank chain and other simple mechanisms.

Instantaneous center method: Instantaneous center of rotation – Three centres in line theorem – Graphical determination of instantaneous centre, diagrams for simple mechanisms and determination of angular velocity of points and links.

Acceleration Analysis: Acceleration diagram for simple mechanisms – determination of acceleration of points and angular acceleration of links – Corioli's acceleration – Klein's construction..

UNIT III

Straight line motion mechanisms, Steering mechanisms, and Hooke's Joint:

Straight line motion mechanisms: Exact and approximate copiers and generated types – Peaucellier, Hart's and Scott Russell – Grosshopper, Watt, T-Chebicheff, Robert mechanisms. Steering mechanisms: Condition for correct steering – Davis steering gear, Ackerman's steering gear. Hooke's Joint: Single and double Hooke's joint – velocity ratio, simple problems.

UNIT IV

Gears and Gear trains:

Gears: Friction wheels and toothed gears – types – law of gearing – condition for constant velocity ratio for transmission of motion – forms of teeth – Cycloidal and involute profiles – velocity of sliding, path of contact, arc of contact and contact ratio – phenomena of interference

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– methods to avoid interference – condition for minimum number of teeth to avoid intereference.
Gear trains: Introduction – train value – types – simple, compound, reverted and epicyclic gear trains – methods of finding train value or velocity ratio of epicyclic gear trains – sun & planetary gear systems – differential gear of an automobile.

UNIT V
Cams:
Definitions – Cam and Follower – uses – types of followers and cams – radial cam terminology – types of follower motion – uniform velocity, simple harmonic, uniform acceleration and retardation motion – maximum velocity and maximum acceleration during outward and return strokes in the above cases.

Textbooks:
1. S.S.Rattan, Theory of Machines, Tata McGraw Hill Education (India) Pvt. Ltd.
2. R.S.Khurmi & J.K.Gupta, Theory of Mahines, S.Chand Publications.

References
1. Jagadish Lal, Theory of Mechanisms and Machines, Metropolitan company pvt. Ltd
2. R.K.Bansal, Theory of Machines, Lakshmi Publications.
3. Thomas Bevan, Theory of Machines, CBS.
4. P L Ballaney, Theory of Machines, Khanna Publishers.

List of COs	PO no. and keyword	Competency	Performance Indicator
CO 1	PO1: Engineering knowledge	1.1.	1.1.2
CO 2	PO1: Engineering knowledge	1.1	1.1.2
CO 3	PO1: Engineering knowledge	1.1	1.1.1
CO 4	PO2: Problem analysis	2.4	2.4.1
CO 5	PO2: Problem analysis	2.4	2.4.1

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Year: II **Semester : II** **Branch of Study : ME**

Subject Code	Subject Name	L	T	P	Credits
19AES0505	Internet of Things (IoT)	2	0	0	2

Course Outcomes:

CO: 1 Interpret the vision of IoT from a global context
CO: 2 Determine the Market perspective of IoT
CO: 3 Compare and Contrast the use of Devices, Gateways and Data Management in IoT
CO: 4 Implement state of the art architecture in IoT
CO: 5 Illustrate the application of IoT in Industrial Automation and identify Real World Design Constraints

UNIT I

M2M to IoT-The Vision-Introduction, From M2M to IoT, M2M towards IoT-the global context, A use case example, Differing Characteristics.

UNIT II

M2M to IoT - A Market Perspective- Introduction, Some Definitions, M2M Value Chains, IoT Value Chains, An emerging industrial structure for IoT, The international driven global value chain and global information monopolies. M2M to IoT-An Architectural Overview- Building an architecture, Main design principles and needed capabilities, An IoT architecture outline, standards considerations.

UNIT III

M2M and IoT Technology Fundamentals- Devices and gateways, Local and wide area networking, Data management, Business processes in IoT, Everything as a Service(XaaS), M2M and IoT Analytics, Knowledge Management.

UNIT IV

IoT Architecture-State of the Art - Introduction, State of the art.

UNIT V

IoT Reference Architecture- Introduction, Functional View, Information View, Deployment and Operational View, Other Relevant architectural views. Real-World Design Constraints-Introduction, Technical Design constraints-hardware is popular again, Data representation and visualization, Interaction and remote control. Industrial Automation- Service-oriented architecture-based device integration, SOCRADES: realizing the enterprise integrated Web of Things, IMC-AESOP: from the Web of Things to the Cloud of Things.

Textbooks:

1. Jan Holler, Vlasios Tsiatsis, Catherine Mulligan, Stefan Avesand, Stamatis Karnouskos, David Boyle, "From Machine-to-Machine to the Internet of Things: Introduction to a New Age of Intelligence", 1st Edition, Academic Press, 2014. (ISBN-13:978-0124076846).

References

1. Vijay Madisetti and Arshdeep Bahga, "Internet of Things (A Hands-on-Approach)", 1st Edition, VPT, 2014. (ISBN-13: 978-8173719547)

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2. Francis daCosta, "Rethinking the Internet of Things: A Scalable Approach to Connecting Everything", 1st Edition, Apress Publications, 2013. (ISBN-13: 978- 1430257400)P L Ballaney, Theory of Machines, Khanna Publishers.

List of COs	PO no. and keyword	Competency	Performance Indicator
CO 1	PO 5: Modern Tool Usage	5.1	5.1.1
CO 2	PO 5: Modern Tool Usage	5.2	5.2.1
CO 3	PO 4: Conduct investigations of complex problems	4.3	4.3.1
CO 4	PO 3: Design/Development of Solutions	3.4	3.4.1
CO 5	PO 6: Engineer & Society	6.1	6.1.1

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Year: II **Semester : II** **Branch of Study : ME**

Subject Code	Subject Name	L	T	P	Credits
19APC0302	Mechanics of Materials	3	0	0	3

Course Outcomes:

CO: 1 Apply the concepts of stress and strain to machine numbers
CO: 2 Determine, shear forces, and bending moments in beams
CO: 3 To find slope and deflection in beams, determine shear forces and bending moments in beams
CO: 4 Estimate the stresses in machine members such as shafts and springs and design
CO: 5 Estimate the stresses in thin cylinders due to internal pressure

UNIT I

Stresses and Strains: Types of stresses and strains, stress-strain relations, stress-strain diagram for ductile and other materials, axial loaded bars of uniform and varying cross section, compound bars, relation between three elastic moduli, thermal stresses. Strain energy, resilience

Principal stresses and strains: Biaxial state of stress with and without shear - Mohr's Circle and analytical methods.

UNIT II

Analysis of Beams: Types of beams and loads, shear force and bending moment diagram for cantilever, simply supported and overhanging beams for different types of loadings, point of contra flexure, relation between shearing force and bending moment.

Bending Stresses: Flexural equation, bending stress distribution and efficiency of various cross sections of beams.

UNIT III

Deflection of Beams: Differential equations of the deflection curve, Slope and deflection: using double integration method, Macaulay's method and Moment area method for simply supported, cantilever and overhanging beams. Deflection under single and several loads.

UNIT IV

Torsional and shear stresses: Theory of pure torsion, Shear Stresses: Shear stress distribution for different cross sections of beams.

UNIT V

Buckling of Columns: Analysis of columns to evaluate buckling loads with different boundary conditions, Euler's formula and its limitations, Rankine's formula.

Thin Cylinders: hoop and stresses, longitudinal, cylindrical and spherical shells subjected to internal pressure calculation of volumetric strain.

Text Books :

1. F.P. Beer, E.R. Johnston, Jr & John. T. De Wolf, Mechanics of Materials, 7/e, Tata McGraw-Hill, 2016.
2. SS Rattan, Strength of materials, 3/e, Tata McGraw-Hill, 2016.

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Reference Books:

1. Timoshenko, Strength of Materials Part-I& II, 3/e, CBS Publishers, 2004.
2. Popov, Mechanics of Solids, 2/e, New Pearson Education, 2015.

List of COs	PO no. and keyword	Competency Indicator	Performance Indicator
CO: 1	PO 1: Engineering knowledge	1.3	1.3.1
CO: 2	PO 2: Problem analysis:	2.1	2.1.3
CO: 3	PO 4: Conduct investigations of complexproblems	4.1	4.1.2
CO: 4	PO 2: Problem analysis:	2.1	2.1.2
CO: 5	PO 1: Engineering knowledge:	2.6	2.6.3

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Year: II **Semester : II** **Branch of Study : ME**

Subject Code	Subject Name	L	T	P	Credits
19APC0304	Manufacturing Technology	2	0	0	2

Course Outcomes:

CO: 1 Demonstrate different metal casting processes and gating systems
CO: 2 Classify working of various welding processes
CO: 3 Evaluate the forces and power requirements in rolling process
CO: 4 Apply the principles of various forging operations
CO: 5 Outline the manufacturing methods of plasticsand ceramics.

UNIT I

Introduction: Importance and selection of manufacturing processes.

Casting Processes: Introduction to casting process, process steps; pattern: types, materials and allowance; Cores and design of gating system; Solidification of casting: Concept, solidification of pure metal and alloy; Special casting processes: Shell casting, investment casting, die casting, centrifugal casting, casting defects and remedies.

UNIT II

Metal Forming: Introduction, nature of plastic deformation, hot and cold working, mechanics of metal forming; Rolling: Principle, types of rolling mill and products, roll passes, forces in rolling and power requirements; Extrusion: Basic extrusion process and its characteristics, hot extrusion and cold extrusion, wire drawing, tube drawing.

UNIT III

Forging: Principles of forging, tools and dies. Types: Smith forging, drop forging, forging hammers, rotary forging and forging defects. Sheet metal forming: Mechanics of sheet metal working, blanking, piercing, bending, stamping.

UNIT IV

Material Joining Processes: Classification of welding processes, types of welds and welded joints and V-I characteristics, arc welding, weld bead geometry, submerged arc welding, gas tungsten arc welding, gas metal arc welding. applications, advantages and disadvantages of the above processes, other fabrication processes. Heat affected zones in welding; soldering and brazing: Types and their applications, Welding defects: causes and remedies. Adhesive Bonding.

UNIT V

Plastics: Types, properties and their applications, processing of plastics, extrusion of plastics, transfer molding and compression molding, injection molding, thermoforming, rotational molding and blow molding

Ceramics: Classification of ceramic materials, properties and their application, ceramic powder preparation; Processing of ceramic parts: Pressing, casting, sintering; Secondary processing of ceramics: Coatings, finishing.

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Text Books :

1. Rao P.N., Manufacturing Technology – Volume I, 5/e, McGraw-Hill Education, 2018.
2. Kalpakjian S and Schmid S.R., Manufacturing Engineering and Technology, 7/e, Pearson, 2018

Reference Books:

1. Millek P. Groover, Fundamentals of Modern Manufacturing: Materials, Processes and Systems, 4/e, John Wiley and Sons Inc, 2010.
2. Sharma P.C., A Text book of Production Technology, 8/e, S Chand Publishing, 2014.
3. Ian Gibson, David W. Rosen, Brent Stucker, Additive Manufacturing Technologies: Rapid Prototyping to Direct Digital Manufacturing, 1st Edition, Springer, 2010.

List of COs	PO no. and keyword	Competency	Performance Indicator
CO: 1	PO 1: Engineering knowledge	1.6	1.3.1
CO: 2	PO 5: Modern tool usage	5.2	5.2.2
CO: 3	PO 2: Problem analysis	2.5	2.1.2
CO: 4	PO 5: Modern tool usage:	5.2	5.2.2
CO: 5	PO 7: Environment and sustainability	7.4	7.4.1

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Year: II **Semester : II** **Branch of Study : ME**

Subject Code	Subject Name	L	T	P	Credits
19APC0314	Fluid Mechanics & Hydraulic Machinery	3	0	0	3

Course Outcomes:

CO: 1 Interpret the behavior under static and dynamic conditions.
CO: 2 analyze one dimensional viscous flows using conservation laws for compressible and incompressible flows.
CO: 3 apply boundary layer flows for laminar and turbulent regimes.
CO: 4 explain Reynolds stresses and its application
CO: 5 explain different types of pumps and their application.

UNIT I

Fluid Statics: Dimensions and units: physical properties of fluids – specific gravity, porosity surface tension – vapor pressure and their influence on fluid motion – atmospheric gauge and vacuum pressure – measurement of pressure – Piezometer, U-tube differential manometers.
Fluid Kinematics: stream line, path line and streak lines and steam tube, classification of flows-steady & unsteady, uniform, non-uniform, laminar, turbulent, rotational and irrotational flows-equation of continuity for one dimensional flow.

UNIT II

Fluid Dynamics: surface and body forces – Euler's and Bernoulli's equations for flowing stream line, momentum equation and its application on force on pipe bend.
Conduit Flow: Reynold'sexperiment – Darcy Weisbach equation – Minor losses in pipes – pipes in series and pipes in parallel – total energy line-hydraulic gradient line. Measurement of flow: pitot tube, venturimeter and orifice meter, Flow nozzle and Turbine current meter.

UNIT III

Turbo Machinery: hydrodynamic force of jets on stationary and moving flat, inclined, and curved vanes, jet striking centrally and at tip, velocity diagrams, work done efficiency, flow over radial vanes.
Hydroelectric Power Stations: Elements of hydro electric power station-types-concept of pumped storage plants-storage requirements.

UNIT IV

Hydraulic Turbines: Classification of turbines, impulse and reaction turbines, Pelton wheel, Francis turbine and Kaplan turbine-working proportions, work done, efficiencies, hydraulic design – draft tube – theory – functions and efficiency.
Performance of Hydraulic Turbines: Unit and specific quantities, characteristics, governing of turbines, selection of type of turbine, cavitation and surge tank.

UNIT V

Pumps: Classification –Rotary & Reciprocating pumps – working – work done – manomertic head – loss efficiencies – specific speed – pumps in series and parallel – performance characteristic curves and NPSH.

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TEXT BOOKS :

1. Fluid Mechanics, FRANK M. WHITE, Mc. Graw Hill Education.
2. Fluid Mechanics, Hydraulic and Hydraulic Machines by Modi & Seth, Standard book house.
3. A Text of Fluid Mechanics and Hydraulic Machines by Dr. R. K. Bansal – Laxmi Publications (P) Ltd., New Delhi.
4. Mechanics of Fluids by Potter, Wiggert, Ramadan, M. M. M. Sarcar, Cengage Publishers.

REFERENCE BOOKS :

1. Fluid Mechanics and Machinery by D. Rama Durgaiah, New Age International.
2. Principles of Fluid Mechanics and Fluid Machines by M. Narayana Pillai, Universities Press.
3. Fluid mechanics and fluid machines by Rajput, S.Chand & Co.

List of COs	PO no. and keyword	Competency Indicator	Performance Indicator
CO: 1	PO 1: Engineering knowledge	1.3	1.3.1
CO: 2	PO 2: Problem analysis	2.1	2.1.3
CO: 3	PO 1: Engineering knowledge	1.3	1.3.1
CO: 4	PO 2: Problem analysis	2.1	2.1.2
CO: 5	PO 1: Engineering knowledge	2.6	2.6.3

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Year: II **Semester : II** **Branch of Study : ME**

Subject Code	Subject Name	L	T	P	Credits
19AMC9901	Biology for Engineers	3	0	0	0

Course Outcomes:

CO: 1 Explain about cells and their structure and function. Different types of cells and basics for classification of living Organisms.

CO: 2 Explain about biomolecules, their structure, function and their role in the living organisms. How biomolecules are useful in Industry.

CO: 3 Brief about human physiology.

CO: 4 Explain about genetic material, DNA, genes and RNA how they replicate, pass and preserve vital information in living Organisms.

CO: 5 Know about application of biological principles in different technologies for the production of medicines and pharmaceutical molecules through transgenic microbes, plants and animals

UNIT I

Evolution: Different patterns of evolution, Darwin's theory of evolution, Cell as Basic unit of life, cell theory, Cell shapes, Cell structure, Cell cycle. Chromosomes. Prokaryotic and eukaryotic Cell. Plant Cell, Animal Cell, Plant tissues and Animal tissues, Brief introduction to five kingdoms of classification, Tissue Engineering.

UNIT II

Carbohydrates, lipids, proteins, Vitamins and minerals, Nucleic acids (DNA and RNA) and their types. Enzymes, Enzyme application in Industry. Large scale production of enzymes by Fermentation.

UNIT III

Digestive system, Respiratory system, (aerobic and anaerobic Respiration). Respiratory organs, respiratory cycle, Central Nerves System and Excretory system.

UNIT IV

Prokaryotic gene and Eukaryotic gene structure. DNA replication, Transcription and Translation. DNA technology. Introduction to gene cloning.

UNIT V

Brief introduction to industrial Production of Enzymes, Pharmaceutical and therapeutic Proteins, Vaccines and antibodies. Basics of biosensors, Properties and Classification of virus, Immune response to virus, Definitions-Pandemic, Epidemic and outbreak, pandemic alert system ranges, Prevention of pandemic disease and pandemic preparation.

TEXT BOOKS :

1. P.K.Gupta, Cell and Molecular Biology, 5th Edition, Rastogi Publications.
2. U. Satyanarayana. Biotechnology, Books & Allied Ltd 2017.

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REFERENCE BOOKS :

1. N. A. Campbell, J. B. Reece, L. Urry, M. L. Cain and S. A. Wasserman, "Biology: A Global Approach", Pearson Education Ltd, 2018.
2. T Johnson, Biology for Engineers, CRC press, 2011
3. J.M. Walker and E.B. Gingold, Molecular Biology and Biotechnology 2nd ed.. Panima Publications. PP 434.
4. David Hames, Instant Notes in Biochemistry –2016
5. Phil Tunner, A. Mctennan, A. Bates & M. White, Instant Notes – Molecular Biology – 2014.
6. Richard Dawkins, River Out of Eden: A Darwinian View of Life Fluid Mechanics and Machinery by D. Rama Durgaiah, New Age International.

List of COs	PO no. and keyword	Competency Indicator	Performance Indicator
CO: 1	PO 1: Apply the knowledge of basic science	1.2	1.2.1
CO: 2	PO 1: Apply the knowledge of basic science	1.2	1.2.1
CO: 3	PO 1: Apply the knowledge of basic science	1.2	1.2.1
CO: 4	PO 1: Apply the knowledge of basic science	1.2	1.2.1
CO: 5	PO 1: Apply the knowledge of basic science	1.2	1.2.1

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Year: II **Semester : II** **Branch of Study : ME**

Subject Code	Subject Name	L	T	P	Credits
19APC0315	Fluid Mechanics & Hydraulic Machinery Lab	0	0	2	1

Course Outcomes:

CO: 1 Interpret the behavior under static and dynamic conditions.
CO: 2 analyze one dimensional viscous flows using conservation laws for compressible and incompressible flows.
CO: 3 apply boundary layer flows for laminar and turbulent regimes.
CO: 4 explain Reynolds stresses and its application
CO: 5 explain different types of pumps and their application.

1. Calibration of Venturimeter
2. Calibration of Orifice meter
3. Determination of Coefficient of discharge for a small orifice by a constant head method.
4. Determination of Coefficient of discharge for an external mouth piece by variable head method.
5. Calibration of contracted Rectangular Notch and /or Triangular Notch.
6. Determination of Coefficient of loss of head in a sudden contraction and friction factor.
7. Varification of Bernoulli‟s equation.
8. Impact of jet on vanes.
9. Study of Hydraulic jump.
10. Performance test on Pelton wheel turbine.
11. Performance test on Francis turbine.
12. Efficiency test on centrifugal pump.

List of COs	PO no. and keyword	Competency	Performance Indicator
CO 1	PO1: Engineering knowledge	1.1.	1.1.2
CO 2	PO1: Engineering knowledge	1.1	1.1.2
CO 3	PO1: Engineering knowledge	1.1	1.1.1
CO 4	PO2: Problem analysis	2.4	2.4.1
CO 5	PO2: Problem analysis	2.4	2.4.1

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Year: II **Semester : II** **Branch of Study : ME**

Subject Code	Subject Name	L	T	P	Credits
19AES0506	Internet of Things Lab (IoT Lab)	0	0	2	1

Lab Experiments:

1. Select any one development board (Eg., Arduino or Raspberry Pi) and control LED using the board.
2. Using the same board as in (1), read data from a sensor. Experiment with both analog and digital sensors.
3. Control any two actuators connected to the development board using Bluetooth.
4. Read data from sensor and send it to a requesting client. (using socket communication) Note: The client and server should be connected to same local area network.
5. Create any cloud platform account, explore IoT services and register a thing on the platform.
6. Push sensor data to cloud.
7. Control an actuator through cloud.
8. Access the data pushed from sensor to cloud and apply any data analytics or visualization services.
9. Create a mobile app to control an actuator.
10. Identify a problem in your local area or college which can be solved by integrating the things you learned so far and create a prototype to solve it (Mini Project).

Text Book:

1. Adrian McEwen, Hakim Cassimally - Designing the Internet of Things, Wiley Publications, 2012

Reference Books:

1. Arshdeep Bahga, Vijay Madisetti - Internet of Things: A Hands-On Approach, Universities Press, 2014.
2. The Internet of Things, Enabling technologies and use cases – Pethuru Raj, Anupama C. Raman, CRC Press.

Reference sites:
https://www.arduino.cc/,https://www.raspberrypi.org/

Course outcomes: At the end of the course, students will be able to

- Choose the sensors and actuators for an IoT application.
- Select protocols for a specific IoT application.
- Utilize the cloud platform and APIs for IoT application.
- Experiment with embedded boards for creating IoT prototypes.

Design a solution for a given IoT application

List of COs	PO no. and keyword	Competency	Performance Indicator
CO 1	PO 5: Modern Tool Usage	5.1	5.1.1
CO 2	PO 5: Modern Tool Usage	5.2	5.2.1
CO 3	PO 4: Conduct investigations of complex Problem	4.3	4.3.1
CO 4	PO 3: Design/Development of Solutions	3.4	3.4.1
CO 5	PO 6: Engineer & Society	6.1	6.1.1

ANNAMACHARYA INSTITUTE OF TECHNOLOGY AND SCIENCES, TIRUPATI
(Autonomous)
Course structure for Four Year Regular B.Tech. Degree Program
(Effective for the batches admitted from 2019-20)
MECHANICAL ENGINEERING (ME)

Year: II **Semester : II** **Branch of Study : ME**

Subject Code	Subject Name	L	T	P	Credits
19APC0303	Mechanics of Materials Lab	0	0	3	1.5

Course Outcomes:

CO: 1 Analyze the strength of the beam, SSB
CO: 2 Design the various types of springs and their loads
CO: 3 Test the load and strength of bricks, cubes.
CO: 4 Define and analyze shear test, stress
CO: 5 Design the strain, stress and compression

List of Experiments:

1. Direct tension test beam
2. Bending test on
   a) Simply supported beam
   b) Cantilever beam
3. Torsion test
4. Hardness test
5. Brinells hardness test
6. Rockwell hardness test
7. Test on springs
8. Compression test on cube
9. Impact test
10. Punch shear test

COs	PO No. and keyword	Competency Indicator	Performance Indicator
CO1	PO 5: Modern tool usage	5.2	5.2.2
CO2	PO 1: Engineering knowledge	1.2	1.2.2
CO3	PO 5: Modern tool usage	5.2	5.2.2
CO4	PO 5: Modern tool usage	5.2	5.2.2
CO5	PO 1: Engineering knowledge	1.6	1.3.1

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MECHANICAL ENGINEERING (ME)

Year: II **Semester : II** **Branch of Study : ME**

Subject Code	Subject Name	L	T	P	Credits
19APC0313	Manufacturing Technology Lab	0	0	3	1.5

Course Outcomes:

CO: 1 Fabricate different types of components using various manufacturing techniques.
CO: 2 Carry out Pattern preparation and Estimate the Sand properties
CO: 3 Carry out the Welding process to join the components
CO: 4 Carry out Blanking & Piercing operation
CO: 5 Adapt material forming methods.

1. **METAL CASTING**
   a) Gating Design and pouring time and solidification time calculations.
   b) Sand Properties Testing – Exercise for Strength and Permeability.
   c) Molding, Melting and Casting for ferrous/ non ferrous materials.
2. **WELDING**
   a) Arc Welding: Lap & Butt Joint - 2 Exercises
   b) Spot Welding - 1 Exercise
   c) TIG Welding - 1 Exercise
   d) Plasma welding and Brazing - 2 Exercises (Water Plasma Device).
3. **MECHANICAL PRESS WORKING**
   a) Blanking & Piercing operation and study of simple, compound and progressive press tool.
   b) Hydraulic Press: Deep drawing and extrusion operation.
   c) Bending and other operations.

COs	PO No. and keyword	Competency Indicator	Performance Indicator
CO1	PO 5: Modern tool usage	5.2	5.2.2
CO2	PO 1: Engineering knowledge	1.2	1.2.2
CO3	PO 5: Modern tool usage	5.2	5.2.2
CO4	PO 5: Modern tool usage	5.2	5.2.2
CO5	PO 1: Engineering knowledge PO 7: Environment and sustainability	1.6 7.2	1.3.1 7.2.1