

Deenbandhu Chhotu Ram University of Science & Technology, Murthal (Sonapat)
Scheme of Studies & Examinations under Choice Based Credit System
Programme: B. Tech. in Mechanical Engineering; Year – 3rd (Semester – V); Session: 2020-21

S. No.	Course Code	Course Title	Teaching Schedule			Marks of Class Work	Examination Marks		Total	Credit	Duration of Exam
			L	T	P		Theory	Practical			
1	ME 301C	Heat Transfer	3	1	0	25	75	-	100	4	3
2	ME 303C	Solid Mechanics	3	1	0	25	75	-	100	4	3
3	ME 305C	Manufacturing Processes	3	0	0	25	75	-	100	3	3
4	ME 307C	Theory of Machines	3	1	0	25	75	-	100	4	3
5	ME 309C	Total Quality Management	3	0	0	25	75	-	100	3	3
6	ME 311C	Laboratory - II (Thermal)	0	0	2	25	-	75	100	1	3
7	ME 313C	Laboratory - III (Design)	0	0	2	25	-	75	100	1	3
8	ME 315C	Professional Training (Level II)	0	0	2	100	-	-	100	1	
9	HUM 301C	Essence of Indian Traditional Knowledge	3	0	0	25	75	-	100	0	3
Total			18	3	6	300	450	150	900	21	

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Scheme of Studies & Examinations under Choice Based Credit System
Programme: B. Tech. in Mechanical Engineering; Year – 3rd (Semester – VI); Session: 2020-21

S. No.	Course Code	Course Title	Teaching Schedule			Marks of Class Work	Examination Marks		Total	Credit	Duration of Exam
			L	T	P		Theory	Practical			
1	ME 302C	Manufacturing Technology and Management	4	0	0	25	75	-	100	4	3
2	ME 304C	Design of Machine Elements	3	1	0	25	75	-	100	4	3
3		Professional Elective-I	4	0	0	25	75	-	100	4	3
4		Professional Elective-II	4	0	0	25	75	-	100	4	3
5		Open Elective-I	3	0	0	25	75	-	100	3	3
6	ME 306C	Laboratory - IV (Design)	0	0	2	25	-	75	100	1	3
7	ME 308C	In-house Project	0	0	6	100	-	-	100	3	
Total			18	1	8	250	375	75	700	23	

List of Professional Elective- I & II Courses			List of Open Elective-I Courses (Any One)		
S. No.	Course Code	Course Title	S. No.	Course Code	Course Title
1	ME 322C	Robotics and Automation	1	HUM350C	Communication Skills for Professionals (Except BME & BTE)
2	ME 324C	Composite Materials	2	HUM352C	Soft Skills and Inter-personal Communication
3	ME 326C	Modern Manufacturing Processes	3	MGT402C	Human Values, Ethics And IPR
4	ME 328C	Internal Combustion Engines	4	MGT404C	Human Resource Management
5	ME 330C	Gas Dynamics and Jet Propulsion	5	HUM354C	Introduction to French language
			6	HUM356C	Introduction to German Language

NOTE: For students admitted in B.Tech. 1st Year (C-Scheme) in 2019 & onwards and all trailing students: Examinations and evaluations of students shall be conducted, covering the entire syllabus, as per guidelines "AICTE Examination Reforms". Students shall be informed about these reforms.

B. Tech. 3rd Year (V & VI semester)ME: Approved in 15th meeting of Academic Council held on 14.08.2020. applicable to all students admitted in 2018-19 & onwards and trailing students

**DEENBANDHU CHHOTU RAM UNIVERSITY OF SCIENCE & TECHNOLOGY,
MURTHAL (SONEPAT)
MECHANICAL ENGINEERING DEPARTMENT
SCHEME OF STUDIES & EXAMINATIONS OF B. TECH. (HONS./MINOR DEGREE) WITH
SPECIALIZATION (W.E.F. 2020-21)**

ROBOTICS (Jointly offered with ECE Department; Hons. Degree for students of ECE & ME, Minor Degree for other students)

S. No.	Semester	Course Code	Course Title	Teaching Schedule			Marks of Class work	Examination Marks		Total	Credit	Duration of Exam
				L	T	P		Theory	Practical			
1	5	SPME301C	Robotics and Applications	4	0	0	25	75	-	100	4	3
2	5	SPEC381C	Robotics Lab	0	0	2	25	-	75	100	1	3
3	6	SPEC302C	Python Programming	4	0	0	25	75	-	100	4	3
4	6	SPEC308C	Embedded Robotics	4	0	0	25	75	-	100	4	3
5	6	SPEC388C	Embedded Robotics Lab	0	0	2	25	-	75	100	1	3
6	7	SPME401C	Mechanics and Control in Robotics	4	0	0	25	75	-	100	4	3
Total				16	0	4	150	300	150	600	18	

Note:

- 1. The ordinance of B. Tech. Programme of the University shall be applicable to this scheme as well.**
- 2. Student can undertake 20% of the courses of this scheme (Hons./Minor Degree with Specialization in the above listed emerging areas) through online platforms SWAYAM/MOOCs/NPTEL etc. with due permission of the chairperson.**
- 3. Any students of the B. Tech. of the University can opt for this scheme (Hons./Minor Degree with Specialization in the above listed emerging areas), however, minimum 10 students are required for running a particular specialization.**
- 4. The choice of the students shall be sought through the respective chairpersons at the end of the 4th Semester.**
- 5. If any of the course in the any of the above scheme opted by a student exist in the list of the electives of the normal B. Tech. Scheme of the stream of that student as well then the student has to opt for some other elective.**

B. Tech. 3rd Year (V & VI semester)ME: Approved in 15th meeting of Academic Council held on 14.08.2020. applicable to all students admitted in 2018-19 & onwards and trailing students

ME 301C HEAT TRANSFER
B. Tech. Semester – V (Mechanical Engineering)

L T P Credits
3 1 -- 4

Class Work : 25 Marks
Examination : 75Marks

Total : 100 Marks

Duration of Examination : 3 Hours

UNIT I

Basics concepts: Thermodynamics Vs Heat transfer, basic modes of heat transfer, thermal conductivity Vs diffusivity, combined heat transfer.

Steady State Heat Conduction: Introduction, I-D heat conduction through a plane wall, long hollow cylinder, hollow sphere, Conduction equation in cartesian, polar and spherical co-ordinate systems, concept of conduction and film resistances, critical insulation thickness, Numericals.

UNIT II

Steady State Conduction with Heat Generation: 1-D heat conduction with heat sources, extended surfaces (fins), Fin effectiveness, Biot number, heat transfer through fins, Numericals

Transient Heat Conduction: Lumped capacitance, semi-infinite and infinite solid conduction modes for walls, cylinders, spheres; Chart solution(Heissler), Relaxation Method, Numericals.

UNIT III

Convection: Heat convection, basic equations, boundary layers- Forced convection, external and internal flows- Natural convective heat transfer- Dimensionless parameters for forced and free convection heat transfer- Correlations for forced and free convection- Approximate solutions to laminar boundary layer equations (momentum and energy) for both internal and external flow- Estimating heat transfer rates in laminar and turbulent flow situations using appropriate correlations for free and forced convection, Numericals.

Thermal Radiation: Interaction of radiation with materials, definitions of radiative properties, Stefan Boltzmann's law, black and gray body radiation, Calculation of radiation heat transfer between surfaces using radiative properties, view factors and the radiosity method. Radiation shields, applications to two and three surface enclosures, introduction to participating media, Numericals.

UNIT IV

Heat Exchangers: Types of heat exchanges, Performance variables, Analysis and design of heat exchangers using both LMTD and ϵ -NTU methods, pressure drop, Numericals.

Heat Transfer with phase change: Laminar film condensation on a vertical plate, Drop-wise condensation, Pool boiling regimes, Nucleate boiling and critical heat flux, film boiling and minimum heat flux, Flow boiling.

Introduction to Mass transfer.

Text Books :

1. Heat Transfer – J.P. Holman, John Wiley & Sons, New York.
2. Fundamentals of Heat & Mass Transfer–Incropera, F.P. & Dewill, D.P –John Willey New York.
3. Heat transfer –P.K. Nag, McGraw Hill

B. Tech. 3rd Year (V & VI semester)ME: Approved in 15th meeting of Academic Council held on 14.08.2020. applicable to all students admitted in 2018-19 & onwards and trailing students

Reference Books :

1. Heat Transfer – A. Bejan, John Wiley & Sons, Inc.
2. Conduction of Heat in Solids – Carslow, H.S. and J.C. Jaeger – Oxford Univ. Press.
3. Conduction Heat Transfer – Arpasi, V.S. – Addison – Wesley.
4. Compact Heat Exchangers – W.M. Keys & A.L. Landon, Mc. Graw Hill.
5. Thermal Radiation Heat Transfer – Siegel, R. and J.R. Howell, Mc. Graw Hill.

NOTES:

1. *In the semester examination, the examiner will set two questions from each unit (total 08 questions in all), covering the entire syllabus. The students will be required to attempt only 5 questions selecting at least one question from each unit.*
2. *The use of scientific calculator will be allowed in the examination. However, programmable calculator and cellular phone will not be allowed.*
3. *For students admitted in B.Tech. 1st Year (C-Scheme) in 2019 & onwards and all trailing students: Examinations and evaluations of students shall be conducted, covering the entire syllabus, as per guidelines “AICTE Examination Reforms”. Students shall be informed about these reforms.*

ME 303C SOLID MECHANICS
B. Tech. Semester – V (Mechanical Engineering)

L T P Credits
3 1 - 4

Class Work : 25 Marks
Examination : 75 Marks
Total : 100 Marks
Duration of Examination : 3 Hours

UNIT I

Introduction to Cartesian tensors, Strains: Concept of strain, derivation of small strain tensor and compatibility, Stress: Derivation of Cauchy relations and equilibrium and symmetry equations, principal stresses and directions

UNIT II

Constitutive equations: Generalized Hooke's law, Linear elasticity, Material symmetry; Boundary Value Problems: concepts of uniqueness and superposition.

UNIT III

Plane stress and plane strain problems, introduction to governing equations in cylindrical and spherical coordinates, axisymmetric problems.

UNIT IV

Application to thick cylinders, rotating discs, torsion of non-circular cross-sections, stress concentration problems, thermo-elasticity, 2-d contact problems.

TEXT BOOKS:

1. Strength of Materials – G. H. Ryder - Macmillan, India
2. Strength of Materials– Andrew Pytel and Fredinand L. Singer, Addison – Wesley
3. Continuum Mechanics for Engineers - G. T. Mase, R. E. Smelser and G. E. Mase, , Third Edition, CRC Press, 2004.
4. Foundations of Solid Mechanics - Y. C. Fung, , Prentice Hall International, 1965.

REFERENCE BOOKS:

1. Strength of Materials – Popov, PHI, New Delhi.
2. Mechanics of Materials - Timoshenko, S.P., and Gere, J.M., 2nd Ed., CBS Publishers 2002
3. An Introduction to the Mechanics of Solids - Crandall, S.H., Dahl, N.C., and Lardner, T.J., Tata McGraw-Hill 1999.

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ME 305C MANUFACTURING PROCESSES
B. Tech. Semester – V (Mechanical Engineering)

L **T** **P** **Credits**
3 **-** **-** **3**

Class Work : **25 Marks**
Examination : **75 Marks**
Total : **100 Marks**
Duration of Examination : **3 Hours**

UNIT – I

Conventional Manufacturing Processes: Casting and molding, Metal casting processes and equipment, design of patterns, moulds and cores; Heat transfer and solidification, shrinkage, riser and gating system design, casting defects and residual stresses.

Introduction to Bulk and Sheet Metal Forming: Plastic deformation and yield criteria, fundamentals of hot and cold working processes, load estimation for bulk forming (forging, rolling, extrusion, drawing) and sheet forming (shearing, deep drawing, bending) principles of powder metallurgy

UNIT – II

Metal Cutting: Single and multi-point cutting, orthogonal cutting, various force components, chip formation, tool wear and tool life, surface finish and integrity, machinability, cutting tool materials and tool geometry, coating, cutting fluids.

Process description of turning, drilling, milling and finishing processes, economics of machining, additive manufacturing, brief description of rapid prototyping and rapid tooling.

UNIT – III

Joining/Fastening Processes: Solid and liquid state joining processes; physics of welding, brazing and soldering; design considerations in welding, welding defects and testing, adhesive bonding.

Unconventional Machining Processes: Principles, process parameters, Applications and Limitations for the following Unconventional Machining Processes: Abrasive Jet Machining, Water Jet Machining, Abrasive Water Jet Machining, Ultrasonic Machining.

UNIT – IV

Electrical discharge machining(EDM), Principle and processes parameters, MRR, surface finish, tool wear, dielectric, power and control circuits, Wire EDM; electron Beam Machining (EBM).

Electro Chemical Machining (ECM), Principle and process parameters, Etchant & Maskant, MRR and surface finish, Laser Beam Machining (LBM), Plasma Arc Machining (PAM).

TEXT BOOK:

1. Kalpakjian and Schmid, Manufacturing processes for engineering materials (5th Edition)-Pearson India
2. Mikell P. Groover, Fundamentals of Modern Manufacturing: Materials, Processes, and Systems
3. P.N. Rao, Manufacturing Technology, Mc Graw Hill Education
4. Manufacturing Science, Amitabh Ghosh and Ashok Kumar Malik, EWP

REFERENCE BOOKS:

1. Schey J, Introduction to Manufacturing Processes, Mc Graw Hill Education
2. DeGarmo E. P., Black J. T. and Kohser R.A, Materials and Processes in Manufacturing, John Wiley & Sons
3. BL Juneja, GS Sekhon, Fundamental of Metal Cutting and Machine Tools, New Age international publishers.

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ME 307C THEORY OF MACHINES (COMMON WITH AERONAUTICAL ENGG.)

B. Tech. Semester – V (Mechanical Engineering)

L T P Credits
3 1 - 4

Class Work : 25 Marks
Examination : 75 Marks
Total : 100 Marks
Duration of Examination : 3 Hours

UNIT I

Introduction: Links-types, Kinematics pairs-classification, Constraints-types, Kinematic chains, Mechanism and machines, Degree of freedom, mobility- Grashof's law, Kinematic inversions of four bar chain and slider crank chains, Limit positions of four-bar mechanism, Transmission angle in four bar mechanism and slider crank mechanism, Synthesis for motion and path generation.

Velocity and Acceleration in Mechanism: Velocity and acceleration analysis of simple mechanisms, graphical velocity analysis using instantaneous centers, Coriolis component of acceleration,

UNIT II

Cams and Followers: Classification of cams and followers, Terminology, Cam profile by graphical methods with knife edge and radial roller follower for Uniform velocity, Parabolic, Simple harmonic and Cycloidal motions,

Gears and Gear Trains: Classification & Terminology, Law of gearing, Tooth Profile, Length of path of contact, Contact ratio, Interference & Under cutting in Involute gear teeth, Gear Trains- Synthesis of simple, Compound and Epicyclic gear train

UNIT III

Balancing of Rotating Components: Balancing of rotating masses, Graphical and analytical methods

Balancing of Reciprocating Parts: Primary and secondary forces and couples, Partial balancing, Effects of partial balancing, Balancing of single cylinder, multi cylinder; inline and radial engines

UNIT IV

Gyroscopes – Gyroscopic couple and their effects on Aircrafts and Ship during steering, rolling and pitching, Stability of two wheel and four wheel vehicles is moving on curved paths, Problems

Governors: Terminology, Centrifugal governors-Watt, Porter, Proell and Hartnell governor, Controlling force diagrams

TEXT BOOKS:

1. Theory of Machines - Thomas Bevan, CBS Publishers & Distributors
2. Mechanisms of Machines - Cleghorn W.L., Oxford University Press
3. Kinematics and Dynamics of Machinery, Robert L. Norton, Tata McGrawHill

REFERENCE BOOKS:

1. Theory of Mechanisms and Machines- Ghosh A. and Mallick A.K., Affiliated East- West Pvt. Ltd, New Delhi,
2. Mechanism and Machine Theory: J.S. Rao and R.V. Dukkipati Second Edition New age International
3. Theory of Machines and Mechanisms: Joseph Edward Shigley and John Joseph Uicker, Jr. Second Edition, MGH, New York
4. Theory and Machines: S.S. Rattan, Tata McGraw Hill.
5. Kinematics of Machines-Dr. Sadhu Singh, Pearson Education

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ME 309C TOTAL QUALITY MANAGEMENT
B. Tech. Semester – V (Mechanical Engineering)

L T P Credits
3 - - 3

Class Work : 25 Marks
Examination : 75 Marks
Total : 100 Marks
Duration of Examination : 3 Hours

UNIT – I Philosophies and fundamentals

Evolution of quality management philosophy, Definitions of quality and importance in industry, concept and scope of total quality control, product quality and service quality.

Contributions of Deming, Juran and Crosby; Quality statements, customer focus, customer orientation & satisfaction, customer complaints, customer retention, Quality costs and economics of quality, Quality assurance and ISO 9000 quality system standards, quality systems-elements, documentation, quality auditing, ISO 14000-concepts, requirements and benefits

UNIT- II Tools and Methods of quality improvement

Tools for quality: Introduction, fundamental seven tools for quality - histogram, Pareto chart, cause and effect diagram, stratification analysis, check sheet, control charts etc., introduction to new management tools of quality.

Total Quality Management (TQM): basic concepts, TQM frame work, TQM principles/elements like leadership, strategic quality planning, employee involvement, motivation, empowerment, team work, quality circles, recognition and reward, performance appraisal, continuous improvement, PDCE cycle, 5S, supplier partnership, supplier rating and selection etc. Benefits, implementation aspects and barriers to TQM.

UNIT – II Statistical Quality Control

Descriptive statistics/basic statistical concepts: Data collection and presentation, measures of central tendency like mean, standard deviation etc., probability distributions- types, characteristics and applications in quality, Introduction to inferential statistics.

Statistical Process Control- concept of variation, control charts-philosophy, types; process capability- brief of six sigma and taguchi method.

Acceptance sampling- concept, advantages, Operating characteristic (OC) curve and its use.

UNIT – IV Advancements in Quality management

Quality function deployment (QFD), Role of Total Productive Maintenance (TPM), Just in Time (JIT) and lean manufacturing, Bench marking, Failure mode and effect analysis (FMEA) etc. in quality improvement

Quality in service sector- Introduction, growing role of service industries in economy, service industries and their characteristics, comparison with manufacturing , a conceptual model for service quality, TQM implementation in manufacturing and service sectors.

TEXT BOOKS:-

- 1) Fundamentals of quality control and improvement by A Mitra, Mcmillan Pub Company
- 2) Managing for Total Quality: N. Logothetis PHI

REFERENCE BOOKS: -

1. Quality Planning and Analysis by J M Juran and Frank M Gryna TMH
B. Tech. 3rd Year (V & VI semester)ME: Approved in 15th meeting of Academic Council held on 14.08.2020. applicable to all students admitted in 2018-19 & onwards and trailing students

2. Besterfield D.H. et al., Total quality Management, 3rd ed., Pearson Education Asia, 2006.
3. Evans J.R. and Lindsay W.M., The management and Control of Quality, 8th ed., first Indian edition, Cengage Learning, 2012.

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ME 311C Laboratory-II (Thermal)
B. Tech. Semester – V (Mechanical & Aeronautical Engineering)

L	T	P	Credits	Class Work	: 25 Marks
--	--	2	1	Examination	: 75 Marks
				Total	: 100 Marks
				Duration of Examination	: 3 Hours

LIST OF EXPERIMENTS:

Unit-I

1. To determine the thermal conductivity of an insulating powder.
2. To find the effectiveness of a pin fin and plot temperature distribution along its length in a rectangular duct under natural and forced convective condition.
3. To determine the surface heat transfer coefficient for a heated vertical tube under natural convection and plot the variation of local heat transfer coefficient along the length of the tube. Also compare the results with those of the correlation.
4. To measure the emissivity of the gray body (plate) at different temperature and plot the variation of emissivity with surface temperature.
5. To find overall heat transfer coefficient and effectiveness of a heat exchange under parallel and counter flow conditions. Also plot the temperature distribution in both the cases along the length of heat of heat exchanger.
6. To verify the Stefan-Boltzmann constant for thermal radiation.
7. To determine the critical heat flux using two phase heat transfer apparatus.

Unit-II

8. To study the constructional details & working principles of two-stroke & four stroke petrol and diesel engine.
9. To prepare heat balance sheet on multi-cylinder diesel engine and petrol engine.
10. To prepare variable speed performance test of a multi-cylinder/single cylinder petrol engine and diesel engine and prepare the curves (i) BHP, IHP, FHP, vs Speed (ii) Volumetric efficiency & indicated specific fuel consumption vs speed.
11. To find FHP of a multi-cylinder diesel engine/petrol engine by Willian'sline method & by motoring method.
12. To perform constant speed performance test on a single cylinder/multi-cylinder diesel engine & draw curves of (i) BHP vs fuel rate, air rate and A/F ratio and (ii) BHP vs mep, Mech efficiency & SFC.

Unit-III

13. To study the Mechanical compression cycle based heat pump and determine its Carnot, theoretical and actual C.O.P. Draw the cycle on P-H and T-S diagrams.
14. To study the various air conditioning psychrometric processes like cooling, heating, cooling and dehumidification, heating and humidification etc using AC tutor and plot them on Psychrometric chart.
15. To study the aqua- ammonia absorption system and find its COP

Note:

1. **At least Ten experiments are to be performed in the Semester selecting atleast 4 from Unit I; 3 from Unit II; and 2 from Unit III**

ME 313C Laboratory- III (Design)

B. Tech. Semester – V (Mechanical Engineering)

L	T	P	Credits
-	-	2	1

Class Work	: 25 Marks
Examination	: 75 Marks
Total	: 100 Marks
Duration of Examination	: 3 Hours

LIST OF EXPERIMENTS:

1. To study various types of Kinematic links, pairs, chains and Mechanisms.
2. To study inversions of 4 Bar Mechanisms, Single and Double slider crank mechanisms.
3. To study various type of cam and follower arrangements.
4. To study various types of gears: Spur, Helical, Double helical, Spiral, Bevel gear, Hypoid
5. To study various types of gear trains: Simple, Compound and Epicyclic
6. To perform experiment on Watt Governors to prepare performance characteristic curves.
7. To perform experiment on Porter Governors to prepare performance characteristic curves.
8. To perform experiment on Proell Governor to prepare performance characteristic curves.
9. To perform experiment on Hartnell Governor to prepare performance characteristic curves.
10. To find experimentally the Gyroscopic couple on motorized gyroscope and compare with applied couple.
11. To perform the experiment for static balancing on Static Balancing Machine.
12. To perform the experiment for dynamic balancing on Dynamic Balancing machine.

Note:

1. Total Ten experiments are to be performed in the Semester.
2. At least eight experiments should be performed from the above list. Remaining two experiments may either be performed from the above list or designed & set by the concerned institute as per the scope of the syllabus.

B. Tech. 3rd Year (V & VI semester)ME: Approved in 15th meeting of Academic Council held on 14.08.2020. applicable to all students admitted in 2018-19 & onwards and trailing students

ME 315C Professional Training (Level – II)

B. Tech. Semester – V (Mechanical Engineering)

Duration of Training

4-6 weeks

Credits

1

Class Work : 100 Marks

Total : 100 Marks

Professional Training is aimed to provide practical experience to the interns in his/her field or discipline to achieve the following objectives:

- To expose Technical students to the industrial environment, which cannot be simulated in the classroom and hence, creating competent professionals in the industry.
- To Provide possible opportunities to learn, understand and sharpen the real time technical / managerial skills required in the job.
- To gain experience in writing Technical reports/projects.
- To expose students to the engineer's responsibilities and ethics.
- To familiarize with various materials, processes, products and their applications along with the relevant aspects of quality control.
- To promote academic, professional and/or personal development.
- To expose the students to future employers.
- To understand the social, economic and administrative considerations that influence the working environment of industrial organizations
- To understand the psychology of the workers and their habits, attitudes and approach to problem solving.

At the end of 4th semester each student would undergo four to six weeks Professional Training in an Industry/ Institute/ Professional / Organization/ Research Laboratory etc. with the prior approval of the Training and Placement Officer of the University and submit in the department a typed report along with a certificate from the organization.

Every student is required to submit a typed report in a prescribed format. The report should contain the activities done by him. The report should also contain the student's Diary / Daily log. The students should record day-to-day account of the observations, impressions, information gathered and suggestions given, if any in the training diary. It should contain the sketches & drawings related to the observations made by the students. The diary should also be shown to the Faculty Mentor visiting the industry from time to time.

The evaluation of Professional Training/Project will be done by a departmental committee in the 5th semester as per time table allocated by the department. The evaluation committee will consist of teachers from different specialization to be constituted by the Chairperson of the department. The student will interact with the committee through presentation to demonstrate his/ her learning. Evaluation will be done on the basis of the following criteria/weightage:

- Regularity in maintenance of the diary (20%)
- Adequacy and quality of report (40%)
- Presentation (Quality of content /Effectiveness of presentation/Communication skill) 40%

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HUM 301 C Essence of Indian Traditional Knowledge
B.Tech. V Semester(Common for All Branches)
Mandatory Course

L T P
3 0 0

External Assessment: 75 Marks

Internal Assessment: 25 Marks

Total : 100 Marks

Duration of Exam: 3 hrs

COURSE OBJECTIVE

- To introduce students to the basics of Indian knowledge traditions and forms
- To impart basic principles of thought process, reasoning and inferencing

UNIT I

Indian Knowledge Traditions and Processes: An Overview

Vedic Tradition, Epical Tradition, Sutra Tradition, Scholastic Tradition

UNIT II

Vedic and Upnishadic Traditions

Vedic Mantras: Hymn of Creation, To Vāk

Upnishadic Narratives: The Story of Nachiketa

UNIT III

Epical Insights

Gyanmarg (The Yoga of Wisdom)

UNIT IV

Folk Wisdom

- (A) Folk Tales as knowledge: “The Blind Man and an Elephant”#
“The Goat who saved the Priest”, “ Buried Treasure” , “ Little Prince, No Father”, “
Demons in the Desert”###
“The Story of Meddlesome Monkey” , “ The Story of the Lion and the Rabbit” “The
Story of Three Fishes””The Story of Dharmabudhi amnd Papabuddhi”###
- (B) Haryanvi Ragini as Moral lesson: Raja Harishchandra

**Note: Different signs such as # etc. indicate source of the primary texts enlisted in the
‘RECOMMENDED READING’**

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COURSE LEARNING OUTCOMES

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

- Understand, appreciate and explain Indian traditional knowledge systems
- Relate life and learning with traditional knowledge in present times

PEDAGOGY

Through lectures, self study, group discussion, Projects and seminar

RECOMMENDED READING

1. Mitchell, Stephen. *The Bhagavad Gita*. Harmony Books, 2007 (Ch.4 for UNIT III).
2. Radhakrishnan, S. & Charles A. Moore. eds. *A Source Book in Indian Philosophy*. Princeton UP, 1957 (“General Introduction: History of Indian Thought” for UNIT I, Ch.1-2 for UNIT II)
3. ####Sharma, Vishnu. *Panchatantra*. Translated by Rohini Chowdhury. Puffin Books.
4. Sharma, Puran Chand. *Pundit Lakhmi Chand Granthavali*. Haryana Sahitya Akademi, 2010.
5. # <https://www.peacecorps.gov/educators/resources/story-blind-men-and-elephant/>
6. ## www. buddhanet.net

SCHEME OF END SEMESTER THEORY EXAMINATION

1. The duration of the exam will be 3 hours.
2. The Question Paper shall have nine questions.
3. Each question will be of 15 marks.
4. The student is required to attempt five questions in all.
5. Questions no. 1 to 8 will be set in such manners that two questions are set from each unit of the syllabus. A student will have to attempt four questions selecting one question from each unit. Each question will have minimum 2 and maximum 4 parts.
6. Question no. 9 will be compulsory covering the entire syllabus and it will be in the form of short-answer type questions. Compulsory question will have minimum 5 and maximum 8 parts with minimum 1 part from each unit of the syllabus.
7. Marks and Bloom's Level (BL) of each part of the question will be there against each part/question, Following are Bloom's Level:- Bloom's Taxonomy Levels (1- Remembering, 2-Understanding, 3-Applying, 4- Analysing, 5-Evaluating, 6-Creating)

B. Tech. 3rd Year (V & VI semester)ME: Approved in 15th meeting of Academic Council held on 14.08.2020. applicable to all students admitted in 2018-19 & onwards and trailing students

ME 302C MANUFACTURING TECHNOLOGY AND MANAGEMENT

B. Tech. Semester – VI (Mechanical Engineering)

L T P Credits
4 - - 4

Class Work : 25 Marks
Examination : 75 Marks
Total : 100 Marks
Duration of Examination : 3 Hours

UNIT – I

Tooling for Conventional and Non-Conventional Machining Processes: Principles of Mould & die design, Press tools Cutting tools; and Holding tools: Jigs and fixtures, principles, applications and design. Brief review of Press Tools: Configuration, design of die and punch, principles of forging die design

Metrology: Dimensions, forms and surface measurements, Limits, fits and tolerances, linear and angular measurements, comparators, gauge design, interferometry; Metrology in tool wear and part quality including surface integrity.

.UNIT – II

Alignment and Testing Methods: Tolerance analysis in manufacturing and assembly, Process metrology for emerging machining processes such as micro scale machining, Inspection and work-piece quality. Assembly Practices: Manufacturing and assembly, process planning, selective assembly, Material handling and devices.

Facility Models and selection of equipments: Principle and Models for Facility Location, Layout Design and selection of Equipments, Simple queuing theory models.

UNIT – III

Linear Programming: Objective function and constraints, graphical method, Simplex and duplex algorithms, transportation assignment, Traveling Salesman problem

Network Models: Shortest route, minimal spanning tree, maximum flow model- Project networks: CPM and PERT, critical path scheduling

UNIT – IV

Production Planning & Control: Forecasting Models, Aggregate production planning, Materials Requirement Planning.

Inventory models: Economic Order Quantity, Quantity Discount Models, Stochastic Inventory Models, Practical Inventory Control models, JIT.

TEXT BOOK:

1. Pandey and Singh, Production engineering sciences, 7e, standard publisher and distributor
2. Buffa and Sarin, Modern Production/Operations Management, 8th Ed, Willey pub

REFERENCE BOOKS:

1. Kalpakjian and Schmid, Manufacturing processes for engineering materials (5th Edition)-Pearson India
2. Modern Machining Processes, PC Pandey, HS Shan, Mc Graw Hill Education
3. Shenoy G.V. and Shrivastava U.K., Operations Research for Management, Wiley Eastern
4. Taha H. A., Operations Research, 6th Edition, Prentice Hall of India

NOTES:

1. In the semester examination, the examiner will set two questions from each unit (total 08 questions in all), covering the entire syllabus. The students will be required to attempt only 5 questions selecting at least one question from each unit.

B. Tech. 3rd Year (V & VI semester)ME: Approved in 15th meeting of Academic Council held on 14.08.2020. applicable to all students admitted in 2018-19 & onwards and trailing students

2. *The use of scientific calculator will be allowed in the examination. However, programmable calculator and cellular phone will not be allowed.*
3. *For students admitted in B.Tech. 1st Year (C-Scheme) in 2019 & onwards and all trailing students: Examinations and evaluations of students shall be conducted, covering the entire syllabus, as per guidelines “AICTE Examination Reforms”. Students shall be informed about these reforms.*

B. Tech. 3rd Year (V & VI semester)ME: Approved in 15th meeting of Academic Council held on 14.08.2020. applicable to all students admitted in 2018-19 & onwards and trailing students

ME 304C DESIGN OF MACHINE ELEMENTS

B. Tech. Semester – VI (Mechanical Engineering)

L	T	P	Credits	Class Work	:	25 Marks
3	1	-	4	Examination	:	75 Marks
				Total	:	100 Marks
				Duration of Examination	:	3 Hours

UNIT – I

Chapter 1: Design considerations - limits, fits and standardization, Stress concentration, Review of failure theories for static and dynamic loading (including fatigue failure)

Chapter 2: Design of shafts under static and fatigue loadings

UNIT – II

Chapter 3: Design of joints: Riveted joint for structures, threaded fasteners, pre-loaded bolts and welded joints, analysis and applications of power screws

Chapter 4: Keys and Couplings: various types of keys and design of keys; muff, split muff, flange, bush-pin flexible flange coupling; flywheels

UNIT – III

Chapter 5: Design of transmission elements: belt and chain drives; analysis of clutches and brakes

Chapter 6: Design of transmission elements: spur, helical, bevel and worm gears

UNIT – IV

Chapter 7: Design of springs: helical compression, tension, torsional and leaf springs

Chapter 8: Analysis and design of hydrodynamic journal bearing, sliding and rolling contact bearings

TEXT BOOK:

1. Mechanical Engineering Design, Fifth Edition, Shigley, J.E. and Mischke, C.R., McGraw-Hill International
2. Machine Design Theory and Practice, Deutschman, D., Michels, W.J. and Wilson, C.E. Macmillan
3. Fundamentals of Machine Component Design, Juvinal, R.C., John Wiley
4. Machine Design Data Book, 2nd edition, Jadon V K, Verma S.I. K. International publication, New Delh, Distributed by Wiley
5. Design Data: Data Book of Engineers, By PSG College-Kalaikathir Achchagam – Coimbatore PSG College- Coimbatore

REFERENCE BOOKS:

1. Design of Machine elements, Spottes, M.F., Prentice-Hall India
2. Mechanical Design – An Integrated Approach, R. L. Norton, Prentice Hall,
3. Analysis and Design of Machine Elements, 2nd edition, Jadon V K, Verma S, I. K. International publication, New Delhi, Distributed by Wiley

NOTES:

1. In the semester examination, the examiner will set two questions from each unit (total 08 questions in all), covering the entire syllabus. The students will be required to attempt only 5 questions selecting at least one question from each unit.
2. The use of scientific calculator will be allowed in the examination. However, programmable calculator and cellular phone will not be allowed.
3. The paper setter will be required to mention in the note in the question paper that use of only those Machine Design Data books which are mentioned in the syllabus are permitted in the examination.
4. For students admitted in B.Tech. 1st Year (C-Scheme) in 2019 & onwards and all trailing students: Examinations and evaluations of students shall be conducted, covering the entire syllabus, as per guidelines “AICTE Examination Reforms”. Students shall be informed about these reforms.

B. Tech. 3rd Year (V & VI semester)ME: Approved in 15th meeting of Academic Council held on 14.08.2020. applicable to all students admitted in 2018-19 & onwards and trailing students

ME 306C Laboratory – IV (Design)
B. Tech. Semester – VI (Mechanical Engineering)

L T P Credits
- - 2 1

Class Work : 25 Marks
Examination : 75 Marks
Total : 100 Marks
Duration of Examination : 3 Hours

LIST OF EXPERIMENTS:

UNIT I - (STRENGTH OF MATERIALS)

1. To study the Hardness testing machine (s) and perform the Rockwell hardness / Brinell hardness / Vickers test.
2. To study the Impact testing machine and perform the Impact tests (Izod and Charpy).
3. To study the Universal Testing Machine and perform the tensile test /compression / bending /shear test tests on UTM.
4. To study the torsion testing machine and perform the torsion test.
5. To study the Erichsen sheet metal testing machine and perform the Erichsen sheet metal test.
6. To draw shear Force, Bending Moment Diagrams for a simply Supported Beam under Point and Distributed Loads.

UNIT II - (MATERIAL SCIENCE)

7. To study crystal structures and crystals imperfections with the help of ball model.
8. To study microstructures of metals/ alloys through microscopic observation.
9. To study hardening (by quenching) of steel specimen by Jominy Test.
10. To observe effect of tempering temperature on the property of given steel specimen.
11. To study the properties of various types of plastics.
12. To study Bravais lattices with the help of models.

Note:

1. Ten experiments are to be performed in the Semester.
2. At least eight experiments should be performed from the above lists, taking at least 04 experiments from each Unit. Remaining two experiments may either be performed from the above list or designed & set by the department as per the scope of the syllabus.

B. Tech. 3rd Year (V & VI semester)ME: Approved in 15th meeting of Academic Council held on 14.08.2020. applicable to all students admitted in 2018-19 & onwards and trailing students

ME 308C INHOUSE PROJECT

B. Tech. Semester – VI (Mechanical Engineering)

L	T	P	Credits	Class Work	:	100 Marks
-	-	6	3	Examination	:	--
				Total	:	100 Marks
				Duration of Examination	:	3 Hours

In-house Project is a group activity with a batch size of 4-5 students. The expected outcome of this course is the development of capability to employ technical knowledge obtained in the field of Engineering & Technology for societal use through an in-house project work involving design/ analysis/fabrication/ testing/ computer simulation/ case studies etc, augmented with creativity, innovation and ingenuity. Students may also choose to work on innovation or entrepreneurial activities resulting in start-up. Each group will work under the guidance of a faculty adviser.

After completion of the Project, the each group should prepare a comprehensive report to indicate what they have observed and learnt in the training period. The format of the cover page and the organization of the body of the report should be circulated by In-house Project coordinator.

At the end of the semester, the project will be evaluated through a panel of examiners consisting of three members. The chairman may constitute stream specific committees for the evaluation of the project. Each committee shall consist of three members as given below:

1. A senior faculty member (Chairman of the committee)
2. In-house Project coordinator (Member Secretary)
3. Respective In-house faculty adviser

The evaluation process will be as given below:

- The group will be required to submit two copies of his/her project report to the department for record (one copy each for the department and participating teacher).
- Project coordinator will be assigned the project load of maximum of 2 hrs. per week including his own guiding load of one hr. However, each faculty adviser will be assigned maximum of one period of teaching load irrespective of number of students/groups under him/her.
- The evaluation of In-house Project will be carried out on the basis of the following criteria:
 - Originality and relevance of the Project (20%)
 - Adequacy and quality of report (40%)
 - Presentation of the Project report (Quality of content /Effectiveness of presentation/Communication skill) 40%

B. Tech. 3rd Year (V & VI semester)ME: Approved in 15th meeting of Academic Council held on 14.08.2020. applicable to all students admitted in 2018-19 & onwards and trailing students

ME 322C ROBOTICS AND AUTOMATION (COMMON WITH AERONAUTICAL ENGG.)

B. Tech. Semester – VI (Mechanical Engineering)

L	T	P	Credits
3	-	-	3

Class Work	:	25 Marks
Examination	:	75 Marks
Total	:	100 Marks
Duration of Examination	:	3 Hours

UNIT I

Introduction: Concept and scope of automation, Socio economic consideration, Low cost automation. Overview of Automation System - Architecture of Industrial Automation Systems, Different devices used in Automation Actuators, definition, types, selection.

Fluid Power Control: Fluid power control elements and standard graphical symbols, Construction and performance of fluid power generators, Hydraulic and pneumatic cylinders - construction, design and mounting; Hydraulic and pneumatic valves for pressure, flow and direction control: Servo valves and simple servo systems with mechanical feedback, governing differential equation and its solution for step position input, Basic hydraulic and pneumatic circuits.

UNIT II

Pneumatic Logic Circuits: Design of pneumatic logic circuits for a given time displacement diagram or sequence of operations.

Fluidics: Boolean algebra, Truth tables, Conda effect, Fluidic elements - their construction working and performance characteristics: Elementary fluidic circuits.

UNIT III

Transfer Devices and Feeders: Their Classification: Construction details and application of transfer devices and feeders

Electrical and Electronic Controls: Introduction to electrical and electronic controls such as electromagnetic controllers - transducers and sensors, microprocessors, programmable logic controllers (PLC), Integration of mechanical systems with electrical, electronic and computer systems.

UNIT IV

Robotics: Introduction, classification based on geometry, devices, control and path movement, End effectors - types and applications, Sensors - types and applications, Concept of Robotic/Machine vision, Teach pendent.

Industrial Applications of Robots: material transfer, machine loading / unloading, welding, assembly and spray painting operations.

TEXT BOOKS:

1. Anthony Esposito, Fluid Power with applications, Pearson.
2. S.R. Deb, Robotics and Flexible Automation, Tata mc Graw Hill
3. A.K Gupta, S.K. Arora, Industrial Automation and Robotics, Laxmi Pubilaction (P) Ltd.
4. Mikell and Groover, Industrial Robotics – Technology, Programming and Applications, McGraw Hill, 2/e, 2012

REFERANCE BOOKS:

1. Ashitava Ghosal, Robotics, Fundamental concepts and analysis, OXFORD University Press, 2006
2. Robert J. Schilling, Fundamentals of Robotics: Analysis & Control, Pearson Education, 2000.
3. Mickell. P. Groover ‘Automation, Production and computer integrated manufacturing’ Prentice Hall of India, 1992.17. Mickell. P. Groover ‘Automation, Production and computer integrated manufacturing’ Prentice Hall of India, 1992.

NOTES:

1. *In the semester examination, the examiner will set two questions from each unit (total 08 questions in all), covering the entire syllabus. The students will be required to attempt only 5 questions selecting at least one question from each unit.*
2. *The use of scientific calculator will be allowed in the examination. However, programmable calculator and cellular phone will not be allowed.*
3. *For students admitted in B.Tech. 1st Year (C-Scheme) in 2019 & onwards and all trailing students:*

B. Tech. 3rd Year (V & VI semester)ME: Approved in 15th meeting of Academic Council held on 14.08.2020. applicable to all students admitted in 2018-19 & onwards and trailing students

Examinations and evaluations of students shall be conducted, covering the entire syllabus, as per guidelines “AICTE Examination Reforms”. Students shall be informed about these reforms.

B. Tech. 3rd Year (V & VI semester)ME: Approved in 15th meeting of Academic Council held on 14.08.2020. applicable to all students admitted in 2018-19 & onwards and trailing students

ME 324C COMPOSITE MATERIALS
B. Tech. Semester – VI (Mechanical Engineering)

L T P Credits
3 - - 3

Class Work : 25 Marks
Examination : 75 Marks
Total : 100 Marks
Duration of Examination : 3 Hours

UNIT I

Introduction : Definition and applications of composite materials, Fibers- glass, carbon, ceramic and aramid fibers; Matrices- polymer, graphite, ceramic and metal matrices; characteristics of fibers and matrices, Manufacturing of composite materials

UNIT II

Lamina: Introduction, Macro-mechanical behavior , stress-strain relations for anisotropic materials, orthotropic material, lamina of arbitrary orientation, invariant properties of an orthotropic lamina, strengths of an orthotropic lamina, biaxial strength criteria for an orthotropic lamina , Micromechanical behavior: Mechanics of materials approach to stiffness and strength , elasticity approach to stiffness

UNIT III

Laminate: classical lamination theory, special cases of laminate stiffness, theoretical versus measured laminate stiffness, strength of laminates, Inter laminar stresses

UNIT IV

Bending, buckling, and vibration of laminated plates: Governing equations for bending , buckling, and vibration of laminated plates, deflection of simply supported laminated plates under distributed transverse load, buckling of simply supported laminated plates under in-plane load, vibration of simply supported laminated plates, introduction to design of composite structures, materials and configuration selection

TEXT BOOKS:

1. Principles of Composite Material Mechanics - Gibson R.F, McGraw Hill
2. Stress Analysis of Fiber Reinforced Composite Materials - Hyer M.W., McGraw Hill
3. Mechanics of composite materials- Robert m. Jones, Taylor & Francis, Inc

NOTES:

1. *In the semester examination, the examiner will set two questions from each unit (total 08 questions in all), covering the entire syllabus. The students will be required to attempt only 5 questions selecting at least one question from each unit.*
2. *The use of scientific calculator will be allowed in the examination. However, programmable calculator and cellular phone will not be allowed.*
3. *For students admitted in B.Tech. 1st Year (C-Scheme) in 2019 & onwards and all trailing students: Examinations and evaluations of students shall be conducted, covering the entire syllabus, as per guidelines "AICTE Examination Reforms". Students shall be informed about these reforms.*

B. Tech. 3rd Year (V & VI semester)ME: Approved in 15th meeting of Academic Council held on 14.08.2020. applicable to all students admitted in 2018-19 & onwards and trailing students

ME 326C MODERN MANUFACTURING PROCESSES

B. Tech. Semester – VI (Mechanical Engineering)

L	T	P	Credits
3	-	-	3

Class Work	:	25 Marks
Examination	:	75 Marks
Total	:	100 Marks
Duration of Examination	:	3 Hours

UNIT I

Limitations of conventional manufacturing processes, Need of unconventional manufacturing processes, Classification of Modern Manufacturing Processes and its future possibilities.

ULTRASONIC MACHINING- Introduction, Basic Principle of USM, Elements of Process, tool feed mechanism, cutting tool system design, effect of parameters on MRR, economic considerations, applications, limitations of the process, advantages and disadvantages.

ABRASIVE JET MACHINING- Process description, features of AJM, Parameters in AJM, metal removal rate (MRR) in AJM. Advantages, limitations and Practical applications of AJM, Water Jet Machining- Jet cutting equipments, process details

UNIT II

CHEMICAL MACHINING: Basic technique of chemical machining, Mechanism of metal removal, process variables, advantages and applications .Electrochemical machining, principle of ECM process, ECM process detail, chemical reactions in ECM, tool work gap, process variables and characteristics in ECM, advantages, disadvantages and application of ECM ,Electrochemical Grinding - Material removal, surface finish, accuracy, advantages, applications.

UNIT III

THERMAL SPARK EROSION PROCESSES: Electric Discharge Machining (EDM) or spark erosion machining processes, practical aspects of spark erosion machining, mechanism of metal removal, spark erosion generators, electrode feed control, dielectric fluids, flushing, electrodes for spark erosion, selection of electrode material, tool electrode design, surface finish, machining accuracy, machine tool selection, applications. Wire cut EDM. Advantages and disadvantages of spark erosion machining.

LASER BEAM MACHINING (LBM)- Introduction, lasing process, Laser machining system, Thermal effect on workpiece, calculation of MRR, description of laser drilling machine, cutting speed and accuracy of cut, advantages and limitations.

UNIT IV

PLASMA ARC MACHINING (PAM): Introduction, non thermal generation of plasma types of plasma arc , the stabilized arc, mechanism of plasma torch, , mechanism of metal removal, PAM parameters, equipments for D.C. plasma torch unit, safety precautions, economics, other applications of plasma jets.

ELECTRON BEAM MACHINING (EBM) – Description of the process, need for high vacuum in EBM, process parameters in EBM. Advantages and disadvantages of EBM, Electron beam welding.

Text Books:

1. Advanced Machining Processes by V.K. Jain. Allied Publishers Pvt Ltd
2. Modern Machining Methods by M. Adithan, Khanna Publishers
3. Modern Machining Processes by P.C. Pandey and H.S. Shan. Tata McGraw- Hill
4. Advanced Methods of Machining by J. A. Mcgeough, Springer
5. Non-Traditional Manufacturing Process by Benedict, CRC pub.
6. Unconventional Manufacturing Process by M K Singh, New Age Publishers
7. Nonconventional manufacturing by P. K. Mishra, Narosa Publishers

NOTES:

1. In the semester examination, the examiner will set two questions from each unit (total 08 questions in all), covering the entire syllabus. The students will be required to attempt only 5 questions selecting at least one question from each unit.

B. Tech. 3rd Year (V & VI semester)ME: Approved in 15th meeting of Academic Council held on 14.08.2020. applicable to all students admitted in 2018-19 & onwards and trailing students

2. *The use of scientific calculator will be allowed in the examination. However, programmable calculator and cellular phone will not be allowed.*
3. *For students admitted in B.Tech. 1st Year (C-Scheme) in 2019 & onwards and all trailing students: Examinations and evaluations of students shall be conducted, covering the entire syllabus, as per guidelines “AICTE Examination Reforms”. Students shall be informed about these reforms.*

B. Tech. 3rd Year (V & VI semester)ME: Approved in 15th meeting of Academic Council held on 14.08.2020. applicable to all students admitted in 2018-19 & onwards and trailing students

ME 328C INTERNAL COMBUSTION ENGINES
B. Tech. Semester – VI (Mechanical Engineering)

L T P Credits
3 - - 3

Class Work : 25 Marks
Examination : 75 Marks
Total : 100 Marks
Duration of Examination : 3 Hours

UNIT I

AIR STANDARD CYCLES: Internal and external combustion engines; classification of I.C. Engines, Brief review of air standard cycles; Deviation of actual engine cycle from ideal cycle. Problems.

CARBURETION, FUEL INJECTION AND IGNITION SYSTEMS: Mixture requirements for various operating conditions in S.I. Engines; Elementary carburetor, Requirements of a diesel injection system; types of injection systems; petrol injection, Requirements of ignition system; Types of ignition systems ignition timing; spark plugs. Problems.

UNIT II

COMBUSTION IN I.C. ENGINES : S.I. engines; Ignition limits; stages of combustion in S.I. Engines; Ignition lag; Velocity of flame propagation; detonation; Effects of engine variables on detonation; theories of detonation; octane rating of fuels; pre-ignition; S.I. engine combustion chambers,

Stages of combustion in C.I. Engines; delay period; variables affecting delay period; Knock in C.I. engines, Cetane rating; C.I. engine combustion chambers.

LUBRICATION AND COOLING SYSTEMS: Functions of a lubricating system, Types of lubrication system; Mist, Wet sump and Dry sump systems; Properties of lubricating oil; SAE rating of lubricants, engine performance and lubrication, Necessity of engine cooling; disadvantages of overcooling; Cooling systems; Air-cooling, Water cooling; Radiators.

UNIT-III

ENGINE TESTING AND PERFORMANCE: Performance parameters: BHP, IHP, Mechanical efficiency, Brake mean effective pressure and indicative mean effective pressure, Torque, Volumetric efficiency; specific fuel consumption (BSFC, ISFC), Thermal efficiency; Heat balance; Basic engine measurements; fuel and air consumption, Brake power, Indicated power and friction power, Heat lost to coolant and exhaust gases; Performance curves. Problems.

AIR POLLUTION FROM I.C. ENGINES AND ITS REMEDIES: Pollutants from S.I. and C.I. Engines, Methods of emission control; alternative fuels for I.C. Engines; the current scenario on the pollution front.

UNIT-IV

ROTARY COMPRESSORS: Root and vane blowers; Static and total head values; Centrifugal compressors-Velocity diagrams, slip factor, ratio of compression, pressure coefficient, pre-whirl; Axial flow compressor-Degree of reaction, polytropic efficiency, surging, choking and stalling, performance characteristics, Problems.

GAS TURBINES: Components of a gas turbine plant; open and closed types of gas turbine plants; Optimum pressure ratio; Improvements of the basic gas turbine cycle; multi stage compression with inter-cooling; multi stage expansion with reheating between stages; exhaust gas heat exchanger, Applications of gas turbines. Problems.

B. Tech. 3rd Year (V & VI semester)ME: Approved in 15th meeting of Academic Council held on 14.08.2020. applicable to all students admitted in 2018-19 & onwards and trailing students

TEXT BOOKS:

1. Internal Combustion Engines –V. Ganesan, Pub.-Tata McGraw-Hill.
2. Gas Turbines - V. Ganesan, Pub.- Tata McGraw Hill.
3. Engineering fundamental of the I. C. Engines – Willard W. Pulkrabek Pub.-PHI,India

REFERENCE BOOKS:

1. Internal Combustion Engines & Air pollution- Obert E.F, Pub.-Hopper & Row Pub., New York
2. Internal Combustion Engines Fundamentals- John B. Heywood, Pub.-McGraw Hill, New York

NOTES:

1. *In the semester examination, the examiner will set two questions from each unit (total 08 questions in all), covering the entire syllabus. The students will be required to attempt only 5 questions selecting at least one question from each unit.*
2. *The use of scientific calculator will be allowed in the examination. However, programmable calculator and cellular phone will not be allowed.*
3. *For students admitted in B.Tech. 1st Year (C-Scheme) in 2019 & onwards and all trailing students: Examinations and evaluations of students shall be conducted, covering the entire syllabus, as per guidelines “AICTE Examination Reforms”. Students shall be informed about these reforms.*

ME 330C GAS DYNAMICS AND JET PROPULSION

B. Tech. Semester – VI (Mechanical Engineering)

L	T	P	Credits
3	-	-	3

Class Work	:	25 Marks
Examination	:	75 Marks
Total	:	100 Marks
Duration of Examination	:	3 Hours

UNIT I

Compressible flow, definition, Mach waves and Mach cone, stagnation states, Mass, momentum and energy equations of one-dimensional flow, Isentropic flow through variable area ducts, nozzle s and diffusers, subsonic and supersonic flow I variable area ducts, choked flow, Area-Mach number relations for isentropic flow

UNIT II

Non-isentropic flow in constant area ducts, Rayleigh and Fanno flows, Normal shock relations, oblique shock relations, isentropic and shock tables

UNIT III

Theory of jet propulsion, thrust equation, thrust power and propulsive efficiency, Operating principle and cycle analysis of ramjet, turbojet, turbofan and turboprop engines.

UNIT IV

Types of rocket engines, propellants & feeding systems, ignition and combustion, theory of rocket propulsion, performance study, staging, terminal and characteristic velocity, space flights

TEXT BOOKS:

1. Ahmed F. El-Sayed, Aircraft Propulsion and Gas Turbine Engines, CRC Press, 2008
2. H.S. Mukunda, "Understanding Aerospace Chemical Propulsion", Interline Publishing, 2004
3. Hill P. and Peterson C., Mechanics & Thermodynamics of Propulsion, Addison Wesley, 1992

TEXT BOOKS:

1. Zucrow N. J., Aircraft and Missile Propulsion, Vol.I& II, John Wiley, 1975
2. Sutton G.P., Rocket Propulsion Elements, John Wiley, New York, 1986

NOTES:

1. *In the semester examination, the examiner will set two questions from each unit (total 08 questions in all), covering the entire syllabus. The students will be required to attempt only 5 questions selecting at least one question from each unit.*
2. *The use of scientific calculator will be allowed in the examination. However, programmable calculator and cellular phone will not be allowed.*
3. *For students admitted in B.Tech. 1st Year (C-Scheme) in 2019 & onwards and all trailing students: Examinations and evaluations of students shall be conducted, covering the entire syllabus, as per guidelines "AICTE Examination Reforms". Students shall be informed about these reforms.*

B. Tech. 3rd Year (V & VI semester)ME: Approved in 15th meeting of Academic Council held on 14.08.2020. applicable to all students admitted in 2018-19 & onwards and trailing students

HUM350C Communication Skills for Professionals (Except BME & BTE)

B.Tech. 3rd YEAR (SEMESTER –VI)

L	T	P	Credits	Class Work	: 25
3	0	0	3	Examination	: 75
				Total	: 100
				Duration of Exam	: 3 Hours

Unit 1 (8 Lectures)

Mechanics of Report Writing: Objectives of Report Writing; Types of Reports on the basis of forms and content. Introduction to Formats of Reports; Structure of Reports: Front Matter, Main Body, Back Matter.

Unit 2 (10 Lectures)

Writing Business and Technical Report: Preliminary Strategies for Report Writing: Data Collection, Report Planning, Use of Illustrations, Point Formation, Preparing Notes/Drafts. Using Appropriate Formats: Memo Format, Letter Format, Manuscript Format, Printed Forms

Unit 3 (10 Lectures)

Oral Communication and Soft Skills : Group Discussions; Interviews for jobs: preparation and facing them. Professional Presentations: Power Point Presentation, Oral Presentation. Role of Kinesics (Body Language) in Communication. General Etiquettes in Office areas, corporate lunch and dinner. Handling Telephone calls.

Unit 4 (8 Lectures)

Resumes and Job application: Writing of Resume--Chronological Resume and Functional Resume. Request for Reference/Recommendation . Writing Application Letters for Job; Writing Covering letter.

Text/ Reference Books:

1. Sharma, Sangeeta, and Binod Mishra. *Communication Skills for Engineers and Scientists*. PHI, 2009.
2. Tyagi, Kavita, and Padma Mishra. *Advanced Technical Communication*. PHI, 2011.
3. Rizvi, M. Ashraf. *Effective Technical Communication*. McGraw Hill Education, 2014.
4. Kumar, Sanjay, and PushpLata. *Communication Skills*. OUP, 2011.
5. Raman, Meenakshi and Sangeeta Sharma. *Communication Skills*. OUP, 2011.
6. *Bhatnagar, Nitin, and Mamta Bhatnagar. *Communicative English for Engineers and Professionals*. Pearson Education, 2013. (The soft copy of the book is available in the university library)
7. Mitra, Barun K. *Personality Development and Soft Skills*. OUP, 2011.
8. Kaul, Asha. *Business Communication*. PHI, 2nd Edition.
9. Namee, Patrick Mc. *Success in Interviews: How to Succeed in any Job Interview*, 1st Edition.
10. Argenti, Paul. *Corporate Communication*. 6th Edition. McGraw Hill Education, 2012.

Course Outcomes: At the end of the course, students will demonstrate the ability to:

1. Get acquainted with multiple forms and formats of various technical and business reports
2. Develop competence for report writing with a focus on its complex writing techniques and procedures.
3. Develop their speaking skills with professional proficiency.
4. Equip themselves for Letter Writing Skills.

Note:

1. In Semester Examinations, the paper setter will set two questions from each unit (total 8 questions in all), covering the entire syllabus. Students will be required to attempt only five questions, selecting at least one question from each unit.
2. The use of scientific calculator will be allowed in the examination. However, programmable calculator, mobile phones or other electrical/ electronic items will not be allowed in the examination.
3. For students admitted in B.Tech. 1st Year (C-Scheme) in 2019 & onwards and all trailing students:
Examinations and evaluations of students shall be conducted, covering the entire syllabus, as per guidelines "AICTE Examination Reforms". Students shall be informed about these reforms.

B. Tech. 3rd Year (V & VI semester)ME: Approved in 15th meeting of Academic Council held on 14.08.2020. applicable to all students admitted in 2018-19 & onwards and trailing students

HUM352C Soft Skills And Interpersonal Communication

B.Tech. 3rd YEAR (SEMESTER –VI)

L	T	P	Credits	Class Work	: 25
3	0	0	3	Examination	: 75
				Total	: 100
				Duration of Exam	: 3 Hours

Unit 1 (8 Lectures)

Soft Skills: Introduction to Soft Skills & their classification. Importance of Soft Skills: Writing Resume/CV, Engaging in Group discussion, Appearing for Job interviews.

Unit 2 (10 Lectures)

Interpersonal Skills, Behaviour, Relationships and Communication: Development and Role of Effective Interpersonal Skills. Development of Effective Speaking and Listening Skills.

Unit 3 (10 Lectures)

Non-Verbal Elements in Interpersonal Communication : Role of Body Language, Paralinguistic Features, Proxemics/Space Distance and Haptics in Interpersonal Communication.

Unit 4 (8 Lectures)

Personality Development for Personal and Professional Growth: Desirable Personality Attributes, Personality Types, Analysis of Personality Development (Freudian and Swami Vivekananda's Concept), Grooming Personality for Personal and Professional Life.

Text/ Reference Books:

1. Mitra, Barun K. *Personality Development and Soft Skills*. Delhi: OUP, 2nd Edition, 2016.
2. Butterfield, Jeff. *Soft Skills for Everyone*. Cengage Learning, 2017.
3. Raman, Meenakshi and Sangeeta Sharma. *Communication Skills*. OUP, 2011.
4. Ramesh, Gopalaswamy and Mahadevan Ramesh. *The ACE of Soft Skills*, Pearson India, 2010.
5. Ribbons, Geoff and Richard Thompson. *Body Language*. Hodder & Stoughton, 2007.
6. Sharma, Sangeeta and Binod Mishra. *Communication Skills for Engineers and Scientists*. PHI, 2017.

Course Outcomes: At the end of the course, students will demonstrate the ability to:

1. Know how soft skills complement hard skills for career growth.
2. Enhance communicative competence for professional enhancement.
3. Learn desirable body language and other non-verbal elements in interpersonal communication.
4. Groom personality for handling effectively various situations of personal and professional life.

Note:

1. In Semester Examinations, the paper setter will set two questions from each unit (total 8 questions in all), covering the entire syllabus. Students will be required to attempt only five questions, selecting at least one question from each unit.
2. The use of scientific calculator will be allowed in the examination. However, programmable calculator, mobile phones or other electrical/ electronic items will not be allowed in the examination.
3. For students admitted in B.Tech. 1st Year (C-Scheme) in 2019 & onwards and all trailing students:
Examinations and evaluations of students shall be conducted, covering the entire syllabus, as per guidelines "AICTE Examination Reforms". Students shall be informed about these reforms.

B. Tech. 3rd Year (V & VI semester)ME: Approved in 15th meeting of Academic Council held on 14.08.2020. applicable to all students admitted in 2018-19 & onwards and trailing students

MGT402C Human Values, Ethics and IPR

B.Tech. 3rd YEAR (SEMESTER –VI)

L	T	P	Credits	Class Work	: 25
3	0	0	3	Examination	: 75
				Total	: 100
				Duration of Exam	: 3 Hours

Unit 1 (10 Lectures)

Human Values: Understanding the need, basic guidelines, Self Exploration - its content and process; 'Natural Acceptance' and Experiential Validation, Continuous Happiness and Prosperity- Human Aspirations, Right understanding, Relationship and Physical Facilities, Understanding Happiness and Prosperity correctly.

Unit 2 (12 Lectures)

Different kinds of value: Understanding human being as a co-existence of the sentient 'I' and the material 'Body' Understanding the needs of Self ('I') and 'Body' - Sukh and Suvidha. Understanding the harmony of I with the Body: Sanyam and Swasthya; correct appraisal of Physical needs, meaning of Prosperity in detail, Programs to ensure Sanyam and Swasthya.

Unit 3 (10 Lectures)

Modern approach to the study of values: Understanding Harmony in the Family and Society- Harmony in Human-Human Relationship Understanding harmony in the Family, Understanding values in human-human relationship; meaning of Nyaya and program for its fulfillment to ensure Ubhay-tripti; Trust (Vishwas) and Respect (Samman).

Unit 4 (10 Lectures)

Professional Ethics & IPR: Values in Work-life, Professional Ethics and Ethos, Code of conduct, Whistle Blowing, Corporate Social Responsibility. IPR: meaning, nature, scope and relevance of IPR. Kinds of IPR: Copyright, Patents, Trademark, Geographical Indication, Industrial design, Plant Variety. Benefits, Emerging dimensions and Rational for protection of IPR.

Suggested Readings:

1. R. R. Gaur, R Sangal, G P Bagaria, 2009, A Foundation Course in Human Values and Professional Ethics, Excel Books, New Delhi
2. A.N. Tripathy, 2003, Human Values, New Age International Publishers.
3. E G Seebauer & Robert L. Berry, 2000, Fundamentals of Ethics for Scientists & Engineers, Oxford University Press.
4. M Govindrajan, S Natrajan & V. S Senthil Kumar, Engineering Ethics (including Human Values), Eastern Economy Edition, Prentice Hall of India Ltd.
5. S. B. Gogate, Human Values & Professional Ethics, Vikas Publishing House Pvt. Ltd., Noida.

Reference Books:

1. A Nagraj, 1998 Jeevan Vidyaek Parichay, Divya Path Sansthan, Amarkantak.
2. P. L. Dhar, R. R. Gaur, 1990, Science and Humanism, Commonwealth Publishers.
3. Prof. A.R. Aryasri, Dharanikota Suyodhana, Professional Ethics and Moral, Maruthi Publications.
4. A. Alavudeen, R. Kalil Rahman and M. Jayakumar, Professional Ethics and Human Values, University Science Press.
5. Prof. D.R. Kiran, 2013, Professional Ethics and Human Values, Tata McGraw-Hill
6. Jayshree Suresh and B. S. Raghavan, Human Values And Professional Ethics, S.Chand Publications

Course Outcomes: At the end of the course, students will demonstrate the ability to:

1. Students will be able to understand the significance of value inputs in a classroom and start applying them in their life and profession
2. Understand and can distinguish between values and skills, happiness and accumulation of physical facilities, the Self and the Body, Intention and Competence of an individual, etc.
3. Understand the role of a human being in ensuring harmony in society and nature.
4. Students will be aware of the significance of Intellectual Property as a very important driver of growth and development in today's world and to be able to statutorily acquire and use different types of intellectual property in their professional life.

B. Tech. 3rd Year (V & VI semester)ME: Approved in 15th meeting of Academic Council held on 14.08.2020. applicable to all students admitted in 2018-19 & onwards and trailing students

Note:

1. In Semester Examinations, the paper setter will set two questions from each unit (total 8 questions in all), covering the entire syllabus. Students will be required to attempt only five questions, selecting atleast one question from each unit.
2. The use of scientific calculator will be allowed in the examination. However, programmable calculator, mobile phones or other electrical/ electronic items will not be allowed in the examination.
3. For students admitted in B.Tech. 1st Year (C-Scheme) in 2019 & onwards and all trailing students:
Examinations and evaluations of students shall be conducted, covering the entire syllabus, as per guidelines “AICTE Examination Reforms”. Students shall be informed about these reforms.

MGT404C Human Resource Management

B.Tech. 3rd YEAR (SEMESTER –VI)

L	T	P	Credits	Class Work	: 25
3	0	0	3	Examination	: 75
				Total	: 100
				Duration of Exam	: 3 Hours

Unit 1 (10 Lectures)

Introduction: Nature and scope of human resource management, HRM objectives and functions, HRM policies, HRM in globally competitive environment; strategic human resource management.

Unit 2 (12 Lectures)

Acquiring human resources: Man power planning, Job evaluation, job analysis and job design. Recruitment: Sources, Methods, constraints & challenges, selection: objectives and process, placement and induction.

Unit 3 (10 Lectures)

Developing human resources: Training: types, methods, training vs. development and evaluation of a training programme and training need assessment, career planning and development.

Unit 4 (10 Lectures)

Performance appraisal: Methods, process and challenges of performance appraisal, performance appraisal vs. potential appraisal, Compensation: wages & salaries administration and factors influencing compensation levels.

Suggested Readings:

1. Jyothi, Human Resource Management, Oxford University Press
2. Bohlander George and Scott Snell, Management Human Resources, Cengage, Mumbai
3. Bhattacharyya, Dipak Kumar, Human Resource Management, Excel Books, NewDelhi
4. Cascio Wayne F., Managing Human Resources, TMH, New Delhi
5. DeCenzo, David A, and Stephan P. Robbins, Fundamentals of Human Resource Management, Wiley India, New Delhi
6. Denisi, Angelo S, and Ricky W Griffin, Human Resource Management, Biztantra, New Delhi

Course Outcomes: At the end of the course, students will demonstrate the ability to:

1. To have an understanding of the basic concepts, functions and processes of human resource management
2. To be aware of the role, functions and functioning of human resource department of the organizations.
3. To Design and formulate various HRM processes such as Recruitment, Selection, Training, Development, Performance appraisals and Reward Systems, Compensation Plans and Ethical Behavior.
4. Develop ways in which human resources management might diagnose a business strategy and then facilitate the internal change necessary to accomplish the strategy.

Note:

1. In Semester Examinations, the paper setter will set two questions from each unit (total 8 questions in all), covering the entire syllabus. Students will be required to attempt only five questions, selecting atleast one question from each unit.
2. The use of scientific calculator will be allowed in the examination. However, programmable calculator, mobile phones or other electrical/ electronic items will not be allowed in the examination.
3. For students admitted in B.Tech. 1st Year (C-Scheme) in 2019 & onwards and all trailing students:
Examinations and evaluations of students shall be conducted, covering the entire syllabus, as per guidelines “AICTE Examination Reforms”. Students shall be informed about these reforms.

B. Tech. 3rd Year (V & VI semester)ME: Approved in 15th meeting of Academic Council held on 14.08.2020. applicable to all students admitted in 2018-19 & onwards and trailing students

HUM354C Introduction To French Language

B.Tech. 3rd YEAR (SEMESTER –VI)

L	T	P	Credits	Class Work	: 25
3	0	0	3	Examination	: 75
				Total	: 100
				Duration of Exam	: 3 Hours

Unit 1 (10 Lectures)

VOCABULAIRE

Les Salutations

Les jours de la semaine, Les mois de l'année, Les couleurs, Les professions

Les nombres cardinaux

Les lieux de la ville, Les nationalités

Personnes et objets caractéristiques d'un pays

Civilisation: France, de la société française, les monuments, les fêtes

Unit 2 (10 Lectures)

GRAMMAIRE

Conjugation des verbes être, avoir, aller; Conjugation des verbes –er, –ir, –re

Masculin/féminin, Singulier/ pluriel

Accord des noms et des adjectifs

Articles indéfinis et définis

Négation simple

Interrogation

Futur proche

On = Nous

Articles partitifs et contractés

La date et l'heure

Unit 3 (8 Lectures)

ÉCRITURE (compréhension des écrits, Production écrite)

Présentez- vous, Mon meilleur ami, Ma famille

Cartes et messages d'invitation, d'acceptation ou de refus

Écrivez des scènes

Unit 4 (8 Lectures)

COMPREHENSION (écouter, production orale)

Se présenter à un groupe

Parlez/ écoutez de votre ville

Parlez/écoutez de ses activités de loisirs

Parlez /écoutez de vos goûts

Demander/ donner une explication

Identifier une personne ou un objet

Demander/dire ce qu'on a fait

Text/ Reference Books:

1. Echo – A1 Methode de Français, CLE International (Distributed in India by W. R. Goyal Publishers & Distributors, Delhi).
2. Connexions, niveau 1, Yves Loiseau and Régine Mérieux (Goyal Publishers).
3. Alter Ego-1, Hachette (Distributed in India by W. R. Goyal Publishers & Distributors, Delhi).
4. Forum- Methode de Français 1, Hachette (Distributed in India by W. R. Goyal Publishers & Distributors, Delhi).
5. 450 Exercices de Grammaire, CLE International (Distributed in India by W. R. Goyal Publishers & Distributors, Delhi).

B. Tech. 3rd Year (V & VI semester) ME: Approved in 15th meeting of Academic Council held on 14.08.2020. applicable to all students admitted in 2018-19 & onwards and trailing students

6. Audio- Video study material.
7. Supplementary handouts

Course Outcomes: At the end of the course, students will demonstrate the ability to:

1. Familiarize with the basics of French language.
2. Understand and express vocabulary and grammar through writing.
3. Demonstrate understanding through simple dialogues in French.

Note:

1. In Semester Examinations, the paper setter will set two questions from each unit (total 8 questions in all), covering the entire syllabus. Students will be required to attempt only five questions, selecting atleast one question from each unit.

2. The use of scientific calculator will be allowed in the examination. However, programmable calculator, mobile phones or other electrical/ electronic items will not be allowed in the examination.

3. For students admitted in B.Tech. 1st Year (C-Scheme) in 2019 & onwards and all trailing students:

Examinations and evaluations of students shall be conducted, covering the entire syllabus, as per guidelines “AICTE Examination Reforms”. Students shall be informed about these reforms.

HUM356C Introduction To German Language

B.Tech. 3rd YEAR (SEMESTER –VI)

L	T	P	Credits	Class Work	: 25
3	0	0	3	Examination	: 75
				Total	: 100
				Duration of Exam	: 3 Hours

Unit 1 (10 Lectures)

Introduction to German alphabets
Numbers 0- 100 (basic algebraic expressions)
Vocabulary of days and months
Adverbs of time
Ordinal numbers in German
Phonetics and pronunciation

Unit 2 (10 Lectures)

Introduction to the simple possessive pronouns
Sentence: statement, question, (question for completion and decision) command
Coordination of clauses
Placing of the verb in the sentence: first, second and last place
Word order in main clause
Details of time, manner and place (casual)

Unit 3 (8 Lectures)

Verb: infinitive, imperative, indicative – Präsens, Perfekt, Präteritum of auxiliary and modal verbs, modal verbs (meaning, indicative Präsens&Präteritum, möchten)
Verbs with prefixes – separable and inseparable
Nouns: Gender, plural, Nominative, Accusative, Dative
Articles: Definite and Indefinite
Adjectives: predicative use

Unit 4 (8 Lectures)

Day-to-day conversation in German: Introducing oneself and other, greeting and taking leave, Meeting people, Time and date, months and weekdays
Inquire and name the country of origin, languages
Introduce family members and friends

Text/ Reference Books:

1. Tangram Aktuell Niveau A1, Max Heuber Verlag, Ismaning, 2005 (Published and distributed in India by German Book Depot, Delhi).
2. Netzwerk A1, Klett Verlag, Muenchen, 2013 (Published and distributed in India by German Book Centre, Delhi 2015).
3. *Sprachkurs Deutsch I & 2*. Diesterweg (Moritz) Verlag, Frankfurt am Main, 1989, (Published and distributed in India by Goyal Saab Publishers & Distributors, New Delhi).
4. *Schuelerduden Grammatik*, Bibliographisches Institut und F.A. Brockhaus, 2000.
5. *Themen Aktuell 1, Kursbuch*, Max Heuber Verlag, Ismaning, Deutschland, 2003 (Published and distributed in India by German Book Centre, Delhi, 2010).
6. Audio-video Study Material.
7. Supplementary Handouts.

Course Outcomes: At the end of the course, students will demonstrate the ability to:

1. Familiarize with the basics of German language.
2. Understand and express vocabulary and grammar through writing.
3. Demonstrate understanding through simple dialogues in German.

B. Tech. 3rd Year (V & VI semester)ME: Approved in 15th meeting of Academic Council held on 14.08.2020. applicable to all students admitted in 2018-19 & onwards and trailing students

Note:

1. In Semester Examinations, the paper setter will set two questions from each unit (total 8 questions in all), covering the entire syllabus. Students will be required to attempt only five questions, selecting atleast one question from each unit.
2. The use of scientific calculator will be allowed in the examination. However, programmable calculator, mobile phones or other electrical/ electronic items will not be allowed in the examination.
3. For students admitted in B.Tech. 1st Year (C-Scheme) in 2019 & onwards and all trailing students:
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B. Tech. 3rd Year (V & VI semester)ME: Approved in 15th meeting of Academic Council held on 14.08.2020. applicable to all students admitted in 2018-19 & onwards and trailing students

SPME301C Robotics and Applications
B. Tech. (Hons./Minor degree) with Specialization in Robotics
3rd YEAR (SEMESTER –V)

L	T	P	Credits	Class Work	: 25
4	0	0	4	Examination	: 75
				Total	: 100
				Duration of Exam	: 3 Hours

Unit 1 (14 Lectures)

Introduction to Robotics: History, evolution of Robots and Robotics, Laws of Robotics, Progressive advancement in Robots- first, second, third and fourth generations; Robot autonomy-links, joints notations scheme, degrees of freedom in a manipulator, arm configuration, wrist configuration, End-effector.

Human arm characteristics, Components of Robotics-mechanics, trajectory generation and motion planning, control system, Sensors and vision, AI in robotics, Robot programming -teach method, off-line programming, Robot programming languages; future prospects-bio robotics and humanoid Robotics.

Unit 2 (15 Lectures)

Robotic Sensors: Human sensing, problem of Robot sensing; Sensors in Robots-status sensors, environmental sensors, quality control sensors, safety sensors, workcell control sensors, classification of Robotic sensors.

Types of sensors used in Robotics: Optical, pneumatic sensors; tactile, acoustic, force, torque; Optical encoders, selecting right sensor.

Unit 3 (15 Lectures)

Robotic Vision: Introduction, industrial application of vision-controlled Robotic systems - presence, object location, pick and place, object identification, visual inspection, visual guidance;

Image acquiring and processing: Processing of imaging, architecture of Robotic vision system, Image acquisition, description of components of vision system, image representation, introduction to image processing.

Unit 4 (16 Lectures)

Robot applications: Industrial applications, Material handling- material transfer, loading and unloading; Processing applications- arc welding, spray painting; Assembly applications- assembly task, peg-in-hole assembly, steps in assembly, providing compliance; Inspection application: sensors and vision based inspection and testing.

Principles for Robot application and application planning, quantitative and qualitative justification of Robots, Robot safety, Non-industrial applications;

Text/ Reference Books:

1. R.K. Mittal and I. J. Nagrath, “ Robotics and control”, McGraw Hill,2003.
2. K. R. Guruprasad, “ Robotics: Mechanics and control”, PHI, 2019.
3. John J. Craig, “ Introduction to Robotics: Mechanics and control”,3rd Edition, Pearson, 2005.
4. Ashitava Ghosal, “ Robotics: fundamental concepts and analysis”, Oxford Pub, 2006.
5. Saeed B. Niku, “ Introduction to Robotics: Analysis, control, applications”, 2nd Edition, Wiley, 2010.
6. King-Sun Fu, C.S. George Lee and Ralph Gonzalez, “Robotics: control, sensing, vision and intelligence”, 3rd Edition, McGraw Hill, 2004.

Course Outcomes: At the end of the course, students will demonstrate the ability to:

1. Explain the characteristics, architecture and applications of Robotic systems.
2. Identify and describe different types of end effectors and sensors required for specific applications.
3. Apply the basic concepts of robotic vision and image processing for robotic systems.
4. Analyze the applications of robots in various industrial applications and select a robotic system for given application.

Note:

1. In Semester Examinations, the paper setter will set two questions from each unit (total 8 questions in all), covering the entire syllabus. Students will be required to attempt only five questions, selecting atleast one question from each unit.
2. The use of scientific calculator will be allowed in the examination. However, programmable calculator, mobile phones or other electrical/ electronic items will not be allowed in the examination.
3. For students admitted in B.Tech. 1st Year (C-Scheme) in 2019 & onwards and all trailing students:

B. Tech. 3rd Year (V & VI semester)ME: Approved in 15th meeting of Academic Council held on 14.08.2020. applicable to all students admitted in 2018-19 & onwards and trailing students

Examinations and evaluations of students shall be conducted, covering the entire syllabus, as per guidelines “AICTE Examination Reforms”. Students shall be informed about these reforms.

SPEC302C Python Programming

B. Tech. (Hons./Minor degree) with Specialization in Artificial Intelligence & Machine Learning/Internet of Things/Robotics
3rd YEAR (SEMESTER –VI)

L	T	P	Credits	Class Work	: 25
4	0	0	4	Examination	: 75
				Total	: 100
				Duration of Exam	: 3 Hours

Unit 1 (15 Lectures)

Introduction and Overview: Introduction to Python, Origin, Comparison, Comments, Operators, Variables and Assignment, Numbers, Strings, Lists and Tuples, Dictionaries, if Statement, while Loop, for Loop and the range(), Built-in Function, Files, Errors and Exceptions, Functions, Classes, Modules Syntax and Style Statements and Syntax, Variable Assignment, Identifiers, Memory Management, Python Applications.

Unit 2 (15 Lectures)

Numbers and Strings: Introduction to Numbers, Integers, Floating Point Real Numbers, Complex Numbers, Operators, Built-in Functions. Sequences: Strings, Lists, and Tuples, Sequences, Strings, Strings and Operators, String-only Operators, Built-in Functions, String Built-in Methods, Special Features of Strings.

Lists and Dictionaries: Operators, Built-in Functions, List Type Built-in Methods, Special Features of Lists, Tuples, Tuple Operators and Built-in Functions, Special Features of Tuples, Introduction to Dictionaries, Operators, Built-in Functions, Built-in Methods, Dictionary Keys.

Unit 3 (15 Lectures)

Functions: Functions, Calling Functions, Creating Functions, Formal Arguments, Positional Arguments, Default Arguments, Default Function Object Argument Example, Variable-length Arguments, Non-keyword Variable Arguments (Tuple), Keyword Variable Arguments (Dictionary).

Classes: Problems in Procedure Oriented Approach, Features of Object Oriented Programming System (OOPS), Classes and objects, Encapsulation, Abstraction, Inheritance, Polymorphism.

Unit 4 (15 Lectures)

Files and Input/output: File Objects, File Built-in Function, File Built-in Methods, File Built-in Attributes, Standard Files, Command-line Arguments, File System, File Execution, Persistent Storage Modules, Using context managers with files.

Errors and Exceptions : Introduction to Exceptions, Exceptions in Python, Detecting and Handling Exceptions, Exceptions as Strings, Raising Exceptions, Assertions, Standard Exceptions, Regular Expressions, Special Symbols and Characters for Regular expressions.

Text/Reference Books:

1. Wesley J. Chun, “Core Python Programming”, 2nd Edition, Pearson, 2007 (Reprint 2010).
2. Paul Barry, “Head First Python”, 2nd Edition, O Rieilly, 2010.
3. Mark Lutz, “Learning Python”, 4th Edition, O Rieilly, 2009.

Course Outcomes: At the end of the course, students will demonstrate the ability to:

1. Explain the various concept of Python Programming.
2. Apply the basic concepts of Python Programming for writing simpler programs in Python.
3. Apply the advance concepts of Python Programming for writing advance programs in Python.
4. Develop applications in Python.

Note:

1. In Semester Examinations, the paper setter will set two questions from each unit (total 8 questions in all), covering the entire syllabus. Students will be required to attempt only five questions, selecting atleast one question from each unit.
2. The use of scientific calculator will be allowed in the examination. However, programmable calculator, mobile phones or other electrical/ electronic items will not be allowed in the examination.
3. For students admitted in B.Tech. 1st Year (C-Scheme) in 2019 & onwards and all trailing students:

B. Tech. 3rd Year (V & VI semester)ME: Approved in 15th meeting of Academic Council held on 14.08.2020. applicable to all students admitted in 2018-19 & onwards and trailing students

Examinations and evaluations of students shall be conducted, covering the entire syllabus, as per guidelines “AICTE Examination Reforms”. Students shall be informed about these reforms.

B. Tech. 3rd Year (V & VI semester)ME: Approved in 15th meeting of Academic Council held on 14.08.2020. applicable to all students admitted in 2018-19 & onwards and trailing students

SPEC381C Robotics Lab
B. Tech. (Hons./Minor degree) with Specialization in Robotics
3rd YEAR (SEMESTER –V)

L	T	P	Credits	Class Work	: 25
0	0	2	1	Examination	: 75
				Total	: 100
				Duration of Exam	: 3 Hours

List of Experiments:

1. Study of Robotic Arm.
2. Write a Programming to demonstrate working of Robotic Arm.
3. Study of Fire bird –V Robotic Platform.
4. Write a Programming to demonstrate working of Fire bird-V Robotic Platform.
5. Study of Hexpod Robotic Platform.
6. Write a Programming to demonstrate working of Hexpod Robotic Platform.
7. Study and working of Quad-copter.
8. Study and working of Scorbot-ER4u (A five degrees of freedom) robot along with its on hardware & software:
 - a) Construction (Sketch) & its specifications.
 - b) Components & their functions.
 - c) Operating instructions.
 - d) Safety instructions.
 - e) Teach Pendant.
9. Programming of Scorbot-ER4u for loading and unloading a job along with its simulation.
10. Make a program for Scorbot-ER4u to weld (spot and seam welding) a job and simulate the code.

Text/ Reference Books:

1. R.K. Mittal and I. J. Nagrath, “Robotics and control”, McGraw Hill, 2003.
2. K. R. Guruprasad, “Robotics: Mechanics and control”, PHI, 2019.
3. John J. Craig, “Introduction to Robotics: Mechanics and control”, 3rd Edition, Pearson, 2005.
4. Ashitava Ghosal, “Robotics: fundamental concepts and analysis”, Oxford Pub, 2006.
5. Saeed B. Niku, “Introduction to Robotics: Analysis, control, applications”, 2nd Edition, Wiley, 2010.
6. King-Sun Fu, C.S. George Lee and Ralph Gonzalez, “Robotics: control, sensing, vision and intelligence”, 3rd Edition, McGraw Hill, 2004.

Course Outcomes: At the end of the course, students will demonstrate the ability to:

1. Analyze various Robotic Platforms.
2. Work on various Robotic Platforms.
3. Write basic programs for running various Robotic Platforms.
4. Perform small jobs with various Robotic Platforms.

Note:

1. Each laboratory class/section shall not be more than about 20 students.
2. To allow fair opportunity of practical hands on experience to each student, each experiment may be either done by each student individually or in group of not more than 3-4 students. Larger groups be strictly discouraged/disallowed.
3. Ten experiments are to be performed out of which at least seven experiments should be performed from the above list. Remaining three experiments should be performed from the above list or designed and set by the concerned department as per the scope of the syllabus.
4. Pre-experimental & post experimental quiz / questions may be offered for each lab experiment to reinforce & aid comprehension of the experiment.

B. Tech. 3rd Year (V & VI semester)ME: Approved in 15th meeting of Academic Council held on 14.08.2020. applicable to all students admitted in 2018-19 & onwards and trailing students

SPEC308C Embedded Robotics
B. Tech. (Hons./Minor degree) with Specialization in Robotics
3rd YEAR (SEMESTER –VI)

L	T	P	Credits	Class Work	: 25
4	0	0	4	Examination	: 75
				Total	: 100
				Duration of Exam	: 3 Hours

Unit 1 (14 Lectures)

Introduction to Embedded Robotics: Introduction to Embedded System Design, Categories of ES, Overview of Embedded System Architecture, Recent Trends in Embedded Systems, Hardware Architecture of Embedded System, Real-time Embedded Systems and Robots, Robots and Robotics, Microprocessors and Microcontrollers, Microcontroller or Embedded Controller.

Unit 2 (16 Lectures)

AVR Microcontroller: Introduction to AVR microcontroller, features of AVR family microcontrollers, different types of AVR microcontroller, architecture, memory access and instruction execution, pipelining, program memory considerations, addressing modes, CPU registers, Instruction set, and simple operations.

Unit 3 (14 Lectures)

Features & Programming of AVR Microcontroller: Timer: Control Word, mode of timers, simple programming, generation of square wave, Interrupts: Introduction, Control word Simple Programming, generation of waveforms using interrupt, Serial interface using interrupt, Watch-dog timer, Power-down modes of AVR microcontroller, UART, SRAM, Programming of AVR microcontroller.

Unit 4 (16 Lectures)

Robotic Platforms & Applications: Introduction to Robotic Platforms such as Robotic Arm, Fire-fird, Hexpod, Quad-copter etc., Robotic Applications such as Motion Control, Line follower, Serial Communication, Zig-bee Communication, Automatic Cruise Control, Drone etc.

Text/ Reference Books:

1. S.K. Saha, "Introduction to Robotics", 2nd Edition, McGraw-Hill Higher Education, New Delhi, 2014.
2. Ashitava Ghosal, "Robotics- Fundamental Concepts and Analysis", Oxford, New Delhi, 2006.
3. Dhananjay V. Gadre, "Programming and customizing the AVR Microcontroller", McGraw-Hill, 2011.
4. Thomas Grace, "Programming and Interfacing Atmel AVR Microcontrollers", Cengage Learning PTR, 2015.

Course Outcomes: At the end of the course, students will demonstrate the ability to:

1. Analyze basics concepts of embedded Robotics.
2. Write Program using AVR Microcontroller.
3. Work on various Robotic Platforms.
4. Develop applications based on these platforms.

Note:

1. In Semester Examinations, the paper setter will set two questions from each unit (total 8 questions in all), covering the entire syllabus. Students will be required to attempt only five questions, selecting atleast one question from each unit.
2. The use of scientific calculator will be allowed in the examination. However, programmable calculator, mobile phones or other electrical/ electronic items will not be allowed in the examination.
3. For students admitted in B.Tech. 1st Year (C-Scheme) in 2019 & onwards and all trailing students:
Examinations and evaluations of students shall be conducted, covering the entire syllabus, as per guidelines "AICTE Examination Reforms". Students shall be informed about these reforms.

B. Tech. 3rd Year (V & VI semester)ME: Approved in 15th meeting of Academic Council held on 14.08.2020. applicable to all students admitted in 2018-19 & onwards and trailing students

SPEC388C Embedded Robotics Lab
B. Tech. (Hons./Minor degree) with Specialization in Robotics
3rd YEAR (SEMESTER –VI)

L	T	P	Credits	Class Work	: 25
0	0	2	1	Examination	: 75
				Total	: 100
				Duration of Exam	: 3 Hours

List of Experiments:

1. To study the Robotic Platforms (Fire Bird V).
2. Write a Program to demonstrate operation of Buzzer Beep using Fire Bird V Robotics Platform.
3. Design a Program to demonstrate I/O interfacing using Fire Bird V Robotics Platform.
4. Write a Program to demonstrate motion control using Fire Bird V Robotics Platform.
5. Write a Program to demonstrate position control using Fire Bird V Robotics Platform.
6. Design a Program to demonstrate velocity control using Fire Bird V Robotics Platform.
7. Write a Program to LCD interfacing using Fire Bird V Robotics Platform.
8. Write a Program to Serial Communication using Fire Bird V Robotics Platform.
9. Design a Program to demonstrate operation of white line follower using Fire Bird V Robotics Platform.
10. Write a Program to demonstrate operation of Adaptive Cruise control using Fire Bird V Robotics Platform.
11. Write a Program to Serial Communication via Zig Bee using Fire Bird V Robotics Platform.
12. Design a Program to demonstrate operation of Robotic Arm.
13. Write a Program to demonstrate operation of Hexapod.

Text/ Reference Books:

1. S.K. Saha, "Introduction to Robotics", 2nd Edition, McGraw-Hill Higher Education, New Delhi, 2014.
2. Ashitava Ghosal, "Robotics- Fundamental Concepts and Analysis", Oxford, New Delhi, 2006.
3. Dhananjay V. Gadre, " Programming and customizing the AVR Microcontroller", McGraw-Hill, 2011.
4. Thomas Grace, " Programming and Interfacing Atmel AVR Microcontrollers", Cengage Learning PTR, 2015.

Course Outcomes: At the end of the course, students will demonstrate the ability to:

1. Write Program using AVR microcontroller.
2. Write interfacing programs using AVR microcontroller.
3. Develop robotics applications using AVR microcontroller.
4. Develop robotics applications using Robotic Platforms.

Note:

1. Each laboratory class/section shall not be more than about 20 students.
2. To allow fair opportunity of practical hands on experience to each student, each experiment may be either done by each student individually or in group of not more than 3-4 students. Larger groups be strictly discouraged/disallowed.
3. Ten experiments are to be performed out of which at least seven experiments should be performed from the above list. Remaining three experiments should be performed from the above list or designed and set by the concerned department as per the scope of the syllabus.

B. Tech. 3rd Year (V & VI semester)ME: Approved in 15th meeting of Academic Council held on 14.08.2020. applicable to all students admitted in 2018-19 & onwards and trailing students

SPME401C Mechanics and Control in Robotics
B. Tech. (Hons./Minor degree) with Specialization in Robotics
4th YEAR (SEMESTER –VII)

L	T	P	Credits	Class Work	: 25
4	0	0	4	Examination	: 75
				Total	: 100
				Duration of Exam	: 3 Hours

Unit 1 (16 Lectures)

Introduction to Robotics, Coordinate frames, mapping and Transforms – coordinate frames, description of objects in space, transformation of vectors, inverting a homogeneous transform, fundamental rotation matrices, exercises.

Forward kinematics: mechanical structure and notations, description of links and joints, kinematic modelling of manipulator, Denavit-Hartenberg notation, kinematic relationship between adjacent links, manipulator transformation matrix.

Unit 2 (15 Lectures)

Inverse kinematics: Manipulator workspace, solvability of inverse kinematic model, solution techniques, closed form solution.

Manipulator differential motion and statics: relationship between transformation matrix and angular velocity, mapping velocity vector, velocity propagation along links, Manipulator Jacobian and its inverse, Jacobian singularities, exercises.

Unit 3 (15 Lectures)

Robot Dynamics: Lagrange mechanics, dynamic model of two degree of freedom manipulator, Lagrange-Euler formulation, Newton-Euler formulation; Inverse dynamics.

Trajectory planning: definition and planning tasks, steps in trajectory planning, joint space technique, Cartesian space techniques.

Unit 4 (14 Lectures)

Control of manipulators: Open and closed loop control, manipulator control problem, linear control schemes, characteristics of second-order linear system.

Joint Actuators – model of a DC motor; Partitioned PD control scheme, PID control scheme.

Text/ Reference Books:

1. R.K. Mittal and I. J. Nagrath, “ Robotics and control”, McGraw Hill,2003.
2. K. R. Guruprasad, “ Robotics: Mechanics and control”, PHI, 2019.
3. John J. Craig, “ Introduction to Robotics: Mechanics and control”,3rd Edition, Pearson, 2005.
4. Ashitava Ghosal, “Robotics- Fundamental Concepts and Analysis”, Oxford, New Delhi, 2006.
5. Saeed B. Niku, “ Introduction to Robotics: Analysis, control, applications”, 2nd Edition, Wiley, 2010.
6. King-Sun Fu, C.S. George Lee and Ralph Gonzalez, “Robotics: control, sensing, vision and intelligence”, 3rd Edition, McGraw Hill, 2004.

Course Outcomes: At the end of the course, students will demonstrate the ability to:

1. Analyze a manipulator through evaluation of forward kinematics, inverse kinematics and Jacobian singularities.
2. Formulate and evaluate the dynamics of robot.
3. Describe the trajectory planning techniques for robotic manipulators.
4. Analyze the control problems and apply the control schemes for manipulators and actuators.

Note:

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2. The use of scientific calculator will be allowed in the examination. However, programmable calculator, mobile phones or other electrical/ electronic items will not be allowed in the examination.

3. For students admitted in B.Tech. 1st Year (C-Scheme) in 2019 & onwards and all trailing students:

Examinations and evaluations of students shall be conducted, covering the entire syllabus, as per guidelines “AICTE Examination Reforms”. Students shall be informed about these reforms.

B. Tech. 3rd Year (V & VI semester)ME: Approved in 15th meeting of Academic Council held on 14.08.2020. applicable to all students admitted in 2018-19 & onwards and trailing students