



## Koneru Lakshmaiah Education Foundation

(Category -1, Deemed to be University estd. u/s. 3 of the UGC Act, 1956)

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Campus: Green Fields, Vaddeswaram - 522 302, Guntur District, Andhra Pradesh, INDIA.

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### XXXV Academic Council – Annexure 2.10

#### Department of Mechanical Engineering

#### Minutes of 22<sup>nd</sup> BOS Minutes

Minutes of the 22nd BOS meeting-Mechanical Department held on 17-05-2022 in online mode in room no.M118(HOD Chamber) from 10:00AM onwards

The following members were present

1. Dr.D.V.A. Ramasastry, Associate Professor, HOD-ME & Chairman BOS
2. Dr.A.Srinath, Professor, Dean Skill Development & principal ASC
3. Dr.S.N.Padhi, Professor, Group Head-Design & Manufacturing
4. Dr.S.S.Rao, Professor Group Head-Robotics & Mechatronics
5. Dr.G.Murali, professor, Group Head-Energy & CFD group head
6. Dr. K.V. Narasimha Rao, Professor-ME, Associate Dean Quality
7. Dr. G. Yedukondalu, Group Head, Associate Dean Skilling
8. Dr.P.Kasi V Rao, Associate Professor, Associate Dean Academics
9. Dr.K.V.Durga Rajesh, Associate Professor
10. Mr. P. Ratna Prasad, Assistant Professor ME
11. Mrs.T.Kanthimathi, Assistant Professor
12. Dr.K.Thirupathi Rao, Professor Additional Dean Academics, Co-opted member
13. Dr.A.Venu Gopal, Professor & Dean Academics, NIT Vwarangal
14. Dr. R. Vijaya Kumar, Senior Manager, R & D HAL Bangalore
15. Dr. P. Srinivasa Rao, Global Training Head, Cyient Technologies, Hyderabad
16. Dr.K.Ravi Teja, Manager, Hyundai R & D Division, Hyderabad

The following members were Absent

1. Dr. K.RamaKrishna, Dean-Quality, Professor-ME
2. Dr. A.Jagadeesh, Director-FED, Professor-ME
3. Dr. Gnana Murthy, Professor-Dept. of ME, IIT Madras

#### AGENDA and RESOLUTIONS

##### AGENDA ITEM-1

To consider the department achievements during the A.Y. 2021-22 Even Sem

Resolution Passed: The achievements made by the department is appreciated and forwarded to the academic council

  
17/5/2022

Head, Department of Mechanical Engineering  
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BOS chairman presented the following achievements of students & faculty of the department during 2021-22 Even sem to the BOS members

### Honours received by Faculty

- Dr. B.Nageswara Rao, Professor is recognized as Recognized as Top Ranked Researchers in World 2% Researchers Category published by Elsevier
- Dr.A.Srinath, Dean Skill Development and progression, Principal Academic Staff College, Achieved Bhartiya Gyan Ratna Award – Best Dean Of The Year by Global Scholars Foundation

### Honours received by Students

- Mr. P Srimannarayana Raju (150070323) was awarded Gold Medal at Regional Competition – South in the skill “Additive Manufacturing” held from 1-12-2021 to 4-12-2021, by National Skill Development Corporation, India Skills 2021.
- Mr. G. Durga Raj (190070025), Participated and stood 229<sup>th</sup> Position in 10M Rifle Men (ISSF) Civilian Championship and 460<sup>th</sup> Position in 10M Rifle Men (ISSF) National Championship, by 64<sup>th</sup> National Shooting Championship Competitions in RIFLE Events held at Bhopal, Madhya Pradesh
- Mr. P Srimannarayana Raju (150070323), was Awarded Gold Medal at India Skills Competitions 2021, held at Talkatora Indoor Stadium, New Delhi in the skill “Additive Manufacturing” held from 7-1-2022 to 10-1-2022. Also won Cash Prize of Rs.1.00 Lakhs and Full paid training and air expenses, boarding expenses to participate at World Skills Competitions to be held in Shanghai, China in August 2022, by India Skills Competitions 2021, held at Talkatora Indoor Stadium, New Delhi 7-10 January 2022.
- Mr. Dasaradha Ramaiah (180079016), Mr. Bhargava Ramaiah (180079018) and Mr. Talari Vamsi (180079048), Won First Prize with 50,000/- Cash Prize on IDEABOX Season-2, a National Level Idea Competition by RootCap Business Consultants in association with Center for Innovation, Incubation & Entrepreneurship (CIIE) on 11-1-2022 conducted by IdeaBox Season – 2 by RootCap Business Consultants in association with CIIE.
- Mr. Rejeti Sriram Swaroop(190079022), Achieved appreciation from TELUGU BOOK OF RECORDS with title " FIRST INDIAN STUDENT TO REGISTER 18 INTELLECTUAL PROPERTY RIGHTS" on 21st March 2022, by Telugu Book of records

### Placements

- 225 Placement offers were received by 140 registered students.
- The maximum package offered was 10 lakh and minimum of 3.36 lakhs with an average package of 5 lakhs per annum.

### Ph.D Awards

- Mr. P. N. V. Bala Subrahmanyam, scholar of Dr. B.Nageswara Rao was awarded Ph.D in the month of Dec'2021.
- Ganesh Vijay More, scholar of Dr. Issac Prasad was awarded Ph.D in the month of Dec'2021.

### Publications & Conference presentations

- 57 papers were published in various International Journals in the 2021 and 17 papers were published in the year 2022 till date.
- 17 papers were presented by faculty in various International Conferences in the year 2021 and 1 paper in 2022 till date.

### Consultancy, Patents & Citations

  
10/5/22

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- 21 faculty members have taken consultancy projects in various industries in the 2021-22 Even Sem.
- 91 Design patents were filed by students and faculty of the department in the A.Y.2021-22. A cumulative of 271 Design patents and 26 utility patents were filed by the students and faculty of the department.
- The patent applied by Dr.A.Srinath and Dr.G.Yedukondalu was granted.


BOS members Congratulated all the award winners and achievers of the department. The detailed list of events is given in **Annexure-1**.

### AGENDA ITEM-2

To consider and approve the resolutions made in DAC-1 & DAC-2.

Resolution Passed: It is resolved to approve the resolutions made in DAC-1 & DAC-2 and the same is recommended to the academic council for approval

1. By considering the feed back given by stake holders following resolutions were made in DAC-1 held on 09-02-2022 on the curriculum of Y22 Admitted batch students
  - Upon considering the feedback given by Student V.Sai Ujwal (180070153), to include more topics related to GATE in the relevant courses, it is resolved that Gate syllabus is previously included in the relevant courses.
  - Mr.T.Dharani Kumar (190079008)-Student requested to include 75% of curriculum with core courses related to latest technology and 25% of the curriculum with coding related courses. It is resolved that Coding is offered as special training course in addition to the regular courses.
  - Based on the request of Mr.N.C.V.J Samaj(190070087)-student, to include more core related software's in the curriculum, it is resolved that Coding is offered as special training course in addition to the regular courses.
  - Mr.V.L.N.Harshavardhan (200079026)-student suggested to focus on Entrepreneurship, rather on more software courses. It is resolved that Entrepreneurship course formerly introduced for Y21 & Y22 admitted batch students.
  - Upon discussing the feedback given by Mr.N.Sai Sampath (190070070)-Student to have more industrial tours, it is resolved that industry internship is included in the curriculum to get industry exposure
  - Upon discussing the feedback given by 190070083, P.Bhanu prakash student to include more practical's for the theory courses, it is resolved that Practical's are included in all core courses and software labs are used for specialization courses.
  - Upon discussing the feedback given by 190080001, B.Chandra Sekhar Varma, student to correlate the topics with the present industry, It is resolved that Specialization courses are designed in line with the present industry.
  - Upon discussing the feedback given by Y20 students to explain the importance of specialization courses before the starting of the semester, It is resolved to conduct orientation on the socialization before the start of the semester.
  - Based on the request of Y19 students to offer Autotronics & Automobile Engineering courses in III-I Semester and Automobile Engine Design & Alternate Energy Resources in III-II Semester, It is resolved to offer Autotronics & Automobile

  
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Engineering courses in III-I Semester and Automobile Engine Design & Alternate Energy Resources in III-II Semester.

- Upon discussing the feedback given by academic Peer Dr. Suresh Babu to separate 21ME3113 Machine Design course as two separate courses considering the static and dynamic loading conditions, and also suggested to include governors concept in 21ME3118 Dynamics of Machines course. He suggested to give practical exposure to students on the topic covered in this course. It is resolved that, Design for static and dynamic loading conditions are formerly included in Mechanical Engineering Design course.
  - Upon discussing the feedback given by Academic peer Dr. K.Srikanth, to include "Kinematic Synthesis(four bar chain)" topic in the course 21ME2211 Kinematic & Machines. He also suggested to refer "Mechanical Vibrations by Prof. R.V.Chalam" text book for 21ME3118 Dynamics of Machines course. It is resolved Include Kinematic Synthesis(four bar chain)" topic in the course 21ME2211 Kinematic & Machines. and "Mechanical Vibrations by Prof. R.V.Chalam" text book for 21ME3118 Dynamics of Machines course.
2. The revised Curriculum in DAC-1 was sent to stake holders to receive any further modifications and these resolutions were made in DAC-2 held on 12-03-2022

It is resolved to approve the resolutions of DAC-1 and DAC-2 and to recommend the same to academic council for approval. (Annexure-2(a), DAC-1 minutes) & (Annexure-2(b), DAC-2 minutes)

### AGENDA ITEM-3

To consider and approve the courses introduced in the Curriculum of B.Tech program of Y22 Admitted batch students based on the feedback of stakeholders.

Resolution Passed: It is resolved to approve the courses introduced in the curriculum of B.Tech Program of Y22 admitted batch students and recommend the same to the academic council for approval

1. Following are the proposals made by the stake holders to be incorporated in the curriculum of B.Tech Y22 admitted batch students.

- As per the feedback of faculty Dr.S.S. Rao, Robotic course is introduced in 5<sup>th</sup> Semester to Y22 admitted batch students. He also recommended to introduce Machine to machine Communication and Reverse Engineering and Rapid Prototyping courses as electives in Smart Manufacturing specialization It is resolved to offer the course Robotics(22ME3119 with L-T-P-S: 2-0-0-0) in 5<sup>th</sup> semester and to introduce Machine to Machine Communication (22ME4062 with L-T-P-S: 2-0-2-0) course in Smart Manufacturing Specialization
- As per the feedback Industry person Mr. S.A. Sunderesan, to offer a course having exposure to Thermal Management of Electric systems, It is resolved to offer a New Course titled "Thermal management and Electric and Electronic Systems"(22ME4077) as professional Elective under Energy & CFD specialization
- Upon discussing the feedback of Industry person Mr.S.Subramanya Sastry, to introduce specialization on Robotics and mechatronics, it is resolved to Introduce Robotics and Mechatronics Specialization in collaboration with ECE department with courses titled: "Robot Motion Planning & Control", "Robot manipulation and Wheeled Mobile Robots", "Mechatronics: Fundamentals and Core Concepts", "Artificial Intelligence for Robotics"

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"Human Machine interface and Brain Machine Interface", "Computer Vision and Applications" and "Autonomous Vehicles and Automotive Electronics" for Y22 admitted batch students in place of existing specialization Product Design and Autotronics specialization

- Upon discussing the feedback given by industry person Mr. Shashikanth, to include specialization on Modern vehicle technology, It is resolved to offer Modern vehicle technology as a new specialization in collaboration with EEE department with the courses titled: "Power train design for Electric Vehicle", Solar Energy Technologies", "Vehicle Dynamics", "Thermal Management of Electric and Electronics Systems", "AI and IOT for Electric vehicle", Communication protocols and testing of Electric vehicle," Autonomous Vehicles and Automotive Electronics" for Y22 admitted batch students in place of existing Automobile Engineering specialization

It is resolved to introduce the courses along with two specializations for B.Tech Y22 admitted batch students as per the recommendations of stakeholders.

### Courses Introduced for B.Tech 2022-23 admitted batch based on the feedback of stakeholders

S.No.	Course Code	Course Title	Course Type	Remarks
1	22ME2107	Thermal Management of Electric and Electronics Systems	Elective	As per the feedback Industry person, to offer a course having exposure to Thermal Management of Electric systems, this course is introduced
2	22ME3119	Robotics	Core	As Per the feedback of faculty to impart knowledge on Robotics concepts this course is introduced in place of Heat Power Engineering Course
3.	22ME4062	Machine to Machine Communication	Elective	As Per the feedback of faculty to have exposure to new technology in manufacturing, this course is introduced as elective in smart manufacturing Specialization
4.	22ME4071	Robot motion Planning Dynamics and Control	Elective	As per the feedback Industry person, this course is introduced under the Robotics and Mechatronics specialization
5.	22ME4072	Robot Manipulation and Wheeled Mobile Robots	Elective	As per the feedback Industry person, this course is introduced under the Robotics and Mechatronics specialization
6.	22ME4073	Mechatronics-Fundamentals	Elective	As per the feedback Industry person, this course is introduced under the

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		and Core concepts		Robotics and Mechatronics specialization
7.	22ME4074	Artificial Intelligence for Robots	Elective	As per the feedback Industry person, this course is introduced under the Robotics and Mechatronics specialization
8.	22ME4075	Human Machine and brain Machine Interface	Elective	As per the feedback Industry person, this course is introduced under the Robotics and Mechatronics specialization
9.	22ME4076	Computer Vision and Applications	Elective	As per the feedback Industry person, this course is introduced under the Robotics and Mechatronics specialization
10.	22ME4077	Autonomous Vehicles and Automotive Electronics	Elective	As per the feedback Industry person, this course is introduced under the Robotics and Mechatronics specialization
11.	22ME4081	Power Train Design for Electric Vehicles	Elective	As per the feedback Industry person, this course is introduced under the Modern Vehicle Technology Specialization
12.	22ME4082	Solar Energy technologies	Elective	As per the feedback Industry person, this course is introduced under the Modern Vehicle Technology Specialization
13.	22ME4083	Vehicle Dynamics	Elective	As per the feedback Industry person, this course is introduced under the Modern Vehicle Technology Specialization
14.	22ME4085	AI and IOT for Electric Vehicles	Elective	As per the feedback Industry person, this course is introduced under the Modern Vehicle Technology Specialization
15.	22ME4086	Communication Protocols and testing for Electric Vehicles	Elective	As per the feedback Industry person, this course is introduced under the Modern Vehicle Technology Specialization
16.	22ME4087	Autonomous Vehicles and Automotive	Elective	As per the feedback Industry person, this course is introduced under the Modern Vehicle Technology

  
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Electronics

Specialization

The detailed course structure of B.Tech Y22 admitted batch is given in **Annexure-3a**, and the syllabus for the introduced courses is given in **Annexure-3b**, the detailed action taken report on stake holders feedback is in **Annexure-3c**.

### AGENDA ITEM-4

To consider and approve the revisions proposed in the Curriculum of B.Tech program for Y22 Admitted batch students based on the feedback of stakeholders.

Resolution Passed: It is resolved to approve the revisions proposed in the curriculum of B.Tech Y22 admitted batch students and recommend the same to the academic council for approval

Following are the revisions proposed by stake holders in the curriculum of Y22 admitted batch students

- Faculty-Dr.K.Lokesh suggested to offer FM & HM(22ME2106) course is in 3<sup>rd</sup> semester instead of 4<sup>th</sup> semester with an L-T-P-S of 3-1-2 0. It is resolved to revise semester wise courses for Y21 and Y22 admitted batch students and to include tutorial to the course
- Upon discussing the feedback given by Dr. G.Naga Srinivasulu, Professor, NIT Warangal, & faculty-Mr.K.Sai Sarath to include Gas turbine cycles in 21ME2210- Analysis of thermal systems course, It is resolved that Analysis of Thermal Systems (CFD S/W-22ME2210) course syllabus is revised by incorporating concepts of IC Engines, gas turbines, refrigeration, unconventional energy. It is offered with an L-T-P-S of 3-1-0-4 in 4<sup>th</sup> Semester. (**Annexure-4(a)**)
- Based on the discussion with BOS members, it is resolved to revise the course Numerical Computation for mechanical Engineers(22ME2209) with L-T-P-S-3-0-2-0, by incorporating scalar problems, dynamic analysis, statistical analysis. It is offered in 4<sup>th</sup> semester. (**Annexure-4(b)**).
- As per the suggestions of Dr.A.Srinath & Dr.K.Raina Krishna- internal members, to merge Design tools Workshop-I & II and offer as Workshop Practices for I year Y22 students and also suggested to offer Design tools Workshop-I & II courses for Y22 I year students and
- As per the recommendation of industry person Mr.K.Krishna Kumar, to involve students in exploring syllabus on their own, it is resolved to deliver 60% of core courses through flipped learning mode
- Based on the recommendations of industry person-Dr.A.Subhananda Rao, it is resolved to offer more skilling courses, real time industry problems, orientation towards industry requirement and the suggestions were forwarded to academic council.
- As per the recommendations of BOS members, it is resolved to include Lab experiments instead of skilling component for Instrumentation and Control Systems(22ME4120) is changed and is offered in semester-6 with an L-T-P-S of 2-0-2-0 (**Annexure-4(c)**).
- Based on the discussion with BOS members; it is resolved to offer Universal Human Values (21UC0010 with L-T-P-S: 2-0-0-0) in 4<sup>th</sup> Semester.
- Upon discussing the feedback of faculty Dr. S.S. Rao, it is resolved to revise the Syllabus of Industry 4.0 & Cyber physical Systems(22ME3114 with L-T-P-S: 2-0-0-4) and to offer in 7<sup>th</sup> semester for Y22 admitted batch students. (**Annexure-4(d)**).

  
17/11/22

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- Upon discussing with the BOS members to modify the credits of various category courses it is resolved to offer Thermodynamics(21ME2105) and Material technology(21PH2007) as ES(Engineering Sciences) courses and Operations Management course is offered as Management Elective(OE-4).

### Proposed revisions for the courses offered to B.Tech 2022-23 admitted batch students

S.No.	Course Code	Course Title	Course Type	Percentage of revision	Remarks
1	22ME2209	Numerical Computations for Mechanical Engineers	Basic Sciences	70%	Topics on MAT lab are included as per the feedback of academic peers
2	22ME2210	Analysis of Thermal Systems	Core	70%	Topics on gas turbines, steam turbines and pumps are included as per the feedback of industry person
3	22ME4120	Instrumentation and Control	Core	25%	Topics on measurement are included as per the feedback of faculty
4	22ME3114	Industry 4.0 & Design of Cyber Physical Systems	Core	80%	Topics on new technology are included and skilling component is introduced as per the feedback of faculty

### AGENDA ITEM-5

To consider and approve the Curriculum of M.Tech programs for Y22 Admitted batch students based on the feedback of stakeholders.	Resolution Passed: It is resolved to approve the curriculum of M.Tech Programs of Y22 admitted batch students and recommend the same to the academic council for approval
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Following are the changes proposed by stake holders for Y22 admitted batch students in M.Tech-Machine Design(MD)& M.Tech-Thermal Engineering programs.

- Upon discussing the feedback given by Academic peer-Dr.G.Rudra Narsimha Rao, to include 3D printing, nano materials and their application topics in M.Tech\_MD courses. He also suggested to add energy conservation act'2021 topic for M.Tech-TE program. It is resolved that 3D printing technology is covered in B.Tech courses and nanomaterials and ceramics topics are covered in Mechanics of Composite materials course for M.Tech-MD and the topic suggested for M.Tech-TE is added in Energy Conservation, Management & Audit Course.
- Upon discussing the feedback given by academic peer Dr. J, Jabinth to include advanced Python programming for M.Tech-MD program, it is resolved to include Python Programming in Design for Optimization Course(22ME5222).

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- Syllabus of M.Tech-MD-Program, Design for Optimization (22ME5222) course is changed by including topics on Optimization through MATLAB & Python programming
- As per the recommendation of Academic Peer Christopher to include lab using dynamics analysis software such as ADAMS for M.Tech-MD program, It is resolved to include ADAMS software based practise exercises in Advanced mechanisms (22ME5112) and rename the course as "Advanced Mechanisms and Manipulator Kinematics"
- As per the recommendation of Academic Peer Christopher to include An advanced Thermal Engineering Lab and Software Competency such as CFD Lab. It is resolved to include lab for M.Tech-TE program course, Numerical method in thermal Engineering(22ME5109) using MATLAB with L-T-P-S:3-0-2-0).
- Based on the feedback of Industry person Mr.A.Chakravarthy to include cryogenics in M.Tech-TE, it is resolved cryogenics is included in Refrigeration & Cryogenics course for M.Tech-TE.
- As per the suggestion of industry Person-Mr. V.Sudhakar, It is resolved to offer the Condition Monitoring course as elective to M.Tech-MD program.
- New Course titled "Engine performance and Emission control(22ME51F1)" (Topics of Engine Systems and performance & IC Engine Combustion and Pollution are combined) with L-T-P-S:3-0-0-0 is introduced in M.Tech-TE program as professional Elective.
- Based on the recommendation of industry person-Mr.S.A.Sundaresan, a new Course titled "Thermal management of Electric and Electronics Systems"(22ME51F2) with 3-0-0-0 L-T-P-S is resolved to offer in M.Tech-TE program as Professional Elective for Y22 admitted batch students.
- As per the suggestions of Dr.A.Srinath & Dr.K.Rama Krishna- internal members to offer one more mathematics course for M.Tech-TE Y22 admitted batch students, it is resolved to use MATLAB as skill component in Numerical methods for mechanical Engineers course in M.Tech\_TE course.

It is resolved to approve the changes proposed for M.Tech-MD Y22 admitted batch students(**Annexure-5a**). It is resolved to approve the changes proposed for M.Tech-TE Y22 admitted batch students(**Annexure-5b**)

### AGENDA ITEM-6

To consider and approve the proposed Minor and Honor degree programs for B.Tech Y22 admitted batch students	Resolution Passed; It is resolved to proposed Minor and Honor degree programs for B.Tech Y22 admitted batch students and the same is recommended to academic council for approval
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Based on the discussion with BOS members, it is resolved to propose following 3 Minor degree programs with 10 course each, out of which 2 are compulsory courses and from remaining 8 student can choose any course such that he/she can attain 20 credits at the end of the program. - (**Annexure-6a**).

- i. Minor Degree in Mechanical Engineering
- ii. Minor Degree in Robotics & mechatronics
- iii. Minor Degree in Computational Fluid Dynamics

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4. It is resolved to propose Honors degree program for advanced learners to earn more credits.(Annexure-6b).

### AGENDA ITEM-7

To consider and approve the skill sets identified for job profiles, Self-learning-MOOC's courses, software tools, activities & evaluation mapped to relevant courses for Y22 admitted batch students	Resolution Passed; it is resolved to approve the skill sets identified for job profiles, Self-learning-MOOC's courses, software tools, activities & evaluation mapped to relevant courses for Y22 admitted batch students and the same is recommended to academic council for approval
--	--

- The Job profiles from recruiters are taken and the required skills are proposed. It is resolved to approve the skill sets identified which are mapped to job profiles. (Annexure-7a, Skill sets).
- It is proposed to offer Self learning MOOC's Courses for the students who require more credits. It is resolved to approve the self-learning MOOCs courses identified. (Annexure-7b, Self-learning courses).
- Software tools are proposed which are mapped to the relevant courses offered to Y22 admitted batch students. It is resolved to approve the software tools proposed.(Annexure-7c)
- It is proposed to map the courses offered for Y22, Y21 batch students with various activities conducted at the department and central level and also to map the evaluation of these activities. It is resolved to approve the activities and evaluation mapped to the courses (Annexure-7d)

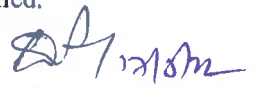
### AGENDA ITEM-8

Other Points: To consider and approve the changes proposed by CC's for 2022-23 ODD Sem Courses and the Global Certifications offered in A.Y. 2022-23	Resolution Passed: It is resolved to approve the changes proposed by CC's and the Global Certifications for A.Y.2022-23 and the same is recommended to academic council for approval.
--	---

1. It is resolved to propose the changes requested by course coordinators for the courses to be offered in 2022-23 Odd Sem

- 20ME3114- Industry 4.0 & Cyber Physical Systems course Syllabus, CO-statements & Evaluation Plan are modified.
- 19ME4076-Automobile Engine System & performance Course CO-statements were modified, and L-T-P-S is modified as 3-0-0-0 in place of 2-0-2-0.
- 19ME4113-Petroleum Production Engineering-II course CO Statements were modified.
- 19UC0009-Ecology & Environment course CO Statements were modified.
- 20ME3113- Machine Design Course CO Statements were modified.
- 20ME3217-production and Operations management course CO statements were modified.

It is resolved to approve the changes proposed by the course coordinators. (Annexure-8a)

  
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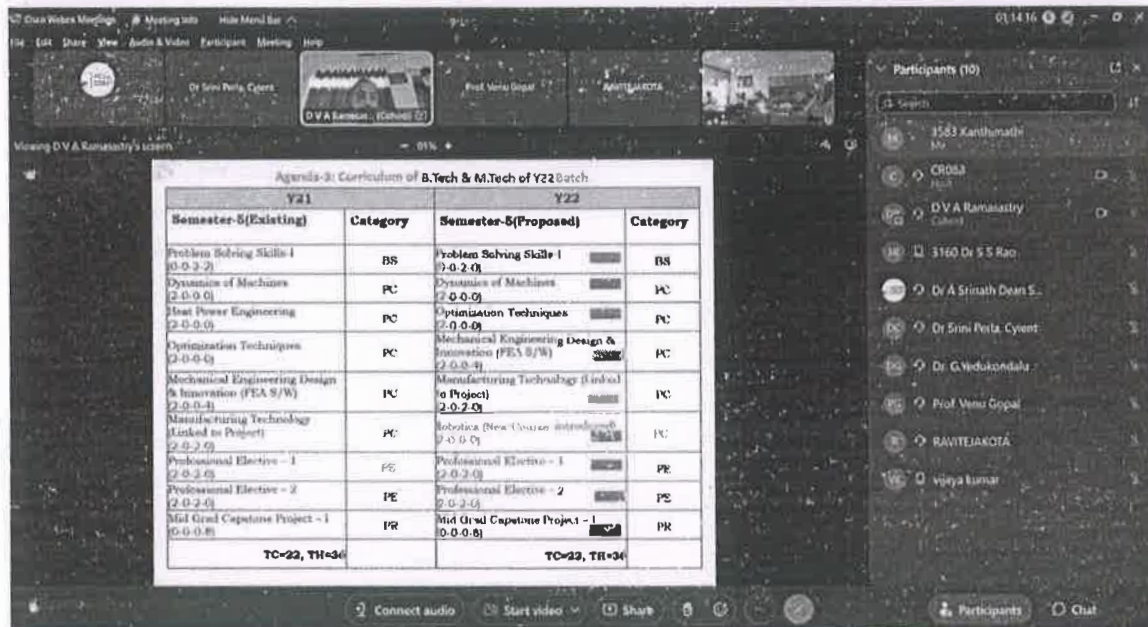
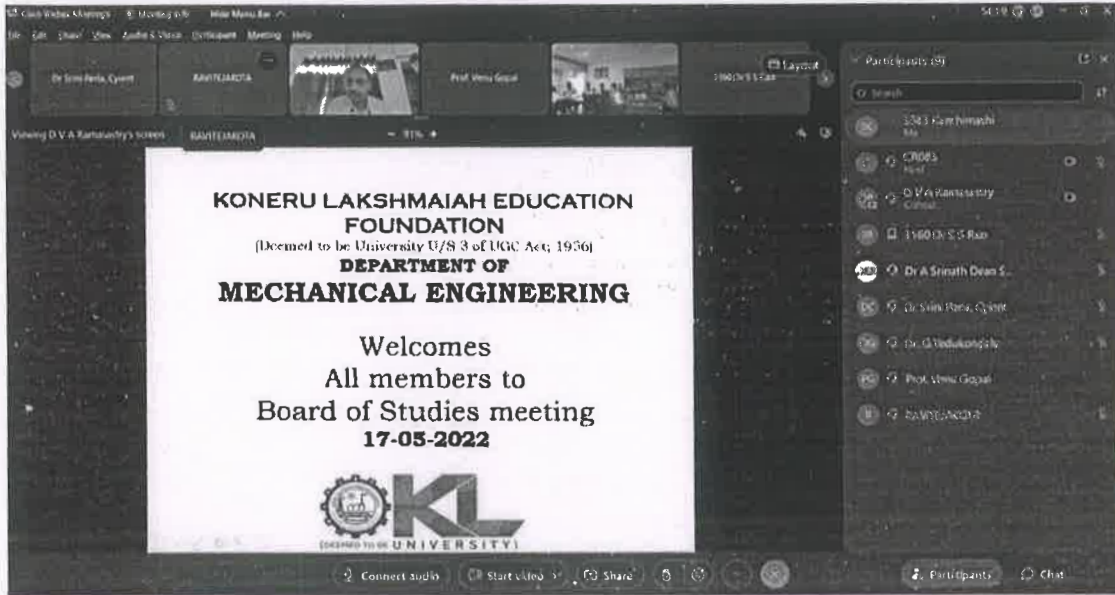
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2. It is resolved to propose the Global Certifications to be offered to the students during the A.Y.2022-23. It is resolved to approve the Global Certifications proposed. (Annexure-8b)



  
Dr. D.V.A. RamaSastry  
HOD-ME, Chairman-BOS  
Head, Department of Mechanical Engineering  
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### Annexures:

#### Annexure-1:

### K L E F

## Department of Mechanical Engineering

### Significant Events happened in the Department from November -2021 to till date

1.0	Honours Received
-----	------------------

1.1	Honours received by Faculty
-----	-----------------------------

Dept.	Name of the Faculty	Details of Honours	By
ME	Dr. B. Nageswara Rao	Recognized as Top Ranked Researchers in World 2% Researchers Category published by Elsevier	Elsevier
ME	Dr. A. Srinath	Achieved Bhartiya Gyan Ratna Award – Best Dean Of The Year	Global Scholars Foundation

1.2	Honours received by Students
-----	------------------------------

Dept.	Name of the Student	Details of Honours	By
ME	Mr. P Srimannarayana Raju (150070323)	Awarded Gold Medal at Regional Competition – South in the skill “Additive Manufacturing” held from 1-12-2021 to 4-12-2021	National Skill Development Corporation, India Skills 2021
ME	Mr. G. Durga Raj (190070025)	Participated and stood 229 <sup>th</sup> Position in 10M Rifle Men (ISSF) Civilian Championship and 460 <sup>th</sup> Position in 10M Rifle Men (ISSF) National Championship	64 <sup>th</sup> National Shooting Championship Competitions in RIFLE Events held at Bhopal, Madhya Pradesh
ME	Mr. P Srimannarayana Raju (150070323)	Awarded Gold Medal at India Skills Competitions 2021, held at Talkatora Indoor Stadium, New Delhi in the skill “Additive Manufacturing” held from 7-1-2022 to 10-1-2022. Also won Cash Prize of Rs.1.00 Lakhs and Full paid training and air expenses, boarding expenses to participate at World Skills Competitions to be held in Shanghai, China in August 2022	India Skills Competitions 2021, held at Talkatora Indoor Stadium, New Delhi 7-10 January 2022
ME	Mr. Dasaradha Ramaiah (180079016) Mr. Bhargava Ramaiah (180079018) Mr. Talari Vamsi (180079048)	Won First Prize with 50,000/- Cash Prize on IDEABOX Season-2, a National Level Idea Competition by RootCap Business Consultants in association with Center for Innovation, Incubation & Entrepreneurship (CIIE) on 11-1-2022	IdeaBox Season – 2 by RootCap Business Consultants in association with CIIE



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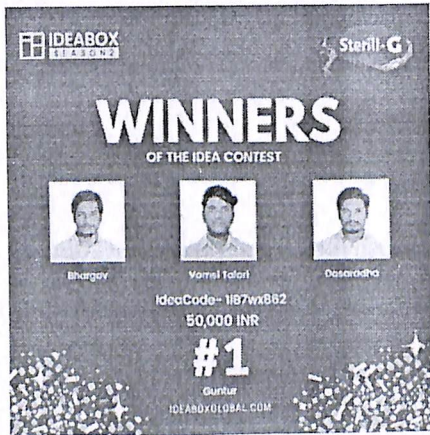
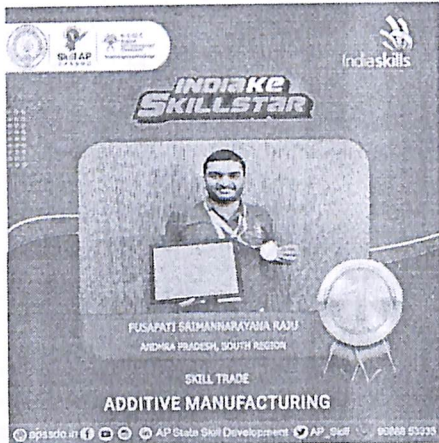
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ME	Mr. Rejeti Sriram Swaroop (190079022)	Achieved appreciation from TELUGU BOOK OF RECORDS with title " FIRST INDIAN STUDENT TO REGISTER 18 INTELLECTUAL PROPERTY RIGHTS" on 21st March 2022	TELUGU BOOK OF RECORDS
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## 1.3 Placements Details

Sl. No.	Company Name	No. of students selected	Package (in Lakhs)
1	Infosys through infyfq	1	3.36 LPA
2	Deloitte USI Consulting	8	7.76 LPA
3	TCS Ninja	10	3.36 LPA plus 50000 per annum HRA
4	TCS Digital	1	7 LPA
5	Cognizant Digital Nurture Phase-1 GenC	11	4 LPA
6	Cognizant Digital Nurture Phase-1 GenC Elevate	6	4.5 LPA

  
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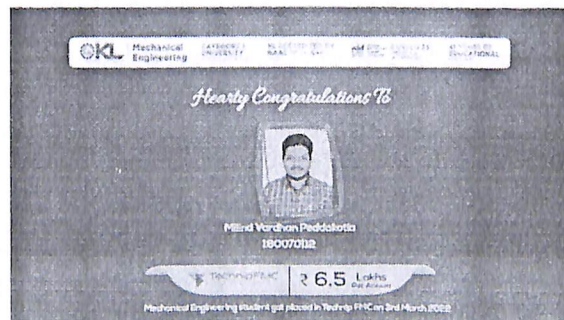
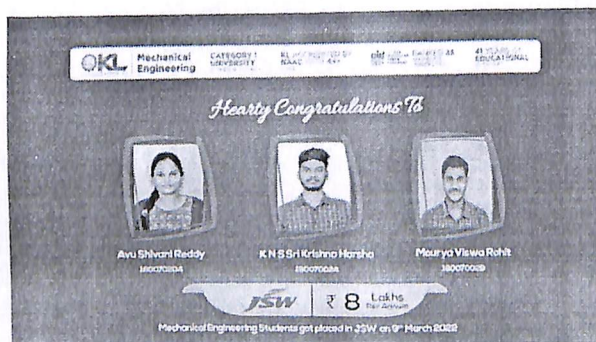
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7	Capgemini in Analyst job role	15	4.0 LPA
8	HCL Technologies	11	4.75 LPA
9	WIPRO	31	3.6 LPA
10	KPIT	1	3.6 LPA
11	EPAM	1	6.0 LPA
12	Hyundai MOBIS	2	5.0 LPA
13	EY Global Delivery Services (GDS)	3	4.5 LPA
14	TCS Ninja Phase-1	4	3.36 LPA
15	Accenture	6	4.5 LPA
16	Accenture (ASE)	2	6.5 LPA
17	Technip FMC	6 (4 B.Tech and 2 M.Tech)	4.26 LPA
		1 (M.Tech)	4.8 LPA
18	HCL	5	4.75 LPA
19	Hyundai Mobis Technical Center of India	3	4.5 LPA + benefits for Hyderabad location.
20	QuEST Global	6	3.25 LPA
21	BYJU'S - Bengaluru	2	10 LPA
22	Pin Click Property Management Pvt Ltd.,	9	4.8 to 5.16 LPA
23	ACC Concrete Limited	3	3.5 LPA
24	Turing minds	3	4 to 5 LPA
25	HCL Technologies	5	4.75 LPA
26	L&T Technology Services Ltd.	11	4.0 LPA
27	TekOne Location, Hyderabad	6	3.4 LPA
28	Technip FMC	1	6.75 LPA
29	Sri Kalahasthi pipes	5	2.4 LPA
30	JSW	3	8 LPA
31	KIA Motors	6	3 LPA
32	EY Global Delivery Services	3	6 LPA
33	Hyundai motors	1	6.65 LPA



*(Handwritten signature)*

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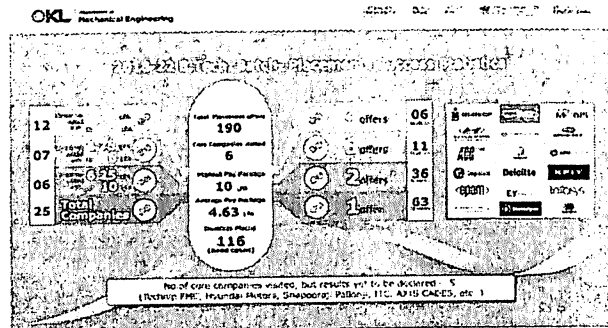


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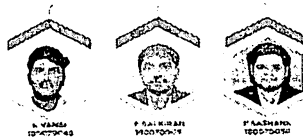
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6.0 Lakhs  
 Mechanical Engineering & Students are placed at the Analyst

## 1.4 Ph.D. awarded

S. No.	Dept.	Name of the Faculty/Scholar	Name of the Supervisor	Month and Year
1	ME	P. N. V. Bala Subrahmanyam	Dr. B. Nageswara Rao	December, 2021
2	ME	Ganesh Vijay More	Dr. P. Issac Prasad	December, 2021

## 2.0 Research Publications

### 2.1 Number of Papers Published by Faculty

S. No	Dept.	National Journals	International Journals
1	ME	-	57 in 2021 17 till date in 2022

### 2.2 Number of Papers Presented by Faculty

S. No	Dept.	National Conferences	International Conferences
1	ME	-	17 in 2021 1 till date in 2022

## 3.0 Consultancy, Patents And Citations

### 3.1 Consultancy

S. No.	Name of the Faculty	Sponsoring Agency	Work
1	Dr. K. V. Ramana	KLEF-ME	Investigation of Mechanical Properties (Metals and Non Metals) using Nano 25 KN UTM
2	Dr. S. N. Padhi	AICTE-SLA PROJECT	AICTE-Student Learning Assessment
3	Dr. S. S. Rao	AICTE-SLA PROJECT	AICTE-Student Learning Assessment
4	Dr. S.S. Rao	Seeram Innovation Private Ltd. Flat no 8, Sunrise Towers Kunchanapalli, Guntur-522501	Modeling of Table Top CNC Machine
5	Dr. B. Nageswararao	Seeram Innovation Private Ltd. Flat no 8, Sunrise Towers	Design Of Table Top CNC Machine

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		Kunchanapalli, Guntur-522501	
6	Dr. Y. V. Hanumantha Rao	Seeram Innovation Private Ltd. Flat no 8, Sunrise Towers Kunchanapalli, Guntur-522501	Thermal Analysis of Tool and work piece of Table Top CNC Machine
7	Dr. P. V. Chalapathi	Seeram Innovation Private Ltd. Flat no 8, Sunrise Towers Kunchanapalli, Guntur-522501	Numerical Simulation and Validation of Table Top CNC Machine
8	Dr. A. Srinath	APSSDC	consultancy rendered to APSSDC
9	Dr. G. Murali	Bhass Engineering pvt ltd, Hosur	Thermal Management of UPS EB Inverter using nano enhanced PCM
10	Dr. KV Narasimha Rao	Cleantech Consultants, Bangalore	Design of a Dryer using Heat Pump
11	Dr. K Ramakrishna	Cleantech Consultants, Bangalore	Validation of Duct design done for air-conditioning system for Commercial complex
12	Dr. P Issac Prasad	Cleantech Consultants, Bangalore	Estimation of CO2 emission from diesel generation sets and reduction methods
13	Dr. D V A Rama Sastry	Seeram Innovation Private Ltd. Flat no 8, Sunrise Towers Kunchanapalli, Guntur-522503	Smart Manufacturing of table top CNC machine tools
14	Dr. N. Tamiloli	Innovative Materials Pct. Ltd., Plot No-23 1P, Padma Nagar, Phase-II, Chintal, Hyderabad-500054.	Mechanical Testing of Reinforcement Composite Materials
15	N. Rajesh	Anantha Lakshmi Industries	Design and modeling of modular metal boxes and press tools
16	Dr. K V Durga Rajesh	Kollipara Electrodes Pvt. Ltd.	Design and model a table top machine to manufacture Consumable electrodes to use in Flux Shielded Metal Arc welding and Submerged Arc welding processes
17	Dr. P. Kasi Visweswara Rao	Kollipara Electrodes Pvt. Ltd.	Design and model a table top machine to manufacture Non-consumable electrodes to use in Tungsten Inert Gas (TIG) Welding Process
18	Dr. Abdul Munaf	R G Industries	Preparation of 3D printing

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19	Dr. Atul Bhattad	R G Industries	The influence of hybrid nanofluid on the performance parameter of plate heat exchanger
20	Dr. M. Nageswara Rao	R G Industries	Expert system through artificial intelligence techniques
21	Dr. S. Sudhakar Babu	R G Industries	Investigation on the influence of hybrid nanofluid of pipe in pipe heat exchanger

### 3.2 Patents

Patent Type	This Academic Year			Cumulative		
	Design	Utility	Plant	Design	Utility	Plant
Filed	53	0	0	158	5	0
Published	0	0	0	0	21	0
Granted	38	0	0	113	0	0
Licensed	0	0	0	0	0	0
<b>Total</b>	<b>91</b>	<b>0</b>	<b>0</b>	<b>271</b>	<b>26</b>	<b>0</b>

### 4.0 Seminars / Workshops

#### 4.1 Workshops / Seminars Attended by the Department through Virtual Mode

S. No.	Dept.	No. of Faculty	Seminar / Workshop / Short Term Course
1	ME	All Course Coordinators	Faculty Development Training Programme on "Preparing Effective Course Handouts" for course coordinators of engineering courses from 8th to 10th November 2021 organized by Academic Staff College - K L E F

#### 4.2 Conferences/workshop/seminar Conducted by the Department through Virtual/Offline Mode

S. No.	Dept.	Conference/Workshop/FDP
1	ME	5 days FDP on "Thermal Analysis in Multi-Phase Systems" by Dr. V. Teja Reddy and Dr. Sudev Das, Assistant Professors, Department of Chemical Engineering, NIT Calicut from 1 <sup>st</sup> to 6 <sup>th</sup> December, 2021.
2	ME	5 days FDP on "Product Design and Modeling using CATIA" by Mr. U. Sumanth, Dassault Systems Trainer, from APSSDC from 6 <sup>th</sup> to 10 <sup>th</sup> December, 2021.
3	ME	One day Seminar on "PUMPS MANUFACTURING – A CASE STUDY" by Mr. K. Krishna Kumar, General Manager (Production), Kumar Pumps on 30-12-2021.
4	ME	Conducted Mech – Project Expo (B.Tech & M.Tech) on 07-03-2022 from 11:00 A.M

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		onwards at SAC Ground Floor.
5	ME	Organized a National Level Technical Fest – YANTRIK '22 based on the theme “Adopt-Learn-Transform” on 7 <sup>th</sup> and 08 <sup>th</sup> March 2022.

Department of Mechanical Engineering

**5 days FDP**

## THERMAL ANALYSIS IN MULTI-PHASE SYSTEMS

1<sup>st</sup> to 6<sup>th</sup> Dec, 2021

Resource Persons:  
 Dr. Teja Ravi Vakamala  
 Assistant Professor  
 Department of Chemical Engineering  
 NIT Calicut.

Dr. Sudev Das  
 Assistant Professor  
 Department of Chemical Engineering  
 NIT Calicut.

Department of Mechanical Engineering

**5 days FDP**

## PRODUCT DESIGN AND MODELING USING CATIA

6<sup>th</sup> to 10<sup>th</sup> Dec, 2021

Resource Person:  
 Mr. U. Sumanth  
 Director Systems Training  
 A/SSIC

FDP coordinators  
 Dr. SN. Pooja & Dr. Suresh

10AM to 12.05 PM and 2.05 PM to 4.05 PM daily

Department of Mechanical Engineering

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 S.A.C Hall  
 7<sup>th</sup> March 2022  
 from 11:00 am onwards

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## 07<sup>th</sup> & 08<sup>th</sup> March 2022

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### 5.0 Guest Lectures/Webinar

### 5.1 Guest Lectures/Webinar Arranged through Offline Mode

S. No.	Dept.	Name of the Guest Faculty	Date	On Topic
1	ME	Dr. Suresh Alapati, School of Mechanical and Mechatronics Engineering, Kyungsung University	19-01-2022	Alumni Guest lecture on “Simulation of Whirling Instabilities of an Elastic Rod in a Viscous Fluid using the Lattice Boltzmann Method Combined with Finite Element Method”
2	ME	Dr. B. Srinivasa Murthy,	12-03-2022	Guest Lecture on “Case

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		Former General Manager, Engineering Design Centre, Group Antolin India Private Limited		Studies on Industrial applications of Geometric Dimensioning and Tolerancing"
3	ME	Mr. S. Chandrasekhar, Chennai	24-03-2022	Guest Lecture on "Mechanics of structures in Automobiles"
4	ME	Mr. K. Pavan Sai, Technical Specialist (Vehicle Dynamics), Continental Ag.	28-03-2022	Alumni Guest Lecture on "Motor cycle control functions for 2 wheels and power sports"
6.0 NSS Activities conducted through Virtual Mode				
S. No.	Dept.	Details of NSS Activities		Conducted On
1	ME	Conducted Free medical camp as a part of Special camp in Revendrapadu village from ME Dept., NSS Unit-3 by Top star hospital and Max vision Eye Hospital		20-04-2022

కేఎల్ఎఫ్ ఆధ్వర్యంలో వైద్య పరీక్షలు  
 దుగ్గిరాల(తెనాలిటౌన్): మండలంలోని కేవేంద్ర  
 పాడు గ్రామ పంచాయతీ కార్యాలయం ఆవర  
 ణలో కేఎల్ యూనివర్సిటీ మెకానికల్ డిపార్ట్  
 మెంట్, ఎన్ఎస్ఎస్ యూనిట్-3 ఆధ్వర్యంలో  
 బుధవారం ఉచిత వైద్యశిబిరం నిర్వహించారు.  
 విజయవాడ టాప్ స్టార్ హాస్పిటల్, మాక్స్విజన్  
 కంటి వైద్యశాల ఆధ్వర్యంలో ఏర్పాటైన శిబిరం  
 లో వైద్యులు రోగులకు కంటిపరీక్షలు, బీపీ,  
 షుగర్ పరీక్షలు చేశారు. ఉచితంగా మందులు  
 పంపిణీ చేశారు. గ్రామసర్పంచ్ పలుకూరి  
 మేరిమ్మ, వైఎస్సార్సీపీ నాయకులు శామ్మేలు,  
 ఎన్ఎస్ఎస్ యూనిట్ అధికారులు పాల్గొన్నారు.

**సాక్షి** Thu, 21 April 2022  
<https://epaper.saksh>

**ఈనాడు**  
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కేఎల్ఎఫ్ విద్యార్థుల సేవ: కేవేంద్రపాడు (దుగ్గిరాల):  
 కేఎల్ఎఫ్ చెందిన మెకానికల్ విభాగం ఎన్ఎస్ఎస్  
 యూనిట్-3 విద్యార్థుల ఆధ్వర్యంలో బుధవారం కేవేంద్రపా  
 డులో వైద్య శిబిరం జరిగింది. పలువురు వైద్యులు శిబిరానికి  
 వచ్చిన ప్రజలకు నేత్ర, రక్తపోటు, చక్కెర నిర్ధారణ పరీక్షలు  
 చేశారు. అవసరమైన వారికి ఉచితంగా మందులు ఇచ్చారు.  
 సర్పంచి పలుకూరి మేరిమ్మ, జాతీయ సేవా విభాగం అధికా  
 రులు, విద్యార్థులు పాల్గొన్నారు.

Date : 21/04/2022 EditionName :  
 ANDHRA PRADESH( AMARAVATI  
 GUNTUR ) PageNo :



**BOS Chairman**  
 Head, Department of Mechanical Engineering  
 K L (Deemed to be University)  
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### Annexure-2(a) DAC-1 minutes

K L E F

DEPARTMENT OF MECHANICAL ENGINEERING

MINUTES OF DEPARTMENT ACADEMIC COMMITTEE (DAC)

KLEF/ ME/ IQAC - ACAD/AQ.5/ DCMs

Date: 09-02-2022

The 21<sup>st</sup> Department Academic Committee (DAC) Meeting was conducted at 1:30 P.M. on 09/02/2022 in HOD Cabin.

#### Agenda of the Meeting:


1. To discuss on the feedback given by the stake holders on the curriculum of 2022-23
2. To discuss on the inputs given by the course coordinators of 2022-23 syllabus, to be put forth in BOS
3. To approve the value-added courses offered in 2021-22 Even Sem
4. To propose the SAC activities for 2022-23 Odd Sem
5. To approve the revisions in syllabus proposed for M. Tech Machine Design for 2022-23 admitted batch.
6. Any other points with the permission of the Chair.

#### The following members were present:

1. Dr. D. V. A. Rama Sastry, Associate Professor & HoD, Chairman-DAC
2. Dr.K.RamaKrishna, Dean Quality, Member
3. Dr. A.Srinath, Dean Skilling, Member
4. Dr. S. S. Rao, Professor & PG Coordinator & R&M Group Head, Member
5. Dr. Y.V.Hanumantha Rao, Associate Professor & CFD Group Head, Member
6. Dr. P. Kasi V. Rao, Associate Professor & Deputy HoD, Member
7. Dr. G.Diwakar, Professor, IV Year Coordinator, Member
8. Dr. K. Lokesh, Associate Professor, Professor I/C Exams, Member
9. Mr. G. R. Sanjay Krishna, Associate Professor Professor I/C Counselling, Member
10. Mr. K. M. V. Ravi Teja, Assistant Professor II & III Year Coordinator, Member
11. Mrs. T. Kanthimathi, Assistant Professor & Professor I/C Academics, Member

#### Minutes:

1. HOD welcomed all the members to the meeting and presented the agenda items before the members.
2. Upon discussing the feedback given by the Y20 students to explain the importance of specialization courses before the starting of the semester, it is resolved to conduct an orientation on the specializations offered by the department earlier to the start of the semester, so that students can choose the specialization of their interest.

  
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3. Upon discussing the feedback given by Y20 students to make mechanical vibrations as core course instead of elective, it is resolved to include vibrations in Dynamics course which covers 90% of GATE syllabus
4. Upon discussing the feedback given by Y19 students to offer Autotronics and Automobile Engineering Courses in III-I and Automobile Engine Design and Alternate Energy sources in III-II, it is resolved to propose the changes in the Upcoming BOS.
5. Following are the proposals made based on the feedback given by stake holders
  - i. Academic peer Dr. K.S.S.Harish include basic concepts in thermodynamics and fluid mechanics it is propose the revise the syllabus of these courses
  - ii. Alumni Gampa Srinath suggested to include courses on industrial engineering and Production Planning. It is resolved to include course on production planning for Y21 and Y22 admitted batch students
  - iii. Alumni K.Lakshmi Narayana suggested to introduce Auto cad Design, it is resolved that AutoCAD is taught in Engineering Graphics course.
  - iv. Upon discussing the feedback given by Dr.K.Lokesh, in the course closure minutes and CO attainment data it is resolved to propose to include 1 tutorial in Fluid Mechanics & Hydraulic Machines Course, in BOS.
  - v. Upon discussing the feedback given by Mr.S.Ramesh, in the course closure minutes, to provide more hands on sessions for Machine learning course, it is resolved to propose the requirement in BOS.

After an elaborate discussion on the feedback given by the stakeholders on curriculum and CO-PO attainment data of earlier semester courses to Y22 admitted batch UG students, following are proposals made

- To offer Fluid Mechanics and Hydraulic Machines with 3-1-2-0 structure in II-I semester
- To review the syllabus of 21ME4120-Instrumentation & Control and 22ME3114-Industry 4.0 & Cyber Physical Systems.
- To merge Heat Power Engineering Course into Analysis of thermal Systems(ATS)and offer as one course with 3-1-0-4 L-T-P-S.
- To change the syllabus of Numerical Computation for Mechanical Engineers course and offer it in 4<sup>th</sup> semester with 3-0-2-0 structure .

It is resolved to propose the above said changes in the upcoming BOS.

8. It is resolved to approve the list of activities proposed for SAC

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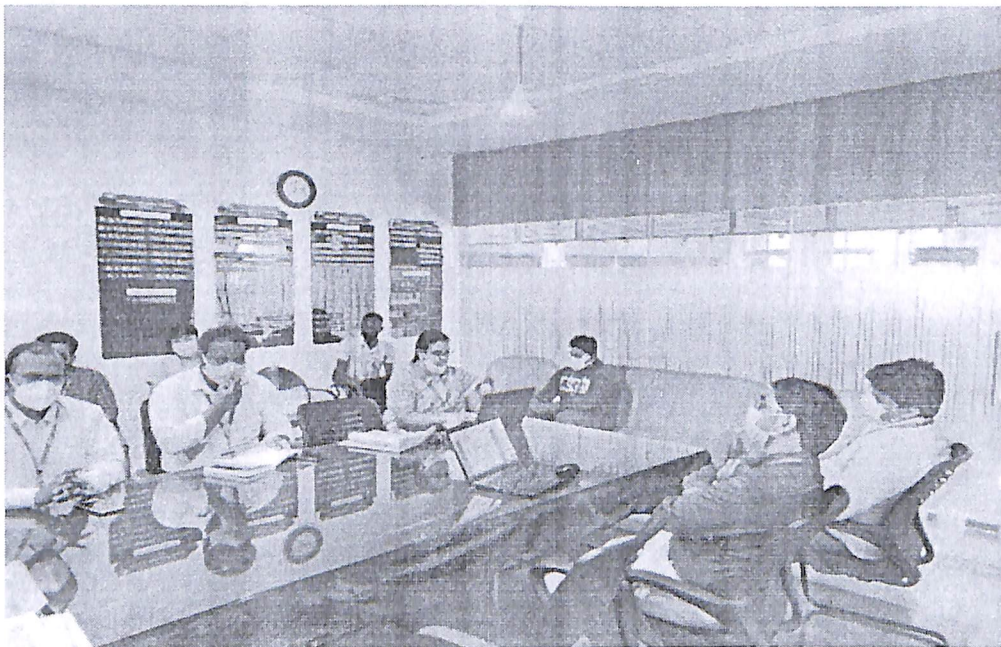
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9. It is resolved to approve the list of value added courses proposed.
10. It is resolved to approve pre Ph.D courses for the A.Y. 2022-23
11. It is resolved to change the syllabus for the following M.Tech-Machine Design courses as proposed by the group heads upon feedback received from course coordinators with effect from 2022-23 admitted batch
  - Advanced Mechanisms
  - Modelling & Analysis-II (FEM)



(Dr. D.V.A. Ramasastry)  
Chairman – DAC

**Head, Department of Mechanical Engineering  
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### Annexure-2(b)

### DAC-2 minutes

### K L E F

### DEPARTMENT OF MECHANICAL ENGINEERING

### MINUTES OF DEPARTMENT ACADEMIC COMMITTEE (DAC-2)

KLEF/ ME/ IQAC - ACAD/AQ.5/ DCMs

Date: 12-03-2022

The 21<sup>st</sup> Department Academic Committee (DAC-2) Meeting was conducted at 1:30 P.M. on 12/03/2022 in HOD Cabin.

#### Agenda of the Meeting:

7. To discuss on the feedback given by the stake holders on the curriculum of 2022-23
8. To discuss on the inputs given by the Group Heads on 2022-23 syllabus, to be put forth in BOS
9. Any other points with the permission of the Chair.

#### The following members were present:

12. Dr. D. V. A. Rama Sastry, Associate Professor & HoD, Chairman-DAC
13. Dr. S. S. Rao, Professor & PG Coordinator & R&M Group Head, Member
14. Dr. Y.V.Hanumantha Rao, Professor & CFD Group Head, Member
15. Dr. S.N. Padhi, Professor & D & M Group Head, Member
16. Dr. P. Kasi V. Rao, Associate Professor & Deputy HoD, Member
17. Dr. G.Diwakar, Professor, IV Year Coordinator, Member
18. Dr. K. Lokesh, Associate Professor, Professor I/C Exams, Member
19. Mr. G. R. Sanjay Krishna, Associate Professor Professor I/C Counselling, Member
20. Mr. K. M. V. Ravi Teja, Assistant Professor II & III Year Coordinator, Member
21. Mrs. T. Kanthimathi, Assistant Professor & Professor I/C Academics, Member

#### Minutes:

6. HOD welcomed all the members to the meeting and presented the agenda items before the members.
7. Following is the feedback given by Stake Holders on curriculum
  - Mr.K.Krishna Kumar, Sri lakshmi Gnapathi Engg works(Kumar pumps), suggested to involve students in exploring syllabus by giving topics of syllabus in each subject rather than lecturers explaining the subject. It is resolved to conduct flipped learning classes for students to encourage self learning concepts.

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- Dr.G.Naga Srinivasulu, Professor, NIT Warangal, suggested to include Gas turbine cycles in 21ME2210- Analysis of thermal systems course. And also suggested to rewrite the convection heat transfer topics in 21ME3115 course. It is resolved to propose the suggested changes in the upcoming BOS.
- Dr.Srikanth K, professor, NIT Warangal, Suggested to include "Kinematic Synthesis(four bar chain)" topic in the course 21ME2211 )Kinematic & Machines. He also suggested to refer "Mechanical Vibrations by Prof. R.V.Chalam" text book for 21ME3118 Dynamics of Machines course. It is resolved to propose the suggested topics to be included in the course in the upcoming BOS.
- Dr.Suresh Babu, professor in NIT Warangal, suggested to separate 21ME3113 Machine Design course as two separate courses considering the static and dynamic loading conditions, and also suggested to include governors concept in 21ME3118 Dynamics of Machines course. He suggested to give practical exposure to students on the topic covered in this course.

It is resolved to propose the suggested changes in the upcoming BOS.

- Dr. A.Subhananda Rao, DG & Chief controller-DRDO, Hyderabad suggested to have
  - i. more skilling for hands on experience.
  - ii. teaching /learning methods to be oriented towards real time problem solving in industry/society.
  - iii. orientation of course content towards Industry 4.0.
  - iv. General degree without tagging specialization is advisable for student's career point of view.
  - v. For each stream one subject covering all advanced concepts in brief is advisable

It is resolved to propose the suggested changes in the upcoming BOS.

3. Upon discussing with group heads and DAC members, it is resolved to propose the mapping of courses with the informal learning activities like Samyak, Yantrik etc. also the softwares required for the skilling courses to be imparted to Y22 admitted are also proposed.
4. It is resolved to propose the MOOCS courses and value added courses for Y21 and

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Y22 admitted batch students.

5. It is resolved to approve the courses for Energy & CFD specialization for Y22 admitted batch students
6. Upon discussing the feedback given by course coordinator, it is resolved to change the L-T-P-S of the course 19ME4076 from 2-0-2-0 to 3-0-0-0.



(Dr. D.V.A. Ramasarthy)  
Chairman-DAC

Head, Department of Mechanical Engineering  
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## Annexure-3(a)

### Y22 Admitted Batch-COURSE STRUCTURE

#### 1. Program structure (with all Courses)containing following categorization

Course Code	Course Name	Course Category	L	T	P	S	CR	Pre-Requsite	New Course/ Revised Course/ Retained Course	Changes Proposed by	Justification
20UC1 101	Integrated Professional English	HSS	0	0	4	0	2	Nil	Retained	No Changes	-
20UC1 202	English Proficiency	HSS	0	0	4	0	2	Nil	Retained	No Changes	-
21UC2 103	Essential Skills for Employability	HSS	0	0	4	0	2	Nil	Retained	No Changes	-
21UC2 204	Corporate Readiness Skills	HSS	0	0	4	0	2	Nil	Retained	No Changes	-
21UC0 010	Universal Human Values & Professional Ethics	HSS	2	0	0	0	2	Nil	Retained	No Changes	-
20UC0 007	Indian Heritage and Culture	HSS	2	0	0	0	0	Nil	Retained	No Changes	-
21UC0 008	Indian Constitution	HSS	2	0	0	0	0	Nil	Retained	No Changes	-
20UC0 009	Ecology & Environment	HSS	2	0	0	0	0	Nil	Retained	No Changes	-
21UC0 011	Gender Sensitization	HSS	2	0	0	0	2	Nil	Retained	No Changes	-
20MT1 101	Mathematics for Computing	BS	2	2	0	2	4.5	Nil	Retained	No Changes	-
21MT2 102	Mathematics for Engineers	BS	2	1	0	0	3	Nil	Retained	No Changes	-
22ME2 209	Numerical Computation for	BS	3	0	2	0	4	Nil	70% of Syllabus Revised	DAC members	As per the feedback of academic peer to Cover the topics of

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	Mechanical Engineers											MAT lab necessary for the skill development
21UC1203	Design Thinking and Innovation	BS	0	0	4	0	2	Nil	Retained	No Changes	-	
21PH1010	Mechanics (Science Elective - 1)	BS	3	1	0	0	4	Nil	Retained	No Changes	-	
21CY1001	Chemistry (Science Elective - 2)	BS	3	0	2	0	4	Nil	Retained	No Changes	-	
21UC3105	Problem Solving Skills-I	BS	0	0	2	2	1.5	Nil	Retained	No Changes	-	
21UC3206	Problem Solving Skills-II	BS	0	0	2	2	1.5	Nil	Retained	No Changes	-	
21SC1101	Computational Thinking for Structured Design	ES	3	0	2	6	5.5	Nil	Retained	No Changes	-	
21ME1103	Design Tools Workshop - I	ES	0	0	4	0	2	Nil	Retained	No Changes	-	
21SC1209	Design Tools Workshop - II	ES	0	0	4	0	2	Nil	Retained	No Changes	-	
21SC1202	Design of Data Structures	ES	3	0	2	4	5	21SC1101	Retained	No Changes	-	
21ME1002	Engineering Graphics & 2D Modelling	ES	1	0	4	0	3	Nil	Retained	No Changes	-	
21ME2104	3D Modeling and Physical Prototyping (Workshop & 3D Modeling S/W)	ES	0	0	4	0	2	Nil	Retained	No Changes	-	

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21EE2205	Circuits and Electronics	ES	3	0	2	0	4	Nil	Retained	No Changes	-
21ME2105	Thermodynamics	ES	3	0	0	0	3	Nil	Retained	No Changes	-
21PH2007	Materials technology	ES	2	0	0	0	2	Nil	Retained	No Changes	-
22ME2106	Fluid Mechanics & Hydraulic machines	PC	3	1	2	0	5	Nil	Retained	No Changes	-
22ME2210	Analysis of Thermal Systems (with CFD & (Linked to Project))	PC	3	1	0	4	5	21ME2105	70% syllabus Revised	DAC members & Industry persons	As per the feedback of industry person to Covers topics on gas turbines, steam turbines and pumps for the skill development
21ME3115	Heat Transfer	PC	3	0	2	0	4	Nil	Retained	No Changes	-
21ME2101	Mechanics of Solids	PC	3	0	2	0	4	21PH1010	Retained	No Changes	-
21ME2208	Mechanical Engineering Design & Innovation (Analysis S/W)	PC	2	0	0	4	3	21ME2101	Retained	No Changes	-
21ME2211	Kinematics of Machines (with Adams s/w)	PC	2	0	2	0	3	21PH1010	Retained	No Changes	-
21ME3118	Dynamics of Machines	PC	2	0	0	0	2	21PH1010	Retained	No Changes	-
21ME3113	Machine Design (Linked to Project)	PC	3	1	0	4	5	21ME2208	Retained	No Changes	-
21ME2107	Manufacturing Processes	PC	2	0	2	0	3	Nil	Retained	No Changes	-
21ME2212	Manufacturing Technology (Linked to Project)	PC	2	0	2	0	3	Nil	Retained	No Changes	-

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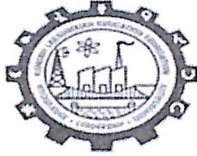
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21ME3 116	Optimization Techniques	PC	2	0	0	0	2	Nil	Retained	No Changes	-
22ME4 120	Instrumentation & Control	PC	2	0	2	0	3	Nil	25% Syllabus revised	DAC Members	Based on the feedback of faculty to Cover the concepts on measurement of various instruments
22ME3 119	Robotics	PC	2	0	0	0	2	Nil	100% New Course	DAC members	Based on the feedback of faculty to Cover the basics concepts of Robotics
22ME3 114	Industry 4.0 & Design of Cyber Physical Systems	PC	2	0	0	4	3	Nil	80% Syllabus Revised	Faculty	As per the feedback of faculty to Cover the topics related to various new technology and imparts skilling
21ME4 051	THEORY OF ELASTICITY AND PLASTICITY	Engineer ing Design Elective	3	0	0	0	3	21M E220 8	Retained	No Changes	-
21ME4 052	FINITE ELEMENT METHOD		2	0	2	0	3	21PH 1010	Retained	No Changes	-
21ME4 053	MODELIN G ANALYSIS & DESIGN OF ROBOTIC SYSTEMS		2	0	2	0	3	NIL	Retained	No Changes	-
21ME4 054	CREEP, FATIGUE AND FRACTURE MECHANICS		3	0	0	0	3	21M E220 8	Retained	No Changes	-
21ME4 055	ADVANCE D STRENGTH OF MATERIAL S		2	0	2	0	3	21M E210 1	Retained	No Changes	-
21ME4 056	MECHANICS OF COMPOSIT		3	0	0	0	3	21M E220 8	Retained	No Changes	-

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	E MATERIAL S										
21ME4 057	SUSTAINABLE DESIGN & SOCIAL INNOVATION IN ENGINEERING DESIGN		1	0	4	0	3	21M E2208	Retained	No Changes	-
21ME4 061	MODERN MANUFACTURING PROCESSES		2	0	2	0	3	21M E2107	Retained	No Changes	-
22ME4 062	MACHINE TO MACHINE COMMUNICATION		2	0	2	0	3	NIL	100% New Course	BOS Members	Enables advanced learning of machine language
21ME4 063	ADVANCED MATERIALS		3	0	0	0	3	NIL	Retained	No Changes	-
21ME4 064	FLEXIBLE MANUFACTURING SYSTEMS		2	0	2	0	3	NIL	Retained	No Changes	-
21ME4 065	ROBOTICS & INDUSTRIAL AUTOMATION		2	0	2	0	3	NIL	Retained	No Changes	-
21ME4 066	REVERSE ENGINEERING & RAPID PROTOTYPING	SMART MANUFACTURING ELECTIVE	3	0	0	0	3	NIL	100% New Course	BOS Members	Helps to understand reverse engineering and creating prototypes for skill development
21ME4 067	SUSTAINABLE DESIGN & SOCIAL INNOVATION IN SMART MANUFACTURING		1	0	4	0	3	NIL	Retained	No Changes	-
21ME4 101	HYDROGEN AND		2	0	2	0	3	NIL		No Changes	-

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	FUEL CELL TECHNOLOGIES							Retained		
21ME4102	SOLAR ENERGY TECHNOLOGIES		2	0	2	0	3	NIL	Retained	No Changes -
21ME4103	ADVANCED ENERGY STORAGE SYSTEMS		2	0	2	0	3	NIL	Retained	No Changes -
21ME4104	ENERGY AUDIT AND MANAGEMENT	ENERGY & CFD	3	0	0	0	3	NIL	Retained	No Changes -
21ME4105	COMPUTATIONAL FLUID FLOW AND HEAT TRANSFER -FDM APPROACH		2	0	2	0	3	NIL	Retained	No Changes -
21ME4106	CFD FOR COMPRESSIBLE AND INCOMPRESSIBLE FLOWS		2	0	2	0	3	NIL	Retained	No Changes -
22ME2107	THERMAL MANAGEMENT OF ELECTRIC AND ELECTRONIC SYSTEMS		3	0	0	0	3	NIL	100% New Course	Academic peers Covers topics on electric and electronic systems on thermal management
22ME4071	Robot Motion Planning, dynamics and Control		2	0	2	0	3	NIL	100% New Course	BOS Members Covers topics on dynamics of robots
22ME4072	Robot Manipulation and Wheeled Mobile Robots	ROBOTICS & MECHANICS	2	0	2	0	3	NIL	100% New Course	BOS Members Covers topics on manipulation and wheel mobile robots
22ME4	Mechatronics		2	0	2	0	3	NIL	100%	BOS Covers topics on

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073	nics : Fundamentals and Core Concepts							New Course	Members	mechatronics fundamentals	
22ME4 074	Artificial Intelligence for Robotics		2	0	2	0	3	NIL	100% New Course	BOS Members	Covers topics on Artificial Intelligence of robotics
22ME4 075	Human Machine Interface & Brain Machine Interface		2	0	2	0	3	NIL	100% New Course	BOS Members	Covers topics on Human Machine Interface & brain Machine interface
22ME4 076	Computer Vision & Applications		2	0	2	0	3	NIL	100% New Course	BOS Members	Covers topics on Computer Vision & applications
22ME4 077	Autonomous Vehicles & Automotive Electronics		2	0	2	0	3	NIL	100% New Course	BOS Members	Covers topics on Autonomous Vehicles
22ME4 081	Power Train Design For Electric Vehicle		2	0	2	0	3	NIL	100% New Course	BOS Members	Covers topics on power train design for electric vehicles
22ME4 082	Solar Energy Technologies	MODERN VEHICLE TECHNOLOGY	2	0	2	0	3	NIL	100% New Course	BOS Members	Covers topics on solar energy technology
22ME4 083	Vehicle dynamics		2	0	2	0	3	NIL	100% New Course	BOS Members	Covers topics on dynamics of vehicles
22ME4 084	Thermal Management Of Electric And Electronic Systems		2	0	2	0	3	NIL	100% New Course	BOS Members	Covers topics on electric and electronic systems on thermal management
22ME4 085	AI and IOT For		2	0	2	0	3	NIL	100% New	BOS Members	Covers topics on AI and IOT for Electric

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	Electric Vehicle							Course		Vehicle	
22ME4086	Communication Protocols & Testing Of Electric Vehicle		2	0	2	0	3	NIL	100% New Course	BOS Members	Covers topics on Communication protocols
22ME4087	Autonomous Vehicles & Automotive Electronics		2	0	2	0	3	NIL	100% New Course	BOS Members	Covers topics on Autonomous Vehicles
20ME40B4	Robotics	OE	3	0	0	0	3	NIL	Retained	No Changes	-
20ME40B5	Mechatronics	OE	3	0	0	0	3	NIL	Retained	No Changes	-
20ME40B6	Operations Research	OE	3	0	0	0	3	NIL	Retained	No Changes	-
20ME40B7	Hybrid Electric vehicles	OE	3	0	0	0	3	NIL	Retained	No Changes	-
20ME40B8	Industry 4.0	OE	3	0	0	0	3	NIL	Retained	No Changes	-
20ME40B9	Industrial Automation	OE	3	0	0	0	3	NIL	Retained	No Changes	-
20ME40C1	Logistics & Supply chain management	OE	3	0	0	0	3	NIL	Retained	No Changes	-
20ME40C2	Total Quality Management	OE	2	0	2	0	3	Nil	Retained	No Changes	-
20ME40C3	Smart Mobility	OE	2	0	2	0	3	Nil	Retained	No Changes	-
20ME40C4	Managerial Economics for Engineers	OE	2	0	2	0	3	Nil	Retained	No Changes	-

  
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OE	Management Elective( OE-4)- Operations management	OE	3	0	0	0	3	Nil	Retained	No Changes	-
OE	Foreign Language Elective( OE-5)	OE	2	0	0	0	2	Nil	Retained	No Changes	-
20IE2050	Social Internship	Project	0	0	0	8	2	Nil	New Course	BOS members	-
20IE3050	Technical Internship	Project	0	0	0	8	2	Nil	Retained	No Changes	-
21IE4042	Industry Internship	PR	0	0	0	4	1	Nil	Retained	No Changes	-
21IE2046	Project Based Learning - 1	PR	0	0	0	6	1.5	Nil	Retained	No Changes	-
21IE2047	Project based learning - 2	PR	0	0	0	6	1.5	Nil	Retained	No Changes	-
20IE3150	Mid Grad Capstone Project - I	Project	0	0	0	8	2	Nil	Retained	No Changes	-
20IE3250	Mid Grad Capstone Project - II	Project	0	0	0	8	2	Nil	Retained	No Changes	-
20IE4150	Capstone Project - I	Project	0	0	0	24	6	Nil	Retained	No Changes	-
20IE4250	Capstone Project - II	Project	0	0	0	24	6	Nil	Retained	No Changes	-
20IE4050	Practice School	Project	0	0	0	24	6		Retained	No Changes	-

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								Nil			
201E40 51	Internship	Project	0	0	0	24	6	Nil	Retained	No Changes	-

Percentage of Syllabus change =  $19.55 \times 100 / 99 = 19.74\%$

Percentage of Courses focusing on Employability =  $5 \times 100 / 99 = 5.05$

Percentage of Courses focusing on Entrepreneurship =  $5 \times 100 / 99 = 5.05$

Percentage of Courses focusing on Skill Development =  $87 \times 100 / 104 = 89.89$

  
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### Annexure-4

Annexure-4(a)

#### 22ME2210- Analysis of Thermal Systems

Existing Syllabus(L-T-P-S: 2-0-0-4)	New Syllabus(L-T-P-S:3-0-0-4)
<p><b>Pure Substance:</b> Definition of Pure substance, Ideal Gases and ideal gas mixtures, Real gases and real gas mixtures, Compressibility charts- Properties of two phase systems - Const. temperature and Const. pressure heating of water; Definitions of saturated states; P-v-T surface; Use of steam tables; Saturation tables; Superheated tables; Identification of states &amp; determination of properties, Mollier's chart.</p> <p><b>Vapour Power Cycles:</b> Rankine cycle, Effect of pressure and temperature, Regenerative cycle, Binary vapour cycle.</p> <p><b>Refrigeration &amp; Air conditioning:</b> Methods of refrigeration, Refrigerator &amp; heat pump, Reversed Carnot and Bell-Coleman cycles, Refrigerating effect, COP, Vapour compression and vapour absorption refrigeration systems.</p> <p><b>Psychrometry:</b> Properties of moist air, Psychrometric processes, use of psychrometric chart, Air conditioning systems for comfort, Infiltration and Indoor Air Quality</p> <p><b>Heating and Cooling load calculations:</b> Solar radiation, heat transfer through building structures, Winter and summer load calculations</p>	<p><b>Vapour Power Cycles:</b> Pure Substance definition, P-v-T surface; Use of steam tables; Saturation tables; Superheated tables; Identification of states &amp; determination of properties, Mollier's chart. Rankine cycle, Effect of pressure and temperature, Regenerative cycle, Binary vapour cycle.</p> <p><b>IC Engines:</b> Classification of I.C. Engines, working principles of S.I. and C.I. Engines (both 4 stroke and 2-stroke), combustion in S.I and CI engines. Parameters of performance - measurement of cylinder pressure, fuel consumption, air intake, exhaust gas composition, Brake power – Determination of frictional losses and Indicated power – Performance test – Heat balance sheet and chart.</p> <p><b>Gas turbines:</b> Overview of Gas turbines, Closed and open Brayton cycle gas turbines, Analysis of closed cycle gas turbine, turbine Efficiencies, Gas turbine cycle with intercooling, reheat and regeneration.</p> <p><b>Jet propulsion:</b> Turbo jet, Turbo prop, ram jet and Pulse jet engines, Rocket engines, principle of working, Thrust, work and propulsive efficiency</p> <p><b>Introduction to Unconventional Energy Sources:</b> Solar, Wind, Biomass, Geothermal, OTEC energy sources.</p> <p><b>Refrigeration &amp; Air conditioning:</b> Methods of refrigeration, Refrigerator &amp; heat pump, Reversed Carnot and Bell-Coleman cycles, Refrigerating effect, COP, Vapour compression and vapour absorption refrigeration systems.</p>

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Annexure-4(b)

### 22ME2107- Numerical Computation for mechanical Engineers

Existing Syllabus (L-T-P-S: 3-0-2-0)	New Syllabus(L-T-P-S:3-0-2-0)
<p>Covers elementary programming concepts, including variable types, data structures, and flow control. Provides an introduction to linear algebra and probability.</p> <p>Numerical methods relevant to Mechanical Engineering, including approximation (interpolation, least squares, and statistical regression), integration, solution of linear and nonlinear equations, and ordinary differential equations.</p> <p>Presents deterministic and probabilistic approaches. Uses examples from Mech.Egg, particularly from robotics, dynamics, and structural analysis.</p> <p>Assignments require MATLAB programming</p>	<p><b>Various Methods of Analysis</b> – Exact Method – Approximate Method (Variational Approach &amp; Weighted Residual Method: Collocation method, Subdomain method, Least Square method, Galerkin method) - Finite Difference Method – Finite Element Formulation - Solution Techniques - Problems of axially loaded beams and beam bending.</p> <p><b>Application to Scalar Problems</b> – Governing equations for boundary value problems – Heat Transfer (one &amp; two-dimensional steady state heat transfer problems) – Torsion of non-circular section – Fluid flow problem (Stream function approach &amp; Potential function approach)</p> <p><b>Dynamics and Stability Analysis</b> – Governing Equations – Longitudinal Vibration – Bar of varying cross-section – Lateral Vibration – Stability of column</p> <p><b>Statistical Analysis of Experimental Data</b> - Characterizing Statistical Distributions – Representing Data – Measures of Central Tendency – Statistical Distribution Functions (Gaussian Distribution, Weibull Distribution) – Confidence Intervals for Predictions – Comparison of Means – Statistical Safety Factor – Statistical Conditioning of Data – Regression Analysis (linear regression – Multivariate Regression – Linear &amp; Nonlinear Least-Squares Methods – Chi-square Analysis.</p> <p><b>Lab Exercises</b> Covers elementary programming concepts, including variable types, data structures, and flow control. Provides an introduction to linear algebra and probability.</p> <p>Numerical methods relevant to Mechanical Engineering, including approximation (interpolation, least squares, and statistical regression), integration, solution of linear and nonlinear equations, and ordinary differential equations.</p> <p>Presents deterministic and probabilistic approaches. Uses examples from Mech.Egg, particularly from robotics, dynamics, and structural analysis.</p> <p>Assignments require MATLAB programming</p>

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Annexure-4(c)

### 22ME4120- Instrumentation & Control Systems

Existing Syllabus (L-T-P-S: 2-0-0-4)	New Syllabus(L-T-P-S:2-0-2-0)
<p><b>Definition – Basic principles of measurement</b> – Measurement systems, Measurement of Displacement: Theory and construction of various transducers to measure displacement – Using Piezo electric, Inductive, capacitance, resistance, Measurement of Speed: Mechanical Tachometers, Electrical tachometers, Non-contact type Stroboscope; <b>Measurement of Temperature:</b> Various Principles of measurement-Classification: Expansion Type: Bimetallic Strip- Liquid in glass Thermometer; Electrical Resistance Type: Thermistor, Thermocouple, RTD; Radiation Pyrometry: Optical Pyrometer; Measurement of Level: Direct methods – Indirect methods – Capacitive, Radioactive, Ultrasonic, Magnetic, Cryogenic Fuel level indicators –Bubbler level indicators. Flow measurement: Rotameter, magnetic, Ultrasonic, Turbine flowmeter, Hot – wire anemometer, Laser Doppler Anemometer (LDA).</p> <p><b>Stress-Strain measurements:</b> Various types of stress and strain measurements – Selection and installation of metallic strain gauges; electrical strain gauge – gauge factor – method of usage of resistance strain gauge for bending, compressive and tensile strains Measurement of Humidity: Moisture content of gases, Sling Psychrometer, Absorption Psychrometer, Dew point meter. Measurement of Force, Torque and Power- Elastic force meters, load cells, Torsion meters, Dynamometers.</p> <p><b>Elements of Control Systems:</b> Introduction, Importance – Classification – Open and closed systems- Servomechanisms – Examples with block diagrams –</p>	<p>Definition – Basic principles of measurement – Measurement systems, Measurement of Displacement: Theory and construction of various transducers to measure displacement – Using Piezo electric, Inductive, capacitance, resistance, Measurement of Speed: Mechanical Tachometers, Electrical tachometers, Non- contact type Stroboscope;</p> <p><b>Measurement of Temperature:</b> Various Principles of measurement-Classification: Expansion Type: Bimetallic Strip- Liquid in glass Thermometer; Electrical Resistance Type: Thermistor, Thermocouple, RTD; Radiation Pyrometry: Optical Pyrometer; Measurement of Level: Direct methods – Indirect methods – Capacitive, Radioactive, Ultrasonic, Magnetic, Cryogenic Fuel level indicators –Bubbler level indicators. Flow measurement: Rotameter, magnetic, Ultrasonic, Turbine flowmeter, Hot – wire anemometer, Laser Doppler Anemometer (LDA).</p> <p><b>Stress-Strain measurements:</b> Various types of stress and strain measurements –Selection and installation of metallic strain gauges; electrical strain gauge – gauge factor – method of usage of resistance strain gauge for bending, compressive and tensile strains Measurement of Humidity: Moisture content of gases, Sling Psychrometer, Absorption Psychrometer, Dew point meter. Measurement of Force, Torque and Power- Elastic force meters, load cells, Torsion meters, Dynamometers.</p> <p><b>Elements of Control Systems:</b> Introduction, Importance – Classification – Open and closed systems- Servomechanisms – Examples with block diagrams – Temperature, speed and position control systems- Transfer functions- First and Second order mechanical systems.</p>



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Temperature, speed and position control systems- Transfer functions- First and Second order mechanical systems

### Skilling components.

1. Temperature measurement using Arduino
2. Flow measurement using Arduino.
3. Humidity measurement using Arduino
4. Strain measurement using Arduino
5. Vibration measurement using Arduino
6. Thickness measurement using Arduino.
7. Level measurement using Arduino
8. Position control using Arduino using Servo motor
9. Speed control of DC motor using Arduino

### List of Experiments:

1. Temperature measurement using Arduino
2. Study and calibration of a Rotameter for flow measurement
3. Study and calibration of LVDT transducer for displacement measurement
4. Flow measurement using Arduino
5. Humidity measurement using Arduino
6. Strain measurement using Arduino
7. Vibration measurement using Arduino
8. Thickness measurement using Arduino
9. Level measurement using Arduino
10. Position control using Arduino using Servo motor
11. Speed control of DC motor using Arduino
12. Calibration of Resistance Temperature Detector (RTD) for temperature measurement

Annexure-4(d)

### 22ME3119-Robotics

Existing Syllabus	New Syllabus(L-T-P-S:2-0-0-0)
Nil	<p><b>FUNDAMENTALS OF ROBOT</b> Robot - Definition - Robot Anatomy - Co ordinate Systems, Work Envelope Types and Classification- Specifications-Pitch, Yaw, Roll, Joint Notations, Speed of Motion, Pay Load-Robot Parts and their Functions-Need for Robots-Different Applications.</p> <p><b>ROBOT DRIVE SYSTEMS AND END EFFECTORS</b> Pneumatic Drives-Hydraulic Drives-Mechanical Drives-Electrical Drives-D.C. Servo Motors, Stepper Motors, A.C. Servo Motors-Salient Features, End Effectors-Grippers-Mechanical Grippers, Pneumatic and Hydraulic- Grippers, Magnetic Grippers, Vacuum Grippers; Two Fingereed and Three Fingereed Grippers; Internal Grippers and External Grippers; Selection and Design Considerations.</p> <p><b>SENSORS AND MACHINE VISION</b> Requirements of a sensor, Principles and Applications of the various types of sensors- Position sensors - Piezo Electric Sensor, LVDT, Resolvers, Optical Encoders, pneumatic Position Sensors, Range Sensors. Image Processing and Analysis-Data Reduction, Segmentation, Feature Extraction, Object Recognition, Other Algorithms, Applications- Inspection, Identification, Visual Serving and Navigation.</p> <p><b>ROBOT PROGRAMMING</b></p>

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Lead through Programming, Robot programming Languages-VAL, AML, RAIL Programming- Motion Commands, Sensor Commands, End Effector commands and simple Programs.

### Annexure-4(e)

#### 22ME3114-Industry 4.0 & Cyber physical Systems

Existing Syllabus(3-0-0-0)	New Syllabus(L-T-P-S:2-0-0-0)
<p><b>Introduction to Industry 4.0:</b> The various Industrial Revolutions, Overview on Technologies of Industry 4.0, Industrial Internet, Applications of Industry 4.0, Comparison of Industry 4.0 Factory and Today's Factory.</p> <p><b>Industry 4.0 Basics:</b> Significant changes in the industry, Design requirements of Industry 4.0, Drivers of Industry 4.0, Cybersecurity, Impacts of Industry 4.0.</p> <p><b>Introduction to Cyber Physical System (CPS):</b> Key Features of CPS, Application Domains of CPS, Basic principles of design and validation of CPS, Challenges in CPS.</p> <p><b>CPS Platform components:</b> CPS Hardware platforms, Processors, Sensors and Actuators, CPS Network -Wireless, CAN, Automotive Ethernet, Scheduling Real Time CPS tasks, Synchronous Model and Asynchronous Model.</p> <p><b>CPS Application:</b> Health care and Medical Cyber-Physical Systems, Smart grid and Energy CyberPhysical Systems, WSN based Cyber-Physical Systems, Smart Cities.</p>	<p><b>Introduction: Sensing &amp; actuation</b>            Communication-Part I, Part II, Networking-Part I, Part II, Industry 4.0: Globalization, The Fourth Revolution, LEAN Production Systems, Industry 4.0: Cyber Physical Systems and Next Generation Sensors, Collaborative Platform and Product Lifecycle Management</p> <p><b>Cybersecurity in Industry 4.0</b>            Basics of Industrial IoT: Industrial Processes-Part I, Part II, Industrial Sensing &amp; Actuation, IIoT-Introduction, Industrial IoT: Business Model and Reference Architecture: IIoT-Business Models-Part I, Part II, IIoT Reference Architecture-Part I, Part II. Industrial IoT-Layers: IIoT Sensing-Part I, Part II, IIoT Processing-Part I, Part II, IIoT Communication-Part I.</p> <p><b>Industrial IoT- Layers</b>            IIoT Communication, IIoT Networking-Part I, Part II, Part III. Industrial IoT: Big Data Analytics and Software Defined Networks: IIoT Analytics - Introduction, Machine Learning and Data Science Part I, Part II, Industrial IoT: Big Data Analytics and Software Defined Networks: SDN in IIoT-Part I, Part I, Data Center Networks, Industrial IoT</p> <p><b>Industrial IoT: Security and Fog Computing</b>            Fog Computing in IIoT, Security in IIoT-Part I, Part II, Industrial IoT- Application Domains, Industrial IoT-Application Domains: Healthcare, Power Plants, Inventory Management &amp; Quality Control, Plant Safety and Security (Including AR and VR safety applications), Facility Management. Industrial IoT- Application Domains: Oil, chemical and pharmaceutical industry, Applications of UAVs in Industries, Real case studies.</p>

### Annexure-4(f)

#### 22ME2107- Thermal Management of Electric & Electronic Systems

Existing Syllabus	New Syllabus(L-T-P-S:2-0-0-0)
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Nil

**Introduction to Thermal Management in Electronics** -heat transfer modes, electronics packaging, contact and spreading resistances, heat sink design, thermal interface material(TIM)

**Cooling Technologies**-thermal interface and phase change materials, active, passive and novel air cooling approaches, microchannels, jet impingement, immersion cooling, heat pipes and vapor chambers, thermoelectric);

**Applications** (avionics, data centers, mobile, internet of things, high-performance computing, automotive, etc.)

Lithium-ion battery configuration and operation, Sources of heat in Lithium-ion battery, Lithium Ion- cell temperature ranges. Battery Thermal Management System (BTMS): Need of BTMS, Technologies of BTMS, Battery pack design.

### Annexure-3(b)

#### ROBOT MOTION, PLANNING DYNAMICS & CONTROL

L-T-P-S : 3-0-0-0

Credits : 3

ContactHours : 3

Pre-requisite :NIL

CO#	Course Outcome	PO/PSO	BTL
CO1	Understand the key concepts of robot motion generation.	PO1/PSO1	2
CO2	Apply motion of robot in the presence of obstacles	PO2/PSO1	3
CO3	Analyze motion planning and control	PO3/PSO1	4
CO4	Perform basic motion, force, and hybrid motion-force control.	PO2/PSO1	3

Syllabus:

**Robot Motion Planning and Control:** key concepts of robot motion generation: planning a motion for a robot in the presence of obstacles, and real-time feedback control to track the planned motion.

**Motion Planning:** foundational material like C-space obstacles, graphs and trees, and graph search, as well as classical and modern motion planning techniques, such as grid-based motion planning, randomized sampling-based planners, and virtual potential fields.

**Robot Control:** motion control, force control, and hybrid motion-force control.

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### Text Books:

1. MODERN ROBOTICS MECHANICS, PLANNING, AND CONTROL, Kevin M. Lynch and Frank C. Park, Cambridge University Press in May 2017.
2. Introduction to Autonomous Mobile Robots, By Roland Siegwart, Illah Reza Nourbakhsh, Davide Scaramuzza · 2011

### ROBOT MANIPULATION & WHEELED MOBILE ROBOTS

L-T-P-S : 3-0-0-0  
Credits : 3  
ContactHours : 3  
Pre-requisite :NIL

CO#	Course Outcome	PO/PSO	BTL
CO1	Determine various contact kinematics of robot manipulator	PO1/PSO1	2
CO2	Analyze contact forces and friction on the performance of manipulator	PO2/PSO1	4
CO3	Apply basic principles used in wheeled mobile robots.	PO3/PSO1	3
CO4	Understand odometry and mobile manipulation	PO2/PSO1	2

### SYLLABUS:

#### Grasping and Manipulation:

Contact Kinematics: First-Order analysis of a Single contact, contact types: Rolling, Sliding, and Breaking free, Multiple contacts, Collection of Bodies, Other types of contacts, Planar Graphical Methods, Form Closure. Contact Forces and Friction: Friction, planar graphical methods, force closure, Duality of force and motion freedoms, manipulation.

#### Wheeled Mobile Robots:

Types of wheeled mobile robots, Omnidirectional wheeled mobile robots, modelling, motion planning, feedback control, nonholonomic wheeled mobile robots, modelling, Controllability, motion planning, and feedback control of odometry for wheeled mobile robots; and mobile manipulation.

### Text Books:

3. MODERN ROBOTICS MECHANICS, PLANNING, AND CONTROL, Kevin M. Lynch and Frank C. Park, Cambridge University Press in May 2017.



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4. Introduction to Autonomous Mobile Robots, By Roland Siegwart, Illah Reza Nourbakhsh, Davide Scaramuzza · 2011

### MECHATRONICS: FUNDAMENTALS & CORE CONCEPTS

L-T-P-S : 3-0-0-0  
Credits : 3  
ContactHours : 3  
Pre-requisite :NIL

CO#	Course Outcome	PO/PSO	BTL
CO1	Analyze mechatronics in manufacturing and distinguish between traditional and mechatronics approaches	PO1, PSO1	4
CO2	Be proficient in the use of Data conversion devices and Microprocessors controllers.	PO1, PSO1	1
CO3	Be able to analyze and select suitable drives and mechanisms for industrial applications	PO1, PSO1	4
CO4	Design and analyze the Hydraulic systems and understand PID controllers and CNC machines.	PO1, PSO1	4

### Syllabus:

**Module I:** Introduction, Definition of Mechatronics, Mechatronics in manufacturing, products and design, Comparison between traditional and Mechatronics approach

**Module II:** Review of fundamentals of electronics, Data conversion devices, sensors, microsensors, trasducers, signal processing devices, relays, contactors and timers. Microprocessors controllers and PLCs.

**Module III:** Drives: Stepper motors, servo drives. Ball screws, linear motion bearings, cams, systems controlled by camshafts, electronic cams, indexing mechanisms, tool magazines, and transfer systems.

**Module IV:** Hydraulic systems: flow, pressure and direction control valves, actuators, and supporting elements, hydraulic power packs, and pumps. Design of hydraulic system components and graphic representations, design of systems.

**Module V:** Description of PID controllers. CNC machines and part programming. Industrial Robotics.

### Recommended Text Books:

1. HMT ltd. Mechatronics, Tata Mcgraw-Hill, New Delhi, 1988
2. G.W.Kurtz, J.K.Schueller, P.W. Claar, Machine design for mobile and industrial applications, SAE, 1994.
3. T.O.Boucher, Computer automation in manufacturing-an introduction, Chappman and Hall, 1996.
4. R. Iserman, Mechatronic Systems: Fundamentals, Springer, 1<sup>st</sup> Edition, 2005.
5. Musa Jouaneh, Fundamentals of Mechatronics, 1<sup>st</sup> Edition, Cengage Learning, 2012.

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### ARTIFICIAL INTELLIGENCE FOR ROBOTICS

L-T-P-S : 2-0-2-0  
Credits : 3  
ContactHours : 3  
Pre-requisite :NIL

CO#	Course Outcome	PO/PSO	BTL
CO1	Understand the concepts of AI	PO1/PSO1	2
CO2	Apply basic principles of AI in solutions that require problem- solving	PO2/PSO1	3
CO3	Apply basic principles of AI in solutions that require planning	PO3/PSO1	3
CO4	Analyze AI in Robotics	PO2/PSO1	4
CO5	Apply the theoretical concepts to conduct various experiments on Search Techniques and Language Representation using AI	PO5/PSO1	3

#### Syllabus :

**Introduction:** History, state of the art, Need for AI in Robotics. Thinking and acting humanly, intelligent agents, structure of agents, Turing Test, State space search - Un informed search.

**Problem Solving:** Solving problems by searching –Informed search and exploration–Constraint satisfaction problems–Adversarial search, knowledge and reasoning–knowledge representation – first order logic.

**Planning:** Planning with forward and backward State space search –Goal Stack Planning, Plan Space Planning, Partial order planning – Planning graphs–Planning with propositional logic – Planning and acting in real world.

**AI in Robotics:** Robotic perception, localization, mapping- configuring space, planning uncertain movements, dynamics and control of movement, Ethics and risks of artificial intelligence in robotics

**Text Books :**1.Stuart Russell, Peter Norvig, “Artificial Intelligence: A modern approach”, Pearson Education, India. 2.Negnevitsky, M, “Artificial Intelligence: A guide to Intelligent Systems”, Harlow: Addison-Wesley

**Reference Books :**1. David Jefferis, “Artificial Intelligence: Robotics and Machine Evolution”, Crabtree Publishing Company.

#### List of Experiments

1. Write a program to implement depth first search algorithm.
2. Write a python program to implement Breadth First Search Traversal
3. (a). Write a program to simulate 4-Queen / N-Queen problem

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- (b). Write a python program to implement simple Chatbot?
- Write a program to solve tower of Hanoi problem.
  - Write a program to implement Hangman game using python.
  - Write a program for Hill climbing problem.
  - Write a python program to implement Water Jug Problem

### HUMAN MACHINE INTERFACE & BRAIN MACHINE INTERFACE

L-T-P-S : 3-0-0-0  
Credits : 3  
ContactHours : 3  
Pre-requisite :NIL

#### Mapping of Course Outcomes to Program outcomes:

CO#	Course Outcome	PO/PSO	BTL
CO1	Understand the Basic Idea of Human Machine Interactions, and its Goals	1	2
CO2	Describe typical human-computer interaction (HCI) models, styles, and various historic HCI paradigms	1	2
CO3	Understand the Basic Idea of Brain Machine Interactions, and brain waves	1,2	2
CO4	Apply an interactive design process and universal design principles to designing HCI/BMI systems	1,2	3

#### Syllabus:

CO No	Topics	Contact Hours
1	<b>Intro. to HMI:</b> Asimov's Laws, GUI Design, Aesthetics, Developments in Bio-Chips, Heuristics Introduction to the course and to HMI/HCI, HMI/HCI Its history Relation to Ergonomics and Human Factors Problems and challenges Recurrent HMI Themes, Historical evolution of the field, Concept of usability - definition and elaboration, HCI and software engineering, GUI design and aesthetics, Prototyping techniques	10
2	HMI Tech: GMOS Models, CMN-GOMS, Fitts laws, Hick-Hyman laws, Norman's 7 principles: (Design rules Authority vs. generality Principles, introduction to different types of models, GOMS family of models (KLM and CMN-GOMS, Fitts' law and Hick-Hyman's law, Guidelines in HCI: Norman's seven principles, Norman's model of interaction, Heuristic evaluation, Contextual inquiry, Cognitive walkthrough.	10
3	Brainwaves & BMI: Alpha, Beta, Theta, Gamma wave, Brain-Control Interface,	10

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	ARMA Model Introduction to <b>Brain Control Interface</b> Fundamentals of BCI – Structure of BCI system – Classification of BCI: Invasive, Non-invasive and Partially invasive BCI Brain signal acquisition, Experiment design and data analysis (with explanation of one-way ANOVA), ARMA Model	
4	Humanoids & HMI/BMI Applications: Hierarchical Task] Analysis, Dialog Design, Use of FSM] Task modelling and analysis through Hierarchical task analysis (HTA), GUI design for a mobile phone based Matrimonial application, Employment Information System for unorganized construction workers on a Mobile Phone. Dialog Design using FSM (finite state machines), Cognitive architecture, Object Oriented Modelling of User Interface Design.	10

### Text Books:

1. Dix A., Finlay J., Abowd G. D. and Beale R. Human Computer Interaction, 3rd edition, Pearson Education, 2005.
2. Preece J., Rogers Y., Sharp H., Baniyon D., Holland S. and Carey T. Human Computer Interaction, Addison-Wesley, 1994.

### Reference Books:

1. B. Schneiderman; Designing the User Interface, Indian Reprint, Addison Wesley 2000.
2. Jonathan Wolpaw, Elizabeth Winter Wolpaw, 'Brain Computer Interfaces: Principles and practice", Edition 1, Oxford University Press, USA, January 2012

### Web References

- 1 <https://www.expertsnotes.com/2016/04/jntuk-r-10-4-2-cse-human-computer.html>
- 2 <https://nptel.ac.in/courses/106103115/4>
- 3 <http://www.eolss.net/sample-chapters/c18/e6-43-37-06.pdf>
- 4 <https://www.Tutorials.in/How Does Your HMI Design.>
- 5 Special Issue on Brain Control Interfaces, IEEE Transactions on Neural Systems and Rehabilitation Engineering, Vol 14, June 2006

## COMPUTER VISION & APPLICATIONS

L-T-P-S : 3-0-0-0  
Credits : 3  
ContactHours : 3  
Pre-requisite :NIL

### Mapping of Course Outcomes to Program outcomes:

CO#	Course Outcome	PO/PSO	BTL
CO1	Understanding of the fundamental concepts related to multi-dimensional signal processing.	1	2
CO2	Understanding of the feature extraction, pattern analysis visual geometric modelling, stochastic optimization.	1	2



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CO3	Knowledge of these concepts is necessary in this field, to explore and contribute to research and further developments in the field of computer vision.	1,2	2
CO4	Applications range from Biometrics, Medical diagnosis, document processing, mining of visual content, to surveillance, advanced rendering.	5	2

### Syllabus:

CO No	Topics	Contact Hours
1	<b>Introduction to Computer Vision (CV)</b> Basic Block Diagram Computer Vision; Principle of Computer Vision; Perception of 2 Dimensional & 3Dimensional Transformation (2DCVT &3DCT); 3D Rotation; Histogram, Texture Analysis;, Image formation, Geometric Primitives and transformations, Geometric Primitives, 3D to 2D Projections, Lens distortions, Color, Compositing and matting, Point, Pixel transforms, Histogram equalization, Application: Tonal adjustment, 4D to 11D Transformation on CV.	10
2	<b>Optical Features Extraction (OFE)</b> Overview of Feature Extraction on Computer Vision ; Edges, HOG, SIFT, SURF, DTW, Gabor Filter, Scale Space Analysis; Analysis Edges, Edge detection , Edge linking , Application: Edge editing and enhancement ,A comparative study of CFs, LBP, HOG, SIFT, SURF, and BRIEF for security and face recognition , Gabor filter for image processing and computer vision.	10
3	<b>Video Features &amp; CV Methods</b> Optical Flow, Optical Flowrate, Elastic Band, Boundary Detection. Optical Flow-Rate ,Optical Flow Estimation,Ealstic Band ,Selection of Terminal Point of the Line, Texture Segmentation, Edge Flow and Anisotropic Diffusion, Edge Flow Definition ,Edge Flow Intensity ,Edge Flow Texture, Edge Flow , Edge Flow Based on Gabor Phase , Edge Flow Integration , Edge Flow Propagation and Boundary Detection.	10
4	<b>Pattern Analysis-Dimension Reduction</b> VQ, ICA, KNN, PCA, LDA, Classifiers: GMM, SVM, CNN, DNN Gaussian Mixture Model and Deep Neural Network Recognizing faces with PCA and ICA, K-nearest Neighbors (KNN) ,Classification ModelLDA in Python for Computer Vision ,LDA in Python for Computer Vision, Deep Learning for Computer Vision, Support Vector Machines (SVM), Image Processing with the Computer Vision APIvision field, LDA in Python for Computer Vision, Robust Principal Component Analysis for Computer Vision, Diagnosis and Treatment of Computer Vision Syndrome, Image Classifier using CNN.	10

  
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### Text Books

- 1 Ayman Al Falou -Advanced Secure Optical Image Processing for Communications APRIL 2008
- 2 Richard Szeliski- Computer Vision: Algorithms and Applications March 30, 2008

### References

- 3 Noah Snavey's - Introduction to Computer Vision class at Cornell Tech (Spring 2019)
- 4 Bharath Hariharan's - Computer Vision class at Cornell (Spring 2019)
- 5 Pascal Fua's - Introduction to Computer Vision class at EPFL (Spring 2019)
- 6 Ioannis Gkioulekas's - Computer Vision class at CMU (Spring 2019)
- 7 Ioannis Gkioulekas's - Computational Photography class at CMU (Fall 2018)

### Web References:

1. <https://www.javatpoint.com/computer-graphics-elastic-or-rubber-band-techniques>
2. <http://www.cs.jhu.edu/~misha/ReadingSeminar/Papers/Ma00.pdf>
3. <https://www.geeksforgeeks.org/image-classifier-using-cnn/>
4. <http://vqlsr.com/vision-services/computer-vision.html>

## Autonomous Vehicles & Automotive Electronics

Course code: **21EC3072**

L-T-P-S: 3-0-0-0

Pre-requisites : NIL

Credits : 3

### Mapping of Course Outcomes to Program outcomes:

CO#	Course Outcome	PO/PSO	BTL
CO1	Understand the basics of Autonomous Vehicles, dynamics and design electronics to complement those features.	1,2	2
CO2	To understand sensors and sensor monitoring mechanisms aligned to automotive systems, different signal conditioning techniques, interfacing techniques and actuator mechanisms. To understand role of Microcontrollers in ECU design and choice of appropriate Hardware and Software	2,3	3
CO3	Describe the function of basic components used in modern automotive systems To provide an overview of the Automotive Open Systems Architecture (AUTOSAR)	2,3	3
CO4	Design and implement Illustrate the practical applications of Automotive Open Systems Architecture (AUTOSAR)	2,3	3

### Syllabus:

CO No	Topics	Contact Hours
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1	<p><b>Introduction to Autonomous Vehicles</b></p> <p>Technological overview concepts of Autonomous Vehicles (AVs); History of Autonomous Vehicles; Vehicle Electronics Architecture; Vehicle Operating Software; Functional Block Diagram of typical Autonomous Vehicle System (AVS); Society of Automotive Engineers Levels of Automation; Major Functions of physical Ecosystem of an Autonomous Vehicle (cameras, radar, lidar, gps, ultrasonic sensors, central computer, DRSC-based Receiver); Autonomous Vehicle architecture (JAUS &amp; GOA);</p> <p><b>Driver Assisted/Driverless Vehicles, Connected Vehicles:</b></p> <p>Basic control system applied to Drive Assisted, Driverless, Connected Vehicles; Overview of the operation of Electronic Control Unit (ECUs); Basic cyber-physical system theory and autonomous vehicles; Comparison chart of driver assisted vs driverless vehicle and connected Vehicles vs Autonomous Vehicles.</p>	10
2	<p><b>Sensor Technology for Autonomous Vehicles</b></p> <p>Basics of Radar Technology and Systems -Ultrasonic Sonar Systems -LIDAR Sensor Technology and Systems-camera technology -night vision technology -Use of Sensor Data Fusion -Kalman Filters Computer Vision and Deep Learning for Autonomous Vehicles Computer Vision Fundamentals -Advanced Computer Vision -Neural Networks for Image Processing -TensorFlow-overview of Deep Neural Networks -Convolutional Neural Networks-DSRC (Direct Short-Range Communication) - Vehicle-to-Vehicle Technology-Vehicle-to-Roadside and Vehicle-to-Infrastructure Localization - Path Planning-Controllers to Actuate a Vehicle - PID Controllers -Model Predictive Controllers, ROS Framework-Technical Issues, Security Issues, Moral and Legal Issues</p>	10
3	<p><b>Automotive Electronics (AE)</b></p> <p>Introduction to Modern Automotive Systems-Evolution of Electronics and Software in automobiles -ECUs and their application areas in Automotive -Engine Management Systems -Body &amp; Comfort Electronics Systems -Infotainment Systems -Advanced Driver Assistance Systems and V2X Systems -Autonomous Driving Systems -Current Trends and Challenges</p> <p>Micro Controllers in ECU Design: Overview of AURIX Micro Controller - Architecture, Memory Map, Lock Step etc. -Peripherals used in Automotive Applications -GTM, QSPI, DSADC etc. -AURIX SafeTLib -Real time Operating Systems and Scheduling Concepts -Practical Experiments using AURIX Eval Kit</p> <p>Bluetooth low energy and the automotive (BLE-AE): Block Diagram-Functional of personalization using BLE-AE, Piloted/assisted/remote parking BLE-AE.</p> <p>Automotive Wireless (AW) :Wireless Networking and Applications to Vehicle Autonomy; Integration of Wireless Networking and On-Board Vehicle Networks; Wireless Access in Vehicular Environments (WAVE) amendment to IEEE 802.11; IEEE 802.11ac WLAN PHY and dual-band (2.4 GHz/5 GHz) support ; IEEE 1609 - Family of Standards for Wireless Access in Vehicular Environments</p>	10



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	(WAVE).Automotive GPRS Vehicle Tracking (AGPRS-VT) Vehicle Tracking System; Principle of working for Vehicle Tracking system. GPS and GPRS tracking system	
4	<b>Embedded to Automotive Electronics and autonomous Vehicles:</b>  Invehicle communication protocols: Overview of In-Vehicle Communication Protocols – CAN, LIN, Flex Ray, MOST, Ethernet -Controller AreaNetwork (CAN)-CANoe, CANalyzer Fundamentals -CAPL Scripting, Panel Simulation.  Vehicle Area Network (VAN):Architecture-EBD-ESP-ICP-OPC-RPVs- UAVVehicle Networking & Diagnostics Stacks– KWP 2000 and UDS.  Automotive Functional Testing: HIL, MIL and SIL testing-AUTOSAR Overview - RTE, BSW, SWC-Practical Experiments using AUTOSAR Tools-Automotive Quality, Safety and Security Standards Common Failures in Automotive Systems -ASPICE Development Process -MISRA C Standard -ISO 26262-Functional Safety Standard -SAE J3061 Security Standard. Case studies on design Project Automotive Sensors, Drives, Actuators	10

### Text Books

- [1]. Ronald K Jurgen: "Distributed Automotive Embedded Systems" SAE International, 2007
- [2]. Williams. B. Ribbens: "Understanding Automotive Electronics", 7th Edition, Elsevier Inc, 2012.
- [3]. Crating Autonomous Vehicle Systems by shaoshanliu, liyun li
- [4]. Autonomous vehicles: opportunities, Strategies, and Disruptions by Michael McGrath

### Reference Books

- [5]. Automotive Embedded Systems Handbook CRC Press Taylor & Francis Group Richard Zurawski
- [6]. Bosch Automotive Electrics and Automotive Electronics Systems and Components, Networking and Hybrid Drive Robert Bosch GmbH (Ed.) 5th Edition
- [7]. William B Ribbens "Understanding Automotive Electronics", SAE Publications, 1998  
Robert Bosch, "Gasoline Engine Management" SAE Publications, 2006.
- [8]. Marc E. Herniter and Zac Chambers: "Introduction to Model Based System Design", RoseHulman Institute of Technology. Rudolf Limpert, "Brake design and Safety". SAE Publications, 2015,

### MOOCS/Web Links

1. <https://www.automotive-iq.com/events-autonomous-vehicles-online>
2. [https://swayam.gov.in/nc\\_details/NPTEL](https://swayam.gov.in/nc_details/NPTEL)  
<https://www.themanufacturer.com/articles/will-autonomous-vehicles-drive-improvement-in-electronic-reliability/>

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### POWER TRAIN DESIGN FOR ELECTRIC VEHICLE

L-T-P-S: 3-0-0-0

Credits: 3

Pre-Requisite: Nil

#### COURSE OUTCOMES (COs):

CO NO	Course Outcome (CO)	PO/PSO	Blooms Taxonomy Level (BTL)
CO1	Understand the History, Economics, Environmental issues and power train of Electric Vehicles	PSO1,PO7	2
CO2	Analyze the dynamics of EV	PO2,PSO1	4
CO3	Select and size the power train for 2W	PSO2,PO7	3
CO4	Select and size the power train for 4W	PSO2,PO6	3

HISTORY, ECONOMIC & ENVIRONMENTAL IMPACT OF ELECTRIC VEHICLE History of EV, Case studies on Economic and Environment aspects of EV, EV markets – Supply and demand, Economical analysis with case study, Environmental impact analysis with case study. Impact of different transportation technologies on environment and energy supply. Power train components: BEV, HEV, PHEV and FCEV including working of Fuel cell, EMU-energy management unit. INTRODUCTION TO EV DYNAMICS Motion and dynamic equations of electric vehicles, General description of vehicle movement, Vehicle resistance, Dynamic equation, Tire Ground Adhesion and maximum tractive effort, different drive cycles for, Drive cycles for vehicle emission, fuel consumption and performance testing. 2W POWER TRAIN SIZING Chassis, differential and transmission selection for different drive trains, Battery, converter and motor drive sizing for different 2W drive trains. Analysis on the effect of sizing of different components for different drive cycles 4W POWER TRAIN SIZING Chassis, differential and transmission selection for different drive trains, Battery, converter and motor drive sizing for different 4W drive trains. Analysis on the effect of sizing of different components for different drive cycles

**Text Books :** 1. “A History of Electric Vehicles” by Nigel Burton, Edition -1, Crowood Publisher.  
2. “Electric Cars: The Ultimate Guide for Understanding the Electric Car And What You Need to Know” by Brad Durant

**Reference Books :** 1. “Electric Vehicle Technology Explained” by James Larminie and John Lowry.  
2. “Modern electric, Hybrid Electric, and Fuel cell Vehicles-fundamentals, Theory, and Design” by Mehrdad Ehsani, Yimin Gao, Ali Emadi-CRC Press.

**Web Links :** <https://theect.org/electric-vehicles-free-online-webinar/>

**MOOCS :** <https://nptel.ac.in/courses/108/102/108102121/#>

<https://nptel.ac.in/courses/108/103/108103009/>

<https://www.coursera.org/learn/electric-vehicles-mobility>

<https://www.edx.org/course/electric-cars-introduction>

<https://www.udemy.com/course/electric-vehicles/>

<https://www.udemy.com/cart/subscribe/course/2700158/>

<https://www.myimprov.com/driving-resources/newtons-three-laws-motion/>

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Vaddeswaram-522502



## Koneru Lakshmaiah Education Foundation

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Campus: Green Fields, Vaddeswaram - 522 302, Guntur District, Andhra Pradesh, INDIA.

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### SOLAR ENERGY TECHNOLOGIES

Course Code:21ME4102

L-T-P-S :

2-0-2-0

Credits: 3

CO#	Course Outcome	PO/PSO	BTL
CO1	Understand the basics of solar radiation and working principle of various solar collectors	PO2	2
CO2	Understand the working of solar thermal systems	PO2	2
CO3	Understand the fundamentals of Solar PV technology	PO2	2
CO4	Apply the knowledge of thermodynamics and heat transfer to calculate the performance of solar PV systems	PO2	3
CO5	Analyze various solar thermal and PV systems using TRNSYS software	PO5	4

#### Syllabus:

**Solar Radiation and collectors:** Solar angles – Sun path diagrams – Radiation - extraterrestrial characteristics - measurement and estimation on horizontal and tilted surfaces - flat plate collector thermal analysis - testing methods- evacuated tubular collectors - concentrator collectors – classification - design and performance parameters- tracking systems - compound parabolic concentrators - parabolic trough concentrators - concentrators with point focus - Heliostats – performance of the collectors

**Solar Thermal Systems:** Principle of working, types, design and operation of - Solar heating and cooling systems – Thermal Energy storage systems – Solar Desalination – Solar cooker : domestic, community – Solar pond – Solar drying

**Solar PV fundamentals** – Semiconductor – properties - energy levels - basic equations of semiconductor devices physics. Solar cells - p-n junction: homo and hetero junctions - metal-semiconductor interface - dark and illumination characteristics - figure of merits of solar cell - efficiency limits - variation of efficiency with band-gap and temperature - efficiency measurements - high efficiency cells – Solar thermo-photovoltaics.

**Analysis of Solar PV Systems:** Solar cell array system analysis and performance prediction-Shadow analysis: reliability - solar cell array design concepts - PV system design - design process and optimization - detailed array design - storage autonomy - voltage regulation - maximum tracking - centralized and decentralized SPVsystems - stand alone - hybrid and grid connected system - System installation - operation and maintenances - field experience - PV market analysis and economics of SPV systems

#### Experiments:

- Analysis of flat plate and parabolic trough arrays
- Simulation and analysis of solar radiation over flat plate solar collector
- Simulation and analysis of solar radiation over parabolic solar collector
- Analysis of solar water heater
- Analysis of CPC collector
- Analysis of Evacuated Tube collector
- Performance estimation of direct solar still

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- Performance estimation of indirect solar still
- Integration of PV cell and battery
- Analysis of sensible heat storage device

### Recommended Books

1. Goswami, D.Y., Kreider, J. F. and Francis., Principles of Solar Engineering, Taylor and Francis, 2000
2. Chetan Singh Solanki, Solar Photovoltaics – Fundamentals, Technologies and Applications, PHI Learning Private limited, 2011
3. Sukhatme S P, J K Nayak, Solar Energy – Principle of Thermal Storage and collection, TataMcGrawHill, 2008.
4. Solar Energy International, Photovoltaic – Design and Installation Manual – New Society Publishers, 2006
5. Roger Messenger and Jerry Vnetre, Photovoltaic Systems Engineering, CRC Press, 2010.

## VEHICLE DYNAMICS

L-T-P-S: 3-0-0-0

Credits: 3

Pre-Requisite: Nil

CO No.	CO Statement	PO/PSO mapping	BTL
1	Analyse the dynamics of Steering system on vehicle performance	PO2-2	4
2	Analyse Dynamics of vehicle suspension systems	PO2-2	4
3	Analyse Dynamics of vehicle body vibrations	PO2-2	4
4	Analyse the 2D stability of automobile vehicles	PO2-1	4

Syllabus:


Syllabus Contents: Tyres: Necessity of rubber tyres in road vehicles. Functions of tyres. Tyre adhesion. Tyre construction. Cross-ply and radial-ply tyres. Tubed and tubeless tyres. Tyre elasticity. Cornering power. Self aligning torque.

Steering and Wheel Alignment: Steering geometry. Ackermann mechanism and Davis mechanism. Steering gears. Power steering. Camber, castor, kingpin inclination and toe-in, toe-out. Scrub radius. Moments on steering wheels.

Suspension system: Functions of suspension system. Rigid axle and independent suspension system. Hotchkiss drive, torque-tube drive and radius rods. Types of suspension springs and their characteristics. Design of leaf spring and coil spring. Anti-roll bar. Wheel balancing. Oscillations of steerable wheels. Shock absorber.

Body vibrations: Bouncing and pitching. Doubly conjugate points. Body rolling. Roll center and roll axis. Stability against body rolling.

Handling Characteristics: Over steer and under steer. Vehicle stability while braking. Dynamic axle loads. Anti-squat, anti-pitch and anti-dive suspension geometry.

  
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2-D Stability of Automobile Vehicles: Steady state response to steering input, side force input and yawing moment input. Transient responses

### References:

1. J.R.Ellis . Vehicle dynamics.
2. P.M. Heldt Automotive Chassis
3. W. "steeds. Mechanics of road vehicles
4. J. G. Giles steering ,suspensions, tires
5. T. D. Gillespie. Fundamentals of Vehicle dynamics.

### THERMAL MANAGEMENT OF ELECTRIC AND ELECTRONIC SYSTEMS

L-T-P-S:3-0-0-0

CREDITS:3

CO#	Course Outcome	PO/PSO	BTL
CO1	Apply the concepts of heat transfer to various electric and electronic systems requiring heat dissipation	PO1-2	3
CO2	Apply different cooling techniques to microchannels, heat pipes and vapor chambers	PO1-2	3
CO3	Apply various thermal management techniques in the fields of automobiles and electronics	PO1-2	3
CO4	Analyze the Battery thermal management system and battery pack design	PO2-1	4

### Syllabus:

Introduction to Thermal Management in Electronics -heat transfer modes, electronics packaging, contact and spreading resistances, heat sink design, thermal interface material(TIM)

Cooling Technologies-thermal interface and phase change materials, active, passive and novel air cooling approaches, microchannels, jet impingement, immersion cooling, heat pipes and vapor chambers, thermoelectric

Applications of thermal management: avionics, data centers, mobile, internet of things, high-performance computing, automotive, etc

Lithium-ion battery configuration and operation, Sources of heat in Lithium-ion battery, Lithium Ion-cell temperature ranges. Battery Thermal Management System (BTMS): Need of BTMS, Technologies of BTMS, Battery pack design.

### TEXT BOOKS:

T.L. Bergman, A.S. Lavine, F.P. Incropera, D.P. DeWitt, Fundamentals of Heat and Mass Transfer, Wiley, 2011)

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### AI AND IOT FOR ELECTRIC VEHICLE

L-T-P-S:3-0-0-0

CREDITS:3

CO#	Course Outcome	PO/PSO	BTL
CO1	Apply the Data analytics using AI and ML for understanding the various sensors in the EV	PO1-2	3
CO2	Apply cloud computing to develop models on cloud computing protocols	PO1-2	3
CO3	Apply Database Services-Relational DBMS, RDS Services. AI and ML on Cloud: Data Pre-processing techniques in Machine Learning	PO1-2	3
CO4	Case studies in M2M monitoring, power management, electric drive application	PO3-1	4

#### Syllabus:

IoT Devices and Enabling Technologies: Sensor Devices- temperature, vibration, irradiance, wind speed, PIR, proximity, current, voltage Controllers, Actuators, Networking and Communication Protocols, Data analytics using AI and ML for - smart cities, smart grid, smart building, electrical vehicles Cloud Computing: Basics-Cloud systems, Cloud computing protocols, Role of Web services, Deployment Models- Public, Community, Hybrid, Private Clouds, Cloud Analytics over Thingspeak, Google Firebase, AWS-console, Functions. Database Services-Relational DBMS, RDS Services. AI and ML on Cloud: Data Pre-processing techniques in Machine Learning, Data-handling, importing libraries, Data pre-processing using python, Missing data, Categorical Data. Regression and Classification algorithms in ML. Cloud based Real- time Monitoring systems, M2M communications, Case Studies Applications: Electric Vehicle Battery state estimation, health monitoring, SOL determination, Power management, Charging optimization and Electric Drive applications, Online vehicle Assistance

**Text Books :**1. Artificial Intelligent Techniques for Electric and Hybrid Electric Vehicles, Chitra A., P. Sanjeevikumar, Jens Bo Holm-Nielsen and S. Himavathi 2. Internet of Things An Application Based approach Using Arduino Platform and Firebase by SOURAV KUMAR BHOI, Independently published (May 31, 2018) 3. Hybrid Electric Vehicles-Principles and Applications with practical perspectives, Chris Mi, M. Abdul Masrur and David Wenzhong Gao, Wiley Publications,1 edition 2011 4. AWS Certified Machine Learning Specialty: MLS-C01 Certification Guide By Somanath Nanda, Wesley Moura · 2021

**Reference Books :**5. Electric and Hybrid Vehicles power sources, models, sustainability, infrastructure and the market, Edited by Gianfranco Pistoia, Elsevier 1 edition 2010. 6. Electric and Hybrid Vehicles Design Fundamentals, by Iqbal Hussain, CRC Press 2nd edition, 2010. 7. Role of Single Board Computers (SBCs) in Rapid IoT Prototyping, By G. R. Kanagachidambaresan · 2021

**Web Links :**<https://www.coursera.org/projects/deploy-ml-model-aws-elastic-beanstalk>


**MOOCS :**<https://www.coursera.org/learn/aws-machine-learning>

### COMMUNICATION PROTOCOLS & TESTING OF ELECTRIC VEHICLE

L-T-P-S:3-0-0-0

CREDITS:3

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CO NO	Course Outcome (CO)	PO/PSO	Blooms Taxonomy Level (BTL)
CO1	Understand the communication protocols used in Electric Vehicles	PSO1,PO1,PO5	2
CO2	Apply the communication protocols for fault diagnostics of Electric Vehicle	PSO1,PO1,PO3	3
CO3	Analyze the intricacies of integrating HV and LV components of vehicle	PSO1,PO1,PO6	4
CO4	Demonstrate system engineering/system validation	PO3,PSO1,PO1	3

### Syllabus:

Introduction to serial communication protocols: SPI I2C CAN, CAN standard, CAN message: Arbitration, message types, valid frame, error checking CANbus: Transceiver features, CAN physical layer, CAN connectors, Bit Timing, Error Handling, High Layer Protocols: IEC 61851, SAE J2601, Vehicle to Vehicle communication protocols Common Sensors modules used in EV: Air Bag, ABS, Window Mirror, Cruise Control, Transmission control, CAN Interface with Sensor Modules Power Distribution Box, Components like HVDC Relays connections, Insulation Monitoring Devices Fuses, BTMS, Driveline Cooling, Coolant tanks, Level Sensors, Vehicle Wiring, Terminals, Electrical Distribution Boards, Temperature Considerations for wiring, Cable selection, Instrument Panel, HVIL, 24V converters, Junction boxes or Fuse Boxes, Fuses, derating, EMI and EMC. V cycle, reliability calculations, DFMEA/FMEA analysis, Design for manufacturing, servicing & data analytics, supply chain management

**Text Books :** Text books: 1 "A History of Electric Vehicles" by Nigel Burton, Edition -1, Crowood Publisher. 2 "Electric Cars: The Ultimate Guide for Understanding the Electric Car And What You Need to Know" by Brad Durant

**Reference Books :** 1 "Electric Vehicle Technology Explained" by James Larminie and John Lowry.

**Web Links :** 1. [https://www.ey.com/en\\_gl/automotive-transportation/why-the-ev-battery-life-cycle-is-more-important-than-the-battery-life](https://www.ey.com/en_gl/automotive-transportation/why-the-ev-battery-life-cycle-is-more-important-than-the-battery-life)

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**Course wise Syllabus revision of approved structure**

Course Code	Course Name	Course Category	Existing Syllabus	New Syllabus	Topics Added/Removed/Replaced	Change in Outcome	Justification for the Modification	Revision Percentage
22ME2209	Numerical Computation for Mechanical Engineers	BS	<p>Covers elementary programming concepts, including variable types, data structures, and flow control. Provides an introduction to linear algebra and probability.</p> <p>Numerical methods relevant to Mechanical Engineering, including approximation (interpolation, least squares, and statistical regression), integration, solution of linear and nonlinear equations, and ordinary differential equations.</p> <p>Presents deterministic and probabilistic approaches. Uses examples from Mech.Egg, particularly from robotics, dynamics, and structural analysis.</p> <p>Assignments require MATLAB programming</p>	<p><b>Various Methods of Analysis –</b> Exact Method – Approximate Method (Variational Approach &amp; Weighted Residual Method: Collocation method, Subdomain method, Least Square method, Galerkin method) - Finite Difference Method – Finite Element Formulation - Solution Techniques - Problems of axially loaded beams and beam bending.</p> <p><b>Application to Scalar Problems –</b> Governing equations for boundary value problems – Heat Transfer (one &amp; two-dimensional steady state heat transfer problems) – Torsion of non-circular section – Fluid flow problem (Stream function approach &amp; Potential function approach)</p> <p><b>Dynamics and Stability Analysis –</b> Governing Equations – Longitudinal Vibration – Bar of varying cross-section – Lateral Vibration – Stability of column</p> <p><b>Statistical Analysis of Experimental Data -</b> Characterizing Statistical Distributions – Representing Data – Measures of Central Tendency – Statistical Distribution Functions</p>	<p>Topics Added: scalar problems, dynamic analysis, statistical analysis with 3-0-2-0 structure</p>	CO-2, 3,4	To cover the important concepts of mathematics	70%

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				<p>(Gaussian Distribution, Weibull Distribution) – Confidence Intervals for Predictions – Comparison of Means – Statistical Safety Factor – Statistical Conditioning of Data – Regression Analysis (linear regression – Multivariate Regression – Linear &amp; Nonlinear Least-Squares Methods – Chi-square Analysis.</p> <p><b>Lab Exercises</b></p> <p>Covers elementary programming concepts, including variable types, data structures, and flow control. Provides an introduction to linear algebra and probability.</p> <p>Numerical methods relevant to Mechanical Engineering, including approximation (interpolation, least squares, and statistical regression), integration, solution of linear and nonlinear equations, and ordinary differential equations.</p> <p>Presents deterministic and probabilistic approaches. Uses examples from Mech.Engg, particularly from robotics, dynamics, and structural analysis. Assignments require MATLAB programming</p>				
22ME2210	Analysis of Thermal Systems (with CFD & (Linked to Project))	PC	<p><b>Pure Substance:</b> Definition of Pure substance, Ideal Gases and ideal gas mixtures, Real gases and real gas mixtures, Compressibility charts- Properties of two phase systems - Const. temperature and Const. pressure heating of water; Definitions of saturated states; P-v-T surface; Use</p>	<p><b>Vapour Power Cycles:</b> Pure Substance definition, P-v-T surface; Use of steam tables; Saturation tables; Superheated tables; Identification of states &amp; determination of properties, Mollier's chart.</p>	<p>Concepts of IC Engines and Gas turbines, unconventional energy sources included with 3-1-0-4 structure</p>	CO-1,2,3	<p>Heat power engineering course content is merged with this course and L-T-</p>	70%

			<p>of steam tables; Saturation tables; Superheated tables; Identification of states &amp; determination of properties, Mollier's chart.</p> <p><b>Vapour Power Cycles:</b> Rankine cycle, Effect of pressure and temperature, Regenerative cycle, Binary vapour cycle.</p> <p><b>Refrigeration &amp; Air conditioning:</b> Methods of refrigeration, Refrigerator &amp; heat pump, Reversed Carnot and Bell-Coleman cycles, Refrigerating effect, COP, Vapour compression and vapour absorption refrigeration systems.</p> <p><b>Psychrometry:</b> Properties of moist air, Psychrometric processes, use of psychrometric chart, Air conditioning systems for comfort, Infiltration and Indoor Air Quality</p> <p><b>Heating and Cooling load calculations:</b> Solar radiation, heat transfer through building structures, Winter and summer load calculations</p>	<p>Rankine cycle, Effect of pressure and temperature, Regenerative cycle, Binary vapour cycle.</p> <p><b>IC Engines:</b> Classification of I.C. Engines, working principles of S.I. and C.I. Engines (both 4 stroke and 2-stroke), combustion in S.I and C.I engines. Parameters of performance - measurement of cylinder pressure, fuel consumption, air intake, exhaust gas composition, Brake power – Determination of frictional losses and Indicated power – Performance test – Heat balance sheet and chart.</p> <p><b>Gas turbines:</b> Overview of Gas turbines. Closed and open Brayton cycle gas turbines, Analysis of closed cycle gas turbine, turbine Efficiencies, Gas turbine cycle with intercooling, reheat and regeneration.</p> <p><b>Jet propulsion:</b> Turbo jet, Turbo prop, ram jet and Pulse jet engines, Rocket engines, principle of working. Thrust, work and propulsive efficiency</p> <p><b>Introduction to Unconventional Energy Sources:</b> Solar, Wind, Biomass, Geothermal, OTEC energy sources.</p> <p><b>Refrigeration &amp; Air conditioning:</b> Methods of refrigeration, Refrigerator &amp; heat pump, Reversed Carnot and Bell-Coleman cycles, Refrigerating effect, COP, Vapour</p>			P-S changed	
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				compression and vapour absorption refrigeration systems.				
22ME4120	Instrumentation & Control	PC	<p><b>Definition – Basic principles of measurement</b> – Measurement systems, Measurement of Displacement: Theory and construction of various transducers to measure displacement – Using Piezo electric, Inductive, capacitance, resistance, Measurement of Speed: Mechanical Tachometers, Electrical tachometers, Non- contact type Stroboscope; <b>Measurement of Temperature:</b> Various Principles of measurement-Classification: Expansion Type: Bimetallic Strip-Liquid in glass Thermometer; Electrical Resistance Type: Thermistor, Thermocouple, RTD; Radiation Pyrometry: Optical Pyrometer; Measurement of Level: Direct methods – Indirect methods – Capacitive, Radioactive, Ultrasonic, Magnetic, Cryogenic Fuel level indicators –Bubbler level indicators. Flow measurement: Rotameter, magnetic, Ultrasonic, Turbine flowmeter, Hot – wire anemometer, Laser Doppler Anemometer (LDA).</p> <p><b>Stress-Strain measurements:</b> Various types of stress and strain measurements –Selection and installation of metallic strain gauges; electrical strain gauge – gauge factor – method of usage of resistance strain</p>	<p>Definition – Basic principles of measurement – Measurement systems, Measurement of Displacement: Theory and construction of various transducers to measure displacement – Using Piezo electric, Inductive, capacitance, resistance, Measurement of Speed: Mechanical Tachometers, Electrical tachometers, Non- contact type Stroboscope;</p> <p><b>Measurement of Temperature:</b> Various Principles of measurement-Classification: Expansion Type: Bimetallic Strip- Liquid in glass Thermometer; Electrical Resistance Type: Thermistor, Thermocouple, RTD; Radiation Pyrometry: Optical Pyrometer; Measurement of Level: Direct methods – Indirect methods – Capacitive, Radioactive, Ultrasonic, Magnetic, Cryogenic Fuel level indicators –Bubbler level indicators. Flow measurement: Rotameter, magnetic, Ultrasonic, Turbine flowmeter, Hot – wire anemometer, Laser Doppler Anemometer (LDA).</p> <p><b>Stress-Strain measurements:</b> Various types of stress and strain measurements –Selection and</p>	L-T-P-S changed from 2-0-0-4 to 3-0-2-0, Lab experiments were added	CO-5	To make students to do lab work and learn the usage of different instruments	25%

			<p>gauge for bending, compressive and tensile strains Measurement of Humidity: Moisture content of gases, Sling Psychrometer, Absorption Psychrometer, Dew point meter. Measurement of Force, Torque and Power- Elastic force meters, load cells, Torsion meters, Dynamometers.</p> <p><b>Elements of Control Systems:</b> Introduction, Importance – Classification – Open and closed systems- Servomechanisms – Examples with block diagrams – Temperature, speed and position control systems- Transfer functions- First and Second order mechanical systems</p> <p><b>Skilling components.</b></p> <ol style="list-style-type: none"> <li>1. Temperature measurement using Arduino</li> <li>2. Flow measurement using Arduino.</li> <li>3. Humidity measurement using Arduino</li> <li>4. Strain measurement using Arduino</li> <li>5. Vibration measurement using Arduino</li> <li>6. Thickness measurement using Arduino.</li> <li>7. Level measurement using Arduino</li> <li>8. Position control using Arduino using Servo motor</li> </ol>	<p>installation of metallic strain gauges; electrical strain gauge – gauge factor – method of usage of resistance strain gauge for bending, compressive and tensile strains Measurement of Humidity: Moisture content of gases, Sling Psychrometer, Absorption Psychrometer, Dew point meter. Measurement of Force, Torque and Power- Elastic force meters, load cells, Torsion meters, Dynamometers.</p> <p><b>Elements of Control Systems:</b> Introduction, Importance – Classification – Open and closed systems- Servomechanisms – Examples with block diagrams – Temperature, speed and position control systems- Transfer functions- First and Second order mechanical systems.</p> <p><b>List of Experiments:</b></p> <ol style="list-style-type: none"> <li>1. Temperature measurement using Arduino</li> <li>2. Study and calibration of a Rotameter for flow measurement</li> <li>3. Study and calibration of LVDT transducer for displacement measurement</li> <li>4. Flow measurement using Arduino</li> <li>5. Humidity measurement using Arduino</li> </ol>				
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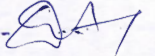


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			Speed control of DC motor using Arduino	6. Strain measurement using Arduino 7. Vibration measurement using Arduino 8. Thickness measurement using Arduino 9. Level measurement using Arduino 10. Position control using Arduino using Servo motor 11. Speed control of DC motor using Arduino  Calibration of Resistance Temperature Detector (RTD) for temperature measurement				
22ME3114	Industry 4.0 & Design of Cyber Physical Systems	PC	<p><b>Introduction to Industry 4.0:</b> The various Industrial Revolutions, Overview on Technologies of Industry 4.0, Industrial Internet, Applications of Industry 4.0, Comparison of Industry 4.0 Factory and Today's Factory.</p> <p><b>Industry 4.0 Basics:</b> Significant changes in the industry, Design requirements of Industry 4.0, Drivers of Industry 4.0, Cybersecurity, Impacts of Industry 4.0.</p> <p><b>Introduction to Cyber Physical System (CPS):</b> Key Features of CPS, Application Domains of CPS, Basic principles of design and validation of CPS, Challenges in CPS.</p>	<p><b>Introduction: Sensing &amp; actuation</b></p> <p>Communication-Part I, Part II, Networking-Part I, Part II, Industry 4.0: Globalization, The Fourth Revolution, LEAN Production Systems, Industry 4.0: Cyber Physical Systems and Next Generation Sensors, Collaborative Platform and Product Lifecycle Management</p> <p><b>Cybersecurity in Industry 4.0</b></p> <p>Basics of Industrial IoT: Industrial Processes-Part I, Part II, Industrial Sensing &amp; Actuation, IIoT-Introduction, Industrial IoT: Business Model and Reference Architecture: IIoT-Business Models-Part I, Part II, IIoT Reference Architecture-Part I, Part II. Industrial IoT- Layers: IIoT Sensing-Part I, Part</p>	Topics included: Sensing & Actuation, Cybersecurity in Industry 4.0, Industrial IoT- Layers, Industrial IoT: Security and Fog Computing	All Co's	To match with the industry requirements the modification in the syllabus is made by adding IOT concepts	90%

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			<p><b>CPS Platform components:</b> CPS Hardware platforms, Processors, Sensors and Actuators, CPS Network - Wireless, CAN, Automotive Ethernet, Scheduling Real Time CPS tasks, Synchronous Model and Asynchronous Model.</p> <p><b>CPS Application:</b> Health care and Medical Cyber-Physical Systems, Smart grid and Energy CyberPhysical Systems, WSN based Cyber-Physical Systems, Smart Cities.</p>	<p>II, IIoT Processing-Part I, Part II, IIoT Communication-Part I.</p> <p><b>Industrial IoT- Layers</b></p> <p>IIoT Communication, IIoT Networking-Part I, Part II, Part III. Industrial IoT: Big Data Analytics and Software Defined Networks: IIoT Analytics - Introduction, Machine Learning and Data Science Part I, Part II, Industrial IoT: Big Data Analytics and Software Defined Networks: SDN in IIoT-Part I, Part I, Data Center Networks, Industrial IoT</p> <p><b>Industrial IoT: Security and Fog Computing</b></p> <p>Fog Computing in IIoT, Security in IIoT-Part I, Part II, Industrial IoT-Application Domains, Industrial IoT-Application Domains: Healthcare, Power Plants, Inventory Management &amp; Quality Control, Plant Safety and Security (Including AR and VR safety applications), Facility Management. Industrial IoT-Application Domains: Oil, chemical and pharmaceutical industry, Applications of UAVs in Industries, Real case studies.</p>				
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**Annexure-3(c) Stake Holder Feedback Analysis and Action  
Taken Report Academic Year: 2022-23**

S.No	Stake Holders	Count
1	Academic Peers	50
2	Alumni	90
3	Faculty	20
4	Industry personnel	40
5	Parents	18
6	Students	139
	<b>Total</b>	<b>357</b>

**Academic Peers**

Sl.No.	Department	Name of the Programme	Recommendations / Suggestion(s)	Analysis	Action Taken	DAC No.	Pg No.	Date	BOS No. Proof	Pg No.	Date
1	ME	B.Tech	Dr.G.Naga Srinivasulu, Professor, NIT Warangal, suggested to include Gas turbine cycles in 21ME2210- Analysis of thermal systems course. And also suggested to rewrite the convection heat transfer topics in 21ME3115 course	The suggested topics are necessary for mechanical students	Gas turbines cycles are covered in Analysis of thermal systems course and convection heat transfer concept topics are revised	21	2	09-02-2022	22	4	17-05-2022
2	ME	B.Tech	Dr.Srikanth K, professor, NIT Warangal, Suggested to include "Kinematic Synthesis(four bar chain)" topic in the course 21ME2211 Kinematic & Machines. He also suggested to refer "Mechanical Vibrations by Prof. R.V.Chalam" text book for 21ME3118 Dynamics of Machines course.	The suggested topics are necessary to cover the advanced concepts	It is proposed to include Kinematic Synthesis(four bar chain)" topic in the course 21ME2211 Kinematic & Machines. and "Mechanical Vibrations by Prof. R.V.Chalam" text book for 21ME3118 Dynamics of Machines course	22	1	12-03-2022	22	4	17-05-2022
3	ME	B.Tech	Dr. Suresh Babu, professor in NIT Warangal, suggested to separate 21ME3113 Machine Design course as two separate courses considering the static and dynamic loading conditions, and also suggested to include governors concept in 21ME3118 Dynamics of Machines course. He suggested to give practical exposure to students on the topic covered in this course.	TO emphasize more on design concepts	Design for static and dynamic loading conditions are included in MED course	22	1	12-03-2022	22	4	17-05-2022
4	ME	B.Tech	Dr. G Rudra Narsimharao, Director, The Energy and Resources Institute (TERI), India, suggested to include (M.Tech-MD) 18 ME 5117 introduction of 3D printing (in tool design) 18 ME 5118 introduction to nanomaterials and their application Ceramics topic: areas of applications	TO upgrade M.Tech Syllabus with new concepts	It is resolved to approve the changes proposed				22	6	17-05-2022


  
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5	ME	B.Tech	Dr G Rudra Narsimha rao, Director, The Energy and Resources Institute (TERI), India suggested that (M.Tech-TE) 18 ME 52 HI Add topics: Energy Conservation Act'2001 Perform Achieve and Trade (PAT) scheme	TO upgrade M.Tech Syllabus with new concepts	It is resolved to approve the changes proposed				22	6	17-05-2022
6	ME	B.Tech	CHRISTOPHER T, Retd prof & HOD, GOVT COLLEGE OF ENGG TIRUNELVELI, India, for M.Tech -TE, Laboratory component is missing. An advanced Thermal Engineering Lab and Software Competency such as CFD may be appropriate	TO upgrade M.Tech Syllabus with new concepts	Lab component is added for the course 22ME5109- Numerical Methods in Thermal engineering				22	6	17-05-2022
7	ME	B.Tech	CHRISTOPHER T, Retd prof & HOD, GOVT COLLEGE OF ENGG TIRUNELVELI, India, suggested for M.Tech -MD, Elective Advanced Dynamics of mechanisms machines is missing; Another lab using dynamics analysis software such as ADAMS would also be appropriate.	TO upgrade M.Tech Syllabus with new concepts	It is resolved to include ADAMS software based practise exercises in Advanced mechanisms (22ME5112)				22	6	17-05-2022
8	ME	B.Tech	Dr. J. Jabinth, Assistant professor, Ramco Institute of Technology, India suggested for M.tech -MD, 1) Advanced Python Programming (an additional subject may be included in the first semester to cater the latest trends) The content in subjects is okay	TO upgrade M.Tech Syllabus with new concepts	It is resolved to include Python Programming in Design for Optimization Course(22ME5222)				22	6	17-05-2022
9	ME	B.Tech	Dr. J. Jabinth, Assistant professor, Ramco Institute of Technology, India suggested for M.tech -TE, A subject related to Electrical Technology (E-Vehicle growing trend) would be more attractive.	TO upgrade M.Tech Syllabus with new concepts	It is resolved to merge Engine System performance and IC Engine & Pollution control courses as Engine Performance & Emission Control and to introduce new elective course on Thermal Management on Electric and Electronic Systems				22	6	17-05-2022

### Alumni

Sl.No.	Department	Name of the Programme	Recommendations / Suggestion(s)	Analysis	Action Taken	DAC No.	Pg No.	Date	BOS No. Proof	Pg No.	Date
1	ME	B.Tech	Gampa Srinath, Supervisor, Emirates Steel Industry, Abu Dhabi suggested to Include a course on Industrial Engineering and Production Planning	To understand the industrial activities these courses are necessary	Concepts of Industrial Engineering and Production Planning are included in Production Technology course	21	2	09-02-2022	22	4	17-05-2022


  
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2	ME	B.Tech	K.Lakshmi Nanrayana suggested to introduce Autocad design	To understand the engineering graphics autocad course is to be taught	Auto caD is taught in Engineering graphics course	21	2	09-02-2022	22	4	17-05-2022
<b>Faculty</b>											
Sl.No.	Department	Name of the Programme	Recommendations / Suggestion(s)	Analysis	Action Taken	DAC No.	Pg No.	Date	BOS No. Proof	Pg No.	Date
1	ME	B.Tech	Mr.S.Ramesh kumar suggested to provide more handson session for the machine learning course	Machine Learning course requires more practice	It is proposed to include mor practise sessions in the curriculum for Machine Learning course.	21	2	09-02-2022	22	4	17-05-2022
2	ME	B.Tech	Dr.K.Lokesh suggested to offer Fluid mechanics in II-I Semester and include one tutorial for the course	TO enable students to understand the concepts of CFD in ATS in II-II	It is proposed to revise semester wise courses for Y21 and Y22 admitted batch students and to include tutorial to the course	21	2	09-02-2022	22	4	17-05-2022
3	ME	B.Tech	Mr.K.Sai Sarath suggested to revise the syllabus of Analysis of thermal systems	Psychrometric concepts are repeated in TD and ATS	It is proposed to revise the syllabus of ATS courses	21	2	09-02-2022	22	4	17-05-2022
4	ME	B.Tech	Dr. S.S.Rao suggested to revise the syllabus of Instrumentation & Control Systems and Industry 4.0 & cyber physical systems	Concepts on Robotics must be incorporated	It is proposed to revise the syllabus of ICS and Industry 4.0 & Cyber Physical Systems	21	2	09-02-2022	22	4	17-05-2022
5	ME	B.Tech	Dr. A.Srinath & Dr.K.Ramakrishna suggested to merge Design tools workshop-I & II and offer as Workshop Practices course for ist year students	worshop practices can be taught as one course	It is resolved to propose the recommendation in the upcoming BOS	21	2	09-02-2022	22	4	17-05-2022
6	ME	B.Tech	Dr. A.Srinath & Dr.K.Ramakrishna suggested to offer one more mathematics course	problems solving skills is dealt in CRT traning	It is proposed to change the syllabus of Numerical methods for Mechanical Engineering by including the maths concepts and MATLAB as skill component	21	2	09-02-2022	22	4	17-05-2022

  
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## Industry Personnel

Sl.No.	Department	Name of the Programme	Recommendations / Suggestion(s)	Analysis	Action Taken	DAC No.	Pg No.	Date	BOS No. Proof	Pg No.	Date
1	ME	B.Tech	Mr.S.S. Subramanya Sastry, head of projects, veego Technologies expressed that the Syllabus is exhaustive and good	Syllabus was good	DAC chairman thanked the industry person	21		09-02-2022	22	4	17-05-2022
2	ME	B.Tech	Mr.K.Krishna Kumar, Sri lakshmi Gnapathi Engg works(Kumar pumps), suggested to involve students in exploring syllabus by giving topics of syllabus in each subject rather than lecturers explaining the subject.	Such methods will explore students talents	It is already been suggested in the curriculum to deliver 60% of the content of the core courses through flipped learning mode				22	7	17-05-2022
3	ME	B.Tech	Mr.G.Srinivasa Rao, Executive Engineer, APGENCO, VTPS appreciated the curriculum and found the syllabus is suitable.	Syllabus was good	DAC chairman thanked the industry person				22	7	17-05-2022
4	ME	B.Tech	Dr. A.Subhananda Rao, DG & Chief controller-DRDO, Hyderabad suggested to have 1. more skilling for hands on experience. 2. teaching /learning methods to be oriented towards real time problem solving in industry/society. 3. Orientation of course content towards Industry 4.0. 4. General degree without tagging specialization is advisable for students career point of view. 5. For each stream one subject covering all advanced concepts in brief is advisable. 6. It is advisable to include unconventional energy sources in the curriculum.	More skilling tools will enhance the job oppuntunities of the students	It is proposed to implement the suggestions mentioned in points 1,2,3. Point no. 4 & 5 are forwarded for discussion in BOS. For Point no.6 Unconventional energy sources are included in Analysis of thermal systems course				22	4	17-05-2022
5	ME	B.tech	Mr.A.Chakravarthy,DGM(Design & Engg.)RINL-VSP, suggested to include Cryogenics in ME syllabus	Cryogenics are important in rocket science	It is proposed to include Cryogenics as an elective course				22	4	17-05-2022
6	ME	B.Tech	Mr. V.Sudhakar, GM(proj), RINL/VSP, Condition monitoring techniques may be included as elective course for ME students	Quality concepts are very much needed for Mechanical engineers	It is proposed to offer Condition monitoring techniques as an elective course				22	4	17-05-2022

  
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7	ME	B.Tech	Mr.S.Rajesh,DGM, RINL, appreciated the curriculum	Syllabus was good	DAC chairman thanked the industry person				22	4	17-05-2022
8	ME	B.Tech	Sreenivasa Rao Perla, senior manager, Cyient, India commented that, Overall the program is design is fine with me. well structured and well thought off. all the best to the Team-KLU.	Syllabus was good	DAC chairman thanked the industry person				22	4	17-05-2022
9	ME	B.Tech	Mr.S A Sundaresan, Vice President, Ashok Leyland, India, commented that for M.Tech-TE, * exposure to thermal management required * more exposure to system engineering - multi-domain (electrical, electronic and mechanical) design challenges required * an elective in power transfer (mechanical, pneumatic, hydraulic and electrical) will help	Due to the increase in the demand of elctetric vehicles thermal management of electric vehicels is an important concept	It is resolved to introduce elective course on Thermal management of electric and electronic components				22	4	17-05-2022
10	ME	B.Tech	Mr.S A Sundaresan, Vice President, Ashok Leyland, India, commented that for M.Tech-TE, * Thermal management for electric and fuel cell electric vehicles will be a good elective. * cooling of electronics and MEMS	Due to the increase in the demand of elctetric vehicles thermal management of electric vehicels is an important concept	It is resolved to introduce elective course on Thermal management of electric and electronic components				22	6	17-05-2022
11	ME	B.Tech	Mr.S A Sundaresan, Vice President, Ashok Leyland, India, commented that for B.Tech, Very good choice of courses and course content.	Syllabus was good	DAC chairman thanked the industry person				22	4	17-05-2022
<b>Student</b>											
Sl.No.	Department	Name of the Programme	Recommendations / Suggestion(s)	Analysis	Action Taken	DAC No.	Pg No.	Date	BOS No. Proof	Pg No.	Date
1	ME	B.Tech	180070153, V.Sai Ujwal suggested to include more topics related to GATE in the relavant courses	To perform better in GATE score	Gate sylalbus is included in the relavant courses	21	1	09-02-2022	22	4	17-05-2022

  
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2	ME	B.Tech	190079008, T.Dharani Kumar Reddy suggested to include 75% of curriculum with core courses related to latest technology and 25% of the curriculum with coding related courses	To enable the student ready for core and coding related jobs	Coding is offered as special training course in addition to the regular courses	21	1	09-02-2022	22	4	17-05-2022
3	ME	B.Tech	190070087, Saamaj N C.V.J suggested to include more core related softwares in the curriculum	To enable the student ready for core and coding related jobs	Coding is offered as special training course in addition to the regular courses	21	1	09-02-2022	22	4	17-05-2022
4	ME	B.Tech	2000079026, V.L.N. Harshavardhan, suggested to focus on Entrepreneurship, rather on more software courses	Some students are interested in Entrepreneurship	Entrepreneurship course is introduced for Y21 & Y22 admitted batch students	21	1	09-02-2022	22	4	17-05-2022
5	ME	B.Tech	190070070, N.Sai Sampath, requested to have more industrial tours	Students will get exposure to the real industry needs	Industry internship is included in the curriculum to get industry exposure	21	1	09-02-2022	22	4	17-05-2022
6	ME	B.Tech	190070083, P.Bhanu prakash requested to include more practicals for the theory courses	Practical knowledge enables to understand the course better	Practicals are included in all core courses and software labs are used for specialization courses	21	1&2	09-02-2022	22	4	17-05-2022
7	ME	B.Tech	190080001, B.Chandra Sekhar Varma requested to correlate the topics with the present industry	To get good job in the core industry	Specialization courses are designed in line with the present industry	21	1&2	09-02-2022	22	4	17-05-2022
8	ME	B.Tech	Y20 students requested to explain the importance of specialization courses before the starting of the semester	Students should be aware of the opportunities in each specialization	It is resolved to conduct orientation on the specializations before the start of the semester	21	1&2	09-02-2022	22	4	17-05-2022
9	ME	B.Tech	Y19 students requested to offer Autotronics & Automobile Engineering courses in III-I Semester and Automobile Engine Design & Alternate Energy Resources in III-II Semester	Autotronics & Automobile Engineering are the basic courses to be studied before engine design and alternate energy sources	It is resolved to offer Autotronics & Automobile Engineering courses in III-I Semester and Automobile Engine Design & Alternate Energy Resources in III-II Semester	21	1&2	09-02-2022	22	4	17-05-2022



Dr.D.V.A.RamaSastry  
HOD-ME

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## Annexure-5(a)

### M.Tech – Machine Design

### 2022-23 admitted batch

S. No.	Course Code	Course Title	Periods			Contact Hours	Credits	New/Revised/Retained Courses	Justification
			L	T	P				
1	22ME 5117	Design Methods	4	0	0	4	4	Retained	
2	22ME 5118	Design with Advanced materials	3	0	0	3	3	Retained	
3	22ME 5119	Theory of Elasticity and Plasticity	3	1	0	4	4	Retained	
4	22ME 5120	Modeling & Analysis-1 (CAD)	4	0	2	6	5	Retained	
5	22ME 5221	Mechanical Vibrations	3	0	0	3	3	Retained	
6	22ME 5222	Design for Optimization	3	1	0	4	4	Retained	
7	22ME 5223	Advanced strength of materials	3	1	0	4	4	Retained	
8	22ME 5224	Modeling & Analysis-2 (FEM)	4	0	2	6	5	Retained	
9	22ME 5112	Elective-1	3	0	0	3	3		
10	22ME 51J1	Elective-2	3	0	0	3	3		
11	22ME 52K3	Elective-3	3	0	0	3	3		
12	22ME 52L2	Elective-4	3	0	0	3	3		
13	22IE5149	Seminar	0	0	4	4	2	Retained	
14	22IE5250	Term Paper	0	0	4	4	2	Retained	
15		Major Project	0	0	72	-	36	Retained	
<b>Total</b>			<b>39</b>	<b>3</b>	<b>84</b>	<b>54</b>	<b>82</b>		

### ELECTIVE COURSES:

Elective – 1							New/Revised/Retained Courses	Justification
1	22ME 5111	Precision and Quality Engineering	3	0	0	3	Retained	
2	22ME 5112	Advanced mechanisms & manipulator kinematics	3	0	0	3	Revised	



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3	22ME 51I3	Concurrent Engineering	3	0	0	3	Retained	
<b>Elective – 2</b>								
1	22ME 51J1	Design of Pressure Vessels and Plates	3	0	0	3	Retained	
2	22ME 51J2	Tribological System Design	3	0	0	3	Retained	
3	22ME 51J3	Product Design and Development	3	0	0	3	Retained	
<b>Elective – 3</b>								
1	22ME 52K1	Mechanics of Composite Materials	3	0	0	3	Retained	
2	22ME 52K2	Machine Tool Design	3	0	0	3	Retained	
3	22ME 52K3	Fracture Mechanics	3	0	0	3	Retained	
<b>Elective – 4</b>								
1	22ME 52L1	Engineering Noise & Control	3	0	0	3	Retained	
2	22ME 52L2	Engineering Failure Analysis and prevention	3	0	0	3	Retained	
3	22ME 52L3	Design for Manufacturing, Assembly and Environment	3	0	0	3	Retained	

## Annexure-5(b)

### KLEF

## DEPARTMENT OF MECHANICAL ENGINEERING

### M.TECH - THERMAL ENGINEERING

### 2022-23 admitted batch

S. No.	Course Code	Course Title	Periods			Contact Hours	Credits	New/Revised/Retained Courses	Justification
			L	T	P				
1	22ME5109	Numerical Methods in Thermal engineering	3	0	2	5	4	Retained	
2	22ME5110	Advanced Thermodynamics	3	1	0	4	4	Retained	
3	22ME5111	Design of Thermal Systems	3	1	0	4	4	Retained	
4	22ME5112	Advanced Heat and Mass Transfer	3	1	0	4	4	Retained	
5	22ME5213	Incompressible and Compressible Flows	3	1	0	4	4	Retained	
6	22ME5214	Computational Fluid Dynamics	3	0	2	5	4	Retained	

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7	22ME5215	Refrigeration and Cryogenics	3	1	0	4	4	Retained
8	22ME5216	Measurements in Thermal Engineering	3	1	0	4	4	Retained
9		Elective - 1	3	0	0	3	3	
10		Elective - 2	3	0	0	3	3	
11		Elective - 3	3	0	0	3	3	
12		Elective - 4	3	0	0	3	3	
13	22IE5149	Seminar	0	0	4	4	2	Retained
14	22IE5250	Term Paper	0	0	4	4	2	Retained
15	22IE6050	Dissertation	0	0	72	36		Retained
			<b>39</b>	<b>3</b>	<b>84</b>	<b>54</b>	<b>82</b>	

## ELECTIVE COURSES

S.No	Course code	Course Title	Periods			Credits	New/Revised/Retained Courses	Justification
			L	T	P			
<b>Elective-1</b>								
1	22ME51E1	Heat Exchanger Design	3	0	0	3	Retained	
2	22ME51E2	Convection and Two-Phase Flow	3	0	0	3	Retained	
3	22ME51E3	Compact Heat Exchangers	3	0	0	3	Retained	
<b>Elective-2</b>								
1	22ME51F1	Engine Performance and Emission Control	3	0	0	3	Retained	
2	22ME51F2	Thermal management of electric and electronic systems	3	0	0	3	New Course	Based on the feedback of industry person a new course is drafted
3	22ME51F3	Alternative Fuels	3	0	0	3	Retained	
<b>Elective-3</b>								
1	22ME52G1	Principles of Turbo-machinery	3	0	0	3	Retained	
2	22ME52G2	Gas Turbine Engineering	3	0	0	3	Retained	
3	22ME52G3	Turbo-Compressors	3	0	0	3	Retained	
<b>Elective-4</b>								
1	22ME52H1	Energy Conservation, Management & Audit	3	0	0	3	Retained	
2	22ME52H2	Renewable Energy Technology	3	0	0	3	Retained	
3	22ME52H3	Solar Energy and Wind Energy	3	0	0	3	Retained	

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### 22ME51F2-THERMAL MANAGEMENT OF ELECTRIC AND ELECTRONIC SYSTEMS

L-T-P-S:3-0-0-0

Credits":3

#### COURSE OUTCOMES (COs):

CO NO	Course Outcome (CO)	PO/PSO	Blooms Taxonomy Level (BTL)
CO 1	Apply the concepts of heat transfer to various electric and electronic systems requiring heat dissipation	PO1	3
CO 2	Apply different cooling techniques to microchannels, heat pipes and vapor chambers	PO1	3
CO 3	Apply various thermal management techniques in the fields of automobiles and electronics	PO1	3
CO 4	Analyze the Battery thermal management system and battery pack design	PO2	4

#### Syllabus:

Introduction to Thermal Management in Electronics -heat transfer modes, electronics packaging, contact and spreading resistances, heat sink design, thermal interface material(TIM)  
Cooling Technologies-thermal interface and phase change materials, active, passive and novel air cooling approaches, microchannels, jet impingement, immersion cooling, heat pipes and vapor chambers, thermoelectric.Applications of thermal management: avionics, data centers, mobile, internet of things, high- performance computing, automotive, etc . Lithium-ion battery configuration and operation, Sources of heat in Lithium-ion battery, Lithium Ion- cell temperature ranges. Battery Thermal Management System (BTMS): Need of BTMS, Technologies of BTMS, Battery pack design.

**Text Books** :1. The Handbook of Lithium-Ion Battery Pack Design Chemistry, Components, Types and Terminology

**Reference Books** :1. THERMAL MANAGEMENT OF MICROELECTRONIC EQUIPMENT HEAT TRANSFER THEORY, 2. ANALYSIS METHODS, AND DESIGN PRACTICES L. T. Yeh, Ph.D., P.E. R. C. Chu ASME PRESS NEW YORK 2002 ASME Press Book Series on Electronic Packagin

**Web Links** :<https://www.youtube.com/watch?v=m7LVcog4bpc>

<https://www.youtube.com/watch?v=RplSmck3R2I>

<https://www.youtube.com/watch?v=nPBo3oNwgyU>

<https://www.youtube.com/watch?v=9yW1BZ8yVBU>

<https://www.youtube.com/watch?v=3MtC2kLjiY>

[https://www.youtube.com/watch?v=m7LVcog4bpc&list=RDCMUCgp23vdLNaUitOkCxxVnRrg&start\\_radio=1&rv=m7LVcog4bpc](https://www.youtube.com/watch?v=m7LVcog4bpc&list=RDCMUCgp23vdLNaUitOkCxxVnRrg&start_radio=1&rv=m7LVcog4bpc) <https://youtu.be/WYsHDkyP9XM?list=PLbRMhDVUMngcwN9HHIOALFj1HYs9T64BF>

  
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### Annexure-6Ka)

#### Minor Degree in Mechanical Engineering offered to all Engineering branches

Sl No	Course Code	Course Title	Type	L	T	P	S	Cr	CH
1		Competitive Coding	Minor					2	
2		Web Technologies	Minor					2	
3	21PH1010	Mechanics	Minor	3	0	0	0	3	4
4	21ME2105	Thermodynamics	Minor	3	0	0	0	3	3
5	21ME2101	Mechanics of Solids	Minor	3	0	2	0	4	5
6	21ME2107	Manufacturing Processes	Minor	2	0	2	0	3	4
7	21ME2210	Analysis of Thermal Systems(Optional)	Minor	2	0	0	4	3	6
8	21ME2208	Mechanical Engineering Design & Innovation(Optional)	Minor	2	0	0	4	3	6
9	21ME3217	Production Technology	Minor	3	0	0	0	3	3
10	21ME3116	Optimization Techniques	Minor	2	0	0	0	2	2

#### Minor Degree in Robotics & Mechatronics offered to all engineering branches

Sl No	Course Code	Course Title	Type	L	T	P	S	Cr	CH
1		Competitive Coding	Minor					2	
2		Web Technologies	Minor					2	
3	21RM2101	Mechatronics : Fundamentals and Core Concepts	Minor	3	0	0	0	3	3
4	21RM2202	Robot motion and kinematics	Minor	3	0	0	0	3	3
5	21RM3103	Robot Motion Planning, dynamics and Control	Minor	3	0	2	0	4	5
6	21RM3204	Robot Manipulation and Wheeled Mobile Robots	Minor	2	0	2	0	3	4
7	21RM4105	Robotics: Vision Intelligence and Machine Learning	Minor	2	0	2	0	3	5
8	21RM4206	Industry 4.0 & Design of cyber physical systems	Minor	3	0	0	0	3	3
9	21ME4065	Artificial Intelligence for Robotics	Minor	2	0	2	0	3	4
10	21ME4066	Robotics & Industrial Automation	Minor	3	0	0	0	3	3

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### Minor Degree in Computational Fluid Dynamics offered to all engineering branches

Sl No	Course Code	Course Title	Type	L	T	P	S	Cr	CH
1		Competitive Coding	Minor					2	
2		Web Technologies	Minor					2	
3	21CF2101	Thermo fluids Engineering	Minor	3	0	2	0	4	5
4	21CF2202	Heat Transfer	Minor	3	0	2	0	4	5
5	21CF3103	Numerical Techniques in Thermal Engineering	Minor	3	0	2	0	4	5
6	21CF3204	Computational Fluid Dynamics(Optional)	Minor	3	0	0	4	4	7
7	21CF4105	Numerical Methods for Multiphase Flows(Optional)	Minor	3	0	2	0	4	5
8	21ME4105	COMPUTATIONAL FLUID FLOW AND HEAT TRANSFER-FDM APPROACH	Minor	2	0	2	0	3	4
9	21ME4106	CFD FOR COMPRESSIBLE AND INCOMPRESSIBLE FLOWS	Minor	2	0	2	0	3	4
10	21ME2107	THERMAL MANAGEMENT OF ELECTRIC AND ELECTRONIC SYSTEMS	Minor	3	0	0	0	3	3

### Annexure-6(b)

### Honors Degree

Sl No	Course Code	Course Title	Type	L	T	P	S	Cr	CH
1	21ME4101	Modelling and Simulation of Mechatronic Systems	Honor	3	0	2	0	4	6
2	21ME4102	Robotics - Advanced Concepts and Analysis	Honor	3	0	2	0	4	6
3	21ME4103	Dynamics of Multi-body Systems	Honor	3	1	0	0	4	4
4	21ME4105	Refrigeration & Air Conditioning	Honor	3	1	0	0	4	4
5	21ME4106	Power Generation Technologies	Honor	3	1	0	0	4	4
6	21ME4107	Gas Dynamics	Honor	3	1	0	0	4	4
7	21ME4108	Emerging Smart Material for Mechatronics Applications	Honor	3	1	0	0	4	4

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### Annexure-7(a)

#### Skill Sets

S.No.	Company Name	Job profile	Skills Required
1	ABB	Trainee, Test Engineer	System design and Smart manufacturing
2	ACC cements	Management trainee	Quality management, material selection and smart manufacturing.
3	AIRBUS	Graduate Engineer	Design, Manufacturing and automotive concepts
4	Alpha Laval	Design Engineer	Renewable energy, CFD and Heat Transfer
5	Altair	CAE Technical specialist	Programming skills with core knowledge
6	Amararaja	Graduate Engineer trainee and Mangament trainee	Manufacturing, supervision and Quality
7	APOLLO	Graduate Engineer trainee, shop floor Engineer	Maintenance, conditional monitoring, additive manufacturing and GD&T
8	Ardee Engineering Company	Trainee - Quality/ Design Engineer	Product design, smart manufacturing and renewable energy technologies.
9	ASAHI GLASS	Hybris Developer - SAP -MM and ERP	Heat treatment, Conditional monitoring and quality management.
10	Ashok Leyland	Trainee Engineer	E- Vehicle, Autotronics, IIOT based vehicle and system design.
11	Axiscades	Design Engineer	Product design and CAD Packages
12	Bajaj Auto Ltd	Graduate Engineer trainee	E-Vehicle, Autotronics and sheet metal.
13	BHARAT BENZ	Design and Graduate Engineer Trainee	System design and Smart manufacturing
14	Bharath forge	Graduate Engineer trainee	Quality management, material selection and smart manufacturing.
15	BOEING	Design Engineer	CAD packages and product development
16	BOSCH	Graduate Engineer trainee	Sheet metal and GD&T
17	Caterpillar	Design Engineer	Modeling, simulation, Autotronics and vehicle intelligence.
18	CEAT	Graduate Engineer trainee, shop floor Engineer	Total quality management, Smart manufacturing and GD&T
19	CYIENT	Design Engineer	CAD packages and product development
20	Dalmia cements	Trainee Quality Engineer	Total quality management, Supply chain management and Smart manufacturing.
21	Dassault systems	Trainee Engineer	Programming skills with core knowledge
22	ESSAR STEEL	Graduate Engineer trainee	SAP-MM, Conditional monitoring, and composites.
23	EXIDE	Graduate Engineer trainee and Mangament trainee	Smart manufacturing, additive manufacturing and GD&T
24	FANUC	Trainee Engineer	Mechatronics and Robotics
25	Force Motors	FNA, SCM Analyst, Graduate Engineer trainee	Heat treatment, smart manufacturing and quality management.
26	Ford	Graduate Engineer Trainee	Design, Manufacturing and automotive concepts
27	Frugal Technologies	Trainee - Quality/ Design Engineer	Product development, System design, Quality management.
28	General Electric	Design Engineer	Renewable energy, CFD and Heat Transfer. Smart manufacturing IIOT
29	Geometric Software(HCL Technologies)	Design Engineer	Product design and CAD Packages
30	GODREJ &BOYCE	Graduate Engineer trainee	System design and Smart manufacturing
31	Hero motocorp	Design Engineer	CAD packages and Quality control

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32	Hinduja Groups	Graduate Engineer trainee	IIOT, additive manufacturing, Material selection and GD&T
33	HONEYWELL	Design Engineer	Renewable energy, CFD and Heat Transfer
34	Hyundai Mobis	Trainee Engineer	Product developemnt and CAD package
35	Hyundai Motors	Graduate Engineer Trainee	Manufacturing, Automotive concepts
36	ISUZU	Graduate Engineer Trainee	Manufacturing and automotive concepts
37	JAGUAR	Graduate Engineer	Design, Manufacturing and automotive concepts
38	JCB India Ltd	Graduate Engineer Trainee	Quality Control, Process, Production supervisor
39	John Deere	FNA, SCM Analyst, Graduate Engineer trainee	Autotronics, System design CFD AND CAD Package
40	JSW Steels Ltd	Trainee Engineer	Product design, smart manufacturing and renewable energy technlogies.
41	Kenna Metals	Trainee Engineer	Additive manufacturing, Material selection
42	KIA Motors	Graduate Engineer Trainee	Manufacturing and automotive concepts
43	Kirloskar Group	Junior technical officer and QA Engineer	Smart manufacturing, GD&T and IIOT.
44	L&T	Trainee Engineer	designing and testing mechanical devices
45	LG	Quality Engineer, Trainee Engineer	Renewable energy, CFD and Heat Transfer
46	Mahindra & Mahindra	Design Engineer	E-Vehicle, Autotronics, sheet metal.
47	Mahindra Trucks and Buses	Graduate Engineer trainee	Product design, smart manufacturing and Autotronics.
48	Maruti Suzuki	Graduate Engineer Trainee	Design, Manufacturing and automotive concepts
49	MEIL	Graduate Engineer trainee and Mangament trainee	designing and testing mechanical devices
50	Mercedes Benz	Design and Graduate Engineer Trainee	Design, Manufacturing and automotive concepts
51	Murugappa group	Graduate Engineer trainee - Core subjects knowledge.	Smart materials, Design and supply chain management
52	Punj Lloyd	Design Engineer	Additive manufacturing, Smart manufacturing (IIOT) and Renewable energy.
53	QUEST GLOBAL through Indeginium	Trainee Engineer	Product design and CAD Packages
54	Reliance Industries	Graduate Engineer trainee, Management trainee	Renewable energy, CFD and Heat Transfer
55	Royal Enfield	Quality Inspector, Trainee Engineer	E-Vehicle design and autotronics
56	Saint Gobin	Hybris Developer - SAP -MM and ERP	Heat treatment, Conditional monitoring and quality management.
57	Sandvik Group	Trainee Engineer	Smart manufacturing (IIOT), ADDITIVE manufacturing
58	SATVEN	Design Engineer	CAD Packages and additive manufacturing
59	SIEMENS	Design Engineer	Product design, smart manufacturing and renewable energy technologies.
60	Stellantis	Graduate Engineer	Autotronics and manufacturing,
61	SUPERSONIC	Graduate Engineer trainee and Mangament trainee	Smart manufacturing, additive manufacturing and GD&T
62	Suzlon Energy Limited	Design Engineer	Renewable energy, CFD and Heat Transfer
63	Tata Motors	Quality inspector and Trainee quality.	E-Vehicle design , autotronics and IIOT
64	TATA POWER	Trainee Engineer	Renewable energy and CFD
65	Tata Steel	Graduate Engineer	CAD packages and product development

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66	Tech Mahindra	Design Engineer	CAD packages.
67	TECHNIMONT ICB	Graduate Engineer Trainee	GD&T, Additive manufacturing, Material selection.
68	Technip FMC	Site Engineer	Manufacturing, Oil and Gas
69	Thermax	Design Engineer, Trainee Engineer	Renewable energy and HVAC
70	Thyssen krup	Graduate Engineer trainee	GD&T, Additive manufacturing, Material selection.
71	Triveni turbines	Trainee Engineer	GD&T, Additive manufacturing, Material selection and product design
72	TVS Motors	Production Engineer, quality Engineer	Supply chain management, SAP -MM and Autotronics.
73	Vedanta	Trainee Engineer	Smart manufacturing (IIOT), Renewable energy.
74	Volkswagon	Design Engineer	Product design, sheet metal and Modelling and simulation package.
75	Volvo India	Trainee Engineer	E- Vehicle, Autotronics, IIOT based vehicle and system design.
76	WHIRLPOOL	Quality Engineer, Trainee Engineer	HVAC and Renewable energy
77	Wipro infra	Design Engineer	CAD Packages and additive manufacturing

### Annexure-7(b)

#### Self Learning & E-learning Components

#### List of Courses identified in Coursera for students & faculty

##### Specialization / Certificate Courses:

1. Autodesk CAD/CAM/CAE for Mechanical Engineering Specialization
2. Modern Robotics: Mechanics, Planning, and Control Specialization
3. Self-Driving Cars Specialization
4. Autodesk CAD/CAM for Manufacturing Specialization
5. CAD and Digital Manufacturing Specialization
6. Machine Learning Engineering for Production (MLOps) Specialization
7. Renewable Energy Specialization

##### Core Courses:

1. Introduction to Thermodynamics: Transferring Energy from Here to There
2. Fundamentals of Macroscopic and Microscopic Thermodynamics
3. Introduction to Engineering Mechanics
4. Applications in Engineering Mechanics
5. Materials Science: 10 Things Every Engineer Should Know
6. Mechanics of Materials I: Fundamentals of Stress & Strain and Axial Loading
7. Mechanics of Materials II: Thin-Walled Pressure Vessels and Torsion
8. Mechanics of Materials III: Beam Bending
9. Mechanics of Materials IV: Deflections, Buckling, Combined Loading & Failure Theories
10. Machine Design Part I

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11. Fundamentals of Fluid Power

12. Modern Robotics, Course 1: Foundations of Robot Motion

### Annexure-7(c)

#### Software tools

Course Code	Courses	Software Tool mapped
21ME2101	Mechanics of Solids	ANSYS
21ME2104	3D Modeling and Physical Prototyping	Fusion 360/Solidworks
22ME2107	Mathematics - 3 (Numerical Computation for Mechanical Engineers)	MATLAB/Octave
21ME2210	Analysis of Thermal Systems (CFD S/W)	ANSYS-CFD
21ME2211	Kinematics of Machines (with ADAMS S/W)	ADAMS
21ME2208	Mechanical Engineering Design & Innovation (FEA S/W)	ANSYS/PYTHON/EXCEL
21ME2212	Manufacturing Technology (Linked to Project)	CNC programming
22ME3119	Robotics	Python/MATLAB
21ME3113	Machine Design	ANSYS/SolidWorks
21ME4120	Instrumentation & Control	TinkerCAD/Aurdino
21ME3114	Industry 4.0 & Design of Cyber Physical Systems	TinkerCAD/Aurdino/Python
21ME4052	FINITE ELEMENT METHOD	ANSYS
21ME4053	MODELING ANALYSIS & DESIGN OF ROBOTIC SYSTEMS	Solidworks & ANSYS
21ME4055	ADVANCED STRENGTH OF MATERIALS	ANSYS
21ME4105	COMPUTATIONAL FLUID FLOW AND HEAT TRANSFER-FDM APPROACH	ANSYS-Fluent
21ME4106	CFD FOR COMPRESSIBLE AND INCOMPRESSIBLE FLOWS	ANSYS-Fluent

### Annexure-7(d)

#### Courses mapped with activities

Course Code	Course Title	Activity mapped	Evaluation
21SC1209	Design Tools Workshop – II	Yantrik-Poster	Lab project Review
21ME1002	Engineering Graphics & 2D Modelling	Yantrik-Quiz	ALM
21ME2101	Mechanics of Solids	Samyak-Quiz	ALM
21ME2104	3D Modeling and Physical Prototyping	Samyak-Quiz	ALM
21ME2105	Thermodynamics	Samyak-Quiz	ALM
21ME2007	Materials Technology	Samyak-Cross word	ALM
21UC0011	Gender Sensitization	Samyak-Quiz	ALM
21ME2107	Mathematics - 3 (Numerical Computation for Mechanical Engineers)	Samyak-Programming Contest	Project Review
21ME2106	Fluid Mechanics & Hydraulic Machines	Samyak-Quiz	ALM

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PBL	Project Based Learning -1	Samyak	Project Review
21ME2209	Manufacturing Processes	Yantrik-Quiz	ALM
21ME2210	Analysis of Thermal Systems (CFD S/W)	Yantrik-Quiz/Crossword	project/certification
21ME2211	Kinematics of Machines (with ADAMS S/W)	Yantrik-Quiz	ALM
21UC0010	Universal Human Values & Professional Ethics	Yantrik-Quiz	ALM
PBL	Project Based Learning -2	Yantrik-Paper/Poster	Project Review
21ME3118	Dynamics of Machines	Samyak-Quiz/Crossword	ALM
21ME3116	Optimization Techniques	Samyak-Quiz/Crossword	ALM
21ME2208	Mechanical Engineering Design & Innovation (FEA S/W)	Samyak-poster	Project Review
21ME2212	Manufacturing Technology (Linked to Project)	Samyak-Poster	Project Review
22ME3119	Robotics	Samyak-Programming	ALM
21IE3044	Mid Grad Capstone Project - I	Samyak-Poster/idea presentation	Project Review
21ME3113	Machine Design	Yantrik-Poster/Paper	Capstone project
21ME3115	Heat Transfer	Yantrik-Quiz	ALM
21ME3217	Production Technology	Yantrik-Quiz	ALM
21ME4120	Instrumentation & Control	Yantrik-Quiz	ALM
21IE3043	Term paper	Yantrik-Paper presentation	Project Review
21IE3045	Mid Grad Capstone Project - II	Yantrik-Expo	Project Review
21ME3114	Industry 4.0 & Design of Cyber Physical Systems	Samyak-Expo/Poster	project/certification
20UC0007	Indian Heritage and Culture	Samyak-Quiz	ALM
21IE4048/21IE4051	Project / Internship -1	Samyak-Expo/Presentation	Project Review
21UC0008	Indian Constitution	Yantrik-Quiz	ALM
21UC0009	Ecology & Environment	Yantrik-Quiz	ALM
21IE4049/21IE4052	Project / Internship 2	Yantrik-Expo	Project Review

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### Annexure-8(a)

## Changes proposed by Course Coordinators for the courses to be offered in 2022-23 Odd Sem

### 20ME3114 – INDUSTRY 4.0 & DESIGN OF CYBER PHYSICAL SYSTEMS

L-T-P-S : 3-0-0-4

Credits 4

Contact Hours 7

Pre-requisite : NIL

Mapping of Course Outcomes with PO/PSO:

CO#	Course Outcome	PO/PSO	BTL
CO1	Apply basic principles of Industry 4.0: Cyber Physical Systems in solutions that require problem solving	PO1-1, PSO1-1	2
CO2	Implement the concepts of Cybersecurity in Industry 4.0 and develop applications	PO3-2, PSO1-2	3
CO3	Implement the concepts of IoT and develop applications	PO3-2, PSO1-2	3
CO4	Implement the concepts of IIoT and develop applications	PO3-2, PSO1-2	3
CO5	Apply the concepts of Cyber security and Control Systems to develop real time applications	PO3-3, PSO2-3	4

### Syllabus

#### Introduction: Sensing & actuation

Communication-Part I, Part II, Networking-Part I, Part II, Industry 4.0: Globalization, The Fourth Revolution, LEAN Production Systems, Industry 4.0: Cyber Physical Systems and Next Generation Sensors, Collaborative Platform and Product Lifecycle Management

#### Cybersecurity in Industry 4.0

Basics of Industrial IoT: Industrial Processes-Part I, Part II, Industrial Sensing & Actuation, IIoT-Introduction, Industrial IoT: Business Model and Reference Architecture: IIoT-Business Models-Part I, Part II, IIoT Reference Architecture-Part I, Part II. Industrial IoT- Layers: IIoT Sensing-Part I, Part II, IIoT Processing-Part I, Part II, IIoT Communication-Part I.

#### Industrial IoT- Layers

IIoT Communication, IIoT Networking-Part I, Part II, Part III. Industrial IoT: Big Data Analytics and Software Defined Networks: IIoT Analytics - Introduction, Machine Learning and Data Science Part I, Part II, Industrial IoT: Big Data Analytics and Software Defined Networks: SDN in IIoT-Part I, Part II, Data Center Networks, Industrial IoT

#### Industrial IoT: Security and Fog Computing

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Fog Computing in IIoT, Security in IIoT-Part I, Part II, Industrial IoT- Application Domains, Industrial IoT- Application Domains: Healthcare, Power Plants, Inventory Management & Quality Control, Plant Safety and Security (Including AR and VR safety applications), Facility Management. Industrial IoT- Application Domains: Oil, chemical and pharmaceutical industry, Applications of UAVs in Industries, Real case studies

### Text books:

1. Artificial Intelligence a Modern Approach by Peter Norvig, Rusell
2. Introduction to Industrial Internet of Things and Industry 4.0 by Anandarup Mukherjee, Chandana Roy and Sudip Misra.
3. Industry 4.0 The Industrial Internet of Things by Alasdair Gilchrist.

### Reference Books:

1. Internet of Things – A hands-on approach, Arshdeep Bahga and Vijay Madiseti
2. Architecting for the Cloud-AWS Best Practices.

### Web References / MOOCs:

1. Introduction to Industry 4.0 and Industrial Internet of Things by Prof. Sudip Misra IIT Kharagpur.  
<https://nptel.ac.in/courses/106105195>

### List of Experiments:

- 1) Write a python program to solve Water Jug Problem in Artificial Intelligence?
- 2) Write a python program to implement a simple Chatbot?
- 3) Introduction to Arduino IDE and Installation of Arduino IDE
- 4) Connecting and making LED to blink
- 5) Connecting and making LED on using pushbutton
- 6) Controlling LED by using LDR sensor
- 7) NodeMCU V3 For Fast IoT Application Development
- 8) Connecting and controlling Servo motor using Arduino Micro controller.
- 9) Connecting and controlling DC motor using Arduino Micro controller.
- 10) Interface Smoke Sensor to activate with a warning RED
- 11) Connecting and controlling LED using Infrared sensor and Arduino Micro controller

### Certifications Required:

It is mandatory for every student to get certification on "Robotic Process Automation". Based on the grade obtained in this certification will be considered for In-Semester Summative Evaluation. It is essential for the student to complete "Introduction to Industry 4.0 and Industrial Internet of Things"

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from NPTEL platform by the end of the semester and get certification. A separate examination will be conducted within the university for those who are not able to complete the NPTEL certification

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Program: B.Tech  
2022-2023

Year/semester of study: IV / Odd


Academic year:

Course Title: Automobile Engine System and Performance  
19ME4076

Course Code:

Item	Existing	Proposed Modification	Justification for the proposed modifications
L-T-P-S	2-0-2-0	3-0-0-0	As Physical Engines laboratory and licensed software's on automobile testing is not available, it was recommended to offer as a theory course

Item	CO No	Existing	Proposed Modification	Justification for the proposed modifications	PO/PSO mapping* (ex:PO1-1 or PO1-2 or PO1-3)
Course Outcome	CO1	Apply the knowledge of basic engine technology along with principle. Summaries of Engine Cycles	Apply the concept of basic engine technology on performance of Engine Cycles	As existing course outcome is not clear, it was modified	PO1-2
	CO2	Apply the concept performance aspect of mixture preparation and ignition system for SI and CI Engines and Combustion in Engines	Apply the concept of mixture preparation and combustion in SI and CI Engines	As existing course outcome is not clear, it was modified	PO1-1
	CO3	Pollutant Formation, Emission control methods and Emission norms	Identify the concepts of Pollutant Formation, Emission control and methods	Verb is missing in the beginning of outcome statement. Added the verb	PO1-1

  
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			Emission norms		
	CO4	Engine Testing, Performance analysis and Emerging Engine Technologies	Analyze Engine Performance and testing	Verb is missing in the beginning of outcome statement. Added the verb	PO2-3

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#### DEPARTMENT OF MECHANICAL ENGINEERING PROPOSED REVISIONS for DAC & BOS APPROVAL

Program: B.Tech  
year: 2022-2023


Year/semester of study: IV year/I Sem

Academic

Course Title: Petroleum Production Engineering-II  
19ME4113

Course Code:

Item	CO No	Existing	Proposed Modification	Justification for the proposed modifications	PO/PSO mapping* (ex: PO1-1 or PO1-2 or PO1-3)
<b>Course Outcome</b>	CO1	Able to understand production operation surface facilities	Apply various techniques in gathering and collecting oil and gas from the well	CO statements are not as per the norms	PO1-1, BTL-3
	CO2	Able to apply oil and gas processing and treatment methods	Apply various methods for the separation of oil and gas and for the treatment of various fluids	CO statements are not as per the norms	PO1-1, BTL-3
	CO3	Able to apply oil and gas storage and metering operations	Apply the different methods for the storage of petroleum products	CO statements are not as per the norms	PO1-2, BTL-3
	CO4	Able to apply production operations and optimization	Analyze the production system for optimizing production cost	CO statements are not as per the norms	PO2-1, BTL-3

  
**Head, Department of Mechanical Engineering:**  
**K L (Deemed to be University)**  
**Vaddeswaram-522502**



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Campus: Green Fields, Vaddeswaram - 522 302, Guntur District, Andhra Pradesh, INDIA.

Phone No. 08645 - 350200. www.klef.ac.in; www.klef.edu.in; www.kluniversity.in

Admin Off: 29-36-28, Museum Road, Governorpet, Vijayawada - 520 002. Ph. +91 - 866 - 3500122, 2577715, 2576129.

Reference Books	No Change	NA	NA	NA
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Existing Syllabus	Proposed Syllabus	Reasons for Changes in Existing Syllabus
No change in Syllabus	No change	NA

## K L E F

### DEPARTMENT OF MECHANICAL ENGINEERING PROPOSED REVISIONS for DAC & BOS APPROVAL

Program: B Tech  
year: 2022-2023

Year/semester of study: 3<sup>rd</sup> year/odd

Academic

Course Title: Machine Design

Course Code: 20ME3113

Item	CO No	Existing	Proposed Modification	Justification for the proposed modifications	PO/PSO mapping* (ex:PO1-1 or PO1-2 or PO1-3)
Course Outcome	CO1	Design of shafts and couplings	Design of transmission shafts, Couplings and Springs	Sentence modification required as per syllabus	PO3-2, PSO2-2
	CO2	Design of fasteners	Design of appropriate fastening system	Sentence modification required as per syllabus	PO3-2, PSO2-2
	CO3	Selection of appropriate bearings and drives	Design and selection of appropriate Bearings, Belt Drives and Chain Drives	Sentence modification required as per syllabus	PO3-2, PSO2-2
	CO4	Design of gears	Design and analysis of different Gears and Brakes.	Sentence modification required as per syllabus	PO3-2, PSO2-2
	CO5	Design various mechanical systems	Design and synthesis of functional prototype using various mechanical	Sentence modification required as per syllabus	PO4-3, PSO2-2

Head, Department of Mechanical Engineering  
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			components		
Reference Books					

Existing Syllabus	Proposed Syllabus	Reasons for Changes in Existing Syllabus
NA	No Change	NA

Head, Department of Mechanical Engineering  
K L (Deemed to be University)  
Vaddeswaram-522 502

Head, Department of Mechanical Engineering  
K L (Deemed to be University)  
Vaddeswaram-522 502



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**K L E F**

## DEPARTMENT OF MECHANICAL ENGINEERING PROPOSED REVISIONS for DAC & BOS APPROVAL

Program: B Tech Year/semester of study: 3<sup>rd</sup> year/odd Academic  
year: 2022-2023  
Course Title: Machine Design Course Code: 20ME3113

Item	CO No	Existing	Proposed Modification	Justification for the proposed modifications	PO/PSO mapping* (ex:PO1-1 or PO1-2 or PO1-3)
Course Outcome	CO1	Design of shafts and couplings	Design of transmission shafts, Couplings and Springs	Sentence modification required as per syllabus	PO3-2, PSO2-2
	CO2	Design of fasteners	Design of appropriate fastening system	Sentence modification required as per syllabus	PO3-2, PSO2-2
	CO3	Selection of appropriate bearings and drives	Design and selection of appropriate Bearings, Belt Drives and Chain Drives	Sentence modification required as per syllabus	PO3-2, PSO2-2
	CO4	Design of gears	Design and analysis of different Gears and Brakes.	Sentence modification required as per syllabus	PO3-2, PSO2-2
	CO5	Design various mechanical systems	Design and synthesis of functional prototype using various mechanical components	Sentence modification required as per syllabus	PO4-3, PSO2-2
Reference Books					

Existing Syllabus	Proposed Syllabus	Reasons for Changes in Existing Syllabus

  
Head, Department of Mechanical Engineering  
K L (Deemed to be University)  
Vaddeswaram-522502



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### Annexure-8(b)

#### Approved Global Certifications

ENGINEERING DESIGN	SMART MANUFACTURING	AUTOMOBILE ENGINEERING	AUTOTRONICS	PRODUCT DESIGN	ENERGY & CFD
SOLIDWORKS	SOLIDWORKS	SOLIDWORKS	SOLIDWORKS	SOLIDWORKS	SOLIDWORKS
AUTOCAD	AUTOCAD	Autodesk Inventor	AUTOCAD	Autodesk Suite	Autodesk CFD
FUSION 360	FUSION 360	FUSION 360	FUSION 360	FUSION 360	OpenFOAM
CATIA	DEFORM-3D	BIW CATIA	CATIA	CATIA	SimScale
HYPERMESH	SIMUFACT	Blender	ABB RoboStudio	Blender	Simcenter
ANSYS	ANSYS	Reno	Python	Onshape	ANSYS-FLUENT
NASTRAN	SIX SIGMA	Alias	ADAMS		Altair CFD
PATRAN		Creo Parametric			Flowsquare
ADAMS					Paraview

Dr.D.V.A.RamaSastry

Chairman-BOS

Head, Department of Mechanical Engineering  
K L (Deemed to be University)  
Vaddeswaram-522502