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XXIX Academic Council – Annexure 2.8
Department of Mechanical Engineering
Minutes of the 18th BOS meeting

The Department BOS meeting held on 23rd June, 2020 from 10:10 AM onwards in Room No.M118

The following Members were present:

1. Dr. A. Srinath, Head of the Dept., and Professor ME – Chairman
2. Dr.A. Jagadeesh, Professor, CCO & Director FED
3. Dr.K.L.Narayana, Professor, Dean R & D
4. Dr. K. Rama Krishna, Dean - Quality and Professor ME
5. Dr.Y.V.Hanumantah Rao, Professor, ME
6. Dr.N.B.V Prasad, Professor, Dean Placements
7. Dr. B. Nageswara Rao, Chairman RPAC ME and Professor ME
8. Dr. G. Diwakar, Professor ME
9. Dr.S.Sudhakar Babu, Energy & CFD group head, Associate Professor,ME
10. Mr.D.V.A.Rama Sastry, Associate professor, Deputy HOD-ME
11. Mr.T.Vijaya Kumar, Associate professor, Deputy HOD-ME
12. Dr. Issac Prasad. Professor, ME
13. Dr.S.N.Padhi, Professor, Group Head, Design & Manufacturing
14. Dr.S.S.Rao, Professor, Group Head, Robotics & Mechatronics
15. Dr. P.V.Chalapathi, Associate Dean-Practise school
16. Dr. K.V. Narasimha Rao, Professor-ME
17. Dr. D. Kiran Kumar, Associate Professor ME
18. Dr. G. Yedukondalu, Group Head, Associate Professor-ME
19. Dr.M.B.S.Sreekar Reddy, Associate Professor ME
20. Dr.Y.Kalyan Chakravarthy, Associate Professor
21. Dr.P.Kasi V Rao, Assistant Professor ME
22. Mr. P. Ratna Prasad, Assistant Professor ME
23. Dr.B.Loveswara Rao, Professor, Co-opted Member
24. Dr. A.S.C.S.Sastry, Controller of Examination, Co-opted Member
25. Dr.K.Thirupathi Rao, Professor, Co-opted member
26. Dr.V.S.Bhagavan, Professor, Co-opted member
27. Dr.A.Venu Gopal, Professor, NIT Warangal
28. Dr. R. Vijaya Kumar, Senior Manager, R & D HAL Bangalore
29. Dr. P. Srinivasa Rao, Global Training Head, Cyient Technologies, Hyderabad
30. Dr.K.Ravi Teja, Manager, Hyundai R & D Division, Hyderabad

25/6/2020
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The following members were Absent.

1. Dr. Gnanamurthy, Professor, Dept. of ME, IIT-Madras

AGENDA and RESOLUTIONS

AGENDA ITEM-1

Department Achievements for the A.Y.2019-20	Resolution Passed: BOS appreciated the duties rendered by all Teaching faculty and university administrators in conducting all the academic activities successfully keeping in view the career prospects of students.

Academics:

- BoS Chairman enlisted about various academic activities being done successfully by the department post lockdown like conducting online classes for all B.Tech and M.Tech students to complete the pending syllabus, conducting online Test-2, makeup tests, Lab and Project reviews and End Semester Exams and online evaluation.

Placements & Progression:

- Placements statistics for the A.Y. 2019-20 were presented to all the members.
- All the 165 students who registered for placements were successfully placed in various core and software companies.
- 78 students got multiple job offers, 42 students got more than 4 job offers.
- The average salary package is 4.05 lakhs per annum and the highest salary package offered is 10 Lakhs per annum.
- 38 students secured job offers in companies with more than 5 lakhs package.
- ME dept. is the first to reach 100 % placements milestone in this academic year in the Institute.
- BoS appreciated the efforts rendered by Dean Placements and his team and faculty members who extended their support to the students in achieving the 100 % placements.

Research & Development:

- The total no. of publications including Scopus and SCI indexed by the department are 898 till date.
- The total no. of Patents filed and granted by the department reached the milestone of 100 in number by 21st June 2020.
- The h index of the department which was 13 in A.Y.2018-19 is reached to 19 in A.Y. 2019-20 which was a remarkable improvement and the target for 2020-21 A.Y. is set as 25.
- 5 scholars of the department were awarded with PhD degree in the even semester of the A.Y.2019-20.

Dr.A.Venugopal, Professor NIT Warangal, one of the external members, appreciated the department faculty and HOD for conducting all the academic activities in time even during the lockdown period.

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Vaddeswaram - 522 50

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AGENDA ITEM-2

To consider and approve the courses introduced to 2020-21 and 2019-20 admitted batch of B.Tech students proposed by stake holders and to consider the proposals of DAC for approval	Resolution Passed: It is resolved to approve the DAC minutes and the courses introduced for B.Tech 2020-21 and 2019-20 admitted batch students. The same is recommended to academic council for approval

2019-20 & 2020-21 Admitted Batch B. Tech Curriculum

- BOS chairman presented the proposals passed in DAC, it is resolved to approve the courses proposed by stake holders as per the recommendations of DAC**(Annexure 1)**

- Upon discussing the feedback given by Group heads and further discussing in DAC, it is resolved to introduce a series of courses "Design Thinking and innovation-1" & "Design Thinking and Innovation-2" to 2020-21 admitted batch students in First year and Second Year with the help of Imagine XP, which will ignite the critical thinking and problem solving capabilities in students.

- Upon Discussing the feedback given by group heads, and further discussing in DAC, it is resolved to offer a new course titled "User Centric Design Techniques" to 2020-21 admitted batch students to enhance design capabilities of students.

- Upon discussing the feasibility of courses offering in first and second year and keeping in view the total no. of credits and contact hours following changes were proposed by BOS members
  i. To offer "Mechanics" course in First Year odd semester for 2020-21 admitted batch where the design thinking, flipped teaching pedagogies will be delivered and application oriented open-ended problems will be given to students as an assignment, peer learning and evaluation will also be implemented.
  ii. To offer the "Workshop Practice for Mechanical Engineers" course in Fourth Semester in offline mode instead of offering in Third semester for Y19 batch students through online mode as the course is designed to get hands-on practice. Hence, it may not be effective and not possible to offer through online mode.
  iii. To introduce Design thinking course phase wise for 2019 admitted batch w.e.f III semester onwards. The increase in credits due to introduction of this new course may be compensated under Open electives.
  iv. "Deep Learning" is introduced as a new course in place of Data Analytics 18ME4102 & 19ME4102 for 2018 and 2019 admitted batches respectively.
  v. "Mathematics for Computing" and "Mathematics for Engineers" courses will be offered in First and Second Semesters for 2020-21 admitted batch and the syllabus is framed based on the application of mechanical concepts.

  It is resolved to approve the above modifications in 2020-21 and 2019-20 admitted batch curriculum.

- Group head, Dr.Y.V.Hanumantha Rao, suggested to offer "Analysis of Thermal Systems" course to 2020-21 admitted batch students to cover the applications of thermal Engineering concepts and also suggested to include skilling component in the course to make students aware of the Fluent software for fluid flow and heat transfer analysis. It is resolved to offer "Analysis of Thermal Systems" course to 2020-21 admitted batch students with an L-T-P-S of 3-1-0-4.

Dr. A. SRINATH
PROFESSOR & HEAD
Department of Mechanical Engineering
KL (Deemed to be University)
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23/6/2020

- Upon discussing the feedback given by thermal Group head Dr.Y.V.Hanumantha Rao, it is resolved to introduce "Engineering in the Physical World" course as a new course in 2019 and 2020 curriculum which will enhance the skills related to Design of various thermal systems.
- Based on the feedback received from Mr.S.S.S.Sastry from Renprotech Solution Private Limited and Mr.S.A.Sundaresan from Ashok Leyland , It is resolved to introduce "Industry 4.0 & Design of Cyber Physical Systems" course in the curriculum of 2019 and 2020 admitted batches.
- Design group head Dr. S.N.Padhi, suggested to introduce course on "3D modelling and Physical prototyping to introduce the 3D modelling technology to students. It is resolved to include the "3D Modelling and Physical Prototyping of Mechanical Components" Course for Y20 admitted Batch students.

- Group heads suggested introducing a new course to enrich the logical thinking of students in design, it is also resolved to offer a new course on "Computational Thinking for Design" to enrich the logical skills of Students.

- Upon discussing the feedback given by Dr.Akhthar Khan, academic peer to introduce AI & Data Analytics course to make students acquainted with latest technologies, it is resolved to offer Artificial Intelligence and Data Analytics course to 2020-21 admitted batch students.

- Upon discussing the feedback of Dr.Akhthar Khan-Academic Peer to offer courses related to different programming languages covering the latest programming languages, it is resolved to offer courses ' OOP's through JAVA ', ' R-Programming", "Python Programming" as flexi core courses to 2020-21 admitted batch students.
- Upon discussing the feedback given by parent to inculcate Entrepreneurship skills and responsibility towards society in students, it is resolved to introduce a series of Skilling courses on Technical Proficiency & Training with (i) Entrepreneurial Incubation (L-T-P-S: 0-0-0-12), (ii) Technopreneur ship (L-T-P-S: 0-0-0-12), (iii) Entrepreneurial Skilling(L-T-P-S: 0-0-0-12), (iv) Entrepreneurial Skilling(L-T-P-S: 0-0-0-12) (v) Entrepreneurship Essentials (2-0-0-0) and also Social Internship courses to Y20 admitted batch students.

- Upon discussing the feedback given by Dr. Ashok Kumar, Academic peer to introduce courses related to multi-body Dynamics & Robotic Design. It is resolved to introduce "Dynamics of Multi-Body Systems" and "Modelling, Analysis and Design of Robotic Systems" courses as professional Electives in Engineering Design Specialization for y20 Admitted batch students.

- As per the feedback of group heads, to introduce courses on sustainability in each specialization as it is the necessary issue in every field, it is resolved to offer "Sustainable Design and Social Innovation in Engineering Design ', "Sustainable Design and Social Innovation in Smart Manufacturing' ', "Sustainable Design and Social Innovation in Automobile Engineering", "Sustainable Design and Social Innovation in Autotronics" and "Sustainable Design and Social Innovation in Product Design" courses under Engineering Design, Smart Manufacturing, Automobile Engineering, Autotronics and Product Design Specializations respectively.

- Upon discussing the feedback given by Dr.Deepak Kumar Naik-Academic peer, to introduce course related to Industrial automation and Robotics, it is resoled to offer "Robotics and Industrial

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PROFESSOR & HEAD
Department of Mechanical Engineering
KL (Deemed to be University)
Vaddeswaram - 522 502

23/6/2020

Automation" course as Professional Elective under Smart Manufacturing Specialization to Y20 admitted batch students.

- Upon discussing the feedback given by Mr. Shashikanth- Industry person, to introduce course on Hybrid and Electric vehicles as it the emerging field in automobile industry, it is resolved to offer "Hybrid and Electric Vehicle Design" course as professional Elective to Y20 admitted batch students.

- As pe the recommendations of Group heads, to offer latest technology related courses in Industry 4.0, Logistics, Quality, Smart mobility as open Electives so that all students can be benefitted with the technology, it is resolved to offer "Industry 4.0", "Industrial Automation", "Logistics & Supply Chain", "Total Quality Management" "Smart Mobility", "Managerial Economic for Engineers" as open electives to y20 admitted batch.

Courses introduced in the curriculum of 2020-21 admitted batch BTech students based on the feedback of stakeholders.

S.No.	Course Code	Course Title	Category	Remarks
1	20UC1102	Design Thinking and Innovation-I	Basic Sciences	Based on the feedback of faculty to impart design skills this course is introduced
2	20UC1203	Design Thinking and Innovation-II	Basic sciences	Based on the feedback of faculty to impart design skills this course is introduced
3	20UC2104	User Centric Design Techniques	Basic Sciences	Based on the feedback of faculty to impart design skills this course is introduced
4	20SC1101	Computational Thinking for Design	Engineering Science	Based on the feedback of faculty this course is introduced in place of Problem Solving and Computer programming course
4	20ME2104	3D Modelling and Physical prototyping of mechanical Components	Engineering Sciences	Based on the feedback of faculty this course is introduced in place of Machine Drawing course
5	20ME2210	Analysis of thermal systems	Core	This course is introduced to impart skilling in thermal systems as per faculty feedback
6	19ME2127	Engineering in Physical World	Core	This course is introduced as per the feedback of faculty to enhance the students knowledge on the practical applications of engineering principles in real world
7	20ME3114	Industry 4.0 & Design of Cyber physical Systems	Core	This course is introduced in place of Vibrations and Control course s per the recommendation of Industry person
8	20ME3216	Artificial Intelligence and Data Analytics	Core	As per the recommendation of academic Peer this course is

Dr. A. SRINATH
PROFESSOR & HEAD
Department of Mechanical Engineering
KL (Deemed to be University)
Vaddeswaram - 522 502
23/6/2020

				introduce in place of Robotics and Artificial Intelligence
9	20MB4052	Entrepreneurship Essentials	Open Elective	As per the recommendation of parents this course is introduced to motivate students towards Entrepreneurship
10	20TS3101	Technical Proficiency-I (Entrepreneur incubation)	Skilling	As per the recommendation of parents this course is introduced to motivate students towards Entrepreneurship in place of skilling for engineers I
11	20TS3202	Technical Proficiency-2 (Technopreneur ship)	Skilling	As per the recommendation of parents this course is introduced to motivate students towards Entrepreneurship in place of skilling for engineers-II
12	20TS4103	Technical Proficiency-3 (Entrepreneurship Skilling)	Skilling	As per the recommendation of parents this course is introduced to motivate students towards Entrepreneurship in place of skilling for engineers-III
13	20TS4204	Technical Proficiency-4 (Entrepreneurship Skilling)	Skilling	As per the recommendation of parents this course is introduced to motivate students towards Entrepreneurship in place of skilling for engineers-IV
14	20ME3221	OOPS through Java	Flexi Core	As per the recommendation of academic Peer this course is introduced to enhance programming skills of students
15	20ME3222	R Programming	Flexi Core	As per the recommendation of academic Peer this course is introduced to enhance programming skills of students
16	20ME3223	Python Programming	Flexi Core	As per the recommendation of academic Peer this course is introduced to enhance programming skills of students
17	20ME4052	Dynamics of Multi Body Systems	Elective	Based on the recommendation of academic peer this course is introduced
18	20ME4053	Modelling analysis and Design of Robotic Systems	Elective	To impart knowledge on Robotic design this course is introduced as er the feedback of academic peer
19	20ME4057	Sustainable Design & Social innovation in Engineering Design	Elective	To make students societal ready this course is introduced as pe the feedback of faculty
20	20ME4065	Robotics & industrial automation	Elective	To impart the knowledge on application of robotics in industries this course is introduced as pe the feedback of academic peer

Dr. A. SRINATH
PROFESSOR & HEAD
Department of Mechanical Engineering
KL (Deemed to be University)
Vaddeswaram - 522 502

21	20ME4067	Sustainable Design & Social Innovation in Smart manufacturing	Elective	As per the recommendation of group heads to impart knowledge on sustainable design in manufacturing this course is introduced
22	20ME4072	Hybrid and Electric Vehicle Design	Elective	Based on the recommendation of Industry person this course is introduced to meet the latest requirements of automotive sector
23	20ME4077	Sustainable design & Social Innovation in automobile engineering	Elective	To introduce the sustainable design in automobiles this course is introduced as per the recommendation of faculty
24	20ME4087	Sustainable Design and Social Innovation in Autotronics	Elective	To make students understand the importance of sustainable design this course is introduced as per the recommendation of faculty
25	20ME4097	Sustainable Design and Social Innovation in product Design	Elective	This course is introduced to make students understand the importance of sustainable deign in product design as per the feedback of faculty
26	20ME40B8	Industry 4.0	Open Elective	To meet the present industry requirements this course is introduced as per the recommendation of faculty
27	20ME40B9	Industrial automation	Open Elective	This course is introduced to make students understand the concept of industrial automation
28	20ME40C1	Logistics and Supply chain Management	Open Elective	This course is introduced to make students industry ready as per the feedback of faculty
29	20ME40C2	Total quality management	Open Elective	This course is introduced to make students industry ready as per the feedback of faculty
30	20ME40C3	Smart Mobility	Open Elective	This course is introduced to make students industry ready as per the feedback of faculty
31	20ME40C4	Managerial Economics for Engineers	Open Elective	This course is introduced to make students industry ready as per the feedback of faculty
32	20IE2050	Social Internship	Project	To make students understand the societal problems this course is introduced as per the feedback of parents.

The Course Structure of 2020-21 admitted batch B.Tech students is given in **Annexure 2 (a)**, the syllabus for new courses is given in **Annexure-2(b)**. The course structure of 2019-20 admitted batch B.Tech students is given in **Annexure-2(c)**.

Dr. A. SRINATH
PROFESSOR & HEAD
Department of Mechanical Engineering
KL (Deemed to be University)
Vaddeswaram - 522 502

AGENDA ITEM-3

To consider the revisions proposed by stake holders in the curriculum of 2020-21 admitted batch of B.Tech students	Resolution Passed: It is resolved to approve the revisions proposed in the curriculum of 2020-21 admitted batch students and to recommend the same to academic council for approval

- Thermal Group Head, Dr.Y.V.Hanumantha Rao suggested to offer "Thermodynamics" & "Fluid Mechanics and Hydraulic Machines" courses to 2020-21 admitted batch students in place of Thermal Fluids Engineering-I & Thermal Fluid Engineering-II so that the students will be have clear idea on the concepts of Thermodynamics and Fluid Mechanics. It is resolved to offer "Thermodynamics", "Fluid Mechanics & Hydraulic Machines courses in place of Thermal Fluids Engineering-I and thermal Fluids Engineering-II.

Revisions proposed in the courses of 2020-21 admitted batch B.Tech students

S.NO	Course Code	Course Title	Category	Percentage of Revision	Remarks
1	20ME2105	Thermodynamics	Engineering Sciences	50%	To make students understand the core concepts of thermodynamics more clearly the syllabus of Thermal Fluids Engineering-I is revised as pe the recommendation of faculty
2	20ME2106	Fluid Mechanics and Hydraulic machines	Core	50%	To make students understand the core concepts of Fluid mechanics more clearly the syllabus of Thermal Fluids Engineering-II is revised as pe the recommendation of faculty

The revisions proposed in the curriculum of 2020-21 admitted batch B.Tech students is given in **Annexure-3**

AGENDA ITEM-4

To consider the courses introduced proposed by stake holders in the curriculum of 2020-21 admitted batch of M.Tech Robotics and Mechatronics program students	Resolution Passed: It is resolved to approve the introduced courses in curriculum of 2020-21 admitted batch M.Tech Robotics and Mechatronics program students and to recommend the same to academic council for approval

2020-21 M.Tech-Robotics and Mechatronics Curriculum

Dr. A. SRINATH
PROFESSOR & HEAD
Department of Mechanical Engineering
KL (Deemed to be University)
Vaddeswaram - 522 502

- Upon discussing the feedback given by faculty member and Robotics & Mechatronics group head Dr.S.S.Rao, to include courses covering latest technologies in Robotics, it is resolved to offer Elective courses "Robot Vision & image processing" in place of Vehicle Dynamics & Multi body Systems, "Control Systems for Robots" in place of Intelligent Surveillance systems, "Mobile Robots" and "Robot manipulation and Grasping" courses for y20 admitted batch students.

  The courses introduced in M.Tech Courses in Robotics & Mechatronics Program as per the above resolutions is shown in **Annexure 4(a)**
  The detailed analysis and action taken report on feedback is shown in **Annexure 4(b).**

AGENDA ITEM-5

Syllabus revision proposed by Courses coordinators for 2020-21 Odd Sem courses	Resolution Passed: It is resolved to approve the changes proposed by Courses coordinators of 2020-21 Odd Sem and recommend the same to the Academic Council

As per the revisions proposed by the course coordinators in syllabus/ Course Outcomes /experiments/teaching pedagogies for the courses to be offered in 2020-21 odd semester. It is resolved to approve the revisions proposed by the course coordinators for the courses offered in 2020-21 odd semester as listed below:

a) Materials for Mechanical Engineering Applications (19PH2007) **(Annexure: 5(a))**
b) Geometric Dimensioning and Tolerancing (17ME4066) **(Annexure: 5(b))**
c) Programming Skills (18ME4101) **(Annexure: 5(c))**
d) Artificial Intelligence for Robotics (18ME4091) **(Annexure: 5(d))**

AGENDA ITEM-6

Courses related to Energy & CFD specialization	Resolution Passed: It is resolved to implement the changes proposed by Energy & CFD Group w.e.f 2020-21 admitted batch and the same is recommended to academic council for approval

Energy and CFD group conducted a meeting on 05-06-2020 with all thermal professors and proposed changes in the curriculum to ensure the students becoming strong in this particular domain and as a result achieve good number of placements in thermal related companies and to file patents **(Annexure 6)**. Hence, it is resolved to implement the changes w.e.f 2020-21 admitted batch as mentioned below.

- Thermodynamics (L-T-P-S: 3-0-0-0) in III Semester
- Fluid Mechanics & Hydraulic Machines (L-T-P-S:3-0-2-0) in III Semester
- Engineering in the Physical World (L-T-P-S:1-0-0-4) in IV Semester
- Analysis of Thermal Systems (L-T-P-S: 3-1-0-4) in IV Semester
- Heat Transfer (L-T-P-S: 3-0-2-0) in V Semester

AGENDA ITEM-7

Certificate, Diploma/PG Diploma courses in Online mode	Resolution Passed: It is resolved to launch certificate, Diploma/PG Diploma courses in online

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	mode and the same is recommended to academic council

As per the proposal for launching certificate, Diploma, PG-Diploma programs in online distance learning mode by the department, BOS resolved to approve of launching certificate, Diploma, PG-Diploma programs in online distance learning mode by the department in principle.

AGENDA ITEM-8

Coursera courses for IV year CRT students	Resolution Passed: It is resolved to approve the Coursera course to IV year CRT batch students and the same is recommended to academic council for approval.

As per the proposal of offering Coursera courses to students, to get extra credits, It is resolved to offer Coursera for IV year CRT Students in 2020-21 odd semester courses as a part of self-learning. **(Annexure 7).**

AGENDA ITEM-9

Value Added/ Certification Courses	Resolution Passed: It is resolved to the value added courses to Y19 admitted batch students and the same is recommended to Academic Council for approval (Annexure-8)

AGENDA ITEM-10

CO-PO Attainment	Resolution Passed: It is resolved to approve the CO-PO attainment of previous semester and the same is recommended to Academic Council for approval

AGENDA ITEM-11

Other Points: Admissions of 2020-21 batch, online examinations, and Evaluation	Resolution Passed: It is resolved to ratify online examination and evaluation for 2020-21 odd Sem courses and the same is recommended to Academic Council

- External member Dr.A.Venugopal enquired about the admission status of 2020-21 admitting batch. HOD explained phase 1 counselling has been completed phase will start in next week. This time good response was obtained for KLEEE 2020 proctored entrance exam wherein around 47000 aspirants were appeared for the exam. The external members appreciated the process implemented by the university during lockdown period.

25/6/2020
Dr. A. SRINATH
PROFESSOR & HEAD
Department of Mechanical Engineering
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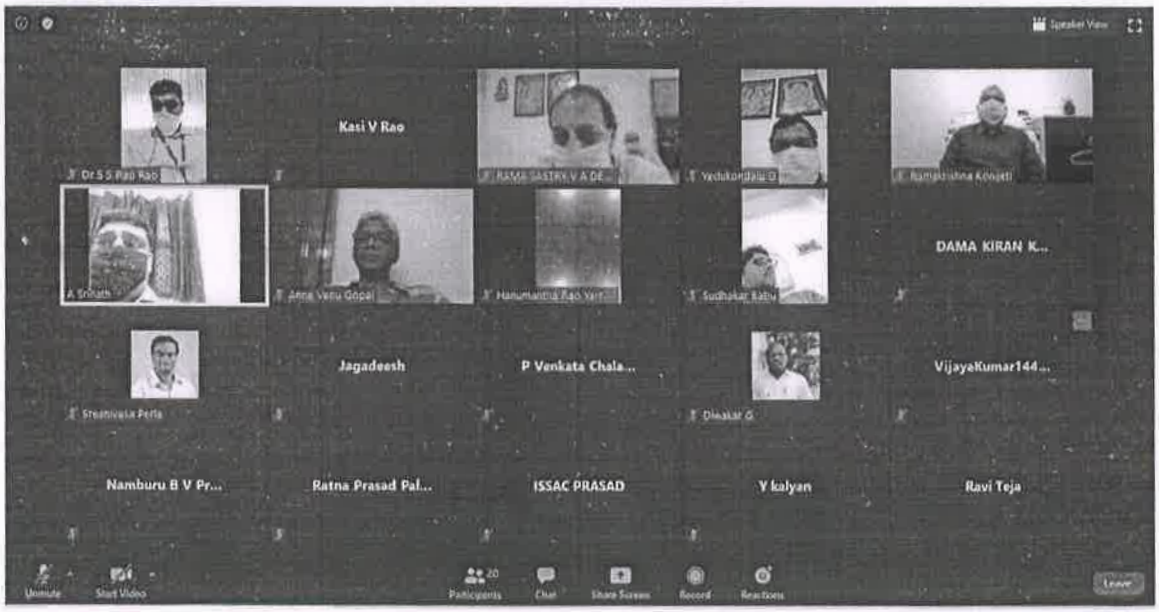
Vaddeswaram - 522 502

- Upon the information given by the Chairman BOS, it is resolved to ratify the online examination and evaluation process being implemented during lockdown period for ensuring timely completion of all academic activities.



23/6/2020

Chairman-BOS

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Annexure - agenda point wise as mentioned in minutes

Annexure 1

K L E F

DEPARTMENT OF MECHANICAL ENGINEERING

MINUTES OF DEPARTMENT ACADEMIC COMMITTEE (DAC)

The Department Academic Committee (DAC) Meeting was conducted at 11:00 A.M. on 11/04/2020 in the HoD Chamber, with HoD in the chair.

Agenda of the Meeting:

1. To discuss the feedback given by the stake holders on curriculum and propose the new courses for 2020-21 admitted batch.

The following Faculty Members were present:

1. Dr. A. Srinath, Professor, Head of the Dept.
2. Mr. D. V. A. Ramasastry, Associate Professor, Deputy HOD
3. Dr. G.Yedukondalu, Associate Professor, Group Head-Robotics & Mechatronics
4. Dr. S. Sudhakar Babu, Professor, Group Head-Energy & CFD
5. Dr. S. N.Padhi, Professor, Group Head-Design & Manufacturing
6. Dr. M. Nageswara Rao, Associate Professor, Y16 Batch Coordinator
7. Mr. G. Sanjay Krishna, Associate Professor, Y18 Batch Coordinator
8. Mr. K. M. V. Ravi Teja, Assistant Professor, Y17 Batch Coordinator
9. Mr. P. Kasi V Rao, Asst. Professor, Prof. I/C Academics
10. Mr. P. Ratna Prasad, Asst. Professor, Prof. I/C Quality

The following Students Members were present:

1. Jaswant Kocherla (170070073), III year B.Tech
2. Kunal Kumar (170070103), III year B.Tech
3. G.Bala Krishna (170070050), III year B.Tech
4. G.Likhith, (170070064), III year B.Tech
5. B.Bhanu Prasad, (170070023), III year B.Tech
6. V.Ravi Raja, (170070030), III year B.Tech
7. Y.Sai Kiran, (170070231), III year B.Tech
8. N.Komal, (170070136), III year B.Tech
9. K.Vamsi, (180079048), II year B.Tech
10. K.Dasaradha Ramaiah, (180079016), II year B.Tech
11. T.Krishna Kaushik, (180070028, II year B.Tech
12. Ch.Sambasiva Rao (180070229), II year B.Tech
13. S.V.S.Tejaswi (180070082), II year B.Tech
14. Anson John (180070100), II year B.Tech
15. Ch.Sai Bhaskar (180070042), II year B.Tech
16. G.Bhushan (180079039), II year B.Tech
17. A.Jagadeesh, (180070226), II year B.Tech
18. V.Naveen, (180070211), II year B.Tech
19. K.Sujan Surya, (180070020), II year B.Tech

Dr. A. SRINATH
PROFESSOR & HEAD
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KL (Deemed to be University)
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20. V.Badrinath, (180070200), II year B.Tech
21. B.Venkatesh, (180070154), II year B.Tech
22. P.Dileep, (180070134), II year B.Tech
23. G.Dheeraj, (160070097), IV year B.Tech
24. Ch.Raja, (160070063), IV year B.Tech
25. V.Vinay, (160070367), IV year B.Tech
26. P.Nithiin, (160070265), IV year B.Tech
27. K.Krishna Vamsi, (180070207), II year B.Tech
28. P.L.N.Bhargav, (160070251), IV year B.Tech
29. P.Praveen Kumar, (160070257), IV year B.Tech
30. V.Sridhar Sai, (160070365), IV year B.Tech

Agenda 1:

To discuss and approve the feedback given by the stake holders on curriculum

(a)The following feedback was received from students:

- T.Sai Kiran, 160060123, suggested to use virtual labs in order to understand the concepts
- S. Akhil, 160070330, suggested to keep more skilling courses like one course in every semester than year
- Y.V.N.Akhil, 160070385, suggested to introduce Python language.
- Y.V.S.S.Dheeraj, 160070357, suggested introducing new modules in ANSYS, CATIA, Fusion 360 software.
- K.Krishna Vamsi, 180070207, suggested to include projects in Machine design course collaborating with automobile clubs and also suggested to include projects in KDOM course.

It is resolved to approve and consider the feedback given by students. It is recommended to projects in skilling course "Product Design and Development" II year level rather than Machine Deign which id tutorial based course..

(b) The following feed back was received from alumni:

- G.E.N.M.S. Satya Sai, Employee, Wipro, suggested that all software tools for Mechanical Engineers must be thought fully and regularly. He also commented that there is a gap between industry needs and academic delivery.
  It is recommended to collect the feedback clearly from the alumni, in order to fit the industry needs during the curriculum revision.

(c) The following feed back was received from faculty:

- Group heads have conducted meeting with their respective group faculty and proposed changes in the curriculum by introducing the following courses in order to strengthen the basics in the core course, **Annexure 1(a).**
  - **3D Modelling and prototyping of mechanical components(0-0-4-0)**
  - **Thermodynamics(3-0-0-0)**

Dr. A. SRINATH
PROFESSOR & HEAD
Department of Mechanical Engineering
Deemed to be University
502 502

- **Fluid Mechanics & Hydraulic Machines(3-0-2-0)**
- **Analysis of thermal systems(3-1-0-4)**
- **Engineering in Physical world(1-0-0-4)**
- **Computational Thinking for design(3-0-2-6)**

➢ It was proposed by the group heads to introduce the following courses for 2020-21 admitted batch students to focus on the societal issues/problems and to take up projects on those issues. **Annexure 1(b)**

- **Sustainable Design & Social innovation in Engineering (1-0-4-0)**
- **Sustainable Design & Social Innovation in Smart Manufacturing (1-0-4-0)**
- **Sustainable Design & Social Innovation in Autotronics (1-0-4-0)**
- **Sustainable Design & Social Innovation in Product Design (1-0-4-0)**

➢ It was proposed by the DAC members to introduce the following open electives to meet the current industry requirements, **Annexure 1(c)**.

- **Hybrid Electric Vehicles (3-0-0-0)**
- **Industry 4.0(3-0-0-0)**
- **Industrial Automation (3-0-0-0)**
- **Logistics and Supply Chain Management (3-0-0-0)**
- **Total Quality Management (3-0-0-0)**
- **Smart mobility (3-0-0-0)**
- **Managerial economics for Engineers (3-0-0-0)**

➢ It was proposed by faculty members to introduce courses related to design thinking to enhance the design skills of students

- **Design Thinking and Innovation-1(1-0-0-4)**
- **Design Thinking and Innovation-2(1-0-0-4)**
- **User Centric Design Techniques(1-0-0-4)**

It is resolved to approve courses introduced by faculty.

(d) The following feedback was received from industry persons

➢ **"Industry 4.0 & Design of cyber Physical Systems (3-0-0-4)" &"Autonomous Vehicle Design (2-0-2-0)** course is proposed by Mr.S.S.S.Sastry from Renprotech Solution private limited and from Mr.S.A.Sunderesan from Ashok Leyland for 2019 2020 admitted batches.

➢ Mr.K.Shasikanth Manager, Hyundai Hyderabad division has proposed a course "**Hybrid & Electric vehicle design(2-0-2-0)"** for the 2019 and 2020 admitted batch students.

Syllabus of the above courses is shown in **Annexure 2**.

It is resolved to approve courses proposed by industry personnel.

(e) The following feedback was received from academic peers

➢ Dr. Akhtar Khan, Assistant professor from IITDM Kurnool has proposed to introduce the following courses on coding to enable students with all the required skills of present day industry

- **Artificial Intelligence and Data Analytics (3-0-2-0)**
- **OOPs through Java (3-0-2-0)**

Dr. A. SRINATH
PROFESSOR & HEAD
Department of Mechanical Engineering
KL (Deemed to be University)

- **R-Programming (3-0-2-0)**
- **Python programming (3-0-2-0)**

➢ **"Dynamics of multi body systems"** and **"Modelling Analysis & Design of Robotic systems (2-0-2-0)"** courses were proposed by Dr. Ashok Kumar Dewangan, Assistant professor from NIT Delhi.

➢ Dr. Deepak Kumar Naik Assistant professor in NIT, Srinagar proposed to introduce course on **"Robotics & Industrial automation (2-0-2-0)"** for 2019 and 2020 admitted batch students

It is resolved to approve the proposed new course by academic peers

Syllabus of the above courses is shown in **Annexure 3**.

(f) The following feedback was received from parents

Parents of Y17 & Y18 batch students proposed to introduce courses on Entrepreneurship. Following courses on entrepreneurship under technical proficiency.

- **Technical Proficiency-1/Entrepreneurial Incubation(0-0-0-12)**
- **Technical Proficiency-2/Technopreneur ship(0-0-0-12)**
- **Technical Proficiency-3/Entrepreneurial Skilling(0-0-0-12)**
- **Technical Proficiency-4/Entrepreneurial Skilling(0-0-0-12)**
- **Entrepreneurship Essentials (2-0-0-0)**

It is resolved to approve the proposed courses by Parents.

Further if any feedback / suggestions that will be received from stake holders can be discussed and considered in BOS meeting.

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Dr. A. SRINATH
PROFESSOR & HEAD
Department of Mechanical Engineering
KL (Deemed to be University)
Vaddeswaram - 522 502

Annexure-2(a)

1. Program structure (with all Courses)containing following categorization(2020-21)

Course Code	Course Name	Course Category	L	T	P	S	CR	Pre-Requisite	New Course/Revised Course/ Retained Course	Changes Proposed by	Justification
20UC1101	Integrated Professional English	HSS	0	0	4	0	2	Nil	Retained	No Changes	
20UC1202	English Proficiency	HSS	0	0	4	0	2	Nil	Retained	No Changes	
20UC2103	Professional Communication Skills	HSS	0	0	4	0	2	Nil	Retained	No Changes	
20UC2204	Corporate Communication Skills	HSS	0	0	4	0	2	Nil	Retained	No Changes	
20UC3005	Aptitude Builder	HSS	0	0	4	0	2	Nil	Retained	No Changes	
	Foreign Language Elective	HSS	2	0	0	0	2	Nil	Retained	No Changes	
20UC0007	Indian Heritage and Culture	HSS	2	0	0	0	0	Nil	Retained	No Changes	
20UC0008	Indian Constitution	HSS	2	0	0	0	0	Nil	Retained	No Changes	
20UC0009	Ecology & Environment	HSS	2	0	0	0	0	Nil	Retained	No Changes	
20UC0010	Universal Human Values & Professional Ethics	HSS	2	0	0	0	0	Nil	Retained	No Changes	
20UC0011	Entrepreneurship	HSS	2	0	0	0	0	Nil	Retained	No Changes	
20MT1101	Mathematics for Computing	BS	2	2	0	2	4.5	Nil	Retained	No Changes	
20UC1102	Design Thinking and Innovation-I	BS	1	0	0	4	2	Nil	New Course	Faculty	As pe the feedback of faculty a series of new courses are drafted to enhance the design skills of students
19MT2102	Mathematics for Engineers	BS	2	1	0	0	3	Nil	Retained	No Changes	

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PROFESSOR & HEAD
Department of Mechanical Engineering
KL (Deemed to be University)

20PH1010	Science Elective - 1 (Mechanics)	BS	3	1	0	0	4	Nil	Retained	No Changes	
20UC1203	Design Thinking and Innovation-2	BS	1	0	0	4	2	Nil	New Course	Facutly	As pe the feedback of faculty a series of new courses are drafted to enhance the design skills of students
20UC2104	User centric Design Techniques	BS	1	0	0	4	2	Nil	New Course	Faculty	As pe the feedback of faculty a new course is drafted to enhance the design skills of students
20PH2007	Science Elective - 2 (Materials for Mechanical Engineering Applications)	BS	3	0	2	0	4	Nil	Retained	No Changes	
19BT1001	Biology for Engineers	BS	2	0	0	0	2	Nil	Retained	No Changes	
20SC1101	Computational Thinking for Design	ES	3	0	2	6	5.5	Nil	New Course	Faculty	As per the feedback of faculty members a new course is drafted to incorporate logical thinking
20ME1103	Design Tools Workshop - I	ES	0	0	4	0	2	Nil	Retained	No Changes	
19SC1202	Data Structures	ES	3	0	2	3	4.75	20SC1101	Retained	No Changes	
19SC1209	Design Tools Workshop - II	ES	0	0	4	0	2	Nil	Retained	No Changes	
20ME1203	Computational Thinking and Data Sciences	ES	3	0	2	3	4.75	20SC1101	Retained	No Changes	

Dr. A. SRINATH
PROFESSOR & HEAD
Department of Mechanical Engineering
KL (Deemed to be University)
Vaddeswaram - 522 502

20ME1002	2D Modeling of Physical Systems using CAD tools	ES	1	0	2	0	2	Nil	Retained	No Changes	
20ME2104	3D Modeling and Physical Prototyping of Mechanical components	ES	0	0	4	0	2	20ME1002	New Course	Faculty	Asper the feedback of faculty, a new course is introduced to include the concepts of 3D modelling in the curriculum
20ME2209	Numerical Computation for Mechanical Engineers	ES	2	0	2	0	3	Nil	Retained	No Changes	
20EE2205	Circuits and Electronics	ES	3	0	2	0	4	Nil	Retained	No Changes	
20ME2105	Thermodynamics	ES	3	0	0	0	3	Nil	Revised	Faculty	As per the recommendation of the faculty the TFE-1 and TFE-II courses are revises and offered as Thermodynamics
20ME2101	Mechanics of Solids	PC	3	0	2	0	4	20PH1010	Retained	No Changes	
20ME2106	Fluid Mechanics & Hydraulic Machines	PC	3	0	2	0	4	Nil	Revised	Group Heads	As per the recommendation of the faculty the TFE-1 and TFE-II courses are revises and offered as Fluid Mechanics and Hydrualic Machines
20ME2107	Manufacturing Techniques	PC	3	0	2	0	4	Nil	Retained	No Changes	
20ME2208	Mechanical Engineering Design	PC	3	0	2	4	5	20ME2101	Retained	No Changes	

Dr. A. SRINATH
PROFESSOR & HEAD
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20ME2210	Analysis of Thermal Systems	PC	3	1	0	4	5	20ME2105	New Course	Faculty	As per the recommendation of faculty a new course is drafted to cover the application so thermal engineering and to introduce skilling concept in thermal course
20ME2211	Analysis of Mechanisms and Machines	PC	3	0	2	0	4	20PH1010	Retained	No Changes	
20ME2212	Engineering in the Physical World	PC	1	0	0	4	2	20ME2105	New Course	Faculty	A new course is drafted to incorporate the design concepts of various thermal systems
20ME3113	Machine Design & Innovation	PC	3	1	0	4	5	20ME2208	Retained	No Changes	
20ME3114	Industry 4.0 & Design of Cyber Physical Systems	PC	3	0	0	4	4	Nil	New Course	Industry person	Based on the feedback of industry person a new course is offered to give emphasis on latest technology
20ME3115	Heat Transfer	PC	3	0	2	0	4	Nil	Retained	No Changes	
20ME3216	Artificial Intelligence and Data Analytics	PC	3	0	2	0	4	Nil	New Course	Academic Peers	As per the recommendation of academic peer a new course is drafted to AI concepts in the curriculum
20MB4051	Modeling Business Systems	OE	3	0	0	0	3	Nil	Retained	No Changes	

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	(Open Elective - 3)										
20MB4052	Entrepreneurship Essentials (Open Elective - 4)	OE	3	0	0	0	3	Nil	New Course	Parents	Based on the feedback of parent to inculcate the Entrepreneur skills among the students a new course is introduced
20TS3101	Technical Proficiency - 1 / Entrepreneurial Incubation	PTA	0	0	0	12	3	Nil	New Course	Parents	Based on the feedback of parent to inculcate the Entrepreneur skills among the students a new course is introduced
20TS3202	Technical Proficiency - 2 / Technopreneurship	PTA	0	0	0	12	3	Nil	New Course	Parents	Based on the feedback of parent to inculcate the Entrepreneur skills among the students a new course is introduced
20TS4103	Technical Proficiency - 3 / Entrepreneural Skilling	PTA	0	0	0	12	3	Nil	New Course	Parents	Based on the feedback of parent to inculcate the Entrepreneur skills among the students a new course is introduced
20TS4204	Technical Proficiency - 4 / Entrepreneural Skilling	PTA	0	0	0	12	3	Nil	New Course	Parents	Based on the feedback of parent to inculcate the Entrepreneur skills among the students a new course is introduced
20ME3221	OOPS through Java	FC	3	0	0	0	3	Nil	New Course	Academic peers	As pe the suggestions of Academic peers

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Vaddeswaram - 522 502

											new programming languages are introduced to impart latest concepts on coding skills
20ME3222	R-Programming	FC	3	0	0	0	3	Nil	New Course	Academic Peers	As pe the suggestions of Academic Peer new programming languages are introduced to impart latest concepts on coding skills
020ME3223	Python Programming	FC	3	0	0	0	3	Nil	New Course	Academic peers	As pe the suggestions of Academic Peer new programming languages are introduced to impart latest concepts on coding skills
20ME3224	Machine Learning	FC	3	0	0	0	3	Nil	Retained	No Changes	
20ME4051	Theory of Elasticity and Plasticity	PE	2	0	2	0	3	20ME2208	Retained	No Changes	
20ME4052	Dynamics of Multi Body Systems	PE	2	0	2	0	3	20PH1010	New Course	Academic Peer	As per the suggestions given by Academic peer a new course is drafted to cover the concepts of multi body dynamics
20ME4053	Modeling Analysis & Design of Robotic Systems	PE	2	0	2	0	3	Nil	New Course	Academic Peers	As per the suggestions given by Academic peer a new course is drafted to

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PROFESSOR & HEAD
Department of Mechanical Engineering
KL (Deemed to be University)

											cover the concepts of Design of Robotic systems
20ME4054	Creep, Fatigue and Fracture Mechanics	PE	2	0	2	0	3	20ME22 08	Retained	No Changes	
20ME4055	Advanced Strength of Materials	PE	2	0	2	0	3	20ME21 01	Retained	No Changes	
20ME4056	Mechanics of Composites	PE	2	0	2	0	3	20ME22 08	Retained	No Changes	
20ME4057	Sustainable Design & Social Innovation in Engineering Design	PE	2	0	2	0	3	20ME22 08	New Course	Faculty	As per the suggestion of faculty a new course on sustainability in Engineering Design is introduced to emphasize the importance of sustainability
20ME4061	Modern Manufacturing Processes	PE	2	0	2	0	3	20ME21 07	Retained	No Changes	
20ME4062	Additive Manufacturing	PE	2	0	2	0	3	Nil	Retained	No Changes	
20ME4063	Advanced Materials	PE	2	0	2	0	3	Nil	Retained	No Changes	
20ME4064	Flexible Manufacturing Systems	PE	2	0	2	0	3	Nil	Retained	No Changes	
20ME4065	Robotics & Industrial Automation	PE	2	0	2	0	3	Nil	New Course	Academic peers	As per the feedback of academic peer a new course is drafted to introduce the concepts of Industrial automation using robotics
20ME4066	Reverse Engineering	PE	2	0	2	0	3	Nil	Retained	No Changes	
20ME4067	Sustainable Design & Social Innovation in Smart	PE	2	0	2	0	3	Nil	New Course	Group Heads	As per the suggestion of faculty a new course on

Dr. A. SRINATH
PROFESSOR & HEAD
Department of Mechanical Engineering
(Deemed to be University)
Guntur - 522 502

	Manufacturing										sustainability in Smart manufacturing is introduced to emphasize the importance of sustainability
20ME4071	Automobile Engineering	PE	2	0	2	0	3	Nil	Retained	No Changes	
20ME4072	Hybrid & Electric Vehicle Design	PE	2	0	2	0	3	Nil	New Course	Industry person	A new course is introduced based on the feedback of Industry person to introduce the concepts of Hybrid and Electric vehicles
20ME4073	Autotronics & Safety	PE	2	0	2	0	3	Nil	Retained	No Changes	
20ME4074	Robotics & Industrial Automation	PE	2	0	2	0	3	Nil	Retained	No Changes	
20ME4075	Automotive Electrical and Electronics System	PE	2	0	2	0	3	Nil	Retained	No Changes	
20ME4076	Automobile Engine System and Performance	PE	2	0	2	0	3	Nil	Retained	No Changes	
20ME4077	Sustainable Design & Social Innovation in Automobile Engineering	PE	2	0	2	0	3	Nil	New Course	Faculty	As per the suggestion of faculty member a new course on sustainability in Automobile Engineering is introduced to emphasize the importance of sustainability
20ME4081	Autotronics	PE	2	0	2	0	3	Nil	Retained	No Changes	
20ME4082	Automotive Sesnsor and Applications	PE	2	0	2	0	3	Nil	Retained	No Changes	

Dr. A. SRINATH
PROFESSOR & HEAD
Department of Mechanical Engineering
KL (Deemed to be University)
Vaddeswaram - 522 502

20ME4083	Electronic Engine Management System	PE	2	0	2	0	3	Nil	Retained	No Changes	
20ME4084	Instrumentation in Automotive Industries	PE	2	0	2	0	3	Nil	Retained	No Changes	
20ME4085	Autotronics and Vehicle Intelligence	PE	2	0	2	0	3	Nil	Retained	No Changes	
20ME4086	Autonomous Vehicle Design	PE	2	0	2	0	3	Nil	Retained	No Changes	
20ME4087	Sustainable Design & Social Innovation in Autotronics	PE	2	0	2	0	3	Nil	New Course	Faculty	As per the suggestion of faculty a new course on sustainability in Autotronics is introduced to emphasize the importance of sustainability
20ME4091	Design for Quality and Reliability	PE	2	0	2	0	3	Nil	Retained	No Changes	
20ME4092	Design of Agricultural Products & Machinery	PE	2	0	2	0	3	Nil	Retained	No Changes	
20ME4093	Designing Intelligence Systems	PE	2	0	2	0	3	Nil	Retained	No Changes	
20ME4094	Sustainable Design	PE	2	0	2	0	3	Nil	Retained	No Changes	
20ME4095	Systems Thinking for Design	PE	2	0	2	0	3	Nil	Retained	No Changes	
20ME4096	Design with Advanced Engineering Materials	PE	2	0	2	0	3	Nil	Retained	No Changes	
20ME4097	Sustainable Design & Social Innovation in Product Design	PE	2	0	2	0	3	Nil	New Course	Faculty	As per the suggestion of faculty a new course on sustainability in product Design is introduced to emphasize the importance of sustainability
20ME40B4	Robotics	PE	2	0	2	0	3	Nil	Retained	No Changes	

Dr. A. SRINATH
PROFESSOR & HEAD
Department of Mechanical Engineering
KL (Deemed to be University)
Vaddeswaram - 522 502

20ME40B5	Mechatronics	PE	2	0	2	0	3	Nil	Retained	No Changes	
20ME40B6	Operations Research	PE	2	0	2	0	3	Nil	Retained	No Changes	
20ME40B7	Hybrid Electric vehicles	PE	2	0	2	0	3	Nil	Retained	No changes	
20ME40B8	Industry 4.0	OE	2	0	2	0	3	Nil	New Course	Faculty	As per the feedback of Faculty an open elective course is drafted to introduce latest technology to all engineering students in the mechanical field
20ME40B9	Industrial Automation	OE	2	0	2	0	3	Nil	New Course	Faculty	As per the feedback of Faculty an open elective course is drafted to introduce latest advancement in the industry all engineering students
20ME40C1	Logistics & Supply chain management	OE	2	0	2	0	3	Nil	New Course	Faculty	As per the feedback of Faculty an open elective course is drafted to make students aware of the concepts in supply chain management
20ME40C2	Total Quality Management	OE	2	0	2	0	3	Nil	New Course	Faculty	As per the feedback of Faculty an open elective course is introduced to impart the knowledge on

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PROFESSOR & HEAD
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Vaddeswaram - 522 502

											Quality Management
20ME40C3	Smart Mobility	OE	2	0	2	0	3	Nil	New Course	Faculty	As per the feedback of Faculty an open elective course is offered impart the knowledge on smart mobility
20ME40C4	Managerial Economics for Engineers	OE	2	0	2	0	3	Nil	New Course	Faculty	As per the feedback of Faculty an open elective course is offered to make students understand the importance of economics in engineering
20IE2050	Social Internship	Project	0	0	0	8	2	Nil	New Course	Parent	As per the feedback of parent, a course on Social Internship is introduced as skilling course to make students understand the societal problems
20IE3050	Technical Internship	Project	0	0	0	8	2	Nil	Retained	No Changes	
-	Design Studio elective		0	0	0	10	2.5	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	Nil	Retained	No Changes	

Dr. A. SRINATH
PROFESSOR & HEAD
Department of Mechanical Engineering
KL (Deemed to be University)
Vaddeswaram - 522 502

20IE4051	Internship	Project	0	0	0	24	6	Nil	Retained	No Changes	

Percentage of Syllabus Revision=37*100/104=35.58

Percentage of Courses focusing on Employability= 7*100/104=6.74

Percentage of Courses focusing on Entrepreneurship= 10*100/104=9.61

Percentage of Courses focusing on Skill Development = 87*100/104=83.65

Dr. A. SRINATH
PROFESSOR & HEAD
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KL (Deemed to be University)
Vaddeswaram - 522 502

Annexure-2 (b)-Syllabus for New Courses

20SC1101 – COMPUTATIONAL THINKING FOR DESIGN

L-T-P-S: 3-0-2-6Credits: 5.5 Contact Hours : 11 Pre-requisite : NIL

Mapping of Course Outcomes with PO/PSO:

CO#	Course Outcome	PO/PSO	BTL
CO1	Design Basic and Complex Building Blocks for real world problems using structured programming paradigm.	PO1,PO2	3
CO2	Translate computational thinking into Logic Design for Solving real world problems.	PO1,PO2	3
CO3	Apply and Analyse CRUD operations on Basic Data Structures using Asymptotic Notations.	PO1,PO2	4
CO4	Apply and Analyse CRUD operations on Linear Data Structures using Asymptotic Notations.	PO4	4
CO5	Apply the structured programming paradigm with logic building skills on Basic and Linear Data Structures for solving real world problems.	PO1,PO2, PO4	3

Syllabus:

Structured Programming Paradigm: Problem Solving Approach, Algorithms and Algorithm Analysis, Program Development Steps, Structure of C Program, Pre-Processor Directives, **Design of Building Blocks for solving real world problems**: Modularization: Functions, Scope of Variables and Storage classes. Data Types: Primitive, Extended and Derived Including Pointers, Operators: Types of operators, Precedence, Associativity. User I/O: Formatted I/O, Command line arguments, Redirecting I/O: Files and File Operations.

Logic Design for Computational Thinking:

Control Flow Statements:

Decision making using conditional statements, Definite and indefinite Iterative statements. Recursion, logic building using complex building blocks.

CRUD operations on Basic Data Structures:

Basic Data Structure: Arrays, 2-D Arrays, Dynamic Memory Allocation

Searching: Linear Search and Binary Search

Sorting: Bubble Sort

CRUD operations on Linear Data Structures: Stacks, Queues and Single Linked List. Introduction to Trees.

8Text Books:

1. Brian W. Kernighan, Dennis M. Ritchie, -The C Programming Language: ANSI C Versionll, 2/e, Prentice-Hall/Pearson Education-2005.
2. E. Balagurusamy, "Programming in ANSI C 4th ed.,Tata McGraw-Hill Education, 2008.
3. R. F. Gilberg, B. A. Forouzan, -Data Structures, 2nd Edition, Thomson India Edition-2005.

Reference Books:

1. Mark Allen weiss, Data Structures and Algorithm Analysis in C, 2008, Third Edition, Pearson Education.
2. Horowitz, Sahni, Anderson Freed, -Fundamentals of Data structures in C, 2nd Edition-2007.
3. Robert Kruse, C. L. Tondo, Bruce Leung, Shashi Mogalla, -Data structures and Program

Dr. A. SRINATH
PROFESSOR & HEAD
Department of Mechanical Engineering
KL (Deemed to be University)

Design in C‖, 4th Edition-2007.
4. C for Engineers and Scientists – An Interpretive Approach by Harry H. Cheng, Mc Graw Hill International Edition-2010.
5. Jeri R. Hanly, Elliot B. Koffman, -Problem Solving and Program Design in C‖, 7/e, Pearson Education-2004.
6. Jean Paul Trembly Paul G.Sorenson, -An Introduction to Data Structures with applications‖, 2nd Edition.

Web References / MOOCS:

- www.hackerrank.com
- www.codechef.com
- www.spoj.com

Independent Learning:

1. Computational Thinking with Beginning C Programming
https://www.coursera.org/specializations/computational-thinking-c-programming
2. CISCO NetAcad Course https://www.netacad.com/courses/programming/cla-programming-c

20UC1102- DESIGN THINKING AND INNOVATION-1

L-T-P-S: 1-0-0-4Credits: 2 Contact Hours : 5 Pre-requisite : NIL

CO NO	Course Outcome (CO)	PO/PSO	(BTL)
CO1	Understand the basics of design thinking and its implications in product or service development	PO3	2
CO2	Understand and Analyse the requirements of a typical problem	PO6	4
CO3	Plan the necessary activities towards solving the problem through ideation and prototyping	PO8	4
CO4	evaluate the solution and refine them based on the customer feedback	PO5,PSO1	5

Syllabus

Overview of Design Thinking: Define Design Thinking, Differentiate Design Thinking from Design, Get an Overview of the Design Thinking Process, Empathize and Understand: Explain how empathy influences the outcomes of Design Thinking, List Different Empathy Research Techniques, Define the Guidelines for an Empathetic Research, Defining Needs: Explain how PoV can be used in defining the design problem, Use a structured approach to arrive at a PoV, Ideation for Solutions: List the best practices for conducting a successful ideating session, Describe the techniques for evaluating and prioritizing ideas, Prototyping: Define prototyping, Explain how prototyping aids in communicating ideas effectively, List various tools for prototyping, Testing the Solution: Define the steps of a successful testing approach, Demonstrate the process of gathering and responding to user feedback.

Text Books :

1. The Design Thinking Playbook: Mindful Digital Transformation of Teams, Products, Services, Businesses and Ecosystems

Dr. A. SRINATH
PROFESSOR & HEAD
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KL (Deemed to be University)
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19ME2127-ENGINEERING IN PHYSICAL WORLD

L-T-P-S: 1-0-2-4 Credits: 3 Contact Hours : 7 Pre-requisite : NIL

CO NO	Course Outcome (CO)	PO/PSO	(BTL)
CO1	Recalling and understanding the fundamental laws and concepts related to basic fluid and thermal systems.	PSO1,PO2	2
CO2	Applying the fundamental laws and concepts on basic fluid and thermal systems.	PO2,PSO1	3
CO3	Examining simple fluid and thermal systems based on existing design.	PSO1,PO2	3
CO4	Analysing real time energy systems (flow and heat) by developing an innovative and novel design.	PSO1,PO2	4
CO5	Modelling and analysis of energy systems (flow and heat transfer systems)	PSO1,PO2	4

Syllabus

Behaviour at different scales – micro, macro, lumped – in engineering applications; molecular origin of thermal and mechanical phenomena; statistical mechanics to thermodynamics and macroscopic behaviour; Fundamentals of fluid mechanics, conservations laws for energy, mass, momentum; origin and limits of macroscopic constitutive relations: physical systems: lumped approximations; equilibrium networks; elementary dynamics: and applications to energy and materials, applications of fluid mechanics in real time systems.

Text Books :

1. Engineering Thermodynamics, Nag, P.K., TMH Publications.
2. A Text Book on Fluid Mechanics and Hydraulic Machines, Bansal, R. K., Lakshmi Publications, 2010.
3. Fundamental of Heat Exchanger Design, R.K. Shah, 2003.

20UC1203-DESIGN THINKING AND INNOVATION-II

L-T-P-S: 1-0-0-4 Credits: 2 Contact Hours : 5 Pre-requisite : NIL

CO NO	Course Outcome (CO)	PO/PSO	(BTL)
CO1	compare and select problems suitable for DT projects and use techniques for empathetic research	PO2	2
CO2	identify and document insights, user habits and identify user needs	PO3	3
CO3	Visualise solutions, evaluate solution concepts and able to create rough prototypes, gather feedback	PO5,PO11,PO4	4
CO4	Able to create high-fidelity prototypes. Able to test user experience,Able to identify a business model for a solution concept. Able to estimate financial results	PO4,PO7,PO11	4

Syllabus

Design Thinking for Contextualized Problem-Solving, Empathetic Research, Analysis of Research, Defining Needs, Brainstorming and Evaluation, Prototyping and Testing, From Testing to Launch, Entrepreneurial Innovation

Text book:

1. Wiley play book

Dr. A. SRINATH
PROFESSOR & HEAD
Department of Mechanical Engineering
KL (Deemed to be University)
Vaddeswaram - 522 502

20ME2104 – 3D MODELING AND PHYSICAL PROTOTYPING OF MECHANICAL COMPONENTS

L-T-P-S : 0-0-4-0 Credits 2 Contact Hours 4 Pre-requisite : 20ME1002

Mapping of Course Outcomes with PO/PSO:

CO#	Course Outcome	PO/PSO	BTL
CO1	Draft various parts of machine components and their assemblies. Conversion of part drawings to assembly drawing and vice versa in conventional form, Draw different line types and various dimensioning, conventional representation of materials and machine components, sectioning, limits, fits and tolerances.	PO1, PSO1	3
CO2	Develop and interpret production drawing for various machine elements, Implement Computer Aided Drafting for various machine components using software.	PO1, PO3, PO5, PSO2	3
CO3	Understand different manufacturing techniques and their relative advantages / disadvantages with respect to different applications and Fabricate components physically using various tools and machines	PO2, PO4, PSO1, PSO2	4
CO4	Get practical knowledge of the dimensional accuracies and dimensional tolerances possible with different manufacturing processes, Assemble different components and produce small devices of their interest	PO2, PO4, PSO1, PSO2	4

Syllabus:

Review: Orthographic projection, missing lines, Interpolation of views and sectioning

Part and assembly drawing: Introduction, assembly drawing of stuffing box, steam engine cross head, air valve, Lathe tailstock, gate valve, screw jack, connecting rods, spark plug, tool post, safety Valves etc. Drawing exercises. **Symbols of Machine, elements and welded joints. Specification of materials:** Engineering materials, code designation of steels, copper, and aluminium and its alloys.Limits, tolerances and fits: Introduction, limit systems, tolerance, fits drawing exercises.**Surface roughness:** Introduction, surface roughness, machining symbols, identification of surface roughness drawing exercises.**Production drawing:** Introduction to developing and reading of production drawing of simple machine elements like helical gear, bevel gear, flange, pinion shaft, connecting rod, crank shaft, belt pulley, piston details etc, idea about tool drawing.**Computer aided drawing:** Introduction, input, output devices, introduction to drafting software like Creo/ Solidworks, basic commands and development of simple 2D and 3D drawings.Carpentry (simple exercise in wood working, pattern making) Fitting operations & power tools. Electrical &Electronics Sheet metal working, Welding (arc welding & gas welding and gas cutting), brazing, Plastic moulding, glass cutting. Manufacturing Methods: casting, forming, machining, joining, advanced manufacturing Methods. CNC machining, Additive manufacturing.

Reference Books:

1. HajraChoudhury S.K., HajraChoudhury A.K. and Nirjhar Roy S.K., -Elements of Workshop Technology‖, Vol. I 2008 and Vol. II 2010, Media promoters and publishers private limited, Mumbai.
2. Kalpakjian S. And Steven S. Schmid, -Manufacturing Engineering and Technology‖, 4th edition, Pearson Education India Edition, 2002.
3. Gowri P. Hariharan and A. Suresh Babu,‖Manufacturing Technology – ‖ Pearson Education, 2008.
4. Roy A. Lindberg, -Processes and Materials of Manufacture‖, 4th edition, Prentice Hall

Dr. A. SRINATH
PROFESSOR & HEAD
Department of Mechanical Engineering
KL (Deemed to be University)

India, 1998.

5 Rao P.N., -Manufacturing Technologyl, Vol. I and Vol. II, Tata McGrawHill House, 2017.

6 Narayana -Machine drawingl, New Age International

7 K.L.Narayana and P.Kannaiah -Production drawingl, New Age International

8 Bhatt N.D -Machine drawingl, Charotar

20ME2105 - THERMODYNAMICS

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

Mapping of Course Outcomes with PO/PSO:

CO#	Course Outcome	PO/PSO	BTL
CO1	Understand the fundamentals of thermodynamic systems and processes.	PO1	2
CO2	Apply first law of thermodynamics to various flow and non-flow processes.	PO1, PO2	3
CO3	Apply second law of thermodynamics and principle of entropy to Engineering Devices.	PO1	3
CO4	Apply principles of combustion for gravimetric and volumetric analysis of fuels.	PO1, PO2	3
CO5	Plan and conduct simple experiments to demonstrate thermodynamic principles.	PO4	4

Syllabus:

Fundamental Concepts and Definitions: Thermodynamic system and control volume, macroscopic and microscopic points of view, thermodynamic properties, processes, state, path, cycle, thermodynamic equilibrium and quasi-static process. Reversible and irreversible processes, zeroth law, concept of temperature. **Work and Heat:** Definition of work, units, work done at the moving boundary of system, work done in various non-flow processes, definition of heat, units, comparison of heat and work. **First Law of Thermodynamics for Non-Flow Systems:** First law of thermodynamics for a closed system undergoing a cycle and for a change of state; energy - a property of system, internal energy and enthalpy. Specific heat at constant volume and constant pressure. **First Law of Thermodynamics for Flow Systems:** Control mass, control volume, first law of thermodynamics for a control volume, steady flow energy equation and applications to engineering equipment andPMM-1. **Second Law of Thermodynamics:** Thermal reservoirs, Kelvin-Plank and Clausius statements of second law of thermodynamics; Equivalence of Kelvin-Plank and Clausius statements, PMM-2; Carnot cycle, Carnot engine, corollary of Carnot_s theorem, absolute thermodynamic temperature scale. **Entropy:** Definition of entropy, Clausius theorem, entropy change in reversible process temperature-entropy plot, inequality of Clausius, entropy change in an irreversible process, principle of increase of entropy, applications of entropy principle, entropy change of an ideal gas; availability and irreversibility.

Fuels and Combustion: Types of fuels, exothermic and endothermic combustion equations, stoichiometry. Conversion of gravimetric to volumetric analysis and vice versa; excess air, exhaust gas analysis.

Text Books:

1. Thermodynamics, an Engineering Approach - Yunus A. Cengel& Michael Boles, 6th Edition, Tata McGraw Hill, NewDelhi.
2. Engineering Thermodynamics - P. K. Nag, 5th Edition, Tata McGraw Hill, NewDelhi.

Dr. A. SRINATH
PROFESSOR & HEAD
Department of Mechanical Engineering
KL (Deemed to be University)

Reference Books:

1. Fundamentals of Thermodynamics - G. J. VanWyle
2. Engineering Thermodynamics - Cohen and Rogers, 5th Edition, Pearson Education India limited.
3. Heat and Thermodynamics - Zemansky, McGraw Hill, 5th Edition.

20ME2106 - FLUID MECHANICS & HYDRAULIC MACHINES

L-T-P-S : 3-0-2-0 Credits 4 Contact Hours 5 Pre-requisite : Nil

Mapping of Course Outcomes with PO/PSO:

CO#	Course Outcome	PO/PSO	BTL
CO1	Understand physical laws related to fluid statics and buoyancy.	PO1, PO2	2
CO2	Apply continuity, Euler and Bernoulli equations in various fluid flow situations.	PO1, PO2	3
CO3	Understand and apply momentum equation and boundary layer concepts to flow through pipes and to impact of jets.	PO1, PO2	3
CO4	Apply fluid dynamical principles to hydraulic machines.	PO1, PO2	3
CO5	Conduct experiments to verify and apply various fluid flow principles and performance evaluation of various hydraulic machines like turbines and pumps	PO4	4

Syllabus:

Fluid Properties: Definition of fluid, properties of fluids - density, specific weight, specific gravity, viscosity, classification of fluids, surface tension, capillarity, vapor pressure. **Fluid Statics**: Introduction, pressure, Pascal law, hydrostatic law, measurement of pressure, simple and differential manometers; total pressure and center of pressure on vertical, horizontal, inclined and curved surfaces. **Buoyancy:** Buoyancy, forces on submerged bodies, stability of submerged and floating bodes. **Fluid kinematics:** Introduction, types of fluid flow, discharge, continuity equation, potential function and stream function. **Fluid dynamics:** Introduction, Euler_s equation of motion, Bernoulli_s equation and applications, venturi meter, orifice meter. **Flow through pipes**: Introduction, major and minor energy losses, friction coefficient in laminar and turbulent flow, Hagen-Poiseuille law, Hydraulic gradient and total energy line, pipes in series and parallel, power transmission through pipes, Reynold_s experiment and water hammer. **Dimensional analysis and model similitude Boundary layer theory**: Introduction, laminar and turbulent boundary layers, boundary layerthickness, displacement thickness, momentum thickness, energy thickness, boundary layer separation, methods of preventing separation. **Impact of Jets**: Introduction to impulse-momentum equation and its applications, force exerted by jet on fixed target, moving target, and series of curved vanes. **Hydraulic Machines - Turbines**: Introduction, types and classification Pelton wheel, Francis turbine, Kaplan turbine-theory, work done and efficiency, design parameters, problems. **Hydraulic Machines - Centrifugal pumps**: Definition of pump, classification, description and general principle of working; priming, work done and efficiency of a centrifugal pump, minimum starting speed, cavitation in centrifugal pumps, multi-stage pumps, problems on centrifugal pumps.

Text Books:

1. Fluid Mechanics by S. K. Som and G. Biswas, Tata McGraw Hill publications.

Dr. A. SRINATH
PROFESSOR & HEAD
Department of Mechanical Engineering
KL (Deemed to be University)

2. Fluid Mechanics by Yunus A. Cengel, McGraw Hill publications.
3. Fluid Mechanics and Hydraulic Machines, D. S. Kumar, Narosa Publishing House Private Limited.

Reference Books:

1. Fluid Mechanics by Frank M. White, Seventh Edition, McGraw Hill.
2. Fluid Mechanics & Hydraulics, K. R. Arora, Standard Book House, New Delhi.
3. Fluid Mechanics & Hydraulics, Modi & Seth, Standard Book House, New Delhi.

20ME2210 - ANALYSIS OF THERMAL SYSTEMS

L-T-P-S : 3-1-0-4 Credits 5 Contact Hours 8 Pre-requisite : 20ME2105

Mapping of Course Outcomes with PO/PSO:

CO#	Course Outcome	PO/PSO	BTL
CO1	Understand phase equilibrium of a pure substance, Determine efficiency of Rankine vapor power cycle	PO1, PO2	2
CO2	Estimate dimensional parameters of various steam nozzles including convergent and divergent nozzles and efficiency of condensers	PO1, PO2	3
CO3	Understand the fundamentals of internal combustion engines	PO1, PO2	2
CO4	Compare various methods of refrigeration by understanding working principles, Understand principle of psychrometry and air-conditioning process	PO4	3
CO5	Analyze internal & external fluid flows and Analyze steady and transient heat transfer through various systems	PO4	4

Syllabus:

Pure Substance: Vapour-liquid-solid phase equilibrium, independent properties, Equations of state, Tables of thermodynamic properties.

Vapour Power Cycles: Rankine cycle, Effect of pressure and temperature, Regenerative cycle, Binary vapour cycle.

Steam Nozzles & Condensers: Types of nozzles, isentropic flow through nozzles, effect of friction, nozzle efficiency, critical pressure ratio and maximum discharge, throat and exit areas using Mollier diagram, Condensers - Jet and surface condensers, condenser vacuum and vacuum efficiency, condenser efficiency, thermodynamic analysis.

IC Engines: Engine nomenclature, classification of I.C. Engines, working principles of S.I. and C.I. Engines (both 4 stroke and 2-stroke) - valve and port timing diagrams - Differences between SI & CI and 2 stroke & 4 stroke engines and combustion in S.I and CI engines.

Refrigeration & Air conditioning: Methods of refrigeration, Refrigerator & heatpump, Reversed carnot and bell-colemancycles, Refrigerating effect, COP, Vapour compression and vapour absorption refrigeration systems, Psychrometric properties, psychrometric chart and air-conditioning process.

Skilling Syllabus:

Introduction to CFD (Computational Fluid Dynamics) – Ansys FLUENT Internal fluid flows, External fluid flows Steady and transient heat transfer Combined study on fluid flow and heat transfer

Text Books:

1. Cengel & Boles -Engineering Thermodynamicsl,Mc Graw Hill Publishers.

Dr. A. SRINATH
PROFESSOR & HEAD
Department of Mechanical Engineering
KL (Deemed to be University)
Vaddeswaram - 522 502

2. P.K.Nag –Basic and Applied Thermodynamics‖,TMH, New Delhi.
3. V.Ganesan –I.C. Engines‖,T.M.H.
4. ANSYS Fluent Tutorial Guide by ANSYS, Inc. Release 17.0 Southpoi.
5. –Computational fluid dynamics, the basics with applications‖ by john D Anderson.
6. S. V. Patankar, Numerical Heat Transfer and Fluid Flow, McGraw-Hill.
7. Mechanical Measurements by Thomas G. Beckwith, Addison-Wesley Publications

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 the basic principles of AI in solutions that require problem solving	PO3, PO4, PSO1	3
CO2	Understand the concepts of Robotics and its control	PO3, PO4, PSO1	2
CO3	Understand the concepts of IoT and its applications	PO3, PO4, PSO1	2
CO4	Understand the concepts of Cloud Technology	PO3, PO4, PSO1	2
CO5	Apply the concepts of Cyber security and Control Systems	PO3, PO4, PSO1	3

Syllabus:

Introduction to Industry 4.0:

The Various Industrial Revolutions, Digitalisation and the Networked Economy, Drivers, Enablers, Compelling Forces and Challenges for Industry 4.0, The Journey so far: Developments in USA, Europe, China and other countries, Comparison of Industry 4.0 Factory and Today's Factory, Trends of Industrial Big Data and Predictive Analytics for Smart Business Transformation.

Need for AI in Robotics: Thinking and acting humanly, intelligent agents, structure of agents, Turing Test, State space search - Uninformed search.

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

Robotics: Robotic perception, localization, mapping- configuring space, planning uncertain movements, dynamics and control of movement

IoT: Introduction to IoT, Design Methodology: Purpose and Requirements specifications, process specifications, Domain model specifications, Information Model specifications, Service specifications, IoT level specifications, Functional and operational view specifications, Device and Component Integration, Application Development.

Cloud Technology: Introduction , Differences Between Traditional and Cloud Computing Environments, IT Assets as Provisioned Resources , Global, Available, and Scalable Capacity, Higher-Level Managed Services, Built-in Security ,Architecting for Cost ,Operations on AWS, Design Principles, Scalability ,Disposable Resources Instead of Fixed Servers, Automation, Loose Coupling, Services, Not Servers, Databases, Managing Increasing Volumes of Data, Removing Single Points of Failure, Optimize for Cost, Caching, Security.

Text books:

1. Artificial Intelligence a Modern Approach by Peter Norvig, Rusell

Reference Books:

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

Dr. A. SRINATH
PROFESSOR & HEAD
Department of Mechanical Engineering
KL (Deemed to be University)
Vaddeswaram - 522 502

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Phone No. 08645 - 350200 www.kluniversity.in
Admin Off: 29-36-38, Museum Road, Governorpet, Vijayawada - 520 002. Ph: +91 - 866 - 3500122, 2577715, 2576129.

20ME3216 – ARTIFICIAL INTELLIGENCE AND DATA ANALYTICS

L-T-P-S : 3-0-2-0 Credits 4 Contact Hours 5 Pre-requisite : NIL

Mapping of Course Outcomes with PO/PSO:

CO#	Course Outcome	PO/PSO	BTL
CO1	Understand about Artificial Intelligence, techniques of AI and Problem solving by Search, Heuristic Search, Randomized search techniques and Finding Optimal paths	PO1, PO5	2
CO2	Analyze the appropriate methodologies for problem decompositions, planning and constraint data constraint satisfactions.	PO1, PO5	4
CO3	Understand the Basics of Descriptive Statistics, Inferential Statistics.	PO1, PO5	2
CO4	Understand the Basics of Regression & ANOVA and Prescriptive analytics.	PO1, PO5	2
CO5	Apply the theoretical concepts to conduct various experiments on Search Techniques and Language Representation.	PO4	3

Syllabus:

Introduction: Overview and Historical Perspective, Turing test, Physical Symbol Systems and the scope of Symbolic AI, Agents. **State Space Search:** Depth First Search, Breadth First Search, DFID. **Heuristic Search:** Best First Search, Hill Climbing, Beam Search, Tabu Search. **Randomized Search:** Simulated Annealing, Genetic Algorithms, Ant Colony optimization. **Finding Optimal Paths:** Branch and Bound, A*, IDA*, Divide and Conquer approaches, Beam Stack Search. **Problem Decomposition:** Goal Trees, AO*, Rule Based Systems, Rete Net. Game Playing: **Planning and Constraint Satisfaction:** Domains, Forward and Backward Search, Goal Stack Planning, Plan Space Planning, Graph plan, Constraint Propagation.

Logic and Inferences: Propositional Logic, First Order Logic, Soundness and Completeness, Forward and backward chaining.
Descriptive Statistics: Introduction to the course Descriptive Statistics Probability Distributions
Inferential Statistics: Inferential Statistics through hypothesis tests Permutation & Randomization Test **Regression & ANOVA:** Regression, ANOVA (Analysis of Variance)

Prescriptive analytics:

Creating data for analytics through designed experiments, creating data for analytics through active learning, creating data for analytics through Reinforcement learning.

Text books:

1. Deepak Khemani. A First Course in Artificial Intelligence, McGraw (India), 2013. Hill Education

Reference Books:

1. Stefan Edelkamp and Stefan Schroedl. Heuristic Search: Theory and Applications, Morgan Kaufmann, 2011.
2. John Haugeland, Artificial Intelligence: The Very Idea, A Bradford Book, The MIT Press, 1985.
3. Pamela McCorduck, Machines Who Think:A Personal Inquiry into the History and Prospects ofArtificial Intelligence,A K Peters/CRC Press; 2 edition, 2004.
4. Zbigniew Michalewicz and David B. Fogel. How to Solve It: Modern Heuristics. Springer; 2nd edition, 2004.

Dr. A. SRINATH
PROFESSOR & HEAD
Department of Mechanical Engineering
KL (Deemed to be University)
Vaddeswaram - 522 502

20ME4053 - MODELING ANALYSIS & DESIGN OF ROBOTIC SYSTEMS

L-T-P-S : 2-0-2-0 Credits 3 Contact Hours 4 Pre-requisites : Nil

Mapping of Course Outcomes with PO/PSO:

CO#	Course outcome	PO/PSO	BTL
CO1	Understand the forward and inverse dynamics and different types of dynamic formulation schemes.	PO1, PO2	2
CO2	Modeling of motion of robots and manipulators	PO1, PO2	3
CO3	Kinematic modeling and analysis of mechanical and robotic systems	PO1, PO2	4
CO4	Understand the control of mechanical / robotic systems	PO1, PO2	2

Syllabus:

Introduction to Robot Dynamics and Kinematics: Forward Dynamics and Inverse Dynamics – Importance – Spatial description and transformations – Different types of dynamic formulation schemes – Lagrangian formulation for equation of motion for robots and manipulators.

Dynamic Modeling and Simulation: Modeling of motion of robots and manipulators using Newton – Euler equations – State space representation of equation of motion and system properties – Importance of Simulation and its types – Numeric Integration solvers and their role in numeric simulation - Numeric simulation of robots and manipulators using MATLAB / Simulink module.

Introduction to Robot Control: Introduction – Need and types of control schemes for robots – joint space control schemes with an example – task space control schemes with an example.

Kinematics and Dynamics Modeling: Kinematic modeling and analysis of mechanical and robotic systems – Forward kinematics and inverse kinematics – Jacobian and velocity analysis – Dynamic/ Kinetic modeling and analysis of mechanical and robotic systems – Forward dynamics, statics and performance analysis.

Kinematics and Dynamics Controlling: System control of mechanical / robotic systems using Adams – Inverse dynamics, regulatory control and tracking control.

Text books:

1. Kelly R, Santibanez V and Loria A, —Conrol of Robot Manipulators in Joint Spacell, Springer, 2005.
2. Devendra K Chaturvedi, —Modeling and Simulation of Systems using MATLAB and Simulink, CRC press, 2010.

Dr. A. SRINATH
PROFESSOR & HEAD
Department of Mechanical Engineer
KL (Deemed to be Universi
Vaddeswaram - 522 5

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Campus: Green Fields, Vaddeswaram - 522 302, Guntur District, Andhra Pradesh, INDIA
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Admin Off: 29-36-38, Museum Road, Governorpet, Vijayawada - 520 002, Ph: +91 - 866 - 3500122, 2577715, 2576129

20ME4057 – SUSTAINABLE DESIGN & SOCIAL INNOVATION IN ENGINEERING DESIGN

L-T-P-S : 1-0-4-0 Credits 3 Contact Hours 5 Pre-requisites : NIL

Mapping of Course Outcomes with PO/PSO:

CO#	Course outcome	PO/PSO	BTL
CO1	Able to know all fundamental concepts related to the courses in Engineering Design Specialization	PO1	3
CO2	Able to gain hands-on experience on all relevant software tools	PO5	3
CO3	Able to identify the real-world problem and inculcate problem solving and critical thinking skills	PO7	3
CO4	Design and execute a fully functional prototype	PO4, PSO1, PSO2	5

Syllabus:

Fundamental concepts in Engineering Design Specialization

Hands-on experience on all relevant software tools **Capstone Project:**

Step-1: Define the problem and identify the objectives

Step-2: Research must be focused and incorporate new ideas and a thorough exploration of old similar ideas.

Step-3: The build process must take into consideration materials, processes, construction limitations, and cost.

Step-4: The entire project must be tested to see if it does the job for which it was designed.

References:

1. Text books
2. E-resources
3. Journals
4. Web resources

Dr. A. SRINATH
PROFESSOR & HEAD
Department of Mechanical Engineering
KL (Deemed to be University)
Vaddeswaram - 522 502

20ME4065 - ROBOTICS & INDUSTRIAL AUTOMATION

L-T-P-S : 2-0-2-0 Credits 3 Contact Hours 4 Pre-requisites : Nil

Mapping of Course Outcomes with PO/PSO:

CO#	Course outcome	PO/PSO	BTL
CO1	Explain the General function of Industrial Automation	PO3	2
CO2	Identify Safety in Industrial Automation,	PO3	2
CO3	Identify and understand the types of Industrial Sensors	PO3	2
CO4	Identify Practical Programmable Logic Controller Applications	PO3	2

Syllabus:

Evolution of Robotics and Automation: Robotics in science fiction, industrial revolution, history and need of robotics, definition of a robot, robot terminology, types and applications of robot, overview of present status and future trends, robotics market and future prospects.

Industrial Automation: Reasons for automation, arguments for and against automation, type of Industries and components of automation.

Types of Industrial Sensors: Optical, Inductive, Capacitive, Encoders, Ultrasonic, Thermocouples, Demonstrate Proper Wiring Techniques and Practical Applications.

Programmable Logic Controller: Introduction to PLC, Need of PLC in Designing, Architecture of PLC, Application and Advantage of PLC, Automation Concept And Basic Design, PLC Programming.

Text Books:

1. Terry Bartlet, -Industrial Control Electronics Devices, Systems, & Applicationsl, 3rd Edition, Delmar Publisher.

Dr. A. SRINATH
PROFESSOR & HEAD
Department of Mechanical Engineeri
KL (Deemed to be University)

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20ME4067 – SUSTAINABLE DESIGN & SOCIAL INNOVATION IN SMART MANUFACTURING

L-T-P-S : 1-0-4-0 Credits 3 Contact Hours 5 Pre-requisites : NIL

Mapping of Course Outcomes with PO/PSO:

CO#	Course outcome	PO/PSO	BTL
CO1	Able to know all fundamental concepts related to the courses in Smart Manufacturing Specialization	PO1	3
CO2	Able to gain hands-on experience on all relevant software tools	PO5	3
CO3	Able to identify the real-world problem and inculcate problem solving and critical thinking skills	PO7	3
CO4	Design and execute a fully functional prototype	PO4, PSO1, PSO2	5

Course Objective:

- The objective of this course is to design a capstone project by providing understanding of all necessary fundamental concepts learned through the core and elective courses and able to identify the real-world problem and provide the solution.

Syllabus:

Fundamental concepts in Smart Manufacturing Specialization

Hands-on experience on all relevant software tools

Capstone Project:

Step-1: Define the problem and identify the objectives

Step-2: Research must be focused and incorporate new ideas and a thorough exploration of old similar ideas.

Step-3: The build process must take into consideration materials, processes, construction limitations, and cost.

Step-4: The entire project must be tested to see if it does the job for which it was designed.

References:

1. Text books
2. E-resources
3. Journals
4. Web resources

Dr. A. SRINATH
PROFESSOR & HEAD
Department of Mechanical Engineering
KL (Deemed to be University)
Vaddeswaram - 522 502

20IE2050-SOCIAL INTERNSHIP

L-T-P-S:0-0-0-8 **Credits:2** **Pre-Requisite:Nil**

Mapping of Course Outcomes with PO's:

COURSE OUTCOMES (COs):

CO NO	Course Outcome (CO)	PO/PSO	Blooms Taxonomy Level (BTL)
CO1	Remember the fundamentals of the science of water cycle along with powerful tools that students can use to diagnose the health of the local water cycle as well as develop targeted action plans to restore the local natural water cycle and bring water prosperity	PO9,PSO1,PO1,PO3	1
CO2	Remember the water sustainability and water resilience of village, city, residential facilities and households using multi-level water scorecards	PSO2,PO4,PO5	1
CO3	Apply the design thinking positive action plan for a village, campus, residential facility and community neighbourhood.	PO5,PO7,PO9	3
CO4	Applying the water positive solutions within an urban watershed, a rural watershed, residential institutional and corporate community	PO1,PO8,PSO1	3

Syllabus:

The module will cover the following 1) Science of Natural Water Cycle 2) Watershed death spiral that is the cause of climate change 3) Water Literacy - Know how water flows in your city, in your residential community and inside your own home. 4) Design Thinking Process 5) Water Accounting - Water Scorecard Tools to rapidly assess and account for water sustainability security & resilience of your own household, your residential community & your city 6) Basic Hydrology 7) Groundwater Fundamentals 8) Water Cycle and Biodiversity 9) Nature Based Solutions to Restore & Repair the Local Natural Water Cycle 10) Model prototype

Dr. A. SRINATH
PROFESSOR & HEAD
Department of Mechanical Engineer.
KL (Deemed to be University)
Vaddeswaram - 522 502

Annexure 2(c)

K L E F

Department of Mechanical Engineering

Annexure 1(b): Revised B.Tech. ME- 2019-20 admitted batch Course Structure - Semester wise

Semester-1

Sl No	Course Code	Course Title	Type	L	T	P	S	Cr	CH	Pre-requisite	Software Tools
1	19UC1101	Basic English	HSS	0	0	4	0	2	4	Nil	-
2	19MT1101	Mathematics for Computing	BS	3	1	0	4	5	8	Nil	-
3	19ME1103	Design Tools Workshop - I	ES	0	0	4	0	2	4	Nil	-
4	19SC1101	Problem Solving and Computer Programming	ES	3	0	2	0	4	5	Nil	-
5	19PH1010	Science Elective - I (Mechanics)	BS	3	1	0	0	4	4	Nil	-
6	19SC1106	Technical Skills - I (Coding)	ES	0	0	0	6	1.5	6	Nil	
7	19GN1101	Counseling		0	0	0	4	0	4		
Total				**9**	**2**	**10**	**14**	**18.5**	**35.0**		

Semester-2

Sl No	Course Code	Course Title	Type	L	T	P	S	Cr	CH	Pre-requisite	Software Tools
1	19UC1202	English Proficiency	HSS	0	0	4	0	2	4	Nil	-
2	19MT2102	Mathematics for Engineers	BS	3	0	0	0	3	3	Nil	MATLAB
3	19SC1209	Design Tools Workshop - II	ES	0	0	4	0	2	4	Nil	-
4	19SC1202	Data Structures	ES	3	0	2	3	4.75	8	19SC1101	-
5	19ME1201	Mechanics of Solids - I	ES	3	0	0	0	3	3	19PH1010	ANSYS
6	19ME1002	Engineering Graphics for Mechanical Engineers	ES	1	0	2	0	2	3	Nil	Fusion 360

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(Deemed to be University)
522 502

7	19ME1204	Computational Thinking and Data Sciences	ES	3	0	2	3	4.75	8	19SC1101	Python
Total				**13**	**0**	**14**	**6**	**21.5**	**33**		

Semester-3

Sl No	Course Code	Course Title	Type	L	T	P	S	Cr	CH	Pre-requisite	Software Tools
1	19UC2103	Professional Communication Skills	HSS	0	0	4	0	2	4	Nil	
2	19ME2003	Workshop Practices for Mechanical Engineers	ES	0	0	4	0	2	4	Nil	
3	19PH2007	Science Elective - 2 (Materials for Mechanical Engineering Applications)	BS	2	0	2	0	3	4	Nil	-
4	19ME2107	Thermal-Fluids Engineering-I	Prof.Core	3	0	2	0	4	5	Nil	EES
5	**19ME2127**	**Engineering in the Physical World**	Prof.Core	1	0	2	4	3	7	Nil	ANSYS Fluent
6	19ME2108	Mechanics of Solids - II	ES	3	0	2	0	4	5	19ME1201	ANSYS
7	19ME2211	Manufacturing Techniques	Prof.Core	3	0	2	0	4	5	Nil	
8	19TS704	Skilling for Engineers-4 (Problem Solving techniques in Design)	Tech.Skill	0	0	0	4	1	4	19ME1201	ANSYS & NASTRAN
9	19EE2205	Circuits and Electronics	ES	3	0	2	0	4	5	Nil	NI Lab View
10	19ME2110	Machine Drawing	ES	0	0	4	0	2	4	19ME1002	SolidWoks/ CREO
Total				**15**	**0**	**24**	**8**	**29**	**47**		

Semester-4

Sl No	Course Code	Course Title	Type	L	T	P	S	Cr	CH	Pre-requisite	Software Tools
1	19UC2204	Aptitude Builder-I	HSS	0	0	4	0	2	4	Nil	
2	19ME2212	Thermal-Fluids Engineering-II	Prof. Core	3	0	2	0	4	5	19ME2107	CFD Fluent
3	19ME2109	Kinematics and Dynamics of Machines	Prof. Core	3	0	2	0	4	5	Nil	MSC ADAMS
4	19ME3115	Design for Manufacturing	Prof. Core	3	0	2	0	4	5	19ME2211	
5	19ME3114	Machine Design	Prof. Core	3	1	0	0	4	4	19ME2108	ANSYS & NASTRAN
6	19ME3116	Robotics and Artificial Intelligence	Prof. Core	3	0	0	0	3	3	Nil	MatLab & NI Lab View

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7	FC-1	Flexi Core -1 (Product Design & Development)	Flexi. Core	0	0	8	0	4	8	Nil	
8	19TS701	Skilling for Engineers-1 (Manufacturing Technologies)	Tech.Skill	0	0	0	4	1	4	Nil	
9	19IE2246	Industrial Training (to be done in summer break for min 150 hours)	Project	0	0	0	0	2	0	Nil	
10	CC	Sports	CC	0	0	0	0	0	2	Nil	
Total				**15**	**1**	**18**	**4**	**28**	**40**		

Semester-5

Sl No	Course Code	Course Title	Type	L	T	P	S	Cr	CH	Pre-requisite	Software Tools
1	19UC3105	Aptitude Builder-II	HSS	0	0	4	0	2	4	Nil	
2	19ME2106	Metrology and Measurements	Prof.Core	2	0	2	0	3	4	Nil	NI Lab View
3	19ME2213	Vibrations and Controls	Prof. Core	3	0	0	0	3	3	19ME2109	MatLab
4	19ME3219	Heat Transfer	Prof. Core	3	0	2	0	4	5	19ME2107	ANSYS Fluent
5	19ME2205	Numerical Computation for Mechanical Engineers	ES	2	0	2	0	3	4	Nil	MatLab
6	19UC0007	Indian Heritage and Culture	HSS	2	0	0	0	0	2	Nil	-
7	PE-1	Professional Elective - 1	Prof. Elective	2	0	2	0	3	4		
8	FC-2	Flexi Core - 2	Flexi. Core	3	0	2	0	4	5	Nil	
9	19TS703	Skilling for Engineers-3 (Problem Solving techniques in Thermal)	Tech.Skill	0	0	0	4	1	4	19ME210	CFD Fluent & EES
10	19TS705	Technical Proficiency & Training-1 (Automobile Design and Building)	Tech.Skill	0	0	0	4	1	4	Nil	Dassault Systems-3D Experience, SolidWorks
Total				**17**	**0**	**14**	**8**	**24**	**39**		

Semester-6

Sl No	Course Code	Course Title	Type	L	T	P	S	Cr	CH	Pre-requisite	Software Tools
1	19UC3206	Campus to Corporate	HSS	0	0	4	0	2	4	Nil	-
2	19ME3218	Engineering Management	Prof. Core	2	0	0	0	2	2	Nil	-
3	19UC0011	Entrepreneurship	HSS	2	0	0	0	0	2	Nil	-

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4	FC-3	Flexi Core -3	Flexi. Core	3	0	2	0	4	5	Nil	-
5	PE-2	Professional Elective - 2	Prof. Elective	2	0	2	0	3	4	-	-
6	PE-3	Professional Elective - 3	Prof. Elective	2	0	2	0	3	4	-	-
7	PE-4	Professional Elective - 4	Prof. Elective	2	0	2	0	3	4	-	-
8	PE-5	Professional Elective - 5	Prof. Elective	2	0	2	0	3	4		
9	**19TS702**	**Skilling for Engineers-2 (Design of Cyber Physical Systems)**	Tech. Skill	0	0	0	4	1	4	Nil	NI LabView & MatLab
10	19TS706	Technical Proficiency & Training -2 (Robot Design)	Tech.Skill	0	0	0	4	1	4	Nil	ADAMS
11	19IE3247	Term Paper	Project	0	0	4	0	2	4	Nil	-
Total				**15**	**0**	**18**	**8**	**24**	**41**		

Semester-7

Sl No	Course Code	Course Title	Type	L	T	P	S	Cr	CH	Pre-requisite	Software Tools
1	19UC0009	Ecology & Environment	HSS	2	0	0	0	0	2	Nil	-
2	19UC0008	Indian Constitution	HSS	2	0	0	0	0	2	Nil	-
3	19UC0010	Universal Human Values & Professional Ethics	HSS	2	0	0	0	0	2	Nil	-
4	19BT1001	Biology for Engineers	BS	2	0	0	0	2	2	Nil	-
5	OE	Management Elective (OE-1)	OE	3	0	0	0	3	3	Nil	-
6	OE	Foreign Language (OE-2)	OE	2	0	0	0	2	2	Nil	-
7	19IE4048/ 19IE4050	Project (Part I) / Practice School	Project	0	0	0	24	6	24	Nil	-
Total				**13**	**0**	**0**	**24**	**13**	**37**		

Semester-8

Sl No	Course Code	Course Title	Type	L	T	P	S	Cr	CH	Pre-requisite	Software Tools
1	OE	Open Elective - 3	OE	3	0	0	0	3	3	Nil	-
2	OE	Open Elective - 4	OE	3	0	0	0	3	3	Nil	-
3	19IE4049/ 19IE4050/1 9IE4051	Project (Part II) / Practice School/ Internship	Project	0	0	0	24	6	24	Nil	-
Total				**6**	**0**	**0**	**24**	**12**	**30**		

Grand Total	**103**	**3**	**98**	**96**	**170**	**302**		

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PROFESSOR & HEAD
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Annexure-3

Course wise Syllabus revision of approved structure of 2020-21 Admitted Batch

Course Code	Course Name	Course Category	Existing Syllabus	New Syllabus	Topics Added/Removed/ Replaced	Change in Outcome	Justification for the Modification	Revision Percentage
20ME2105	Thermodynamics	ES	Fundamental principles of thermodynamics and fluid mechanics, Flow and Non-flow process, Law of conservation of energy and momentum with applications. Work study during various Non-flow processes, Steady flow energy equation and its applications, first and second law of thermodynamics with special emphasis on Entropy generation. Study of properties of fluids, hydrostatics, fluid kinematics and applications of Bernoulli equation. Internal and external laminar and turbulent viscous flow analysis and Boundary layer theory	Thermodynamic system and control volume. macroscopic and microscopic points of view. thermodynamic properties. processes. state. path. cycle. thermodynamic equilibrium and quasi-static process. Reversible and irreversible processes. zeroth law. concept of temperature. **Work and Heat:** Definition of work. units. work done at the moving boundary of system. work done in various non-flow processes. definition of heat. units. comparison of heat and work. **First Law of Thermodynamics for Non-Flow Systems:** First law of thermodynamics for a closed system undergoing a cycle and for a change of state; energy - a property of system. internal energy and enthalpy. Specific heat at constant volume and constant pressure. **First Law of Thermodynamics for Flow Systems:** Control mass. control volume. first law of thermodynamics for a control volume. steady flow energy equation and applications to engineering equipment andPMM-1. **Second Law of Thermodynamics:** Thermal reservoirs. Kelvin-Plank and Clausius statements of second law of thermodynamics; Equivalence of Kelvin-Plank and Clausius statements. PMM-2; Carnot cycle. Carnot engine. corollary of Carnot_s theorem. absolute thermodynamic temperature scale. **Entropy:** Definition of entropy.	Clausius theorem. entropy change in reversible process temperature-entropy plot. inequality of Clausius. entropy change in an irreversible process. principle of increase of entropy, applications of entropy principle. entropy change of an ideal gas; availability and irreversibility. **Fuels and Combustion**: Types of fuels, exothermic and endothermic combustion equations, stoichiometry. Conversion of gravimetric to volumetric analysis and vice versa; excess air, exhaust gas analysis	2 Course Outcomes Changed	As per the feedback of thermal group head the topics of related to thermodynamics in TFE-1 and TFE-2 are combined to enable students understand the concepts of thermodynamics completely	50%

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				Clausius theorem, entropy change in reversible process temperature-entropy plot, inequality of Clausius, entropy change in an irreversible process, principle of increase of entropy, applications of entropy principle, entropy change of an ideal gas; availability and irreversibility. **Fuels and Combustion:** Types of fuels, exothermic and endothermic combustion equations, stoichiometry. Conversion of gravimetric to volumetric analysis and vice versa; excess air, exhaust gas analysis.				
20ME2106	Fluid Mechanics and Hydraulic and Machines		Fundamental principles of thermodynamics and fluid mechanics, Flow and Non-flow process, Law of conservation of energy and momentum with applications. Work study during various Non-flow processes, Steady flow energy equation and its applications, first and second law of thermodynamics with special emphasis on Entropy generation. Study of properties of fluids, hydrostatics, fluid kinematics and applications of Bernoulli equation. Internal and external laminar and turbulent viscous flow analysis and Boundary layer theory	**Fluid Properties:** Definition of fluid, properties of fluids - density, specific weight, specific gravity, viscosity, classification of fluids, surface tension, capillarity, vapor pressure. **Fluid Statics:** Introduction, pressure, Pascal law, hydrostatic law, measurement of pressure, simple and differential manometers; total pressure and center of pressure on vertical, horizontal, inclined and curved surfaces. **Buoyancy:** Buoyancy, forces on submerged bodies, stability of submerged and floating bodes. **Fluid kinematics:** Introduction, types of fluid flow, discharge, continuity equation, potential function and stream function. **Fluid dynamics:** Introduction, Euler_s equation of motion, Bernoulli_s equation and applications, venturi meter, orifice meter. **Flow through pipes:** Introduction, major and minor energy losses, friction coefficient in laminar and turbulent flow, Hagen-Poiseuille law, Hydraulic gradient and total energy line, pipes in series and parallel, power transmission through pipes, Reynold_s	**Buoyancy:** Buoyancy, forces on submerged bodies, stability of submerged and floating bodes. **Impact of Jets:** Introduction to impulse-momentum equation and its applications, force exerted by jet on fixed target, moving target, and series of curved vanes. **Hydraulic Machines - Turbines:** Introduction, types and classification Pelton wheel, Francis turbine, Kaplan turbine-theory, work done and efficiency.	2 Co's Changed	As per the feedback of thermal group head the topics of related to Fluid Mechanics from in TFE-1 course are combined with concept of Hydraulic Machines to enable students understand the in detail the applications of Fluid Mechanics	50%

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Department of Mechanical Engineering
KL (Deemed to be University)

				experiment and water hammer. **Dimensional analysis and model similitude Boundary layer theory**: Introduction, laminar and turbulent boundary layers, boundary layerthickness, displacement thickness, momentum thickness, energy thickness, boundary layer separation, methods of preventing separation. **Impact of Jets**: Introduction to impulse-momentum equation and its applications, force exerted by jet on fixed target, moving target, and series of curved vanes. **Hydraulic Machines - Turbines**: Introduction, types and classification Pelton wheel, Francis turbine, Kaplan turbine-theory, work done and efficiency, design parameters, problems. **Hydraulic Machines - Centrifugal pumps**: Definition of pump, classification, description and general principle of working; priming, work done and efficiency of a centrifugal pump, minimum starting speed, cavitation in centrifugal pumps, multi-stage pumps, problems on centrifugal pumps.	design parameters, problems. **Hydraulic Machines - Centrifugal pumps**: Definition of pump, classification, description and general principle of working; priming, work done and efficiency of a centrifugal pump, minimum starting speed, cavitation in centrifugal pumps, multi-stage pumps, problems on centrifugal pumps.			

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Annexure 4(a)

M.Tech-Robotics and mechatronics Course Structure

COURSE STRUCTURE & SYLLABUS

2020-21 admitted batch Course Structure

S. No.	Course Code	Course Title	Periods L	T	P	S	CH	CR	New Course/Revised	Recommended by
1	18 ME 5101	Fundamentals of Mechatronics	3	1	0	0	4	4	-	-
2	18 ME 5102	Advanced Engineering Mathematics	3	1	0	0	4	4	-	-
3	18 ME 5103	Sensors and Actuators	3	1	0	0	4	4	-	-
4	18 ME 5205	Robotics:Advanced Concepts and Analysis	3	1	0	0	4	4	-	-
5	18 ME 5206	Control of Mechatronic Systems	3	1	0	0	4	4	-	-
6	18 ME 5207	Mechatronics Product Design	3	1	0	0	4	4	-	-
7	18 ME 5208	Precision Engineering	3	1	0	0	4	4	-	-
8	18 ME 5104	Modelling & Simulation of Mechatronics Systems	3	0	2	0	4	4	-	-
9		Elective-1	3	0	0	0	3	3		
10		Elective-2	3	0	0	0	3	3		
11		Elective – 3	3	0	0	0	3	3		
12		Elective – 4	3	0	0	0	3	3		
13	18 IE 5250	Term Paper	0	0	4	0	4	2	-	-
14	18 IE 5149	Seminar	0	0	4	0	4	2	-	-
15	18 IE 6050	Dissertation	0	0	72	0	-	36	-	-
		Total	**18**	**3**	**6**	**0**	**26**	**4**		

ELECTIVE COURSES:

		Elective – 1	L	T	P	S	CH	Cr		
1	18 ME 51A1	Signal Processing in Mechatronic Systems	3	0	0	0	3	3	-	-
2	18 ME 51A2	MEMS and NEMS	3	0	0	0	3	3	-	-
3	20ME51A3	Robot Vision and Image Processing	3	0	0	0	3	3	New Course	BOS members
		Elective – 2								
1	18 ME 51B1	Emerging Smart Materials for Mechatronics Applications	3	0	0	0	3	3	-	-
2	20ME51B2	Control Systems for Robots	3	0	0	0	3	3	New Course	BOS members
3	18 ME 51B3	Microprocessors and Embedded Systems	3	0	0	0	3	3	-	-
		Elective – 3								
1	18 ME 52C1	Computational Fluid Dynamics	3	0	0	0	3	3	-	-
2	18 ME 52C2	Nonlinear Optimization	3	0	0	0	3	3	-	-
3	20ME52C3	Mobile Robotics	3	0	0	0	3	3	New Course	BOS members

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Elective – 4										
1	18 ME 52D1	Industrial Automation	3	0	0	0	3	3	-	-
2	18 ME 52D2	Fuzzy Sets and Artificial Intelligence	3	0	0	0	3	3	-	-
3	20ME52D3	Robot Manipulation and Grasping	3	0	0	0	3	3	New Course	BOS members

Syllabus for New M.Tech R & M courses

20ME51A3-ROBOT VISION AND IMAGE PROCESSING

L-T-P: 3-0-0 **Credits: 3** **Pre-requisite: NIL**

CO#	Course outcome	PO/PSO	BTL
CO1	Understand the importance of vision in robotics and mechatronics.	1	2
CO2	Apply Knowledge of image acquisition techniques using cameras and sensors.	2	3
CO3	Analyze the images by applying filters, enhancing quality, and reducing noise.	3	4
CO4	Analyze the image segmentation to identify relevant regions of interest	3	4

Syllabus

Introduction to Robot Vision: Role of vision in robotics and mechatronics. Image Acquisition: Techniques for capturing images using cameras and sensors. Image Preprocessing: Filtering, enhancement, and noise reduction of images. Image Segmentation: Techniques for partitioning images into meaningful regions. Feature Extraction: Identification of relevant features for object recognition and analysis. Object Detection and Tracking: Algorithms for detecting and tracking objects in images and videos. Image Registration: Methods to align multiple images for comparison or fusion. Image-Based Localization: Localization techniques using visual information. Image-Based Measurement: Measuring dimensions and other properties from images.

Textbooks:

1. "Computer Vision: Algorithms and Applications" by Richard Szeliski
2. "Robot Vision" by Berthold Klaus Paul Horn

Reference Books:

1. "Digital Image Processing" by Rafael C. Gonzalez and Richard E. Woods
2. "Computer Vision: Models, Learning, and Inference" by Simon J. D. Prince

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20ME51B2-CONTROL SYSTEM FOR ROBOTICS

L-T-P: 3-0-0 **Credits: 3** **Pre-requisite: NIL**

CO#	Course outcome	PO/PSO	BTL
CO1	Understand the control system concepts and their relevance in robotics.	1	2
CO2	Apply differential equations and transfer functions to model dynamic systems.	3	3
CO3	Apply PID and state-space techniques to designand implement feedback control	3	3
CO4	Apply the robust control methods to handle uncertainties and disturbances in robotic systems.	3	3

Syllabus

Introduction to Control Systems: Concepts and types of control systems. Modeling of Dynamic Systems: Differential equations and transfer functions. Feedback Control: PID control, stability, and transient response. State-Space Control: State-space representation and design of state feedback controllers. Robust Control: Control design for systems with uncertainties and disturbances. Nonlinear Control: Control techniques for nonlinear systems and stability analysis. Adaptive Control: Self-tuning and adaptive control algorithms. Optimal Control: Optimal control theory and application to robotics. Force and Compliance Control: Control strategies for force-sensitive robotic systems. Case Studies: Real-world examples of control systems in robotics applications.

Textbooks:

1. "Modern Control Engineering" by Katsuhiko Ogata
2. "Feedback Systems: An Introduction for Scientists and Engineers" by Karl Johan Aström and Richard M. Murray
3. "Control Systems Engineering" by Norman S. Nise

Reference Books:

1. "Automatic Control Systems" by Benjamin C. Kuo and Farid Golnaraghi
2. "Robust and Adaptive Control: With Aerospace Applications" by Eugene Lavretsky and Kevin A. Wise
3. "Feedback Control of Dynamic Systems" by Gene F. Franklin, J. David Powell, and Abbas Emami-Naeini

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PROFESSOR & HEAD
Department of Mechanical Engineering
KL (Deemed to be University)

20ME52C3-MOBILE ROBOTICS

L-T-P: 3-0-0 **Credits: 3** **Pre-requisite: NIL**

CO#	Course outcome	PO/PSO	BTL
CO1	Understand the mobile robot systems and their diverse applications.	1	2
CO2	Analyze the kinematics and dynamics of wheeled and legged mobile robots.	3	4
CO3	Apply the knowledge of localization techniques, including sensor-based and map-based methods.	2	3
CO4	Apply SLAM algorithms for simultaneous mapping and localization.	2	3

Syllabus

Introduction to Mobile Robotics: Overview of mobile robot systems and applications. Robot Locomotion: Kinematics and dynamics of wheeled and legged mobile robots. Localization Techniques: Sensor-based and map-based localization methods. Simultaneous Localization and Mapping (SLAM): Techniques for building maps while localizing the robot. Path Planning and Navigation: Algorithms for planning collision-free paths and robot navigation. Robot Exploration: Strategies for autonomous exploration and mapping of unknown environments. Multi-Robot Systems: Coordination and communication in multi-robot environments. Robot Swarms: Collective behavior and self-organization in robot swarms. Robot Autonomy: Challenges and approaches to achieving higher levels of robot autonomy. Case Studies: Examination of real-world mobile robot systems and their functionalities.

Textbooks:

1. "Introduction to Autonomous Robots: Mechanics, Sensors, Actuators, and Algorithms" by Nikolaus Correll, Bradley Hayes, et al.
2. "Probabilistic Robotics" by Sebastian Thrun, Wolfram Burgard, and Dieter Fox
3. "Robotics, Vision and Control: Fundamental Algorithms in MATLAB" by Peter Corke

Reference Books:

1. "Mobile Robotics: A Practical Introduction" by Ulrich Nehmzow
2. "Robotics: Modelling, Planning and Control" by Bruno Siciliano, Lorenzo Sciavicco, Luigi Villani, and Giuseppe Oriolo
3. "Robotics, Vision and Language: On Embodied Agents" by Cordelia Schmid and Jean Ponce

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20ME52D3-ROBOT MANIPULATION AND GRASPING

L-T-P: 3-0-0 **Credits: 3** **Pre-requisite: NIL**

CO#	Course outcome	PO/PSO	BTL
CO1	Understand the robot kinematics and inverse kinematics for manipulator motion analysis.	1	2
CO2	Apply dynamics principles to calculate forces and torques in robot manipulators	3	3
CO3	Analyze the robot motion for planning smooth trajectories.	4	
CO4	Apply Knowledge of forward and inverse dynamics to calculate robot joint torques and accelerations.	3	3

Syllabus

Robot Kinematics and Inverse Kinematics: Analysis of robot manipulator motion. Robot Dynamics: Study of forces and torques in robot manipulators. Trajectory Planning: Techniques for planning smooth robot trajectories. Forward and Inverse Dynamics: Calculation of robot joint torques and accelerations. Robot Grasping: Methods for grasp planning and analysis of grasping stability. Dexterous Manipulation: Control strategies for precision and dexterous manipulation. Object Recognition: Techniques for identifying objects and determining their properties. Haptic Feedback: Providing tactile feedback for robot manipulation tasks. Teleoperation: Control of robots from a distance for hazardous or remote tasks. Case Studies: Examination of real-world robotic manipulation systems and their applications.

Text Books

1. Introduction to Robotics: Mechanics and Control" by John J. Craig.
2. "Robot Modeling and Control" by Mark W. Spong, Seth Hutchinson, and M. Vidyasagar
3. "Robot Hands and Multi-Fingered Haptic Interfaces: Fundamentals and Applications" by Haruhisa Kawasaki and Hideo Fujimoto

Reference Books:

1. "Robotics: Modelling, Planning and Control" by Bruno Siciliano, Lorenzo Sciavicco, Luigi Villani, and Giuseppe Oriolo
2. "Robotics, Vision and Control: Fundamental Algorithms in MATLAB" by Peter Corke
3. "Robot Grippers" by Gareth J. Monkman and Martin T. H. Liu

Dr. A. SRINATH
PROFESSOR & HEAD
Department of Mechanical Engineering
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Phone No. 08645 - 350200 www.kluniversity.in
Admin Off: 29-36-38, Museum Road, Governorpet, Vijayawada - 520 002. Ph. +91 - 866 - 3500122, 2577715, 2576129

Annexure 4(b)

KLEF

Department of Mechanical Engineering

Action Taken Report on Stake Holders Feedback (A.Y.2020-21)

S.No	Type of Stake Holder	Number of feedbacks
1	Students	25
2	Parents	116
3	Alumni	05
4	Faculty	45
5	Industry personnel	03
6	Academic Peers	03
	Total	193

S.No,	Recommendations/Suggestions/Feedback	Action Taken
Students Feedback		
1.	180070207: Suggested that in mechanical design course, projects can be done by collaborating with automobile clubs so that student can be industry ready in automobile field	It is recommended to do projects in the skilling course entitled "product Design & Development in II year level rather than Machine Design course which is tutorial based course
2.	180070207: Suggested that in Kinematics and Dynamics of Machines (KDOM) course, group projects can be included in Lab sessions to get more practical knowledge and possible to publish papers and patents	As students will be overburdened to do project in every course, it is recommended to limit to single project in every semester under skilling course. Hence KDOM course is taught along with skilling course "Product Design & Development" in II year
3.	160060123: suggested to include virtual labs	It is recommended to introduce virtual labs for courses having laboratory component
4.	160070330:Suggested to include more skilling courses like one course in every semester	It is recommended to include skilling courses during next curriculum revision
5.	16070385: Suggested to introduce Python Language	It is recommended to introduce coding language during the curriculum revision
6.	160070357:Suggested to introduce new modules in ANSYS, CATIA and Fusion 360 softwares	It is recommended to introduce the new software during next curriculum revision
Alumni Feedback		
1.	Mr G.E.N.M.S Satya Sai, Employee, Wipro, gave feedback that there is gap between industry needs and current academic delivery	It is recommended to collect the feedback in detail from the said alumni in order to fit the industry needs as stated by him during curriculum revision
Parents Feedback		
1.	S.Venkateswara Rao, parent of 170070196, suggested to include in more skilling courses especially in entrepreneurship and also suggested to include social internship in the curriculum	It is recommended to include following skilling course under technical proficiency, Entrepreneurial skilling, in the Curriculum for Y20 admitted batch

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		• **Technical Proficiency-1/Entrepreneurial Incubation(0-0-0-12)** • **Technical Proficiency-2/Technopreneur ship(0-0-0-12)** • **Technical Proficiency-3/Entrepreneurial Skilling(0-0-0-12)** • **Technical Proficiency-4/Entrepreneurial Skilling(0-0-0-12)** • **Entrepreneurship Essentials (2-0-0-0)**
2.	Mr.K.Sudhakar Babu, parent of 180070170, suggested to give more practical exposure for automobile specialization courses than virtual labs	As courses are delivered in online mode, the labs were conducted in virtual mode. It is recommended to conduct physical lab sessions for such course once the offline classes commence
3.	Mr. R.Venkateswara Rao, parent of 170070169, suggested adding courses or project related to railways, keeping in view the wide scope of railway sector in India.	It is recommended to encourage the students to do projects in the area of Railway sector
Faculty Feedback		
1	Thermal group head "Dr.Y.V.Hanumantha Rao suggested to include courses **"Thermodynamics", "Fluid Mechanics and Hydraulic Machines", "Analysis of thermal systems" and Engineering in Physical world"** to strengthen the basics in the curriculum	It is recommended to include the courses said by Thermal group head in the for Y20 admitted batch students
2	Design group head Dr. S.N.Padhi, suggested to introduce course on **"3D modelling and prototyping of mechanical components"**.	It is recommended to include the course suggested by design group head.
3	Group heads Dr.Y.V.Hanumantha Rao, Dr.S.N. Padhi and Dr.G.Yedukondalu suggested to include courses on sustainability to encourage students to focus on societal problems/issues	It is recommended to introduce courses on **sustainability design & Social Innovation in Engineering, Smart Manufacturing, Autotronics, product design and Computational thinking for design**
4.	Mr.S.Ramesh Kumar, Course Coordinator of the course entitled **"Robotics and Artificial intelligence"(19ME3116)** proposed the revision in the syllabus	It is recommended to approve the changes proposed by the Course Coordinator
5	Courses related to design thinking were proposed by the group heads to enhance the design skills of students	It is recommended to introduce the following courses on design thinking • **Design Thinking and Innovation-1** • **Design Thinking and Innovation-2** • **User Centric Design Techniques**
6.	Mr.V.Shanmukh Prasad, Course Coordinator of the course entitled "Vibrations and Controls "(18ME2213) proposed the revision in the syllabus	It is recommended to approve the changes proposed by the Course Coordinator
7.	Dr.Anshuman Kumar, Course Coordinator of the course entitled "Industrial Robotics and	It is recommended to approve the changes proposed by the Course Coordinator

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	Material handling "(18ME4095) proposed the revision in the syllabus	
9.	Mr.T.Eswar Rao, Course Coordiantor of the course entitled "Micro Controllers and PLC" (18ME4096) proposed the revision in the syllabus	It is recommended to approve the changes proposed by the Course Coordinator
10.	Mr.K.Siva Kishore Babu, Course Coordinator of the course entitled "Machine Learning"(18ME4104) proposed the revision in the syllabus	It is recommended to approve the changes proposed by the Course Coordinator
11.	Mr.P.Ratna Prasad, Course Coordinator of the course entitled "principles of Industrial Engineering"(17ME40C6) proposed the revision in the syllabus	It is recommended to approve the changes proposed by the Course Coordinator
Industry persons		
1.	Mr.S.A. Sunderesan, Manager, Ashok Leyland, suggested to introduce courses related to autonomous vehicles, machine vision; embedded software programming skills.	An elective entitled " Autonomous Vehicle Design" is offered for Y20 batch. The topics related to machine vision, embedded software programming skills will be added in electives of Soft computing & data Analytics specialization
2.	Mr.S.Subramanya Sastry, Director-Projrcts. Renpoptech Solution Pvt.Ltd suggested include more mini/major projects, so that students can use more software tools in that projects and also to introduce courses on cyber physical systems,	The software tools are already mapped to all core and skilling courses, and also projects based labs. It is recommended to introduce "Industry 4.0 & Cyber physical systems" course for Y20 admitted batch
3.	Mr.K.Shahikanth, Manager, Hyundai Hyderabad division suggested to introduce courses on electric and hybrid vehicle design	It is recommended to introduce course titled "Hybrid Vehicle design" for Y219 & Y20 admitted batch
Academic Peers		
1.	Dr. Akthar Khan, Assistant professor IITDM Kurnool has suggested to include courses on Artificial Intelligence, OOPs, Python and R programming	It is recommended to introduce courses titled • **Artificial Intelligence and Data Analytics (3-0-2-0)** • **OOPs through Java (3-0-2-0)** • **R-Programming (3-0-2-0)** • **Python programming (3-0-2-0)**
2.	Dr.Ashok Kumar,Dewangan, Assistant professor NIT Delhi, suggested to include course on modelling and design of robotic system	It is recommended to introduce course titled "**Modelling Analysis & Design of Robotic systems"**
3.	Dr. Deepak Kumar Naik Assistant Professor in NIT Srinagar, suggested to include course related to industry automation and robotics.	It is recommended to introduce course titled **" Robotics and Industrial Automation"**

Dr. A. SRINATH
PROFESSOR & HEAD
Department of Mechanical Engineer
KL (Deemed to be University)
Vaddeswaram - 522 502

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Annexure 5(a)

K L E F

DEPARTMENT OF MECHANICAL ENGINEERING

PROPOSED REVISIONS BOS APPROVAL in 2020-21 ODD Sem Courses

Program: B.Tech — Year/semester of study: II-I Sem

Academic year:2020-21

Course Title: MMEA — Course Code:19PH2007

CO No	Topics to be added	Topics to be removed	Justification for the proposed modifications
1.			
2.			
3.		**Semiconducting Materials**	This topic will again come in III rd year for the same Batch.
4.			
5.			

Existing COs / Syllabus / Experiments	Proposed COs / Syllabus / Experiments
Crystallography: Potential energy vs Inter atomic distance, difference between crystalline and amorphous materials, basic definitions, seven crystal system, bravais lattice, Inter planar spacing and problems, production and characteristics of X-rays, Bragg's law and problems, different XRD Techniques -transmission and back reflection methods using by Laue XRD technique, rotating crystal method. calculation of lattice parameters by Powder XRD method, **Heat treatments:** Constitutions of alloys, cooling curves: pure metal, solid solution, electric system electric alloy. Phase diagrams and classifications, Iron Carbon Cycle, Introduction of heat treatments, definitions and Steps involved in Heat treatments and its significance, *conventional heat treatments:* annealing, normalizing, hardening, tempering. *Special heat treatments:* superfast heat treatments -	**CO-1** Introduction to Engineering materials(brief explanation about all engg. Materials) Crystallography,terms related to crystallography,crystalline and noncrystalline solids Crystal systems and Bravi's lattices Characteristics of unitcell (no. of atoms, density of packing, coordination No.) Crystal Defects (Point, Edge, screw dislocation and Surface type) Material testing methods: Destructive and Non Destructive types(dye, magnetic) Non Destructive types(Ultrasonic, Radiography and eddy current test) **CO-2**

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flame hardening and induction hardening, case hardening methods - carburizing, nitriding, cyaniding, and carbonitriding.

Smart Materials: Introduction, shape memory effect, classification of shape memory alloys, compositions, properties applications of shape memory alloys.

Semiconducting Materials: Classification of semiconducting materials, bond and energy band diagrams for intrinsic and extrinsic semiconductors, role of temperature and doping effect on conductivity, influence of temperature on mobility, factors effecting on carrier concentration, conductivity mechanism, applications.

Ceramics: Introduction, classification, electrical and thermal conductivity, abrasive and refractory materials, applications.

Ferrous Materials:Introduction to steels and their classification, properties and uses

Ferrous Materials:Introduction to Cast iron and their types, properties and uses

Ceramics: Introduction, classification,applications, advantages and disadvantages

Ceramics: Glasses, abrasives, refractories

Composites: Introduction, properties of matrix and dispersed phases, applications

& Composites: Classification, advantages and disadvantages

Nanomaterials: Introduction, properties, applications, classification

CO-3

Constitution of Alloys: Terms related, necessity of alloying

Solid solution types and conditions to be satisified (Hume Rothery rules)

Gibb's phase rule and Cooling Curve(pure metal, solid solution alloy)

Gibb's phase rule and Cooling Curve(eutectic type and off eutectic type)

Phase Diagrams: Inroduction, classification based on components

Phase Diagrams: classification based on transformations, Reations

Phase Diagrams: Construction methods, Fe-c type, Cu-Ni, Al-Cu

CO-4

Strengthening mechanisms: Introduction, classification

Heat Treatment of steels: Introduction, stages, classification

Heat Treatment of steels: Annealing and its types, Normalising, Tempering & its types

Heat Treatment of steels: TTT diagram, CCT diagram

Heat Treatment of steels: Hardening, Hardenabilitytest, Martempering,Austempering

Special heat Treatment of steels: Introduction, Surface hardening methods

Special heat Treatment of steels: Case hardening methods(carburising,nitriding etc.)

Dr. A. SRINATH
PROFESSOR & HEAD
Department of Mechanical Engineering
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Annexure 5(b)

K L E F
DEPARTMENT OF MECHANICAL ENGINEERING
PROPOSED REVISIONS for BOS APPROVAL

Program: B.Tech
Course Title: Geometric Dimensioning and Tolerancing (GD&T)
Course Code: 17ME4066
Year: IV

Existing Syllabus/COs	Proposed Syllabus/COs	Topics or COs added/removed/modified	Justification for the modifications
Introduction: Applications and advantages of GD&T, fundamental drawing rules, dimensions and tolerances, limits & fits. Maximum Material Condition (MMC), Least Material Condition (LMC) and Regardless of Feature Size: The feature control frame, general rules of GD&T. Use of MMC, LMC, RFS, Virtual condition (VC) and Resultant condition (RC), components of feature control frame Geometric characteristic symbols, External feature, Internal feature, Taylor Principle. Rules, concepts, Characteristics, and Untoleranced Dimensions, Individual or related datum, material condition, The Maximum Material Condition symbol and its Ramifications, Relationship between Individual Features. A Logical Approach to part Tolerancing: Refining functional Geometric Control to be more cost effective, Implying manufacturing sequence on complex part configurations. Dimensioning and Tolerancing Schemes: Common tolerancing methods, Design, Inspection, Production and prototype needs and capabilities regarding Dimensioning and tolerancing Methods. Steps for the Development of a Dimensional Inspection Plan: Dimensional Inspection Plan format, Plan development, Choosing Gauge. Paper gaging, Composite Positional Controls, paper gaging with Datum Feature size, Functional Gage design, Tolerance on work, Push pin gages.	Introduction: Applications and advantages of GD&T, fundamental drawing rules, dimensions and tolerances, limits & fits. Maximum Material Condition (MMC), Least Material Condition (LMC) and Regardless of Feature Size: The feature control frame, general rules of GD&T. Use of MMC, LMC, RFS, Virtual condition (VC) and Resultant condition (RC), components of feature control frame Geometric characteristic symbols, External feature, Internal feature, Taylor Principle. Datums, Form Controls, Orientation Controls, Untoleranced Dimensions, Individual or related datum, material condition, The Maximum Material Condition symbol and its Ramifications. Location Controls, Runout Controls, Profile Controls, Dimensioning and Tolerancing Schemes: Common tolerancing methods, Design, Inspection, Production and prototype needs and capabilities regarding Dimensioning and tolerancing Methods. Steps for the Development of a Dimensional Inspection Plan: Dimensional Inspection Plan format, Plan development, Choosing Gauge. Paper gaging, Composite Positional Controls, paper gaging with Datum Feature size, Functional Gage design, Tolerance on work, Push pin gages,	Added Topics: Orientation Controls, Location Controls, Runout Controls, Profile Controls, Datums Removed Topics: A Logical Approach to part Tolerancing: Refining functional Geometric Control to be more cost effective, Implying manufacturing sequence on complex part configurations.	Knowledge on controls and Datums is must for GD&T Engineer. Added these topics in detail. Sessions will not be sufficient to deal part tolerancing topic.

Dr. A. SRINATH
PROFESSOR & HEAD
Department of Mechanical Engineering
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Annexure-5(c)

K L E F

DEPARTMENT OF MECHANICAL ENGINEERING

PROPOSED REVISIONS for BOS APPROVAL

Program: **B.Tech**

Course Title: **PROGRAMMING SKILLS**

Course Code: **18ME4101**

Year: **III / IV**

Existing Syllabus/COs	Proposed Syllabus/COs	Topics or COs added/removed/modified	Justification for the modifications
Basic model of computation, Notion of Algorithms, Principle of Mathematical Induction. Basics of functional programming, notion of types. Correctness and efficiency issues in programming, time and space measures. Iterative versus recursive style. Basics of imperative style programming. Assertions and loop invariants. Top down design and examples of step-wise refinement. Programming using structures, introduction to encapsulation and object-oriented programming.	Basic model of computation, Notion of Algorithms, Principle of Mathematical Induction. Basics of functional programming, notion of types. Basic Java application, Variables and Types, Text Input and Output. Correctness and efficiency issues in programming, time and space measures. Iterative versus recursive style. Java Objects and Subroutines, Details of Expressions. Basics of imperative style programming. Assertions and loop invariants. Java Blocks, Loops and Branches, Algorithm Development, while and do..while, for Statement, if Statement, switch Statement. Top down design and examples of step-wise refinement. Programming using structures, introduction to encapsulation and object-oriented programming. Java Objects and Instance Methods, Constructors and Object Initialization, Inheritance and Polymorphism.	**Topics Added:** Programming in Java Environment.	The existing Syllabus of *Programming Skills* for the B.Tech, Third year I semester students is very beneficial when it is added with hands on practice. So, I would like to propose the Proposed Syllabus for the Third-Year I semester students, to introduce knowledge of Java technology in programming.

Dr. A. SRINATH
PROFESSOR & HEAD
Department of Mechanical Engineering
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Annexure-5(d)

K L E F

DEPARTMENT OF MECHANICAL ENGINEERING

PROPOSED REVISIONS for BOS APPROVAL

Program: B.Tech

Course Title: Artificial Intelligence for Robotics

Course Code: 18ME4091

Year: III[rd] B.Tech

Existing Syllabus/COs	Proposed Syllabus/COs	Topics or COs added/removed/modified	Justification for the modifications
Introduction, Problem Solving, Planning, Reasoning, Learning, AI in Robotics. **Syllabus:** **Introduction:** History, state of the art, Need for AI in Robotics. Thinking and acting humanly, intelligent agents, structure of agents. **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 – Partial order planning – Planning graphs– Planning with propositional logic – Planning and acting in real world. **Reasoning:** Uncertainty – Probabilistic reasoning– Filtering and prediction– Hidden Markov models– Kalman filters–Dynamic Bayesian Networks, Speech recognition, making decisions. **Learning:** Forms of learning – Knowledge in learning – Statistical learning methods –	**Introduction, Problem Solving, Planning, AI in Robotics.** **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 - Uninformed 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 – 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 **Lab Experiments:**	**Reasoning:** Uncertainty – Probabilistic reasoning– Filtering and prediction– Hidden Markov models– Kalman filters–Dynamic Bayesian Networks, Speech recognition, making decisions. **Learning:** Forms of learning – Knowledge in learning – Statistical learning methods – reinforcement learning, communication, perceiving and acting, Probabilistic language processing, perception. **Lab Experiments:** 1. Introduction about the lab and dividing the students into batches 2. (a)Write a python program to print the multiplication table for the given number? (b). Write a python program to check whether the given number is prime or not? (c) Write a python program to find	These topics were highly advanced and has the prerequisite knowledge in Statistics, Algorithms and Machine Learning, Computer vision and Deep Learning. Designed Experiments are in Python Language which is relevant rather than prolog.

Dr. A. [illegible]
PROFESSOR & HEAD
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reinforcement learning, communication, perceiving and acting, Probabilistic language processing, perception.

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

Lab Experiments:

1. Write a program in prolog to implement simple facts and Queries.
2. Write a program in prolog to implement simple arithmetic.
3. Write a program in prolog using Depth First Search.
4. Write a program in prolog using Best First Search.
5. Write a program in prolog for handling the list and its operations.
6. Write a program in prolog to solve Monkey banana problem.
7. Write a program in prolog to solve Tower of Hanoi.
8. Write a program in prolog to solve 8 Puzzle problems using Best first Search.
9. Write a program in prolog to solve 4-Queens problem.
10. Write a program in prolog to solve Travelling salesman problem.
11. Write a program for Robot (Traversal) using Mean End Analysis.
12. Write a program in prolog for Water jug problem.

1. Introduction about the lab and dividing the students into batches
2. (a)Write a python program to print the multiplication table for the given number?
   (b). Write a python program to check whether the given number is prime or not?
   (c) Write a python program to find factorial of the given number?
3. Write a python program to implement simple Chatbot
4. (a) Write a python program to implement List operations (Nested List, Length, Concatenation, Membership, Iteration, Indexing and Slicing)?
   (b) Write a python program to implement List methods (Add, Append, Extend & Delete).
5. (a). Write a python program to Illustrate Different Set Operations?
   (b). Write a python program to generate Calendar for the given month and year?
   (c). Write a python program to implement Simple Calculator program?
6. (a). Write a python program to Add Two Matrices.
   (b). Write a python program to Transpose a Matrix.
7. Write a python program to implement Breadth First Search Traversal
8. Write a python program to implement Water Jug Problem
9. Write a python program to remove punctuations from the given string
10. Write a python program to sort the sentence in alphabetical order

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2. (a)Write a python program to print the multiplication table for the given number?
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Annexure-6

Energy and CFD Group Meeting Minutes

Date: 05-06-2020

Members Present:

1. Dr K. Rama Krishna
2. Dr Y. V. Hanumantha Rao
3. Dr K. V. Narasimha Rao
4. Dr T. Anup Kumar
5. Dr P. Issac Prasad
6. Dr S. Sudhakar Babu
7. Dr N. Rajesh
8. Dr Atul Bhattad
9. Mr K. M. V. Ravi Teja
10. Mr J. Naveen

The Energy and CFD research group faculty assembled in Room No C-203 on 5th June, 2020 from 12 Noon to 1:30 PM for having a detailed discussion on planning of the delivery components of courses, which are being offered in odd semester of AY 2020-2021, to ensure the students achieve course outcomes.
The following are the changes proposed in the curriculum to ensure the students becoming strong in this particular domain and as a result achieve good number of placements in thermal related companies and to file patents:

1. Problem Solving Techniques in Thermal Engg (PSTT) is being offered with an L-T-P-S structure of 0-0-0-6. This subject has the potential of making the students to file patents and also publishing few research articles. In addition, a thorough practice of real time problems enables them to face the MNC Interviews with ease. Hence, we recommend for increase in L-T-P-S from the existing 0-0-0-6 to 0-0-0-8 from the next semester. Further, this course necessitates the thorough understanding and applied knowledge of thermodynamics including combustion analysis, FM&HM, heat transfer, etc. Hence, we propose that this subject should be offered to the Mechanical Engineering branch Students preferably in sixth semester (III – II) only.
2. The Department has taken a decision couple of years ago to combine Basic Thermodynamics and FM & HM Courses in to TFE-I and TFE-II. These subjects are being offered in third (TFE-I) and fourth (TFE-II) semesters. We feel that the students are not able to grasp the rudiments of either Thermodynamics or FM & HM.
Even the contact hours have been reduced for these courses making us to reduce the syllabus.
In view of the above reasons, we STROGLY recommend offering Thermodynamics (2- 1-2-0), FM & HM (2-1-2-0) in third semester and Applied Thermodynamics (3-1-2-0) in fourth semester.
3. Heat Transfer should be offered with an L-T-P-S Structure of (3-1-2-2), the additional hours requested will help the students become familiar with fundamentals of thermal design equipment and necessary software tools, which is the need of the hour.
4. In the proposed scenario, there will be FOUR thermal related courses, all of Lecturing-Tutorial type as against THREE courses, which are offered presently. PSTT is going to remain as it is with a little more thrust.
5. Further, the following Elective subjects shall be offered to make the interested students learn the thermal sciences to the full extent:
   i. Turbo-Machinery
   ii. Refrigeration & Air-conditioning
   iii. Energy Conservation in HVAC
   iv. Renewable Energy Technology

Conclusion:

The syllabus pertaining to above courses takes care of GATE/UPSC/Other competitive exams and is expected to provide necessary inputs to get placed in Thermal related companies.

(Group Head)

Dr. A. SRINATH
PROFESSOR & HEAD
Department of Mechanical Engineering
KL (Deemed to be University)
Vaddeswaram - 522 502

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Annexure- 7: List of 2020-21 Odd Semester Courses identified in COURSERA

The coursera courses are equivalent to only theory part of the course and doing lab as per department time table is mandatory.

Hence, cummulative of both theory & lab will lead to completion of the course and attainment of concerned credits

IV / IV B.Tech (Y17 CRT Batch)						
S. No	Course Code	Course Title	Category	Credits	Equivalent Coursera Titles	Coursera Link
1	17AC1003	Environment and sustainability	Audit	Nil	Introduction to Sustainability	https://www.coursera.org/learn/sustainability
2	17AC1004	Gender Sensitization	Audit	Nil	Gender and Sexuality: Diversity and Inclusion in the Workplace	https://www.coursera.org/learn/gender-sexuality
3	17MB4057	Economics for Engineers	HSS	2	Time Value of Money	https://www.coursera.org/learn/time-value-of-money?
4	17ME4084	Instrumentation in Automotive Industries	Prof. Elective - 4 (Autotronics)	3	Pressure, Force, Motion, and Humidity Sensors	https://www.coursera.org/learn/pressure-force-motion-humidity-sensors
5	17ME4085	Autotronics and Vehicle Intelligence	Prof. Elective - 5 (Autotronics)	3	Introduction to Self-Driving Cars	https://www.coursera.org/learn/intro-self-driving-cars?

Dr. A. SRINATH
PROFESSOR & HEAD
Department of Mechanical Engineering
KL (Deemed to be University)
Vaddeswaram - 522 502

Annexure-8

Syllabus of Value Added/Certificate Courses

DEPARTMENT OF MECHANICAL ENGINEERING

Certificate Course Syllabus for the A.Y 2020-21

Course Title : AutoCAD	**Course Code :** 18CC3001, 19CC3001, 20CC0006, 21CC0006
Category : Employability	**Level-1:** for Y18, Y19, Y20,Y21 Batch of Students
Mode : Offline Teaching and CC Exam on Online	**Duration :40 Hrs** (4 Hrs/Week x 10 Week)
Source: Certified and Trained Faculty from Department	
CC Outcome: Registered students will learn about all the tool bars in AutoCAD package and able to draw Orthogonal, Sectional and Isometric Views of Machine Components as per the given dimensions.	
Title of Global Certificate : Autodesk Certified User - AutoCAD	

SYLLABUS

S.No	Topic	Course Content	Duration in Hrs
1	**Basic Drawing Skills**	User Coordinate System, Create Selection Sets, Use Dynamic Input, Direct distance	4
2	**Draw Objects**	Draw Lines, Rectangles, Circles, Arcs, Poly lines and Polygons	4
3	**Draw with Accuracy**	Working with Grid and Snap, Use object-snap tracking, Use Coordinate Systems	4
4	**Modify Objects**	Move and Copy objects, Rotate, Scale objects, Create and Use Array, Trim and Extend Objects, Offset, Mirror objects, Chamfer and Fillet object corner	8
5	**Additional Drawing Techniques**	Draw and Edit Poly lines and apply Hatches and Gradients	8
6	**Organize Objects**	Change Object Properties, Layers, and control the Visibility	4
7	**Annotate Drawings**	Add and Modify text, Use Dimension Tool	4
8	**Layout and Printing**	Page Set, Setting Printing and Plotting options.	4
		Total Course Duration:	**40 Hrs**

Course Title : Autodesk Inventor (3D Modelling)	**Course Code :** 19CC3006, 20CC0007,21CC0007
Category : Employability	**Level-2:** for Y19,Y20, Y21 Batch of Students
Mode : Offline Teaching and CC Exam on Online	**Duration : 40 Hrs** (4 Hrs/Week x 10 Week)
Source: Certified and Trained Faculty from Department	

Dr. A. SRINATH
PROFESSOR & HEAD
Department of Mechanical Engineering
KL (Deemed to be University)
Vaddeswaram - 522 502

Koneru Lakshmaiah Education Foundation
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Accredited by NAAC as 'A++' ❖ Approved by AICTE ❖ ISO 9001-2015 Certified
Campus: Green Fields, Vaddeswaram - 522 302, Guntur District, Andhra Pradesh, INDIA
Phone No. 08645 - 350200, www.kluniversity.in
Admin Off: 29-36-38, Museum Road, Governorpet, Vijayawada - 520 002, Ph. +91 - 866 - 3500122, 2577715, 2576129.

CC Outcome: Students will learn the procedure and techniques to Model and Assemble 3D Machine components per the given dimensions, Generate orthographic views using Drawing Module.

Title of Global Certificate : Autodesk Certified User – Autodesk Inventor

SYLLABUS

S.No	Topic	Course Content	Duration in Hrs
1	USER INTERFACE AND NAVIGATION	Change the viewpoint using the View Cube, Change setting of the View Cube, Understand Inventor file types and standard templates	2
2	SKETCHING	Assign parameters Identify dimension types Share sketches Use sketch constraints Project geometry	8
3	PART MODELING	Create parts Apply fillets and chamfers, Create a pattern of features, Create a Rib Feature, Create a shell feature Create extrude features, Create hole features	10
4	ASSEMBLY MODELING	Apply basic assembly constraints (mate, flush, insert, directed angle) Ground base component of an assembly Apply an offset to constrained parts, Determine the degrees of freedom of a component Create a presentation model	10
5	DRAWING	Control sheet size and add a title block Select and place a front view Create a drawing view from an existing view Add annotation and dimensioning to a drawing Add sheets to a drawing Create a drawing view based on an assembly and presentation file Add balloons to a drawing Create and edit a parts list in a drawing	8
6	BROWSER EDITING	Reorder features Delete features	2
		Total Course Duration:	**40 Hrs**

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Course Title : Autodesk Fusion 360 (Modelling)	**Course Code :**19CC3005, 20CC0032,21CC0032
Category : Employability	**Level-3:** for Y19,Y20, Y21 Batch of Students
Mode : Offline Teaching and CC Exam on Online	**Duration : 40 Hrs** (4 Hrs/Week x 10 Week)
Source: Certified and Trained Faculty from Department	
CC Outcome: Students will learn the procedure and techniques to Model and Assemble 3D Machine components per the given dimensions, Generate orthographic views using Drawing Module.	
Title of Global Certificate : Autodesk Certified User – Autodesk Fusion 360	

SYLLABUS

S.No	Topic	Course Content	Duration in Hrs
1	**Sketching**	Sketch Creation Create Dimensions Constraint selection and creation Edit a sketch Project Edges Edit a Sketch	**5**
2	**Drawing**	Creating a Drawing View, Base, Projected, Section, Detail Add Annotations Editing a Created View Edit Border and Title block	**5**
3	**Sculpt**	Create a Form Edit a Form Thicken a Form	**3**
4	**Direct Modelling**	Feature Deletion Press & Pull Too	**3**
5	**Part Modelling**	Create extrude features Apply Fillets and Chamfers Create complex hole features Create revolve features Create a pattern of features Create a shell feature Create Construction Planes and Axes Inspect command; measure, and section analysis	**10**
6	**Advanced Modelling**	Sweep and Loft Boundary Fill Split and Combine bodies	**4**
7	**Assembly Modelling**	Create and Manage Top Level Assembly and Subassemblies Create a Component From a Body Align and Assembly Joints Interference Rigid Groups Motion Studies	**5**
8	**Practice Exercises**	Modelling and Assembly of Screw Jack, Stuffing Box, Single Lathe tools Post, Flanged Coupling	**5**
		Total Course Duration:	**40 Hrs**

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Course Title : Static and Dynamic Analysis using Altair Hyperworks	**Course Code :** 19CC3221, 20CC0034
Category : Employability	**Level-3:** for Y19 and Y20 Batch of Students
Mode : Offline Teaching and CC Exam on Online	**Duration : 40 Hrs** (4 Hrs/Week x 10 Week)
Source: Certified and Trained Faculty from Department	
CC Outcome: Students will learn the procedure and techniques to Model, Mesh, apply load and boundary conditions and Solve to generate final results and graphs.	
Title of Global Certificate : Certification from Design Tech.	

SYLLABUS

S.No	Topic	Course Content	Duration in Hrs
1	**Introduction**	Importance of Hyper works and its advantages, Various modules in Altair Hyper works, Screen components, 7 Pages on the working screen, Various Tool Bars and its usage during analysis., About the various stages to analyze the given problem, Step by Step procedure to solve any problem, Listing and Plotting the results with Example	**16**
2	**Solving the given problems using Radioss Solver**	1. RD-1000: Linear Static Analysis of a Plate with a Hole 2. RD-1010: Thermal Stress Analysis of a Coffee Pot Lid 3. RD-1020: Normal Modes Analysis of a Splash Shield 5. RD-1040: 3-D Buckling Analysis using RADIOSS 6. RD-1110: Setting up a Modal Analysis 7. RD-2000: Frequency Response Analysis of a Flat Plate 8. RD-2020:Transient Dynamic Analysis of a Bracket	**16**
3	**Topology Optimization (Optistruct Solver)**	9. OS-2000: Design Concept for a Structural C-clip 10. OS-2005: Design Concept for a Structural C-clip with Minimum Member Size Control	**4**
4	**Advanced Topics**	Topography Optimization, Size Optimization, Shape Optimization with example	**4**
		Total Course Duration:	**40 Hrs**

Course Title : Introduction to Programming using Python	**Course Code :** 19CC3217, 20CC0031, 21CC0031

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Category : Employability	**Level-2:** for Y19,Y20,Y21 Batch of Students
Mode : Offline Teaching and CC Exam on Online	**Duration : 40 Hrs** (4 Hrs/Week x 10 Week)
Source: Certified and Trained Faculty from Department	
CC Outcome: Students will be able to recognize and write syntactically correct Python code, recognize data types supported by Python, and be able to recognize and write Python code that will logically solve a given problem statement.	
Title of Global Certificate : Microsoft Technology Associate-Python	

SYLLABUS

S.No	Topic	Course Content	Duration in Hrs
1	Evaluate an expression to identify the data type Python will assign to each variable.	Data types include str, int, float, and bool	5
2	Convert between and work with data types.	Type casting; constructing data structures; indexing and slicing operations	5
3	Determine the sequence of execution based on operator precedence. Select the appropriate operator to achieve the intended result.	Assignment; Comparison; Logical; Arithmetic; Identity (is); Containment (in)	5
4	Construct and analyze code segments that use branching statements	if; elif; else; nested and compound conditionals	5
5	Construct and analyze code segments that perform iteration	while; for; break; continue; pass; nested loops and loops that include compound conditionals	5
6	Construct and analyze code segments that perform file input and output operations.	open; close; read; write; append; check existence; delete; with statement	4
7	Construct and analyze code segments that include function definitions.	Call signatures; default values; return; def; pass Syntax errors; logic errors; runtime errors	5
8	Solve complex computing problems by using built-in modules.	math; date time; io; sys; os; os.path; random	6
		Total Course Duration:	**40 Hrs**

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