



RAMAIAH
Institute of Technology

CURRICULUM

Outcome Based Education
(Academic Year 2022 – 2023)

INDUSTRIAL ENGINEERING AND MANAGEMENT

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 air-conditioned library with good collection of book volumes and subscription to International and National Journals. The Digital Library subscribes to online e-journals from Elsevier Science Direct, IEEE, Taylor & Francis, Springer Link, etc. MSRIT is a member of DELNET, CMTI and VTU E-Library Consortium. MSRIT has a modern auditorium and several hi-tech 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 67th rank among 1249 top Engineering Institutions.

17th Rank for School of Architecture in India for the year 2022 and is 1st amongst the Engineering Colleges affiliated to VTU, Karnataka.

About the Department:

The department was established in the year 1979 as Industrial & Production Engineering and renamed as Industrial Engineering & Management in the year 1992, with an intake of 60 students and M.Tech program was commenced in the year 2012. The department has been recognized as R&D center by VTU with 14 scholars pursuing their Ph.D. The department has well modernized laboratories namely Industrial & Quality Engineering lab, Computer Lab and Mechanical Measurement & Metrology lab. The department is having highly qualified, motivated and result oriented faculty members. All the faculty are involved in research and technical paper publications in reputed technical journals, conferences across the world. The department was accredited by the NBA in 2001, 2004, 2010 & reaccredited in year 2015 as per the new NBA format laid down by Washington Accord. It has consistently bagged university ranks in Bangalore University & VTU. It has set a unique record of achieving 1st rank eleven times. The department has successfully conducted around 37 faculty development programs, seminars & workshops for academicians as well as industry personnel, students and technical staff. The society of Industrial Engineering and Management, “INDEMAN SOCIETY”- a student body was established in the year 1996. The activities of this society includes: Regular Industrial visits and Guest lectures are conducted twice every semester for all students. Many research projects are executed which are sponsored by UGC, AICTE, DST, VTU and VGST.

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 socio- economic needs

MISSION OF THE INSTITUTE

MSRIT shall meet the global socio-economic 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 socio-economic 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

THE VISION OF THE DEPARTMENT

To produce globally competent Industrial Engineers, Researchers and Entrepreneurs capable of developing solutions to continually improve socio-technical systems and add value to the society.

THE MISSION OF THE DEPARTMENT

The Industrial Engineering and Management department shall transform the entrants of the Industrial Engineering and Management program into professionally competent engineers through -

- Innovative educational curricula
- Balanced research program
- Effective collaboration with industry and academia

PROGRAM EDUCATIONAL OBJECTIVES (PEOs)

PEO1: Use the knowledge and skills of industrial engineering to model and analyze the real life problems and interpret the results.

PEO2: Effectively design, implement, improve and manage the integrated socio-technical systems.

PEO3: Build and lead cross-functional teams, upholding the professional responsibilities and ethical values.

PEO4: Engage in continuing education and life-long learning to be competitive and enterprising.

PROGRAM OUTCOMES (POs):

The graduate of Industrial Engineering and Management will have the ability to

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: Life-long learning: Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change.

THE PROGRAMME SPECIFIC OUTCOMES (PSOs):

The graduates of Industrial Engineering and Management program will

PSO1: Develop Knowledge, Skills and abilities in the fields such as System design and development, Manufacturing and Research.

PSO2: Apply the core competence in the field of industrial and systems engineering to solve real world problem and continuously improve its performance.

PSO3: Exhibit innovative abilities and develop towards entrepreneurial careers with a focus on leadership and responsibility.

SCHEME OF TEACHING III SEMESTER

Sl. No.	Subject Code	Subject	Teaching Department	Category	Credits				Total contact hours /week
					L	T	P	Total	
1	IM31	Integral Transforms and Applications	Maths	BSC	2	1	0	3	4
2	IM32	Mechanical Behavior of Materials	IEM	IPCC	2	0	1	3	4
3	IM33	Manufacturing processes	IEM	PCC	3	0	0	3	3
4	IM34	Work Study and Ergonomics	IEM	PCC	3	0	0	3	3
5	IM35	Materials Management	IEM	PCC	3	0	0	3	3
6	IML36	Manufacturing Processes lab	IEM	PCC	0	0	1	1	2
7	IML37	Work Study and Ergonomics Lab	IEM	PCC	0	0	1	1	2
8	UHV38	Universal Human Values	IEM	UHV	2	0	0	2	2
9	HS392	Constitution of India & Professional Ethics	HSS	HSMC	1	0	0	1	1
10	AEC310	Ability Enhancement Course- III	IEM	AEC	1	0	0	1	1
Total								21	25
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 *	Maths	NCMC	0	0	0	0	3

<p>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</p> <p>Branches: EEE, MLE, ETE, EIE, ME, CV, IEM, CH, BT: Constitution of India & Professional Ethics in III Semester Kannada (Kali / Manasu) in IV Semester</p>
<p>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, NCMC: Non-credit Mandatory Course</p>
<p>L –Lecture, T – Tutorial, P- Practical/ Drawing</p>

<p>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.</p>
<p>HS39/ HS49 Kannada Manasu is for students who speak, read and write Kannada and HS39/ HS49 Kannada Kali is for non-Kannada speaking, reading, and writing students.</p>
<p>The Non Credit Mandatory Course, Physical Education (Sport and Athletics)/Yoga/National Service Scheme (NSS):</p> <ol style="list-style-type: none"> 1. Student shall select any one of the NCMC'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 NCMC'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 viva-voce examination. The marks of the report shall be 50 marks and for the presentation/viva-voce 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 Non-Credit 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 Internship-I of 03 weeks during the intervening vacation of III and IV semesters. Summer Internship shall include Inter / Intra Institutional activities. A Viva-voce 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 4-year 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 (non-credit) 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	IM41	Numerical methods and graph theory*	Maths	BSC	2	1	0	3	4
2	IM42	Operations Research	IEM	IPCC	2	0	1	3	4
3	IM43	Mechanical Measurements and Metrology	IEM	PCC	3	0	0	3	3
4	IM44	Facilities Planning and Design	IEM	PCC	3	0	0	3	3
5	IM45	Applied Probability and Statistics	IEM	PCC	2	1	0	3	4
6	IML46	Mechanical Measurements and Metrology Lab	IEM	PCC	0	0	1	1	2
7	IML47	Applied Probability and Statistics Lab	IEM	PCC	0	0	1	1	2
8	IML48	Computer Aided Machine Drawing	IEM	PCC	0	0	1	1	2
9	HS491	Kannada (Kali / Manasu)	HSS	HSMC	1	0	0	1	1
10	AEC410	Ability Enhancement Course – IV	MCA	AEC	1	0	0	1	1
11	INT411	Inter/ Intra Institutional Internship		INT	0	0	2	2	-
				Total				22	26
12	AM41	Additional Mathematics II *	Maths	NCMC	0	0	0	0	3

<p>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</p> <p>Branches: EEE, MLE, ETE, EIE, ME, CV, IEM, CH, BT: Constitution of India & Professional Ethics in III Semester Kannada (Kali / Manasu) in IV Semester</p>
<p>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: Non-credit Mandatory Course</p>
<p>L –Lecture, T – Tutorial, P- Practical/ Drawing</p>

<p>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.</p>
<p>HS39/ HS49 Kannada Manasu is for students who speak, read and write Kannada and HS39/ HS49 Kannada Kali is for non-Kannada speaking, reading, and writing students.</p>
<p>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 centre’s or incubation centres. 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 Viva-Voce 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 take-up/complete the internship shall be declared fail and shall have to complete during subsequent examination after satisfying the internship requirements. The in-charge 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.</p>
<p>* <u>Lateral Entry Students:</u> 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</p>

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 fulfil 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 4-year 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 (non-credit) 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: IM31	Credits: 2:1:0
Pre – requisites: Calculus	Contact Hours: 28L+14T
Course Coordinator: Dr G Neeraja, Dr Vijay Kumar & Dr A Sreevallabha Reddy	

Course Content

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 Periodic function.

- Pedagogy/Course delivery tools: Chalk and talk, Power point presentation, Videos.
- Links: <https://nptel.ac.in/courses/111/105/111105134/>
- Impartus 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, Power point presentation, Videos.
- Links: <https://nptel.ac.in/courses/111/105/111105134/>
- Impartus 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, complex of Fourier series, half range Fourier series, Practical harmonic analysis.

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

Unit IV

Fourier Transforms: Derivation of Fourier series to Fourier transforms, Infinite Fourier transform, Infinite Fourier sine and cosine transforms, properties, Inverse

transforms, Convolution theorem and its significance, Parseval's identities (statements only). Limitations of Fourier transform and need of Wavelet transform.

- Pedagogy/Course delivery tools: Chalk and talk, Power point presentation, Videos.
- Links: <https://nptel.ac.in/courses/111/108/111108066/>
- Impartus 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, Power point presentation, Videos.
- Links: <https://nptel.ac.in/courses/111/101/111101153/>
- Impartus 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, 10th edition, 2015
2. **B.S. Grewal** – Higher Engineering Mathematics, Khanna Publishers, 44th edition, 2017.

Reference Books:

1. **George B. Thomas, Maurice D. Weir, Joel R. Hass** - Thomas' Calculus, Pearson, 13th edition, 2014.
2. **Peter V. O' Neil** – Advanced Engineering Mathematics, Thomson Brooks/Cole, 7th edition, 2011.
3. **Glyn James & Phil Dyke** – Advanced Modern Engineering Mathematics, Pearson Education, 5th 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. Determine Laplace transform of standard functions. (PO-1, PO-2, PSO-1, PSO-2)
2. Solve initial and boundary value problems using Laplace transforms. (PO-1, PO-2, PSO-1, PSO-2)
3. Construct the Fourier series expansion of functions/tabulated data. (PO-1, PO-2, PSO-1, PSO-2)
4. Evaluate Fourier transforms of given functions and use Z-transforms to solve difference equations. (PO-1, PO-2, PSO-1, PSO-2)
5. Find the solution of PDE's analytically using Fourier techniques. (PO-1, PO-2, PSO-1, PSO-2)

Course Assessment and Evaluation:

Continuous Internal Evaluation (CIE): 50 Marks		
Assessment Tool	Marks	Course outcomes addressed
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.		
Other components		
Quiz	10	CO1, CO2, CO3
Assignment	10	CO3, CO4, CO5
Semester End Examination (SEE)	100	CO1, CO2, CO3, CO4, CO5

MECHANICAL BEHAVIOUR OF MATERIALS	
Course Code: IM32	Credits: 2:0:1
Pre – requisites: Nil	Contact Hours: 56
Course Coordinator: Dr. M Shilpa / Mrs. Hamritha S	

Course Content

Unit I

Introduction to materials and imperfections: Metals and Non Metals, Composites, Nano composites. Imperfections: Point defects and Line defects and surface defects

Fracture: Ductile and brittle fracture, Ductile to brittle fracture transition.

Fatigue: Types of loading, Fatigue parameters, S-N curves, Factors affecting fatigue, design consideration to prevent fatigue

Creep: Fundamental mechanism of creep, properties affecting creep.

- Pedagogy / Course delivery tools: Black board teaching, Power Point Presentation
- Links: <https://www.youtube.com/watch?v=FxQiS8buoDo>
https://www.youtube.com/watch?v=LRKzOui_kS8&list=PLfIFNJ1DPG4ksAjeCgpbm8nLGM1Pgxr&index=3
<https://www.youtube.com/watch?v=OlexdbPETPw>
<https://www.youtube.com/watch?v=zH05sDLKMoU>

Unit II

Phase Diagrams: Solid solutions, Hume Rothary rules, Gibbs phase rule, Lever rule. Iron carbon equilibrium diagram: Construction and description of phases, Solidification of steels and cast irons, Time Temperature Transformation curves.[Problems on Eutectic Phase Diagram only]

Heat treatment: Heat treatment of ferrous alloys: Classification of heat treatment processes

Full heat treatment: Annealing and its types, normalizing, hardening, tempering, martempering, austempering, Surface heat treatment: carburizing, cyaniding, Nitriding, Flame hardening and induction hardening, Heat treatment of non-ferrous alloys: Age hardening

- Pedagogy / Course delivery tools: Black board teaching, Power Point Presentation
- Links: <https://www.youtube.com/watch?v=BJrTZ07bHm4&list=PLfIFNJ1DPG4IENg4VUTWyKxxB911aHuJz>
<https://www.youtube.com/watch?v=bgpBJcIlrY4&list=PLfIFNJ1DPG4IENg4VUTWyKxxB911aHuJz&index=4>
<https://www.youtube.com/watch?v=erOKm7wbkJE&list=PLfIFNJ1DPG4IENg4VUTWyKxxB911aHuJz&index=11>

Unit III

Simple stress and strain: Introduction, Properties of Materials, Stress, Strain, Hook's law, Poisson's Ratio, Stress- Strain Diagram for structural steel and non- ferrous materials, Principles of superposition, Total elongation of tapering bars of circular cross section.

Compound bars: Introduction, Principal planes and stresses, Mohr's circle of stresses (Derivations Not Included-Analytical only).

Torsion of circular shafts: Introduction, Pure torsion, torsion equation of circular shafts, strength and stiffness, torsional rigidity, torsional flexibility, Power transmitted by shaft solid and hollow circular sections. (Simple problems)

- Pedagogy / Course delivery tools: Black board teaching, Power Point Presentation
- Links:<https://www.youtube.com/watch?v=XGxMASBebw&list=PLcwp2fRcIXJVJbLOtIX9OeGCKRp4R1lhX&index=2>
<https://www.youtube.com/watch?v=xDxeNUogj1Q&list=PLcwp2fRcIXJVJbLOtIX9OeGCKRp4R1lhX&index=4>
<https://www.youtube.com/watch?v=3CuAE9hwFM0&list=PLcwp2fRcIXJVJbLOtIX9OeGCKRp4R1lhX&index=10>

Unit IV

Bending moment and shear force in beams: Introduction, Types of beams loadings and supports, Shearing force in beam, Bending moment, Sign convention, Relationship between loading shear force and bending moment, SFD and BMD with salient values for cantilever beams, simply supported beams and overhanging beams considering point loads, UDL, UVL and Couple.

- Pedagogy / Course delivery tools: Black board teaching, Power Point Presentation
- Links:<https://www.youtube.com/watch?v=09c0JtVXapI&list=PLcwp2fRcIXJVJbLOtIX9OeGCKRp4R1lhX&index=12>
<https://www.youtube.com/watch?v=NHLzMpIp4kE&list=PLcwp2fRcIXJVJbLOtIX9OeGCKRp4R1lhX&index=13>

Unit V

Elastic stability of columns: Introduction, Euler's theory on columns, Effective length slenderness ratio, Short and long columns, radius of gyration, buckling load, Assumptions, derivations of Euler's Buckling load for different end conditions, Limitations of Euler's theory, Rankine's formula

Thin and thick cylinders: Thin and thick cylinders-Thin cylinders subjected to change in length, diameter and volume, Lames equations for thick cylinders (compound cylinders not included)

- Pedagogy / Course delivery tools: Black board teaching, Power Point Presentation

- Links: <https://www.youtube.com/watch?v=SC114pvgw2E&list=PLcwp2fRcIXJVJbLOtIX9OeGCKRp4R1lhX&index=29>
<https://www.youtube.com/watch?v=akOHC4gebR0&list=PLcwp2fRcIXJVJbLOtIX9OeGCKRp4R1lhX&index=30>
<https://www.youtube.com/watch?v=dB5QG4c7Whw&list=PLcwp2fRcIXJVJbLOtIX9OeGCKRp4R1lhX&index=31>
<https://www.youtube.com/watch?v=GJ7DhqqK9Vo>

Lab Component:

SI No	Name of the Experiment
1	Rockwell Hardness Test
2	Izod and Charpy Test
3	Tensile Test
4	Single and Double Shear
5	Bending Test
6	Compression Test
7	Erosion test

Text Books:

1. Marc Andr'e Meyers, Krishan Kumar Chawla "Mechanical behaviour of Materials", Second Edition, Cambridge University Press, 2009.
2. William & Smith –Materials Science and Engineering, in SI units, TMH, Special Indian edition 2008.
3. Basavarajaiah and Mahadevappa, Strength of Materials, University Press, 2010

References:

1. V Raghavan -Physical Metallurgy, Principles and Practices, PHI, 2nd Edition 2006, New Delhi.
2. James F Shackelford -Introduction to Material Science for Engineering, 6th edition Pearson Prentice hall, New Jersey, 2006.
3. L.S.Srinath, Prakash Desai and AnanthRamu - Strength of Materials, TMH Publishers, Chennai, 2008.
4. S.S Bhavikatti -Strength of Materials, Vikas Publications House pvt. Ltd, 3rd edition 2009.
5. Timoshenko and Young -Elements of Strength of Materials, Affiliated East- Wes Press, 2nd edition 2007.
6. Ramamrutham, Strength of Materials, Dhanapath Rai Publishers, 2008.

Course Outcomes (COs):

Students will be able:

1. To identify the types of materials, structures and defects in them. They will also understand how materials fail and how the failures can be reduced. (PO-7, PSO-2)
2. To construct the phase diagrams and identify the different phases. Also, understand how heat treatment will increase the strength of the material with the help of different heat treatment process. (PO-7, PSO-2)
3. Judge the effect of stress & strain on various mechanical/machine members of various engineering materials and analyze the effect of compound stresses on members. Also study the effect of torsional moment on rigidity and strength of circular members. (PO-3, PO-7, PO-12, PSO-2)
4. Determine the strength and rigidity of various cross sections using SFD and BMD. (PO-3, PO-7, PSO-2)
5. Determine the cross sectional dimensions of cylindrical pressure vessels for various stress conditions and to design suitable dimensions for columns and struts based on suitability of Euler's and Rankine's formula for crushing stresses. (PO-3, PO-7, PSO-2)

Course Assessment and Evaluation:

Continuous Internal Evaluation (CIE): 50 Marks		
Assessment Tool	Marks	Course outcomes attained
Internal Test – I	30	CO1, CO2
Internal Test – II	30	CO3, CO4, CO5
Average of the two internal tests shall be taken for 30 marks		
Other Components		
Assignments	10	CO1, CO2, CO3, CO4, CO5
Quiz	10	CO1, CO2, CO3, CO4, CO5
Semester End Examination (SEE)	100	CO1, CO2, CO3, CO4, CO5

MANUFACTURING PROCESSES	
Course Code: IM33	Credits: 2:0:1
Pre – requisites: Nil	Contact Hours: 42L
Course Coordinator: Dr. N.D. Prasanna, Sudheer D. Kulkarni, Dr. Siddhartha Kar	

Course Content

Unit I

Metal Casting Process: Introduction, Steps involved in casting, advantages and limitations, Pattern types, pattern allowances, pattern materials. Sand Casting, Types of molding sand, Ingredients of molding sand, properties.

Special Metal Casting Processes: Shell-mold casting, Plaster-mold casting, Ceramic-mold casting, Vacuum casting, Investment casting (lost-wax process), Pressure Casting, Die casting, Centrifugal Casting, Continuous Casting.

Melting Furnaces: Constructional features and working of Electric furnaces- Arc, resistance and induction furnaces; Cupola

Testing and Inspection of Castings: Defects in Castings-Causes and remedies, Non-destructive testing: X-ray radiography, dye penetrate test, ultrasonic test, magnetic particle inspection.

- Pedagogy / Course delivery tools: Chalk and talk, Power point presentations, Animated videos

- Links:

Casting: Introduction and Suitability:

<https://www.youtube.com/watch?v=ozFdTBG93uU&t=1s>

Steps of casting: <https://www.youtube.com/watch?v=rL3dLQYEEKw>

Casting terminology: <https://www.youtube.com/watch?v=yPpyyABaqcw>

Pattern allowances: <https://www.youtube.com/watch?v=8EO25lnMj-I>

Shell-mold casting: <https://www.youtube.com/watch?v=ZmAkMgl3V3w>

Investment and Permanent Mold Casting:

<https://www.youtube.com/watch?v=ps2cWctKLBQ>

Melting Furnaces and Practice:

<https://www.youtube.com/watch?v=GUctNyh1FR0>

Casting defects and their preventions: <https://www.youtube.com/watch?v=ICB41-cihGk>

Unit II

Advanced Welding Processes: Introduction, Thermit welding, Friction welding, Explosive welding, Ultrasonic welding, Electron beam welding, Laser welding. Welding principle, advantages, disadvantages and applications.

Bulk Deformation Processes: Definition, Types, Hot Working, Warm Working and Cold working of metals. Forging; Rolling; Extrusion; Rod, Wire, and Tube drawing.

Processing of Metal Powders: Powder Metallurgy, Compaction of Metal Powders, Sintering, Secondary and Finishing Operations

- Pedagogy/Course delivery tools: Chalk and talk, Power point presentations, Animated videos
- Links:
Metal Working Processes: Hot & Cold Working:
<https://www.youtube.com/watch?v=dNbVsmVgOnM>
Powder Metallurgy: <https://www.youtube.com/watch?v=MgukjCT9o80>

Unit III

Theory of Metal Cutting: Single point tool nomenclature, geometry, orthogonal & oblique cutting, mechanism of chip formation, types of chips, Merchants analysis, Ernst-Merchant's solution, shear angle relationship, problems on Merchants analysis

Selection of Cutting Tool Materials: Desired properties, types of cutting tool materials- HSS carbides, coated carbides, ceramics; Cutting Fluids- properties, types & selection, machinability, factors affecting machinability.

Tool Wear & Tool Failure: Effects of cutting parameters, Tool life criteria, Taylor's tool life equation, problems on tool life evaluation

- Pedagogy/Course delivery tools: Chalk and talk, Power point presentations, Animated videos
- Links:
Single point cutting tool: <https://www.youtube.com/watch?v=81Fdif5e85c&t=7s>
Mechanism of chip formation:
<https://www.youtube.com/watch?v=WiY60zAa4c4&t=20s>
Machining forces and MCD:
https://www.youtube.com/watch?v=Dcx1Vf_1Z3o&t=117s
Tool life: <https://www.youtube.com/watch?v=-R-fySRLa9Q>

Unit IV

Machine Tools: Capstan & Turret lathes-constructural features, Drilling Machines: Classification, constructional features, drilling & related operations, types of drill & drill bit nomenclature. Shaper- Classification, constructional features, Specification of shaper, Shaper Mechanisms. Numerical Problems on calculation of machining time.

Milling Machines: Classification, constructional features, milling cutters & nomenclatures, milling operations, up milling & down milling concepts.

Grinding Machines: Classification and principles of Surface, cylindrical & centre-less grinding operations

- Pedagogy/Course delivery tools: Chalk and talk, Power point presentations, Animated videos
- Links:
 Lathe: <https://www.youtube.com/watch?v=T6vR81ysTG8&t=270s>
<https://www.youtube.com/watch?v=XLriJNaygQc&t=2015s>
 Drilling: <https://www.youtube.com/watch?v=OBO7Keg2Lv8&t=2750s>
 Shaping: <https://www.youtube.com/watch?v=6OCFKE6Gqa0>
 Milling: <https://www.youtube.com/watch?v=DWtcjWltRFw&t=4s>
 Grinding: https://www.youtube.com/watch?v=RtGl5hpiT_w

Unit V

Modern Machining Methods: Electric Discharge Machining (EDM), Electro-Chemical Machining, Hybrid Machining Processes: Overview, Classification, Basic Principles of Vibration assisted EDM, Electro-Chemical Discharge Machining.

Micromanufacturing: Introduction, Semiconductors and Silicon, Crystal Growing and Wafer Preparation, Films and Film Deposition, Oxidation, Lithography, Etching, Diffusion and Ion Implantation, Metallization and Testing, Wire Bonding and Packaging, Printed Circuit Boards

- Pedagogy/Course delivery tools: Chalk and talk, Power point presentations, Animated videos
- Links:
 EDM: https://www.youtube.com/watch?v=rA09KaPL7_8&t=88s
 ECM: <https://www.youtube.com/watch?v=fOc65syJvDM>
 ECDM: https://www.youtube.com/watch?v=-tcaR7oSx_w

Text Books:

1. Serope Kalpakjian and Steven R. Schniid - Manufacturing Processes for Engineering Materials Technology, Pearson Education Asia, 5 th Edition. 2015.
2. Amitabha Ghosh & Mallik -Manufacturing science, Affiliated East West press, 1995
4. HMT -Production Technology, Tata McGraw Hill, 2020
3. E. Paul Degarmo -Materials and Processes in Manufacturing, 9th edition, PHI, 2011.

References:

1. John A. Schey–Introduction to Manufacturing Processes, 3rd Edition, McGraw Hill International Editions, 2012
2. Roy A Lindberg -Material and Processes of Manufacture, PHI Publishers, 4th edition, Pearson Education, 2006

3. Pandey & Shan -Modern machining process, TMH, 2000.
4. El-Hofy, H., Youssef, H. (2020). Non-traditional and Advanced Machining Technologies. United Kingdom: CRC Press.

Course Outcomes (COs):

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

1. Understand and compare various moulding methods, select a suitable furnace for a given metal and identify the defects in castings by suitable inspection / testing methods. (PO-1, PO-6, PO-7, PO-9, PO-12, PSO-1)
2. Select a suitable welding technique for the given application and enhance their knowledge in the area of metal forming / processing techniques. (PO-1, PO-6, PO-7, PO-9, PO-12, PSO-1)
3. Apply the concept of metal cutting operations, analyze the forces acting during metal cutting and estimate the tool life (PO-1, PO-6, PO-7, PSO-1)
4. Apply the knowledge of operations of various machine tools (PO-1, PO-2, PSO-1)
5. Appreciate the application of modern machining methods and understand various micromachining methods (PO-1, PO-6, PO-7, PSO-1)

Course Assessment and Evaluation:

Continuous Internal Evaluation CIE): 50 Marks		
Assessment Tool	Marks	Course outcomes attained
Internal Test – I	30	CO1, CO2
Internal Test – II	30	CO3, CO4, CO5
Average of the two internal tests shall be taken for 30 marks		
Other Components		
Assignments	10	CO1, CO2, CO3, CO4, CO5
Quiz	10	CO1, CO2, CO3, CO4, CO5
Semester End Examination (SEE)	100	CO1, CO2, CO3, CO4, CO5

WORK STUDY AND ERGONOMICS	
Course Code: IM34	Credits: 3:0:0
Pre – requisites: Nil	Contact Hours: 42L
Course Coordinator: Dr. M Rajesh / Dr. Hemavathy S	

Course Content

Unit I

Productivity: Definition of productivity, Productivity and Standards of living, Individual enterprises, Work content, Productivity of materials, and, building, machine and power. Measurement of productivity (labor, material, multifactor), factors affecting the productivity.

Work Study: Definition, objective and scope of work study. Work-study procedure, Human factor in work study Work study and management, work study and supervision, work study and worker.

- Pedagogy / Course delivery tools: Chalk and talk, Power point presentation, animated videos
- Links: Productivity - <https://www.youtube.com/watch?v=gJDYV2SmFeY>

Unit II

Introduction to Method Study: Definition, objective and scope of method study, Charts to record moments in shop operation – process charts, flow diagram, string diagram, travel chart and multiple activity charts, questioning technique.

Micro and Memo Motion Study: Principles of motion economy, classification of movements, two handed process chart, and micro motion study.

- Pedagogy / Course delivery tools: Chalk and talk, Power point presentation, animated videos
- Links: Introduction to Method Study
<https://www.youtube.com/watch?v=gJDYV2SmFeY>
Micro and Memo Motion Study -
<https://www.youtube.com/watch?v=dgWeLrtvcQ>

Unit III

Introduction to Work Measurement: Definition, objective and benefit of work measurement. Work measurement techniques. Work sampling with simple problems.

Time Study: Time Study, Definition, time study equipment, selection of job, steps in time study, breaking jobs into elements.

- Pedagogy / Course delivery tools: Chalk and talk, Power point presentation, animated videos
- Links: Introduction to Work Measurement
<https://www.youtube.com/watch?v=NaNWD6JLLeM>
 Time Study -
https://www.youtube.com/watch?v=zWQovrjB7Uc&list=PLLy_2iUCG87BbIF6sF5sy_ZZLFoUcnncb

Unit IV

Time Study (Contd...): Rating, Systems of rating. Scales of rating, factors affecting rate of working, Allowances and Standard time calculation: (Problems with no machine allowance, with machine allowance).

- Pedagogy / Course delivery tools: Chalk and talk, Power point presentation, animated videos
- Links: Time Study - https://www.youtube.com/watch?v=p0RX0w-vVtQF6sF5sy_ZZLFoUcnncb

Unit V

Ergonomics: Introduction, areas of study under ergonomics, history of ergonomics, man-machine system-components and their functions, simple design of workplace using ergonomics.

Design of man-machine system: Quantitative, qualitative and representational display. Influence of climate, illumination, noise on human efficiency.

- Pedagogy / Course delivery tools: Chalk and talk, Power point presentation, animated videos
- Links: Ergonomics - <https://www.youtube.com/watch?v=ZU9pYim15fl>
 Design of man-machine system -
<https://www.youtube.com/watch?v=cTBA5SC6HsQ>

Text Books:

1. Geroge Kanawaty - ILO -Introduction to work study, ISBN 13:9788120406025
 Publisher: India Book House Pvt. Ltd, 4th Revised Edition, 2008.
2. M.P.Groover-Work Systems: The Methods, Measurement & Management of Work, ISBN: 978-93-325-8124-1, Pearson, 1st Edition, 2013.
3. Ralph M Barnes -Motion and Time study, ISBN: 13:978981426182
 Publisher:John Wiley, 7th edition 2009.

References:

1. Andris Freivalds and Benjamin Niebel - Niebel's Methods, Standards, & Work Design, ISBN-13: 978-0073376318, Mc Graw Hill, 13th Edition, 2014
2. M S Sanders and E J McCormic -Human Factors in Engineering Design, ISBN: 13:9780070549012, Mc Graw Hill, 7th Edition.
3. William Stevenson, Operations Management, ISBN: 13: 978-9353163419,McGraw Hill Education; 12th edition.

Web links and video lectures (e-Resources)

1. https://www.youtube.com/watch?v=yhywrCChJBQ&list=PLLy_2iUCG87D5n9zraFS2QYajk0OAOIVK
2. <https://www.youtube.com/watch?v=yhywrCChJBQ>

Course outcomes (COs):

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

1. Identify areas where there would be a need for improvement of productivity, reduction of ineffective time in an organization. (PO-1, PO-2, PO-3, PO-5, PSO-1)
2. Analyze and Develop method study techniques and use the correct set of method study techniques, tools for a given scenario (PO-2, PO-3, PO-5, PSO-2)
3. Determining sample size based on work sampling study and understanding time study concepts. (PO-1, PO-2, PO-5, PSO-2)
4. Apply the tools and techniques of work study in order to measure the rate of working and establish standard time for simple and complex process (PO-1, PO-2, PO-5, PSO-2)
5. Design and develop the man machine system and its function in industry, society and areas where the effect of such a system can be created(PO-1, PO-2, PO-5, PSO-3)

Course Assessment and Evaluation:

Continuous Internal Evaluation (CIE): 50 Marks		
Assessment Tool	Marks	Course outcomes attained
Internal Test – I	30	CO1, CO2
Internal Test – II	30	CO3, CO4, CO5
Average of the two internal tests shall be taken for 30 marks		
Other Components		
Assignments	10	CO1, CO2, CO3, CO4, CO5
Quiz	10	CO1, CO2, CO3, CO4, CO5
Semester End Examination (SEE)	100	CO1, CO2, CO3, CO4, CO5

MATERIALS MANAGEMENT	
Course Code: IM35	Credits: 3:0:0
Pre – requisites: Nil	Contact Hours: 42L
Course Coordinator: Dr Hemavathy S / Dr. Shobha. R	

Course Content

Unit I

Inventory Fundamentals: Operating Environment, Material and Information Flow, Aggregate Inventory Management, Supply and Demand Patterns, Functions and Objectives of Inventory Management, Inventory Costs.

- Pedagogy / Course delivery tools: Chalk and talk, Power point presentation, animated videos
- Links: Inventory and Flow of Material - <https://www.youtube.com/watch?v=9J91Lo1D8MI>
Supply and Demand Patterns - <https://www.youtube.com/watch?v=KJOvsvA0FME>

Unit II

Purchasing: Establishing Specifications of purchasing, Functional Specification Description, Selecting Suppliers, Price Determination, Impact of MRP on Purchasing, Supply Chain Concept, Supply Chain Metrics, Organizational Implications of SCM.

- Pedagogy / Course delivery tools: Chalk and talk, Power point presentation, animated videos
- Links: Supply Chain Concept - <https://www.youtube.com/watch?v=lZPO5RclZEO>
Impact of MRP on Purchasing - <https://www.youtube.com/watch?v=TXID6w2UV6s>
Organizational implications of SCM - <https://www.youtube.com/watch?v=LZYEREK0qz4>

Unit III

Order Quantities: Financial Statements and Inventory, Making the Production Plan, ABC Inventory Control, Economic Order Quantity (EOQ), Variations of EOQ Model, Quantity Discounts, Use of EOQ when Costs are not known, Period Order Quantity (POQ).

- Pedagogy / Course delivery tools: Chalk and talk, Power point presentation.
- Links: ABC Inventory Control - <https://www.youtube.com/watch?v=BWbnKgFNcKg>

Unit IV

Independent Demand Ordering Systems: Order Point System, Determining Safety Stock, Determining Service Levels, Different Forecast and Lead Time Intervals, Determining when Order Point is reached, Periodic Review System, Distribution Inventory.

- Pedagogy / Course delivery tools: Chalk and talk, Power point presentation, animated videos
- Links: Determining Safety Stock - https://www.youtube.com/watch?v=8KMUIH_3qZE
Forecast and Lead time interval - <https://www.youtube.com/watch?v=kARq9TIxsOM>

Unit V

Physical Inventory and Warehouse Management: Warehousing Management, Physical Control and Security, Inventory Record and Accuracy, Vendor Rating Problems.

Physical Distribution: Physical Distribution System, Transportation, Warehousing, Packaging, Materials Handling, Multi-Warehouse Systems.

- Pedagogy / Course delivery tools: Chalk and talk, Power point presentation, animated videos
- Links: Warehousing Management - <https://www.youtube.com/watch?v=OZWY87oeSOU>
Physical Distribution System - <https://www.youtube.com/watch?v=UYZdIHUYh6M>

Text Books:

1. **Steve Chapman & Tony Arnold** – Introduction to Materials Management, Pearson, 2016.

References:

1. **P Gopalakrishna & M Sundaresan** – Materials Management: An Integrated Approach, PHI, 2012.
2. **A K Dutta** – Materials Management: Procedures, Text and Cases, PHI, 2009.
3. **S D Sharma** – Operations Research, 4th edition, 2009.
4. **Kanti Swaroop** – Operations Research, S Chand, 2001.

Web links and video lectures (e-Resources)

1. <https://nptel.ac.in/courses/110105095>
2. <https://nptel.ac.in/courses/110106045>
3. <https://nptel.ac.in/courses/110107073>
4. <https://www.digimat.in/nptel/courses/video/110105095/L01.html>
5. <https://egyankosh.ac.in/bitstream/123456789/14842/1/Unit-13.pdf>

Course Outcomes (COs):

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

1. Analysis of the fundamental concepts of materials management and its implications. (PO-1,2,3& PSO1,2)
2. Develop suitable purchasing system which could be efficient and effective in a particular system. (PO-1,2,3& PSO1,2)
3. Implement various inventory control systems to make the system cost effective. (PO-1,2,3& PSO1,2)
4. Assess the advanced inventory control systems for better control of the process. (PO-1,2,3& PSO1,2)
5. Analysis of a basic warehousing system and its effectiveness. (PO-1,2,3& PSO1,2)

Course Assessment and Evaluation:

Continuous Internal Evaluation (CIE): 50 Marks		
Assessment tool	Marks	Course outcomes addressed
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		
Other components- 20 Marks		
Assignment	10	CO1, CO2, CO3, CO4, CO5
Quiz	10	CO1, CO2, CO3, CO4, CO5
Semester End Examination (SEE)	100	CO1, CO2, CO3, CO4, CO5

MANUFACTURING PROCESSES LAB	
Course Code: IML36	Credits: 0:0:1
Pre – requisites: Nil	Contact Hours: 14P
Course Coordinator: Dr. N.D. Prasanna, Sudheer D. Kulkarni, Dr. Siddhartha Kar	

Part A- Manufacturing processes

I. Testing of Moulding Sand

1. Moisture Content test
 2. Clay Content Test
 3. Grain Fineness test
 4. Compression strength test
 5. Shear Strength test
- Pedagogy: Demonstration and hands-on training
 - Links: Permeability test: <https://www.youtube.com/watch?v=aeIrFFFhNRY>
Compression Test: <https://www.youtube.com/watch?v=RGitRZQkaiQ>

II. Foundry practice

1. Preparation of moulds using split patterns
 2. Preparation of moulds without patterns (i.e.with hand cutting)
- Pedagogy: Demonstration and hands-on training
 - Links: <https://www.youtube.com/watch?v=PkjpmPLNKZs>

III. Forging operations

1. Preparation of square headed bolt
 2. Preparation of Hexagonal rod
- Pedagogy: Demonstration and hands-on training
 - Links: Metal Forming Virtual Simulation Lab: <http://msvs-dei.vlabs.ac.in/>

Part B - Machine Tool Operations

IV. Lathe with four jaw chuck

1. Thread cutting operation
 2. Eccentric operation
- Pedagogy: Demonstration and hands-on training
 - Links: Lathe Operations: <https://www.youtube.com/watch?v=XXpOwsD0fWM>

V. Milling Machine

1. Spur gear cutting
- Pedagogy: Demonstration and hands-on training
 - Links: Gear cutting: <https://www.youtube.com/watch?v=39ZiVUA-JNY>

VI. Shaping Machine

1. Rectangular groove cutting
 2. Dovetail cutting
- Pedagogy: Demonstration and hands-on training
 - Links: https://www.youtube.com/watch?v=_Xn-rSI0ZqE

Text Books:

1. Amitabha Ghosh & Mallik -**Manufacturing science**, Affiliated East West press, 1995
2. HMT -**Production Technology**, Tata McGraw Hill, 2001
3. P.Radhakrishnan -**Manufacturing Technology**, Scitech Publications, Chennai, Vol- I, 2002
4. P.N.Rao -**Manufacturing Technology and M/C tool & metal cutting**, Tata McGraw Hill, 1998

References:

1. John A. Schey -**Introduction to Manufacturing Processes**, McGraw Hill, 3rd Edition, 2001.
2. Pandey & Shah -**Modern machining process**, TMH, 2000.
3. B J Ranganath -**Metal Cutting and tool design**, Vikas Publications.

Course Outcomes (COs):

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

1. Analyze the properties of moulding sand and derive conclusions (PO-1, PO-2, PO-3, PSO-1, PSO-2)
2. Apply casting and forging technologies to create various shapes (PO-1, PO-2, PO-3, PSO-1, PSO-2)
3. Apply the concepts of metal cutting to create components by using various machine tools (PO-1, PO-2, PO-3, PSO-1, PSO-2)

Course Assessment and Evaluation:

Continuous Internal Evaluation (CIE): 50 Marks		
Assessment Tool	Marks	Course outcomes attained
Weekly evaluation of laboratory manuals / records after the conduction of every experiment	30	CO1, CO2, CO3
Practical Tests	20	CO1, CO2, CO3
Semester End Examination (SEE)	50	CO1, CO2, CO3

WORKSTUDY AND ERGONOMICS LAB	
Course Code: IML37	Credits: 0:0:1
Pre – requisites: Nil	Contact Hours: 14P
Course Coordinator: Dr. M Rajesh	

Course Content List of Experiments

1. Construction of Outline Process Chart for simple assembly
2. Recording the given activity using Flow Process Chart (Men/Material/Equipment)
3. Constructing the String Diagram for a shop-floor activity
4. Construction of Two Handed Process Chart for pin board assembly
5. Rating practice using walking simulator
6. Rating practice for dealing a deck of cards
7. Rating Practice for pin board assembly
8. Rating Practice for marble experiment
9. Determination of standard time for simple operations using stop watch method
10. Determination of standard time for simple operations using Predetermined time standards
11. Measurement of parameters (heart beat rate, calorie consumption) using walking simulator
12. Measurement of parameters (heart beat rate, calorie consumption, revolutions per minute) using ergometer
13. Strength and Endurance test on a person.
14. Effect of noise, light and heat on human efficiency in work environment.

Text Books:

1. Gerogen Kanawaty - ILO -Introduction to work study, ISBN 13:9788120406025 Publisher: India Book House Pvt. Ltd, 4th Revised Edition, 2008.
2. M P Groover-Work Systems: The Methods, Measurement & Management of Work, ISBN: 978-93-325-8124-1, Pearson, 1st Edition, 2013.
3. Ralph M Barnes -Motion and Time study, ISBN: 13:978981426182 Publisher: John Wiley, 7th edition 2009.

References:

1. Andris Freivalds and Benjamin Niebel - Niebel's Methods, Standards, & Work Design, ISBN-13: 978-0073376318, Mc Graw Hill, 13th Edition, 2014

2. M S Sanders and E J McCormic - Human Factors in Engineering Design, ISBN: 13:9780070549012, Mc Graw Hill, 7th Edition

Course Outcomes (COs):

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

1. Identify areas where work study tools and techniques can be applied (PO1,3& PSO 1,2)
2. Apply the tools and techniques to various simulated scenarios and real life problems in industry and society (PO-1,3& PSO1,2)
3. Create novel designs of work place and other areas where improvement can be applied with perspective of various constraints faced in real life situation at society and industry level (PO-1,3& PSO1,2,3)

Web links and video lectures (e-Resources)

1. https://www.youtube.com/watch?v=zWQovrjB7Uc&list=PLLy_2iUCG87BbIF6sF5sy_ZZLFoUcnncb
2. https://www.youtube.com/watch?v=GxT0LD1kZFk&list=PLLy_2iUCG87BbIF6sF5sy_ZZLFoUcnncb&index=2

Course Assessment and Evaluation:

Continuous Internal Evaluation (CIE): 50 Marks		
Assessment tool	Marks	Course outcomes attained
Weekly Evaluation-Lab Record	30	CO1, CO2, CO3
Lab Test	20	CO1, CO2, CO3
Semester End Examination (SEE)	50	CO1, CO2, CO3

UNIVERSAL HUMAN VALUES	
Course Code: UHV38	Credits: 2:0:0
Pre – requisites: Nil	Contact Hours: 28L
Course Coordinator: Dr. M R Shivakumar	

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

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*;
3. Trust (*Vishwas*) and Respect (*Samman*) as the foundational values of relationship
4. Understanding the meaning of *Vishwas*; Difference between intention and competence
5. Understanding the meaning of *Samman*, Difference between respect and differentiation; the other salient values in relationship
6. Understanding the harmony in the society (society being an extension of family):
7. *Samadhan, Samridhi, Abhay, Sah-astitva* as comprehensive Human Goals
8. 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
Links: Harmony in family- Other Feeling Justice <https://youtu.be/TcYJB7reKnM>
Links: Harmony in the Society <https://youtu.be/BkWgFinmPw>

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
- Links: Harmony in Existence 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
2. <https://www.youtube.com/watch?v=P4vjfE-YnVk&list=PLWDeKF97v9SP7wSlapZcQRrT7OH0ZlGC4>
3. **Course handouts:**
https://drive.google.com/drive/folders/1zioX_4L2fCNX4Agw282PN86pcZZT3Osr?usp=sharing
4. **Presentation slides:**
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:

Continuous Internal Evaluation (CIE)		
Assessment Tool	Marks	Course outcomes addressed
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.		
Other components		
<ul style="list-style-type: none">• Assignment• Quiz• Presentation• Model / mini project• Any other	20 (10 + 10)	CO1, CO2, CO3, CO4, CO5
Semester End Examination (SEE)	100	CO1, CO2, CO3, CO4, CO5

CONSTITUTION OF INDIA AND PROFESSIONAL ETHICS	
Course Code: HS392	Credits: 1:0:0
Pre – requisites: Nil	Contact Hours: 14L
Course Coordinator: 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' - 19th/20th edition 2001
2. M.V.Pylee.- 'An Introduction to Constitution of India, 4th 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:

Continuous Internal Evaluation (CIE): 50 marks		
Assessment tool	Marks	Course outcome attained
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.		
Other components		
Assignment	10	CO1, CO2
quiz	10	CO3, CO4, CO5
Semester end examination (SEE)	100	CO1, CO2, CO3, CO4, CO5

ABILITY ENHANCEMENT COURSE - III	
Course Code: AEC310	Credits: 1:0:0
Pre – requisites: Nil	Contact Hours: 14L
Course Coordinator: 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	
Course Code: PE83	Credits: NCMC
Pre – requisites: Nil	
Course Coordinator: 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	Note: Students should bring their own sports attires			
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 8th Semester.
6. The final marks shall be calculated after scaling down CIE to 50 marks & combining with 50 marks for SEE.

YOGA	
Course Code: YO83	Credits: NCMC
Pre – requisites: Nil	
Course Coordinator: 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, Sheetali, 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
- Suryanamaskar: <https://www.youtube.com/watch?v=nUdlucNd6go&t=133s>
- Yoga for anxiety and stress: https://www.youtube.com/watch?v=hJbRpHZr_d0
- Common yoga protocol: https://www.youtube.com/watch?v=Av5ib_XRKT4
- Relevance of yoga in modern times:
www.youtube.com/watch?v=HUzBCts7BTo

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 8th 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
Total	50 marks

NATIONAL SERVICE SCHEME	
Course Code: NS83	Credits: NCMC
Pre – requisites: Nil	
Course Coordinator: 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

Course Code: AM31	Credits: 0:0:0
Pre – requisites: Nil	Contact Hours: 42L
Course Coordinator: 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, 44th edition, 2017.
2. **Erwin Kreyszig** – Advanced Engineering Mathematics – Wiley Publication, 10th 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 & GRAPH THEORY	
Course Code: IM41	Credits: 2:1:0
Pre – requisites: Nil	Contact Hours: 28L+14T
Course Coordinator: Mr. B. Azghar Pasha	

Course Content

Unit I

Interpolation: Forward and Backward differences, Interpolation, Newton-Gregory Forward and Backward Interpolation, Lagrange's interpolation and Newton's divided difference interpolation techniques. Cubic spline interpolation.

Bivariate Interpolation: Lagrange's bivariate interpolation. Newton's bivariate interpolation.

Problem solving/demonstration of methods using any open source software such as Scilab.

- 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/111/106/111106101/>
- Impartus recording: <https://a.impartus.com/ilc/#/course/96127/452>
<https://a.impartus.com/ilc/#/course/132243/636>

Unit II

Numerical Differentiation: Derivatives using Newton-Gregory forward and backward interpolation formula. Derivatives using finite differences of higher order.

Numerical Integration: Newton-Cotes quadrature formula: Trapezoidal, Simpson's $1/3^{\text{rd}}$ and Simpson's $3/8^{\text{th}}$ rule (no proof).

Gaussian Quadrature: Gauss Legendre one point, two point and three point techniques. Romberg integration.

Problem solving/demonstration of methods using any open source software such as Scilab.

- 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/111/106/111106101/>
- Impartus recording: <https://a.impartus.com/ilc/#/course/96127/452>
<https://a.impartus.com/ilc/#/course/132243/636>

Unit III

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

- Pedagogy/Course delivery tools: Chalk and talk
- Links: <https://nptel.ac.in/courses/111/106/111106101/>
- Impartus recording: <https://nptel.ac.in/courses/111104074>
<https://a.impartus.com/ilc/#/course/619570/1030>

Unit IV

Fundamentals of Graph Theory: Introduction - Basic concepts of graphs, standard definitions, types of graphs, connected & disconnected graphs, Operations on Graphs, Euler graphs, Hamiltonian Paths and Circuits. Trees, properties of trees, Rooted & Binary Trees. Cut-sets, Spanning trees, fundamental circuit and fundamental cut-sets.

- Pedagogy/Course delivery tools: Chalk and talk
- Links: <https://nptel.ac.in/courses/111106050>
<https://nptel.ac.in/courses/106104170>
<https://nptel.ac.in/courses/111106102>

Unit V

Applications of Graph Theory: Konigsberg Bridge problem, Travelling salesman problem, Seating arrangement problem. Prim's and Kruskal's algorithm for minimal spanning tree. Matrix representation of graphs - Incidence Matrix, Circuit Matrix, Fundamental Circuit Matrix & Rank of B, Application to Switching network. Application to Transport network – Max flow & Min-cut theorem.

- Pedagogy/Course delivery tools: Chalk and talk
- Links: <https://nptel.ac.in/courses/111106050>
<https://nptel.ac.in/courses/106104170>
<https://nptel.ac.in/courses/111106102>

Text Books:

1. **B.S. Grewal** – Higher Engineering Mathematics, Khanna Publishers, 44th edition, 2017.
2. **Narsingh Deo** - Graph theory with Application to Engineering and Computer science, PHI Learning Private Limited, 2010.

Reference Books:

1. **Richard. L. Burden, J. Douglas Faires, Annette M. Burden** - Numerical Analysis, Brooks Cole - 10th edition, 2015.

2. **M.K. Jain, S.R.K. Iyengar and R.K. Jain** – Numerical methods for scientific and Engineering computation – New Age International Publisher, 6th edition, 2012.
3. **J. A. Bondy and U.S.R. Murty** - Graph theory, Springer, 2008.
4. **R. Diestel**, Graph theory, 5th edition, Springer, 2017.

Course Outcomes (COs):

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

1. Interpolate the given data. (PO-1, PO-2, PSO-1)
2. Find derivative and integral of a given data numerically. (PO-1, PO-2, PSO-1, PSO-2)
3. Fit a least squares curve to a given data and analyse the relation between them. (PO-1, PO-2, PSO-1, PSO-2)
4. Analyse different types of graphs and perform operations on graphs. (PO-1, PO-2, PSO-1, PSO-2)
5. Analyse the characteristics of graphs through their matrix representations and solve some application problems. (PO-1, PO-2, PSO-1, PSO-2)

Course Assessment and Evaluation:

Continuous Internal Evaluation (CIE): 50 Marks		
Assessment Tool	Marks	Course outcomes addressed
Internal test-I	30	CO1, CO2, CO3
Internal test-II	30	CO3, CO4, CO5
Average of the two internal tests shall be taken for 30 marks.		
Other components		
Quiz	10	CO1, CO2, CO3
Assignment	10	CO3, CO4, CO5
Semester End Examination (SEE)	100	CO1, CO2, CO3, CO4, CO5

OPERATIONS RESEARCH	
Course Code: IM42	Credits: 2:0:1
Pre – requisites: Nil	Contact Hours: 42L+14T
Course Coordinator: Dr. G S Prakash / Dr. Sridhar B S	

Course Content

Unit I

Introduction: OR methodology, Definition of OR, Application of OR to engineering and Managerial problems, Features of OR models, Limitation of OR, Models of OR.

Linear Programming: Definition, Mathematical formulation, standard form, Solution space, solution – feasible, basic feasible, optimal, infeasible, multiple, optimal, Redundancy, Degeneracy. Graphical method.

Product mix problems.

- Pedagogy/Course delivery tools: Chalk and talk
- Links: <https://elearning.vtu.ac.in/econtent/courses/video/IPIM74.html>

Unit II

Linear Programming: Simplex method, variants of simplex algorithm – Artificial variable techniques, Duality concept.

- Pedagogy/Course delivery tools: Chalk and talk
- Links: <https://elearning.vtu.ac.in/econtent/courses/video/IPIM74.html>

Unit III

Transportation Problem: Formulation of transportation model, Basic feasible solution using different methods (North-West corner, Least Cost, Vogel's Approximation Method) Optimality Methods. Unbalanced transportation problem, Degeneracy in transportation problems.

- Pedagogy/Course delivery tools: Chalk and talk
- Links: <https://elearning.vtu.ac.in/econtent/courses/video/IPIM74.html>

Unit IV

Assignment Problem: Formulation of the Assignment problem, unbalanced assignment problem, Typical Assignment problems, Traveling salesman problem.

Project Management: Network construction, determination of critical path, project duration and floats. PERT - estimation of project duration and variance.

- Pedagogy/Course delivery tools: Chalk and talk
- Links: <https://elearning.vtu.ac.in/econtent/courses/video/IPIM74.html>

Unit V

Queuing Theory: Queuing system and their characteristics, The M/M/I Queuing system, Steady state performance analyzing of M/M/1 queuing model.

Game Theory: Formulations of games, two person zero sum game, games with and without saddle point, graphical solutions (2x n, mx2 game), and dominance property.

- Pedagogy/Course delivery tools: Chalk and talk
- Links: <https://elearning.vtu.ac.in/econtent/courses/video/IPIM74.html>

Lab component: Using TORA Software/ Excel

1. Introduction to optimization problems and software.
2. Formulation of LPP and solving LPP using software (Minimization problem)
3. Formulation of LPP and solving LPP using software (Maximization problem)
4. Formulation of Transportation problems and solving.
5. To solve an assignment problem.
6. To solve traveling salesman problems

Text Books:

1. Taha-Operation Research an Introduction, ISBN-81-203-3043-9, 8th Edition, 2006.
2. Ravindran, Philips and Soleberg-Operations Research Principles and practice, John Wiley & Sons, ISBN-13 978-81-265-1256-0, 2nd Edition-2007.
3. Operation Search, Kanti Swarup, Publisher: Sultan Chand & Sons ,ISBN: 9788180549090, 8180549097, Edition: 2014.

References:

1. Hiller and Libermann-Introduction to Operation Research, Mc Graw NHill 5thedn. -2000
2. J K Sharma -Operations Research Theory and Application, Pearson Education Pvt Ltd, 2nd Edn, ISBN-0333-92394-4-2006

Web links and video lectures (e-Resources)

1. https://onlinecourses.nptel.ac.in/noc20_ma45/preview
2. <https://nptel.ac.in/courses/110106062>
3. <https://nptel.ac.in/courses/112106131>

Course outcomes (COs):

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

1. Appreciate the wide applicability of operations research technology from agriculture to defense, covering almost all domains of science, arts, commerce and technology. (PO-1, PSO-1)
2. Build the optimum solution for numerous problems of operations research by systematic defining, formulating, analyzing, developing an optimum solution and further refining the solution using simplex method. (PO-1, PO-2, PO-3, PSO-2)
3. Obtain optimum cost /profit by the application of transportation algorithm. (PO-1, PO-2, PO-3, PSO-2)
4. Develop minimum cost and maximum profit solutions to Assignment and travelling salesman problems. Optimize the project duration and cost using PERT/CPM techniques. (PO-1, PO-2, PO-3, PSO-2)
5. Provide probabilistic and heuristic solutions for real life problems using the Queuing and Game theory models. (PO-1, PO-2, PO-3, PSO-2)

Course Assessment and Evaluation:

Continuous Internal Evaluation (CIE): 50 Marks		
Assessment tool	Marks	Course outcomes addressed
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		
Other components- 20 Marks		
Assignment	10	CO1, CO2, CO3, CO4, CO5
Quiz	10	CO1, CO2, CO3, CO4, CO5
Semester End Examination (SEE)	100	CO1, CO2, CO3, CO4, CO5

MECHANICAL MEASUREMENTS AND METROLOGY	
Course Code: IM43	Credits: 3:0:0
Pre – requisites: Nil	Contact Hours: 42L
Course Coordinator: Dr. N D Prasanna/ Dr. M R Shivakumar	

Course Content

Unit I

Standards of Measurement: Definition and objectives of metrology, Standards, standards of length, International prototype meter, Wavelength standard. Slip gauges, Wringing phenomena, Numerical problems on building of slip gauges.

Measurements and Measurement System: Definition, methods of measurements, generalized measurement system. Definition and concept of accuracy, precision, sensitivity, Calibration, threshold. Concepts of hysteresis, repeatability, Linearity and Loading effect. Errors in measurement, classification of errors.

- Pedagogy/Course delivery tools: Chalk and talk. Power point presentation, Videos
- Lab components/Practical topics: Slip gauges, measuring system
- Links: Standards - <https://www.youtube.com/watch?v=oCkaxMI19X8>
- Mechanical measurements - https://www.youtube.com/watch?v=U8y48L_qn6E, impartus RIT

Unit II

Systems of Limits, Fits, Tolerances and Gauging: Introduction, Definition of Tolerance, Principle of Inter changeability and selective assembly, concepts of limits of size and tolerance, definition of fit, Different types of fit, Hole basis system and shaft basis system. Introduction to gauges, classification of gauges, design of gauges using Taylor's Principle. Introduction to surface roughness.

- Pedagogy/Course delivery tools: Chalk and talk. Power point presentation, Videos
- Lab components/Practical topics: Gauges/Surface roughness tester
- Links: Systems of Limits, Fits - <https://www.youtube.com/watch?v=6jWLImlfG1Y>
- Surface roughness - https://www.youtube.com/watch?v=U8y48L_qn6E

Unit III

Comparators: Need of comparator, Characteristics, classification and advantages, Dial gauge, Johansson Mikrokator, Zeiss Ultra – Optimeter.

Angle measurements and interferometry: Introduction, sine bar- principle of sine bar, Errors in sine bar. Principle of interferometry, optical flat, principle of autocollimator.

Screw thread and gear measurement: Terminology of screw threads, measurement of major diameter, Measurement of Minor diameter and pitch. Measurement of angle and effective diameter of screw threads by 2– wire method, Profile projector-working principle, Tool maker's microscope – construction and working principle. Gear terminology, Parkinson gear tester- construction. Use of gear tooth vernier calliper and gear tooth micrometer.

- Pedagogy/Course delivery tools: Chalk and talk. Power point presentation, Videos
- Lab components/Practical topics: Dial gauge, Sine bar, optical flat, autocollimator, floating carriage diameter measuring instrument, profile projector, tool maker's microscope, Parkinson gear tester
- Links: Comparator - <https://www.youtube.com/watch?v=5YLvHXMr7f4>
Interferometry - <https://www.youtube.com/watch?v=Qv5YzrqL6sU>
Screw thread measurements - <https://www.youtube.com/watch?v=xPGi2e-gOo8>

Unit IV

Coordinate measuring machine- Features of CMM, performance of CMM, application and advantages of CMM.

Transducer: Classification of transducers, mechanical transducers-mechanical springs, pressure sensitive elements, Electrical transducers- resistive transducers, strain gauge, LVDT.

Measurement of Force, torque and pressure: Analytical balance, Platform balance. Proving ring – sketch and working principle. Torque measurement-Prony brake dynamometer, Basic bourdon tube, Elastic diaphragms. McLeod Vacuum gauge – working principle.

- Pedagogy/Course delivery tools: Chalk and talk. Power point presentation, Videos
- Lab components/Practical topics: CNC-CMM, LVDT
- Links: CMM - <https://www.creaform3d.com/blog/what-is-cmm-and-their-types/>
Transducers - <https://gmw.com/transducers/>
Measurement of Force, and pressure - <https://www.fierceelectronics.com/components/pressure-measurement-principles-and-practice>

Unit V

Temperature Measurement: Resistance thermometers – sketch and working principles, Thermocouple, Laws of thermocouple, Optical Pyrometer.

Strain gauges – Mechanical strain gauge, optical strain gauge, Electrical resistance strain gauges-bonded type.

ISO: Concepts and Practices: Introduction, What is system? , Summary of elements of ISO 9001, Advantages of Adopting ISO 9000, Registration of ISO 9000, Validity of registration, preparation, organizing documentation and metrological requirements

of ISO 9000 standards.

- Pedagogy/Course delivery tools: Chalk and talk. Power point presentation, Videos
- Lab components/Practical topics: Thermocouple
- Links:
<https://www.cedengineering.com/userfiles/Principles%20and%20Methods%20of%20Temperature%20Measurement-R1.pdf>
Strain gauge - <https://www.sciencedirect.com/topics/engineering/mechanical-strain>
<https://www.iso.org/obp/ui/#iso:std:iso:9000:ed-4:v1:en>

Text Books:

1. R K Jain, Engineering metrology, Khanna Publications, 21st Edition.
2. Beckwith -Margaroni and Lienhard – **Mechanical Measurements**, 6th Edition, Pearson Education Asia, 2020
3. I.C. Gupta -**Engineering Metrology**, Dhampat Rai Publications, 7th edition, 2013.

References:

1. Doebelin -**Mechanical Measurements**, THM, 5th edition, 2003
2. Alsutko Jerry D. Faulk -**Industrial Instruments**, Thompson Asia Pvt. Ltd. - 2002.

Web links and Video Lectures (e-Sources)

1. <https://nptel.ac.in/courses/112106138>
2. https://onlinecourses.nptel.ac.in/noc19_me70/preview
3. <https://a.impartus.com/ilc/#/course/119876/593>

Course Outcomes (Cos):

At the end of 5th course, students will be able to

1. Apply the concepts of metrology and measurements in industries. (PO-1, PO-3, PSO-1)
2. Design the inspection gauges. (PO-1, PO-2, PO-3, PSO-1)
3. Use the metrology instruments in angle measurements, screw thread measurements, gear measurements and measurements using CMM. (PO-1, PO-2, PO-5, PSO-1, PSO-2)
4. Understand the use of transducers in measurements and working of torque, force and pressure measuring instruments. (PO-1, PO-2, PO-5, PSO-1, PSO-2)

5. Understand the concept of temperature and strain measurement and able to develop ISO procedure in metrology and measurements. (PO-5, PO-6, PO-10, PSO-1, PSO-2, PSO-3)

Course assessment and Evaluation:

Continuous internal Evaluation: 50 marks		
Assessment tool	Marks	Course outcomes attained
Internal Test-I	30	CO1, CO2
Internal test Test-II	30	CO3, CO4
Average of two internal tests shall be taken for 30 marks		
Other Components		
Assignment	10	CO1, CO2, CO3, CO4, CO5
Quiz/Surprise test/ Assignment	10	CO3, CO4, CO5
Semester End Examination (SEE)	100	CO1, CO2, CO3, CO4, CO5

FACILITIES PLANNING AND DESIGN	
Course Code: IM44	Credits: 3:0:0
Pre – requisites: Nil	Contact Hours: 42L
Course Coordinator: Dr. M Rajesh / Dr. Shilpa M	

Course Content

Unit I

Plant Location and layout: Factors influencing plant location, location economics - problems. Objectives of plant layout, Principles of plant layout, Line Balancing-Problems.

- Pedagogy/Course delivery tools: Chalk and talk, Power point presentation, animated videos
- Links: Plant Location and layout - <https://www.youtube.com/watch?v=x8WBqsMLF8A>

Unit II

Material Handling: Objectives and principles of Material handling, Unit load concept, classification and types of material handling equipment, Modern material handling concepts and equipment, RFID. Muther's Systematic Layout Planning procedure – problems

- Pedagogy/Course delivery tools: Chalk and talk, Power point presentation, animated videos
- Links: Material Handling - <https://www.youtube.com/watch?v=Up1oSSJn6oM>

Unit III

Space Determination and Area Allocation: Factors for consideration in space planning, area allocation factors to be considered, Plot plan, Sequence demand Straight line and non-directional methods – Analytical treatment. Determination of manpower and equipment requirement, use of travel chart for layout planning, analytical treatment.

- Pedagogy/Course delivery tools: Chalk and talk, Power point presentation, animated videos
- Links: Space Determination and Area Allocation - <https://www.youtube.com/watch?v=IBeubZYAGLU>

Unit IV

Layout Evaluation: Methods of constructing the layout, efficiency indices.

Layout models: Single facility and multi facility location models, warehouse design.

- Pedagogy/Course delivery tools: Chalk and talk, Power point presentation, animated videos
- Links: Layout Evaluation - <https://www.youtube.com/watch?v=xk7hS8zCHgA>

Unit V

Computer Aided Layout: Introduction to CRAFT, COFAD, PLANET, CORELAP and ALDEP – Analytical treatment.

- Pedagogy/Course delivery tools: Chalk and talk, Power point presentation, animated videos
- Links: Computer Aided Layout - <https://www.youtube.com/watch?v=q8xxKVtRbws>

Text Books:

1. James M Apple -**Plant Layout and Material handling**, 2nd Edition, John, Wiley and Sons. 2017-Reprint
2. Francis, R.L. and White, J.A -**Facility layout and Location**, Mc Graw Hill, 2nd edition. 2015
3. Tompkins J A and White -**A Facilities planning**, Wiley; 3rd edition, November 11, 2002

References :

1. Muther Richard -**Practical layout**, Mc Graw Hill-1955.
2. Sunderesh Heragu -**Facilities Design**, PWS Publishing Company, ISBN-0-534 - 95183.
3. James M Moore -**Plant Layout Design**, Mac Millan Co. 1962 LCCCN61- 5204.

Web links and video lectures (e-Resources)

1. <https://www.youtube.com/watch?v=ZwGXOoiToTA>
2. https://www.youtube.com/watch?v=aSd8Hbg-tuY&list=PLLy_2iUCG87A-kHGx4YUY97ShTTqBfA6-

Course Assessment and Evaluation:

Continuous Internal Evaluation (CIE): 50 Marks		
Assessment tool	Marks	Course outcomes attained
Internal Test-I	30	CO1, CO2
Internal Test-II	30	CO3, CO4, CO5
Average of the two internal test shall be taken for 30 marks		
Other components		
Assignment	10	CO1, CO2, CO3, CO4, CO5
Quiz/Surprise test/ Assignment	10	CO3, CO4, CO5
Semester End Examination (SEE)	50	CO1, CO2, CO3, CO4, CO5

APPLIED PROBABILITY AND STATISTICS	
Course Code: IM45	Credits: 2:1:0
Pre – requisites: Nil	Contact Hours: 42L
Course Coordinator: Dr. M Shilpa / Dr. Niranjan C A	

Course Content

Unit I

Introduction to statistics: Measure of central tendency and dispersion, Tabular and Graphical display- Histogram, Ogive curve, Box plot, Stem and Leaf plot

- Pedagogy/Course delivery tools: Chalk and talk
- Links: <https://nptel.ac.in/courses/111106112>
<https://nptel.ac.in/courses/111105041>
<http://elearning.vtu.ac.in/econtent/courses/video/MBA/MBA23.html>

Unit II

Random Variables and Probability distributions:

Discrete Random Variables and Probability distributions: Introduction to Discrete Random variables (No analytical treatment), Discrete probability distributions - Binominal distribution, Poisson distribution, Uniform distribution, Applications.

Continuous Random Variables and Probability Distributions: Introduction to Continuous random variables (No analytical treatment), Continuous Probability distributions - Exponential Distribution, Normal distribution
Central Limit Theorem

- Pedagogy/Course delivery tools: Chalk and talk
- Links: <https://nptel.ac.in/courses/117105085>
<https://nptel.ac.in/courses/111105041>
<http://elearning.vtu.ac.in/econtent/courses/video/MBA/MBA23.html>

Unit III

Sampling Distributions – Introduction (simple problems)

Statistical Intervals for single sample – Confidence interval Estimation on mean of a Normal distribution, variance known and variance unknown.

Tests of hypotheses - Introduction, Tests on the mean of a Normal distribution, Tests of hypotheses on means of two normal distributions, Goodness of fit test on Uniform, Binomial and Poisson distributions

- Pedagogy/Course delivery tools: Chalk and talk
- Links: <https://nptel.ac.in/courses/111105041>
<http://elearning.vtu.ac.in/econtent/courses/video/MBA/MBA23.html>

Unit IV

Regression and Correlation: Simple Linear Regression Analysis, correlation coefficient, Karl Pearson and Spearman's coefficients, Coefficient of Determination, Multiple linear Regression (2 independent variables)

- Pedagogy/Course delivery tools: Chalk and talk
- Links: <https://nptel.ac.in/courses/111105042>
<https://nptel.ac.in/courses/111104074>
<http://elearning.vtu.ac.in/econtent/courses/video/MBA/MBA23.html>

Unit V

Design of Experiments: Introduction, terminologies, principles of experimental design, Introduction to ANOVA (simple problems)

Introduction to Big data: Definition of data science, Characteristics of Big Data, Categorization of Analytical methods Data, Visualization, Multivariate Statistics Missing Data, Outliers, Normality, Linearity, and Homoscedasticity (no analytical treatment)

- Pedagogy/Course delivery tools: Chalk and talk
- Links: <https://nptel.ac.in/courses/111104075>
<https://nptel.ac.in/courses/110105087>

Text Books:

1. William W Hines, Douglas C Montgomery -Probability and Statistics in Engineering, John Wiley and Sons, 2nd Edn.
2. Richard I Levin, David S Rubin -Statistics for Management, Prentice Hall India, ISBN-81- 203-0893-X, 6th Edn.

References:

1. George C Runger-Applied statistics and Probability for Engineers, John Wiley and Sons, ISBN-0-471-17027-5, 2ndEdn.
2. Douglas C. Montgomery, George C. Runger, Norma F. Hubele, "Engineering Statistics", John Wiley and Sons, 5th Edn, ISBN-13: 978-0470631478 ISBN-10: 0470631473 year: 2010
3. Schaum's Outline of Statistics, 5th Edition (Schaum's Outlines) March 14, 2014, ISBN- 13: 978-0071822527 ISBN-10:0071822526
4. Daniel, Terrell -Business Statistics for Management and Economics, Houghton Mifflin Company, ISBN-0-395-62835-0, 6thEdn.
5. Walpole & Mayer -Probability and Statistics, MacMillan Publishing Company, 1989.
6. Probability and Statistics for Engineers. Richard A. Johnson, Irwin Miller, John Freund

Course Outcomes (COs):

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

1. Collect, organize and analyze the data in the real life situation and represent the data in graphical form (PO-1, PO-2 & PSO-2)
2. Apply the correct probability distribution for the given situation to determine the probability (PO-1, PO-2, PO-5 & PSO-2)
3. Set up, test and make decisions about hypotheses when uncertainty exists. (PO-2,5 & PSO-1)
4. Identify the degree and direction of relationship among process variables and develop appropriate regression models for the same. (PO-1, PO-2, PO-4, PO-5 & PSO-1)
5. Perform Analysis of Variance for simple experimental designs and understand the importance for big data in real world situation (PO-4)

Course Assessment and Evaluation:

Continuous Internal Evaluation (CIE): 50 Marks		
Assessment tool	Marks	Course outcomes addressed
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		
Other components- 20 Marks		
Assignment	10	CO1, CO2, CO3, CO4, CO5
Quiz	10	CO1, CO2, CO3, CO4, CO5
Semester End Examination (SEE)	100	CO1,CO2, CO3, CO4, CO5

MECHANICAL MEASUREMENTS AND METROLOGY LAB	
Course Code: IML46	Credits: 0:0:1
Pre – requisites: Nil	Contact Hours: 14P
Course Coordinator: Dr. N D Prasanna / Dr. M R Shivakumar	

Course Content

1. Demonstration of optical flats, clinometers, load cell, stroboscope, slip gauges, sine bar, drill tool and lathe tool dynamometers.
2. Measurements of gear elements using Toolmaker’s microscope.
3. Measurements of angle using autocollimator.
4. Measurement of screw thread elements using floating carriage diameter measuring
 - a. instruments.
5. Alignment test on drilling machine.
6. Testing of gear concentricity using Parkinson gear tester.
7. Measurement of thread parameters using profile projector.
8. Calibration of dial gauge using standard LVDT.
9. Calibration of LVDT using micrometer.
10. Determination of elastic modulus using strain gauges.
11. Determination of thermal expansion of metal specimen.
12. Calibration of CMM using standard sphere.
13. Measurement of specimen dimensions in CMM using MCS.
14. Measurement of specimen dimensions in CMM using PCS.

References:

1. Beckwith -Margaroni and Lienhard – **Mechanical Measurements**, Prentice Hall Publishers, 6th Edition, 2006.
2. I.C. Gupta -**Engineering Metrology**, Dhampat Rai Publications, 7th edition, 2013.
3. R K Jain, Engineering Metrology, Khanna Publications, 8th Edition, 2002.
4. AC – DMIS EXT Version Guide - AEH Industrial Metrology Company limited.
5. Quadra Check 200 Users Guide - Metronics, Inc., Bedford, New Hampshire, USA.
6. J.F.W. Galyerand C.R. Shotbolt– “Metrology for Engineers”, 5th edition. Published by London: Cassell, 1990.

Web links and Video Lectures (e-sources)

1. <https://kkwmqclab.blogspot.com/2020/08/experiment-no-4-measurement-of-thread.html>
2. <https://www.ijariit.com/manuscripts/v3i6/V3I6-1241.pdf>
3. <https://www.keyence.co.in/ss/products/measure-sys/measurement-selection/type/3d.jsp>

Course Outcome (COs):

1. Perform measurement precisely using various measuring devices. (PO-1, PO-2, PSO-1)
2. Develop calibration methods to the various measuring devices. (PO-1, PO-2, PO-3, PSO-1)
3. Compare and contrast the measuring equipment required for various applications in industry. (PO-4, PO-5, PSO-1, PSO-2)
4. Interpret the measured results. (PO-4, PO-5, PSO-1, PSO-2)
5. Solve the measurement related problems encountered in industries. (PO-4, PO-5, PSO-2)

Course Assessment and Evaluation:

Continuous Internal Evaluation (CIE): 50 marks		
Assessment tool	Marks	Course outcomes attainment
Weekly evaluation of laboratory manuals/ records after the conduction of every experiment	30	CO1, CO2, CO3, CO4, CO5
Practical test	20	CO1, CO2, CO3, CO4, CO5
Semester End Examination (SEE)	50	CO1, CO2, CO3, CO4, CO5

APPLIED PROBABILITY AND STATISTICS LAB

Course Code: IML47	Credits: 0:0:1
Pre – requisites: Nil	Contact Hours: 14P
Course Coordinator: Dr. M. Shilpa /Dr. Niranjana C A	

Course Content

Part - A

Software: MS Excel

1. Determining the measures of central tendency and dispersion of a given process
2. Graphical/ Pictorial representation of data – Histogram, Ogive curve, Bar Chart, Column chart, Pie chart, Line chart
3. Interval estimation and hypothesis testing on single population mean
4. Interval estimation and hypothesis testing on Two population means
5. Interval estimation and hypothesis testing on single population Proportion
6. Construction of scatter plot and determination of Karl Pearson's correlation coefficient
7. Determination of Spearman's Correlation Coefficient
8. Conduction of simple linear regression analysis
9. Conduction of ANOVA to test significance of regression
10. Testing the goodness of fit using Normal distribution
11. Testing the goodness of fit using Binominal distribution
12. Testing the goodness of fit using Poisson distribution
13. Testing the goodness of fit using Uniform distribution (for experiments 11 to 14, calculations through MS Excel)

Part - B

Software: SYSTAT statistical software package and Python

1. Determination of basic statistics and construction of histogram for a given quality Characteristic
2. Construction of Box Plot and Density Dot Graph
3. Determining the probability for discrete probability distributions –Hyper Geometric, Binominal and Poisson distributions
4. Determining the probability for Continuous probability distributions – Normal and Exponential distributions
5. Generation of random samples for the probability distributions – Poisson, Binomial, Normal and Exponential distributions

6. Interval estimation and Hypothesis testing on single population mean.
7. Interval estimation and Hypothesis testing on two population means
8. Interval estimation and Hypothesis testing on single population Proportion.
9. Testing the goodness – of – fit using Chi- Square test for Normal Distribution
10. Construction of scatter plot and determining Karl Pearson's correlation coefficient.
11. Conduction of simple linear regression analysis.
12. Conduction of Multiple linear regression analysis.
13. Construction of function plots for non-linear regression problems
14. Case study on engineering and management related problems.
15. Python Descriptive Statistics – Measuring Central Tendency & Variability

Suggested software packages: MS Excel, SYSTAT / MINITAB 17 –Statistical Software Package/ R studio, Python

Note: At least 13 experiments have to be conducted from the above list of experiments

Text Books:

1. George C Runger-Applied statistics and Probability for Engineers, John Wiley and Sons, ISBN-0-471-17027-5, 2ndEdn.2003.
2. Richard I Levin, David S Rubin -Statistics for Management, Prentice Hall India, ISBN- 81-203-0893-X, 6th Edn. 1991
3. McKinney, W. (2012). Python for data analysis: Data wrangling with Pandas, NumPy, and IPython. " O'Reilly Media, Inc."

References:

1. William W Hines, Douglas C Montgomery -Probability and Statistics in Engineering, John Wiley and Sons, 2nd Edn.
2. Daniel, Terrell -Business Statistics for Management and Economics, Houghton Mifflin Company, ISBN-0-395-62835-0, 6th Edn.
3. Walpole & Mayer -Probability and Statistics, MacMillan Publishing Company, 4th edition, 1989. ISBN: 9780024242228.
4. Douglas C. Montgomery, George C. Runger, Norma F. Hubele, "Engineering Statistics", John Wiley and Sons, 5th Edn, ISBN-13: 978-0470631478 ISBN10: 0470631473 year: 2010.
5. Schaum's Outline of Statistics, 5th Edition (Schaum's Outlines) March 14, 2014, ISBN- 13: 978-0071822527 ISBN-10:0071822526.
6. The Elements of Statistical Learning, Data Mining, Inference, and Prediction (2nd Edn.), Trevor Hastie Robert Tibshirani Jerome Friedman, Springer, 2014

Course outcomes (COs):

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

1. Collect and present the real life data numerically as well as graphically. (PO-1, PO-3, PSO- 1)
2. Arrive at appropriate estimates and inferences and take decisions in uncertainty (PO-1, PO-2, PSO-2)
3. Apply the right probability distribution for a real life problem (PO-1, PO-5, PSO-2)
4. Conduct correlation and regression analysis in situations involving many variables. (PO-1, PO-5, PSO-1)

Course Assessment and Evaluation:

Continuous Internal Evaluation (CIE): 50 Marks		
Assessment tool	Marks	Course outcomes attained
Weekly Evaluation-Lab Record	30	CO1, CO2,CO3
Lab Test	20	CO1, CO2,CO3
Semester End Examination (SEE)	50	CO1,CO2,CO3

COMPUTER AIDED MACHINE DRAWING LAB	
Course Code: IML48	Credits: 0:0:1
Pre – requisites: CAED Lab	Contact Sessions: 1
Course Coordinator: Dr. M R Shivakumar / Dr. M Rajesh	

Course Content

PART - A

Introduction: Graphic interface software, 3D environment, basic commands of software and drawing standards.

Construction of simple machine parts: Conversion of orthographic views into 3D views of simple machine parts.

- 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>
<https://www.youtube.com/watch?v=AzFz8A5HgiQ>
https://www.youtube.com/watch?v=j20W2k4XIiY&list=RDCMUCqG32kBhpL8Vjb4WsCUc4dQ&start_radio=1&rv=j20W2k4XIiY&t=18

PART - B

Assembly Drawings (Part drawing should be given):

Screw jack

Plummer block (pedestal bearing)

Protected type flanged coupling

Knuckle joint

- 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>

Text Books:

1. A premier on computer aided engineering drawing-2007- VTU Publication Belguam.
2. K R Gopala Krishna -Machine drawing, Subhash Publications, 2006 Bangalore.
3. S Trymbakamurthy -A text book Computer aided machine drawing, CBS publisher, New Delhi 2006

References:

1. N Siddeswar, P Kannaih, V V S Shastri -Machine drawing, Tata Mc Graw Hill, 2006.
2. N D Bhatt and V M Panchal -Machine drawing, Charotar Publishing House, 43rd edition, 2008.

Course Outcomes (COs):

At the end of the course, students will be able

1. Apply drawing standards and construct 3D machine components. (PO-1, PO-2, PO-3, PO-10, PSO-1, PSO-2)
2. Create complex machine drawings. (PO-1, PO-2, PO-3, PO-10, PSO-1, PSO-2)

Web links and video lectures (e-Resources)

1. <https://www.youtube.com/watch?v=fHqolQwz93U>
2. <https://www.youtube.com/watch?v=JZ-6AfadSQI>
3. <https://www.youtube.com/watch?v=5IEKtwLOQCM>
4. <https://www.youtube.com/watch?v=jWBO9HQxJyo>
5. <https://www.youtube.com/watch?v=bb3zelbCEAY>
6. https://www.youtube.com/watch?v=e16S_87zU_s
7. <https://www.youtube.com/watch?v=SGfLx9YsCSQ>
8. <https://www.youtube.com/watch?v=lwYIw0C9RTk>

Course Assessment and Evaluation:

Continuous Internal Evaluation : 50 Marks		
Assessment tool	Marks	Course outcomes attained
Weekly Evaluation-Lab Record	30	CO1, CO2,CO3
Lab Test	20	CO1, CO2,CO3
Semester End Examination (SEE)	50	CO1,CO2,CO3

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 Bhahuvachana- (Singular and Plural nouns) Conversation- Sambhashaneyalli Linga rupagaLu- Genders in Conversation

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

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

Aaharakke sambandisida padagaLu(Names connected with food)

Manavana shareerada bhagagalu / Angagalu (Parts of the Human body) Manava Sambhandhada da padhagalu (Terms Relating to Human Relationship)

Manavana Bhavanegalige sambandisida Padagalu (Words Relating to Human's feelings and Emotions)

Vaasada staLakke sambhandisidanthaha padhagalu (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 muurthy, '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, 6th 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:

Continuous Internal Evaluation (CIE): 50 marks		
Assessment tool	Marks	Course outcome attained
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		
Other components		
Assignment	10	CO1, CO2
quiz	10	CO3, CO4, CO5
Semester end examination (SEE)	100	CO1, CO2, CO3, CO4, CO5

ಕನ್ನಡ ಮನಸು	
Course Code: HS491M	Credits: 1:0:0
Pre – requisites: Nil	Contact Hours: 14L
Program: B.E(Common to all the Branches)	Semester: IV
Course Coordinator: 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:

Continuous Internal Evaluation (CIE): 50 marks		
Assessment tool	Marks	Course outcome attained
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		
Other components		
Assignment	10	CO1, CO2
quiz	10	CO3, CO4, CO5
Semester end examination (SEE)	100	CO1, CO2, CO3, CO4, CO5

ABILITY ENHANCEMENT COURSE - IV	
Course Code: AEC410	Credits: 1:0:0
Pre – requisites: Nil	Contact Hours: 14L
Course Coordinator: 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	
Course Code: AM41	Credits: 0:0:0
Pre – requisites: Nil	Contact Hours: 42
Course Coordinator: 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>

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, 44th edition, 2017.
2. **Erwin Kreyszig** – Advanced Engineering Mathematics – Wiley Publication, 10th 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.