

# CURRICULUM STRUCTURE

# SECOND YEAR UG: B.E.

# **MECHANICAL ENGINEERING**

**REVISION: FRCRCE-1-24** 

**Effective from Academic Year 2024-25** Board of Studies Approval: 9/03/2024 Academic Council Approval: 16/3/2024



Dr. DEEPAK BHOIR Dean Academics



Dr. BHUSHAN T. PATIL Head of Department

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DR. SURENDRA RATHOD Principal



# Preamble:

Greetings and congratulations to all the education partners Fr Conceicao Rodrigues College of Engineering for getting autonomous status to the college from the year 2024-25. University Grant Commission vide letter No. F. 2-10/2023(AC-Policy) dated 23<sup>rd</sup> Nov 2023 conferred the autonomous status to Fr. Conceicao Rodrigues College of Engineering, Fr. Agnel Ashram, Bandstand, Bandra (West), Mumbai 400050 affiliated to University of Mumbai for a period of 10 years from the academic year 2024-2025 to 2033-2034 as per clause 7.5 of the UGC (Conferment of Autonomous Status Upon Colleges and Measures for Maintenance of Standards in Autonomous Colleges) Regulations,2023. We look towards autonomy as a great opportunity to design and implement curriculum sensitive to needs of Learner, Indian Society and Industries. Government of Maharashtra has also directed Autonomous Colleges to revise their curriculum in line with

National Education Policy (NEP) 2020 through Government Resolution dated 4<sup>th</sup> July 2023. We commit to ourselves to the effective implementation of UGC Regulations and NEP 2020 in its spirit.

Based on recent recommendations of the GR, we are pleased to offer our holistic curriculum for 2024-28, a "H-Tree Model" of Engineering Education. A unique "H-Tree Model" of Engineering Education Curriculum is carefully designed to systematically develop IQ (Intelligence Quotient), PQ (Physical Quotient), EQ (Emotional Quotient) and SQ (Spiritual Quotient) of a learner. This curriculum aims at the development of an all-rounded personality with holistic approach to education in which learner receives 25% teacher-led learning, 25% peer learning, 25% self-learning and 25% experiential learning. The curriculum model is outcome based that focuses on learning by doing. Curriculum is designed to provide multiple learning opportunities for students to acquire and demonstrate competencies for rewarding careers. It ensures multiple choices to leaner acquiring skills through systematic planning. It has 7 verticals aligned to GR recommendations with strong science, and mathematics foundation and program core, sequel of electives, Multidisciplinary Minor courses, humanities & management courses and sufficient experiential learning through projects and semester-long industry / research internship along with employable skill-based courses. Learner gets an opportunity to acquire skills through NSDC aligned courses during summer vacations. Learner also gets additional option to choose the kind of degree i.e. Honors or Double Minor or Honors with Research.

Various steps are taken to transform teaching learning process to make learning a joyful experience for students. We believe that this curriculum will raise the bar of academic standards with the active involvement and cooperation from students, academic and administrative units.



# Curriculum Structure for UG Programs at Fr CRCE w.e.f. A.Y. 2024-25

Nomer	clature of the courses in the curriculum
Abbreviation	Title
BSESC	Basic Science & Engineering Science Courses
PCPEC	Program Core and Program Elective Courses
MDC	Multidisciplinary Courses
SC	Skill Courses
HSSM	Humanities, Social Sciences and Management
EL	Experiential Learning
LLC	Liberal Learning Courses
BSC	Basic Science Courses
ESC	Engineering Science Courses
PCC	Program Core Courses
PEC	Program Elective Courses
MDM	Multidisciplinary Minor
OE	Open Elective
VSEC	Vocational and Skill Enhancement Course
VSC	Vocational Skill Courses
SEC	Skill Enhancement Courses
AEC	Ability Enhancement Course
EEMC	Entrepreneurship, Economics and Management Course
IKS	Indian Knowledge System
VEC	Value Education
RM	Research Methodologies
CEFP	Community Engagement or Field Project
ELC	Experiential Learning Courses
PRJ	Project
INT	Internship
CC	Cocurricular Courses
HMM	Honors and Multidisciplinary Minor
DM	Double Minor
BC	Bridge Course

## **Credit Specification:**

- Theory: 1 credit=13 to 15 hrs of teaching
- ✤ Lab: 1 Credit=26 to 30 hrs of lab work
- Studio Activities: 1 Credit= 26 to 30 hrs of creative activities
- Workshop Based Activities: 1 Credit=26 to 30 hrs of hands-on activities related to vocation/professional practice/skill based
- Seminar/Group Discussion: 1 Credit=13 to 15 hrs of participation
- Internship: 1 Credit=Per 2 weeks OR 36 to 40 hrs of engagement
- Field Based Learning/Practices: 1 Credit=26 to 30 hrs of learning activities
- Community Engagement Projects: 1 Credit=26 to 30 hrs of contact time along with 13 to 15 hrs of activities preparation, report writing, independent reading etc.



# **Credit requirements for different options of the Degrees:**

Degree/SEM	I	Ш	III	IV	V	VI	VII	VIII	Total
B.E	18	20	22+4#	23+5#	20	20	20	20	163+9#=172
B.E with	18	20	22+4#	23+5#	20+4*	20+4*	20+6*	20+4*	163+9#+18*=190
Honors/Minors									

# Bridge courses

\*Optional Credits

1. Learners who earn a minimum of total **172 credits** will be awarded "**Bachelor of Engineering**" degree.

2. Learners will have the following options to earn **B. E. in ......(regular) Engineering with Honours/Minor** in ...... (specialization)

Sr. No.	Honors/Minor degree programs	Programs who can offer this Honours Degree Program	Programs who can offer this as Minor Degree program
1	Internet of Things	<ol> <li>Computer Engineering</li> <li>Artificial Intelligence &amp; Data Science</li> <li>Electronics and Computer Science</li> <li>Mechanical Engineering</li> </ol>	
2	Artificial Intelligence and Machine Learning	<ol> <li>Computer Engineering</li> <li>Electronics and Computer Science</li> </ol>	Mechanical Engineering
3	Data Science	<ol> <li>Computer Engineering</li> <li>Electronics and Computer Science</li> <li>Mechanical Engineering</li> </ol>	
4	Blockchain	<ol> <li>Computer Engineering</li> <li>Artificial Intelligence &amp; Data Science</li> <li>Electronics and Computer Science</li> </ol>	Mechanical Engineering
5	Cyber Security	<ol> <li>Computer Engineering</li> <li>Artificial Intelligence &amp; Data Science</li> <li>Electronics and Computer Science</li> </ol>	Mechanical Engineering
6	Robotics	Mechanical Engineering	<ol> <li>Computer Engineering</li> <li>Artificial Intelligence &amp; Data Science</li> <li>Electronics and Computer Science</li> </ol>
7	3D Printing	Mechanical Engineering	<ol> <li>Computer Engineering</li> <li>Artificial Intelligence &amp; Data Science</li> <li>Electronics and Computer Science</li> </ol>

#### 3. Honours and Minor Degree Eligibility Criteria for Students:

i. Following is the eligibility criteria for students opting the Honours/ Minor Degree program:

- a. Students with no backlog in semester I, II, and III
- b. The CGPI (based on semester I, II, and III) of the students must be 6.75 and above

c. For direct second year (DSE) admitted students - No backlog in semester III and CGPI must be 6.75 and above



ii) Each eligible student can opt for maximum one Honour's or one Minor Programs at any time.

iii) However, it is optional for leaners to take Honours/Minor degree program.

iv) The Honours/ Minor degree program can be opted only during regular engineering studies

v) The student shall complete the Honours/ Minor degree program in stipulated four semesters only.

4. Courses offered during internship semester shall be in online mode

5. Learner can earn additional credits by enrolling to skill courses offered in summer. College shall explore feasibility to offer NSDC aligned skill based courses to the learners

6. Technical support team for registration of Academic Bank of Credits (ABC), registration of elective/optional courses, registration of online courses, registration for degree options etc. under supervision of Dean Academics.

#### Salient Features of Curriculum:

- ✓ Framed as per Government Resolution dated 4<sup>th</sup> July 2023 in line with National Education Policy (NEP) 2020.
- ✓ Minimum 172 choice-based credit structure with options of Degrees earning additional credits
- ✓ Unique 'H-Tree' Model of Curriculum: Hybrid model for holistic development with happy learning environment having bridge connecting verticals providing unique path for each learner for 3dimensional growth, Life Long Learning, bridge courses, inclusive model indicating equal distribution of central resources
- ✓ More emphasis on laboratory based and experiential learning
- ✓ More weightage to continuous assessment to reduce examination stress
- Mandatory Semester-long internship, courses with emotional & spiritual learning and skill-based learning aligned with NSDC framework
- ✓ Well balanced curriculum to attain Program Outcomes and skills of 21<sup>st</sup> century learner
- Curriculum is designed to create excitement among learners for education through stories, activities, collaboration, hackathon, contest, case studies, creative art etc.
- Curriculum is designed to make graduates responsible citizens of country with future ready skills to handle challenges of 21<sup>st</sup> Century



# SEMESTERWISE CURRICULUM STRUCTURE

# **SECOND YEAR Mechanical Engineering Program:**

				SEM-II	l i i i i i i i i i i i i i i i i i i i							
Course Code	Course	Sub-	Course Name		Contact		Ex: (1	aminatio Credit=5	on Marks 0 Marks	5 )	Cre	dits
	vertical	Ventical			Hours	ISE1	MSE	ISE2	ESE	Total	Points	Total
DSC12MEOE	DSESC	PSC	Statistical Techniques and Partial	TH	2	20	30	20	30	100	2	2
B3C12IVIE03	BSESC	BSC	Differential Equations	TU	1	20	-	30	-	50	1	5
PCC12ME05	PCPEC	PCC	Mechatronics	TH	2	20	30	20	30	100	2	2
DCC12ME06	DCDEC	PCC	Pasia Manufacturing Processos	TH	2	20	30	20	30	100	2	2
FCCIZIVILOO	Terre	ice	Basic Manufacturing Processes	PR	2	20	-	30	-	50	1	5
PCC12ME07	PCPEC	PCC	Machine Shop Practice	PR	2	20	-	30	1	50	1	1
MDM01	MDC	MDM	Law for Engineers	TH	2	50	-	50	-	100	2	2
OEME1V	MDC	OF	Open Elective 1	TH	1	10	15	10	15	50	1	2
OEWIEIX	MDC	OE	Open Elective-1	PR	2	20	-	30	1	50	1	2
	MDC	OE	Onen Elective 2	TH	1	10	15	10	15	50	1	2
UEIVIEIX	MDC	UE	Open Elective-2	PR	2	20	-	30	1	50	1	2
EEM12ME01	HSSM	EEMC	Financial Planning, Taxation and Investment	тн	2	50		50		100	2	2
		1/50	Human Values and Professional	TH	1					400	1	
VEC12ME01	HSSIM	VEC	Ethics	PR	2	50	-	50	-	100	1	2
CEP12ME01	EL	CEFP	Community Engagement Project	PRJ	4	50	-	50	-	100	2	2
LLCXX	LLC	CC	One Course from CC	PR	2	-	-	50	-	50	2	1
0004414500				TH	2	20	30	20	30	100	2	
PCC11ME03	BC	BC	Digital Electronics	PR	2	20	-	30	-	50	1	3*
PCC11ME01	BC	BC	Innovation and Design Thinking	PR	2	20	-	30	-	50	2	1*
				Total	TH:TU:PR			-	-	1100+200*	-	22+4*

\* Introduced as Bridge Courses to fulfil Credit Requirements of University of Mumbai

				SEM-	IV							
Course Code	Course	Sub-	Course Name		Contact Hours		Ex (1	aminatio Credit=5	on Mark 0 Marks	s 5)	C	redits
	vertical	vertical				ISE1	MSE	ISE2	ESE	Total	Points	Total
DSC12ME06	DSESC	PSC	Fundamentals of Thermodynamics	TH	2	20	30	20	30	100	2	
BSCIZIVIE00	DSESC	BSC	Fundamentals of Thermodynamics	TU	1	20	-	30	-	50	1	3
DCC12ME09	DCDEC	DCC	Mochanics of Solids	TH	2	20	30	20	30	100	2	
PCC12IVIE08	FCFEC	FCC	Mechanics of Solids	TU	1	20	-	30	-	50	1	3
PCC12ME09	PCPEC	PCC	Materials Science and Engineering	TH	2	20	30	20	30	100	2	2
FCCIZIVIE05	PEPEC	FCC	Materials Science and Engineering	TU	1	20	-	30	-	50	1	5
PCC12ME10	PCPEC	PCC	Materials and Material Testing	PR	2	20	-	30	-	50	1	1
MDM02	MDC	MDM	Emerging Technology and Law	TH	2	50	-	50	-	100	2	2
OEMEDY	MDC	OF	Open Elective 2	TH	1	10	15	10	15	50	1	2
OEIVIEZA	WIDC	UE	Open Elective-S	PR	2	20	-	30	-	50	1	2
VSE12ME03	SC	VSEC	Computer Aided Machine Drawing	PR	4	50	-	50	-	100	2	2
AEC12ME02X	HSSM	AEC	Modern Indian Language	TH	2	50	-	50	-	100	2	2
EEM12ME02	HSSM	EEMC	Technology Entrepreneurship	TH	2	50	-	50	-	100	2	2
		1/50	Technology Innovation for	TH	1					400	1	
VEC12ME02	HSSM	VEC	Sustainable Development	PR	2	40	-	60	-	100	1	2
LLCXX	LLC	CC	One Course from CC	PR	2	-	-	50	-	50	2	1
IKS11ME01	BC	BC	Indian Knowledge System	TH	2	50	-	50	-	100	2	2*
ESC11ME04	BC	BC	Human Health Systems	TH	1	20	-	30	-	50	1	1*
VSE11ME02	BC	BC	Creative Coding in Python	PR	4	50	-	50	-	100	2	2*
				Total	TH:TU:PR 17:3:16=36			-	-	1150+250*	-	23+5*

\* Introduced as Bridge Courses to fulfil Credit Requirements of University of Mumbai



				SEM-V								
Course Code	Course	Sub-	Course Name		Contact Hours		Ex (1	aminatio Credit=5	on Mark 0 Marks	s ;)	Cre	dits
	vertical	vertical				ISE1	MSE	ISE2	ESE	Total	Points	Total
DCC12ME11	DCDEC	PCC	Applied Thermodynamics	TH	2	20	30	20	30	100	2	
PCCISIVIEII	FCFEC	rcc	Applied Thermodynamics	PR	2	20	-	30	-	50	1	3
DCC12ME12	PCPEC	PCC	Theory of Machines	TH	2	20	30	20	30	100	2	
PCCISIVIEIZ	TELLE	ice	Theory of Wachines	PR	2	20	-	30	-	50	1	3
DCC13ME13	PCPEC	PCC	Metrology and Quality	TH	2	20	30	20	30	100	2	2
PCC15IVIE15	FCFEC	rcc	Engineering	TU	1	20	-	30	-	50	1	5
PCC13ME14	PCPEC	PCC	Measurements and Systems Lab	PR	2	20	-	30	-	50	1	1
	DCDEC	DEC	Program Elective Course	TH	2	20	30	20	30	100	2	
PECISIVIEXA	PUPEL	PEC	Program Elective Course	TU	1	20	-	30	-	50	1	3
PEC13MEXX	PCPEC	PEC	Program Elective Lab	PR	2	20	-	30	-	50	1	1
MDM03	MDC	MDM	Health, Wellness and Psychology	TH	2	50	-	50	-	100	2	2
MDM04	MDC	MDM	Public Relations and Corporate Communication	тн	2	50	-	50	-	100	2	2
OFMERY	MDC	OF	Onen Elective 4	TH	1	10	15	10	15	50	1	2
UEIVIESA	MDC	UE	Open Elective-4	PR	2	20	-	30	-	50	1	2
HXXXC501	HMM/DM	HMM/DM	Honors/Minor Degree Course	TH	4	20	30	20	30	100	4	4*
				Total	TH:TU:PR 13:2:10=25 17:2:10=29*			-	-	1000+100*	-	20+4*

\* Introduced as Optional Honors/Minor Degree Courses

				SEM-	VI							
Course Code	Course	Sub-	Course Name		Contact Hours		Ex (1	aminatic Credit=5	on Mark 0 Marks	s .)	Cre	dits
	Vertical	vertical				ISE1	MSE	ISE2	ESE	Total	Points	Total
DOCTONAL	DCDEC	DCC	CADICAN	TH	2	20	30	20	30	100	2	2
PCCI3IVIEIS	PUPEU	PCC	CAD/CAM	TU	1	20	-	30	-	50	1	5
DCC12ME16	DCDEC	DCC	Mashina Dasian	TH	2	20	30	20	30	100	2	2
PCCISIVIEID	PUPEL	PCC	Machine Design	TU	1	20	-	30	-	50	1	3
PCC13ME17	PCPEC	PCC	FEA and CFD Lab	PR	2	20	-	30	-	50	1	1
PCC13ME18	PCPEC	PCC	Project Based Learning Lab	PR	2	20	-	30	-	50	1	1
DECTONATIVY	DCDEC	DEC	Description Course	TH	2	20	30	20	30	100	2	2
PECI3IVIEXX	PUPEU	PEC	Program Elective Course	TU	1	20	-	30	-	50	1	5
BE040045307	DODEC	DEC		TH	2	20	30	20	30	100	2	
PECI3MEXX	PCPEC	PEC	Program Elective Course	TU	1	20	-	30	-	50	1	3
PEC13MEXX	PCPEC	PEC	Program Elective Lab	PR	2	20	-	30	-	50	1	1
PEC13MEXX	PCPEC	PEC	Program Elective Lab	PR	2	20	-	30	-	50	1	1
MDM05	MDC	MDM	Emotional and Spiritual Intelligence	TH	2	50	-	50	-	100	2	2
VSE13ME04	SC	VSEC	CNC and 3D Printing Lab	PR	4	50	-	50	-	100	2	2
HXXXC601	HMM/DM	HMM/DM	Honors/Minor Degree Course	TH	4	20	30	20	30	100	4	4*
				Total	TH:TU:PR 10:4:12=26 14:4:12=30*			-	-	1000+100*	-	20+4*

\* Introduced as Optional Honors/Minor Degree Courses

			SE	M-VII								
Course Code	Course	Sub-	Course Name		Contact		Ex (1	aminatio Credit=5	on Mark 0 Marks	s 5)	Cre	dits
	vertical	vertical			Hours	ISE1	MSE	ISE2	ESE	Total	Points	Total
DCC14ME10	DCDEC	PCC	Fluid Mechanics and Tourbo	TH	2	20	30	20	30	100	2	2
PCC14IVIE19	TCTLC	rcc	Machinery	PR	2	20	-	30	-	50	1	5
PCC14ME20	PCPEC	PCC	Hydraulics and Pneumatics Lab	PR	2	20	-	30	-	50	1	1
	DCDEC	DEC	Program Elective Courses	TH	2	20	30	20	30	100	2	2
PEC14IVIEXX	rCrEC	PEC	Program Elective Course	TU	1	20	-	30	-	50	1	3
	DCDEC	DEC	Dragon Elective Course	TH	2	20	30	20	30	100	2	2
PEC14IVIEXX	PUPEC	PEC	Program Elective Course	TU	1	20	-	30	-	50	1	5
MDM06	MDC	MDM	Principles of Management	TH	2	50	-	50	-	100	2	2
DMC14ME01	EI	DM	Econticle of Bessensh Methodology	TH	1	40		60		100	1	2
RIVIC14IVIEU1	EL	KIVI	Essentials of Research Methodology	TU	1	40	-	60	-	100	1	2
DNAC14N4E02	EI	DM	Intellectual Droporty, Biohto	TH	1	40		60		100	1	2
RIVIC14IVIEU2	EL	KIVI	Intellectual Property Rights	TU	1	40	-	60	-	100	1	2
PRJ14ME01	EL	PR	Project	PR	8	100	-	100	-	200	4	4
HXXXC701	HMM/DM	HMM/DM	Honors/Minor Degree Course	TH	4	20	30	20	30	100	4	4*
HXXXSBL701	HMM/DM	HMM/DM	Honors/Minor Degree Course Lab	PR	4	50	-	50	-	100	2	2*
				Total	TH:TU:PR 10:4:12=26 14:4:16=34*			-	-	1000+200*	-	20+6*

\* Introduced as Optional Honors/Minor Degree Courses



			SE	M-VIII								
Course Code	Course Vertical	Sub-Vertical	Course Name		Contact Hours		Exam	ination N	/larks		Cre	dits
						ISE1	MSE	ISE2	ESE	Total	Points	Total
PCC14ME21	PCPEC	PCC	Program Core Course	TH	SWAYAM		As P	er SWAY	ΆM		2	2
PCC14ME22	PCPEC	PCC	Program Core Course	TH	SWAYAM		As P	er SWAY	ΆM		2	2
PEC14MEXX	PCPEC	PEC	Program Elective Course	TH	SWAYAM		As P	er SWAY	ΆM		2	2
MDM07	MDC	MDM	One MDM Course	TH	SWAYAM		As P	er SWAY	ΆM		2	2
INT14ME01	EL	INT	Semester long Internship	PR	36-40 hrs		As Per In	ternship	Manual		12	12
HXXXC701	HMM/DM	HMM/DM	Honors/Minor Degree Course	TH	SWAYAM		As P	er SWAY	ΆM		4	4*
				Total							_	20+4*

\* Introduced as Optional Honors/Minor Degree Courses

# Online course 1 Credit=4 Week course from SWAYAM can be taken in SEM 7 or SEM VIII

# Online min 8 week course from SWAYAM can be taken in SEM 7 or SEM VIII to complete 2 credit course (Combination of two 4-week credit courses shall be allowed with prior approval)

\* Online min 12 week course from SWAYAM can be taken in SEM 7 or SEM VIII to complete 3 credit course

#### List of Program Elective Courses:

#### **Choice for Third Year:**

#### **Track-A: Manufacturing and Management**

SEM-V: Any one Theory: Advanced Manufacturing Processes, Additive Manufacturing, Supply chain management, Costing and Cost Control

Lab: Additive Manufacturing

SEM-VI: *Any two Theory:* Mould and Metal Forming Technology, Tool Engineering, Optimization Techniques, Project Management, Industrial Engineering and Operations Research, Advanced Materials

Lab: Manufacturing Systems, Industrial Engineering and Operations Research

#### **Track-B: Design and Automation**

SEM-V: Any one Theory: Automation and Control, Product Design and Development Lab: Product Design

SEM-VI: *Any two Theory*: Automation and Control, Mechanical Vibrations, Industrial Robotics, Modelling and Simulation, Design of Mechanical Systems Lab: Automation, Condition Monitoring

SEM- VII: Any two theory courses from the other track

#### **Open Electives offered to Mechanical students:**

- 1. SEM-III Any two: Control Systems OR Database Management Systems OR JAVA programming OR OR Data Structure
- SEM-IV Any one: Microprocessors & Microcontrollers OR Web Technology OR Fundamentals of AI & ML
- 3. SEM-V Any one: Embedded Systems OR IoT OR E-Vehicle

#### List of Multi-Disciplinary Minor Courses (MDM):

- 1. SEM-III: Law for Engineers
- 2. SEM-IV: Emerging Technology and Law
- 3. SEM-V: Public Relations and Corporate Communication
- 4. **SEM-V:** Health, Wellness and Psychology
- 5. SEM-VI: Emotional and Spiritual Intelligence
- 6. SEM-VII: Principles of Management
- 7. SEM-VIII: From SWAYAM (To be approved by Dean Academics)



#### List of Modern Indian Language (2 credit) (AEC):

- 1. Sanskrit for Beginners
- 2. Telugu for Beginners
- 3. Kannada for Beginners
- 4. Tamil for Beginners

Indicative List of Cocurricular Courses (CC): (Min 15 to Max 20 students in each course: Except Social Activities). Will be offered based on student choice and availability of resources to conduct a course. LLCO1. Culinary Arts: Foundations of Cooking

LLC02. Indian Aesthetics

LLC03. Sketching

LLC04. Personality Development and People Management

LLC05. Work Life Balance

LLC06. Art of Living

LLC07. Yoga Vidya

LLC08. First Aid and Self Defence

LLC09. Fire Safety and Electronic Security

LLC010. Sports Technology

LLC011. Athletics

LLC012. Aerobics and Fitness

LLC013. Study of Dance Forms

LLC014. Introduction to Dramatics: Exploring Theatre Arts

LLC015. Fundamentals of Photography

LLC016. Cinematography

LLC017. Music Appreciation and Composition

LLC018. Script writing

LLC019. Vehicle maintenance and traffic rules

LLC020. Garden Design and Maintenance

LLC021. Managing Social Media

LLC022. Server and Network Maintenance

LLC023. Electrical Safety

LLC024. Mentoring of School Children

LLC025. Social Club Activities



LLC026. Cultural Club Activities

LLC027. Any other course approved by Dean Academic

# Honors Degree Offered to Mechanical Engineering Students from SEM-V to SEM-VIII:

#### A. Name: Robotics

- 1. SEM-V: HRBC501: Industrial Robotics
- 2. SEM VI: HRBC601: Mechatronics & IoT
- 3. SEM VII: HRBC701: Artificial Intelligence & Data Analysis
- 4. SEM VII: HRBSBL701: Robotics and Automation Lab
- 5. SEM VIII: HRBC801: Autonomous Vehicle Systems

#### B. Name: 3D Printing

- 1. SEM-V: H3DPC501: Introduction to CAD
- 2. SEM VI: H3DPC601: 3D Printing: Introduction & Processes
- 3. SEM VII: H3DPC701: Applications of 3D Printing
- 4. SEM VII: H3DPSBL701: Skill Based Lab– Digital Fabrication
- 5. SEM VIII: H3DPC801: 3D Printing in Medical Technology

#### C. Name: Data Science

- 1. SEM-V: HDSC501: Mathematics for Data Science
- 2. SEM VI: HDSC601: Statistical Learning for Data Science
- 3. SEM VII: HDSC701: Data Science for Health and Social Care
- 4. SEM VII: HDSSBL701: Data Science for Health and Social Care Lab
- 5. SEM VIII: HDSC801: Text, Web and Social Media Analytics

#### **D.** Name: Internet of Things

- 1. SEM-V: HIoTC501: IoT Sensor Technologies
- 2. SEM VI: HIoTC601: IoT System Design
- 3. SEM VII: HIoTC701: Dynamic Paradigm in IoT
- 4. SEM VII: HIOTSBL701: Interfacing & Programming with IoT Lab (SBL)
- 5. SEM VIII: HIoTC801: Industrial IoT

#### Minors Degree Offered to Mechanical Engineering Students from SEM-V to SEM-VIII:

#### A. Name Artificial Intelligence and Machine Learning

- 1. SEM-V: HAIMLC501: Mathematics for AI & ML
- 2. SEM VI: HAIMLC601: Game Theory using AI & ML
- 3. SEM VII: HAIMLC701: AI & ML in Healthcare
- 4. SEM VII: HAIMLSBL701: AI & ML in Healthcare: Lab
- 5. SEM VIII: HAIMLC801: Text, Web and Social Media Analytics

#### B. Name: Blockchain

- 1. SEM-V: HBCC501: Bit coin and Crypto currency
- 2. SEM VI: HBCC601: Blockchain Platform
- 3. SEM VII: HBCC701: Blockchain Development
- 4. SEM VII: HBCSBL701: Private Blockchain Setup Lab (SBL)
- 5. SEM VIII: HBCC801: DeFi (Decentralized Finance)



#### C. Name: Cyber Security

- 1. SEM-V: HCSC501: Ethical Hacking
- 2. SEM VI: HCSC601: Digital Forensic
- 3. SEM VII: HCSC701: Security Information Management
- 4. SEM VII: HCSSBL601: Vulnerability Assessment Penetration Testing (VAPT) Lab
- 5. SEM VIII: HCSC801: Application Security

# Comparison of Credit Distribution for Four Year UG Program for Fr CRCE and GR:

#### **UG: Mechanical Engineering**

								<b>C</b> οι	<mark>ırse Verti</mark>	cals								Total
	BS	ESC	PC	PEC	MD	С	SC		HSS	М			E	L		LLC	BC	Credits
SEM	BSC	ESC	PCC	PEC	MDM	OE	VSEC	AEC	EEMC	IKS	VEC	RM	CEFP	PRJ	INT	CC	BC	
1	9	9																18
II	9	8						3										20
III	3		6		2	4			2		2		2			1	4	22+4
IV	3		7		2	2	2	2	2		2					1	5	23+5
V			10	4	4	2												20
VI			8	8	2		2											20
VII			4	6	2							4		4				20
VIII			4	2	2										12			20
Total Credits as	24	17	39	20	14	8	4	5	4	-	4	4	2	4	12	2	9	163+9
per Fr CRCE																		=172
Total Credits as per GR	14	12	44	20	14	8	8	4	4	2	4	4	2	4	12	4		160



Course Code	Course Name	Teaching (Hrs/weel	Schem (x)	e	С	redits Assign	ed	
	Statistical	L	Т	Р	L	Т	Р	Total
BSC12ME05	<b>Techniques and</b>	2	1	0	2	1	0	3
	<b>Partial Differential</b>				Exa	mination Scl	heme	
	Equations		ISE1	MSE	ISE2	ESE		Total
		Theory	20	30	20	100		100
						(30% weight	age)	
		Tutorial	20		30			50

Pre-requisite Course Codes	BSC1	1ME01, BSC11ME03
Course Outcomes	CO1	Implement numerical and analytical methods for one dimensional heat and wave equations in solving partial differential equations.
	CO2	Apply probability distributions of Poisson and Normal to some of the real-life situations.
	CO3	Apply the concept of sampling distribution in hypothesis testing of small samples using sampling theory.
	CO4	Apply the concept of Correlation and Regression to engineering problems in data science, machine learning, and AI.

#### Theory.

Module	Unit	Topics	Ref.	Hrs.
No.	No.			
1	Title	Partial Differential Equations	1,2,3,4	06
	1.1	Introduction of Partial Differential equations, method of separation		04
		of variables, Vibrations of string, Analytical method for one		
		dimensional heat and wave equations. (only problems)		
	1.2	Crank Nicholson method		01
	1.3	Bender Schmidt method		01
2	Title	Probability Distribution and Sampling Theory-I	1,2,3,4	07
	2.1	Probability Distribution: Poisson and Normal distribution		03
	2.2	Sampling distribution, Test of Hypothesis, Level of Significance, Critical region, One-tailed, and two-tailed test, Degree of freedom.		02
	2.3	Students' t-distribution (Small sample). Test the significance of single sample mean and two independent sample means and paired t- test)		02
3	Title	Sampling Theory-II	1,2,3,4	06
	3.1	Chi-square test: Test of goodness of fit and independence of attributes (Contingency table) including Yate's Correction.		03
	3.2	Analysis of variance: F-test (significant difference between variances of two samples)		03



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(Autonon	nous College	affiliated to	University of M	Iumbai)

4	Title	Statistical Techniques	1,2,3,4	07
	4.1	Karl Pearson's Coefficient of correlation (r) and related concepts with problems.		02
	4.2	Spearman's Rank correlation coefficient (R) (Repeated & non repeated ranks problems)		01
	4.3	Lines of regression		02
	4.4	Fitting of first- and second-degree curves.		02
Total				26

#### Tutorial:

Exp. No.	Tutorial Details	Hours
1	Partial differential equations 1	01
2	Partial differential equations 2	01
3	Probability distributions	01
4	Testing of hypothesis	01
5	Chi-square test	01
6	F-Test	01
7	Correlation and Regression	01
8	Curve fitting	01
	Total Hours	08

#### **Course Assessment:**

#### **Theory:**

ISE-1: Quiz : 20 Marks

ISE-2: Quiz: 20 Marks

MSE: Two hours 30 Marks written examination based on 50% syllabus

**ESE:** Three hours 100 Marks (30% weightage) written examination based on entire syllabus

#### **Tutorial:**

**1. ISE-1** will be conducted for three tutorials. Continuous pre-defined rubrics-based evaluation for 20 marks.

**2. ISE-2** will be conducted for five tutorials. Continuous pre-defined rubrics-based evaluation for 30 marks.



#### **Recommended Books:**

- [1] Dr B.S. Grewal, "*Higher Engineering Mathematics*", Khanna Publications, 4<sup>nd</sup> Edition.
- [2] H. K. Dass, "Advanced Engineering Mathematics", S. Chand, 28th Edition.
- [3] Erwin Kreysizg, "Advanced Engineering Mathematics", John Wiley & Sons, 10th Edition.
- [4] Jain and Iyengar, "Advanced Engineering Mathematics", Narosa Publications, 4th Edition.



# Society of St. Francis Xavier, Pilar's Fr. Conceicao Rodrigues College of Engineering Fr. Agnel Ashram, Bandstand, Bandra (W), Mumbai - 400 050

(Autonomous College affiliated to University of Mumbai)

Course Code	Course Name	Teaching (Hrs/week	Schem (x)	e	Cı	redits Assign	ed	
		L	Т	Р	L	Т	Р	Total
		2			2			2
PCC12ME05		Examination Sche						
	Mechatronics		ISE1	MSE	ISE2	ESE		Total
		Theory	20	30	20	100		100
						(30% weight	age)	
		Lab						

Pre-requisite	e Cours	e Codes -
	CO1	Understand the basic concept of Mechatronics and its industrial
Commo		applications
Course	CO2	Understand the basic architecture of 8051 Microprocessor
Outcomes	CO3	Understand working of different sensors
	CO4	Demonstrate the use of Arduino for various applications

Module	Unit	Topics	Ref.	Hrs.
No.	No.			
1	1.1	Introduction to Mechatronics: Traditional and Mechatronics	1	4
		Design, Mechatronics Key Elements, Basic Components of		
		Mechatronic Systems, Integrated Design issues in Mechatronics,		
		Mechatronics Design Process, Mechatronics System in Factory,		
		Home and Business Applications, Objectives, Advantages and		
		Disadvantages of Mechatronics		
2	2.1	Overview of Micro-processor ad Micro-controller: 8051 Micro-	2,3	5
		controllers, Functional Block Diagram and Architecture,		
		Instruction set and Assembly Language Programming,		
3	3.1	Introduction to sensors, specifications: Thermistor, Humidity,	4	5
		Temperature, Pressure, displacement, Velocity and		
		Acceleration		
4	4.1	Introduction to Arduino. Arduino Boards, Arduino Uno –	5	2
		processor, USB, pins, power, Clock, Arduino IDE,		
	4.2	Arduino Programming: Basic Parts of Arduino Sketch, Custom	5	5
		Functions, Using Variables, 'If' statement, "While" statement,		
		"For" statement and "Switch" statement		
5	5.1	Case Studies of Mechatronics Systems - Timed Switch, Pick and	1	5
		Place Robot, Car Park Barrier, Automatic Camera, Car Engine		
		Management, Bar Code System, CNC Machine, ABS, Artificial		
		Intelligence in Mechatronics, Fuzzy Logic applications in		
		Mechatronics.		
			Total	26

#### Course Assessment:-

**ISE-1:** Activity: Design Contest (20 Marks)

**ISE-2:** Activity: Quiz and assignments (20 Marks)



MSE: Two hours 30 Marks written examination based on 50% syllabus ESE: Three hours 100 Marks (30% weightage) written examination based on entire syllabus

#### **Recommended Books:**

- [1] Mechatronics. Hmt
- [2] The 8051 microcontroller Architecture, Programming and Applications Kenneth J T Ayala, Pemam International Publishing, (India).
- [3] The 8051 microcontroller and embedded systems using assembly and C by M.A. Mazidi, J. Mazidi and R. D. McKinlay. PHI, second edition
- [4] Sensors and Transducers by Ian Sinclair, Elsevier, Dec 2000
- [5] Getting started with Arduino, by Massimo Banzi, 2009, Make Community, LLC, 2022



Course Code	Course Name	Teaching (Hrs/weel	ng Scheme eek) Credits Assigned					
		L	Т	Р	L	Т	Р	Total
		2		2	2		1	3
DCC12ME06	Basic				Examination Scheme			
I CC12WIE00	Manufacturing		ISE1	MSE	ISE2	ESE		Total
	Processes	Theory	20	30	20	100		100
						(30% weight	tage)	
		Lab	20		30			50

Pre-requisite	e Cours	e Codes -
	CO1	Identify and differentiate between various manufacturing processes.
	CO2	Explain the function of the basic parts of the machine tools and its
Course		accessories.
Outcomes	CO3	Analyse various machining processes and select the particular process for
		a specific job.
	CO4	Calculate machining time for various manufacturing processes.

#### Part A (Theory)

Module	Unit	Topics	Ref	Hrs.		
No.	No.					
		Introduction to the various manufacturing processes.	1,2	03		
1	1.1	Definition and need of various manufacturing processes.				
	1.2	Classification of various manufacturing processes based on chip-				
		less and chip-removal processes.				
	Cutting off machines					
	2.1	Types of circular saws, Band saw, Power hacksaw, Friction saw,				
2		Abrasive cutting off machines.				
	2.2	Advantages, Limitations, and Applications of different types of				
		cutting off machines.				
		Lathe machine	1,2	08		
	3.1	Descriptions and functions of lathe parts. Lathe specifications,				
		Lathe operations, and Taper turning.				
	3.2	Turning parameters like speed, feed, depth of cut, and metal				
3		removal rate. Calculation of machining time.				
	3.3	Single point cutting tool nomenclature. Work and tool holding				
		devices & accessories.				
	3.4	Types of Lathe machines including Capstan and Turret Lathe.				
		Boring operation.				
		Drilling machine	1,2	04		
	4.1	Drilling operations. Types of Drilling machines.				
4	4.2	Drill nomenclature. Work and tool holding devices. Calculation				
		of machining time in drilling.				
	4.3	Deep hole drilling and Boring machines.				
5		Milling machine	1,2	05		



	5.1	Types of milling operations and their difference. Milling				
		parameters.				
	5.2	Types of milling machines. Types of Milling cutters.				
	5.3	Special milling attachments and accessories. Calculation of				
		machining time in milling.				
		Grinding machine	1,2	04		
	6.1 Principle of grinding. Types of grinding machines and operations.					
6	6.2	Grit, grade, and structure of grinding wheels. Balancing of				
		grinding wheels.				
	6.3	Truing, dressing, and shaping of grinding wheels.				
Total				26		

#### Course Assessment:

Theory:

#### <u>ISE-1:</u>

<u>Activity:</u> A visit will be arranged for students in a workshop (other than CRCE) to get a demonstration on Lathe, Drilling, and Milling machines. Students will submit a report as part of ISE-1 based on their observation of their visit. (20 Marks)

## **ISE-2:**

<u>Activity</u>: An Industrial Visit will be organized to a production facility where students will be able to gain more knowledge of the various machine tools. Students will submit a report as part of ISE-2 based on their observation of their industrial visit. (20 Marks)

MSE: Two hours written examination based on 50% syllabus (30 Marks)

ESE: Three hours 100 Marks (30% weightage) written examination based on entire syllabus

#### Lab:

Part B (Lab)

	Activities to be completed during lab time	Ref.	Hrs.
A1	Visit to Fr. CRCE workshop (Demonstration of Lathe, Drilling,	1,2	12
	Milling, and Shaping machines) and report writing.		
A2	Calculation of machining time (Lathe, Drilling and Milling	1,2	6
	operation).		
A3	Draw and label a lathe machine.	1,2	2
A4	Draw and label any one type of drilling machine.	1,2	2
A5	Draw and label the single-point cutting tool.	1,2	2
A6	Draw and label the drill nomenclature.	1,2	2
	Total		26



Course Assessment:-

(Lab)

ISE:

- **1. ISE-1** will be conducted for two activities (A1 and A2) Continuous pre-defined rubricsbased evaluation for 20 marks.
- **2. ISE-2** will be conducted for four activities (A3, A4, A5, A6) Continuous pre-defined rubrics-based evaluation for 30 marks.

#### **Recommended Books:**

#### **Text Books:**

- [1] Elements of Workshop Technology: Machine Tools (Volume 2) by S. K. Hajra Choudhary, K. Hajra Choudhary, Nirjhar Roy, Media promoters 15 th Edition (2023).
- [2] A Course in Workshop Technology Vol. II (Machine Tools) by B. S. Raghuwanshi, Dhanpat Rai & Co. (2015).

#### **Reference Books:**

- [3] Manufacturing, Engineering and Technology, 5th Edition by Serope Kalpakjian, Steven R. Schmid, Pearson (2018).
- [4] A Text Book Of Production Technology Vol. II by O. P. Khanna, Dhanpat Rai Publication (2012).

#### AICTE Prescribed Textbook:

Manufacturing Engineering, (Based on Model Curriculum of AICTE) - Santosh Kumar, All India Council for Technical Education, Feb 2023

(https://ekumbh.aicte-india.org/allbook.php#)



# Society of St. Francis Xavier, Pilar's Fr. Conceicao Rodrigues College of Engineering Fr. Agnel Ashram, Bandstand, Bandra (W), Mumbai - 400 050

(Autonomous College affiliated to University of Mumbai)

Course Code	Course Name	Teach (H	ing Sch rs/week	Credits Assigned					
	Machine Shop Practice	L	Т	Р	L	Т	Р	Total	
				2			1	1	
<b>PCC12ME07</b>		Examination Scheme							
			ISE1	MSE	ISE2	ESE	Total		
		Lab	20		30			50	

Pre-requisite Course	-	
Codes		
		Learner will be able to
	COL	Know the specifications, controls and safety measures
Course Outcomes	COI	related to machines and machining operations
Course Outcomes	CO2	Use the machines for making various engineering jobs.
	CO3	Perform various machining operations.
	CO4	Perform Tool Grinding

Sr. No.	Experiments Details	Ref	Hrs
1	One composite job consisting minimum two parts employing operations performed of various machine tools.	1	16
2	Tool Grinding – To know basic tool Nomenclature	1	5
	Total		21

#### **Course Assessment:**

#### Laboratory work:

#### 1. ISE-1 (20 marks)

Submission of the one part made on Lathe machine and complete workshop book giving details of drawing of the job and timesheet.

#### 2. ISE-2 (30 marks)

- i. Submission of the second part made on shaper, drilling machine and milling machine and complete workshop book giving details of drawing of the job and timesheet
  - (20 marks)
- ii. Lab interaction: (10 marks)

#### **Recommended Books:**

[1] Production Technology Manufacturing Processes volume-II by O. P. Khanna

#### AICTE Prescribed Textbook:

Workshop Manufacturing Practices by Prof. Veeranna D.K, Khanna Book Publishing (https://ekumbh.aicte-india.org/allbook.php#)



Course Code	Course Name	Teach (H	Credits Assigned						
	Law for Engineers	L	Т	Р	L	Т	Р	Total	
		2			2			2	
		Examination Scheme							
MIDNUI			ISE1	MSE	ISE2	ESE	To	otal	
		Theory	50		50		100		
		Lab							

Pre-requisi	te Cou	rse Codes					
	CO1	To demonstrate awareness of basic structure of Indian Legal System					
	CO2	To demonstrate awareness of principles of contract					
Course	CO3	fo demonstrate awareness of legal aspects related to establishment of factory					
Outcomos		and various legislations related to employees, labours, and workmen's					
Outcomes		welfare					
	CO4	To demonstrate awareness about right ot information, intellectual creations					
		from infringement and laws related to energy, food and environment					

Module	Unit	Topics	Ref.	Hrs.
No.	No.			
1		Foundation of Legal System	1,2,3	4
	1.1	Indian Legal System: An Introduction, Human Rights,		
		Fundamental Rights, The Supreme Court of India, Statutory		
		Commissions- NHRC, NCW, NCM, NC-SC/ST etc.,		
	1.2	Representation of Peoples Act 1950, Prevention of Corruption		
		Act, 1988, Understanding the Importance of Stamp Duty		
	1.3	Few Illustrated Cases of Supreme Court of India		
2		General Principles of Contract: India Contract Act 1872	2,3	8
	2.1	Contract Law: Agreement and Its Kinds,		
	2.2	Who Can Enter into a Contract, Contract and Its Enforceability,		
		Offer and Acceptance in a Contract,		
	2.3	Essentials of Valid Contract- Lawful Consideration and Lawful		
		Object, Essentials of Valid Contract- Free Consent,		
	2.4	Types of Contract, Contract of Agency, Performance of		
		Contracts, Government Contracts, Standard Form Contracts		
3		Industrial and Labour Laws	2,3	8
	3.1	Labour Laws in India: An Overview, Industrial Disputes Act,		
		1947, Industrial Employment (Standing Orders) Act, 1946		
	3.2	Factories Act, 1948, Industries (Development and Regulation)		
		Act, 1951		
	3.3	Contract Labour (Regulation and Abolition) Act, 1970, Bonded		
		Labour System (Abolition) Act, 1976, Child and Adolescent		
		Labour (Prohibition and Regulation) Act, 1986		
	3.4	Workmens Compensation Act, 1923, Equal Remuneration Act,		
		1976, Payment of Bonus Act, 1965, Payment of Gratuity Act,		
		1972, Employees' State Insurance Act, 1948, Employees'		



			Total	26
		Security Act 2013, Environment Protection Act 1986		
		Act 1988, Food Safety and Standards Act 2006, National Food		
	6.1	Electricity Act 2003, Atomic Energy Act 1962, Motors Vehicle		2
6		Other Important Laws	2,3	
		Indian Trademark Act 1999, Indian Patent Act 1970		
	5.1	Types of Intellectual Property, Indian Copyright Act 1957,		
5		Intellectual Property Rights	2,3	2
		Act		
	4.2	Right to Information Act, 2005, Impact of Right to Information		
	4.1	Official Secret Act, 1923, Indian Evidence Act, 1872		
4		Right to Information	2,3	2
		Bargaining		
		Harassment of Women at Workplace Act, 2013, Collective		
		Accidents Act, 1855, Trade Unions Act, 1926, Sexual		
	3.5	Apprentices Act, 1961, Maternity Benefit Act, 1961, Fatal		
		Employees' Pension Scheme 1995		
		Payment of Wages Act, 1936, Minimum Wages Act, 1948,		
		Provident Funds and [Miscellaneous Provisions] Act, 1952,		

#### **Course Assessment:**

**ISE-1:** Quiz: 20Marks Activity: Debating Session: 20 Marks Activity: Poster Making: 10 Marks

**ISE-2:** Quiz: 20 Marks Activity: Client Counseling: 10 Marks Activity: Animation Making: 20 Marks

#### **Recommended Books:**

- [1] N. S. Nappinai, "Technology Laws Decoded," LexisNexis, 2017
- [2] Vibha Arora and Kunwar Arora, "Law for Engineers" Central Law Publications, 2017
- [3] Vandana Bhatt and Pinky Vyas, "Laws for Engineers", ProCare, 2015



Course Code	Course Name	Teaching Scheme (Hrs/week)Credits Assigned								
		L	Т	Р	L	Т	Р	Total		
		1		2	1		1	2		
	Control Systems	Examination Scheme								
OFME11		Head	ISE1	MSE	ISE2	ESE	Tot	tal		
UENIEII		Theory	10	15	10	50	50	0		
						(30%				
						weightage)				
		Lab	20		30		50	0		

<b>Pre-requisite Course Codes</b>	-	
	CO1	Describe elements of control systems with their types
	CO2	Obtain transfer functions of given physical (mechanical) systems
	CO3	Derive mathematical models using various modeling approaches
	CO4	Analyze performance of control systems based on time response
	CO5	Evaluate the stability of a given control system

Module	Unit	Topics		Hrs.
No.	No.			
1		Introduction to Feedback Control Systems		1
	1.1	Overview of open loop system & closed loop system, block diagram,	1	1
		types, practical examples, comparison with advantages & disadvantages	1	1
2		Mathematical Modeling of Physical Systems		3
	2.1	The transfer function – definition, advantages, disadvantages, poles &		
		zeros in s-plane, characteristic equation, transfer function derivations of	2,3	1
		simple mechanical systems		
	2.2	Block diagram algebra – elements of block diagram representation,	22	2
		block diagram reduction rules, numerical examples	2,5	Z
3		System Response to Transient & Steady State Conditions		3
	3.1	Standard test signals, definition of first order systems & second order		
		systems, time domain specifications, analysis of transient response by	1,2,3	1
		second order model		
	3.2	Types of systems – type 0, type 1 & type 2, steady state errors, static		
		error constants, analysis of different system types using impulse, step,	2,3	2
		ramp & parabolic signals		
4		Stability Analysis of Control Systems		3
	4.1	Concept of stability, necessary conditions for stability, Routh-Hurwitz	1.0	1
		stability criterion, relative stability analysis	1,2	1
	4.3	Root Locus technique for stability analysis, numerical examples	1,2	2
5		Frequency Response Analysis of Control Systems		3
	5.1	Frequency domain specifications, importance of gain margin (GM) &		
		phase margin (PM), correlation between the time domain response &	1,2,3	1
		frequency domain response		
	5.2	Bode plots for stability analysis, numerical examples on Bode plots	1,2,3	2
	l (Hours)	13		



# List of Experiments:

Sr. No.	Title of Experiment	Ref.
1	Obtain time response characteristics of first order system	1, 2
2	Obtain time response characteristics of second order system	1, 2
3	Determine step & impulse response for type 0, type 1 & type 2 systems	1, 2
4	Frequency response characteristics of first order & second order	1, 2
	systems	
5	Obtain root locus plot for given LTI system	1, 2
6	Obtain Bode plot for given LTI system	1, 2
7	Simulation of block diagram reduction techniques	1, 2, 3
8	Simulation of LTI system transfer functions	1, 2, 3

#### **Course Assessment:**

#### 1. Theory:

#### (a) ISE-1:

Tutorial on transfer function derivation & mathematical modeling -05 marks Multiple choice questions (MCQ) quiz -05 marks (b) **ISE-2:** 

Homework assignments with viva-voce for self-evaluation – 10 marks

(c) MSE:

One hour 15 marks written (theory) examination based on initial 50% syllabus (d) ESE:

Two hours 50 Marks (30% weightage) written examination based on entire syllabus

## 2. Laboratory:

## (a) ISE-1:

Conducted for four experiments with continuous pre-defined rubrics-based evaluation for 20 marks. **(b) ISE-2:** 

i. Conducted for four experiments with continuous pre-defined rubrics-based evaluation for 20 marks ii. Viva-voce (oral) examination based on entire syllabus for 10 marks

## **Recommended Books:**

[1] I.J. Nagrath & M. Gopal, "Control Systems Engineering", New Age International Publishers, 5th edition.

- [2] Norman S. Nise, "Control Systems Engineering", John Wiley & Sons, 2<sup>nd</sup> edition.
- [3] Benjamin C. Kuo, "Automatic Control Systems", Prentice Hall India (PHI), 4<sup>th</sup> edition.



Course Code	Course Name	Teaching Scheme (Hrs/week)			<b>Credits Assigned</b>					
		L	Т	Р	L	Т	Р	Total		
		1		2	1		1	2		
	Database	Examination Scheme								
OFME12	Management Systems		ISE1	MSE	ISE2	ESE	]	<b>Fotal</b>		
<b>UEWIE12</b>		Theory	10	15	10	50		50		
						(30%				
						weightage)				
		Lab	20		30			50		

Pre-requisite Course	-	
Codes		
	CO1	Explain the basic concepts and the applications of database
	000	D i ED/EED I'. ( 1 11 i
	CO2	Design ER/EER diagrams for real-world scenario.
	CO3	Convert ER/EER diagram to relational model and write
		relational algebra queries.
<b>Course Outcomes</b>	CO4	Formulate SQL queries to retrieve, manipulate, and
		analyze data stored in a relational database.
	CO5	Apply the concept of normalization to relational database
		to improve the database design.
	CO6	Describe the concepts of transaction and concurrency
		control.

# Theory:

Module	Unit	Topics	Ref.	Hrs.
No.	No.			
1		Module 1: Introduction To Database Systems	1,2,6	2
	1.1	Characteristics of Database systems		
	1.2	File System Vs. Database systems		
	1.3	Three Schema Architecture and Data Independence		
	1.4	DBMS Architecture, Applocations of DBMS		
2		Module 2: Conceptual Data Modelling using Entity-	1,2,6	2
		Relation Diagram		
	2.1	The Entity-Relationship (ER) Model: Entity types, Types of		
		Attributes, Types of Keys		
	2.2	Relationships: Types of Relationships (Unary, Binary,		
		Ternary, N-ary), Constraints on Relationship (Cardinality and		
		Participation)		
	2.3	Extended ER Diagram: Generalization, Specialization, and		
		Aggregation.		
3		Module 3: Relational Model and Relational Algebra	1,2,6	2



	3.1	Introduction to Relational Model: Relational Schema and		
		Concepts of keys.		
	3.2	Mapping the ER and EER Model to the Relational Model		
	3.3	Relational Algebra: Operators and Relational Algebra		
		Queries		
4		Module 4: Structured Query Language	1,2	3
	4.1	DDL commands: CREATE, ALTER, DROP, TRUNCATE,		
		Integrity constraints: Key constraints, Domain constraints,		
		Referential integrity constraints, and Check constraints		
	4.2	DML Commands: Insert, Update, Delete, WHERE clause,		
		OrderBy clause.		
	4.3	Aggregate Functions, GroupBy – Having clause		
	4.4	SQL Joins, Set operations, Nested queries		
5		Normalization	1,2,4,6	2
	5.1	Pitfalls in Relational Database designs, Concept of		
		Normalization, Function Dependencies.		
	5.2	1NF, 2NF, 3NF, BCNF		
6		Transaction and Concurrency Control	1,2	2
	6.1	Introduction to Transaction, Transaction States, ACID		
		properties, Serial and Concurrent Schedules,		
		Serializability: Conflict and View serializability.		
		Transaction Control Commands (TCL)		
	6.2	Introduction to Concurrency Control: Lock-based protocols,		
		Timestamp-based protocols.		
			Total	13

# Lab Experiments:

Exp. No	Experiment	Ref.			
1.	Identify the case study and formulate the detailed problem statement.				
	Design Entity-Relationship (ER)/Extended Entity-Relationship (EER)				
	Model for the same.				
2.	Map the ER/EER Diagram designed in Experiment 1 into relational model 1,				
	and write SQL queries to create all PRIMARY KEY TABLES using DDL				
	commands (Apply the constraints like PRIMARY KEY, NOT NULL, and				
	DOMAIN Constrains)				
3.	Create all FOREIGN KEY tables. Apply Referential Integrity constraints.	1,2,5			
4.	Perform operations involving ALTER, DELETE, and UPDATE commands 1,2				
	on the tables created in Experiment 2 and 3.				
5.	Write SQL queries to implement JOINS and Nested queries for tables	1,2,5			
	created in Experiment 2 and 3.				
6.	Write the query for implementing the aggregate functions MAX(), MIN(),	1,2,5			
	AVG(), COUNT(), SUM() with Group by and Having clause for the				
	previously created tables.				



7.	Implement PL/SQL and TRIGGERS for the previously created tables.	1,2,5
8.	Create Views and Indices for the previously created tables.	1,2,5

#### **Course Assessment:**

#### Theory:

ISE-1: Two hours (10 Marks) Activity: Database Design Contest (Group Activity) Assessment will be done by the panel of internal teachers ISE-2: Two hours (10 Marks) Activity: Quiz and assignments MSE: One hour 15 Marks written examination based on 50% syllabus ESE: Two hours 50 Marks (30% weightage) written examination based on entire syllabus

# Lab:

<u>ISE-1 (20M)</u> Four experiments. Continuous pre-defined rubrics-based evaluation for 20 marks. <u>ISE-2 (30M)</u>

a. Four experiments. Continuous pre-defined rubrics-based evaluation for 20 marks.b. Activity: Internal Hackathon (Group Activity) for 10 marks

# **Recommended Books/Online Resources:**

[1] Korth, Slberchatz, Sudarshan, Database System Concepts, 6th Edition, McGraw Hill

[2] Elmasri and Navathe, Fundamentals of Database Systems, 5th Edition, Pearson education.

[3] Raghu Ramkrishnan and Johannes Gehrke, Database Management Systems, TMH.

[4] G. K. Gupta, Database Management Systems, McGraw Hill., 2012.

[5] <u>SQL Tutorial (w3schools.com)</u>

[6] Course: Database Management System By Prof. Partha Pratim Das, Prof. Samiran Chattopadhyay IIT Kharagpur : https://onlinecourses.nptel.ac.in/noc22\_cs91/preview



Course Code	Course Name	Teaching Schem (Hrs/week)			Credits Assigned				
		L	Т	Р	L	Т	Р	Total	
	JAVA Programming E13	1		2	1		1	2	
		Examination Scheme							
OEME12		ISI	E1	MSE	ISE2	ESE	Т	otal	
<b>UEWIE15</b>		10	)	15	10	50		50	
						(30%			
						weightage)			
		20	)		30			50	

Pre-requisite Course Codes	ESC1	1ME03
	CO1	Implement Java programs applying fundamental programming constructs
	CO2	Demonstrate a comprehensive understanding of core Java concepts
Course Outcomes	CO3	Explore Java programming concepts including multithreading, File I/O, and exception handling
	CO4	Develop a Java application that integrates concepts learned in the course

Module	<b>I</b> Init	Tonics	Ref	Hrs
No	No	Topics	INCI.	111 5.
1	1	Introduction to Java Basics:	1.2	2
-	_	Introduction to Java features.	-, -	
		Basic programming constructs: variables, data types, operators,		
		expressions, branching and looping.		
		Packages in java, Scanner class		
2	2	Introduction to object-oriented programming (OOP) concepts:	1, 2	3
		OOP concepts: Objects, class, Encapsulation, Abstraction, Inheritance,	,	
		Polymorphism, message passing, Java Virtual Machine, Class, object,		
		data members, member functions Constructors, types, static members		
		and functions Method overloading		
3	3	Array, Strings, String Buffer, Vectors:	1, 2	3
		Introduction to arrays (1D and 2D), Vectors, String and String Buffer		
		and manipulations.		
4	4	Inheritance:	1, 2	2
		Types of Inheritance, Interface, Abstract class and methods, super and		
		final keywords		
5	5	Exception Handling:	1, 2	2
		Handling exceptions in Java (try-catch-throw- throws-finally)		
6	6	Multithreading:	1, 2	2
		Introduction to Multithreading- lifecycle, Creation of threads- Thread		
		Class and Runnable Interface, Synchronization		
7	7	Introduction to JavaFx:	1, 2, 3	2
		Setting Up a JavaFX Application, Creating UI Elements, Event		
		Handling in JavaFX		



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Module	Sr	Suggested List of Experiments			
No.	No.	Suggested List of Experiments			
1	1	Program based on Input and Output, Control Structures and Functions			
2	2	Program based on Class and Objects, linking classes using association and			
		Polymorphism.			
3	3	Program based on Array, array of Objects and Vector			
4	4	Programs based on String and String Buffer manipulations,			
5	5	Program based on types of inheritance, Abstract class and interface			
6	6	Program based on Exception handling keywords (try-catch-finally, throw and			
		throws)			
7	7	Program based on creating threads using Thread Class and Runnable Interface.			
8	8	Program based on adding UI Elements and Event Handling			
9	9	Database Connection and Queries handling Demonstration			
10	10	Mini Project- Mini Project based on the content of the syllabus (Group of 2-3			
		students), Defining the problem statement and objectives, Implement the idea of			
		Mini Project based on the content of the syllabus.			

#### Course Assessment:

#### Theory:

- 1. ISE-1 Tutorials and Quizzes to be conducted for (40-50%) syllabus. Continuous pre-defined rubrics-based evaluation for 10 marks.
- 2. ISE-2 Tutorials and Quizzes will be conducted for remaining syllabus. Continuous predefined rubrics-based evaluation for 10 marks
- 3. MSE: One hour 15 Marks written examination based on 50% syllabus
- 4. ESE: Two hours 50 Marks (30% weightage) written examination based on entire syllabus

# Lab

ISE:

- 1. ISE1- Practical exam for (50-60%) syllabus. Continuous pre-defined rubrics-based evaluation for 20 marks
- 2. ISE2- Practical exam for remaining syllabus. Continuous pre-defined rubrics-based evaluation for 20 marks and Mini project evaluation for 10 marks.

## **Recommended Books:**

- [1] "Java: The Complete Reference" by Herbert Schildt
- [2] "Programming with JAVA" by E. Balaguruswamy
- [3] "Head First Java" by Kathy Sierra and Bert Bates
- [4] "Effective Java" by Joshua Bloch
- [5] "JavaFX 8: Introduction by Example" by Carl Dea, Gerrit Grunwald, and José Pereda

## **Online Recourses**

- 1. Java Course Online for Beginners by Scaler Topics
- 2. Java Tutorial for Complete Beginners by Udemy
- 3. Object-Oriented Programming in Java by Coursera
- 4. Java Programming by Great Learning
- 5. Core Java Basics by UpGrad



6. Practice Java by Building Projects on Udemy 7. Java for Absolute Beginners by Udemy



Course		Tea		Credits Assigned					
Code	Course Name	(.	Hrs/weel	<u>()</u>					
		L	Т	Р	L	, T	P	Total	
	Data Structure	1		2	1		1	2	
		Examination Scheme							
			ISE	MSE	ISE	ESI	Ŧ	Total	
OEME14		Theory	10	15	10	50		50	
						(30%	6		
						weight	age)		
		Lab	20		30			50	

Pre-requisite Course Codes	ESC11ME03					
	CO1	Implement various operations of linear data structures.				
	CO2	Implement various operations of non-linear data				
<b>Course Outcomes</b>		structures.				
	CO3	Implement appropriate searching and hashing technique				
		on a given problem				
	CO4	Apply appropriate data structure to solve different				
		computing problems.				

Module No.	Unit No.	Topics	Ref.	Hrs.
1	1.1	<b>Introduction to Data structure.</b> Introduction to Data Structures, Concept of ADT, Types of Data Structures: Linear and Nonlinear	1,2,3	1
2	2.1	<b>Stack and Queue:</b> <b>Stack:</b> Introduction, Stack as ADT, Operations, Implementation using array, Applications of stack.	1,2,3	2
	2.2	<b>Queue:</b> Introduction, Queue as ADT, Operations, Implementation using array, Types of queue - Circular queue, Priority queue. Applications of queue	1,2,3	2
3	3.1	Linked List: Linked list as an ADT, Types of Linked List: Singly Linked List, Doubly linked list, Circular linked list concept, Operation on Singly linked list. Applications of Linked List:	1,2,3	3
4	4.1	<b>Tree:</b> Basic Terminology, Array and Linked Representation of Binary Tree ADT, Traversal of Binary Tree, Binary Search Tree and operations on it. Applications of these binary trees.	1,2,3	3
5	5.1	<b>Graphs:</b> Basics Terminology, Adjacency List and Adjacency Matrix Representation, Graph traversals BFS and DFS. Applications of Graph	1,2,3	2



6	6.1	Searching Techniques and Hashing: Linear Search and Binary Search, Hashing: Basic concepts, Hash function, Collision Resolution using Linear Probing.	2,3	2
		Total		15

Total

Module		Name of the experiment
No.		*
1		Stack ADT
	1	a. Implement Stack ADT using array
	2	b. Convert Infix to Postfix and evaluate the postfix using Stack ADT
2		Queue ADT
	3	a. Implement Linear Queue ADT using array.
	4	b. Implement Circular Queue ADT using array.
3		Linked List ADT
	5	a. Implement Singly Linked List ADT. <b>OR</b>
		Implement Circular Linked List ADT.
	6	b. Implement stack and queue using linked list.
4		Binary Tree, BST ADT
	7	a. Implement Binary Search Tree ADT using Linked List
	8	b. Implement a program to represent infix, prefix and postfix form of
		arithmetic expressions using binary tree traversal techniques. The
		expression is represented as a binary tree, where each operator is a parent
		node, and its operands are the left and right children
5		Graph:
	9	Implement a program to represent a graph using an adjacency list or
		adjacency matrix data structure. And perform breadth-first search (BFS)
		or depth-first search (DFS) traversal algorithms.
6		Searching and Hashing
	10	Implement Binary Search
	11	Mini Project: (Suggested list of Mini Project Topics) (Any One)
		a. Text Edition Application: Implement a text editor with an undo feature.
		Every time a change is made to the text, save the previous state. When
		the user performs an undo operation, last state should be reverted.
		b. Develop a print job scheduler. Users submit print jobs to the printer, and
		they are processed in the order they were received.
		c. Design and implement a music application to manage and organize
		playlists efficiently. The application should allow users to perform the
		following operations: Add, Edit, delete and play song,
		d. Develop a browser history manager using a doubly linked list to
		efficiently track and navigate through the user's browsing history. The
		application should facilitate the following functionalities: Navigation
		torward and backward, Add page, remove page, search page, display
		history etc.



	e. Develop a word dictionary application to efficiently store and retrieve
	words and their definitions. The application should provide the following
	functionalities: Insertion, deletion, search, update etc.
	f. Given a network of cities connected by roads with different weights
	representing distances. Visit each city exactly once and print the
	sequence of all the cities visited.

#### **Course Assessment:**

Theory:

ISE-1: (10 Marks)-Activity: Regular Quizzes of 10 Marks

ISE-2: (10 Marks)-Activity: Programming Assignment of 10 Marks

MSE: One hour 15 Marks written examination based on 50% syllabus

ESE: Two hours 50 Marks (30% weightage) written examination based on entire syllabus

#### **Practical Assessment:**

ISE-1: (20 Marks)-Practical Exam after completing first five experiments

ISE2: Activity: Mini Project (10 Marks), Final Practical Exam based on full syllabus(20 Marks)

#### **Reference Books:**

- Data Structures using C and C++ by Yedidyah Langsam, Moshe J. Augenstein, Aaron M.Tenenbaum, Second Edition.
- [2] Data Structures using C, Reema Thareja, Third Edition.
- [3] Data Structures and Program Design in C++, Robert L. Kruse, Alexander J. Ryba Prentice- Hall India.

#### **Further Reading:**

- [1] Data Structures and Algorithm in Java, Goodrich and Tamassia, John Wiley and Sons, Sixth Edition 2014.
- [2] Data Structures and Pseudocode approach with C, 2nd Edition by Richard F. Gilberg & amp; Behrouz A. Forouzan

#### **Online Resources:**

- 1. https://nptel.ac.in/courses/106/102/106102064/
- 2. https://www.coursera.org/specializations/data-structures-algorithms
- 3. https://visualgo.net
- 4. www.leetcode.com
- 5. www.hackerrank.com
- 6. https://www.youtube.com/playlist?list=PLDV1Zeh2NRsB6SWUrDFW2RmDotAfPbeHu



# Society of St. Francis Xavier, Pilar's Fr. Conceicao Rodrigues College of Engineering Fr. Agnel Ashram, Bandstand, Bandra (W), Mumbai - 400 050

(Autonomous College affiliated to University of Mumbai)

Course Code	Course Name	Teaching Scheme (Hrs/week)Credits Assigned					ed	
	Financial Planning, Taxation and Investment	L	Т	Р	L	Т	Р	Total
		2			2			2
EEM19ME01		Examination Scheme						
EEMI12MEU1			ISE1	MSE	ISE2	ESE	Te	otal
		Theory						
		Lab	50		50		100	

Pre-requisite Course Codes		rse Codes	
	CO1	To prepare financial plan by understanding owns need	
Course	CO2	To demonstration awareness of taxation policies and show respect towards	
Outcomes		overnment norms and regulations	
	CO3	To prepare investment plan by understanding owns futuristic needs	

**Financial Planning:** It is possible to manage income more effectively through financial planning. Managing income helps to understand how much money is required for tax payments, other expenditures and savings. It increases cash flows by carefully monitoring the spending patterns and expenses. Knowledge of comprehensive financial planning will help students to make right financial decisions in their life. It gives guidance in helping choose the right types of investments to fit needs, personality, and goals of their life. In this activity students need to prepare the financial plan for their life.

**Taxation Policies:** Taxes are levied in almost every country of the world, primarily to raise revenue for government expenditures, although they serve other purposes as well. The simple fact in economics is that there are certain common public goods and public needs that require some form of government and regulation to provide or promote. Taxation is the way to pay for these common goods. In this activity student will learn various types of taxes like Income tax, Corporate tax, Capital gains, Property tax, Inheritance and Sales tax.

**Investments:** Investments are important because in today's world, just earning money is not enough. But that may not be adequate to lead a comfortable lifestyle or fulfil our dreams and goals. Money lying idle in the bank account is an opportunity lost. Therefore, students should have a knowledge to invest money smartly to get good returns out of it. This activity will give insight to the students about investment in the form of Stocks, Mutual Funds, Fixed Deposits, Recurring Deposit, Public Provident Fund, Employee Provident Fund and National Saving Schemes.

**Methodology:** Guest lectures or workshops by professionals shall be arranged on Financial Planning, Taxation and Investments. Invite guest speakers, such as tax professionals or financial advisors, shall conduct a tax planning workshop for students. The workshop can cover topics such as tax-efficient investment strategies, retirement planning, and tax-saving opportunities for individuals and businesses. Students should be engaged in assessment driven activities throughout the course. For better learning outcomes following methods of content delivery via student engagement can be adopted.

**Investment Simulation Game:** Divide students into groups and have them participate in a simulated investment game. Each group is given a virtual budget to invest in stocks, bonds, mutual funds, or other investment vehicles. Throughout the course, they track the performance of their investments and make decisions based on real-world market trends and economic indicators.



**Financial Planning Board Game:** Design a board game that simulates the process of financial planning, including setting financial goals, creating budgets, managing debt, and making investment decisions. Students play the game in groups, competing or collaborating to achieve their financial objectives.

**Stock Market Simulation:** Use online stock market simulation platforms that allow students to buy and sell stocks in a virtual trading environment. They can experiment with different investment strategies, track the performance of their portfolios, and compete against their classmates or other teams.

#### **Course Assessment:**

#### ISE-1: Quiz: 20 Marks

#### Activity: Presentation on Financial Instruments: 10 Marks

Activity: Preparing Investment Portfolio (20 Marks): Assign each student or group of students to create a hypothetical investment portfolio based on specific criteria such as risk tolerance, time horizon, and financial goals. They research different investment options, analyze their potential returns and risks, and justify their portfolio allocations in a written report or presentation.

#### ISE-2: Quiz: 20 Marks

Activity: Tax Return Case Studies (*Perquisite: Pan Card (if not available, student should immediately apply and get pan card)*) (10 Marks): Consider case study of fictional individuals or families and prepare tax returns based on their financial situations. This hands-on activity allows students to apply their knowledge of taxation laws and regulations in a practical context.

Activity: Financial Literacy Podcast (10 Marks): Have students create their own podcasts or audio recordings discussing key concepts related to financial planning, taxation, and investments. They can *interview experts*, share personal finance tips, or discuss current events and trends in the financial industry.

Activity: Personal Finance Blog (10 Marks): Students create their own personal finance blogs or websites where they share articles, tutorials, and resources related to financial planning, taxation, and investments. This activity helps them develop their writing and research skills while sharing valuable information with their peers



Course Code	Course Name	Teachin	g Schem	e (Hrs/week)	Cr	edits A	ssign	ed	
		L	Т	Р	L	Т	Р	Total	
	Human Values and Professional Ethics	1		2	1		1	2	
			Examination Scheme						
VEC12ME01			ISE-I	MSE	ISE-II	ES	E	Total	
	[HVPE]	Theory	50		50			100	
		Lab							

Pre-requisite Course Codes		rse Codes	
	CO1	Adhere to the core rights and shape one's values.	
Course	CO2	isplay the role and responsibility of Engineering professionals	
Outcomes	CO3	Holds moral and Ethical solutions to problems through case studies.	
	CO4	Apply the knowledge of human values to contemporary ethical and global issues.	

Module	Unit	Topics	Ref.	Hrs.
No.	No.			
1		Background and Approach: Fundamental Rights and Duties		
	1.1	Fundamental Rights and Duties, Right to Compensation for being		2
		Illegally Deprived of one's Right to Life or Liberty, Right to Travel		
		Abroad and Return to one's Country		
	1.2	Promotion of Inter-Religious harmony and inter-faith values,		1
		Composite Culture		
2		Professional Ethics and Human Values		
	2.1	Sense of Engineering Ethics - Variety of moral issues- Types of		3
		inquiry- Moral dilemmas –Moral Autonomy		
		Moral dilemmas, Moral Autonomy, Kohlberg's theory		
		Gilligan's theory, Consensus and Controversy, Profession&		
		Professionalism, Models of professional roles, Theories about right		
		action Codes of Ethics, Plagiarism		
	2.2	Human Values. Morals, values, and Ethics – Integrity- Academic		2
		integrity- Work Ethics- Service Learning- Civic Virtue Respect for		
		others- Living peacefully- Caring and Sharing- Honestly-		
		Cooperation Commitment Empathy-Self Confidence -Social		
		Expectations.		
	2.3	Managing conflict- Respect for authority- Collective bargaining-		2
		Confidentiality, Role of confidentiality in moral integrity-Conflicts of		
		interest		
3		Global Ethical Concerns		
	3.1	Multinational Corporations- Environmental Ethics- Business Ethics-		2
		Computer Ethics		
	3.2	Engineers as Expert witnesses and advisors-Moral leadership- case		1
		studies		
			Total	13


# **Course Assessment:**

ISE-1: AICTE & UNESCO's certificate course on <u>Self-directed Emotional Learning for</u> Empathy and Kindness (SEEK) 30 marks Link : <u>https://www.framerspace.com/course/seek</u> (Select SEEK self- directed cohort under the category of youth courses)

Activity: Quiz and assignments 20 Marks

ISE-2: AICTE & UNESCO'S certificate course on <u>Social Emotional Learning for Youth</u> Waging Peace (SEL4YWP)- UNESCO **30 Marks** Link: <u>https://www.framerspace.com/course/ywp?cid=5eaff2c239109c2c12ef8bd3</u>

\*\*Participants need to register themselves in the link <u>https://docs.google.com/spreadsheets/d/1dECtZbAmcPhKKelSEimVv-hzPV7dA\_g-</u> <u>Brty2rxC2vE/edit?usp=sharing</u>, before accessing the course content.

Activity: Article Discussion, Quiz and Assignments 20 Marks

# **Recommended Books:**

- [1] Mike W Martin and Roland Schinzinger, Ethics in Engineering,4th edition, Tata McGraw Hill Publishing Company Pvt Ltd, New Delhi,2014
- [2] Charles D Fleddermann, Engineering Ethics, Pearson Education/ Prentice Hall of India, New Jersey,2004.
- [3] Charles E Harris, Michael S Protchard and Michael J Rabins, Engineering Ethics-Concepts and cases, Wadsworth Thompson Learning, United States, 2005.
- [4] M Govindarajan, S Natarajan and V S Senthil Kumar, Engineering Ethics, PHI Learning Private Ltd, New Delhi,2012.
- [5] R S Naagarazan, A textbook on professional ethics and human values, New Age International (P) limited, New Delhi, 2006.
- [6] http://www.slideword.org/slidestag.aspx/human-values-and-Professional-ethics.



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(Autonomous College affiliated to University of Mumbai)

Course Code	Course Name	Teach (H	Credits Assigned						
		L	Т	Р	L	Т	Р	Total	
CEP12ME01	Community Engagement Project			4			2	2	
		Examination Scheme							
			ISE1	MSE	ISE2	ESE	Т	otal	
		Theory							
		Lab	50		50		100		

Pre-requisi	te Cou	rse Codes				
	CO1	Identify and address community needs and challenges which help learners to				
		develop problem-solving skills and creativity in finding innovative solutions.				
	CO2	Enhance their cultural competence and ability to work effectively in				
Course		nulticultural settings				
Outcomos	CO3	Critically think on complex issues considering multiple view points				
Outcomes	CO4	Demonstrate collaboration, team work, civic engagement, empathy and				
		compassion while engaging directly with community				
	CO5	Develop a lifelong commitment to social justice and making a positive				
		impact in the world				

This course requires students to participate in field-based learning/projects generally under the supervision of faculty. The curricular component of 'community engagement and service' involve activities that would expose students to the socio-economic issues in society so that the theoretical learnings can be supplemented by actual life experiences to generate solutions to real-life problems.

At the end of the course it is expected that students will have valuable learnings in terms of enhanced communication skills, increased cultural competence, improved critical thinking, leadership skills, collaboration skills, empathy & compassion, civic engagement, problem-solving skills, self-reflection & personal growth and long-term commitment to social justice.

# It is expected that 26-30 hours of contact time per credit in a semester (52 to 60 hours in a semester for 2 credits) along with 13-15 hours of activities such as preparation for community engagement and service, preparation of reports, etc., and independent reading and study.

# **Other Guidelines to students for successful Community Engagement:**

Community engagement is the process of working collaboratively with and through groups of people affiliated by geographic proximity, special interest, or similar situations to address issues affecting the well-being of those people It is a powerful vehicle for bringing about environmental and behavioral changes that will improve the health of the community and its members. It often involves partnerships and coalitions that help mobilize resources and influence systems, change relationships among partners, and serve as catalysts for changing policies, programs, and practices.

Community engagement project is different as compared to traditional consultation. It is a regular engagement of community for achieving an identified goal or vision. It recognizes the role of community engagement in its broadest sense in the development of local democracy, while noting that the focus of the report is on the practice of community engagement as it relates to local authority activity.



Communication, diplomacy, patience, and flexibility are essential to engage with a community. For a successful engagement conditions include: Shared and defined purpose. Willingness to collaborate. Commitment to contributing. Participation of the right people. Open and credible process. Involvement of a champion with credibility and clout. Ensure that the engagement process is complex but manageable. Initially the team will: Discuss and define the initiative and its potential impact. Set the purpose and goals for community engagement. Define the community. Know and respect the community's characteristics. Develop a relationship with the community, build trust, work with formal and informal leadership, find the community gatekeeper, identify the project champion, meet with the local organizations, and learn the assets and challenges for that community. Find the common interests.

# The following four phases provide broad outline for the community engagement process: Phase-I: Outreach

Go to the community instead of having the community come to you. Invite the stakeholders to a conversation. Create a constructive environment for dialogue allowing time to get to know the participants remembering that the community's time is valuable and must be respected. Identify the person or the organization that has convened the group and will provide initial leadership and organizational management. Outline the purpose and process for the conversation. Use a facilitator when appropriate. Define the issue and why it is important. Outline what is broken and focus on what is working. Is the issue a people problem or a situation problem? Can the problem be solved with technical expertise or will it require something else? Determine the interest and merit in hosting future discussions.

# Phase-II: Gather Facts, Brainstorm and Select

Create an environment for discussion where people are comfortable asking questions, expressing doubts, and brainstorming new ideas. Gather the facts related to the issue and its impact. Use a SWOT, appreciative inquire, asset mapping, and other tools during the factfinding stage. Clarify the issue's alignment with the community's values and ethics. Establish the common ground on which conversations will be based. Brainstorm and gather alternative solutions. Ask the "what if" questions. Spend time discussing the options and the potential impact. Allow the process to equip the participants to see the change, feel the change, and then be prepared to change. Select the best practice/solution. If required use decision-making tools to reduce the number of options.

# **Phase-III: Plan and Review**

Write the implementation action plan. Include the evaluation procedure that will answer the question "What will it look like when the change has happened?". Discuss the proposal with the appropriate stakeholders searching for insight and response. Use the feedback to assess and revise the plan. Stay focused on the solution.

# **Phase-IV: Implement and Evaluate**

Implement the plan. Remember, groups want a rapid success. Identify an action that will provide a "meaningful win" within the "immediate reach." Evaluate the impact. Report the status to the community and gather feedback. Revise the plan and evaluate again.

Keep the participants informed through discussion agendas, written summaries of previous discussions, goals/assignments for the next discussion, and progress reports providing accountability for delivering what was promised.



# **Course Assessment:**

# <u>ISE-1:</u>

Activity: Report Submission: 20 Marks Activity: Report Presentation: 30 Marks

# <u>ISE-2:</u>

Activity: Report Submission: 20 Marks Activity: Report Presentation: 30 Marks



Course Code	Course Name	Teaching (Hrs/weel	Schem (x)	e	Credits Assigned				
	Digital Electronics	L	Т	Р	L	Т	Р	Total	
PCC11ME03		2		2	2		1	3	
		Examination Scheme							
			ISE1	MSE	ISE2	ESE		Total	
		Theory	20	30	20	100		100	
						(30% weightage)			
		Lab	20		30			50	

Pre-requisite	e Cours	se Codes Binary number system and codes, binary arithmetic				
	After	the successful completion students should be able to				
Course	CO1	O1 Compare TTL and CMOS families w.r.t. their characteristic parameters				
Outcomes	CO2	Construct combinational circuits using given MSI devices.				
	CO3	pply the knowledge of flip-flops and MSI devices to design sequential circuits				
	CO4	Analyze the given sequential circuits to identify the state transitions and race				
		conditions.				
	CO5	Implement the given logic function using programmable logic devices.				

Module	Unit	Topics	Ref	Hrs.
No.	No.			
		Implementation of Logic functions		
1	1.1	Logic gates, Implementation of functions using basic gates and	1,2,	4
		using Universal gates	3,4	
	1.2	Formulating a logic function, Sum of Products (SOP), Product of	1,2,	
		Sums (POS), Minimization using Boolean Algebra, De Morgan's	3,4	
		Theorems, Minimization using Karnaugh map (upto 4 variables),		
		Quine-McClusky Technique		
		Logic Families		
	2.1	Characteristic parameters of logic families: Voltage and Current	1,2,	3
		parameters, Fan in, Fan out, Noise margin, Power Dissipation,	3,4	
2		Propagation Delay		
	2.2	TTL NAND gate and its transfer characteristics, CMOS inverter		
		and transfer characteristics, comparison of TTL and CMOS logic		
		families		
		Combinational Circuit Design		
	3.1	Full adders, ripple carry adders, Carry Look ahead Adders, Binary	1,2,	5
2		Subtractors	3,4	
5.	3.2	Multiplexer/ Demultiplexer, Encoders, Priority Encoders, Parity		
		Generators, Code Converters, comparator, ALU		
	3.3	Static and dynamic hazards in combinational circuits		
		Elements of Sequential Circuit		
1	4.1	Storage elements: Latches and Flip-flops (S-R, J-K, D, T Flip-	1,2,	5
4.		flop), Master Slave Flip-flop	3,4	
	4.2	Synchronous and Asynchronous counters, Shift registers and their	1,2,	



# Society of St. Francis Xavier, Pilar's Fr. Conceicao Rodrigues College of Engineering Fr. Agnel Ashram, Bandstand, Bandra (W), Mumbai - 400 050

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(	(Autonomous	College	affiliated to	University	of Mu	mbai)

		applications	3,4	
		Analysis of Sequential circuits		
5.	5.1	Analysis of Moore and Mealy type Finite State Machines (FSM),	1,2,	5
	State Reduction			
	5.2	Introduction to Asynchronous Sequential circuits, Essential hazards	1,2,	
		in asynchronous sequential circuits	3,4	
		Programmable devices		
6		Structure of Programmable Logic Devices (PLDs), Function	1,2,	4
0.		implementation with PAL and PLAs,	3,4	
		Introduction to CPLD and FPGA		
			Total	26

# Laboratory Experiments:

Sr. No.	Title of experiment	Module	Ref
1.	To implement the combinational logic for a given function using basic gates and Universal gates.	1	1,2
2.	To simulate a CMOS inverter and to plot the transfer characteristics (using SPICE)	2	1,2
3.	a. To verify the function of 8 bit binary adder IC7483 b. To implement a BCD adder using IC7483	3	1,2
4.	a. To implement the function of 8 bit Multiplexer using IC74151 b. To implement a given 4 variable Boolean function using Multiplexer IC 74151	3	1,2
5.	To implement an 8 bit binary comparator using IC 7485	3	1,2
6.	a. To implement a Mod n asynchronous counter using flip-flops b. To implement a Mod n counter using IC 74163	4	1,2
7.	Implementation of a combinational circuit using reconfigurable devices a. To write an HDL code for the parity generator and simulate verify the operation by simulation. b. To implement the HDL code on FPGA and verify the operation.	6	7,8
8.	Implementation of a sequential circuit using reconfigurable devices a. To write an HDL code for a 4 bit shift register and verify the operation by simulation. b. To implement the HDL code on FPGA and verify the operation.	6	7.8



#### Course Assessment:

#### Theory:

# ISE-1: 20 marks

1. Quiz/ crossword ...10 Marks

2. Open book test ....10 marks

# ISE-2: 20 Marks

1. Case study ...10 Marks

2. Oral examination....10 marks

MSE: Two hours 30 Marks written examination based on 50% syllabus

**ESE:** Three hours 100 Marks (30% weightage) written examination based on entire syllabus

#### Laboratory Assessment:

#### 40 Marks (08 experiments of 05 marks each) + 10 Marks (activity based) = 50 Marks

#### **ISE:**

**1. ISE-1** will be conducted for four experiments. Continuous pre-defined rubrics-based evaluation for 20 marks.

# 2. ISE-2

- a. Four experiments. Continuous pre-defined rubrics-based evaluation for 20 marks.
- b. Activity based: Testing and debugging activity for 10 marks

#### **Recommended Books:**

- [1] John F. Wakerly, "Digital Design Principles and Practice"- Pearson Publications, 4th edition
- [2] Morris Mano, Michael D. Ciletti, "Digital Design with introduction to Verilog HDL" Pearson, 5th edition
- [3] John M. Yarbrough, "Digital Logic Applications and Design" Thomson Publications
- [4] Stephen Brown and ZvonkoVranesic, "Fundamentals of digital logic design with Verilog design", McGraw Hill, 3rd Edition
- [5] Roth and Kinney, "Fundamentals of Logic Design", Cengage learning, 7th edition
- [6] William I.Fletcher, "An Engineering Approach to Digital Design", PrenticeHall of India
- [7] J. Bhaskar, A Verilog HDL Primer, Third Edition, Star Galaxy Publishing
- [8] Sameer Palnitkar, "Verilog HDL: A guide to digital design and synthesis"

#### **Online References:**

https://archive.nptel.ac.in/content/storage2/courses/106108099//Digital%20Systems.pdf



Course Code	Course Name	Teach (H	Credits Assigned						
	Innovation and Design Thinking	L	Т	Р	L	Т	Р	Total	
				2			1	1	
DCC11ME01		Examination Scheme							
FCCIIMEOI			ISE1	MSE	ISE2	ESE	Te	otal	
		Theory							
		Lab	20		30		50		

Pre-requisite Course		rse
Codes		
	At the	end of the course the students will be able
	CO1	To discuss case studies of innovative products and services.
	CO2	To identify the market needs and customer demand analysis.
Course	CO3	To generate ideas through brainstorming and frame product/service idea
Outcomes	CO4	To empathize with the customer.
	CO5	To design and develop a prototype.
	CO6	To pitch their idea.

Module	Unit	Topics	Ref.	Hrs.
No.	No.			
1		Innovation and Creativity:		04
		(Takeaway)		
		Innovation, Invention and Creativity. Mindset. Convergent and		
		Divergent Thinking. Case Studies – levels and types of		
		Innovations. Market Impact. Linear and Non-Linear		
		Innovations.		
		(Key Exercises)		
		1. Exercises/Games/Activities to boost creativity and		
		Inspiration		
		2. Article/Case Studies Discussion		
		3. Digital Market Survey Report and Customer Demand		
		Analysis, Preparing competencies report to identify		
		desired level of innovation & domain definition.		
2		Introduction of Design Thinking:		04
		(Takeaway)		
		Five stage model of design thinking. Empathize, Define, Ideate,		
		Prototype, Testing. Non-linearity of the Model.		
		(Key Exercises)		
		1. Live examples and videos		
		2. Design Thinking Activity for given problem		
		3. Find the impact and value of Innovation		
3	3.1	Empathize:		04
		(Takeaway)		
		Empathize with users. Step into the customer's shoes. Ask right		
		questions.What? Why? Empathy Map. Draw inference from		
		research.		



		(Key Exercises) 1. Demo day	
		(Kev Exercises)	
	1	Bernie Besign Chanenge, i rototyping heration, i hennig, Media	
		Define Design Challenge Prototyping Iteration Pitching Media	
6		The Design Challenge:	04
(		2. Business Model canvas	0.4
		1. Value Proposition Canvas	
		(Key Exercises)	
		(Takeaway)	
		Product Market Fit. Business Model validation	
3	3.1	Prototyping Testing for Desirable Feasible and viable solution	00
5	51	Prototyning:	06
4	4.1	<ul> <li>4. Story Telling, K-Scripts for case study, Role Playing</li> <li>Definition and Ideation: <ul> <li>(Takeaway)</li> </ul> </li> <li>Idea Generation, Themes, Thinking for refinement, Storytelling and Tools for Innovation</li> <li>(Key Exercises) <ol> <li>Brainstorming, Sketch</li> <li>Situation, Constraints, Objectives, People, Estimates and Scope (SCOPES) tool</li> <li>Social. Technology, Economy, Environment and Political (STEEP) trend analysis for opportunity framing by using steep matrix template.</li> <li>Defining the strategic priorities of customer demand and stakeholder mapping</li> <li>Generating new ideas with Substitute, Combine, Adapt, Magnify/Minify, Reverse, Eliminate, put to other use (SCAMPER) tool.</li> </ol></li></ul>	04
		<ol> <li>Creation of Empathy Map, Affinity Map, Mind Map, Journey Map</li> </ol>	
		Framework	
		2. Finding the user needs in the market by using Social, Physical Identity Communication Emotional (SPICE)	
		1. Immersion Activity-Body Storming.	
		(Key Exercises)	



### Course Assessment:

### Lab:

#### ISE:

- **1. ISE-1** will be conducted for first three experiments. (Article discussion, Design thinking workshop for a sample idea, Empathy Map)
  - Continuous pre-defined rubrics-based evaluation for 20 marks.
- 2. ISE-2
- a. Idea Competition. Continuous pre-defined rubrics-based evaluation for 10 marks.
- b. Business Model Canvas for identified Idea for 10 marks
- c. Demo Day Prototype for 10 marks

# **Recommended Books:**

- [1] Prof. Bala Ramadurai, "Karmic Design Thinking", ISBN-13 January 2020.
- [2] Idris Mootee, "Design Thinking For Strategic Innovation: What They Can't Teach You at Business or Design School", 2013, Wiley Publications.
- [3] Christoph Meinel, Larry Leifer, Hasso Plattner, "Design Thinking: Understand Improve Apply", Springer, 2011.
- [4] Roger Martin, "The Design of Businesses: Why Design Thinking is the next Competitive Advantage", Harward Business Press, 2009

#### **Referenced Books:**

- [1] Peter F. Drucker, "Innovation and Entrepreneurship", Routledge.
- [2] Tim Brown, "Change by Design: How Design Thinking Transforms Organizations and Inspires Innovation", 2009 HarperBusiness.
- [3] Blake Masters, Peter Thiel, "Zero to One: Notes on Start Ups, or How to Build the Future"
- [4] Eric Ries, "The Lean Startup: How Today's Entrepreneurs Use Continuous Innovation to Create Radically Successful Businesses" 2011 Penguin
- [5] Andrew King, Jeanne Liedtka, Kevin Bennett, "Solving Problems with Design Thinking: Ten Stories of What Works", Columbia Business School Publishing, 2013.
- [6] Maurício Vianna, Ysmar Vianna, Isabel K. Adler, Brenda Lucena, Beatriz Russo, "Design Thinking: Business Innovation Kindle Edition", MJV Press 2011
- [7] Robert A. Burgelman, Clayton M. Christensen, Steven C Wheelwright, "Strategic Management of Technology and Innovation", McGraw-Hill, 2017, 5<sup>th</sup> Edition.

#### **Online Courses:**

https://www.classcentral.com/course/youtube-design-thinking-transforming-teams-110078 https://www.coursera.org/learn/uva-darden-design-thinking-innovation https://www.coursera.org/learn/creative-thinking-techniques-and-tools-for-success https://www.coursera.org/specializations/uva-darden-design-thinking learning.edx.org: Design Thinking and Creativity for Innovation



Course Code	Course Name	Teaching Scheme (Hrs/week)			Credits Assigned					
		L	Т	Р	L	Т	Р	Total		
	Fundamentals of Thermodynamics	2	1		2	1		3		
RSC12EC06		Examination Scheme								
DSC12EC00			ISE1	MSE	ISE2	ESE		Total		
		Theory	20	30	20	100		100		
						(30% weight	age)			
		Tutorial	20		30			50		

Pre-requisite Course		
Codes		
	CO1	Understand fundaments of thermodynamics and concept of temperature measurement
	CO2	Understand basic laws of thermodynamics and their significance.
Comme Orthographic	CO3	Understand applications of First and Second Laws and significance of disorder in a system.
Course Outcomes	CO4	Understand use of above concepts in estimating availability and unavailability.
	CO5	Understand steam properties and use of steam tables and Mollier Chart
	CO6	Understand basic thermodynamic cycles used in different thermodynamic systems.

Module	Unit	Topics	Ref.	Hrs.
No.	No.	-		
1	1.1	Basic Concepts: Thermodynamics system and types,	1-5	2
		Macroscopic and Microscopic approach, Thermodynamic		
		properties of the system, state, path, process and cycle, Point		
		and Path functions, Quasi-static process & Equilibrium.		
	1.2	Zeroth law of thermodynamics, Characteristic gas equation,	1-5	1
		Concept of Internal energy, Enthalpy, Heat and Work. Concept		
		of PdV work. (No numericals)		
2	2.1	First Law of Thermodynamics:	1-5	1
		Statement & Equation, First law for Cyclic process (Joule's		
		experiment), Perpetual Motion Machine of the First Kind.		
	2.2	Application of first law to nonflow systems executing non-flow	1-5	2
		processes. (No numericals)		
	2.3	First law applied to flow systems: Concept of flow process and	1-5	2
		flow energy, Concept of the steady flow process, Energy		
		balance in a steady flow. Application of steady flow energy		
		equation to different devices. Steady flow work, Relation		
		between flow and non-flow work (No numericals)		
3	3.1	Second Law of Thermodynamics:	1-5	3



		· · · · ·	Total	26
		same compression Ratio. (Only theory. No proofs, No numericals)		
		Cycle and Dual cycle, Comparison of Otto and Diesel cycle for		
		pressure, Assumptions of air Standard Cycle, Otto cycle, Diesel		
		Nomenclature of a reciprocating engine, Mean effective		
	6.2	Gas Power cycles:	1-6	2
		addition, Reheat Rankine Cycle (No numericals)		
		different turbine inlet conditions. Mean temperature of heat		
		cycle and its limitations as a vapour cycle. Rankine cycle with		
0	0.1	Principal components of a simple steam power plant. Carnot	1-0	3
6	61	Steam table and Mollier Chart (No numericals)	1.6	3
		various properties of wet, dry and superheated steam using the		
		triple point, T-s and an h-s diagram for water, Calculation of		
		associated with steam, Different types of steam. Critical and		
		water, Saturation pressure and temperature, Terminology		
		Advantages and applications of steam, Phase change process of		
5	5	Properties of Pure Substance:	1-6	5
		function (No numericals)		
		closed system& steady flow process, Helmholtz & Gibbs		
		energy, Dead State, Useful work, Irreversibility, Availability of		
-		High -grade and low- grade energy. Available and Unavailable	10	5
4		Availability.	1-6	3
		process (No numericals)		
		antropy principle. T. ds relations. Entropy change During a		
		Clausius theorem, Entropy a property of the system,		
	3.2	Entropy:	1-5	2
		(No numericals)		-
		irreversibility, Perpetual Motion Machine of the second kind,		
		Statement of the second law of thermodynamics. Causes of		
		reservoir, Concept of heat engine, Heat pump and Refrigerator,		
		Limitation of the first law of thermodynamics, Thermal		

# Course Assessment:

**Theory:** 

ISE-1: Activity: Assignments, viva/voice on each topic (20 marks) ISE-2: Activity: Assignments, vica/voice on each topic (20 marks) MSE: Two hours 30 Marks written examination based on 50% syllabus ESE: Three hours 100 Marks (30% weightage) written examination based on entire syllabus

# Tutorial:

ISE:

**1.** ISE-1

Examples on Module 1, Module 2 and Module 3 Continuous pre-defined rubrics-based evaluation for 20 marks.

2. ISE-2



Examples on Module 4, Module 5 and Module 6

Continuous pre-defined rubrics-based evaluation for 30 marks.

# **Recommended Books:**

# **Text Books:**

[1] Thermodynamics by P K Nag, 6th Edition, TMH

[2] Thermodynamics by Onkar Singh, 4th Edition New AgeInternational

[3] Thermal Engineering By Ajoy Kumar, G. N. Sah, 2nd Edition, Narosa Publishing house

#### **Reference Books**:

[4] Fundamentals of Classical Thermodynamics by Van Wylen G.H. & Sonntag R.E., 9th Edition John Wiley& Sons

[5] Thermodynamics by W.C. Reynolds, McGraw-Hill &Co

[6] Thermodynamics by J P Holman, 4th Edition McGraw-Hill & Co

#### AICTE Prescribed Textbook:

Basics of Thermodynamics by Dr. Pramod Kumar, Atul Dhar

(https://ekumbh.aicte-india.org/allbook.php#)



Course Code	Course Name	Teaching (Hrs/weel	Schem (x)	e	Cı				
		L	Т	Р	L	Т	Р	Total	
	Mechanics of Solids	2	1		2	1		3	
DCC12ME08		Examination Scheme							
I CC12MEU0			ISE1	MSE	ISE2	ESE		Total	
		Theory	20	30	20	100		100	
						(30% weight	age)		
		Tutorial	20		30			50	

Pre-requisite Course	Engin	Engineering Mechanics				
Codes						
	CO1	Demonstrate fundamental knowledge about various types of loading and stresses induced.				
	CO2	Draw the SFD and BMD for different types of loads and support conditions.				
<b>Course Outcomes</b>	CO3	Analyse the bending and shear stresses induced in beam.				
	CO4	Analyse the deflection in beams and stresses in shaft.				
	CO5	Analyse the stresses and deflection in beams and estimate				
		the strain energy in mechanical elements.				
	CO6	Analyse buckling phenomenon in columns.				

Module	Unit	Topics	Ref.	Hrs.
No.	No.			
1	1.1	Introduction-Concept of Stress and strain	1-3	2
		Deformation in solids- Hooke's law, stress and strain under		
		tensile, compressive and shear forces, longitudinal and lateral		
		strain, Poisson's ratio, stress-strain diagram for ductile and brittle		
		materials, Elastic constants, Young's modulus of elasticity,		
		modulus of rigidity and bulk modulus and their relations-		
		volumetric, linear and shear strains		
	1.2	Thermal stress and strain in single and compound bars	1-3	1
	1.3	Two-dimensional stress system, stress at a point on a plane,	1-3	2
		principal stresses and principal planes, Mohr's circle of stress,		
		principal stresses related to principal strains		
	1.4	Introduction to area moment of inertia and polar moment of	1-3	1
		intertia		
2	2.1	Shear Force and Bending Moment in Beams:	1-3	2
		Introduction to types of beams, supports and loadings. Definition		
		of bending moment and shear force, Sign conventions,		
		Relationship between load intensity, bending moment and shear		
		force.		
	2.2	Shear force diagrams for statically determinate beams subjected	1-3	2
		to point loads, uniformly distributed loads, uniformly varying		
		loads, couple and their combinations. Calculation of maximum		
		S.F under different loads		



	2.3	Bending moment diagrams for statically determinate beams subjected to point loads, uniformly distributed loads, uniformly	1-3	2
		varying loads, couple and their combinations. Calculation of		
		maximum B.M. and the point of contra flexure under different		
		loads		
3	3.1	Stresses in Beams:	1-3	1
		Theory of bending of beams, Assumptions in the simple bending		
		theory, derivation of formula and its application to beams of		
		rectangular, circular channel, I and T- sections. Combined direct		
		and bending stresses in afore-mentioned sections		
	3.2	bending stress distribution for point and distributed loads in	1-3	2
		simply supported beams and cantilevers for common symmetrical		
		sections.		
	3.3	shear stress distribution for point and distributed loads in simply	1-3	2
		supported beams and cantilevers for common symmetrical		
		sections.		
4	4.1	Deflection of Beams:	1-3	1
		Introduction to deflection of a beam, Relationship between		
		moment, slope and deflection, Double integration method (no		
		numericals)		
		Maxwell's reciprocal theorem		
	4.2	Macaulay's method for computation of deflection and slope	1-3	2
	4.3	Torsion:	1-3	2
		Introduction to Twisting moment or Torque, Theory of Torsion,		
		strength of shaft, Torsional stiffness, flexibility and rigidity,		
		Stresses in solid and hollow circular shafts.		
5	5.1	Strain Energy:	1-3	2
		Strain energy stored in the member due to gradual, sudden and		
		impact loads, Strain energy due to bending and torsion.	<u> </u>	_
	5.2	Columns:	1-3	2
		Introduction, failure of columns, Buckling load, Types of end		
		conditions for column, Euler's formula and its limitations,		
		Rankine-Gordon's formula, Johnson's empirical formula		
			Total	26

# **Course Assessment:**

Theory:

ISE-1: Activity: Quiz (10 Marks) Assignment on simple stresses and strains and Thermal Stresses (10 Marks) ISE-2: Activity: Quiz (10 Marks) Assignment on Torsion, strain energy and Columns (any two) (10 Marks) MSE: Two hours 30 Marks written examination based on 50% syllabus ESE: Three hours 100 Marks (30% weightage) written examination based on entire syllabus



# Tutorial:

ISE:

- 3. ISE-1
  - Lab Exercises:
    - i. Numericals on Principal stresses and Principal planes (1 hour)
    - ii. Numericals on Shear Force and Bending Moment Diagrams (3 hours)
  - Continuous pre-defined rubrics-based evaluation for 20 marks.
- 4. ISE-2

Lab Exercises:

- i. Numericals on Shear stress and Bending Stress (3 hour)
- ii. Numericals on Deflection of Beams (2 hours)
- Continuous pre-defined rubrics-based evaluation for 20 marks.
- iii. Activity: Presentations (10 Marks) Students in a group of three to four should study and present the applications of mechanics of solid in real life case examples related to any of the following topics: deformation of solids, simple stress and strain, thermal stress and strain, principal stresses, shear force and bending moment diagrams, deflection and slope, torsion, columns, cylinders, Software analysis etc.

# **Recommended Books:**

# **Text Books:**

- [1] Mechanics of Materials by S. S. Ratan, Tata McGraw Hill Pvt. Ltd, Third Edition, 2017
- [2] Strength of Materials by R. K. Rajput, S Chand Publications, Revised Edition, 2018
- [3] A textbook of Strength of Materials by R. K. Bansal, Laxmi Publications, 2006

# **Reference Books:**

- [4] Strength of Materials by S. Ramamrutham, Dhanpat Rai Pvt. Ltd, 16th Edition
- [5] Strength of Materials by R. Subramanian, Oxford University Press, Third Edition 2016
- [6] Mechanics of Structures by S. B. Junnarkar, Charotar Publication, 24th Edition, 2015
- [7] Strength of Materials by Ryder, Macmillan
- [8] Mechanics of Materials by James M. Gere and Barry J. Goodno, Cengage Learning, 6thEd, 2009
- [9] Mechanics of Materials by Gere and Timoshenko, CBS 2nd Edition
- [10] Elements of Strength of Materials by Timoshenko and Youngs, Affiliated East -West Press
- [11] Mechanics of Materials by Beer, Jhonston, DEwolf and Mazurek, TMHPvt Ltd., New Delhi
- [12] Introduction to Solid Mechanics by Shames, PHI
- [13] Strength of Materials by W. Nash, Schaum's Outline Series, McGraw Hill Publication, Indian Edition

# AICTE Prescribed Textbook:

Strength of Materials by Dr. Uday Shanker Dixit, Nelson Muthu, S. M. Kamal

(https://ekumbh.aicte-india.org/allbook.php#)



Course Code	Course Name	Teaching Scheme (Hrs/week)			Credits Assigned			
	Materials Science and Engineering	L	Т	Р	L	Т	Р	Total
		2	1		2	1		3
DCC12ME00		Examination Scheme						
			ISE1	MSE	ISE2	ESE		Total
		Theory	20	30	20	100		100
						(30% weight	tage)	
		Tutorial	20		30			50

Pre-requisite Course Codes	-				
	CO1	Identify and fundamentally differentiate between various			
		classes of materials.			
	CO2	Demonstrate knowledge of various types of imperfection,			
		deformation, and strengthening mechanisms in solids.			
	CO3	Categorize various modes of failure.			
<b>Course Outcomes</b>	CO4	Predict the phases by analyzing various types of phase			
		diagrams.			
	CO5	Propose appropriate heat treatment for various metals and			
		alloys studied for a particular application.			
	CO6	Able to understand the properties and behavior of different			
		new-age materials.			

# Part A (Theory)

Module No.	Unit No.	Topics	Ref	Hrs.				
1	1.1	Introduction to Materials Science and Engineering, Why study MSE. Processing/Structure/Properties/Performance correlations.	12	03				
-	1.2	Materials classification. Types of atomic bonding.						
	2.1	Imperfection in solids – point defects, line defects, Surface defects, and volume defects.						
2	2.2	Elastic and plastic deformation. Stress-Strain behavior. Mechanisms of deformation. Slip systems. Critical resolved shear stress. Deformation in Single and Polycrystalline materials.	1,2	05				
	2.3	Strengthening mechanism in metals. Recovery, Recrystallization, and Grain Growth.						
3	3.1	Fracture: Definition and types of fractures. Ductile fracture and Brittle fracture. Fracture mechanics. Fracture toughness. Ductile- to-Brittle transition.		04				
	3.2	Fatigue Failure: Definition of fatigue. Cyclic stress. Mechanism of fatigue. Fatigue testing. S. N. Curve. Factors that affect fatigue life.	1,2	04				



	1						
	3.3	Creep: Definition and significance of creep. Effect of temperature and creep on the mechanical behavior of materials. Creep testing					
	0.0	Mechanism and types of creep.					
	11	Solidification of metals. Crystalline and noncrystalline materials.					
	4.1	Anisotropy. Theory of alloying.					
	42	Phase diagrams – definition, basic concepts, and types.					
4	-112	Development of microstructure.	1.2	05			
-		The Iron-Iron Carbide Phase Diagram: Importance and allotropic	-,-	00			
	4.3	forms of Iron. Iron-Iron carbide diagram and its analysis.					
		Classification of Plain carbon steels and Cast irons. Types of					
		metal alloys – Ferrous and nonferrous (Basics)		ļ			
		Principles of Heat treatment: Technology of heat treatment.					
	5.1	Classification of the heat treatment process. Time-Temperature-					
		Transformation diagram. Continuous Cooling Transformation					
		Diagram. Superimposition of cooling curves on the TTT diagram.					
5	5.2	Heat treatment Process and applications: Annealing,	1.2	05			
5		Austemporing Martemporing Maraging and Austerming	1,2				
		rocess					
		Surface Hardening methods. Their significance and applications					
	53	Carburizing Nitriding Cyaniding Carbon-nitriding Induction					
	0.0	hardening and Flame hardening processes.					
		Ceramic Material: Structures, imperfections, and mechanical					
	6.1	6.1 properties.					
6	()	Nanomaterials: Introduction, classification, fabrication methods.	1,3				
	6.2	Biomaterials: Basic concept, classes, application.					
		Semiconductors: Introduction. Intrinsic and extrinsic		04			
		semiconductors. Material preparation technique. Applications.		04			
	63	Magnetic Material: Introduction, Classification of Magnetic	1 2 3				
	0.5	Materials. Magnetic Dipoles and Magnetic Moments.	1,2,3				
		Diamagnetic, Paramagnetic, Ferromagnetic, Ferrimagnetic, and					
		Superparamagnetic Materials					
Total							

# **Course Assessment:**

# Theory:

ISE-1: Quiz (20 Marks)

**ISE-2:** Quiz (20 Marks)

MSE: Two hours of written examination based on 50% syllabus (30 Marks)

ESE: Three hours 100 Marks (30% weightage) written examination based on entire syllabus

# Tutorial

ISE:

- 1. <u>ISE-1</u>
  - Lab activity:

i. Superimposition of the cooling curve on the TTT plot.



ii. Drawing and labeling of Iron-Carbon Phase Diagram. <u>Assignments:</u> One assignment each on any 3 out of 6 modules. Continuous pre-defined rubrics-based evaluation for 20 marks.

# 2. <u>ISE-2</u>

Presentations by students in groups of 3 on recent topics related to Materials Science and Engineering (30 marks)

# **Recommended Books:**

# Text books:

- [1] Materials Science and Engineering: An Introduction, 9 th edition by William D. Callister Jr. Adapted by R. Balasubramaniam. Wiley India (P) Ltd (2020).
- [2] Materials Engineering, Dhirendra Kumar Dwivedi, All India Council for Technical Education, December 2022.

# **Reference Books:**

- [3] The Science and Engineering of Materials, 7 th edition by Donald R. Askeland, Wendelin JWright, Cengage Learning (2016).
- [4] Materials Science and Engineering, 6 th edition by V. Raghavan, Prentice Hall India(2015).

# AICTE Prescribed Textbook:

Materials Engineering, – Dhirendra Kumar Dwivedi, All India Council for Technical Education, December 2022.

(https://ekumbh.aicte-india.org/allbook.php#)



# Society of St. Francis Xavier, Pilar's Fr. Conceicao Rodrigues College of Engineering Fr. Agnel Ashram, Bandstand, Bandra (W), Mumbai - 400 050

(Autonomous College affiliated to University of Mumbai)

Course Code	Course Name	Teach (H	ing Sch rs/weel	neme x)	C	redits	Assign	ed
PCC12ME10	Materials and Material Testing	L	Т	Р	L	Т	Р	Total
				2			1	1
		Examination Scheme						
			ISE1	MSE	ISE2	ESE	T	otal
		Lab	20		30			50

Pre-requisite Course	-	
Codes		
	CO1	Able to determine the hardenability of steel samples.
	CO2	Compare different microstructures of steel samples
	CO3	Predict the heat treatment required to impart required
Course Outcomes	COS	properties in samples.
Course Outcomes	COA	Perform impact, tensile, and fatigue tests on the given
	04	components.
	CO5	Conduct compression and bending test on wooden
		samples.

Sr. No.	Experiments Details	Hours
1	Impact Testing on steel specimen (Charpy and Izod test).	2
2	Determination of hardenability of steel using the Jominy End Quench Test.	2
3	Sample preparation for metallographic observations.	4
4	Experiments based on any two heat treatment methods.	2
5	Fatigue test on a steel rod.	2
6	Tensile test on a mild steel rod.	4
7	Compression test on a wooden block.	2
8	Bending test on a wooden specimen.	2
	Total	20

# **Course Assessment:**

# Laboratory work:

# 2. ISE-1 (20 marks)

Submission of the observations made during the lab performance for the first 4 experiments covered during this assessment duration. Assessment will be based on pre-defined rubrics.

# 2. ISE-2 (30 marks)

- iii. Submission of the observations made during the lab performance for the last 4 experiments covered during this assessment duration. Assessment will be based on pre-defined rubrics (20 marks).
- iv. Lab interaction: (10 marks)



# Text books:

- [1] Materials Science and Engineering: An Introduction, 9 th edition by William D. Callister Jr. Adapted by R. Balasubramaniam. Wiley India (P) Ltd (2020).
- [2] Materials Engineering, Dhirendra Kumar Dwivedi, All India Council for Technical Education, December 2022.

# **Reference Books:**

- [3] The Science and Engineering of Materials, 7 th edition by Donald R. Askeland, Wendelin JWright, Cengage Learning (2016).
- [4] Materials Science and Engineering, 6 th edition by V. Raghavan, Prentice Hall India (2015).

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Course Code	Course Name	Teach (H	ing Sch rs/week	eme x)	C	redits	Assign	ed	
MDM02	Emerging Technology and Law	L	Т	Р	L	Т	Р	Total	
		2			2			2	
		Examination Scheme							
			ISE1	MSE	ISE2	ESE	To	otal	
		Theory	50		50		100		
		Lab					-		

Pre-requisi	te Cou	rse Codes MDM01
	CO1	To recognize the importance of legal technology domain
	CO2	To demonstrate awareness of the laws related to emerging technologies and
Course		legal implications of their work
Course	CO3	To demonstrate understanding of the impact of emerging/contemporary
Outcomes		technologies on the legal ecosystem
	CO4	To demonstrate awareness about company laws, FEMA and few other
		important acts related to engineering design and consumer protection

Module	Unit	Topics	Ref.	Hrs.
No.	No.			
1		Tech Legal Market	1	4
	1.1	Legal Marketplace, Impact of Technology on Legal Profession		
	1.2	How technologists can help reshape legal system		
	1.3	Career Development in Legal Tech Domain		
2		<b>Emerging Technologies and Legal Implications-1</b>	1	8
	2.1	Cyber Crimes, Cyber Threats and Issues: Information		
		Technology Act 2000		
	2.2	Blockchain and Legal Issues		
	2.3	Legal Implications of Artificial Intelligence		
	2.4	Electronic and Digital Signatures		
	2.5	Implications of Social Media Laws		
3		Emerging Technologies and Legal Implications-2	1	6
	3.1	Legal Ecosystem for Autonomous Vehicles and Unmanned		
		Aerial Vehicles (UAV)		
	3.2	Privacy and Data Protection with a Trillion Connected &		
		Cognitive Devices		
	3.3	Legal Ecosystem for 5G		
4		Company Laws	2,3	4
	4.1	Companies Act, 1956- Nature and Meaning, Classification of		
		Companies, Incorporation of Companies		
	4.2	Sources of Capital, Board of Directors, Company Meetings	2,3	
5		Regulation and Management of Foreign Exchange		2
	5.1	Foreign Exchange Management Act FEMA 1999		
6		Other Important Laws	2,3	2
	6.1	Consumer Protection Act, Competition Act 2002, Semiconductor		
		Integrated Circuits Layout-Design Act 2000, Designs Act 2000,		
		Bureau of Indian Standards Act 2016,		



Total 26

### **Course Assessment:**

**ISE-1:** Quiz: 20 Marks Activity: Negotiation: 30 Marks

**ISE-2:** Quiz: 20 Marks Activity: Moot Court: 30 Marks

#### **Recommended Books:**

- [1] N. S. Nappinai, "Technology Laws Decoded," LexisNexis, 2017
- [2] Vibha Arora and Kunwar Arora, "Law for Engineers" Central Law Publications, 2017
- [3] Vandana Bhatt and Pinky Vyas, "Laws for Engineers", ProCare, 2015



Course Code	Course Name	Teaching Scheme (Hrs/week)				Credits Assign	ned		
		L	Т	Р	L	Т	Р	Total	
OEME21		1	-	2	1	-	1	2	
	Microprocessors	Examination Scheme							
	and		ISE1	MSE	ISE2	ESE	r	Total	
OEME21	Microcontrollers	Theory	10	15	10	50		50	
						(30%			
						weightage)			
		Lab	20		30			50	

Pre-requisite Course Codes	-			
	At the	At the end of the course, Learners will be able to		
	CO1	Describe the core concepts of the 8086 microprocessor like Pipelining and Memory Segmentation		
	CO2	Describe the architecture and memory organization of the 8051 Microcontroller		
<b>Course Outcomes</b>	CO3	Program the 8086 and 8051 in assembly language for a given application		
	CO4	Design 8051 Microcontroller systems for a given application		
	CO5	Analyze the internal architecture of Pentium Processor and		
		ARM cores		

Module	Unit	Topics	Ref	Hrs
No.	No.			
1		Introduction to Microcontrollers and Microprocessors		01
	1.1	Basic Microprocessor architecture, Harvard and Von Neumann	1	
		architectures with examples, Microprocessor versus Microcontroller,		
		CISC and RISC architectures, 8-bit & 16-bit Microprocessor and		
		Microcontroller, Overview of Embedded systems.		
2		8086 Architecture		03
	2.1	8086 Architecture, Memory Segmentation, Pin description, Register	1	
		Organization, Memory addressing, 8086 Interrupt structure and		
		Interrupt Servicing		
	2.2	Addressing modes, Instruction Set and Assembler Directives,	1	
		Minimum mode and Maximum mode operation		
3		8051 Microcontroller		02
	3.1	8051 Architecture, I/O Ports, Memory Organization	2	
	3.2	Addressing Modes, Instruction set of 8051, Assembly language	2	
		programming.		
4		8051 Microcontroller hardware		03
	4.1	I/O port structure	2	
	4.2	Timer/Counter section and modes	2	]
	4.3	Serial Port structure and modes	2	]
	4.4	Interrupt structure and Priority	2	



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5		8051 Interfacing		02
	5.1	LCD & Keyboard Interfacing	2	l
	5.2	ADC, DAC & Sensor Interfacing	2	l
6		High-Performance Architectures		02
	6.1	Pentium Processor: Pentium Architecture, Superscalar Operation,	4	l
		Integer & Floating-Point Pipeline Stages		l
	6.2	ARM Architecture: ARM Processor fundamentals, Introduction to	3,5	l
		CORTEX Processor cores		l
			Total	13

#### Course Assessment:

#### **Theory:**

<u>ISE-1:</u> 10 Marks
Activity: Quiz (05 Marks) and Assignment (05 Marks)
<u>ISE-2:</u> 10 Marks
Activity: Implement a mini-project based on the 8051 Microcontroller
<u>MSE:</u> One hour 15 Marks written examination based on 50% syllabus
<u>ESE:</u> Two hours 50 Marks (30% weightage) written examination based on entire syllabus

List of experiments:				
Sr. No	Name of the experiment			
1	Arithmetic operations using 8086 [Assembly language programming]			
2	Block transfer using 8086 (using string instructions)			
3	To find the minimum/ maximum number from a given data bytes stored in			
	internal/external data memory location			
4	I/O port programming using 8051			
5	Serial port programming using 8051			
6	Timer programming using 8051			
7	Stepper Motor/DC motor interfacing using 8051			
8	Arduino programming (any application)			
Digital Materia	al:			
1	Virtual Lab simulator for Microcontroller			
	http://vlabs.iitkgp.ernet.in/rtes/index.html			

# **Practical:**

**ISE:** 

1. ISE-1 will be conducted for first five experiments. (20marks)

2. ISE-2

a. Remaining three experiments. (10 marks).

b. Activity: Technical paper (IEEE/ACM) presentation on latest issues in processor/microcontroller system design (20 marks)

# **Recommended References:**



- [1] John Uffenbeck, "8086/8088 family: Design Programming and Interfacing", PHI.
- [2] Muhammad Ali Mazidi and Janice Gillispie Mazidi, "The 8051 Microcontroller and Embedded Systems",7th Edition, Pearson Education
- [3] Andrew N. Sloss, Dominic Symes, Chris Wright and John Rayfield, "ARM System Developer's Guide, Designing and Optimizing System Software", Elsevier, 2004.
- [4] Tom Shanley and Don Anderson, "Pentium Processor System Architecture", Addison Wesley.
- [5] Joseph Yiu, "The Definitive guide to ARM CORTEX-M3 & CORTEX-M4 Processors", Elsevier, 3rd Edition
- [6] https://www.arduino.cc



Course Code	Course Name	Teach (H	ing Scho rs/week)	eme )	Credits Assigned			
		L	Т	Р	L	Т	P Total	
		1		2	1		1 2	
		Examination Scheme						
OFME??	Web Technology		ISE1	MSE	ISE2	ESE	Total	
OEME22		Theory	10	15	10	50	50	
						(30%		
						weightage)		
		Lab	20		30		50	

Pre-requisite Course Codes	ESC11ME03					
	CO1	Develop static webpages using HTML				
	CO2	Apply CSS styling techniques effectively to enhance the				
		visual presentation of web pages				
<b>Course Outcomes</b>	CO3	Design interactive user interfaces (UIs) using JavaScript				
		and DOM				
	CO4	Recognize the basics of backend development and				
		database connectivity to complement their frontend skills.				

Module	Unit	Topics	Ref.	Hrs.
No.	No.			
1	1.1	Web Technology Overview	1,2,3,4	1
		Introduction to Full Stack Development, understanding the		
		client-server architecture.		
	1.2	HTML Fundamentals:		2
		Structure of HTML documents; Basics of color theory;		
		Typography fundamentals: font selection, hierarchy, and		
		readability; Tags, attributes, and elements; Semantic		
		HTML5		
	1.3	Grid systems and layout principles; Forms and input		2
		elements; Embedding media (images, videos, audio).		
2 2.1 <b>CSS Funda</b>		CSS Fundamentals:	1,2,3,4	2
		Introduction to CSS; Selectors, properties, and values; Basic		
		styling techniques; Cascading and inheritance in CSS.		
	2.2	CSS Box Model: margin, border, padding; Flexbox and Grid		2
		layout for responsive design; Responsive design principles.		
3	3.1	Introduction to JavaScript :	1,2,3,4	2
		Basics of JavaScript; Variables, data types, and operators;		
		Functions and control flow.		
	3.2	JavaScript DOM Manipulation:		2
		Introduction to the Document Object Model (DOM);		
		Accessing and manipulating HTML elements with		
		JavaScript.		
	3.3	Asynchronous JavaScript:		2



		Callbacks, Pro	mises, a	nd Async/	Await;	Handling		
		asynchronous eve	ents.					
4		Introduction to	1,2,3,4,	1				
	Overview of databases and their role in web applications.						5	
		Basics of database connections using JavaScript.						
		Total						16

Module	Sr.	Suggested Experiments
No.	No	
1		HTML Fundamentals:
		Suggested Experiment Titles (Any one)
1	1	Story Blog:
		Create a webpage that tells a story using HTML elements like headings,
		paragraphs, images, and hyperlinks.
	2	Virtual museum experience:
		Design a webpage that showcases various museum exhibits with interactive
		elements and descriptions.
	3	Recipe Showcase:
		Create a webpage showcasing recipes illustrating ingredients and cooking
		steps.
2		CSS Fundamentals:
		Suggested Experiment Titles (Any one)
	4	CSS Art Gallery
		Design an art gallery webpage using CSS for layout, color schemes, and
		visual effects.
	5	Animated CSS Infographics
		Design infographics on topics like environmental conservation or space
		exploration, animating data visualization elements.
	6	CSS Typography Showcase
		Create a webpage showcasing various font styles, sizes, and text effects using
		CSS
3		Introduction to Java Script :
		Suggested Experiment Titles (Any one)
	7	Interactive Quiz Game
		Develop a quiz game where users can answer questions and receive instant
		feedback using JavaScript
	8	Dynamic Weather Forecast Display
		Create a webpage that fetches weather information based on the user's
		location using JavaScript and displays it with dynamic animations.
	9	Virtual Pet Simulation
		Develop a webpage where users can interact with a virtual pet (e.g., feeding,
		playing) with JavaScript handling the pet's actions and responses.
4		Introduction to Database Connections:
		Suggested Experiment Titles (Any One)
	10	Personal Recipe Manager with Local Storage



	Develop a recipe manager application that allows users to add, edit, and
	delete recipes, with data stored locally using browser storage APIs.
11	Online Bookstore with Backend Database:
	Build an online bookstore where users can browse books, add them to a
	shopping cart, and make purchases, with data stored in a backend database.
12	Interactive Travel Planner with Google Maps API
	Create a travel planning webpage that utilizes the Google Maps API to
	display destinations, routes, and points of interest dynamically
13	Mini Project- Defining the problem statement and objectives.
	Implement the idea of Mini Project based on the content of the syllabus

# **Course Assessment:**

**Theory:** 

1. ISE-1 Tutorials and Quizzes to be conducted for (40-50%) syllabus. Continuous predefined rubrics-based evaluation for 10 marks.

2. ISE-2 Tutorials and Quizzes will be conducted for remaining syllabus. Continuous predefined rubrics-based evaluation for 10 marks

3. MSE: One hour 15 Marks written examination based on 50% syllabus

4. ESE: Two hours 50 Marks (30% weightage) written examination based on entire syllabus

# Lab:

ISE:

1. ISE1- Practical exam for (50-60%) syllabus. Continuous pre-defined rubrics-based evaluation for 20 marks

2. ISE2- Practical exam for remaining syllabus. Continuous pre-defined rubrics-based evaluation for 20 marks and Mini project evaluation for 10 marks

# **Recommended Books:**

- [1] HTML & CSS: The Complete Reference Thomas A. Powell, Fifth Edition, Tata McGraw Hill
- [2] WEB PROGRAMMING with HTML5, CSS and JavaScript, John Dean, Jones & Bartlett Learning.
- [3] The Full Stack Developer, Chris Northwood, Apress publication.
- [4] Full Stack JavaScript: Learn Backbone.js, Node.js and MongoDB, AZAT MARDAN, Apress publication, Second Edition.
- [5] Learning SQL: Generate, Manipulate, and Retrieve Data, by Alan Beaulieu. O'Reilly publication. Third Edition

# **Online Recourses**

- 1. Web links and Video Lectures (e-Resources): https://onlinecourses.swayam2.ac.in/aic20\_sp11/preview
- 2. https://www.w3.org/html/
- 3. <u>http://www.htmlref.com/</u>
- 4. http://w3schools.org/
- 5. http://www.tutorialspoint.com/css/



Course Code	Course Name	Teach (H	ing Scho rs/week)	eme )	Credits Assigned						
OEME23		L	Т	Р	L	Т	P Total				
		1	-	2	1	-	1 2				
	Fundamentals of			Examin	ation Sch	eme	P Total 1 2 Total 50				
	Intelligence and		ISE1	MSE	ISE2	ESE Tota	Total				
	Machine Learning	Theory	10	15	10	50	50				
						(30%					
						weightage)					
		Practical	20		30		50				

Pre-requisite Course Codes	VSE1	VSE11ME02				
	Learn	ers will be able to				
	CO1	identify the suitable agent architecture and environment characteristics for the given problem.				
Course Outcomes	CO2	apply a suitable search strategy to design problem solving agents.				
Course Outcomes	CO3	apply reasoning and planning strategies to solve problems.				
	CO4	apply appropriate machine learning technique to solve learning problems.				
	CO5	illustrate industrial applications of AI and ML.				

Module	Module Unit Topics				
No.	No.		•	•	
1		Introduction to Artificial Intelligence		02	
	1.1	Definition of artificial intelligence, dimensions of human intelligence and their correlation to artificial intelligence, different approaches of artificial intelligence	1,2	1	
	1.2	Intelligent agents, the nature of environment, structure of agent, types of agent	1	1	
2		Solving Problems by Searching		03	



	2.1	Defining a problem, Uninformed search strategies- Breadth First Search, Depth First Search, Depth Limited Search, Iterative Deepening Search, Bidirectional Search, Uniform Cost Search	1,2	1
	2.2	Informed (heuristic) search strategies- greedy best first search, A* search	1,2	1
	2.3	Game Playing with adversarial search, minimax algorithm, alphabeta pruning	1,2	1
3		Reasoning and Planning		02
	3.1	Reasoning under uncertainty- knowledge representation in uncertain domain, Bayesian network, inference in Bayesian network	1	1
	3.2	Planning- definition, components of a planning system, partial order and full order planning	1,2	1
4		Introduction to Machine Learning		04
	4.1	Definition of learning, different forms of learning- supervised learning, unsupervised learning, semi-supervised learning, reinforcement learning, K-nearest neighbor classification algorithm.	1,3	1
	4.2	Decision trees and classification	3	1
	4.3	Linear regression with one variable, linear regression with multiple variables	3	1
	4.4	Clustering, k-means clustering algorithm	3	1
5		Industrial Applications of Artificial Intelligence and Machine Learning		02
	5.1	Artificial Intelligence and Machine Learning in Robotics and object detection (in robotic cars, healthcare industry)	1	2
			Total	13

# Course Assessment:

Theory:

ISE-1: 10 Marks Activity: Quiz (05 Marks) and assignments (05 Marks) ISE-2: 10 Marks Activity: Quiz (05 Marks) and assignments (05 Marks) MSE: One hour 15 Marks written examination based on 50% syllabus ESE: Two hours 50 Marks (30% weightage) written examination based on entire syllabus



# Lab:

- ISE:
- 1. ISE-1 will be conducted for first four experiments. (20marks)
- 2. ISE-2
- a. Remaining four experiments. (20 marks).
- b. Activity: Reading technical article on emerging applications of AI and ML in industry
- 4.0 and presentation on critical appreciation of the same. (10 marks)

Suggested List of experiments:				
Sr. No	Name of the experiment			
1	To implement relations, rules, operators in Prolog			
2	To implement trivial AI problems using Prolog.			
3	To implement informed search.			
4	To implement minimax algorithm.			
5	To implement Bayesian network.			
6	To perform classification using KNN/decision tree algorithm.			
7	To implement linear regression.			
8	To implement clustering using K-means.			

# **Recommended Books:**

[1] S. Russell and P. Norvig, "Artificial Intelligence: A Modern Approach", PHI, 3<sup>rd</sup> Edition.

[2] E. Rich, K. Knight and S. Nair, "Artificial Intelligence", Tata McGraw Hill Education, 3<sup>rd</sup> Edition.

[3] Z. Nagy, "Artificial Intelligence and Machine Learning Fundamentals", Packt Publishing, 1<sup>st</sup> Edition.

# Web References:

[1] https://www.swi-prolog.org/pldoc/index.html

[2] https://python-data-science.readthedocs.io/en/latest/



Course Code	Course Name	Teaching Scheme (Hrs/week)			C	Credits Assigned			
VSE12ME03	Computer Aided Machine Drawing	L	Т	P	L	Т	Р	Total	
				4			2	2	
		Examination Scheme							
			ISE1	MSE	ISE2	ESE	Т	otal	
		Lab	50		50		100		

Pre-requisite Course Codes	ESC11ME01				
		Learner will be able to			
	CO1	Illustrate basic understanding of types of CAD model creation.			
	CO2	Visualize and prepare 2D modeling of a given object using modeling software.			
<b>Course Outcomes</b>	CO3	Build solid model of a given object using 3D modeling software.			
	CO4	Visualize and develop the surface model of a given object using modeling software.			
	CO5	Generate assembly models of given objects using assembly tools of a modeling software			
	CO6	Perform product data exchange among CAD systems.			

Sr. No.	Practical Details	Ref	Duration
1	CAD Introduction, CAD models Creation, Types and uses of	1,2,3,4,	4
1	models from different perspectives. Parametric modeling.	5,6,7,8	
	2D Modeling Geometric modeling of an Engineering	1,2,3,4,	
2	component, demonstrating skills in sketching commands of	5,6,7,8	8
2	creation (line, arc, circle etc.) modification (Trim, move, rotate		
	etc.) and viewing using (Pan, Zoom, Rotate etc.)		
	Solid Modeling 3D Geometric modeling of an Engineering	1,2,3,4,	
3	component, demonstrating modeling skills using commands like	5,6,7,8	10
	Extrude, Revolve, Sweep, Blend, Loft etc		
4	Surface Modeling Extrude, Sweep, Trim etc and Mesh of	1,2,3,4,	
	curves, free form surfaces etc. Feature manipulation using	5,6,7,8	8
	Copy, Edit, Pattern etc.		
5	Assemble the components using assembly Constraints,	1,2,3,4,	
	Exploded views, interference check. Drafting (Layouts,	5,6,7,8	8
	Standard & Sectional Views, Detailing & Plotting).		
6	Data Exchange CAD data exchange formats Like IGES, PDES,	1,2,3,4,	
	PARASOLID, DXF and STL along with their comparison and	5,6,7,8	8
	applicability		



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(Autonomous College affiliated to University of Mumbai)

Total	46

#### Course Assessment

### 1. ISE-1 (50marks)

Term work Printouts/Plots: 40 marks Lab interaction: 10 marks

Using the above knowledge and skills acquired through six modules students should complete Minimum three assemblies from the given sets of assignments using standard CAD modeler like PTC Creo/CATIA/ Solid work/UG /any other suitable software.

Set 1: 3D modeling of basic Engineering components likes Nuts, Bolts, Keys, cotter, Screws, Springs etc.

Set 2: 3D modeling of basic Machine components like Knuckle joint, Couplings: simple, muff, flanged Protected flange coupling, Oldham's coupling, Universal coupling.

#### 2. ISE-2 (50 marks)

Printouts/Plots: 20 marks

- i. 3D modeling of basic Machine components like Clapper block, Single tool post, Shaper tool head slide, jigs and fixtures, element of engine system and Miscellaneous parts.
- ii. Generation of any Assembly model (minimum five child parts) along with Production drawing for any of the system by creating 3D modeling with assembly constraints, Interference check, Exploded view, GD&T, Bill of material.
- iii. Reverse Engineering of a physical model: disassembling of any physical model having not less than five parts, measure the required dimensions of each component, sketch the minimum views required for each component, convert these sketches into 3-D model and create an assembly drawing with actual dimensions
- iv. End Semester Practical/Oral examination:

To be conducted by pair of Internal Examiners

1. Practical examination duration is two hours, based on Advance level of the Term work. Oral examination should also be conducted to check the knowledge of CAD Modeling Tools.

2. The distribution of marks for practical examination shall be as follows:

a. Practical Exam ....20 marks

b. Oral Exam .....10 marks

3. Evaluation of practical examination to be done based on the printout of students work

4. Students work along with evaluation report to be preserved till the next examination



# **Recommended Books:**

### Text books:

- [1] Machine Drawing by N.D. Bhatt.
- [2] A textbook of Machine Drawing by Laxminarayan and M.L.Mathur, Jain brothers Delhi
- [3] Machine Drawing by Sidheshwar and Kanheya

### **Reference Books:**

- [4] Machine Drawing by Kamat and Rao
- [5] Machine Drawing by M.B.Shah
- [6] A text book of Machine Drawing by R.B.Gupta, Satyaprakashan, Tech. Publication
- [7] Machine Drawing by K.I. Narayana, P. Kannaiah, K. Venkata Reddy
- [8] Autodesk Inventor 2011 for Engineers and Designers by ShamTickoo and SurinderRaina, Dreamtech press

#### AICTE Prescribed Textbook:

Computer Aided Machine Drawing Practice by Dr. Kanak Kalita

(https://ekumbh.aicte-india.org/allbook.php#)



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(Autonomous College affiliated to University of Mumbai)

Course Code	Course Name	Teaching Scheme (Hrs/week)			0	Credits Assigned			
AEC12ME021	Sanskrit for Beginners	L	Т	Р	L	Т	Р	Total	
		2			2			2	
		Examination Scheme							
			ISE1	MSE	ISE2	ESE	Total		
		Theory	50		50		100		
		Lab							

<b>Pre-requisite Course Codes</b>		rse Codes	AEC11ME01			
Course Outcomes	CO1	Demonstra	Demonstrate understanding of the Fundamentals of Sansrkit Language			
	CO2	Apply Voc	abulary and grammar skills for day to day conversation			
	CO3	Developing	g Speaking and Learning skills			

Module	Unit	Topics	Ref.	Hrs.
No.	No.			
1	1.1	Introduction: Some Unique characteristics of Sanskrit	1-8	6
		The Sounds of Sanskrit: Its Alphabet		
		Sentence Construction and Its underlying logic		
		Introduction of Self and Others		
		Basic verbs and some conjugations		
2	2.1	Introduction to Genitive (6 <sup>th</sup> Case)	1-8	
		Counting and Reading the Time		
		Plural of Pronouns and Nouns		6
		Conjugation of Basic Verbs in the Plural		
		Introduction to the Locative (7 <sup>th</sup> Case)		
3	3.1	Days of the week, Months, Future Tense	1-8	6
		Past Tense and More Verbs		
		Introduction to the Accusative (2 <sup>nd</sup> Case)		
		Introduction to the Instrumental (3 <sup>rd</sup> Case)		
4	4.1	Introduction to the Ablative (5 <sup>th</sup> Case)	1-8	6
		Introduction to the Dative (4 <sup>th</sup> Case)		
		Introduction to the Vocative (8 <sup>th</sup> Case)		
	4.2	Stories and Motivational Shlok with word by word meaning	1-8	2
			Total	26

# **Course Assessment:**

**ISE-1:**Activities and Assignments: 20 MarksOral Examination : 30 Marks**ISE-2:**Activities and Assignments: 20 Marks


- [1] Kumari, S. "Sanskrita Chitrapadakoshah," Mysuru: Bharatiya Bhasha Sansthanam, 1993
- [2] Samkrita-vyavahaara-sahasri (Samskrit-English), New Delhi: Sanskrita Bharati
- [3] Sampad, & Vijay, "The Wonder that is Sanskrit" Pondicherry: Sri Aurobindo Society, 2005.
- [4] Satvlekar, S. D. "Sanskrit Swayam Shikshak," Delhi: Rajpal & Sons, 2013
- [5] Shastri, V K. "Teach Yourself Samskrit: Prathama Diksha" Delhi: Rashtryia Sanskrita Samsthana, 2012
- [6] Vishwasa "Abhyāsa-pustakam", New Delhi: Samskrita Bharati, 2014
- [7] https://onlinecourses.nptel.ac.in/
- [8] https://www.learnsanskrit.org/



Course Code	Course Name	Teach (Hi	C	Credits	s Assigned			
AEC12ME022		L	Т	Р	L	Т	Р	Total
	Tamil for Beginners	2			2			2
		Examination Scheme						
			ISE1	MSE	ISE2	ESE	To	otal
		Theory	50		50		10	00
		Lab						

Pre-requisite Course Codes			AEC11ME01
Course	CO1	Demonstra	te understanding of the Fundamentals of Tamil Language
Course	CO2	Apply Voc	abulary and grammar skills for day to day conversation
Outcomes	CO3	Developing	g Speaking and Learning skills

Module	Unit	Topics	Ref.	Hrs.
No.	No.			
1	1.1	Introduction to Tamil Alphabets and Pronunciation		1
		History of Tamil language		
	1.2	Learning Tamil Alphabets		1
	1.3	Basic Pronunciation and Oral drills with visual learning		2
	1.4	Greetings and common expressions		2
2	2.1	Basic Grammar and Sentence Structure		
		Sentence Construction : Subject, Verb, Object (SVO)		2
	2.2	Present tense, Past tense and Future tense		2
	2.3	Common Nouns, Pronouns with negative imperatives		2
3	3.1	Building Vocabulary for Everyday Conversation		2
		Learning Numerals (Cardinal numbers ) 1-20, 100. 2001000		_
	3.2	Forming Simple sentences with interactive lessons		3
	3.3	Learning Days of week, Months of the year, Fruit, Food grains, Parts of the Body, Names of Common places like Hospitals, Market place, shops, Saloonsetc.		3
4	4.1	Daily life and Survival Phrases		
		Day to day usage of language for daily routines in conversation with		
		Student to Teacher, Vegetable shop vendor, Railway Station.		3
		conversation with Auto Drivers, Hospitals etc.		
	4.2	Role Play exercises in common situations		3
	L -		Total	26



## **Course Assessment:**

- **ISE-1:** Activities and Assignments: 20 Marks Oral Examination : 30 Marks **ISE-2:** Activities and Assignments: 20 Marks
  - Oral Examination : 30 Marks

- [1] Kesav.,"A practical course to learn tamil for Absolute beginners( Standard and Colloquial), Notion Press, 2020
- [2] Dr.R.Kalidasan, Dr.S.Velayuthan, "English Grammar-An easy way to learn with Tamil Explanation and key, Shanlax publisher, 2019
- [3] Oxford English-English Tamil Dictionary, Oxford.



Course Code Course Name Teaching Scheme Credits As						ssigne	d			
				(H	rs/week	() 				
				L	Т	Р	L	Т	Р	Total
				2			2			2
AEC12MI	E023	Kannada	for Beginners		]	Examin	ation S	cheme		
					ISE1	MSE	ISE2	ESE	Tot	al
				Theory	50		50		10	0
				Lab						
Pre-requ	isite (	ourse Code	AFC11ME	01						
110-1040		1 Demon	strate understand	ing of the	Fundam	pentals (	of Kann	ada Lana	11200	
Course		$\frac{1}{2}$ $\frac{1}{2}$	Vocabulary and C	Ing of the	kills for	· day to	day con	aua Lang	n	
Outcome	$s \frac{cc}{cc}$	12 Apply	vocabulary allu C	d listoning	kills loi	uayto	uay co	IVEISatio	1	
			ping speaking an	u instenning	, SKIIIS					
Module	Unit	Topics							Ref	Hrs
N0.	<u>No.</u>		• • • • •		1.0		• .•		•	•
1	1.1	Introduct	ion to Kannada	Alphabet	s and P	ronunc	elation			1
		History of	Kannada Langua	age						
	1.2	Learning	Kannada Alphabe	ets						1
	1.0									
	1.3	Pronuncia	Pronunciation and visual learning							2
	1.4	Greetings	Greetings and Common expressions							2
2	2.1	Basic Gr	asic Grammar and Sentence Structure with Subject, Verb,							2
		Objective	(SVO)							
		Basics of	Sentence Formati	lon	1.7					
	2.2	Present te	nse, Past tense, F	uture tense	e, and In	troducti	on to			2
		Adjective	8							
	• •		N D	•.1	, <b>.</b> .					
	2.3	Common	Nouns, Pronouns	with nega	tive im	perative	S			2
3	3.1	Conversa	tion Phrases and	d Langua	ge Voca	bulary				2
		T		1 NT1		/ 100	1000			
	2.2	Learning	Numerais (Cardin	iai Numbe	rs) 1-20 ·	) / 100 -	1000			2
	3.2	Classified	Classified Sentences and Useful expressions							3
		T	D		т			Dente		
	<b>~</b>	Learning	af the hadry Nemes of common places like Hearitale mediate share							2
	3.3	of the bod	of the body, Names of common praces like Hospitals, markets, shops,							3
	11	Developin	ender, weather, e	nov and 1	Duoficia	nov				2
4	4.1	Developii	ig Language fill	ency and l		ncy.	nuoraet	ion with		3
		Day to da	y usage of Langua	age for dat	in Dai		niversat	ion with		
		driver in	Hospitals ato	ole venuol	, in Kai	nway st	auon, W	IIII AULO		
	1 2	Dolo class	nospitais, etc.	monsiture	iona					2
	4.2	Kole play	exercises in com	mon situat	IONS				T-4-1	3
									1 otal	20



### Course Assessment:

- **ISE-1:** Activities and Assignments: 20 Marks Oral Examination : 30 Marks **ISE-2:** Activities and Assignments: 20 Marks
  - Oral Examination : 30 Marks

- [1] Upadhaya, U.P & N.K.Krishnamurthy, "Conversational Kannada" Prism Books, 2018
- [2] Thomas Hodson, "Grammar of the Kannada or Canarese language", Gyan publishing house, 2020
- [3] Ramanja Reddy Merugu, "Learn kannada through English" 2021
- [4] Dr. Prabhu sankara & B.V.Sridhar," Oxford English-English-Kannada dictionary", Oxford Publications.



Course Code	Course Name	Teach (Hi	(	Credits	Assigne	ed		
		L	Т	Р	L	Т	Р	Total
AEC12ME024	Telugu for Beginners	2			2			2
		Examination Scheme						
			ISE1	MSE	ISE2	ESE	To	otal
		Theory	50		50		10	00
		Lab						

Pre-requisite Course Codes			AEC11ME01
Course	CO1	Demonstra	te understanding of the fundamentals of Telugu Language
Course	CO2	Apply voca	abulary and grammar skills for day to day conversation
Outcomes	CO3	Developing	g Speaking and Listening skills

Module	Unit	Topics	Ref.	Hrs.
No.	No.			
1	1.1	Introduction to Telugu Alphabets and Pronunciation		1
		History of Telugu language		
	1.2	Learning Telugu Alphabets and Symbols		1
	12	Pasia Pronunciation		2
	1.5	Basic Fronunciation		2
	1.4	Greetings and Common expressions		2
2	2.1	Basic Grammar and Sentence Structure		
				2
		Sentence Structure : Subject , verb, Object (SVO)		
	2.2	Present tense, Past tense and Future tense		2
	2.3	Common nouns, Pronouns, Adjectives		2
3	3.1	<b>Conversation Phrases for Daily Situations</b>		
				2
		Learning numerals (Cardinal Numbers) 1- 20, 100 -1000		
	3.2	Forming Simple sentences / Listening and Speaking skills		3
	3.3	Days of week, Months of the year, Gender, Fruits, Parts of the body,		_
		Names of common places like hospitals, markets, shops, saloons etc.		3
4	4.1	Common Phrases and Developing Language Fluency and		3
		Proficiency		
		Day to day usage of Telugu language for daily routines in		
		conversation with Student to teacher, Vegetable Shop vendor,		
		Railway passengers, Auto drivers, in Hospitals., etc		
	4.2	Role Play Exercises in Common situations, presentation on Telugu		3
		culture, Telugu scripts, Telugu classical music, Telugu festivals.		
			Total	26



## **Course Assessment:**

<b>ISE-1:</b>	Activities and Assignments: 20 Marks
	Oral Examination : 30 Marks
ISE-2:	Activities and Assignments: 20 Marks

Oral Examination : 30 Marks

- [1] Sanjay, D, "Spoken Telugu for Absolute Beginners", Notion Press, 2019.
- [2] Praveen Ragi, "Learn Telugu Through English .V1" Evincepub Publications, 2020
- [3] Oxford compact English-English Telugu Dictionary
- [4] English- Telugu Conversation guide / Aarthi Janyavula , 2018



Course Code	Course Name	Teaching Scheme (Hrs/week)Credits Assigned					ed	
EEM12ME02		L	Т	Р	L	Т	Р	Total
		2			2			2
	Technology	Examination Scheme						
	Entrepreneurship		ISE1	MSE	ISE2	ESE	T	otal
		Theory	50		50		1	00
		Lab						

Pre-requisi	te Cou	rse Codes	PCC11ME01
	CO1	Identify prol	blems worth solving
Course	CO2	Craft value	proposition
Outcomes	CO3	Prepare B-P	lan
	CO4	Register virt	tual company

Module	Unit	Topics	Ref.	Hrs.
No.	No.			
1		Opportunity Discovery	1	6
	1.1	Self-discovery		
	1.2	Effectuation Principle		
	1.3	Identification of problem worth solving		
	1.4	Looking for solutions		
	1.5	Present the problem		
2		Value Proposition Canvas and Business Model	2,3	7
	2.1	Craft your value proposition		
	2.2	Presentation of Value Proposition Canvas		
	2.3	Business Model and Lean Approach (Finance, Marketing,		
		Operations)		
	2.4	Presentation of Lean Canvas		
3		Business Plan	4	6
	3.1	Creation of Business Plan		
4		Company Formation	5	7
	4.1	Promoters, Capital, Shareholders		
	4.2	Directors, DIN		
	4.3	Company Name, Registrations		
	4.4	Branding		
			Total	26



## **Course Assessment:**

### <u>ISE-1:</u>

Quiz: 10 Marks Assignment: Effectuation case study: 10Marks Activity: Presentation of Value Proposition Canvas: 30 Marks Rubric Based assessment

## <u>ISE-2:</u>

Quiz: 10 Marks Assignment: Presentation of Lean Canvas: 10Marks Activity: Virtual Company registration: 30 Marks Rubric Based assessment

- [1] Sarasvathym "Elements of Entrepreneurial Expertise (New Horizons in Entrepreneurship Series)" Edward Elgar Publishing.
- [2] Alexander Osterwalder "Business Model Generation :A Handbook for Visionaries, Game Changers, and Challengers"
- [3] Alex Osterwalder, Yves Pigneur, Greg Bernarda, Alan Smith, Trish Papadakos "Value Proposition Design: How to create Products and Services Customers Want"
- [4] Garrett Sutton "Writing Winning Business Plans"
- [5] M.C. Bhandari "Company Law Procedures" LexiNexis, 2018



Course Code	Course Name	Teaching Scheme (Hrs/week)		Credits Assigned				
		L	Т	Р	L	Т	Р	Total
	Technology Innovation for Sustainable Development	1		2	1		1	2
VECIMEN		Examination Scheme						
VECIZMEUZ			ISE1	MSE	ISE2	ESE	Te	otal
		Theory						
		Lah	40		60		1	00

Pre-requisite Course Codes		rse Codes	PCC11ME01					
	CO1	Demonstrate	e a broad and coherent knowledge of United Nations Sustainable					
		Developmer	nt Goals (SDGs)					
Course	CO2	Build the v	uild the vocabulary and develop a nuanced understanding of the SD					
Course		themes: peor	themes: people, planet, prosperity, peace and partnership					
Outcomes	CO3	Identify tech	nological solutions to address challenges of SDGs					
	CO4	Build the v	ision to explain how to create a technological solution for					
		sustainabilit	y					

Module	Unit	Topics	Ref.	Hrs.
No.	No.			
1		What are SDGs	1,2,3	3
	1.1	Concept of Sustainability. The Role of UN and the Need for		
		SDGs. Why SDGs are important.		
	1.2	Introduction to 17 SDGs		
2		People Theme	4,5	4
	2.1	Sustainable development goals 1-5		
	2.2	Technological Solutions to advance people theme		
3		Planet Theme		6
	3.1	Sustainable development goals 6, 12-15	4,5	
	3.2	Technological Solutions to advance planet theme		
4		Prosperity Theme		7
	4.1	Sustainable development goals 7-11		
	4.2	Technological Solutions to advance prosperity theme		
5		Peace Theme	4,5	3
	5.1	Sustainable development goal 16		
	5.2	Technological Solutions to advance peace theme		
6		Partnership Theme	4,5	3
	4.1	Sustainable development goals 17		
	4.2	Technological Solutions to advance partnership theme		
			Total	26



## **Course Assessment:**

**ISE-1:** Quiz: 20 Marks Activity: Case Study Presentation: 20 Marks

ISE-2: Quiz: 20 Marks Activity: Short Film Creation and Presentation: 30 Marks

- [1] https://sdgs.un.org/goals
- [2] https://sdgs.un.org/tfm
- [3] Himanshu Sharma, Tina Sobti "An Introduction to Sustainable Development Goals" 2018
- [4] Henrik Skaug Sætra "Technology and Sustainable Development" Routledge, 2023
- [5] Sinan Kufeoglu "Emerging Technologies: Value Creation for Sustainable Development", Springer International Publishing, 2022



Course Code	Course Name	Teaching Scheme (Hrs/week)			C	redits Assigned			
		L	Т	Р	L	Т	Р	Total	
	Indian Knowledge System	2			2			2	
IKS11ME01		Examination Scheme							
			ISE1	MSE	ISE2	ESE	Te	otal	
		Theory	50		50		1	00	
		Lab							

Pre-requisi	ite Cou	rse Codes				
	CO1	umerate the main characteristics of education system in Vedic and post				
		Vedic period to enrich the intellectual imagination				
	CO2	Review the ancient discovery and research in Indian number system and				
		ancient Indian mathematics				
Course	CO3	Review the contribution from Ancient Indian system to astronomy and				
Outcomes		metallurgy				
	CO4	Trace the significant developments in Indian engineering and technology in				
	Irrigation, painting, surgical techniques and shipbuilding					
	CO5 Cultivate a deep sense of identity and pride in enriched scientific In					
		heritage				

Module	Unit	Topics	Ref.	Hrs.
No.	No.			
1	1.1	What is Indian Knowledge System (IKS)? Why do we need it?	1	2
		Salient aspects of IKS.		
	1.2	The Vedic Corpus: Introduction to Vedas, Sub-classification of	1	3
		Vedas, Messages in Vedas, Vedic Life: A Distinctive Features		
2	2.1	Number systems in India, Measurements for time, distance, and	1	4
		weight, Bhūta-Samkhyā system, Katapayādi system, Pingala and		
		the Binary system		
	2.2	Unique aspects of Indian Mathematics, Indian Mathematicians	1	4
		and their Contributions, Algebra, Geometry and Trigonometry		
3	3.1	Indian contributions in astronomy, The celestial coordinate	1	4
		system, Elements of the Indian calendar, Notion of years and		
		months, Indian Astronomical Instruments		
	3.2	Wootz Steel, Mining and ore extraction, Metals and	1	4
		Metalworking Technology, Iron and steel in India, Lost wax		
		casting of idols and artefacts, Apparatuses used for extraction of		
		metallic components		
4	4.1	Irrigation systems and practices in South India, Dyes and painting	1	3
		technology, Surgical techniques, Shipbuilding		
	4.2	Temple architecture in India, Perspective of Arthaśāstra on town	1	2
		planning.		
			Total	26



#### Course Assessment:

**ISE-1:** Quiz: 20Marks (Two 10 marks each) Activity: Group Discussion on Indian Knowledge System: 10 Marks Activity: Creative Activity: 20 Marks

**ISE-2:** Quiz: 20 Marks (Two 10 marks each) Activity: Reflection discussion on Indian Knowledge System: 10 Marks Activity: Creative Activity: 20 Marks

- B Mahadevan, Vinayak Rajat Bhat, Nagendra Pavana R. N., "Introduction to Indian Knowledge System: Concepts and Applications" PHI, 2022
- [2] Kapil Kapoor, Avadhesh K. Singh, "Indian Knowledge Systems, Volume 1", Indian Institute of Advanced Study, 2005
- [3] R. P. Kulkarni, "Glimpses of India Engineering and Technology: Ancient and Medieval Period," Munshiram Manoharlal Publishers Pvt. Ltd., 2018



Course Code	Course Name	Teaching Scheme (Hrs/week)			C	Credits Assigned			
	Human Health Systems	L	Т	Р	L	Т	Р	Total	
		1			1			1	
ESC11ME04		Examination Scheme							
ESCIINIE04			ISE1	MSE	ISE2	ESE	Te	otal	
		Theory	20		30		50		
		Lab							

Pre-requisite Course Codes		rse Codes Basic Science
	CO1	Familiarize the students with the basic biological concepts and their
Course		engineering applications.
Course	CO2	Understand bio-design principles to create novel devices and structures in
Outcomes		the future
	CO3	Develop the interdisciplinary vision of biological engineering

Module No.	Unit No.	Topics	Ref.	Hrs.
1100	Topic	Significance of Biology in Engineering		2
	1.1	Introduction, Aspects of Biology as an Independent scientific discipline		
1	1.2	Biological observations of the 18 <sup>th</sup> Century that led to major discoveries, Brownian motion, Origin of Thermodynamics concerning original observations of Robert Brown and Julius Mayor		
	1.3	Fundamental importance of observation in any scientific inquiry		
	Topic	Human Organ Systems and Bio Designs – 1		4
	2.1	Brain as a CPU System, Architecture of the human brain as a CPU system- Comparison between Brains Computing System with Conventional Von Neumann Computing System		
	2.2	Central Nervous System (CNS) and Peripheral Nervous System (PNS)-2 types: Somatic and Autonomic, Signal Transmission		
		EEG (Electroencephalography- Applications, EEG Signals and Types of Brain Activity)		
2	2.3	Robotic Arms for Prosthetics- Robotic Arm Prosthetic Direct Control through Muscle Signals (myoelectric control), Robotic Arm Prosthetic by Brain- Machine Interfaces		
	2.4	Parkinson's disease Engineering Solutions for Parkinson's Disease		
	2.5	Artificial Brain		
	2.6	Eye as a Camera system (architecture of rod and cone cells, optical corrections, cataract, lens materials, bionic eye)	,	
	2.7	Heart as a pump system (architecture, electrical signaling - ECG monitoring and heart-related issues, reasons for blockages of blood vessels, design of stents, pacemakers, defibrillators)		



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		,	,		
(	(Autonomous	College affilia	ted to Unive	ersity of Mu	ımbai)

	Topic	Human Organ Systems and Bio Designs – 2						
		Lungs as purification system (architecture, gas exchange						
	2.1	mechanisms, spirometry, abnormal lung physiology –						
	5.1	COPD(Chronic obstructive pulmonary disease), Ventilators, Heart-						
_		lung machine)						
3	2.2	Kidney as a filtration system (architecture, mechanism of filtration,						
	3.2	Chronic Kidney Disease, dialysis systems)						
		Muscular and Skeletal Systems as scaffolds (architecture,						
	3.3	mechanisms, bioengineering solutions for muscular						
		dystrophy and osteoporosis)						
	Topic	Nature-Bioinspired Materials And Mechanisms						
	4.1 Echolocation (ultrasonography, sonars),							
	4.2 Photosynthesis (photovoltaic cells, bionic leaf).							
	4.3	Lotus leaf effect (Super hydrophobic and self-cleaning surfaces),						
4	4.4	Plant burrs (Velcro)						
	4.5 Kingfisher beak (Bullet train)							
	4.6 Shark skin (Friction reducing swimsuits)							
	4.7 Human Blood substitutes - hemoglobin-based oxygen							
		carriers (HBOCs) and Perfluorocarbons (PFCs)						
	Topic	Trends in Bioengineering						
	5.1	Bioprinting techniques and materials,						
	5.2	3D printing of ear, bone, and skin. 3D printed foods,						
		Electrical tongue, and electrical nose in food science,						
	5.3	DNA origami and Biocomputing,						
5	5.4	Bioimaging and Artificial Intelligence for disease diagnosis.		2				
	5.5	Self-healing Bio concrete (based on bacillus spores, calcium						
	lactate nutrients, and biomineralization processes)							
		Bioremediation and Biomining via microbial surface						
	5.6	adsorption (removal of heavy metals like Lead, Cadmium, Mercury,						
		and Arsenic)						
			Total	13				

### **ISE Marks**

1.	ISE1-1 Ouiz/ Assignment	= 20 Marks
<b>1</b> .		

2. ISE2-1 Quiz/ Assignment

Presentation / Poster Making = 20 Marks

## Suggested Learning Resources:

3.

• Human Physiology, Stuart Fox, Krista Rompolski, McGraw-Hill eBook. 16th Edition, 2022

**= 10 Marks** 

- Biology for Engineers, Thyagarajan S., Selvamurugan N., Rajesh M.P., Nazeer R.A.,
- Thilagaraj W., Barathi S., and Jaganthan M.K., Tata McGraw-Hill, New Delhi, 2012.
- Biology for Engineers, Arthur T. Johnson, CRC Press, Taylor and Francis, 2011
- Biomedical Instrumentation, Leslie Cromwell, Prentice Hall 2011.
- Biology for Engineers, Sohini Singh and Tanu Allen, Vayu Education of India, New Delhi, 2014.



- Biomimetics: Nature-Based Innovation, <u>Yoseph Bar-Cohen</u>, 1st edition, 2012, CRC Press.
- Bio-Inspired Artificial Intelligence: Theories, Methods and Technologies, D. Floreano and C. Mattiussi, MIT Press, 2008.
- Bioremediation of heavy metals: bacterial participation, by <u>C R Sunilkumar, N Geetha A C</u> <u>Udayashankar</u> Lambert Academic Publishing, 2019.
- 3D Bioprinting: Fundamentals, Principles and Applications by Ibrahim Ozbolat, Academic Press, 2016.
- Electronic Noses and Tongues in Food Science, Maria Rodriguez Mende, Academic Press, 2016
- Blood Substitutes, Robert Winslow, Elsevier, 2005

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

- https://nptel.ac.in/courses/121106008
- https://freevideolectures.com/course/4877/nptel-biology-engineers-other-non-biologists
- https://ocw.mit.edu/courses/20-020-introduction-to-biological-engineering-design-spring-2009
- https://ocw.mit.edu/courses/20-010j-introduction-to-bioengineering-be-010j-spring-2006
- https://www.coursera.org/courses?query=biology
- https://www.classcentral.com/subject/biology
- https://www.futurelearn.com/courses/biology-basic-concepts



Course Code	Course Name	Teaching Scheme (Hrs/week)			C	Credits Assigned			
		L	Т	Р	L	Т	Р	Total	
	Creative Coding in Python			4			2	2	
VSE11ME02		Examination Scheme							
			ISE1	MSE	ISE2	ESE	T	otal	
		Lab	50		50		1	00	

Pre-requisit	e Cours	e Codes
Course Outcomes	CO1	Demonstrate awareness of skills of 21 <sup>st</sup> century engineer
	CO2	Demonstrate basic concepts of python programming.
	CO3	Identify, install and utilize python packages.
	CO4	Illustration of data analytics and data visualization using Python libraries
	CO5	Create GUI Applications using Python.
	CO6	Demonstrate creativity while implementing solution for a given problem
		using python

Module	Unit	Topics
No.	No.	
1		21 <sup>st</sup> century skills
		Introduction and Importance of 21 <sup>st</sup> Century skills, case studies of creativity in
		engineering, Creator Tool PictoBlox, Github
2		Python Fundamentals:
	2.1	Basic Data Types: Letter Counter App, Right Triangle Solver App, Multiplication
		Exponent Table Program
	2.2	Lists: Grade Sorter App, Grocery List App, Basketball Roster Program
	2.3	Dictionaries: Thesaurus App, Code Breakers App
3		Decision Flow Control Statements
	3.1	For Loops: Binary Hexadecimal Conversion App, Grade Point Average Calculator
		Арр
	3.2	Conditionals: Voter Registration App, Rock, Paper, Scissors App
	3.3	While Loops: Guess the Word App, PowerBall Simulation App
4		Functions
	4.1	Functions: Head to Head Tic-Tac-Toe App, Bank Deposit and Withdrawal
		Program
	4.2	Classes: Casino Blackjack App
5		Graphics and GUI
	5.1	<i>Turtl</i> e - Hirst Painting
	5.2	Tkinter- Building a Password Manager GUI App.
6		Python in Data Sciences for Beginner
	6.1	NumPy, Pandas, Matplotlib: Data Analysis and visualization of any data set
		(Stock market/healthcare/weather/Agriculture)
7		Project Development using Python for various engineering domains like
		electronics, mechanical etc.



### **Course Assessment:**

Lab:

#### ISE: 1. ISE-1

Experiments: 20 Marks Quiz: 10 Marks Design contest: 20 Marks 2. ISE-2 Experiments: 20 Marks Quiz: 10 Marks Mini Project: 20 Marks

#### **Recommended Books:**

- [1] Yashvant Kanetkar, "Let us Python: Python is Future, Embrace it fast", BPB Publications; 1<sup>st</sup> edition (8 July 2019).
- [2] Dusty Phillips, "Python 3 object-oriented Programming", Second Edition PACKT Publisher, August 2015.
- [3] John Grayson, "Python and Tkinter Programming", Manning Publications (1 March 1999).
- [4] Core Python Programming, Dr. R. Nageswara Rao, Dreamtech Press
- [5] Beginning Python: Using Python 2.6 and Python 3.1. James Payne, Wrox publication
- [6] Introduction to computing and problem solving using python, E Balagurusamy, McGraw Hill Education

#### **Online Resources:**

- 1. Python 3 Documentation: https://docs.python.org/3/
- 3. "The Python Tutorial", http://docs.python.org/release/3.0.1/tutorial/
- 4. http://spoken-tutorial.org
- 5. Python 3 Tkinter library Documentation: https://docs.python.org/3/library/tk.html
- 6. Numpy Documentation: https://numpy.org/doc/
- 7. Pandas Documentation: https://pandas.pydata.org/docs/
- 8. Matplotlib Documentation: https://matplotlib.org/3.2.1/contents.html
- 9. Scipy Documentation : https://www.scipy.org/docs.html
- 10. Machine Learning Algorithm Documentation: https://scikit-learn.org/stable/
- 11. https://nptel.ac.in/courses/106/106/106106182/
- 12. NPTEL course: "The Joy of Computing using Python"