



**RAMAIAH**  
Institute of Technology

# **CURRICULUM**

**Outcome Based Education**  
**(Academic Year 2022 – 2023)**

**MECHANICAL ENGINEERING**

**III & IV SEMESTER B.E.**

**RAMAIAH INSTITUTE OF TECHNOLOGY**  
(Autonomous Institute, Affiliated to VTU)  
Bangalore – 560054.

## About the Institute:

Dr. M. S. Ramaiah a philanthropist, founded 'Gokula Education Foundation' in 1962 with an objective of serving the society. M S Ramaiah Institute of Technology (MSRIT) was established under the aegis of this foundation in the same year, creating a landmark in technical education in India. MSRIT offers 17 UG programs and 15 PG programs. All these programs are approved by AICTE. All eligible UG and PG programs are accredited by National Board of Accreditation (NBA). The institute is accredited with 'A+' **grade by NAAC in March 2021** for 5 years. University Grants Commission (UGC) & Visvesvaraya Technological University (VTU) have conferred Autonomous Status to MSRIT for both UG and PG Programs since 2007. The institute is also been conferred autonomous status for Ph.D program since 2021. The institute is a participant to the Technical Education Quality Improvement Program (TEQIP), an initiative of the Government of India. The institute has 380 competent faculty out of which 65% are doctorates. Some of the distinguished features of MSRIT are: State of the art laboratories, individual computing facility for all faculty members, all research departments active with sponsored funded projects and more than 300 scholars pursuing Ph.D. To promote research culture, the institute has established Centre of Excellence for Imaging Technologies, Centre for Advanced Materials Technology, Centre for Antennas and Radio Frequency systems (CARFS), Center for Cyber Physical Systems, Schneider Centre of Excellence & Centre for Bio and Energy Materials Innovation. **M S Ramaiah Institute of Technology has obtained "Scimago Institutions Rankings" All India Rank 107 & world ranking 600 for the year 2022.**

The Entrepreneurship Development Cell (EDC) and Section 8 company "Ramaiah Evolute" have been set up on campus to incubate startups. **M S Ramaiah Institute of Technology is recognized by Atal Ranking of Institutions on Innovation Achievements (ARIIA), MoE, Govt. of India.** MSRIT has a strong Placement and Training department with a committed team, a good Mentoring/Proctorial system, a fully equipped Sports department, large airconditioned library with good collection of book volumes and subscription to International and National Journals. The Digital Library subscribes to online ejournals from Elsevier Science Direct, IEEE, Taylor & Francis, Springer Link, etc. MSRIT is a member of DELNET, CMTI and VTU ELibrary Consortium. MSRIT has a modern auditorium and several hitech conference halls with video conferencing facilities. The institute has excellent hostel facilities for boys and girls. MSRIT Alumni have distinguished themselves by occupying high positions in India and abroad and are in touch with the institute through an active Alumni Association.

**As per the National Institutional Ranking Framework (NIRF), MoE, Government of India, M S Ramaiah Institute of Technology has achieved 67<sup>th</sup> rank among 1249 top Engineering Institutions & 17<sup>th</sup> Rank for School of Architecture in India for the year 2022 and is 1<sup>st</sup> amongst the Engineering Colleges affiliated to VTU, Karnataka.**

## **About the Department:**

The Department of Mechanical Engineering started in the year 1962 with an intake of 40 students. The department has grown strong over the last 60 years and today has an intake of 120 students and 39 teaching staff. All the faculty members are well qualified and possess post graduate degree with 27 doctorates. The department offers four-year degree course and also offers two Master's Degree in Manufacturing Science & Engineering and Computer Integrated Manufacturing, with an intake of 18 each. The Department also offers research program which includes MSc Engineering by research and PhD degree from Visvesvaraya Technological University and at present 15 researchers are pursuing PhD. The department received software grants from Autodesk a leading Computer Aided Design multinational company and has been using them in the curriculum. The faculty members have taken up number of research projects funded by external agencies like DRDO, DST, AICTE and Visvesvaraya Technological University and received funding to the tune of 1 Crore. In view of the golden jubilee celebrations, the department has conducted a national level project exhibition and an International Conference on "Challenges and Opportunities in Mechanical Engineering, Industrial Engineering and Management Studies" – ICCOMIM. Faculty members from the department have published books on different domains of Mechanical Engineering and are recommended by Visvesvaraya Technological University Board of Studies as reference text books.

The students from the department participate both at the national and international competition throughout the year, in the year 2013 – AeRobusta – 4-member student team from the department participated in SAE Aero Design competition and stood 18<sup>th</sup> position out of 64 teams from all over the world. The team AeRobusta stood FIRST AMONG THE ASIAN COUNTRIES.

Another team from the department also participated in the "Unmanned Air Vehicle System" conducted by U.S. Navy at Maryland, USA. The team secured 5<sup>th</sup> Place in the technical session out of 36 participating teams from all over the world.

A team of two students also participated in the CAD Design Competition conducted by Autodesk, a CAD multinational company, in association with IIT Madras and secured FIRST PLACE among the teams from all over India with a cash prize of Rs1,20,000 and also received a free Trip to Autodesk University, held at Las Vegas, USA.

## **VISION OF THE INSTITUTE**

To be an Institution of International Eminence, renowned for imparting quality technical education, cutting edge research and innovation to meet global socioeconomic needs

## **MISSION OF THE INSTITUTE**

**MSRIT shall meet the global socioeconomic needs through**

- Imparting quality technical education by nurturing a conducive learning environment through continuous improvement and customization
- Establishing research clusters in emerging areas in collaboration with globally reputed organizations
- Establishing innovative skills development, techno-entrepreneurial activities and consultancy for socioeconomic needs

## **QUALITY POLICY**

We at M S Ramaiah Institute of Technology strive to deliver comprehensive, continually enhanced, global quality technical and management education through an established Quality Management System complemented by the synergistic interaction of the stake holders concerned

## **VISION OF THE DEPARTMENT**

To be a centre of International repute in Mechanical Engineering and to create qualified human resources needed to meet the demanding challenges in different areas and emerging fields of Mechanical Engineering and allied sciences.

## **MISSION OF THE DEPARTMENT**

To impart quality technical education to meet the growing needs of the profession through conducive and creative learning environment, to produce qualified and skilled human resources, create R&D environment, to be a centre of excellence and to offer post graduate programs in the emerging fields of Mechanical Engineering.

## **PROGRAM EDUCATIONAL OBJECTIVES (PEOs)**

- To produce engineers with sound basic theoretical knowledge along with required practical skills in various specialized fields of Mechanical Engineering.
- To inculcate team work capabilities and communication skills among students through cocurricular activities.
- To motivate students for higher studies in specialised areas of Mechanical Engineering and explore possible profession in R & D, academic and self employment opportunities.
- To bring in awareness on environmental issues and commitments towards Professional ethics, social responsibilities and need for lifelong learning

## **PROGRAM OUTCOMES (POs):**

**PO1: Engineering knowledge:** Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.

**PO2: Problem analysis:** Identify, formulate, review research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.

**PO3: Design/development of solutions:** Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.

**PO4: Conduct investigations of complex problems:** Use research based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.

**PO5: Modern tool usage:** Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modeling to complex engineering activities with an understanding of the limitations.

**PO6: The engineer and society:** Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional engineering practice.

**PO7: Environment and sustainability:** Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.

**PO8: Ethics:** Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.

**PO9: Individual and team work:** Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.

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

**PO11: Project management and finance:** Demonstrate knowledge and understanding of the engineering and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.

**PO12: Lifelong learning:** Recognize the need for, and have the preparation and ability to engage in independent and lifelong learning in the broadest context of technological change.

**PSOs of the program offered:** Mechanical Engineering Graduates will be able to:

**PSO1:** Ability to apply their knowledge in engineering mechanics, materials science, design, thermal engineering, production, management, CAD/CAM, robotics on an applied basis.

**PSO2:** Ability to apply the learned principles to the analysis, design, development and implementation to advanced mechanical systems and processes, be prepared to work professionally in Mechanical Engineering domain.

## Breakup of Credits for BE Degree Curriculum. (I to VIII Semester)

BATCH 2021-2025

Semester	HSMC	Ability Enhancement Courses (AEC)+UHV	(BSC)	ESC	PCC	PEC	IOE	PW	Project / Seminar/ Internship INT/TS	Total Credits
I	02	01	08	09						<b>20</b>
II		01	08	11						<b>20</b>
III	01	03	03		14					<b>21</b>
IV	01	01	03		15				2	<b>22</b>
V	06	01			08	03	03			<b>21</b>
VI					08	06	03	3	2	<b>22</b>
VII					10	03			6	<b>19</b>
VIII								14	1	<b>15</b>
<b>Total</b>	<b>10</b>	<b>7</b>	<b>22</b>	<b>20</b>	<b>55</b>	<b>12</b>	<b>06</b>	<b>17</b>	<b>11</b>	<b>160</b>

## SCHEME OF TEACHING III SEMESTER

Sl. No.	Subject Code	Subject	Teaching Department	Category	Credits				Total contact hours /week
					L	T	P	Total	
1	ME31	Integral Transforms and applications	Mathematics	BSC	2	1	0	3	4
2	ME32	Manufacturing Process I	Mechanical	IPCC	2	0	1	3	4
3	ME33	Basic Thermodynamics	Mechanical	PCC	2	1	0	3	4
4	ME34	Mechanics of Materials	Mechanical	PCC	3	0	0	3	3
5	ME35	Material Science & Metallurgy	Mechanical	PCC	3	0	0	3	3
6	MEL36	Materials Testing Laboratory	Mechanical	PCC	0	0	1	1	2
7	MEL37	Computer Aided Machine Drawing	Mechanical	PCC	0	0	1	1	2
8	UHV38	Universal Human Value Course	Mechanical	UHV	2	0	0	2	2
9	HS392	Constitution of India & Professional Ethics	Humanities	HSMC	1	0	0	1	1
10	MEAEC3 10	Ability Enhancement Course III **	Mechanical	AEC	1	0	0	1	1
<b>Total</b>								<b>21</b>	<b>26</b>
11	PE83	Physical Education		NCMC	All students have to register compulsorily for any one of the courses with the concerned coordinator (Yoga Teacher/ Physical Education Director/ NSS Coordinator) in the beginning of the III semester. Attending the registered course from III to VIII semesters. Qualifying is mandatory for the award of the degree.				
	YO83	Yoga							
	NS83	NSS							
12	AM31	Additional Mathematics I *		NCMC	0	0	0	0	3

Ability Enhancement Course III \*\*



**NOTE: Branches: CSE, AI & ML, AI & DS, CSE(CS), CSE (AI & ML), ISE, ECE:** Kannada (Kali / Manasu) in III Semester Constitution of India & Professional Ethics in IV Sem

**Branches: EEE, MLE, ETE, EIE, ME, CV, IEM, CH, BT:** Constitution of India & Professional Ethics in III Semester Kannada (Kali / Manasu) in IV Semester

**Nomenclature: BSC:** Basic Science Course, **IPCC:** Integrated Professional Core Course, **PCC:** Professional Core Course, **HSMC:** Humanity and Social Science & Management Courses, **AEC**–Ability Enhancement Courses, **UHV:** Universal Human Value Course, **NMC:** Noncredit Mandatory Course

**L –Lecture, T – Tutorial, P Practical/ Drawing**

**Integrated Professional Core Course (IPCC):** Refers to Professional Theory Core Course Integrated with practical of the same course. Credit for IPCC is 03 and its Teaching–Learning hours (L : T : P) can be considered as (2 : 0 : 1). The theory part of the IPCC shall be evaluated both by CIE and SEE. The practical part shall be evaluated only by CIE (no SEE). However, questions from the practical part of IPCC can be included in the SEE question paper.

**HS39/ HS49Kannada Manasu** is for students who speak, read and write Kannada and  
**HS39/ HS49 Kannada Kali** is for nonKannada speaking, reading, and writing students.

**The Non Credit Mandatory Course, Physical Education (Sport and Athletics)/Yoga/National Service Scheme (NSS):**

1. Student shall select any one of the NMC's namely, Physical Education (Sport and Athletics)/Yoga/ NSS prescribed for VIII semesters and shall attend the course from the III semesters and upto end of VIII semesters to complete all the formalities of the course and appear for the SEE. Marks scored in SEE shall be included in the VIII semester grade card.
2. The above mentioned NMC's shall not be considered for vertical progression as well as for the calculation of SGPA/CGPA but completion of the courses shall be mandatory for the award of degree.
3. SEE marks will be allotted by the concerned course teacher based on attendance and performance in the practice sessions/field in the ratio of 50:50. Maximum CIE marks are 50. SEE should be awarded by the course teacher every semester (III to VIII) for 50 marks and marks scored by the student are scaled down to 50 in the VIII semester.
4. The students who take a course on Physical Education and Yoga, he/she has to take up the semester end practical examination prescribed for 100 marks. The students who opt for NSS course have to submit report and attend vivavoce examination. The marks of the report shall be 50 marks and for the presentation/vivavoce 50 marks. SEE scale down to 50 marks.
5. In case, any student fails to secure the minimum 40% of the prescribed marks, he/she shall be deemed to have secured 'F' grade.

**\* Lateral Entry Students:**

**The NonCredit Mandatory Course, Additional Mathematics I** is prescribed for III Semester Lateral Entry Diploma students admitted to III Semester of BE Program. The student shall register for this course along with other III semester courses. The students shall attend classes for the course during the semester and complete all formalities of attendance and CIE. In case, any student fails to secure the minimum 40% of the prescribed CIE marks, he/she shall be deemed to have secured 'F' grade. In such a case, the student has to fulfill the requirements during subsequent semester/s to appear for CIE. Incase student fails to register for the said course/ falls short of attendance, he/she will repeat the course whenever it is offered next. Additional Mathematics I shall have CIE component only and no SEE component. This Course shall not be considered for vertical progression, but completion of the course shall be mandatory for the award of the degree.

**Inter/Intra Institutional Internship:** All the students admitted under lateral entry category shall have to undergo a mandatory summer InternshipI of 03 weeks during the intervening vacation of III and IV semesters. Summer Internship shall include Inter / Intra Institutional activities. A Vivavoce examination shall be conducted during IV semester and the prescribed credit shall be included in IV semester after students clearing this head. The internship shall be considered as a head of passing and shall be considered for vertical progression and for the award of degree. Those, who do not take up / complete the internship shall be

declared fail and shall have to complete during subsequent examination after satisfying the internship requirements during subsequent semesters.

**Lateral Entry Students:**

**AICTE Activity Points to be earned by students admitted to BE program (For more details refer to Chapter 6, AICTE, Activity Point Program, Model Internship Guidelines):**

Every regular student, who is admitted to the 4year degree program, is required to earn 100 activity points in addition to the total credits earned for the program. Students entering 4 years degree program through lateral entry are required to earn 75 activity points in addition to the total credits earned for the program. The activity points earned by the student shall be reflected on the students VIII semester grade card. The activities to earn the points can be spread over the duration of the course. However, minimum prescribed duration should be fulfilled. Activity points (noncredit) have no effect on SGPA/CGPA and shall not be considered for vertical progression. Incase student fail to earn the prescribed activity points; VIII semester grade card shall be issued only after earning the required activity Points. Students shall be eligible for the award of degree only after the release of the VIII semester grade card.

## SCHEME OF TEACHING IV SEMESTER

Sl. No.	Subject Code	Subject	Teaching Department	Category	Credits				Total contact hours /week
					L	T	P	Total	
1	ME41	Numerical methods, complex analysis and probability models	Mathematics	BSC	2	1	0	3	4
2	ME42	Machine Design I	Mechanical	IPCC	2	0	1	3	4
3	ME43	Applied Thermodynamics	Mechanical	PCC	2	1	0	3	4
4	ME44	Mechanical Measurements & Metrology	Mechanical	PCC	3	0	0	3	3
5	ME45	Manufacturing Process II	Mechanical	PCC	3	0	0	3	3
6	MEL46	Applied Thermodynamics Laboratory	Mechanical	PCC	0	0	1	1	2
7	MEL47	Mechanical Measurements & Metrology Laboratory	Mechanical	PCC	0	0	1	1	2
8	MEL48	Manufacturing Process Laboratory	Mechanical	PCC	0	0	1	1	2
9	HS491	Kannada (Kali /Manasu)	Humanities	HSMC	1	0	0	1	1
10	MEAEC4 10	Ability Enhancement Course IV **	Mechanical	AEC	1	0	0	1	1
11	INT411	Inter/ Intra Institutional Internship	Mechanical	INT	0	0	2	2	
<b>Total</b>								<b>22</b>	<b>26</b>
12	AM41	Additional Mathematics II *	Mathematics	NCMC	0	0	0	0	

Ability Enhancement Course – IV \*\*

**NOTE: Branches: CSE, AI & ML, AI & DS, CSE(CS), CSE (AI & ML), ISE, ECE: Kannada (Kali / Manasu) in III Semester  
Constitution of India & Professional Ethics in IV Sem**

**Branches: EEE, MLE, ETE, EIE, ME, CV, IEM, CH, BT: Constitution of India & Professional Ethics in III Semester  
Kannada (Kali / Manasu) in IV Semester**

**Nomenclature: BSC: Basic Science Course, IPCC: Integrated Professional Core Course, PCC: Professional Core Course, INT –Internship, HSMC: Humanity and Social Science & Management Courses, AEC–Ability Enhancement Courses, NCMC: Noncredit Mandatory Course**

**L –Lecture, T – Tutorial, P Practical/ Drawing**

**Integrated Professional Core Course (IPCC):** Refers to Professional Theory Core Course Integrated with practical of the same course. Credit for IPCC is 03 and its Teaching–Learning hours (L : T : P) can be considered as (2 : 0 : 1). The theory part of the IPCC shall be evaluated both by CIE and SEE. The practical part shall be evaluated only by CIE (no SEE). However, questions from the practical part of IPCC can be included in the SEE question paper.

**HS39/ HS49Kannada Manasu** is for students who speak, read and write Kannada and

**HS39/ HS49 Kannada Kali** is for nonKannada speaking, reading, and writing students.

**Innovation/ Societal/ Entrepreneurship based Internship:** At the End of fourth Semester four weeks summer internship shall be carried out at industry, State and Central Govt./NGO/MSME, Innovation center’s or incubation centers. The internship can be Rural Internship. All the students shall have to undergo mandatory internship of 04 weeks during the intervening period of IV & V semesters. A VivaVoce examination (CIE) shall be conducted during V semester and the prescribed credit shall be included in VI semester. Internship shall be considered as a head of passing and shall be considered for the award of degree. Those, who do not takeup/complete the internship shall be declared fail and shall have to complete during subsequent examination after satisfying the internship requirements. The incharge faculty has to monitor the student’s internship progress and interact to guide them for the successful completion of the internship. Innovation/ Societal/ Entrepreneurship based Internship shall have only CIE no SEE component.

**\* Lateral Entry Students:**

**The Non Credit Mandatory Course, Additional Mathematics II** is prescribed for IV Semester Lateral Entry Diploma students admitted to III Semester of BE Program. The student shall register for this course along with other IV semester courses. The students shall attend classes for the course during the semester and complete all formalities of attendance and CIE. In case, any student fails to secure the minimum 40% of the prescribed CIE marks, he/she shall be deemed to have secured an F grade. In such a case, the student has to fulfill the requirements during subsequent semester/s to appear for CIE. In case student fails to register for the said course/ falls short of attendance, he/she will repeat the course whenever it is offered next. Additional Mathematics II shall have CIE component only and no SEE component. This Course shall not be considered for vertical progression, but completion of the course shall be mandatory for the award of the degree.

**AICTE Activity Points to be earned by students admitted to BE program (For more details refer to Chapter 6, AICTE, Activity Point Program, Model Internship Guidelines):**

Every regular student, who is admitted to the 4year degree program, is required to earn 100 activity points in addition to the total credits earned for the program. Students entering 4 years' degree program through lateral entry are required to earn 75 activity points in addition to the total credits earned for the program. The activity points earned by the student shall be reflected on the students VIII semester grade card. The activities to earn the points can be spread over the duration of the course. However, minimum prescribed duration should be fulfilled. Activity points (noncredit) have no effect on SGPA/CGPA and shall not be considered for vertical progression. In case student fail to earn the prescribed activity points; VIII semester grade card shall be issued only after earning the required activity Points. Students shall be eligible for the award of degree only after the release of the VIII semester grade card.

### III SEMESTER

INTEGRAL TRANSFORMS AND APPLICATIONS	
Course Code: ME31	Credits: 2:1:0
Pre – requisites: Calculus	Contact Hours: 28 L+14T = 42
Course Coordinator: Dr. G Neeraja, Dr Vijay Kumar & Dr. A Sreevallabha Redd	

#### Unit I

**Laplace Transforms:** Definition, transforms of elementary functions, properties of Laplace transforms, existence conditions, transform of derivatives, integrals, multiplication by  $t^n$ , division by  $t$ , evaluation of integrals by Laplace transforms. Transform of and Periodic function.

- Pedagogy/Course delivery tools: Chalk and talk, PowerPoint Presentation, Videos
- Links: <https://nptel.ac.in/courses/111/105/111105134/>
- Impart us recording: <https://a.impartus.com/ilc/#/course/119640/593>

#### Unit II

**Application of Laplace Transforms:** Unit–step function, Unit–impulse function. Inverse transforms, Convolution Theorem, Solution of linear differential equations and Simultaneous linear differential equations using Laplace transforms. Engineering applications.

- Pedagogy/Course delivery tools: Chalk and talk, PowerPoint Presentation, Videos
- Links: <https://nptel.ac.in/courses/111/105/111105134/>
- Impart us recording: <https://a.impartus.com/ilc/#/course/119640/593>

#### Unit III

**Fourier Series:** Trigonometric Fourier series and its convergence, Periodic functions, Dirichlet conditions, Fourier series of periodic functions, Fourier series of even and odd functions, half range Fourier series, Practical harmonic analysis.

- Pedagogy/Course delivery tools: Chalk and talk, PowerPoint Presentation, Videos
- Links: <https://nptel.ac.in/courses/111/105/111105134/>
- Impart us recording: <https://a.impartus.com/ilc/#/course/619570/1030>

#### Unit IV

**Fourier Transforms:** Infinite Fourier transform, Infinite Fourier sine and cosine transforms, properties, Inverse transforms, Convolution theorem, Parseval’s identities (statements only).

- Pedagogy/Course delivery tools: Chalk and talk, PowerPoint Presentation, Videos
- Links: <https://nptel.ac.in/courses/111/108/111108066/>
- Impart us recording: <https://a.impartus.com/ilc/#/course/119635/593>

### Unit V

**Applications of Fourier series and Fourier transform:** Solution of one dimensional wave equation, one dimensional heat equation and two dimensional Laplace equation using Fourier series, Solution of one dimensional wave equation and one dimensional heat equation using Fourier Transforms.

- Pedagogy/Course delivery tools: Chalk and talk, PowerPoint Presentation, Videos
- Links: <https://nptel.ac.in/courses/111/101/111101153/>
- Impart us recording: <https://a.impartus.com/ilc/#/course/290290/703>  
<https://a.impartus.com/ilc/#/course/171951/703>

#### Text Books:

1. **Erwin Kreyszig** –Advanced Engineering Mathematics, Wiley publication, 10<sup>th</sup> edition, 2015
2. **B.S. Grewal** – Higher Engineering Mathematics, Khanna Publishers, 44<sup>th</sup> edition, 2017.

#### Reference Books:

1. **George B. Thomas, Maurice D. Weir, Joel R. Hass** Thomas' Calculus, Pearson, 13<sup>th</sup> edition, 2014.
2. **Peter V. O' Neil** – Advanced Engineering Mathematics, Thomson Brooks/Cole, 7<sup>th</sup> edition, 2011.
3. **Glyn James & Phil Dyke** – Advanced Modern Engineering Mathematics, Pearson Education, 5<sup>th</sup> edition, 2018.
4. **Srimanta Pal & Subobh C Bhunia** Engineering Mathematics, Oxford University Press, 3<sup>rd</sup> Reprint, 2016.

#### Course Outcomes (COs):

At the end of the course the student will be able to

1. Evaluate Laplace Transforms of given function and understand their Properties (PO1, PO2, PSO1, PSO2).
2. Obtain inverse Laplace transforms and use the same to solve system of ODE's (PO1, PO2, PSO1, PSO2).

3. Construct the Fourier series expansion of a function/tabulated data (PO1, PO2, PSO1, PSO2).
4. Evaluate Fourier transforms and use Ztransforms to solve difference equations (PO1, PO2, PSO1, PSO2).
5. Find the solution of PDE's analytically using Fourier techniques. (PO1, PO2, PSO1, PSO2).

**Course Assessment and Evaluation:**

<b>Continuous Internal Evaluation (CIE): 50 Marks</b>		
<b>Assessment Tool</b>	<b>Marks</b>	<b>Course outcomes addressed</b>
Internal test – I	30	CO1, CO2, CO3
Internal test – II	30	CO3, CO4, CO5
Average of the two internal tests will be taken for 30 marks.		
<b>Other components</b>		
Quiz	10	CO1, CO2, CO3
Assignment	10	CO1, CO2, CO3, CO4, CO5
<b>Semester End Examination (SEE)</b> Course end examination (Answer any one question from each unit – Internal choice)	100	CO1, CO2, CO3, CO4, CO5



# MANUFACTURING PROCESS I

<b>Course Code:</b> ME32	<b>Credits:</b> 2:0:1
<b>Pre – requisites:</b> Nil	<b>Contact Hours:</b> 28L+14P
<b>Course Coordinator:</b> Bharath M R	

## Unit I

### Casting Process

**Introduction to Casting** Casting, Steps involved in casting, Advantages and limitations of casting.

**Pattern Making** Types of pattern, allowance.

**Moulding Sand** Ingredients of molding sands and its properties. Core sand ingredients. Core Making.

**Gating System** – Definition, elements of gating system, functions and gating ratio

**Molding Methods** Green molding, hand and machine molding. Jolt/Squeeze Machine and Sand slingers. Shell Molding and investment casting.

**Melting Furnaces** Classification of Furnaces, Oil fired furnaces, Electric furnaces Arc, resistance and Induction furnaces.

**Cleaning and Inspection of Castings** fettling operations, Defects in Casting.

- Pedagogy/Course delivery tools: Chalk and talk, Power point presentation
- Lab component/ Practical topics: Preparation of Mould cavity using single piece, Clay Content Test and moisture content test,
- Links: Casting Process: <https://www.youtube.com/watch?v=2CIcvB72dmk>
- Links: Furnaces for casting: <https://www.youtube.com/watch?v=GUctNyh1FR0>

## Unit II

### Forming Process – I

**Introduction to forming** Forming, classification, Advantages, limitations and applications.

**Forging** Classification of forging processes, forging machines & equipment, Die design parameters, Material flow lines in forging, forging defects.

**Drawing** Steps involved in wire drawing, drawing die details, Types of tube drawing processes.

- Pedagogy/Course delivery tools: Chalk and talk, Power point presentation
- Lab component/ Practical topics: Forging of a mild steel component into different shapes
- Links: Forging: <https://www.youtube.com/watch?v=r5FXtKoThj4>
- Links: Drawing: <https://www.youtube.com/watch?v=rL9iEgeNCr0>

## Unit III

### Forming Process – II

**Extrusion** Types of extrusion processes, Special type of extrusion processes, Metal flow pattern in extrusion, Defects in extruded products.

**Rolling** Classification. Types of rolling mills, Metal flow pattern in rolling, Defects in rolled products.

**Sheet metal forming** Introduction, Material used, Operations, Punches and Dies used.

- Pedagogy/ Course delivery tools: Chalk and talk, Power point presentation
- Lab component/Practical topics: Permeability Test, Sand Hardness test, Sheet Metal forming demo
- Links: Extrusion: <https://www.youtube.com/watch?v=wuVnnfEocks>
- Links: Rolling: <https://www.youtube.com/watch?v=MLRpwAEuVjI>
- Links: Sheet Metal Work: <https://www.youtube.com/watch?v=LTZ4K3NoIr0>

## Unit IV

### Fabrication Process:

**Welding** Introduction, classification. Principles, TIG, MIG, SAW, FCAW, and Electro slag welding.

**Other Welding Processes** Principle and applications of resistance welding (Spot), Thermit Welding, Friction welding, Explosive Welding, Ultrasonic welding, Laser Welding Processes.

- Pedagogy/ Course delivery tools: Chalk and talk, Power point presentation
- Lab component/ Practical topics: Electric Arc Welding Demo, Sieve analysis
- Links: Welding: <https://www.youtube.com/watch?v=jQddm3YONNc>
- Links: Special Welding Processes:  
<https://www.youtube.com/watch?v=TIhGTSDfQxc>

## Unit V

### Testing of Manufactured Components:

**Destructive Testing** – Tensile test, compressive test, fatigue test, bending test, shear strength test, corrosion test.

**Introduction to NDT** Nondestructive Testing, X –Ray radiography, dye penetrant test, Ultrasonic test, Magnetic particle Inspection, Eddy Current testing, Holography methods of Inspection.

NDT Techniques Penetrant test, Magnetic particle Inspection, Ultrasonic test, Eddy Current testing, Holography methods of Inspection, X –Ray radiography.

- Pedagogy/ Course delivery tools: Chalk and talk, Power point presentation
- Lab component/Practical topics: Sand Test Using UTM

- Links: Destructive Testing:  
[https://www.youtube.com/playlist?list=PL7Le4pic01uIA3SFGHMsRb3\\_wBG8eru](https://www.youtube.com/playlist?list=PL7Le4pic01uIA3SFGHMsRb3_wBG8eru)
- Links: NDT: <https://www.youtube.com/watch?v=0VwKaHNvxLk>

### **Text Books:**

1. Manufacturing Technology: Foundry Forming and Welding, P.N.Rao 2 Edition TMH,2003
2. Manufacturing Technology”, Serope Kalpakjian, Steuen.R.Sechmid, Pearson Education Asia, 5<sup>th</sup> Ed. 2006..
3. Mechanical metallurgy by George E. Dieter Tata McGraw Hill publication. 3<sup>rd</sup> edition 2013.
4. Manufacturing Processes for Engineering materials by Serope kalpakajiam and
5. Steven R Schimid, Pearson education, 4th edition 2007.
6. Manufacturing ProcessIII, By Dr.Radha Krishna, Sudha Publications.2010. 2<sup>nd</sup>.

### **Reference Books:**

1. Materials and Process of Manufacture, Roy A Lindberg, PHI Publications, 2 edition 2006.
2. Principal of Metal Casting, Heine, Loper, Philip Rosenthal, TMH. 1 21<sup>st</sup> edition2005.
3. Materials & Processes in Manufacturing by Paul Degarmo E, Jt Black, Ronald A Kohser. Prentice hall of India, 8<sup>th</sup> edition 2006
4. Manufacturing Science, by Asok Kumar Mallik & Amitabha Ghosh – Affiliated Eastwest Press Pvt Ltd, 2<sup>nd</sup> edition 2012.
5. Fundamentals of Metal forming processes, B.L. Juneja, First edition New age International, 2007.
6. Theory of Plasticity and Metal forming Processes, Dr. Ssadhu singh, Khanna Publishers, 3<sup>rd</sup> edition 2003
7. Metal Forming processes, by G.R Nagpal, Khanna Publishers, Second edition, 2005.

### **Web links and video lectures (e-Resources)**

- 1) <https://nptel.ac.in/courses/112107083>
- 2) <https://nptel.ac.in/courses/112107250>
- 3) <https://nptel.ac.in/courses/112107089>
- 4) <https://www.youtube.com/watch?v=DK1dItmI8mM>

## Course Learning Outcomes (COs):

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

1. List and define the manufacturing processes such as casting, forming, joining processes. (PO1, PO4, PO5, PO6, PO7, PO10, PO11, PO12, PSO1, PSO2)
2. Classify and compare different manufacturing processes. (PO1, PO2, PO3, PO4, PO5, PO7, PO10, PO11, PO12, PSO1, PSO2)
3. Select suitable manufacturing processes for said applications (PO1, PO2, PO3, PO4, PO5, PO7, PO10, PO11, PO12, PSO1, PSO2)
4. Illustrate with sketches and arrive at the working principle of said manufacturing processes and inspection methods employed. (PO1, PO2, PO3, PO4, PO5, PO7, PO10, PO11, PO12, PSO1, PSO2)
5. Justify the importance of examining a manufactured product before being put into service. (PO1, PO2, PO3, PO4, PO5, PO7, PO10, PO11, PO12, PSO1, PSO2)

## Course Assessment and Evaluation

<b>Continuous Internal Evaluation (CIE): 50 Marks</b>		
<b>Assessment tool</b>	<b>Marks</b>	<b>Course outcomes addressed</b>
Internal test-I	30	CO1, CO2, CO3, CO4, CO5
Internal test-II	30	CO1, CO2, CO3, CO4, CO5
Average of the two internal tests will be considered for evaluation of 30 Marks		
<b>Other components 20 Marks</b>		
Experiment Conduction and Record Writing and Viva Voce	10	CO1, CO2, CO3, CO4, CO5
Assignment writing	10	CO1, CO2, CO3, CO4, CO5
<b>Semester End Examination (SEE) 100 Marks</b>		
	100	CO1, CO2, CO3, CO4, CO5

<b>BASIC THERMODYNAMICS</b>	
<b>Course Code:</b> ME33	<b>Credits:</b> 2:1:0
<b>Pre – requisites:</b> Nil	<b>Contact Hours:</b> 28 L +14T
<b>Course Coordinator:</b> Mr. Ashok Kumar K	

### Unit I

**Fundamental concepts and definitions:** Thermodynamics; definition and scope, microscopic and macroscopic approaches, types of system, thermodynamic properties, thermodynamic state, path and process, path and point function, quasistatic process, cyclic and noncyclic processes, thermodynamic equilibrium, Zeroth law of thermodynamics, Work and heat, Thermodynamic definition of work, expressions for displacement work in various processes through p v diagrams, heat definition, unit and sign convention, equivalence of heat and work

- Pedagogy/Course delivery tools: Chalk and talk, animated videos
- Lab component/ Practical topics: ATD lab
- Links: Thermodynamic properties:  
<https://www.youtube.com/watch?v=iUEjQQtrT50>

### Unit II

**First Law of Thermodynamics:** Statement of first law of thermodynamics, extension of first law to non cyclic processes, energy, energy as a property of the system, enthalpy, specific heat at constant volume and constant pressure, Steady state, steady flow energy equation, some important applications

**Second Law of thermodynamics:** Thermal reservoir, Heat engine, schematic representation and efficiency, reversed heat engine, schematic representation and coefficient of performance, KelvinPlanck statement and Clasius' statement of second law of thermodynamics, PMMI and PMMII, equivalence of the two statements

- Pedagogy/ Course delivery tools:Chalk and talk, Power point presentation, animated videos
- Lab component/ Practical topics:ATD lab
- Links: First law of TD: [https://www.youtube.com/watch?v=ZvuhbYIMU\\_U](https://www.youtube.com/watch?v=ZvuhbYIMU_U)
- Links: Kelvin plank and Clasius statements:  
[https://www.youtube.com/watch?v=L30WZ4PXp\\_c](https://www.youtube.com/watch?v=L30WZ4PXp_c)

### Unit III

**Carnot cycle:** Reversible and irreversible processes, factors that make a process irreversible, reversible heat engine, carnot cycle, carnot principle

**Entropy:** Clausius inequality; statement, proof, application to a reversible cycle, entropy a property, entropy definition, principle of increase of entropy, calculation of entropy using  $T dS$  relations, entropy as a coordinate.

- Pedagogy/ Course delivery tools: Chalk and talk, animated videos
- Lab component/ Practical topics: ATD lab
- Links: Carnot cycles: <https://www.youtube.com/watch?v=7WeX3yx1gM>
- Links: Entropy: <https://www.youtube.com/watch?v=umV67dqWVKw>

#### Unit IV

**Pure substance:** PT and PV diagrams, triple point and critical points, subcooled liquid, saturated liquid, mixture of saturated liquid and vapour, saturated vapour and superheated vapour states of a pure substance with water as example. Enthalpy of change of phase (Latent heat), dryness fraction, TS and hs diagrams, representation of various processes on these diagrams, Steam tables and its use

**Combustion thermodynamics:** Theoretical (Stoichiometric) air for combustion of fuels, excess air, mass balance, actual combustion. Exhaust gas analysis. A/F ratio, energy balance for a chemical reaction, enthalpy of formation, enthalpy and internal energy of combustion, combustion efficiency. Numerical problems

- Pedagogy/ Course delivery tools: Chalk and talk, Power point presentation, animated videos
- Lab component/ Practical topics: ATD lab
- Links: Pure substance: <https://www.youtube.com/watch?v=OHhnm2p5G3o>
- Links: Combustion thermodynamics: <https://www.youtube.com/watch?v=uvR7zNJIKoI>

#### Unit V

**Ideal and Real gases:** Introduction, Vander wall's equation, Vander wall's constants in terms of critical properties, law of corresponding states, compressibility factor, compressibility chart, ideal gas, equation of state, internal energy and enthalpy as functions of temperature only, universal and particular gas constants, ideal gas mixture; Dalton's law of additive pressure, Amagat's law of additive volumes, evaluation of properties, analysis of various processes.

- Pedagogy/ Course delivery tools: Chalk and talk, Power point presentation, animated videos
- Lab component/Practical topics: Heat transfer lab Air conditioning test rig
- Links: Ideal gases: <https://www.youtube.com/watch?v=1yymkQQOPAo>
- Links: Real gases: <https://www.youtube.com/watch?v=sTufBlv9e20>

### **Text Books:**

1. Fundamental of Classical Thermodynamics G J Van Wylen and R E Sonntag, Wiley Eastern. 1<sup>st</sup> dition, 2002
2. Basic and Applied Thermodynamics P K Nag, Tata McGrawHill, 3<sup>rd</sup> edition., 2002

### **Reference Books:**

1. Thermodynamics an engineering approach Yunus A Cengel and Michael A Boles. Tata McGraw hill Pub. 1st edition 2002
2. Engineering Thermodynamics R K Rajput, Laxmi publications Pvt Ltd, 3rd Edition., 2007

### **Web links and video lectures (eResources)**

1. <https://www.youtube.com/watch?v=9GMBpZZtjXM&list=PLD8E646BAB3366BC8>
2. <https://www.youtube.com/watch?v=fdW7HmgEPgA>
3. <https://www.youtube.com/watch?v=3btbPs5wvNw>
4. <https://www.youtube.com/watch?v=GL81TfsqKI>
5. <https://www.youtube.com/watch?v=WomsUEVVtCk>

### **Course Outcomes (COs):**

Students will be able to

1. Analyze problems on temperature scale, work and heat, understand principles of thermodynamics in engineering applications. [PO1, PO2, PO3, PO4, PO5, PO12, PSO1, PSO2]
2. Solve problems associated with various thermodynamic processes and calculate properties of the thermodynamic system during execution of process or cycle. [PO1, PO2, PO3, PO4, PO5, PSO1, PSO2].
3. Understand the importance of Carnot principle and apply the concept of entropy principle to calculate entropy during the execution of a process or cycle [PO1, PO2, PO3, PO4, PSO1, PSO2]
4. Analyze the behavior of working fluid in thermodynamic system during a process or cycle and solve the problems related to combustion thermodynamics, Ideal and Real gases [PO1, PO2, PO3, PO4, PO7, PO12, PSO1, PSO2]
5. Develop a capability to apply principles of thermodynamics to solve numerical and design problems of engineering devices and provide useful solutions. [PO1, PO2, PO3, PO4, PO5, PO7, PO12, PSO1, PSO2]

**Course Assessment and Evaluation:**

<b>Continuous Internal Evaluation (CIE): 50 Marks</b>		
<b>Assessment tool</b>	<b>Marks</b>	<b>Course outcomes addressed</b>
Internal test-I	30	CO1, CO2
Internal test-II	30	CO3, CO4, CO5
Average of the two internal tests will be considered for evaluation of 30 Marks		
<b>Other components 20 Marks</b>		
Assignment	10	CO1, CO2, CO3
Quiz	10	CO4, CO5
<b>Semester End Examination (SEE)</b>	100	CO1, CO2, CO3, CO4, CO5



# MECHANICS OF MATERIALS

**Course Code:** ME34

**Credits:** 3:0:0

**Pre – requisites:** Nil

**Contact Hours:** 42L

**Course Coordinator:** Dr. Aruna Kumar P C

## Unit I

**Simple stress and strain, volumetric strain, temperature stresses** **Simple stress and strain:** Introduction, stress, strain, mechanical properties of materials, linear elasticity, Hook's law and Poisson's ratio, stress – strain relation – behavior in tension for mild steel and non ferrous metals. Extension / shortening of a bar, bars with cross sections varying in steps, bars with continuously varying cross sections (circular and rectangular) Elongation due to self weight, principle of super position, **Volumetric strain:** expression for volumetric strain, Stress in composite section, Elastic constants, simple shear stress, shear strain.

**Temperature stresses** (including compound bars)

- Pedagogy/Course delivery tools: Chalk and talk, animated videos
- Lab component/Practical topics: Tensile and compression tests
- Links: Simple stress and strain:  
[https://www.youtube.com/watch?v=B9lyGZzb\\_6M](https://www.youtube.com/watch?v=B9lyGZzb_6M)
- Links: volumetric strain: <https://www.youtube.com/watch?v=w8IZOi0n3Mk>
- Links: temperature stresses: <https://www.youtube.com/watch?v=dzeCpS7xTno>

## Unit II

**Compound stresses:** Introduction, plane stress, stresses on inclined sections, principal stresses and maximum shear stresses, Mohr's circle for plane stress.

**Thick and thin cylinders:** stresses in thin cylinders, changes in dimensions of cylinder (diameter, length and volume), Thick cylinders subjected to internal and external pressures (Lame's equation) (Compound cylinders not included)

- Pedagogy/Course delivery tools: Chalk and talk, animated videos
- Lab component/Practical topics: Tensile, compression tests
- Links: compound stresses: <https://www.youtube.com/watch?v=bY9PW66AUQQ>
- Links: Thick and thin cylinders:  
<https://www.youtube.com/watch?v=y2dbpuBYPjU>

## Unit III

**Bending moment and shear force in beams:** Introduction, rate of loading, sign conventions, relationship between shear force and bending moments, shear force and

bending moment diagrams for different beams subjected to concentrated loads, uniform distributed load (UDL), Uniformly Varying Load (UWL) and couple.

- Pedagogy/ Course delivery tools: Chalk and talk, Power point presentation, animated videos
- Lab component/ Practical topics: Bending test
- Links: SFD & BMD: [https://www.youtube.com/watch?v=pMUG\\_2CoP4I](https://www.youtube.com/watch?v=pMUG_2CoP4I)
- Links: SFD & BMD: [https://www.youtube.com/watch?v=arr\\_xwkJsM](https://www.youtube.com/watch?v=arr_xwkJsM)

#### Unit IV

**Bending stresses in beams:** Introduction, theory of simple bending. Assumptions in simple bending, relationship between bending stresses and radius of curvature, relationship between bending moment and radius of curvature, moment carrying capacity of a section.

**Shear stresses in beams:** Shear stress across rectangular, I Section & circular sections.

- Pedagogy/ Course delivery tools: Chalk and talk, Power point presentation, animated videos
- Lab component/ Practical topics: Bending and shear tests
- Links: Bending stresses: <https://www.youtube.com/watch?v=EDN9yFr4ehY>
- Links: shear stresses: <https://www.youtube.com/watch?v=PZJxokhWL3E>

#### Unit V

**Deflection of beams:** Introduction, differential equation for deflection, equations for deflections, slope and moments, double integration method for cantilever and simply supported beams for point load, UDL. Macaulay's Method.

**Torsion of circular shafts:** Introduction, pure torsion, assumptions, derivation of torsional equations, polar modulus, torsional rigidity / stiffness of shafts, power transmitted by solid and hollow circular shafts.

- Pedagogy/ Course delivery tools: Chalk and talk, Power point presentation, animated videos
- Lab component/Practical topics: Torsion test
- Links: Deflection of beams: <https://www.youtube.com/watch?v=Qtlls7jV5I>
- Links: torsion of circular shafts:  
<https://www.youtube.com/watch?v=OBTZAYqHSY8>

#### Text Books:

1. Mechanics of materials, S.I units, Ferdinand Beer & Russell Johnston, TATA McGrawHill – 1<sup>st</sup> edition 2003
2. Strength of materials, W.A Nash, Schaums outline series, 4<sup>th</sup> edition – 2007

## Reference Books:

1. Mechanics of materials, K.V. Rao, G.C. Raju, 1<sup>st</sup> edition, 2007
2. Strength of materials, Ramamrutham, 5<sup>th</sup> edition 2006.
3. Mechanics of materials, James. M Gere. Thomson, 5<sup>th</sup> edition, 2004

## Web links and video lectures (e-Resources)

1. <https://www.youtube.com/watch?v=DzyIEz3dKXQ>
2. <https://www.youtube.com/watch?v=2PM4mT3nKwk>
3. <https://www.youtube.com/watch?v=d22GM6wMQ>
4. <https://www.youtube.com/watch?v=sP34uzn7diA>
5. <https://www.youtube.com/watch?v=r0YA2Nr6bxQ>

## Course Outcomes (COs):

1. Develop an understanding of behavior of components when subjected to various type of loading.
2. Compile fundamentals of MOM for engineering applications.
3. Develop ability to identify a problem and apply the fundamental concepts of MOM.
4. Develop competence to design and analyze problems of engineering involving design of components subjected to stresses and strains.
5. Demonstrate ability to have the competence for undergoing knowledge up gradation in the Advanced subjects of Machine Design, FEM, Theory of Elasticity and Vibrations.

## Course Assessment and Evaluation:

<b>Continuous Internal Evaluation (CIE): 50 Marks</b>		
<b>Assessment tool</b>	<b>Marks</b>	<b>Course outcomes addressed</b>
Internal test-I	30	CO1, CO2
Internal test-II	30	CO3, CO4, CO5
Average of the two internal tests will be considered for evaluation of 30 Marks		
<b>Other components 20 Marks</b>		
Assignment	10	CO1, CO2, CO3
Surprise test	10	CO4, CO5
<b>Semester-End Examination (SEE)</b>	100	CO1, CO2, CO3, CO4, CO5

# MATERIAL SCIENCE & METALLURGY

**Course Code:** ME35

**Credits:** 3:0:0

**Pre – requisites:** Nil

**Contact Hours:** 42L

**Course Coordinator:** Dr. K R Phaneesh

## Unit I

**Structure of Crystalline solids:** Fundamental concepts of Unit cell, space lattice, Bravais space lattices, Coordination Number and Atomic Packing Factor for different cubic and HCP structures. Crystal imperfections: Classification, point, line, surface & volume defects,

**Diffusion:** Diffusion mechanisms, and factors affecting diffusion, Fick's laws of diffusion, Stress vs. Strain diagrams to show ductile & brittle behavior of metals.

- Pedagogy/Course delivery tools: Chalk and talk, Power point presentation, animated videos
- Links: Unit Cells Number of Atoms in a Unit Cell:  
<https://www.youtube.com/watch?v=qAeaHYSX0hs>
- Links: Crystal imperfections: <https://www.youtube.com/watch?v=HuMQqSj8zdo>

## Unit II

**Mechanical Behavior of Materials:** Linear & nonlinear elastic properties, Concept of true stress and true strain. Plastic deformation of metals by Slip and Twinning, strain hardening and strengthening mechanisms in crystalline materials.

**Fatigue:** Definition of Fatigue, types of fatigue loading, mechanism of fatigue failure, fatigue properties, SN diagram, factors affecting fatigue strength

- Pedagogy/Course delivery tools: Chalk and talk, Power point presentation, animated videos
- Links: Plastic deformation of metals by Slip and Twinning:  
<https://www.youtube.com/watch?v=LifLDNdtpU>
- Links: Fatigue cycles: <https://www.youtube.com/watch?v=OlexdbPETPw>

## Unit III

**Fracture and Creep** Fracture, types, transition from ductile to brittle fracture. Creep Definition, three stages of creep, creep properties, Creep mechanisms

**Solidification & Solid solutions:** Nucleation, homogeneous & heterogeneous nucleation, crystal growth, cast metal structures. Solid solutions, Types, Rules governing the formation of solids solutions.

- Pedagogy/Course delivery tools: Chalk and talk, Power point presentation, animated videos
- Links: Creep: <https://www.youtube.com/watch?v=zH05sDLKMoU>
- Links: Nucleation: <https://www.youtube.com/watch?v=Od5yTl7aK4>

#### Unit IV

**Phase diagrams:** Basic terms, phase rule, Lever rule, cooling curves, construction of phase diagrams, Types of phase diagrams, interpretation of equilibrium diagrams eutectic, eutectoid, peritectic & peritectoid, problems in phase diagrams.

**Iron carbon equilibrium diagram& TTT diagram:** Equilibrium phases in the FeC system, Microstructure of slowly cooled steels, TTT diagram, construction of TTT diagram, Superimposing cooling curves on TTT diagram, nonequilibrium phases in Fe-C system,

- Pedagogy/Course delivery tools: Chalk and talk, Power point presentation, animated videos
- Links: Phase Diagrams: <https://www.youtube.com/watch?v=7hmF3WoQkTg>
- Links: Iron carbon equilibrium diagram: <https://www.youtube.com/watch?v=Izhv87GIL4U>

#### Unit V

**Heat Treatment:** Annealing and its types, Normalizing, Hardening, Tempering, Martempering, Austempering, Surface hardening like case hardening, carburizing, cyaniding, nitriding, Induction hardening, Age hardening taking the example of duralumin.

**Alloys and composites:** Ferrous alloys and its classification, Important Aluminum, Magnesium, Titanium and Copper alloys. Composites materials and its classification, advantages, and applications of composites.

- Pedagogy/Course delivery tools: Chalk and talk, Power point presentation, animated videos
- Links: Heat Treatment types: <https://www.youtube.com/watch?v=8H3TiUUks8>
- Links: Composite Materials: <https://www.youtube.com/watch?v=wrnuljdwjpo>

#### Text Books:

1. Introduction to Material Science for Engineering, 6<sup>th</sup> edition, James F.Shackel Ford, Pearson, Prentice Hall, New Jersey, 2006.
2. Physical Metallurgy, Principles & Practices, V.Raghavan, PHI, 2<sup>nd</sup> edition, 2006, New Delhi.

**Reference Books:**

1. Materials Science & Engineering An Introduction, William D.Callister Jr., Wiley, India Pvt. Ltd., 6<sup>th</sup> edition, 2006, New Delhi.
2. Essentials of Materials for Science and Engineering, Donald R. Askeland, Pradeep P.Phule Thomson Engineering, 2<sup>nd</sup> edition 2006
3. Foundation of Material Science and Engineering, Smith, 3<sup>rd</sup>Edition, McGraw hill,1997 edition.

**Course Outcomes (COs):**

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

1. Discuss the concept of crystal structure, crystal imperfections and Mechanical properties in metals. [PO1, PO2, PO4, PO7, PO8, PO11, PSO1, PSO2]
2. Explain the concept of true stress and true strain, plastic deformation and various modes of failure. [PO1, PO2, PO4, PO7, PO8, PO11, PSO2]
3. Summarize the solidification of metals and alloys and classify draw phase diagrams. [PO1, PO2, PO4, PO7, PO8, PO11, PSO1, PSO2]
4. Distinguish between various heat treatment processes for metals and alloys [PO1, PO2, PO4, PO7, PO8, PO11, PSO1, PSO2]
5. Examine composite manufacturing processes and list advantages and applications of engineering and composite materials [PO1, PO2, PO4, PO7, PO8, PO11, PSO1, PSO2]

**Course Assessment and Evaluation:**

<b>Continuous Internal Evaluation (CIE): 50 Marks</b>		
<b>Assessment tool</b>	<b>Marks</b>	<b>Course outcomes addressed</b>
Internal test-I	30	CO1, CO2
Internal test-II	30	CO3, CO4, CO5
Average of the two internal tests will be considered for evaluation of 30 Marks		
<b>Other components 20 Marks</b>		
Assignment	10	CO1, CO2, CO3
Surprise test	10	CO4, CO5
<b>Semester-End Examination (SEE)</b>	100	CO1, CO2, CO3, CO4, CO5

## MATERIALS TESTING LABORATORY

<b>Course Code:</b> MEL36	<b>Credits:</b> 0:0:1
<b>Pre – requisites:</b> Nil	<b>Contact Hours:</b> 14P
<b>Course Coordinator:</b> Dr. Girish V Kulkarni	

### Part A

#### Conduct the following experiments

1. Rockwell Hardness Test
2. Brinell Hardness Test
3. Vickers Hardness Test (Demo)
4. Charpy Impact Test
5. Izod impact test
6. Study of Metallurgical Microscope – Calibration of eyepiece reticle
7. Microstructure Examination

### Part B

#### Conduct the following experiments

1. Tensile Test
2. Compression Test
3. Shear Test
4. Bending Test
5. Torsion Test
6. Wear Test
7. Fatigue Test (Demo)

#### Reference Books:

1. Mechanics of materials James M. Gere, Barry J. Goodno Publication CL Engineering; 8 edition, 2012. [PO1,PO3,PO7,PO8,PO10, PO12,PSO1 &PSO2]
2. Materials Science & Engineering An Introduction, William D.Callister Jr. Publication Wiley, 9 edition , 2013 [PO1, PO3, PO7, PO8, PO10, PO12, PSO1, PSO2]
3. Materials testing laboratory manual, Department of Mechanical Engineering, MSRIT [PO1, PO3, PO7, PO8, PO10, PO12, PSO1, PSO2]

### Web Links and Video Lectures:

1. <https://smnitk.vlabs.ac.in/exp/rockwellhardnesstest/videos.html>
2. <https://smnitk.vlabs.ac.in/exp/brinellhardnesstest/videos.html>
3. <https://smnitk.vlabs.ac.in/exp/vickershardnesstest/videos.html>
4. <https://smnitk.vlabs.ac.in/exp/charpyimpacttest/videos.html>
5. <https://smnitk.vlabs.ac.in/exp/izodimpacttest/videos.html>
6. <https://smnitk.vlabs.ac.in/exp/tensiletestmildsteel/videos.html>
7. <https://smnitk.vlabs.ac.in/exp/compressiontestmildsteel/videos.html>
8. <https://smnitk.vlabs.ac.in/exp/directshearteststeelrod/videos.html>
9. <https://smnitk.vlabs.ac.in/exp/bendingtestmildsteel/videos.html>
10. <https://smnitk.vlabs.ac.in/exp/torsiontestmildsteel/videos.html>

### Course Outcome (COs):

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

1. Demonstrate the knowledge and the skills required with respect to the procedure conduction and analysing the results with respect to Tensile, Shear and Compression, Torsion Test, Bending Test etc.
2. Knowledge of various heat treatment processes, hardness test, and wear test.
3. Microstructures examination and identification of metals.

### Course Assessment and Evaluation:

<b>Continuous Internal Evaluation (CIE): 50 Marks</b>		
<b>Assessment Tool</b>	<b>Marks</b>	<b>Course Outcomes addressed</b>
Weekly evaluation of laboratory journals/ reports after the conduction of every experiment	30	CO1, CO2, CO3
Practical Test	20	CO1, CO2, CO3
<b>Semester-End Examination (SEE)</b>	50	CO1, CO2, CO3



## COMPUTER AIDED MACHINE DRAWING

<b>Course Code:</b> MEL37	<b>Credits:</b> 0:0:1
<b>Pre – requisites:</b> CAED	<b>Contact Hours:</b> 14P
<b>Course Coordinator:</b> Dr. C M Ramesha	

Drawing is the language of engineers. It is true for Mechanical Engineers. Mechanical Engineers have the important task of converting concepts into reality. The job of a mechanical engineer becomes easy if he can clearly understand the drawing released by the design department. The basic objective of Machine drawing is to create and release drawings, which are unambiguous, crisp and clear to the personnel on the shop floor.

### PART A

**Systems of dimensioning:** Linear, Radial, Angular, Ordinate, Arc length, Baseline and Continued, Concepts of Limits Fits and Tolerance.

**3D Modeling and Orthographic Views:** Conversion of Pictorial Views into 3D Models and converting 3D Models into Orthographic projections (Drafting) of simple machine parts with and without section, (ISO - Technical Drawings and Specifications) Hidden Lines. (3D CAD Software)

**Sections of Solids:** Sections of pyramids, prisms, cubes, cones and cylinders resting only on their bases (HP only). (No problems on axis inclinations, spheres and hollow solids). The true shape of sections. (3D CAD Software)

- Pedagogy/Course delivery tools: Chalk and talk, Powerpoint presentation, Animated videos
- Lab Component / Practical Topics: Machine Components in Machine Shop
- Links: <https://www.youtube.com/watch?v=3j2YEuTiAOc>
- Links: <https://www.youtube.com/watch?v=AzFz8A5HgiQ>

### Part B

**Parametric Modeling:** Parametric Modeling of simple machine parts (Sketch Work – Show orthographic views only) with parametric equations. Input based on Excel Sheet. (3D CAD Software)

- Pedagogy/Course delivery tools: Chalk and talk, powerpoint presentation, Animated videos

- Lab Component / Practical Topics: Creation of 3D CAD Model Creation of parametric models
- Links: <https://www.youtube.com/watch?v=JvsJf1huMXQ>
- Links: <https://www.youtube.com/watch?v=SDFjnAsBqLU>

### **Part C**

**Assembly Drawings** – Wheel Assembly, Screw Jack, Plummer Block. (3D CAD Software)

- Pedagogy/Course delivery tools: Chalk and talk, Powerpoint presentation, Animated videos
- Lab Component / Practical Topics: Subassemblies in Machines at Machine Shop
- Links: <https://www.youtube.com/watch?v=mSWGCPZW3xg>
- Links: [https://www.youtube.com/watch?v=b6h\\_ZiGoLY0](https://www.youtube.com/watch?v=b6h_ZiGoLY0)

#### **Textbooks:**

1. Computer Aided Machine Drawing K.R. Gopalakrishna, Subhash Publications, 2<sup>nd</sup> edition 2012.
2. Computer Aided Machine Drawing, Tryambaka Murthy.

#### **Reference Book:**

1. SOLIDWORKS 2021 for Designers, 19th Edition Paperback – 8 February 2021, Publisher : CADCIM Technologies (8 February 2021), Language : English, Paperback : 1040 pages, ISBN10 : 1640571035, ISBN13 : 9781640571037

#### **Course Outcome (COs):**

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

1. Acquire the skills needed to draw the orthographic and sectional views of the solid and develop its lateral surface.
2. Create 3D Models and Present sectional view, orthographic views and Isometric views of the part that can be read by a shop floor engineer.
3. Create and assemble the 3D part models using a CAD tool and draw the sectional view, orthographic views, and Isometric view of the assembly including the bill of materials, section plane, and ballooning.

## Course Assessment and Evaluation

<b>Continuous Internal Evaluation (CIE): 50 Marks</b>		
<b>Assessment tool</b>	<b>Marks</b>	<b>Course outcomes addressed</b>
Internal Test	20	CO1, CO2, CO3
Assignment, Sketch Work and Printout	30	CO1, CO2, CO3
<b>Semester-End Examination (SEE)</b>	50	CO1, CO2, CO3

**Exam Pattern - Answer any ONE out of TWO Questions from PART A, B and C  
Part A 10 Marks; Part B 10 Marks; Part C 30 Marks; Total 50 Marks  
Duration of Exam: 3Hrs**

# UNIVERSAL HUMAN VALUES

<b>Course Code:</b> UHV38	<b>Credits:</b> 2:0:0
<b>Pre – requisites:</b> Nil	<b>Contact Hours:</b> 42L
<b>Course Coordinator:</b> Dr. R Kumar	

## Course content

### Unit I

#### Course Introduction - Need, Basic Guidelines, Content and Process for Value Education

1. Understanding the need, basic guidelines, content and process for Value Education
  2. Self-Exploration–what is it? - its content and process; ‘Natural Acceptance’ and Experiential Validation- as the mechanism for self-exploration
  3. Continuous Happiness and Prosperity- A look at basic Human Aspirations
  4. Right understanding, Relationship and Physical Facilities- the basic requirements for fulfillment of aspirations of every human being with their correct priority
  5. Understanding Happiness and Prosperity correctly- A critical appraisal of the current scenario
  6. Method to fulfill the above human aspirations: understanding and living in harmony at various levels
- Pedagogy / Course delivery tools: Chalk and talk, Power point presentation, Videos.
  - Lab component / Practical Topics: Survey/polls for self-exploration
  - Links: Holistic Development and Role of Education <https://youtu.be/sGZtTPe-lhQ>

### Unit II

#### Understanding Harmony in the Human Being - Harmony in Myself!

- 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 Body as an instrument of ‘I’ (I being the doer, seer and enjoyer)
- Understanding the characteristics and activities of ‘I’ and harmony in ‘I’
- 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*

Practice Exercises and Case Studies will be taken up in Practice Sessions.

- Pedagogy / Course delivery tools: Chalk and talk, Power point presentation, Videos.
- Lab component / Practical Topics: Survey/polls for self-exploration
- Links: Harmony in Human Being- Self and Body  
<https://youtu.be/0ERSMkRPQBM>  
Links: Harmony in Human Being- Self <https://youtu.be/83oGJ4oDeIg>  
Links: Harmony between Self and Body Prosperity  
[https://youtu.be/aJ\\_BU2OgpKs](https://youtu.be/aJ_BU2OgpKs)

### Unit III

#### Understanding Harmony in the Family and Society- Harmony in Human- Human Relationship

1. *Understanding Harmony in the family – the basic unit of human interaction*
2. Understanding values in human-human relationship; meaning of *Nyaya* and program for its fulfillment to ensure *Ubhay-tripti*; Trust (*Vishwas*) and Respect (*Samman*) as the foundational values of relationship
3. Understanding the meaning of *Vishwas*; Difference between intention and competence
4. Understanding the meaning of *Samman*, Difference between respect and differentiation; the other salient values in relationship
5. Understanding the harmony in the society (society being an extension of family): *Samadhan, Samridhi, Abhay, Sah-astitva* as comprehensive Human Goals
6. Visualizing a universal harmonious order in society- Undivided Society (*Akhand Samaj*), Universal Order (*Sarvabhaum Vyawastha* )- from family to world family!

Practice Exercises and Case Studies will be taken up in Practice Sessions.

- Pedagogy / Course delivery tools: Chalk and talk, Power point presentation, Videos.
- Lab component / Practical Topics: Survey/polls for self-exploration
- Links: Harmony in Family- Trust <https://youtu.be/F2KVVW4WNnS8>  
Links: Harmony in family- Respect [https://youtu.be/iLqNRPUv0\\_8](https://youtu.be/iLqNRPUv0_8)  
Links: Harmony in family- Other Feeling Justice <https://youtu.be/TcYJB7reKnM>  
Links: Harmony in the Society <https://youtu.be/BkWgFinrnPw>

## Unit IV

### Understanding Harmony in the Nature and Existence - Whole existence as Co-existence

1. Understanding the harmony in the Nature
2. Interconnectedness and mutual fulfillment among the four orders of nature-recyclability and self-regulation in nature
3. Understanding Existence as Co-existence (*Sah-astitva*) of mutually interacting units in all-pervasive space
4. Holistic perception of harmony at all levels of existence

Practice Exercises and Case Studies will be taken up in Practice Sessions.

- Pedagogy / Course delivery tools: Chalk and talk, Power point presentation, Videos.
- Lab component / Practical Topics: Survey/polls for self-exploration
- Links: Harmony in Nature [https://youtu.be/K1Jpd\\_ojydw](https://youtu.be/K1Jpd_ojydw)
- Links: Harmony in Existence [https://youtu.be/mormUeZ\\_RUE](https://youtu.be/mormUeZ_RUE)

## Unit V

### Implications of the above Holistic Understanding of Harmony on Professional Ethics

- Natural acceptance of human values
  - Definitiveness of Ethical Human Conduct
  - Basis for Humanistic Education, Humanistic Constitution and Humanistic Universal Order
  - Competence in professional ethics:
- A. Ability to utilize the professional competence for augmenting universal human order
  - B. Ability to identify the scope and characteristics of people-friendly and eco-friendly production systems,
  - C. Ability to identify and develop appropriate technologies and management patterns for above production systems.
    - Case studies of typical holistic technologies, management models and production systems
    - Strategy for transition from the present state to Universal Human Order:
- A. At the level of individual: as socially and ecologically responsible engineers, technologists and managers
  - B. At the level of society: as mutually enriching institutions and organizations

### Suggested Learning Resources:

- Pedagogy / Course delivery tools: Chalk and talk, Power point presentation, Videos.
- Lab component / Practical Topics: Survey/polls for self-exploration

### Text Books:

1. **R.R Gaur, R Sangal, G P Bagaria**, A foundation course in Human Values and professional Ethics, Excel books, New Delhi, 2010, ISBN 978-8-174-46781-2

### Reference Books:

1. **B L Bajpai**, 2004, *Indian Ethos and Modern Management*, New Royal Book Co., Lucknow. Reprinted 2008.
2. **PL Dhar, RR Gaur**, 1990, *Science and Humanism*, Commonwealth Publishers.
3. **Sussan George**, 1976, *How the Other Half Dies*, Penguin Press. Reprinted 1986, 1991
4. **Ivan Illich**, 1974, *Energy & Equity*, The Trinity Press, Worcester, and HarperCollins, USA
5. **Donella H. Meadows, Dennis L. Meadows, Jorgen Randers**, William W. Behrens III, 1972, *limits to Growth*, Club of Rome's Report, Universe Books.
6. **Subhas Palekar**, 2000, *How to practice Natural Farming*, Pracheen(Vaidik) Krishi Tantra Shodh, Amravati.
7. **A Nagraj**, 1998, *Jeevan Vidya ek Parichay*, Divya Path Sansthan, Amarkantak.
8. **E.F. Schumacher**, 1973, *Small is Beautiful: a study of economics as if people mattered*, Blond & Briggs, Britain.
9. **A.N. Tripathy**, 2003, *Human Values*, New Age International Publishers.

### Web links and Video Lectures (e-Resources):

1. [https://www.youtube.com/channel/UCQxWr5QB\\_eZUnwxSwxXEKQw](https://www.youtube.com/channel/UCQxWr5QB_eZUnwxSwxXEKQw)
2. <https://www.youtube.com/watch?v=P4vjfE-YnVk&list=PLWDeKF97v9SP7wSlapZcQRrT7OH0ZIGC4>
3. **Course handouts:**  
[https://drive.google.com/drive/folders/1zioX\\_4L2fCNX4Agw282PN86pcZZT3Osr?usp=sharing](https://drive.google.com/drive/folders/1zioX_4L2fCNX4Agw282PN86pcZZT3Osr?usp=sharing)
4. **Presentation slides:**  
[https://drive.google.com/drive/folders/1rMUKh1s0HPRBlpp\\_b1mpS-duNRcwS6YH?usp=sharing](https://drive.google.com/drive/folders/1rMUKh1s0HPRBlpp_b1mpS-duNRcwS6YH?usp=sharing)

### Course Outcomes (COs):

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

1. Apprehend the need of Value Education over Human aspirations (PO-6)
2. Assimilate Harmony over the physical needs and to overcome the self- needs for a prosperous life. (PO-6)
3. Recognize the need of Harmony in the Family and Society for a better World. (PO-6)
4. Explain the need of mutual understanding for Holistic Harmony in all the Levels of Human Existence. (PO-6)
5. Explain the Holistic understanding of Harmony and Professional Ethics at Individual Level and Society. (PO-6, PO-8)

### Course Assessment and Evaluation:

<b>Continuous Internal Evaluation (CIE)</b>		
<b>Assessment Tool</b>	<b>Marks</b>	<b>Course outcomes addressed</b>
Internal test-I	30	CO1, CO2, CO3
Internal test-II	30	CO3, CO4, CO5
Average of the two internal tests will be taken for 30 marks.		
<b>Other components</b>		
<ul style="list-style-type: none"><li>• Assignment</li><li>• Quiz</li><li>• Presentation</li><li>• Model / mini project</li><li>• Any other</li></ul>	20 (10 + 10)	CO1, CO2, CO3, CO4, CO5
<b>Semester End Examination (SEE)</b>	100 (Scale down to 50 Marks)	CO1, CO2, CO3, CO4, CO5



# CONSTITUTION OF INDIA AND PROFESSIONAL ETHICS

<b>Course Code:</b> HS392	<b>Credits:</b> 1:0:0
<b>Pre – requisites:</b> Nil	<b>Contact Hours:</b> 14L
<b>Course Coordinator:</b> Mrs. Kanya Kumari S	

## Course Content

### Unit I

#### Introduction to the Constitution of India

Meaning and Significances of the Constitution, making of the Indian Constitution and its salient features, Preamble of the Constitution, Fundamental Rights and relevant cases.

- Pedagogy/Course delivery tools: Chalk and Talk, power point presentation

### Unit II

#### Relevance of Directive Principles of State Policy -part-IV

Fundamental Duties & their significance. Special constitutional provisions for the betterment of Women, children and backward classes in India.

- Pedagogy/Course delivery tools: Chalk and Talk, power point presentation

### Unit III

#### Union executive and State executive

President of India, Vice President, Prime Minister & Council of Ministers. The Union Legislature, Compositions & the functions of Parliament and the Supreme court of India -composition & Jurisdictions

State executive-Governor, Chief Minister& council of Ministers, State legislature-composition & functions of legislative assembly& legislative council and State Judiciary.

- Pedagogy/Course delivery tools: Chalk and Talk, power point presentation

### Unit IV

#### Local self-Governments, Emergency provisions, Electoral process & Major Constitutional Amendments

Local Self Governments- Panchayath Raj system, Emergency provisions, election commission of India & Electoral process, Amendment procedure and Major Constitutional amendments.

- Pedagogy/Course delivery tools: Chalk and Talk, power point presentation

## Unit V

### Human Rights and Professional Ethics

Human Rights - meaning and significances of Human Rights. Universal Declaration of Human Rights (UDHR) protection of Human Rights in Indian Context. Scope and Aim of Ethics. Responsibility of Engineers, impediment to Responsibility.

- Pedagogy/Course delivery tools: Chalk and Talk, power point presentation

#### Text Books:

1. A Primer on Constitution of India & Professional ethics, VTU Publication-2007.

#### Reference Books:

1. Durga Das Basu,- ' Introduction to Constitution of India' - 19<sup>th</sup> /20<sup>th</sup> edition 2001
2. M.V.Pylee.- ' An Introduction to Constitution of India, 4<sup>th</sup> edition, 2008
3. Dr. K. R. Phaneesh,- 'Constitution of India & Professional ethics' –Sudha publication, Tenth revised edition 2018.

#### Course outcomes (COs):

At the end of the course students will be able to

1. Identify the fundamental principles of Indian constitution. (PO-12)
2. Examine various provisions of the Directive principles of state policies and fundamental duties. (PO-6, PO-12)
3. Understand the powers & functions of executive, Legislature and judicial system at the center and state level. (PO-6, PO-12)
4. Identify the role of government. (PO-12)
5. Understand about basic Human rights in India (PO-6, PO-8, PO-12)

#### Course Assessment and Evaluation:

<b>Continuous Internal Evaluation (CIE): 50 marks</b>		
<b>Assessment tool</b>	<b>Marks</b>	<b>Course outcome attained</b>
Internal test-I	30	CO1, CO2, CO3
Internal test-II	30	CO4, CO5
Average of the two internal tests will be taken for 30 marks.		
<b>Other components</b>		
Assignment	10	CO1, CO2
quiz	10	CO3, CO4, CO5
<b>Semester End Examination (SEE)</b>	100	CO1, CO2, CO3, CO4, CO5

### ABILITY ENHANCEMENT COURSE - III

<b>Course Code:</b> AEC310	<b>Credits:</b> 1:0:0
<b>Pre – requisites:</b> Nil	<b>Contact Hours:</b> 14L
<b>Course Coordinator:</b> Dr. Rama Shivakiran Reddy	

Ability Enhancement Courses (AEC) are the generic skill courses which are basic and needed by all to pursue any career. These courses are designed to help students enhance their skills in communication, language, and personality development. They also promote a deeper understanding of subjects like social sciences and ethics, culture and human behaviour, human rights and the law.

Every student shall register for AEC course under the supervision of his/her proctor. For III, IV & V semester, the student shall select the Ability Enhancement Course online such that the selected course does not overlap with any professional core/ elective course offered by the parent department of the student. After selection, the registration of the course has to be done by the student at his/her parent department.

## PHYSICAL EDUCATION

<b>Course Code:</b> PE83	<b>Credits:</b> NCMC
<b>Pre – requisites:</b> Nil	
<b>Course Coordinator:</b> Dr. Kiran Kumar H K	

### Course Learning Objectives:

1. To introduce students to the importance of physical fitness for success in any career.
2. To instill in them concepts of team spirit and team building
3. To develop positive thinking, goal setting and decision-making abilities under duress.
4. To harness values and skills like leadership, communication and sacrifice.
5. To inculcate in students, the ability to handle success and failures with equanimity.

**Selection Process:** A Student shall select any one of the following Sports based on his/her interest and the facility available. The details of **Sports Facilities available (both indoor and outdoor) at institute campus** are as below:

Outdoor Games		Indoor Games		Athletics	
Games	No. of Students	Games	No. of Students	Events	No. of Students
Volleyball	12 x 4 = 48	Badminton	30	Sprint - 100mt, 200mt, 400mt	60
Basketball	12 x 4 = 48	Table Tennis	30	Middle distance running – 800mt, 1,500mt	
Kabaddi	12 x 4 = 48	Chess	30	Long distance running – 5,000mt, 10,000mt	
Kho Kho	12 x 4 = 48	Weight Training [Gym]	35	Jumping Events – Long Jump Triple Jump High Jump	30
Throw ball	12 x 4 = 48			Throwing Events Shot Put Discuss Javelin	30
Football	16 x 4 = 64	<b>Note: Students should bring their own sports attires</b>			
Hockey	16 x 4 = 64				
Cricket	16 x 4 = 64				

**Contact Sessions:** A student shall abide by the following during the sessions scheduled in the semester.

### **Session 1**

Fundamentals of Physical Education, value addition to personality through fitness education, discipline and team building activities, Orientation towards particular sports and skill training

### **Session 2**

Formation of teams based on student's orientation and preference. Team practice and skill enhancement.

### **Session 3**

Conduction of matches in all sporting events registered by Students. Evaluation of each student shall be based on their performance either in team or individual. The student representing the Institute at University/State/National/International Level will be awarded additional marks during evaluation.

### **Course Outcomes (COs):**

1. Develop interest and skill in playing particular sports.
2. Understand the process of organizing sporting events.
3. Appreciate the role of fitness for a better lifestyle.
4. Derive lessons from sports activities for effective planning and discipline in Life.
5. Analyze situations and optimize end results.

### **Course Assessment & Evaluation:**

1. A committee consisting of Sports Director and Coaches of respective Sports will be formed to observe and evaluate the students for CIE in each semester.
2. Students shall follow the schedules, rules and regulations as prescribed by the Committee.
3. Students shall mandatorily have 85% attendance to be eligible for evaluation.
4. All the Sessions and evaluation process will be common for all semesters of the academic year.
5. The final result will be reflected on the grade card of 8<sup>th</sup> Semester.
6. The final marks shall be calculated after scaling down CIE to 50 marks & combining with 50 marks for SEE.

<b>YOGA</b>	
<b>Course Code:</b> YO83	<b>Credits:</b> NCMC
<b>Pre – requisites:</b> Nil	
<b>Course Coordinator:</b> Dr. Hari Chandra B P & Dr. Parimala P	

### **Course Learning Objectives:**

1. To introduce to the students, the fundamental theoretical aspects of yoga.
2. To inculcate in students a habit of practicing yoga.
3. To be able to demonstrate basic yoga asanas.
4. To be able to practice fundamental breathing practices and mudras.
5. To understand the relevance of yoga and research in modern times.

### **Course Content**

**Introduction:** Definition of yoga, benefits, astangas of yoga, Relevance of yoga and yoga-research in modern times.

**Asanas:** Kriyathmakachalanas, Suryanamaskar, Superbrain yoga, Vrikshasana, Trikonasana, Veerabhadrasana, Paschimotasana, Purvothanasana, Bharadwajasana, Amruthasana, Parivruttha Trikonasana, Parsvakonasana, Ustrasana, Padmasana, Jaaanushirshasana, Navasana, Ardachakrasana, Ardhatichakrasana, Jataraparivarthanasana, Sethubandasana, Sarvangasana, Mathyasana, Dhanurasana, Shirshasana.

**Pranayamas:** Anuloma-Viloma, Suryanuloma, Chandranuloma, Brahmari, Suryanbedhana, Chandrabedhana, Sheetal, Seethkari, Sadantha, bastrika.

**Mudras:** Chinmudra-Jnanamudra, Praana mudra, panchaprana mudras, panchabhoota mudras, Pruthvi mudra, Shoonya mudra, Surya mudra, Jalodharanashaka mudra, Kundalini mudra, shoonyaavaayu mudra, shakti mudra, sandhi mudra, vajra mudra and garuda mudra.

### **Course Outcomes (CO's):**

At the end of the course, a student will

1. Understand the fundamental and theoretical aspects of yoga.
2. Develop a habit of practicing yoga.
3. Demonstrate basic yoga asanas.
4. Demonstrate fundamental breathing practices.
5. Understand the relevance of yoga and its research in modern times.

### **Reference books:**

1. Light on yoga, B K S Iyengar, Publisher -Thorsons, UK, 2006

2. Light on pranayama, B K S Iyengar, Publisher - Element; First Edition
3. The Essential Yoga Mudras for Healing, Dr. Aasoori K. Rangaraja Iyengar, Saranga Publishing; First Edition 2021

**Pedagogy:**

Chalk and talk, demonstration, videos, ppt.

**Contact Sessions:**

There would be one introduction class, and five contact classes in each semester.

The candidates shall practice yoga on a daily basis, or in the worst case on alternate days at their place of residence and maintain a short diary in the format provided by yoga teacher. The same shall be brought to the classes.

**Online reference sources:**

- Yoga for beginners part 1: <https://www.youtube.com/watch?v=VwPeThpwfWI>
- Yoga for beginners part 2: [https://www.youtube.com/watch?v=s\\_pnJTcOp8A](https://www.youtube.com/watch?v=s_pnJTcOp8A)
- Suryanamaskar: <https://www.youtube.com/watch?v=nUdlucNd6go&t=133s>
- Yoga for anxiety and stress: [https://www.youtube.com/watch?v=hJbRpHZr\\_d0](https://www.youtube.com/watch?v=hJbRpHZr_d0)
- Common yoga protocol: [https://www.youtube.com/watch?v=Av5ib\\_XRKT4](https://www.youtube.com/watch?v=Av5ib_XRKT4)
- Relevance of yoga in modern times:  
[www.youtube.com/watch?v=HUzBCts7BT0](http://www.youtube.com/watch?v=HUzBCts7BT0)

**Course Assessment & Evaluation:**

1. A committee consisting of Yoga Instructors will be formed to observe and evaluate the students for CIE in each semester.
2. Students shall follow the schedules, rules, and regulations as prescribed by the Committee.
3. Students shall mandatorily have 85% attendance to be eligible for evaluation.
4. All the Sessions and evaluation processes will be common for all semesters of the academic year.
5. The final result will be reflected on the grade card of 8<sup>th</sup> Semester.
6. The final marks shall be calculated after scaling down CIE to 50 marks & combining it with 50 marks for SEE.

**Scheme of SEE**

Practical Demonstration	30 marks
Write-up	10 marks
Viva	10 marks
<b>Total</b>	<b>50 marks</b>

## NATIONAL SERVICE SCHEME

<b>Course Code:</b> NS83	<b>Credits:</b> NCMC
<b>Pre – requisites:</b> Nil	
<b>Course Coordinator:</b> Dr. Puttabore Gowda & Dr. Siddaraju C	

### Course Learning Objectives:

1. To introduce students to the importance of national service
2. To harness values and skills like leadership, teamwork and sacrifice.
3. To serve society through educational services and health
4. To work towards rural and local development through technological services
5. To inculcate in students, the ability to handle socially relevant projects.

### Students shall involve in activities related to national and regional technical and non-technical services, as listed below.

- Serving society by bringing awareness on education and cleanliness.
- Blood donation camps
- Developing technologies for rural masses.
- Conduction and participation in camps for a social cause.
- Educating towards health and well-being of individuals/society.
- Cultural and educational programs for society.
- Contributing towards the improvement of civil services and bringing certain shortcomings to the notice of higher authorities for suitable remedial actions.
- Contribution towards traffic management and other public services.
- Clean up and development of water sources around public places.
- Services during a disaster or other needy situations.
- Camps for the rejuvenation of lakes and water bodies.
- Serving nature and agriculture.
- Awareness programs on health and food adulteration.
- Presenting papers/talks in various fora on the above topics.
- Developing technologies for rural masses beyond academic requirements.
- Plantation programs.
- Conducting programs for self-sustainability, and human and national development.
- Contribution towards orphans and challenged individuals through well-recognized organizations.
- Carrying out designated activities in villages.



- Development and implementation of strategies for solid waste, E-waste etc.
- Education towards pollution control and traffic management.
- Production of documentaries and short films/videos for motivating people on any of the above causes.

### **Course Outcomes (CO's):**

At the end of the course, a student will be able to

1. Understand the importance of national service.
2. Gain skills like leadership and teamwork.
3. Volunteer towards educational services and health.
4. Contribute to rural and local development through technical services.
5. Comprehend socially relevant projects

### **Contact Sessions:**

The students shall attend the review and contact sessions as scheduled by the course coordinator.

### **Course Assessment & Evaluation:**

1. The candidates shall maintain a record of activities in a Diary, and get them endorsed during the contact sessions at least 3 times in a semester.
2. A detailed project report should be submitted during the last fortnight of the semester
3. Evaluation will be done during each semester based on the nature of the contribution.
4. The final marks shall be calculated after scaling down CIE to 50 marks & combining with 50 marks for SEE

## ADDITIONAL MATHEMATICS – I

<b>Course Code:</b> AM31	<b>Credits:</b> 0:0:0
<b>Pre – requisites:</b> Nil	<b>Contact Hours:</b> 42L
<b>Course Coordinator:</b> Dr. Shashi Prabha Gogate S	

### Course Content

#### Unit I

**Differential Calculus:** Successive differentiation, nth derivatives of some standard functions, Leibnitz theorem, Polar curves. Angle between the radius vector and the tangent, angle between curves, length of the perpendicular from pole to the tangent, pedal equations. Taylor’s and Maclaurin’s expansions.

- Pedagogy/Course delivery tools: Chalk and Talk
- Links: <https://nptel.ac.in/courses/111/105/111105121/>  
<https://nptel.ac.in/courses/111/104/111104144/>
- Impartus recording: <https://a.impartus.com/ilc/#/course/107625/1030>

#### Unit II

**Integral Calculus:** Introduction, Reduction formula, Reduction formula for  $\int \sin^n x \, dx$ ,  $\int \cos^n x \, dx$  and  $\int \sin^n x \cos^m x \, dx$ . Evaluation of double and triple integrals.

- Pedagogy/Course delivery tools: Chalk and Talk
- Links: <https://nptel.ac.in/courses/111/105/111105121/>
- <https://a.impartus.com/ilc/#/course/107625/1030>

#### Unit III

**Vector Algebra:** Scalar and vectors. Vector addition and subtraction. Multiplication of vectors (Dot and Cross products). Scalar and vector triple product-simple problems. Vector functions of a single variable. Derivative of a vector function, geometrical interpretation. Velocity and acceleration.

- Pedagogy/Course delivery tools: Chalk and Talk
- Links: <https://nptel.ac.in/courses/111/105/111105134>
- Impartus recording: <https://a.impartus.com/ilc/#/course/107625/1030>

#### Unit IV

**Vector Differentiation:** Scalar and vector fields, gradient of a scalar field, directional derivative, divergence of a vector field, solenoidal vector, curl of a vector field,

irrotational vector. Laplace's operator. Vector identities connected with gradient, divergence and curl.

- Pedagogy/Course delivery tools: Chalk and Talk
- Links: <https://nptel.ac.in/courses/111/105/111105134>
- Impartus recording: <https://a.impartus.com/ilc/#/course/107625/1030>

### Unit V

**First Order Differential Equations:** Solution of first order and first degree differential equations, variable separable methods, homogeneous equations, linear and Bernoulli's equations, exact differential equations.

- Pedagogy/Course delivery tools: Chalk and talk, Power Point Presentation
- Links: <https://nptel.ac.in/courses/111/105/111105121/>
- Impartus recording: <https://a.impartus.com/ilc/#/course/59742/295>

#### Text Books:

1. **B.S. Grewal** – Higher Engineering Mathematics, Khanna Publishers, 44<sup>th</sup> edition, 2017.
2. **Erwin Kreyszig** – Advanced Engineering Mathematics – Wiley Publication, 10<sup>th</sup> Edition, 2015.

#### Reference Books:

1. **H. K. Dass** – Higher Engineering Mathematics – S Chand Publications, 1998.
2. **B. V. Ramana** – Engineering Mathematics – Tata McGraw-Hill Publishing Co. Ltd., New Delhi, 2008.

#### Course Outcomes (COs):

At the end of the course the student will be able to

1. Solve problems related to nth derivative to some standard functions, polar curves and power series expansions.
2. Apply the concept of reduction formula to determine the length, area, volume of revolution of an arc of the curve.
3. Solve the problems related to velocity and acceleration.
4. Apply vector differentiation to identify solenoidal and irrotational vectors.
5. Apply the concept of various methods to solve first order first degree differential equations.

## IV SEMESTER

NUMERICAL METHODS, COMPLEX ANALYSIS AND PROBABILITY METHODS	
Course Code: ME41	Credits: 2:1:0
Pre – requisites: Calculus & Probability	Contact Hours: 28 L+14T = 42
Course Coordinator: Dr G Neeraja, Dr Vijay Kumar & Dr A Sreevallabha Reddy	

### Unit I

**Finite Differences and Interpolation:** Forward and backward differences, Interpolation, Newton Gregory forward and backward interpolation formulae, Lagrange's interpolation formula, Newton's divided difference interpolation formula (no proof).

**Numerical Differentiation and Numerical Integration:** Derivatives using Newton Gregory forward and backward interpolation formulae, Newton Cote's quadrature formula, Trapezoidal Rule, Simpson's (1/3)rd rule, Simpson's(3/8)th rule

- Pedagogy/Course delivery tools: Chalk and talk, PowerPoint Presentation, Videos
- Links: <https://nptel.ac.in/courses/111/106/111106101/>
- Impartus recording: <https://a.impartus.com/ilc/#/course/96127/452>

### Unit II

**Statistics:** Curve fitting by the method of least squares, Fitting linear, quadratic and geometric curves. Correlation and Regression, Multiple regression.

**Probability Distributions:** Random variables. Binomial distribution, Poisson distribution, Exponential distribution, Normal distribution.

- Pedagogy/Course delivery tools: Chalk and talk, PowerPoint Presentation, Videos
- Links: <https://nptel.ac.in/courses/111/105/111105035/>
- impartus recording: <https://a.impartus.com/ilc/#/course/96127/452>  
<https://a.impartus.com/ilc/#/course/132243/636>  
<https://a.impartus.com/ilc/#/course/119635/593>

### Unit III

**Sampling and Statistical Inference:** Sampling distributions, Concepts of standard error and confidence interval, Central Limit Theorem, Type1 and Type2 errors, Level of significance, One tailed and two tailed tests, Ztest: for single mean, Student's t – test: for single mean, for difference between two means, F – test: for equality of two variances, Chisquare test: for goodness of fit.

- Pedagogy/Course delivery tools: Chalk and talk, PowerPoint Presentation, Videos

- Links: <https://nptel.ac.in/courses/111/107/111107119/>
- impartus recording: <https://a.impartus.com/ilc/#/course/96151/1112>

### Unit IV

**Complex Differential Calculus:** Functions of complex variables, Analytic function, Cauchy Riemann Equations in Cartesian and polar coordinates (without proof), Construction of analytic functions. Transformations: Conformal transformation,

Discussion of the transformations  $w = e^z$ ,  $w = z^2$  and  $w = z + \frac{1}{z}$ , ( $z \neq 0$ ),  
Bilinear transformations

- Pedagogy/Course delivery tools: Chalk and talk, PowerPoint Presentation, Videos
- Links: <https://nptel.ac.in/courses/111/107/111107119/>
- Impartus recording: <https://a.impartus.com/ilc/#/course/619570/1030>

### Unit V

**Complex Integral Calculus:** Complex integration, Cauchy's theorem, Cauchy's integral formula, Taylor's and Laurent's series (statements only), Singularities, poles and residues, Cauchy residue theorem.

- Pedagogy/Course delivery tools: Chalk and talk, PowerPoint Presentation, Videos
- Links: <https://nptel.ac.in/courses/111/107/111107119/>
- impartus recording: <https://a.impartus.com/ilc/#/course/619570/1030>

### Text Books:

1. **Erwin Kreyszig** –Advanced Engineering Mathematics, Wiley publication, 10<sup>th</sup> edition, 2015
2. **B.S. Grewal** – Higher Engineering Mathematics, Khanna Publishers, 44<sup>th</sup> edition, 2017.

### Reference Books:

1. **George B. Thomas, Maurice D. Weir, Joel R. Hass** Thomas' Calculus, Pearson, 13<sup>th</sup> edition, 2014.
2. **Peter V. O' Neil** – Advanced Engineering Mathematics, Thomson Brooks/Cole, 7<sup>th</sup> edition, 2011.
3. **Glyn James & Phil Dyke** – Advanced Modern Engineering Mathematics, Pearson Education, 5<sup>th</sup> edition, 2018.
4. **Srimanta Pal & Subobh C Bhunia** Engineering Mathematics, Oxford University Press, 3rd Reprint, 2016.

### Course Outcomes (COs):

At the end of the course the student will be able to

1. find functional values, derivatives, areas and volumes numerically from a given data (PO1, PO2, PSO1, PSO2).
2. fit a least squares curve to the given data and analyze the given random data and their probability distributions (PO1, PO2, PSO1, PSO2).
3. Choose an appropriate test of significance and make inference about the population from a sample (PO1, PO2, PSO1, PSO2).
4. examine and construct the analytic functions (PO1, PO2, PSO1, PSO2).
5. classify singularities of complex functions and evaluate complex integrals (PO1, PO2, PSO1, PSO2).

### Course Assessment and Evaluation:

<b>Continuous Internal Evaluation (CIE): 50 Marks</b>		
<b>Assessment Tool</b>	<b>Marks</b>	<b>Course outcomes addressed</b>
Internal test – I	30	CO1, CO2, CO3
Internal test – II	30	CO3, CO4, CO5
Average of the two internal tests will be taken for 30 marks.		
<b>Other components</b>		
Quiz	10	CO1, CO2, CO3
Assignment	10	CO1, CO2, CO3, CO4, CO5
<b>Semester End Examination (SEE)</b> Course end examination (Answer any one question from each unit – Internal choice)	100	CO1, CO2, CO3, CO4, CO5

<b>MACHINE DESIGN I</b>	
<b>Course Code:</b> ME42	<b>Credits:</b> 2:0:1
<b>Pre – requisites:</b> Nil	<b>Contact Hours:</b> 28L+14P
<b>Course Coordinator:</b> Dr. Mahantesh S Matur	

### Unit I

**Introduction: Design considerations:** codes and standards, Static Strength, Static loads and Factor of safety. Impact loads, Impact stresses due to axial and bending.

**Theories of failure:** Maximum normal stress theory, Maximum shear stress theory, Distortion energy theory. Failure of brittle materials, Failure of ductile materials.

**Stress concentration:** Determination of Stress concentration factor for axial, bending, torsion.

- Pedagogy/Course delivery tools: Chalk and talk, Power point presentation, animated videos
- Lab component/Practical topics: Simulation and stress analysis of simple machine component using software
- Links: <https://a.impartus.com/ilc/#/video/id/1620141>
- Links: <https://www.youtube.com/watch?v=SA4D098uQ>

### Unit II

**Design for Fatigue Load:** Introduction SN Diagram, Low cycle fatigue, High cycle fatigue, Endurance limit, Endurance limit modifying factors: size effect, surface effect, Stress concentration effects; Fluctuating stresses, Goodman and Soderberg relationship; stresses due to combined loading.

- Pedagogy/ Course delivery tools: Chalk and talk, Power point presentation, animated videos, Demonstration using IC engine models
- Lab component/Practical topics: Simulation and fatigue analysis of simple machine components using software
- Links: Fatigue loading: <https://a.impartus.com/ilc/#/course/130428/636>

### Unit III

**Shafts:** ASME & BIS codes for design of transmission shafting, shafts under fluctuating loads and combined loads.

Cotter and Knuckle joints: Design of Cotter and Knuckle joints.

- Pedagogy/ Course delivery tools: Chalk and talk, Power point presentation, animated videos

- Lab component/Practical topics: Design and Drawing of Cotter joint and Knuckle joint using 3D Modelling Software
- Links: Shafts: <https://a.impartus.com/ilc/#/video/id/1654576>

#### Unit IV

**Keys:** Types of keys, Design of keys and design of splines. **Couplings,** Rigid and flexible couplings, Flange coupling, Bush and Pin type coupling.

**Riveted Joints** – Types, rivet materials, failures of riveted joints, Joint Efficiency, Boiler Joints, Tank and Structural Joints, Riveted Brackets

- Pedagogy/ Course delivery tools: Chalk and talk, Power point presentation, animated videos
- Lab component/Practical topics: Design and Drawing of Couplings using 3D Modelling Software  
Design and drawing of different types of riveted joints
- Links: <https://a.impartus.com/ilc/#/video/id/1568859>

#### Unit V

**Threaded Fasteners:** Stresses in threaded fasteners, Effect of initial tension. Design threaded fasteners under static. Design of eccentrically loaded bolted joints.

**Power Screws:** Mechanics of power screw, Stresses in power screws, efficiency and self locking, Design of Power Screw.

- Pedagogy/ Course delivery tools: Chalk and talk, Power point presentation, animated videos
- Lab component/Practical topics: Design and Drawing of Threaded fasteners 3D Modelling Software
- Design and drawing of screw jack (Bottle Type)
- Links: <https://a.impartus.com/ilc/#/video/id/1603316>

#### Design Data Hand Books:

1. Design Data Hand Book vol.1 & 2 – K. Lingaiah, McGraw Hill, 2<sup>nd</sup> Ed. 2003.
2. Design Data Hand Book by K. Mahadevan and Balaveera Reddy, CBS Publication

#### Text Books:

1. Mechanical Engineering Design: Joseph E Shigley and Charles R. Mischke McGraw Hill International edition, 6<sup>th</sup> Edition 2003.
2. Design of Machine Elements: V.B. Bhandari, Tata McGraw Hill Publishing Company Ltd., New Delhi, 2<sup>nd</sup> Edition 2007.



## Reference Books:

1. Machine Design: Robert L. Norton, Pearson Education Asia, 2001.
2. Design of Machine Elements: M.F.Spotts, T.E. Shoup, L.E. Hornberger, S.R. Jayram and C.V. Venkatesh, Pearson Education, 2006.
3. Machine Design: Hall, Holowenko, Laughlin (Schaum's Outlines series) Adapted by S.K. Somani, Tata McGraw Hill Publishing Company Ltd., New Delhi, Special Indian Edition, 2008.
4. Fundamentals of Machine Component Design: Robert C. Juvinall and Kurt M Marshek, Wiley India Pvt. Ltd., New Delhi, 3rd Edition, 2007.

## Web links and video lectures (eResources):

1. <https://youtu.be/ofmbhbVCUqI>
2. <https://youtu.be/m911tVXYfp8>
3. <https://youtu.be/jolY82CpmGo>
4. <https://www.digimat.in/nptel/courses/video/112105124/L10.html>
5. <https://a.impartus.com/ilc/#/video/id/1603316>

## Course Outcomes (COs):

1. Apply concepts of static loads, stress concentration and theories of failure in the design of machine components [PO1, PO2, PO3, PO4, PO12, PSO1, PSO2]
2. Understand concepts of Fatigue loads and stress concentration effect in the design of machine element. [PO1, PO2, PO3, PO4, PO12, PSO1, PSO2]
3. Develop the ability to understand the procedural design of shafts, cotter and knuckle joints [PO1, PO2, PO3, PO4, PO12, PSO1, PSO2]
4. Demonstrate the ability to analyze the problems of riveted, keys and couplings. [PO1, PO2, PO3, PO4, PO12, PSO1, PSO2]
5. Develop competence to design of power screws and threaded fasteners. [PO1, PO2, PO3, PO4, PO12, PSO1, PSO2]

## Course Assessment and Evaluation

<b>Continuous Internal Evaluation (CIE): 50 Marks</b>		
<b>Assessment tool</b>	<b>Marks</b>	<b>Course outcomes addressed</b>
Internal test-I	30	CO1 & CO2
Internal test-II	30	CO3, CO4 & CO5
Average of the two internal tests will be considered for evaluation of 30 Marks		
<b>Other components 20 Marks</b>		
Experimental conduction and record writing	10	CO1, CO2, CO3
Viva voce and assignment	10	CO4 & CO5
<b>Semester-End Examination (SEE)</b>	100	CO1, CO2, CO3, CO4 & CO5

## APPLIED THERMODYNAMICS

<b>Course Code:</b> ME43	<b>Credits:</b> 2:1:0
<b>Pre – requisites:</b> ME 33	<b>Contact Hours:</b> 28 L +14P
<b>Course Coordinator:</b> Dr. P B Nagaraj	

### Unit I

**Combustion in SI and CI engines:** Ignition limits, stages of combustion in SI engine, Effect of engine variables on Ignition lag, abnormal combustion, Detonation or knocking and its effect, stages of combustion in CI engines, Delay period in CI engines and variables affecting the delay period, diesel knock and methods of controlling the diesel knock, Testing and Performance of Single Cylinder and Multi cylinder Engines, measurement of performance parameters, heat balance sheet. Numerical problems

- Pedagogy/Course delivery tools: Chalk and talk, animated videos
- Lab component/Practical topics: ATD lab2S & 4S test rigs.
- Links: Fundamentals of combustion: <https://nptel.ac.in/courses/101104070>
- Links: Performance of I C Engine:  
<https://www.youtube.com/watch?v=2b0YaDrdO1I>

### Unit II

**Gas power cycles:** Air standard cycles, Otto, Diesel, Dual, p v and T s diagrams, description, efficiencies and mean effective pressures, comparison of otto, diesel and dual combustion cycles

**Gas turbines and Jet propulsion:** Classification of gas turbines, analysis of open cycle gas turbine cycle, methods to improve thermal efficiency ( no numerical on this topic), Jet propulsion and Rocket propulsion

- Pedagogy/ Course delivery tools: Chalk and talk, Power point presentation, animated videos
- Lab component/Practical topics: ATD lab Computerized 4S Petrol & Diesel engine
- Links: Gas turbines and I C engines: <https://nptel.ac.in/courses/112103262>
- Links:Introduction to Air breathing propulsion:  
[https://onlinecourses.nptel.ac.in/noc20\\_ae13/preview](https://onlinecourses.nptel.ac.in/noc20_ae13/preview)

### Unit III

**Steam Nozzles:** Introduction, types of nozzles, steady flow energy equation in nozzles, entropy changes with friction, nozzle efficiency, mass discharge through

nozzle, throat pressure for maximum discharge, critical pressure ratio for adiabatic and frictionless expansion from a given initial velocity, numerical problems

**Vapour power cycles:** Carnot vapour power cycle, drawbacks as a reference cycle, simple Rankine cycle; description, TS diagram, analysis for performance, comparison of Carnot and Rankine cycles. Effects of pressure and temperature on Rankine cycle performance. Actual vapour power cycles, numerical problems

- Pedagogy/ Course delivery tools: Chalk and talk, animated videos
- Lab component/Practical topics: Turbo Machinery lab Nozzles
- Links: Introduction to Steam nozzles:  
<https://www.youtube.com/watch?v=AXcb3TBLETY>
- Links: Use of hs diagram: <https://www.youtube.com/watch?v=iZQlt1kp1dw>

#### Unit IV

**Reciprocating Compressors:** Operation of a single stage reciprocating compressors, work input through pv diagram, effect of clearance and volumetric efficiency, adiabatic, isothermal and mechanical efficiencies. Multistage compressor, saving in work, optimum intermediate pressure, intercooling, minimum work for compression.

**Refrigeration:** Principle, methods of refrigeration, units of refrigeration, COP, Vapour compression refrigeration (VCR) system; description, analysis, refrigerating effect, capacity, power required, Thermodynamic analysis of VCR cycle, operating parameters affecting the COP of VCR cycle.

- Pedagogy/ Course delivery tools: Chalk and talk, Power point presentation, animated videos
- Lab component/Practical topics: ATD lab & Heat transfer lab Air compressor test rig, Refrigeration tutor & Air conditioning test rig
- Links: Air compressor: <https://www.youtube.com/watch?v=VO0IVe9ZHY0> & list=PL07gcSkcblxqX3itLTFpAcX7B\_SSRYSr
- Links: Refrigeration: <https://www.youtube.com/watch?v=nlsNmhiID74> & list=PLfUUbfVVTzXcXbSUD0BXdPxGXFGkedLXa

#### Unit V

**Psychrometrics:** Atmospheric air and psychrometric properties: DBT, WBT, DPT, partial pressures, specific and relative humidity and relation between the two, enthalpy and adiabatic saturation temperatures, Construction and use of psychrometric chart. Analysis of various processes: Heating, cooling, dehumidifying and humidifying. Adiabatic mixing of stream of moist air. Summer and winter air conditioning.

- Pedagogy/ Course delivery tools: Chalk and talk, Power point presentation, animated videos
- Lab component/Practical topics: Heat transfer lab Air conditioning test rig
- Links: Basic concepts of Psychrometric processes:  
<https://www.youtube.com/watch?v=YonN5251ta18>
- Links: Psychrometric chart: <https://www.youtube.com/watch?v=e2IryaMQQ6A>

### **Text Books:**

1. Basic and Applied thermodynamics by P K Nag, Tata McGraw Hill pub co., 2<sup>nd</sup> edition 2002
2. Thermodynamics An Engineering Approach Yunus, A Cengel and Michael A Boles, Tata McGraw Hill Publications., 1<sup>st</sup> edition 2002

### **Reference Books:**

1. Internal combustion engines M L Mathur and R P Sharma, Dhanpat Rai Publications., 3<sup>rd</sup> edition 2007
2. Thermal Engineering R K Rajput, Laxmi Publications, 3<sup>rd</sup> edition 2003

### **Web links and video lectures (eResources):**

1. <https://www.youtube.com/watch?v=cQnj8DOc9B8>
2. <https://www.youtube.com/watch?v=30FdRgygI0>
3. <https://www.youtube.com/watch?v=PoiFmnFiTSA4>
4. <https://www.youtube.com/watch?v=4liAb3LiOXo>
5. <https://www.youtube.com/watch?v=r6uN3f9o5PQ>

### **Course Outcomes (COs):**

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

1. Analyze the combustion phenomenon and solve the practical problems associated with the performance parameters of the Internal combustion engine and create awareness of current advancement in I C engines [PO1, PO2, PO3, PO4, PO7, PO12, PSO1, PSO2]
2. Apply the knowledge of thermodynamics in the analysis of air standard and gas turbine cycles and determine cycle efficiency, work output and heat supply. [PO1, PO2, PO3, PO4, PO7, PO12, PSO1, PSO2]
3. Solve practical problems on steam nozzles, gas turbines and make modifications to improve Rankine cycle efficiency [PO1, PO2, PO3, PO4, PO7, PO12, PSO1, PSO2]

4. Evaluate the performance parameters of single and multistage air compressors and analyze the different types of refrigeration systems for given comfort conditions. [PO1, PO2, PO3, PO4, PO7, PO12, PSO1, PSO2]
5. Solve the problems on design of air conditioning systems with the use of psychrometric chart and develop ability to apply the concept of air conditioning systems to solve design problems of real systems. [PO1, PO2, PO3, PO4, PO7, PO12, PSO1, PSO2].

**Course Assessment and Evaluation:**

<b>Continuous Internal Evaluation (CIE): 50 Marks</b>		
<b>Assessment tool</b>	<b>Marks</b>	<b>Course outcomes addressed</b>
Internal test-I	30	CO1, CO2
Internal test-II	30	CO3, CO4, CO5
Average of the two internal tests will be considered for evaluation of 30 Marks		
<b>Other components 20 Marks</b>		
Assignment	10	CO1, CO2, CO3
Quiz	10	CO4, CO5
<b>Semester-End Examination (SEE)</b>	100	CO1, CO2, CO3, CO4, CO5

# MECHANICAL MEASUREMENTS & METROLOGY

<b>Course Code:</b> ME44	<b>Credits:</b> 3:0:0
<b>Pre – requisites:</b> Nil	<b>Contact Hours:</b> 42L
<b>Course Coordinator:</b> Dr. Jyothilakshmi R	

## Unit I

**Standards of Measurement:** Definition and Objectives of metrology, Standards of length– International prototype meter, Imperial Standard yard, Wave length standard, subdivision of standards, line and end standard, comparison, transfer from line standard to end standard, calibration of end bars (Numerical), Slip gauges, wringing phenomena, Indian Standards (M81, M112), Numerical Examples on building of slip gauges.

System of limits, Definition of tolerance, Specification in assembly, Principle of interchangeability and selective assembly limits of size, Indian Standards, concept of limits of size and tolerances, compound tolerances, accumulation of tolerances.

- Pedagogy/ Course delivery tools: Chalk and talk, Power point presentation, Animated Videos
- Lab component/Practical topics: Slip Gauge, Micrometer
- Links: Standards of Measurement:  
[https://www.youtube.com/watch?v=U8y48L\\_qn6E&t=214s](https://www.youtube.com/watch?v=U8y48L_qn6E&t=214s)
- Links: Slip Gauges: <https://www.youtube.com/watch?v=CnSRaTTeNrK>

## Unit II

**Fits, Tolerances and gauging & Comparators:** Definition of fits, types of fits and their designation (IS 9191963), geometrical tolerance, positional – tolerances, hole basis system, shaft basis system, classification of gauges, brief concept of design of gauges (principles), Wear allowance on gauges, Types of gauges – Plain plug gauge, ring Gauge, snap gauge, limit gauge and gauge materials.

Introduction to Comparators, Characteristics, classification of comparators, mechanical comparators –Sigma Comparators, dial indicator, Optical comparators – principles, Zeiss ultra Optimeter.

- Pedagogy/ Course delivery tools: Chalk and talk, Power point presentation, Animated Videos
- Lab component/Practical topics: LVDT, Pneumatic Comparator
- Links: Limits, Fits and Tolerances:  
<https://www.youtube.com/watch?v=G8TSfAeQRaw>

- Links: Mechanical Comparators:  
<https://www.youtube.com/watch?v=bKLUtRLL8tY>

### Unit III

**Angular measurement, Interferometer and Screw thread gear measurement:** Angular measurements, Bevel Protractor, Sine Principle and use of Sine bars, Sine center, use of angle gauges, (numericals on building of angles) Clinometers. Interferometer Principle of interferometry, autocollimator. Optical flats. Terminology of screw threads, measurement of major diameter, minor diameter, pitch, angle and effective diameter of screw threads by 2wire method, Best size wire.

- Pedagogy/ Course delivery tools: Chalk and talk, Power point presentation, Animated Videos
- Lab component/Practical topics: Sine Bar, Sine Centre, 2 Wire and 3 Wire Method, Autocollimator, Screw thread measurement using Tool maker's microscope, Gear Tooth Vernier Caliper,
- Links: Angular Measurement: <https://www.youtube.com/watch?v=saoOUXYXde0>
- Links: Autocollimator: <https://www.youtube.com/watch?v=joKSUJm2v2Q>

### Unit IV

**Measurements and Measurement systems, Intermediate modifying and terminating devices:** Definition, Significance of measurement, generalized measurement system, definitions and concept of accuracy, precision, calibration, threshold, sensitivity, hysteresis, repeatability, linearity, loading effect, system response times delay. Errors in Measurements, classification of errors. Transducers, Transfer efficiency, Primary and Secondary transducers, Electrical, Mechanical, Electronic transducers, advantages of each type transducers. Mechanical systems, inherent problems, Electrical intermediate modifying devices, Input circuitry, Ballast, Ballast circuit and telemetry. Terminating devices, Cathode Ray Oscilloscope, Oscillographs.

- Pedagogy/ Course delivery tools: Chalk and talk, Power point presentation, Animated Videos
- Lab component/Practical topics: Calibration of Pressure Transducer, Micrometer, Load Cell
- Links: Generalized Measurement System:  
<https://www.youtube.com/watch?v=PEpL0ukTWhs>
- Links: Intermediate modifying and terminating devices, inherent problems:  
<https://www.youtube.com/watch?v=5wqaGZICdTI>

## Unit V

### **Measurement of Force and Torque, Pressure Temperature and Strain Measurement:**

Principle, Analytical balance, platform balance, Hydraulic dynamometer. Pressure Measurements, Principle, use of elastic members, Bridgeman gauge, McLeod gauge. Temperature and Strain Measurement: Resistance thermometers, thermocouple, law of thermocouple, materials used for construction, Pyrometer, Optical Pyrometer. Strain Measurements, Strain gauge, preparation and mounting of strain gauges, gauge factor, methods of strain measurement.

**Coordinate measuring machine:** Introduction, design, types and its applications.

- Pedagogy/ Course delivery tools: Chalk and talk, Power point presentation, Animated Videos
- Lab component/Practical topics: Thermocouple, Coordinate Measuring Machine
- Links: Torque Measurement: <https://www.youtube.com/watch?v=ydyVsVk96z8>
- Links: Coordinate Measuring Machine: <https://www.youtube.com/watch?v=xgDpq4orAFM>

### **Text Books:**

1. Mechanical measurements, by Beckwith Marangoni and Lienhard, Pearson Education, 6thEd., 2006.
2. Engineering Metrology, by R.K.Jain, Khanna Publishers, 5<sup>th</sup> edition 2006.

### **Reference Books:**

1. Engineering Metrology, by I.C.Gupta, Dhanpat Rai Publications, Delhi. 2<sup>nd</sup> edition 2006 edition.
2. Industrial Instrumentation, Alstutko, Jerry.D.Faulk, Thompson Asia Pvt. Ltd. 1<sup>st</sup> edition 2002.
3. Measurements Systems Applications and Design, by Ernest O. Doblin, McGraw Hill Book Co. 2<sup>nd</sup> edition. 2006

### **Web links and video lectures (eResources)**

1. <https://www.youtube.com/watch?v=Pn7VHO1LOAw>
2. [https://www.youtube.com/watch?v=HpIEcBtJupY&list=PLbMVogVj5nJSZiwuh\\_tp50dKry8mCxzKA](https://www.youtube.com/watch?v=HpIEcBtJupY&list=PLbMVogVj5nJSZiwuh_tp50dKry8mCxzKA)
3. <https://www.youtube.com/watch?v=8DTtf6wQxE&list=PL41FA714195562989>
4. [https://www.youtube.com/watch?v=tN7iAzVEqa0&list=PLwdnzlV3ogoXJLQ8l\\_SGb1hszt24I9kZZ](https://www.youtube.com/watch?v=tN7iAzVEqa0&list=PLwdnzlV3ogoXJLQ8l_SGb1hszt24I9kZZ)
5. [https://www.youtube.com/watch?v=\\_tFLoOyVtM](https://www.youtube.com/watch?v=_tFLoOyVtM)



**Course Outcomes (COs):**

1. Explain the concept of measurements in engineering. [PO1, PO2, PO4, PO7, PO8, PSO1, PSO2]
2. Examine the applications of Limits, Fits, Tolerances and Analyse comparators for different engineering applications. [PO1, PO2, PO4, PO6, PO7, PO8, PSO1, PSO2]
3. Identify the uses of Gauges for Angular measurement, Screw thread and Gear Measurement. [PO1, PO2, PO3, PO4, PO6, PO12, PSO1, PSO2]
4. Understand the significance of measurement system, Errors, Transducers, Intermediate modifying and terminating devices. [PO1, PO2, PO3, PO4, PO6, PO7, PO8, PSO1, PSO2]
5. Apply the techniques for force, torque, pressure, temperature and strain measurement systems [PO1, PO2, PO3, PO4, PO6, PO7, PO8, PO12, PSO1, PSO2]

**Course Assessment and Evaluation:**

<b>Continuous Internal Evaluation (CIE): 50 Marks</b>		
<b>Assessment tool</b>	<b>Marks</b>	<b>Course outcomes addressed</b>
Internal test-I	30	CO1, CO2, CO3
Internal test-II	30	CO3, CO4, CO5
Average of the two internal tests will be considered for evaluation of 30 Marks		
<b>Other components 20 Marks</b>		
Assignment	10	CO1, CO2, CO3
Quiz	10	CO4, CO5
<b>Semester-End Examination (SEE)</b>	100	CO1, CO2, CO3, CO4, CO5

## MANUFACTURING PROCESSES II

<b>Course Code:</b> ME45	<b>Credits:</b> 3:0:0
<b>Pre – requisites:</b> Nil	<b>Contact Hours:</b> 42L
<b>Course Coordinator:</b> Mr. Rajendra P	

### Unit I

**Fundamentals of Metal Cutting:** Introduction, Basic elements of machining, Orthogonal and oblique cutting, Classification of cutting tools, Principal angles of single point cutting tools, Tool signature, Chip formation, Types of chips, Chip thickness ratio, chip breakers, Velocity relationships, Force relationship in orthogonal cutting, Stress and strain in chip, Work done in cutting, Horse power calculation, Sources of heat in metal cutting, Numerical problems.

- Pedagogy/Course delivery tools: Chalk and talk, Power point presentation, animated videos
- Links: Nomenclature of Single point cutting tool:  
<https://www.youtube.com/watch?v=BHEYrGrvp6U>
- Links: Chip formation, Types of chips, Chip thickness ratio:  
<https://www.youtube.com/watch?v=u7lpccLxuMI>

### Unit II

**Cutting Tool Materials:** Tool failure, Mechanism of wear, Tool life, Factors affecting tool life, desirable properties of cutting tool materials, Machinability, Machinability index. Cutting fluids, functions, requirements, types of cutting fluids

**Turret & Capstan lathes and Automatic machines:** Introduction, Main parts of a Turret & capstan lathe, Differences between Turret & capstan lathe, Classification of Turret lathe, Primary and secondary motions, bar feed mechanism, Turret index and stop drum mechanisms

- Pedagogy/Course delivery tools: Chalk and talk, Power point presentation, animated videos
- Links: Tool failure, mechanism of wear:  
<https://www.youtube.com/watch?v=eCD2g1njeZQ>
- Links: Turret & Capstan lathes:  
<https://www.youtube.com/watch?v=hbNmMYoIAtg>

### Unit III

**Milling:** Introduction, working principle in milling, milling cutter nomenclature, Types of milling machines horizontal, vertical and fixed bed type plain milling

machines, Milling operations, Indexing or dividing head, Indexing methods and Numerical problems.

- Pedagogy/Course delivery tools: Chalk and talk, Power point presentation, animated videos
- Links: Types of milling machines: <https://www.youtube.com/watch?v=aeOaAZRwpfY>
- Links: milling indexing: <https://www.youtube.com/watch?v=aGkDjXGJI0>

#### Unit IV

**Drilling:** Introduction, Twist drills parts and nomenclature, Types of drilling machines Bench and Radial, drilling operations, cutting speeds, feeds and depth of cut time with Numerical.

**Grinding:** Introduction, Common forms of abrasive tools, Wheel material, Symbolic representation of bonds, Grain, Grade, Structure, Loading, glazing Trueing and dressing of grinding wheels, Wheel balancing, Use of coolants, centerless grinder, cylindrical Grinder Plain and universal.

- Pedagogy/Course delivery tools: Chalk and talk, Power point presentation, animated videos
- Links: Types of drilling machines: <https://www.youtube.com/watch?v=w08kcbMhBho>
- Links: Loading, glazing Trueing and dressing of grinding wheels,: <https://www.youtube.com/watch?v=pBQsjCxI>

#### Unit V

**Jigs and Fixtures:** Introduction, Differences between jigs and fixtures, important consideration in jigs and fixture design, Main elements of jigs and fixtures, types of locating and clamping devices, basic requirements.

**Powder Metallurgy:** Basic steps in Powder metallurgy, Production of metal powders, blending of metal powders, Compaction, Sintering and Finishing, Application, advantages and limitations of powder metallurgy.

- Pedagogy/Course delivery tools: Chalk and talk, Power point presentation, animated videos
- Links: Jigs and Fixtures: [https://www.youtube.com/watch?v=ko0\\_d7EDsTQ](https://www.youtube.com/watch?v=ko0_d7EDsTQ)
- Links: Powder Metallurgy: <https://www.youtube.com/watch?v=AZMbSBVVWhI>

#### Text Books:

1. A Course in Workshop Technology, Volume II (Machine Tools), B.S. Raghuwanshi, Dhanpat Rai Publication, 2012

- Processes and Materials of Manufacture, 4th Edition, Roy A. Lindberg, PHI Learning Publication, 2008

### Reference Books:

- Fundamentals of Metal Machining and Machine Tools, 3<sup>rd</sup> Edition, Winston A. Knight, Geoffrey Boothroyd, Taylor and Francis Publication, 2005
- Production Technology, Volume I, O.P.Khanna, Dhanpat Rai Publication, 2015.

### Course Outcomes (COs):

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

- Recognize the various cutting forces acting in metal cutting on cutting tool materials and their tool life [PO1, PO2, PO3, PSO1]
- Understand the working of Capstan and Turret lathes, drilling machine, reaming machine, milling machine and grinding machines. [PO1, PO2, PSO1]
- Apply the design aspects of jigs and fixture and the recent advancement in the areas of machining in terms of numerically controlled machine tool. [PO1, PO2, PO3, PSO1]
- Comprehend the preparation of powders, mixing, compaction and sintering of various components using powders metallurgy techniques. [PO1, PO2, PO6, PO7, PSO1]
- Demonstrate the knowledge in machining and newer techniques adopted in industries to solve the real world problems in production. [PO1, PO2, PO6, PO7 & PSO1].

### Course Assessment and Evaluation:

<b>Continuous Internal Evaluation (CIE): 50 Marks</b>		
<b>Assessment tool</b>	<b>Marks</b>	<b>Course outcomes addressed</b>
Internal test-I	30	CO1, CO2, CO3
Internal test-II	30	CO3, CO4, CO5
Average of the two internal tests will be considered for evaluation of 30 Marks		
<b>Other components 20 Marks</b>		
Assignment	10	CO1, CO2, CO3
Quiz	10	CO4, CO5
<b>Semester-End Examination (SEE)</b>	<b>100</b>	<b>CO1, CO2, CO3, CO4, CO5</b>

## APPLIED THERMODYNAMICS LABORATORY

<b>Course Code:</b> MEL46	<b>Credits:</b> 0:0:1
<b>Pre – requisites:</b> Nil	<b>Contact Hours:</b> 14P
<b>Course Coordinator:</b> Dr. P B Nagaraj	

Experiment No.	Description
<b>Part A</b>	
1	Determination of Flash and Fire point of Light, medium and heavy oils.
2	Determination of solid fuel calorific value using Lewis Thomson Calorimeter
3	Determination of viscosity of oil using Redwood Viscometer.
4	Determination of viscosity of oil using Torsion Viscometer.
5	Determination of liquid and gaseous fuel calorific value using Boy's gas Calorimeter
6	Valve timing diagram for I C Engine.
7	Measurement of an irregular area using Planimeter
<b>Part B</b>	
1	Two stroke Petrol engine test rig (Mechanical loading)
2	Two stroke Petrol engine test rig (Electrical loading)
3	Computerised Four stroke Petrol engine test rig
4	Computerised Four stroke Diesel (VCR) engine test rig
5	Multi cylinder petrol engine – Morse Test
6	Performance testing of a 2 stage reciprocating Air Compressor
7	Performance testing of Centrifugal Blower

Students are required to do experiments individually from Part A and in a group of 4 to 5 students from Part B

### Text Book:

1. Applied Thermodynamics Manual, Department of Mechanical Engineering, MSRIT

### Reference Books:

1. Basic and Applied Thermodynamics by P K Nag, Tata McGraw Hill publications, 2008
2. Applied thermodynamics, Kestoor praveen, SUGGi Publishing, 2014

### Web links and video lectures (eResources):

1. <https://www.youtube.com/watch?v=2ths8kOkqPU>
2. <https://www.youtube.com/watch?v=SHdESVROvVs>
3. <https://www.youtube.com/watch?v=30FdRgygiI0>
4. [https://www.youtube.com/watch?v=H\\_RgFXjg5s](https://www.youtube.com/watch?v=H_RgFXjg5s)
5. [https://www.youtube.com/watch?v=1\\_Jw6XUScvo](https://www.youtube.com/watch?v=1_Jw6XUScvo)

### Course Outcomes (COs):

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

1. Determine properties such as flash and fire point, viscosity and calorific value of various types of fuels. [PO1, PO2, PO4, PO6, PO7, PO10, PO12, PSO1, PSO2]
2. Demonstrate the use of Valve timing diagram of I C Engines and use of Planimeter [PO1, PO2, PO3, PO4, PO10, PO12, PSO1, PSO2]
3. Conduct experiments on I C Engines, Blowers and Air compressors to determine performance parameters [PO1, PO2, PO3, PO4, PO5, PO6, PO7, PO10, PO11, PO12, PSO1, PSO2]

### Course Assessment and Evaluation:

<b>Continuous Internal Evaluation (CIE): 50 Marks</b>		
<b>Assessment tool</b>	<b>Marks</b>	<b>Course outcomes addressed</b>
Weekly evaluation of laboratory records after the conduction of every experiment	30	CO1, CO2, CO3
Practical test	20	CO1, CO2, CO3
<b>Semester-End Examination (SEE)</b>	50	CO1, CO2, CO3

## MECHANICAL MEASUREMENTS AND METROLOGY LAB

<b>Course Code:</b> MEL47	<b>Credits:</b> 0:0:1
<b>Pre – requisites:</b> Nil	<b>Contact Hours:</b> 14P
<b>Course Coordinator:</b> Dr. Nagesh S N	

**Tests conducted are listed below**

**A. Conduct the following Experiments.**

1. Calibration of pressure transducer
2. Calibration of thermocouple
3. Calibration of LVDT
4. Determination of material constants, E & G.
5. Calibration of stroboscope
6. Calibration of micrometer using slip gauges
7. Double flank test using gear roll tester
8. Determination of gear tooth profile using gear tooth tester
9. Measurement of tooltip temperature
10. Digimatic miniprocessor

**B. Conduct the following Experiments.**

1. Measurements using tool makers microscope
2. Measurements using profile projector
3. Measurement of angles using sine center, sine bar and bevel protractor
4. Determination form tolerance of a ground product using pneumatic comparators
5. Drawing of Merchant's circle diagram
6. Determination of screw thread parameters using floating carriage diameter measuring machine.
7. Measurement of alignment using autocollimator

**C. Conduct the following Experiments.**

1. Monochromatic checklite
2. Surface finish measurement

- Pedagogy/Course delivery tools: Chalk and Talk, laboratory Manuals,
- Links: <https://www.youtube.com/watch?v=upitS3jefQ>
- [https://www.youtube.com/watch?v=DC5u\\_SvO8r4](https://www.youtube.com/watch?v=DC5u_SvO8r4)  
[https://www.youtube.com/watch?v=qwhc2pGco\\_Y](https://www.youtube.com/watch?v=qwhc2pGco_Y)

<https://www.youtube.com/watch?v=kMFZfH8DeQ>  
<https://www.youtube.com/watch?v=MdCifxRSzMk>  
<https://www.youtube.com/watch?v=3CFXzctvHAo>  
<https://www.youtube.com/watch?v=moFETpF7Ezo>

### **Text Books:**

1. Mechanical measurements, by Beckwith Marangoni and Lienhard, Pearson Education, 6th Ed., 2006.
2. Engineering Metrology, by R.K. Jain, Khanna Publishers, 1st edition 1994.

### **Reference Books:**

1. Engineering Metrology, by I.C.Gupts, Dhanpat Rai Publications, Delhi. 2<sup>nd</sup> edition 2006 edition.
2. Mechanical measurements, by R.K.Jain. 5<sup>th</sup> edition 2006.
3. Industrial Instrumentation, Alstuko, Jerry.D.Faulk, Thompson Asia Pvt. Ltd.1<sup>st</sup> edition 2002.
4. Measurements Systems Applications and Design, by Ernest O. Doblin, McGraw Hill Book Co. 2<sup>nd</sup> edition. 2006

### **Course Assessment and Evaluation:**

<b>Continuous Internal Evaluation (CIE): 50 Marks</b>		
<b>Assessment tool</b>	<b>Marks</b>	<b>Course outcomes addressed</b>
Weekly evaluation of laboratory records after the conduction of every experiment	30	CO1, CO2, CO3
Practical test	20	CO1, CO2, CO3
<b>Semester-End Examination (SEE)</b>	50	CO1, CO2, CO3



# MANUFACTURING PROCESS LABORATORY

**Course Code:** MEL48

**Credits:** 0:0:1

**Pre – requisites:** Nil

**Contact Hours:** 14P

**Course Coordinator:** Dr. Mohandas K N

## Part A

### Conduct the following experiments

1. Casting: Preparing mould cavity, melting and pouring of molten metal and finishing the cast metal.
  2. Forging: Forging the given workpiece to required shape and dimension and subjecting the same workpiece to heat treatment (Quenching water, oil, air, etc.)
- Pedagogy/Course delivery tools: Chalk and talk, Powerpoint presentation, animated videos
  - Lab Component / Practical Topics: Couplings in Machines at Machine Shop
  - Links: [https://www.youtube.com/watch?v=36Bry\\_57Pcc](https://www.youtube.com/watch?v=36Bry_57Pcc)
  - Links: <https://www.youtube.com/watch?v=SU92Uh2Amwg>

## Part B

### Conduct the following experiments

1. Lathe: Step turning, thread cutting (V thread, Square thread, left hand and Right hand threads), Eccentric turning.
  2. Milling Machine: Indexing, cutting of gear tooth (Spur gear, Helical gear), face milling and grooving.
  3. Surface Grinding: Finishing of the obtained cast metal using surface grinding machine. (Demonstration only)
  4. Shaping Machine: Cutting of V groove and Dovetail.
- Pedagogy/Course delivery tools: Chalk and talk, Powerpoint presentation, animated videos
  - Lab Component / Practical Topics: Subassemblies in Machines at Machine Shop
  - Links: [https://www.youtube.com/watch?v=b6h\\_ZiGoLY0](https://www.youtube.com/watch?v=b6h_ZiGoLY0)
  - Links: [https://www.youtube.com/watch?v=\\_HkCFMnkoYg](https://www.youtube.com/watch?v=_HkCFMnkoYg)

### Reference Book:

1. Serope Kalpakjian, Joyjeet Ghose, Steven R. Schmid “Manufacturing Processes for Engineering Materials” Sixth Edition, Pearson Publication, 2018.
2. Manufacturing Process – II laboratory manual, Department of Mechanical Engineering, RIT.

### Video Links:

1. <https://www.youtube.com/watch?v=x1N1mpxGB0Y>
2. <https://www.youtube.com/watch?v=ZhCmhzC6PyI>
3. [https://www.youtube.com/watch?v=\\_viYnlfXAEA](https://www.youtube.com/watch?v=_viYnlfXAEA)
4. <https://www.youtube.com/watch?v=XTU0ZFkhtU>
5. <https://www.youtube.com/watch?v=6jQ4y0LK1kY>
6. [https://www.youtube.com/watch?v=c8M\\_xYOceLg](https://www.youtube.com/watch?v=c8M_xYOceLg)
7. <https://www.youtube.com/watch?v=xarj36BpiB4>
8. <https://www.youtube.com/watch?v=Bc0wZLVKI6U>
9. <https://www.youtube.com/watch?v=Gun5Krlmls>
10. [https://www.youtube.com/watch?v=7tN\\_uGHNknM](https://www.youtube.com/watch?v=7tN_uGHNknM)
11. <https://www.youtube.com/watch?v=qxBTSUtK11M>

### Course Outcomes (COs):

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

1. Acquire the skill to create machine parts based on dimensions and assemble the parts to create assemblies
2. Generate assemblies from part files and generate the relevant views
3. Create and assemble the 3D part models using a CAD tool and draw the sectional view, orthographic views and Isometric view of the assembly including the bill of materials, section plane and ballooning.

### Course Assessment and Evaluation:

<b>Continuous Internal Evaluation (CIE): 50 Marks</b>		
<b>Assessment tool</b>	<b>Marks</b>	<b>Course outcomes addressed</b>
Weekly evaluation of laboratory records after the conduction of every experiment	30	CO1, CO2, CO3
Practical test	20	CO1, CO2, CO3
<b>Semester-End Examination (SEE)</b>	<b>50</b>	<b>CO1, CO2, CO3</b>

## KANNADA KALI

**Course Code:** HS491K

**Credits:** 1:0:0

**Pre – requisites:** Nil

**Contact Hours:** 14L

**Course Coordinator:** Mrs. Kanya Kumari S

### Unit I

#### (Parichaya) - Introduction

Kannada Bhashe - About Kannada Language, Eight Kannada Authors – JnanpiTh Awardies

Introduction to Kannada Language, Karnataka State and Literature.

- Pedagogy/Course delivery tools: Chalk and Talk, power point presentation

### Unit II

#### naamapadagaLu – Sarva namapadagaLu – (Nouns -Pronouns) and it’s usage in Kannada

Kannada namavisheshanagaLu - (Adjectives-Interrogatives)

kriyapadagaLu, kriya visheshaNagaLu- (verb-adverb)

Sambhashaneyalli Prashnarthaka padagalu –vaakyagaLu mattu kriyapadagaLu-visheshaNagaLu (Kannada- Interrogative words & Sentences and verb-adverb in Conversation)

- Pedagogy/Course delivery tools: Chalk and Talk, power point presentation

### Unit III

#### Samanya Sambhashaneyalli Kannadada Padagalu mattu Vaakyagalu

(Kannada Words and Sentences in General Conversation with activities)

sambhashaNe: (Conversation with Friends- Teachers, between Friends)

(Conversation in Shop, Hostel, Market, Bus and Train)

Shabdakosha: Vocabulary – chaTuvaTike: Exercises

Vicharaneya / Bedikeya vakyagalu(Enquiry /Request sentences in Conversation)

Sambhashane Conversation with House Owner and Room mate

Shabdakosha – Vocabulary - Exercises to test their knowledge of understanding the Language.

- Pedagogy/Course delivery tools: Chalk and Talk, power point presentation

## Unit IV

### **Kannada padagaLu (eakavachana,bahuvachanagaLu,virudda padagaLu dina nityadalli baLasuva padagaLu mattu sankya vyavaste**

Sambhashaneyalli Eakavachana mattu Bahuvachana- (Singular and Plural nouns)

Conversation- Sambhashaneyalli Linga rupagaLu- Genders in Conversation

Viruddha padagalalu /Virodathaka padagalalu (Antonyms) Asamanjasa Uchcharane (Inappropriate Pronunciation)

Sankhya Vyavasthe(Numbers system) -Samaya /Kalakke Sambhandhisida padhagalalu (Words Relating to time) – Dikkugalige sambhadhisida padhagalalu (Words Relating to Directions)

Aaharakke sambandhisida padagaLu(Names connected with food)

Manavana shareerada bhagalalu / Angagalalu (Parts of the Human body) Manava Sambhandhada da padhagalalu (Terms Relating to Human Relationship)

Manavana Bhavanegalige sambandhisida Padagalalu (Words Relating to Human's feelings and Emotions)

Vaasada stalaLakke sambhandhisidanthaha padhagalalu (Words Relating to place of leaving)

- Pedagogy/Course delivery tools: Chalk and Talk, power point presentation

## Unit V

### **Kannada akshara maale (Kannada alphabets and their practices with pronunciations)**

swara aksharagaLu –vyanjanaksharagaLu- gunitaksharagaLu, tantragnana mattu AaDalita padagaLu-Technical and administrative worlds in Kannada

- Pedagogy/Course delivery tools: Chalk and Talk, power point presentation

### **Text Book:**

1. Dr. L. Thimmesha, Prof. Keshava murthy, 'BaLake kannada' prasarangaa, VTU,2020.

### **Reference Book:**

1. Smt. KanyaKumari.S –'Kannada Kali ' Kinnari publications' First edition, Bengaluru,2022
2. Lingadevaru Halemane – 'Kannada Kali', Prasaranga kannada University Hampi, 6<sup>th</sup> Edition. 2019

### Course out comes (COs):

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

1. Develop vocabulary (PO-10)
2. Identify the basic Kannada language skill (PO-10)
3. Develop listening & speaking skill in Kannada language. (PO-6, PO-12)
4. Enrich language skill. (PO-12)
5. Apply Kannada language skill for various purpose (PO-12)

### Course Assessment and Evaluation:

<b>Continuous Internal Evaluation (CIE): 50 marks</b>		
<b>Assessment tool</b>	<b>Marks</b>	<b>Course outcome attained</b>
Internal test-I	30	CO1, CO2, CO3
Internal test-II	30	CO4, CO5
Average of the Two Internal Test Two will be Taken for 30 Marks		
<b>Other components</b>		
Assignment	10	CO1, CO2
Quiz	10	CO3, CO4, CO5
<b>Semester end examination (SEE)</b>	100	CO1, CO2, CO3, CO4, CO5

## ಕನ್ನಡ ಮನಸು

<b>Course Code:</b> HS491M	<b>Credits:</b> 1:0:0
<b>Pre – requisites:</b> Nil	<b>Contact Hours:</b> 14L
<b>Program:</b> B.E(Common to all the Branches)	<b>Semester:</b> IV
<b>Course Coordinator:</b> Mrs. Kanya Kumari S	

### ಘಟಕ – 1 (Unit I)

ಲೇಖನಗಳು (Articles)– ಕಾವ್ಯಭಾಗ (poetry)

ಕನ್ನಡ ಭಾಷೆ ನಾಡು – ನುಡಿ

ಕರ್ನಾಟಕ ಸಂಸ್ಕೃತಿ

ಆಡಳಿತ ಭಾಷೆಯಾಗಿ ಕನ್ನಡ

ವಚನಗಳು–ಅಕ್ಕಮಹಾದೇವಿ–ಬಸವಣ್ಣ–ಅಲ್ಲಮಪ್ರಭು

- Pedagogy/Course delivery tools: Ch Chalk and Talk, power point presentation

### ಘಟಕ – 2 (Unit II)

ಕೀರ್ತನೆ ಮತ್ತು ತತ್ವ ಪದಗಳು

ಪುರಂದರ ದಾಸರು ಮತ್ತು ಕನಕದಾಸರ ಪದಗಳು

ಶಿಶುನಾಳ ಶರೀಫರು ಮಹಾಂತ ಶಿವಯೋಗಿಗಳ ಪದಗಳು

ಜನಪದ ಗೀತೆ

- Pedagogy/Course delivery tools: Ch Chalk and Talk, power point presentation

### ಘಟಕ – 3 (Unit III)

ಆಧುನಿಕ ಕಾವ್ಯಗಳು

ಮಂಕುತಿಮ್ಮನ ಕಗ್ಗ

ಕುರುಡು ಕಾಂಚಾಣ

ಚೋಮನ ಮಕ್ಕಳ ಹಾಡು

Pedagogy/Course delivery tools: Ch Chalk and Talk, power point presentation

### ಘಟಕ –4 (Unit IV)

ತಾಂತ್ರಿಕ ಧುರೀಣರು( ವ್ಯಕ್ತಿ ಪರಿಚಯ) ಕಥೆ–ಪ್ರವಾಸ ಕಥನ

ಡಾ.ಸರ್.ಎಂ.ವಿಶ್ವೇಶ್ವರಯ್ಯ– ವ್ಯಕ್ತಿ ಮತ್ತು ಐತಿಹ್ಯ – ಎ,ಎನ್.ಮೂರ್ತಿರಾಯರು  
ಯುಗಾದಿ –ವಸುಧೇಂದ್ರ

ಮೆಗಾನೆ ಎಂಬ ಗಿರಿಜನ ಪರ್ವತ -ಹಿ.ಚಿ.ಬೋರಲಿಂಗಯ್ಯ

- Pedagogy/Course delivery tools: Ch Chalk and Talk, power point presentation

### ಘಟಕ- ೫ (Unit V)

ಕರಕುಶಲ ಕಲೆಗಳು -ತಾಂತ್ರಿಕ ವಿಜ್ಞಾನ (technical science)

ಕರಕುಶಲ ಕಲೆಗಳು -ಮತ್ತು ಪರಂಪರೆ ವಿಜ್ಞಾನ- ಕರಿಗೌಡ ಬೇಚನ ಹಳ್ಳಿ

ಕಂಫ್ಯೂಟರ್ ಹಾಗೂ ಮಾಹಿತಿ ತಂತ್ರಜ್ಞಾನ-

ಕೆ'ಮತ್ತು ಬ ಬರಹ ತಂತ್ರಾಂಶಗಳು ಮತ್ತು .ಕಂಫ್ಯೂಟರ್ ಮುಖಾಂತರ ಕನ್ನಡ ಟೈಪಿಂಗ್  
ತಾಂತ್ರಿಕ ಪದಕೋಶ ತಾಂತ್ರಿಕ ಹಾಗೂ ಪಾರಿಭಾಷಿಕ ಕನ್ನಡ ಪದಗಳು

- Pedagogy/Course delivery tools: Ch Chalk and Talk, power point presentation

**ಪಠ್ಯ ಪುಸ್ತಕ (text book):**

ಸಾಂಸ್ಕೃತಿಕ ಕನ್ನಡ'

ಸಂಪಾದಕರು : ಡಾ.ಹಿ.ಚಿ, ಬೋರಲಿಂಗಯ್ಯ -ವಿಶ್ರಾಂತ ಕುಲಪತಿಗಳು, ಕನ್ನಡ

ವಿಶ್ವವಿದ್ಯಾಲಯ ,ಹಂಪಿ,ಪ್ರಸಾರಂಗ ವಿಶ್ವೇಶ್ವರಯ್ಯತಾಂತ್ರಿಕ ವಿಶ್ವವಿದ್ಯಾಲಯ,ಬೆಳಗಾವಿ,ಪ್ರಥಮ  
ಮುದ್ರಣ-2020

**ಪೂರಕ ಪಠ್ಯ (reference book)**

ಕನ್ನಡ ಮನಸು, ಪ್ರಸಾರಂಗ - ಕನ್ನಡ ವಿಶ್ವವಿದ್ಯಾಲಯ-ಹಂಪಿ,ಆರನೇಮುದ್ರಣ 2016

**ಕನ್ನಡ ಕಲಿಕೆಯ ಉದ್ದೇಶಗಳು:**

- ಸಾಂಸ್ಕೃತಿಕ ಕನ್ನಡದ ಜೊತೆಗೆ ಕ್ರಿಯಾತ್ಮಕ, ಸಾಹಿತ್ಯ ಮತ್ತು ಸಂಸ್ಕೃತಿ ಮತ್ತು ನಾಡು-ನುಡಿಯ ಪರಿಚಯ ಮಾಡಿಕೊಡುವುದು (PO-6)
- ಕನ್ನಡ ಭಾಷೆಯ ವ್ಯಾಕರಣ, ಭಾಷಾರಚನೆ ಯ ನಿಯಮಗಳನ್ನು ಪರಿಚಯಿಸುವುದು(PO-10)
- ಕನ್ನಡ ಭಾಷಾಬರಹದಲ್ಲಿ ಕಂಡು ಬರುವ ದೋಷಗಳು ಮತ್ತು ಅವುಗಳ ನಿವಾರಣೆ(PO10)
- ಸಾಮಾನ್ಯ ಅರ್ಜಿಗಳು, ಸರ್ಕಾರಿ ಹಾಗೂ ಸರ್ಕಾರಿ ಪತ್ರವ್ಯವಹಾರದ ಬಗ್ಗೆ ಅರಿವು ಮೂಡಿಸುವುದು(PO-12)
- ಭಾಷಾಂತರ ಮತ್ತು ಪ್ರಬಂಧ ರಚನೆ ಬಗ್ಗೆ ಅರಿವು ಮೂಡಿಸುವುದು ಕನ್ನಡ ಭಾಷಾಭ್ಯಾಸ,ಸಾಮಾನ್ಯ ಕನ್ನಡ ಹಾಗೂ ಆಡಳಿತ ಕನ್ನಡದ ಪದಗಳ ಪರಿಚಯ ಮಾಡಿಕೊಡುವುದು. (PO-12)

**Course Assessment and Evaluation:**

<b>Continuous Internal Evaluation (CIE): 50 marks</b>		
<b>Assessment tool</b>	<b>Marks</b>	<b>Course outcome attained</b>
Internal test-1	30	CO1, CO2, CO3
Internal test-II	30	CO4, CO5
Average of the Two Internal Test Two will be Taken for 30 Marks		
<b>Other components</b>		
Assignment	10	CO1, CO2
quiz	10	CO3, CO4, CO5
Semester end examination (SEE)	100	CO1, CO2, CO3, CO4, CO5



## ABILITY ENHANCEMENT COURSE - IV

<b>Course Code:</b> AEC410	<b>Credits:</b> 1:0:0
<b>Pre – requisites:</b> Nil	<b>Contact Hours:</b> 14L
<b>Course Coordinator:</b> Dr. Rama Shivakiran Reddy	

Ability Enhancement Courses (AEC) are the generic skill courses which are basic and needed by all to pursue any career. These courses are designed to help students enhance their skills in communication, language, and personality development. They also promote a deeper understanding of subjects like social sciences and ethics, culture and human behaviour, human rights and the law.

Every student shall register for AEC course under the supervision of his/her proctor. For III, IV & V semester, the student shall select the Ability Enhancement Course online such that the selected course does not overlap with any professional core/ elective course offered by the parent department of the student. After selection, the registration of the course has to be done by the student at his/her parent department.

## ADDITIONAL MATHEMATICS - II

<b>Course Code:</b> AM41	<b>Credits:</b> 0:0:0
<b>Pre – requisites:</b> Nil	<b>Contact Hours:</b> 42
<b>Course Coordinator:</b> Dr. Veena B N	

### Unit I

**Differential Calculus- I:** Partial differentiation, Euler’s theorem, total differential coefficient, differentiation of composite and implicit functions.

- Pedagogy/Course delivery tools: Chalk and talk
- Online tools: Use of open source software’s to demonstrate methods and solve problems on interpolation
- Links: <https://nptel.ac.in/courses/111/105/111105121/>
- Impartus recording: <https://a.impartus.com/ilc/#/course/107625/1030>

### Unit II

**Differential Calculus- II:** Jacobian and Properties. Taylor’s theorem for function of two variables, maxima and minima for functions of two variables.

- Pedagogy/Course delivery tools: Chalk and talk
- Online tools: Use of open source software’s to demonstrate methods and solve problems on numerical differentiation and integration.
- Links: <https://nptel.ac.in/courses/111/105/111105121/>
- Impartus recording: <https://a.impartus.com/ilc/#/course/107625/1030>  
<https://a.impartus.com/ilc/#/course/59742/295>

### Unit III

**Vector Integration:** Line integrals, surface integrals and volume integrals. Green’s theorem, Stokes’ and Gauss divergence theorem (without proof) and problems, orthogonal curvilinear coordinates.

- Pedagogy/Course delivery tools: Chalk and talk
- Links: <https://nptel.ac.in/courses/111/105/111105134/>
- Impartus recording: <https://a.impartus.com/ilc/#/course/619570/1030>

### Unit IV

**Higher Order Differential Equations:** Higher order linear differential equations, method of variation of parameters, Cauchy’s and Legendre’s homogeneous differential equations.

- Pedagogy/Course delivery tools: Chalk and talk
- Links: <https://nptel.ac.in/courses/111/105/111105121/>
- Impartus recording: <https://a.impartus.com/ilc/#/course/96127/452>  
<https://a.impartus.com/ilc/#/course/59742/295>

### Unit V

**Probability:** Introduction. Sample space and events. Axioms of probability. Addition and multiplication theorems. Conditional probability- illustrative examples. Bayes theorem – examples.

- Pedagogy/Course delivery tools: Chalk and talk
- Links: <https://nptel.ac.in/courses/111/107/111107119/>  
<https://nptel.ac.in/courses/111/107/111107119/>
- Impartus recording: <https://a.impartus.com/ilc/#/course/283623/703>

#### Text Books:

1. **B.S. Grewal** – Higher Engineering Mathematics, Khanna Publishers, 44<sup>th</sup> edition, 2017.
2. **Erwin Kreyszig** – Advanced Engineering Mathematics – Wiley Publication, 10<sup>th</sup> Edition, 2015.

#### Reference Books:

1. **H. K. Dass** – Higher Engineering Mathematics – S Chand Publications, 1998
2. **B. V. Ramana** – Engineering Mathematics – Tata McGraw-Hill Publishing Co. Ltd., New Delhi, 2008.

#### Course Outcomes (COs):

At the end of the course the student will be able to

1. To carryout differentiation of function of several variables.
2. Solve the problems related to Jacobians, the extreme values of a function and Taylors series.
3. Exhibit the interdependence of line, surface and volume integrals using integral theorems.
4. Find the solution of second and higher order ODEs with constant and variable coefficients.
5. Solve the problems on conditional probability and Baye’s theorem.