DAV UNIVERSITY

Empowering Students with 21st century Skills

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DAV UNIVERSITY

ACADEMIC REGULATIONS

COURSE STRUCTURE

AND

DETAILED SYLLABUS

FOR

B. TECH
Mechanical Engineering

(Batch: 2025-26)

www.davunivesity.org

1. About the University:

DAV University stands as a pioneer in contemporary education in India, emphasizing 21st-century skills crucial for success in today's competitive landscape. The campus, marked by modern infrastructure and verdant spaces, serves as an inspiring backdrop for academic pursuits, cooperative experiences, and extracurricular activities.

Our curriculum spans engineering, business, sciences, humanities, and social sciences, strategically designed to foster critical thinking, creativity, and adaptability among students. The forward-thinking faculty prioritizes skill development, problem-solving, communication, and collaboration, aiming to prepare graduates for the challenges of the modern world.

DAV network covers 900+ campuses spread over 21 states of India, with nearly 2 million students being trained yearly.

2. About the Department of Academic Affairs:

The Department of Academics Affairs, DAV University works for the continuous improvement of the quality of academic activities of the university. The department is comprised of experienced faculty members and staff contributing from different functional domains and specializations. The department strongly believes that quality in education could only be envisaged with stronger cohesion between the different stakeholders of an academic body. This can only be achieved with an appropriate blend of a constructive teaching pedagogy with the student learning process. The department regularly monitors the quality of teaching-learning process in the university and works to provide necessary solutions as and when desired.

3. Vision:

To ardently seek, consider and implement latest nuances, developments and innovations in Sciences, Languages, Engineering and Technology, Business Studies and Computer Sciences in order to ensure that students develop a holistic acumen for making strategic and judicious decisions in the local and global spectra.

To harness and transform natural, human and technological resources to ensure sustainable development, so that they enhance, enrich and bequest human life with imagination, skills and vision. Thereby, they become instrumental in the integral development of society and mankind.

4. Mission:

To facilitate our stakeholders to have a broad, encompassing access to knowledge & education and to assist individuals unravel deeper dimensions of learning & experimentation.
To enable students become imaginative, integrated beings who constructively and creatively contribute to environment and society and who play a vital role in the advancement of learning and understanding.

5. Goals:

We envision the creation of excellent human resource through the integration of multi-dimensional Personality Development Programme with the university curriculum in order to produce world-class professionals.

Our four main educational goals are:
- Humanized education (to educate an individual to be an intellectual with strong moral character);
- Socialized education (to educate an individual who can willingly serve the community);
- Specialized education (to foster creativity, well balanced with practicality);
- Globalized education (a forward-looking, global-minded individual);

6. Core Values:

- Competence
- Integrity
- Creativity
- Innovation
- Trust
- Excellence
- Community

7. Objectives:

- To provide an academically ambient environment for its stakeholders.
- To develop scientifically superior, socially awake, and responsible citizens.
- To generate industry-oriented competent manpower to meet the needs of globalization.
- To provide state-of-the-art equipment for R&D facilities in the university.
- To provide effective linkage between industry and university for sponsored research and consultancy.
- To ensure regular up-gradation of knowledge and skills of the faculty.
- To attain National and International accreditations.
- To develop centres of excellence in the emerging areas of science and technology.
- Merging of knowledge with the spirit of good ethics, values and Vedic teachings.

8. Eligibility for Admission:

Student must have successfully completed the 10+2 examination with physics and Mathematics as compulsory subjects: Additionally, they should have studies one of the following subjects: Chemistry, Biotechnology, Biology, or Technical Vocational subjects. The applications must have obtained a minimum of 45% marks (40% marks for SC/ST applicants) in aggregate.

The medium of instruction for the entire UG Degree Programme shall be English only.

9. Programme Structure:

The B.Tech. Degree Programmes at DAV University is of 4 Academic Years (8 semesters), with each academic year divided into two semesters of 90 working days in each semester.

10. Choice Based Credit System (CBCS):

The DAV University is followed Choice Based Credit System. All the courses are to be registered by a student in a semester to earn Credits. Credit shall be assigned to each course in a L: T: P (Lecture: Tutorial: Practical).

One Credit- for one hour/week/Semester for Theory/Lecture (L) course and Tutorials
One Credit- for two hour/week/Semester for Laboratory/Practical (P)

Each student shall Register for and secure the specified number of Credits (160 Credits) require for the completion of the B.Tech. Degree in the respective Brach of Engineering.

Each Semester is structured to provide 20 Credits, totalling to **160 Credits** for the entire B.Tech. Programme.

11. Student Attendance System

- The subject teacher marks online attendance on DAVIS portal and students keep track of their attendance online by using their user ID and password.
- The students are expected to attend all scheduled lectures (theory and practical) regularly. The attendance of the students is taken by their respective teachers at the start of the lecture/ lab session. A student, who reports late for class or leaves before the class is over, is not given attendance by the teacher. All absences are counted, regardless of the reason for the absence. Further, the percentage of attendance of a student in a subject also contributes to the internal marks of that subject.
- The attendance should be recorded in progressive manner. Absent students should be marked 'X' in the student attendance register.

12. Attendance Requirements:

- A student failing to attend 75% of the scheduled lectures in Theory & Practical courses will be detained in that course and will not be allowed to appear in the University exam of that course. A student detained in the course(s) would be allowed to appear in the university exam only on having completed the attendance in the course(s), when the course(s) is offered as regular course(s).
- The University is following a semester system for all its programmes. Each semester has elements of Mid Semester Examination (MST), Written Quiz (Objective Type MCQs)/Assignment/Project Work/Seminar (evidence based) and End Semester Examination (ESE). To be eligible for appearing in the ESE (End Semester Examination) each student has to fulfil the following conditions:

    (i)   Minimum 75% attendance of the lecture delivered/classes engaged in each subject.
    (ii)   Maintained discipline and good character in the campus

(iii)   Not involved in any case of criminal nature outside the University during the period of study.

- A candidate who fails to attain 75% of attendance in any subject, he/she will not be allowed to appear in that subject. However, if the attendance is between 50% to 74.9% in a subject, he /she can complete the attendance in the next academic year, whenever, the subject is offered. He/she will be required to attend the classes to extent he/she reaches the 75% of attendance as required in the subject. He/she will not be eligible for marks reserved for attendance. Candidate will have to pay University fee and examination fee as decided by the University from time to time.

- If the attendance is between 25% to 49.9%, he/she can complete it in the next two consecutive semesters whenever it is offered in two academic years. By attending 25% in the next academic year remaining in the next-to-next academic year. Candidate has to pay fee and examination fee as decided by the University from time to time. No attendance marks shall be awarded in this case also.

- Candidate completing the shortage of attendance can appear in the ESE in the next available opportunity i.e. Supplementary/End Semester examination whichever is earlier after paying the necessary fee for this purpose.

- Where attendance is less than 24.9% the candidate or takes semester off due to unavoidable circumstances will have to repeat the semester by registering the same at the end of the programme whenever offered by paying the applicable semester fee and continuation fee.

- Under no circumstance a candidate can be allowed to register for two semesters simultaneously.

- Vice-Chancellor on the recommendation of subject teacher through HOD and Dean (Academics) may condone 1% of attendance in each subject for exceptional cases.

- A student shall be given a medical leave up to maximum of 15 days in a semester provided medical certificate submitted is from CMO/SMO/MO of a Govt. Hospital or taken from a private hospital/Nursing Home/Doctor it has to be counter signed by Civil Surgeon/CMO/SMO of a Govt. hospital or by the University authorized Doctor/University Doctor. The medical certificate submitted after one week joining the University as fit candidate shall not be entertained.

- A student shall be given duty leave up to maximum of 20 days per semester to participate in the cultural/NSS/Sports/NCC duly recommended by the Head of the activity in-charge.

- However, in exceptional cases the duty leave can go maximum up to 50 % of the lecture delivered. The exceptional cases shall be decided by a committee of experts constituted by the Vice-Chancellor. The exceptional cases should participate at National/International level.

- Candidate missing their MST due to above exigencies a special exam be conducted and if he/she misses ESE a chance in the supplementary examination/next ESE without charge of any examination fee be provided.

- Non-payment of full semester fee or hostel charges or bus/transport charges or due if any kind: In case of non-payment of semester fee or hostel charges or bus/transport charges or dues, if any by a candidate but who has fulfilled the attendance condition is permitted to appear in the final examination (ESE) but his /her result shall not be declared and will be kept withheld and his/her portal shall be blocked till the time he/she clears his/her dues and will not be eligible for promotion to next semester. Once the pending dues are cleared the result shall be declared and portal be re-opened.

13. Examination Policy/Scheme

The Examinations/Assessment will be as under:

1. **Mid Semester Examination**: Weightage 25% (Question Paper of 25 marks of 1½ hours duration). More than one paper in a day may be held.
2. **Written Quiz** (Objective Type MCQs) and **Assignment and Project Work/Seminar** (evidence based): Weightage 20% and will be completed at departmental level at least fifteen days before the start of End Semester Examinations/Practical.

   Note: *After the completion of every lecture/module the teacher is required to take a quiz based on the module taught to get an idea of the understanding/learning of the student.*
3. **End Semester Examination**: Weightage 50% (Question Paper of 50 marks of 3 hours' duration) (Appearance compulsory)
4. Attendance: 5%

   Total weightage of the course: 100%

   Pattern of Question Paper:
   1. Mid Semester Examination: One MSE per course shall be conducted in the middle of a semester having 50% of syllabus. This MSE shall be subjective type examination of 1½ hours duration with a maximum of 25 marks. The composition of MSE shall be as follows:

Section	Max Marks per question	No. of questions to be attempted	Type of question	Total Marks (25)
A	1	5	Very Short Answer Type: Each Question to be answered with in 5-8 lines. (indicative)	5
B	4	3	Short Answer Type (3 questions out of 5 questions to be attempted). Each question to be answered in maximum 2 pages (indicative)	12
C	8	1	Long Answer Type (One question out of 2 questions to be attempted). Each question to be answered in maximum 4 pages (Indicative)	8

   2. **Written Quiz** (Objective type questions i.e. MCQs) **and Assignment/Project Work/Seminar**: This has to be conducted at Departmental Level by informing the schedule date to the students well in advance. The department is free to have its own pattern and to be conducted after the conduct of the Mid Semester Examinations and

at least one week before the schedule of the End Semester Examinations/End Term Practical.

Sufficient care should be taken to set the questions out of higher order thinking skills (HOTS) for assignments and out of three assignments given to the students, one must be an open-ended assignment.

(a) **Written Quiz** (Objective Type MCQs): 10 Marks
(b) **Assignment and Project Work/Seminar** (evidence based): 10 Marks

3. **End Semester Examination**: One ESE per course will be conducted in the end of a semester. This ESE shall be subjective type examination of 3 hours' duration with a maximum of 50 marks. The composition of ESE shall be as follows:

Section	Max Marks per question	No. of questions to be attempted	Type of question	Total Marks (50)
A	1	10	Very Short Answer Type. Each Question to be answered with in 5-8 lines. (indicative)	10
B	4	6	Short Answer Type (6 Questions out of 10 questions to be attempted). Each Question to be answered in maximum 2 pages) (indicative)	24
C	8	2	Long Answer Type (2 Questions to be attempted out of 4 questions). Each question to be answered in maximum 4 pages. (indicative)	16

4. **Attendance:** 5 marks

75%	0 marks
More than 75% and less than 80%	1 marks
80% and less than 85%	2 marks
85% and less than 90%	3 marks
90% and less than 95%	4 marks
95% and above	5 marks

Note: The weightage in the End Semester Examination paper be given as under to cover whole of the syllabi of the course:

i.   25% of the ESE paper be set from the first half of the syllabi covered in the Mid Semester Examination.

ii. 75% of the ESE paper be set from the rest of the half of the syllabi taught after mid semester examination.

5.   To qualify for the grant of credits for a particular course, a candidate must get at least 40% pass marks. In case a course contains both theory and practical in a single course code, a candidate must get at least 40% pass marks in theory and practical together.

6.   In case course code of theory and practical are different then the candidate has to pass separately in both practical and theory.

7.   Candidates' appearance in End Term Examination is compulsory and should score at least pass marks separately in each paper other than the marks obtained in other components of assessment.

8.   If a student fails in a particular course by not getting minimum of 40% marks, he/she will be awarded 'R' grade in that course. In such case, a student will be allowed to re-appear as under:

i.   Reappear examination will be conducted only for those students who are unable to attain minimum passing grade 'P', i.e. 40%

ii. The Reappear Practical Examination will be conducted only for ESE for those students who are unable to attain minimum passing grade, i.e. 40% till his/her last attempt of re-appear examination.

iii. Number of attempts other than the regular one will be given to a student to qualify the course in which he/she is having reappear grade within time limit to qualify the degree i.e. +2 years.

iv. In each of the attempts, a student would be allowed to appear in re-appear examination by paying a fee of Rs. 2000/- per course or as per the University fee decided from time to time.

v.   Re-appear examination shall be conducted in every semester in the month of September/October and March/April for candidates who are unable to get grade required to pass. The Re-appear examination shall have the same template as that of ESE and the weightage shall be 100%.

vi. If a student gets re-appear in a course which contains theory as well as practical, then he/she has to re-appear in theory examination only and marks/weightage of practical examination shall be carried forwarded till he/she passes the course will be kept as it is.

vii. Maximum Duration: The maximum duration allowed to complete a course will be 2 additional years across the Programmes irrespective of the normal duration of the programme.

   The student who fails to qualify the Programme within the maximum duration allowed. The Governing Body shall be authorized to review individual hardship cases where a student fails to clear all chances available and permit to him/her a golden chance.

viii. Chances for Improvement in Marks (Scores) – The students shall also be provided along with the re-appear examination, chance for improvement in their earlier marks (scores). This would be available for all the courses. A student will have to pay an improvement fee of Rs. 4000/- per course per chance or as per the University fee

decided from time to time. This chance however will be offered along with reappear examination when that particular course is being offered. In case a student opting for improvement examination scores less marks than the previous, his/her original result will stand.

ix. In case of On Job Training/Live Project Training which ranges for a period of three months to 6 months, student shall be evaluated on the basis of report submitted by the industry/organization on the prescribed Proforma and the report submitted by the surprise team of the university visiting the industry/organization to assess the student's performance of On Job Training/Live Project Training. For the award of marks, 50% weightage of each industry and university evaluation will be considered.

9. The University has adopted 10-point scale grading system of evaluation as recommended by UGC as per details below:

Class Interval (Percentage)	Letter Grade	Grade Point
> 90 - < =100	O (Outstanding)	10
> 80- < =90	A+ (Excellent)	9
>70- < =80	A (Very Good)	8
>60- < =70	B+ (Good)	7
>50- < =60	B (Above Average)	6
>40- < =50	C (Average)	5
40	P (Pass)	4
Below 40	R (Re-appear)	0

Formula for Equivalent Percentage = 10 x CGPA

In addition, the following grading systems would be adopted as per the contingency:

Description	Letter Grade	Grade Point
Detained	F	0
Absent	Ab	0
Incomplete	I	0
UMC/Fee Default/Indiscipline Issue/Any other reason	RL	0
Satisfactory*	S	0
Unsatisfactory*	U	0

*Satisfactory grade and unsatisfactory grade will be given in the courses which have no grade point and are qualifying in nature to complete the programme as per the requirements of the statutory bodies such as ICAR, AICTE, etc.

10. To take cognizance of Unfair Means of Conduct (UMC) cases reported during various examinations, UMC Committee constituted will decide the matter to deal with such cases, the decision of the Committee shall be final.

11. To maintain transparency in the evaluation system, every student shall be given a chance to scrutinize his/her answer sheet free of cost within the notified period after the conduct of examination and declaration of result by the concerned teacher.

12. In case candidate fails to turn up for scrutiny on time it will be presumed that he/she has no objection and will lose chance to scrutinize the paper in future.

13. Controller of Examination will send a sample of question papers and a sample of evaluated answer sheets to external experts to maintain the quality in Examination process with prior permission of Dean Academics and Vice-Chancellor.

14. The medium of instructions for teaching and examination is English.

14. Earning Credits through Massive Online Open Courses (MOOC'S)

- Students can avail a facility of earning up to a maximum of 40% credits of their degree requirements through MOOC's.
- MOOC's eligible for this purpose are the courses offered by NPTEL/SWAYAM courses only
- MOOC's can be taken in respective area only in lieu of Elective courses, such as HSS Electives, Science Electives, Open electives, Departmental Electives. No core, lab or project courses can be dropped in lieu of MOOC's.
- A student desirous of opting for a MOOC's shall submit an application not later than one week prior to the scheduled normal date of semester registration to the concerned HoD/ Dean Faculty) giving the following details:

  a) Course Title, Agency offering MOOC, Examination System and Credits of the Course.

  b) Timing and duration of the course and its examination centres.

  c) Centres for conducting of examination, facilities at the centre of the examination.

  d) The course to be dropped in lieu of the MOOC, transcript and electives opted in current semester.

  e) Fee and other charges, if any, payable to MOOC providing and certification agency shall be borne by concerned student at his/her level.

  f) The student shall submit to the COE the original certificate issued by MOOC authorities along with a photocopy of the same. The original will be returned after verification and verification shall be certified by the COE on the photocopy which shall be kept in records.

  g) An equivalent Grade corresponding to grade/marks awarded by MOOC agency shall be determined by a committee consisting of Dean (Faculty) and an HoD. This equivalent Grade shall be shown in the transcript and accounted in the SGPA and CGPA calculations.

15. Mentor-Mentee System

At the start of the session, a student group consisting of 20-30 students is allotted to a faculty mentor of the respective department. Mentors then serve as thought partners for students in their academic journey and help to become autonomous learners and agents of their change. They express understanding of student's aspirations, and fears & support their success by acting as an advocate for their best interests. Mentors interact with students on a regular basis (at

least one lecture per week) to assess their academics and discuss their difficulties. Students are also counseled by their respective mentors individually to know the reasons for poor performance in Internal Assessment Tests.

16. Feedback of the Faculty by the students

The student feedback of the faculty is scheduled twice a semester (online). The students can submit their feedback through an online link shared by the department of academic affairs. Feedback from the students to strengthen the quality of teaching-learning environment and to look for opportunities to improve teacher's performance in classroom engagement to bring excellence in teaching and learning.

17. Teaching Learning Pedagogies

- **Activity-based learning:** Various indoor and outdoor activities are designed, developed, and implemented in all the departments to ensure that students become more aware of design and team processes. Various activities like Mind Mapping, Concept Map, Ball of Knowledge, etc. are conducted in the class during each semester.
- **Problem Solving Learning**: Open assignments, tutorials, crosswords, puzzles, and quizzes as per the Bloom Taxonomy levels are given to the students to enhance their learning.
- **Project-based learning:** Most of the UG and PG courses have projects/dissertation as the subject of their curriculum. The students are encouraged to work on projects using the latest technologies. Students are encouraged to take capstone projects with industry participation.

Department of Mechanical Engineering

Vision

The Mechanical Engineering Department aims to be recognized as an **outstanding educational centre** to **develop innovative engineers** who are proficient in advanced fields of engineering and technology and can **contribute effectively to the industry** as well as for socio-economic up liftment of the **society**.

Mission

M1: To impart outcome-based education with a research orientation to the students to develop them as globally competitive engineers.

M2: To imbibe the students with academic, leadership and entrepreneurship skills needed by the industry in particular and society in general.

M3: To adopt flexibility and dynamism in designing the programme structures to cope up with emerging market needs.

M4: Establishment of liaison with top R & D organizations/Industries and leading educational institutions for practical exposure of the students and faculty as well as to the state of the art.

In the **B.Tech. Mechanical Engineering** programme, students build upon their foundational knowledge of science and mathematics acquired in school to delve into various disciplines of mechanical engineering. Through a diverse range of courses, students explore topics such as materials science, solid and fluid mechanics, thermodynamics, heat transfer, control systems, product design, and manufacturing processes.

PROGRAMME EDUCATIONAL OBJECTIVES (PEO's)

PEO:1 To develop professional engineers in the field of manufacturing, design, thermal, industrial and automation engineering by imparting sciences and engineering pedagogies.

PEO:2 To nurture students towards creativity and innovation to develop out of the box thinking, respond effectively to the needs of the industry and the ever-changing world scenario.

PEO:3 To impart the highest quality education to students to build their capacity and enhance their skill to expand their reasoning, communication, and problem-solving abilities and to make them globally competitive mechanical engineers.

PEO:4 To provide students with academic environment of excellence, leadership, ethical guidelines, and lifelong learning needed for a long productive career & entrepreneurship skill.

PROGRAMME OUTCOMES (POs)

After the successful completion of undergraduate course, Mechanical Engineering, graduates will be able to:

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

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

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

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

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

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

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

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

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

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

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

PO12: Life-long learning: Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change.

PROGRAMME SPECIFIC OUTCOMES (PSO's)

PSO1: Academic Competence: Apply mechanical and interdisciplinary knowledge to analyze, design and manufacture products to address the needs of the society.

PSO2: Professional Competence: Apply state of the art tools and techniques to conceptualize, design and introduce new products, processes, systems and services.

Code	Definitions
L	Lecture
T	Tutorial
P	Practical
HS Courses	Humanities & Social Science
BS	Basic Science Courses
ES	Engineering Science Courses
PC	Program Core Courses
PE	Program Elective Courses
OE	Open Elective Courses
EEC	Employment Enhancement Courses (Project/Summer
AEC-C	Internship/Seminar)
VAC-C	Ability Enhancement Course-Common
	Value Added Course-Common

Mapping of PEO with PO

POs \ PEOs	PEO1	PEO2	PEO3	PEO4
PO1			Y	Y
PO2			Y	Y
PO3	Y		Y	Y
PO4			Y	Y
PO5	Y	Y	Y	Y
PO6	Y	Y	Y	Y
PO7	Y	Y	Y	Y
PO8			Y	Y
PO9			Y	Y
PO10				Y
PO11				Y
PO12	Y	Y	Y	Y

Mapping of PEO with PSO

PEOs \ PSOs	PSO1	PSO2
PEO1	Y	Y
PEO2	Y	Y
PEO3	Y	Y
PEO4	Y	Y

Scheme of Courses
B. Tech Mechanical Engineering
Semester-1

S.NO.	Course Code	Course Title	L	T	P	Cr	Nature of Course
1.	MAT151	Engineering Mathematics-I	3	1	0	4	BS
2.	PHS151	Engineering Physics	3	0	2	4	BS
3.	EED101	Basic Electrical Engineering	3	0	0	3	ES
4.	EED102	Electrical Engineering Laboratory	0	0	2	1	ES
5.	MED101	Engineering Graphics and Design	0	0	6	3	ES
6.	MED103	Design Thinking and Idea Lab	0	0	2	1	ES
7.	HVE101	Human Values and Ethics	2	0	0	2	VAC-C
8.	ENH111	Cambridge English-I	1	0	2	2	AEC-C
						Total=20CR	

L: Lectures   T: Tutorial   P: Practical   Cr: Credits

Scheme of Courses
B. Tech Mechanical Engineering
Semester-2

S.NO.	Course Code	Course Title	L	T	P	Cr	Nature of Course
1.	MAT152	Engineering Mathematics-II	3	1	0	4	BS
2.	CHM151	Chemistry	3	0	2	4	BS
3.	MED102	Manufacturing Practice	0	0	4	2	ES
4.	CST100	Programming for Problem Solving	3	0	0	3	PC
5.	CST102	Programming for Problem Solving Laboratory	0	0	4	2	PC
6.	EVS104	Environmental Studies	1	0	2	2	VAC-C
7.	ENH112	Cambridge English-II	1	0	2	2	AEC-C
8.	NSS103	Societal Contribution (NSS)	0	0	2	1	VAC-C
						Total=20CR	

L: Lectures   T: Tutorial   P: Practical   Cr: Credits

Scheme of Courses
B. Tech Mechanical Engineering
Semester-3

S.NO.	Course Code	Course Title	L	T	P	Cr	Nature of Course
1.	MAT256	Numerical Methods	3	0	2	4	PC
2.	MED201A	Applied Thermodynamics	3	0	2	4	PC
3.	MED202	Kinematics and Dynamics of Machines	3	0	2	4	PC
4.	MED203	Engineering Mechanics	3	1	0	4	PC
5.	MED204A	Machine Drawings	0	0	6	3	PC
6.	CEC103	Community Engagement Course	1	0	2	2	AEC-C
7.	MED200	Industrial Training	0	0	0	2	AE
							Total=23CR

L: Lectures   T: Tutorial   P: Practical   Cr: Credits

Scheme of Courses
B. Tech Mechanical Engineering
Semester-4

S.NO.	Course Code	Course Title	L	T	P	Cr	Nature of Course
1	MED251	Heat and Mass Transfer	3	0	2	4	PC
2	MED252	Fluid Mechanics & Hydraulic Machines	3	0	2	4	PC
3	MED253	Mechanics of Deformable Solids	3	0	2	4	PC
4	MED254	Engineering Materials & Applications	3	0	2	4	PC
5	MED255	Manufacturing Processes-I	3	0	2	4	PC
6	MED205	Swachh Bharat	0	0	2	1	VAC-C
							Total=21CR

L: Lectures   T: Tutorial   P: Practical   Cr: Credits

Note: At the end of the examination of 4th Semester the students will undergo compulsory industrial training for a period of 4 weeks duration in reputed industries. Every student will submit the "Training Report along with Minor Project" within two weeks from the start of teaching for 5thSemester. The marks for this will be included in the 5th Semester.

**Scheme of Courses
B. Tech Mechanical Engineering
Semester-5**

S.NO.	Course Code	Course Title	L	T	P	Cr	Nature of Course
1	MED301	Machine Element & System Design	3	1	0	4	PC
2	MED302	Mechatronics, Robotics & Control	3	0	2	4	PC
3	MED303	Manufacturing Processes-II	3	0	2	4	PC
4	MED304	Measurement & Metrology	3	0	2	4	PC
5	MEDXXX	Program Elective-I	3	0	0	3	PE
6	MED305A	Mechanical Engineering Laboratory -I	0	0	4	2	PC
7	MED300	Industrial Training	0	0	0	2	AE
						Total=23CR	

L: Lectures   T: Tutorial   P: Practical   Cr: Credits
Note:
• Program elective-I should be from the basket of "Program Elective-I."

**Scheme of Courses
B. Tech Mechanical Engineering
Semester-6**

S.NO.	Course Code	Course Title	L	T	P	Cr	Nature of Course
1.	MED351	CAD & Analysis	3	0	2	4	PC
2.	MED352	Manufacturing Automation	3	0	2	4	PC
3.	MED353	Production & Operation Management	3	1	0	4	PC
4.	MED354	Entrepreneurship Development and Management	3	1	0	4	PC
5.	MEDXXX	Program Elective-II	3	0	0	3	PE
6.	MED356	Engineering Project-I (Seminar)	0	0	4	2	EEC
						Total=21CR	

L: Lectures   T: Tutorial   P: Practical   Cr: Credits

Note:
- *Program Elective-II should be from the basket of "Program Elective-II".*
- *At the end of the examination of 6th Semester the students will undergo compulsory industrial training for a period of 6 weeks duration in reputed industries. Every student will submit the "Training Report along with Major Project" within two weeks from the start of teaching of 7th Semester. The marks for this will be included in the 7th semester.*

Scheme of Courses
B. Tech Mechanical Engineering
Semester-7

L: Lectures   T: Tutorial   P: Practical   Cr: Credits
Note:

S.NO.	Course Code	Course Title	L	T	P	Cr	Nature of Course
1.	MEDXXX	Program Elective-III	3	0	0	3	PE
2.	MEDXXX	Program Elective-IV	3	0	0	3	PE
3.	MEDXXX	Open Elective-I	3	0	0	3	OE
4.	MED400	Industrial Training	0	0	0	3	AE
5.	MED401	Seminar/Technical Report Writing	0	0	4	2	AE
6.	MED402	Mechanical Engineering Laboratory -II	0	0	4	2	PC
7.	MED403	Engineering Project-II (Design and Analysis)	0	0	10	5	EEC
							Total=21CR

- *Program elective-III should be from the basket of "Program Elective-III."*
- *Program elective-IV should be from the basket of "Program Elective-IV, Open Elective Basket and*
- *Interdisciplinary course."*
  Open elective-I should be from the "Open Elective Basket or MOOC Course."

Scheme of Courses
B. Tech Mechanical Engineering
Semester-8

L: Lectures   T: Tutorial   P: Practical   Cr: Credits

	Course Code	Course Title	L	T	P	Cr	Nature of Course
1.	MED451	Engineering Project-III (Prototyping and Testing)	0	0	16	8	EEC
2.	MEDXXX	Open Elective-II	3	0	0	3	PC
							Total=11CR

Note:
- *Student can also opt OJT (On job Training) in 8th sem.*
- *Open elective-II should be from the "Open Elective Basket or MOOC Course."*

Program Elective-I

S.NO.	Course Code	Course Title	L	T	P	Cr	Nature of Course
1.	MED311	Finite Element Method	3	0	0	3	Design
2.	MED312	Tool Design	3	0	0	3	Manufacturing
3.	MED313	Industrial Engineering	3	0	0	3	Industrial
4.	MED314	Refrigeration and Air Conditioning	3	0	0	3	Thermal
5.	MOOC Courses		3	0	0	3	

Program Elective-II

S.NO.	Course Code	Course Title	L	T	P	Cr	Nature of Course
1.	MED361	Mechanical Vibrations	3	0	0	3	Design
2.	MED362	Flexible Manufacturing System	3	0	0	3	Manufacturing
3.	MED363	Total Quality Management	3	0	0	3	Industrial
4.	MED364	Gas Dynamics	3	0	0	3	Thermal
5.	MOOC Courses		3	0	0	3	

Program Elective-III

S.NO.	Course Code	Course Title	L	T	P	Cr	Nature of Course
1.	MED411	Advanced Materials	3	0	0	3	Design
2.	MED412	Non-Destructive Testing	3	0	0	3	Manufacturing
3.	MED413	Basics of Management	3	0	0	3	Industrial
4.	MED414	Non-conventional Energy Resources	3	0	0	3	Thermal
5.	MOOC Courses		3	0	0	3	

Program Elective-IV

S.NO.	Course Code	Course Title	L	T	P	Cr	Nature of Course
1.	MED461	Mechanical Behaviour of Materials	3	0	0	3	Design
2.	MED462	Product Design and Development	3	0	0	3	Manufacturing
3.	MED463	Ergonomics and Workplace Design	3	0	0	3	Industrial
4.	MED464	Power Plant Engineering	3	0	0	3	Thermal
5.	MOOC Courses		3	0	0	3	

Note:

In addition to above program electives courses if the topics or subjects- a group of students requires to opt like- Machine drawing, IC engines, Optimization Techniques, Automobile Engineering, Maintenance and Reliability, Machine Learning, Artificial Intelligence, Python Programing, Internet of Things and Metlab programming etc can also be offered by mapping total credit.

Open Elective

S.NO.	Course Code	Course Title	L	T	P	Cr	Nature of Course
1			3	0	0	3	OE

Note:
- List of open electives provided by other departments

			B Tech ME 2025-26 Course Structure				
CBCS	Nature of Courses	Core	Elective Courses			Ability Enhancement Courses	Total Credits
Year	Course Structure	Core	Dissertation/ Project (EEC)	Open Elective /MOOC Courses	Program Elective/ MOOC Courses	Ability Enhancement Compulsory Courses	Value Added Courses	
2025	B.TECH ME	108	15	6	12	13	6	160

Core	Basic Sciences (BS) including Mathematics, Physics, Chemistry, Biology	Engineering Sciences (ES) including Materials, WS, ED, Basics of EE/ME/CSE	Discipline Core	Total Credits
83	16	10	27	136

Detailed Syllabus

	In hours		
L	**T**	**P**	**Credit**
3	1	0	4

Course Code	**MAT151**						
Course Title	**Engineering Mathematics-I**						
Course Outcomes	On the completion of the course, the student will gain the following knowledge and skills: CO1: Understand the theory of matrices used in solving the problems in mechanics and other streams. CO2: Understand the concept of partial differentiation, Euler's theorem and its extension, total derivative, maxima and minima of a function of two variables, and Lagrange's method of multipliers. CO3: Understand the concept of ordinary differential equation and their solutions (Homogeneous, differential equation, Exact differential equations). CO4: Understand the solution of differential equations with constant coefficients by method of variation of parameters and simultaneous linear differential equations.						
Examination Type	Theory						
Assessment Tools	Written Quiz	Assignment/Project Work	MSE	MSP	ESE	ESP	Attendance
Weightage	**10**	**10**	**25**	**0**	**50**		**5**
Examination Mode	Theory						
Syllabus	**Unit 1: (15hours)** Rank of matrices, Inverse of Matrices, Gauss Jordan Method, reduction to normal form, Consistency and solution of linear algebraic system of equations, Gauss Elimination Method, Eigen values and Eigen vectors, Diagonalisation of Matrix, Cayley Hamilton theorem. Orthogonal, Hermition and unitary matrices.						**CO1**
	Unit 2: (15hours) Concept of limit and continuity of a function of two variables, Partial derivatives, Homogenous Function , Euler's Theorem Total Derivative, Differentiation of an implicit function, chain rule Change of variables, Jacobian, Taylor's and McLaurin's series, Maxima and minima of a function of two and three variables: Lagrange's method of multipliers.						**CO2**
	Unit 3: (15hours) Formation of ordinary differential equations, solution of first order differential equations by separation of variables Homogeneous equations, Reduce to Homogenous Exact differential equations, equations reducible to exact form by integrating factors Equations of the first order and higher degree, clairaut's equation.						**CO3**

	Unit 4: (15hours)	CO4
	Solution of differential equations with constant coefficients Method of differential operators. Homogeneous equations of second order with constant coefficients: Solution by method of variation of parameters Simultaneously Linear differential equation	
Reference Books:	1. Grewal, B.S. Higher Engineering Mathematics. New Delhi: Khanna Publication, 2009. 2. Jain, R K, and K Iyengar S R. Advanced Engineering Mathematics, New Delhi: Narosa Publishing House, 2003.Artificial Intelligence by Rich and Knight, The McGraw Hill, 2017. 3. Kreyszig, Erwin. Advanced Engineering Mathematics. New Delhi: Wiley Eastern Ltd., 2003. **4.** Thomas, George B. and Finney Ross L. Calculus and Analytic Geometry. New Delhi Addison Wesley, 1995.	

In hours			
L	**T**	**P**	**Credit**
3	0	2	4

Course Code	**PHS151**
Course Title	**Engineering Physics**
Course Outcomes	On the completion of the course, the student will gain the following knowledge and skills: CO1: To generate Knowledge of wave optics with particular emphasize on interference, diffraction, polarization CO2: To enhance understanding LASER, its working mechanism and various types. Knowledge of fibre optics CO3: To create cognizance of superconductivity, Quantum Physics and Nanophysics CO4: To make students cover the bridge between theory and practical by analysing the obtained data.
Examination Type	Theory + Practical(30hrs)

Assessment Tools	Written Quiz	Assignment/Project Work	MSE	MSP	ESE	ESP	ATTENDANCE
Weightage	**10**		**25**	**0**	**35**	**25**	**5**
Examination Mode	Theory + Practical						

Syllabus	**Unit 1: (15hours)** **Interference:** Division of wave front, Fresnel's biprism, division of amplitude, Newton's rings and applications **Diffraction:** Difference between Fraunhofer and Fresnel diffraction, Fraunhofer diffraction through a slit, plane transmission diffraction grating, its dispersive and resolving power **Polarization:** Polarized and unpolarised light, double refraction, Nicol prism, quarter and half wave plates.	**CO1**
	Unit 2: (15hours) LASER: Spontaneous and stimulated emission, Laser action, Characteristics of laser beam, concept of coherence, He-Ne laser, Semiconductor laser, Ruby laser and applications, Holography FIBRE OPTICS: Propagation of light in fibers, numerical aperture, single mode and multimode fibers, applications	**CO2**
	Unit 3: (15hours) Difficulties with Classical physics, Introduction to quantum mechanics, Black Body radiation, Planck's Law of radiation, Photo electric effect , Wave particle duality, Heisenberg uncertainty principle, Time dependent and Time independent Schrodinger's wave equation concept of wave function. Introduction to Nano science and Nanotechnology, Electron confinement, Nanomaterial, Nanoparticles, Quantum structure, CNT, Synthesis of Nanomaterial and Application of Nanomaterial. Introduction (experimental survey), Meissner effect, Type I and	**CO3**

	type II superconductors, London equation, Elements of BCS theory, Applications of superconductors.	
	Unit 4: (15hours) **Experimental skills:** General Precautions for measurements and handling of equipment, representation of measurements, Fitting of given data to a straight line, and Error analysis, Significant figures and interpretation of results. 1. To determine wavelength of sodium light using Newton's Rings. 2. Study of Solar Cell characteristics. 3. To compare the focal length of two lenses by Nodal slide method. 4. To determine the beam divergence of the He-Ne laser. 5. To compare the two unknown capacitances of two capacitors by using De Sauty's bridge. 6. To find our out the unknown inductance by using the Anderson's bridge method. 7. To determine the Refractive Index of the Material of a given Prism using Sodium Light. 8. Determination of Plank's constant using photoelectric effect. 9. To study the capacitance by flashing/quenching of Neon bulb kit. To study the specific rotation of sugar solution Laurent's half shade Polari meter method.	CO4
Reference Books:	1. Beiser, A. Perspective of Modern Physics. New Delhi: McGraw Hill Ltd., 2002 2. Verm, N.K Physics for Engineers. New Delhi: Prentice Hall., 2014. 3. Malik,H.K and Singh, A.K. Engineering Physics. New Delhi: McGraw Hill Ltd., 2017(second edition). 4. Sear, F.W. Electricity and Magnetism. London: Addison-Wesley, 1962 5. Resnick and Halliday. Physics.New York: Wiley, 2002. 6. Jenkins, and White. Fundamental of Physical Optics. New York: Tata McGraw-Hill, 1937	

In hours			
L	**T**	**P**	**Credit**
3	0	0	3

Course Code	**EED101**
Course Title	**Basic Electrical Engineering**
Course Outcomes	On the completion of the course, the student will gain the following knowledge and skills: CO1: Apply the knowledge of Electrical Engineering principles to solve DC and AC circuits. CO2: Formulate and analyse electrical circuits. Understand basic principles of electromagnetism CO3: Understand electrical machines and transformers CO4: Identify and select various electrical machines according to the applications. CO5: Apply the ethical principles for troubleshooting & installation of safety devices as per norms.
Examination Type	Theory

Assessment Tools	Written Quiz	Assignment/Project Work	MSE	MSP	ESE	ESP	ATTENDANCE
Weightage	**10**	**10**	**25**	**0**	**50**	**0**	**5**
Examination Mode	Theory						

Syllabus	**Unit 1: (11hours)** **D.C Circuit Analysis:** Voltage source, current source, dependent and independent sources, analysis of D.C circuit by KCL and KVL, Nodal and Mesh analysis, Superposition theorem, Maximum Power Transfer Theorem, Thevenin and Norton Theorems	CO1
	Unit 2: (12hours) **A.C Circuit Analysis:** Review of single phase A.C. circuit under sinusoidal steady state, RMS Value, Average Value, Form factor, Peak factor solution of RL, RC, R.L.C. Series circuit, the j operator, complex representation of impedance, solution of series circuit, series resonance, 3 phase A.C. Circuit, star and delta connections, line and phase quantities solution of 3 phase circuits, balance supply voltage and balanced supply voltage and balance load, Phasor diagram, measurement of power and power factor.	CO2
	Unit 3: (12hours) **Magnetic Circuit & Transformers:** H Curve, saturation leakage and fringing. Hysteresis and eddy currents. Single phase transformer, basic concepts constructional, voltage, current Transformation, Ideal transformer and its Phasor diagram, voltage regulation, OC/SC test, losses and efficiency, Autotransformer.	CO3

	Unit 4: (12hours) **Rotating Electrical Machines:** Basic concepts, working principle and general construction of DC machines (motor/generators), torque and EMF expression. Generation of rotating magnetic fields, Construction and working of a three-phase induction motor, Significance of torque-slip characteristic. Loss components and efficiency, starting and speed control of induction motor. **Electrical Installations** Components of LT Switchgear: Switch Fuse Unit (SFU), MCB, ELCB, MCCB, Types of Wires and Cables, Earthing. Types of Batteries, Important Characteristics for Batteries. Various faults in Battries, Elementary calculations for energy consumption, power factor improvement and battery backup.	CO4
Reference Books:	1. M.S. Sukhija, T.K. Nagsarkar, "Basic Electrical and Electronics Engineering", Oxford University Press, 2012. 2. Ashfaq Husain, HarsoonAshfaq, "Fundamentals of Electrical Engineering, 4th Edition, Dhanpat Rai and Co., 2013 3. V.N. Mittle, "Basic Electrical Engineering", 2nd Edition, Tata McGraw Hill Publication. 4. B.L. Theraja, A.K. Theraja, "A Text Book of Electrical Technology, Volume-1, S. Chand Publication 5. Debashisha Jena, "Basic Electrical Engineering", 1st edition, Wiley India Publication, 2012. 6. B.L. Theraja, R.S. Sedha, "Principles of Electric Devices and Circuits", S. Chand Publication, 1st edition, 2006	

In hours			
L	**T**	**P**	**Credit**
0	0	2	1

Course Code	**EED102**
Course Title	**Electrical Engineering Laboratory**
Course Outcomes	CO1 Identify DC and AC circuits. CO2 Formulate and analyze electrical circuits for voltage, current and power measurements. CO3 Apply the ethical principles for troubleshooting & installation of safety devices as per norms of engineering practice. CO4 Interpret basic principles of electromagnetism to implement in electrical machines and transformers. CO5 Recognize and select various electrical machines according to the applications.
Examination Type	Practical

Assessment Tools	Lab Perform ance	Assignment/Pr oject Work	MSE	MSP	ESE	ESP	ATTENDA NCE
Weightage	**20**	**0**	**0**	**30**	**0**	**50**	**0**
Examination Mode	Practical						
1	Basic safety precautions. Introduction and use of measuring instruments digital multi meter.					CO1	
2	Demonstration of cut-out sections of machines: dc machine (commutator-brush arrangement), induction machine (squirrel cage rotor)					CO1	
3	To verify Kirchhoff's Current Law and Kirchhoff's Voltage Law.					CO2	
4	To verify Thevenin's theorem.					CO3	
5	To verify Superposition theorem.						
6	To study frequency response of a series R-L-C circuit and determine resonant frequency and Q-factor for various values of R, L and C					CO3	
7	To perform direct load test of a transformer and plot efficiency versus load characteristics.					CO4	
8	To perform open circuit on transformer					CO4	
9	To perform short circuit test on transformer.					CO4	
10	Measurement of power in a three-phase system by: one wattmeter method, two-wattmeter method and three wattmeter method					CO5	

In hours			
L	**T**	**P**	**Credit**
0	0	6	3

Course Code	**MED101**						
Course Title	**Engineering Graphics and Design**						
Course Outcomes	On the completion of the course the student will be able to: CO1: To provide the basic knowledge about Engineering Drawing, technical lettering, and dimensioning. Theory of projections for point, line and plane. CO2: Detailed concepts of orthographic and isometric projections for point, line and plane. CO3: Detailed concepts of orthographic and isometric projections for regular solids. To evaluate the sectional view of solids and developing their lateral surface CO4: To impart knowledge of layers command and building 3D objects. To impart knowledge of the CAD software and to use edit, modify and draw commands.						
Examination Mode	Practical(72hr)						
Assessment Tools	Continuous Assessment (CA)				MSE	MSP	ESE	ESP	Total
	Quiz	Assignment/ Project Work	Attendance	Lab Performance				

Assessment Tools	Continuous Assessment (CA)				MSE	MSP	ESE	ESP	Total
	Quiz	Assignment/ Project Work	Attendance	Lab Performance					
Weightage	-	-	-	20	-	30	-	50	100

Syllabus		**CO Mapping**
Unit 1	***Introduction and Theory of Projection*** ***No. of Sheets: 3***	18hr
	Engineering Graphics/Technical Drawing, Introduction to drawing equipment's and use of instruments, Conventions in drawing practice. Types of lines and their uses, BIS codes for lines, Technical lettering as per BIS codes, Introduction to dimensioning, Types, Concepts of scale drawing, Types of scales. Theory of projections, Perspective, Orthographic, System of orthographic projection: in reference to quadrants, Projection of Points, Projection in different quadrants, Projection of point on auxiliary planes. Distance between two points, Illustration through simple problems.	CO1
Unit 2	***Projections of Lines and Planes*** ***No. of Sheets: 4***	18hr
	Line Parallel to both H.P. and V.P., Parallel to one and inclined to other, Other typical cases: three view projection of straight lines, true length and angle orientation of straight line: rotation method, Trapezoidal method and auxiliary plane method, traces of line. Projection of Planes Parallel to one and perpendicular to other, Perpendicular to one and inclined to other, Inclined to both reference planes, Plane oblique to reference planes, traces of planes.	CO2
Unit 3	***Projection of Solids, Section of Solids*** ***No. of Sheets: 4***	18hr
	Projection of solids in first or third quadrant, Axis parallel to one and perpendicular to other, Axis parallel to one inclined to other, Axis inclined to both the principle plane, Axis perpendicular to profile plane and parallel to both H.P. and V.P., Visible and invisible details in the projection, Use of rotation and auxiliary plane method.	CO3

	Definition of Sectioning and its purpose, Procedure of Sectioning, Illustration through examples, Types of sectional planes-application to few examples.	
Unit 4	***Development of Surface, Isometric and Orthographic Projection*** ***No. of Sheets: 3***	18 hr
	Purpose of development, Parallel line, radial line and triangulation method, Development of prism, cylinder, cone and pyramid surface for both right angled and oblique solids, Development of surface. Classification of pictorial views, Basic Principle of Isometric projection, Difference between isometric projection and drawing, Isometric projection of solids such as cube, prism, pyramid and cylinder. Review of principle of Orthographic Projection, Examples of simple machine parts, Drawing of Block and machine parts. Introduction to CAD: Interfacing and Introduction to CAD Software, Coordinate System, 2D drafting: lines, circles, arc, polygon, etc., Dimensioning, 2-D Modelling, Use of CAD Software for engineering drawing practices.	CO4
	Total No. of Sheets: 14	
Text Books	1. P.S. Gill, "Engineering Graphics & Drafting", S.K. Kataria & Sons 2. Bhatt N.D., Panchal V.M. & Ingle P.R., (2014), Engineering Drawing, Charotar Publishing. 3. Jain, Maheshwari, Gautam (2021), Engineering Graphics & Design, Khanna Book Publishing. 4. S. Vishal "AutoCAD" Dhanpat rai publishing company.	
Reference Books	1. Shah, M.B. & Rana B.C. (2008), Engineering Drawing and Computer Graphics, Pearson. 2. Agrawal B. & Agrawal C. M. (2012), Engineering Graphics, TMH Publication. 3. M.B. Shah, B.C. Rana, "Engineering Drawing", 3rd Ed., Pearson Education, New Delhi, 2009 4. Frederick E. Giesecke, Shawna Lockhart, Marla Goodman, Cindy M. Johnson, "Technical Drawing with Engineering Graphics", 15th Ed., Prentice Hall, USA, 2016 5. (Corresponding set of) CAD Software Theory and User Manuals.	

In hours			
L	**T**	**P**	**Credit**
0	0	2	1

Course Code	MED103
Course Title	**Design Thinking and Idea Lab**
Course Outcomes	On the completion of the course the student will be able to: **CO1**: To learn all the skills associated with the tools and inventory associated with the IDEA Lab. **CO2:** Learn useful mechanical and electronic fabrication processes. **CO3**: Learn necessary skills to build useful and standalone system/ project with enclosures. **CO4**: Perceive individual differences and its impact on everyday decisions and further Create a better customer experience.
Examination Mode	Practical (24hr)

Assessment Tools	Continuous Assessment (CA)				MSE	MSP	ESE	ESP	Total
	Quiz	Assignment/ Project Work	Attendance	Lab Performance					
Weightage	-	-	-	20	-	30	-	50	100

S. No.	LIST OF EXPERIEMENTS	CO Mapping
1.	To study the working principles and operation of normal lathe machine.	CO1
2.	To study the, working and operation of different welding equipment's.	CO1
3.	To study the working principles and operation of wood lathe machine.	CO1
4.	To Study the machining of 3D geometry on soft material such as soft wood or modelling wax.	CO2
5.	To Study the 2D profile cutting on plywood /MDF (6-12 mm) for press fit designs.	CO2
6.	To Study the 3D 2D profile cutting of press fit box/casing in acrylic (3 or 6 mm thickness)/cardboard, MDF (2 mm) board using laser cutter & engraver.	CO2
7.	Scanning of computer mouse geometry surface. 3D printing of scanned geometry using FDM or SLA printer.	CO2
8.	Schematic and PCB layout design of a suitable circuit, fabrication and testing of the circuit.	CO3
9.	Embedded programming using Arduino and/or Raspberry Pi.	CO3
10.	Design and implementation of a capstone project involving embedded hardware, software and machined or 3D printed enclosure.	CO4

	Reference content for theory Syllabus	CO Mapping
Unit 1	***An Insight to Learning, Remembering Memory and Emotions: Experience & Expression***	
	Understanding the Learning Process, Kolb's Learning Styles, Assessing and Interpreting. Understanding the Memory process, Problems in retention, Memory enhancement techniques. Understanding Emotions: Experience & Expression, Assessing Empathy, Application with Peers	CO1
Unit 2	***Basics of Design Thinking***	

	Definition of Design Thinking, Need for Design Thinking, Objective of Design Thinking, Concepts & Brainstorming, Stages of Design Thinking Process (explain with examples) – Empathize, Define, Ideate, Prototype, Test. Understanding Creative thinking process, Understanding Problem Solving, Testing Creative Problem Solving. Process of Engineering Product Design, Design Thinking Approach, Stages of Product Design, Examples of best product designs and functions, Assignment – Engineering Product Design	CO2
Unit 3	***Prototyping & Testing***	
	What is Prototype? Why Prototype? Rapid Prototype Development process, Testing, Sample Example, Test Group Marketing. Understanding Individual differences & Uniqueness, Group Discussion and Activities to encourage the understanding, acceptance and appreciation of Individual differences	CO3
Unit 4	***Design Thinking & Customer Centricity***	
	Practical Examples of Customer Challenges, Use of Design Thinking to Enhance Customer Experience, Parameters of Product experience, Alignment of Customer Expectations with Product Design. Feedback loop, Focus on User Experience, Address "ergonomic challenges, User focused design, rapid prototyping & testing, final product, Final Presentation – "Solving Practical Engineering Problem through Innovative Product Design & Creative Solution".	CO4
Text Books	1. E Balaguruswamy (2022), Developing Thinking Skills (The way to Success), Khanna Book Publishing Company. 2. AICTE's Prescribed Textbook: Workshop / Manufacturing Practices (with Lab Manual), ISBN: 978-9391505332 3 Amrinder Singh, Manufacturing Practice. Mahalakshmi Publication, New Delhi.	
Reference Books	1. All-in-One Electronics Simplified, A.K. Maini; 2021. ISBN-13: 978-9386173393, Khanna Book Publishing Company, New Delhi. 2. 3D Printing & Design, Dr. Sabrie Soloman, ISBN: 978-9386173768, Khanna Book Publishing Company, New Delhi 3. The Big Book of Maker Skills: Tools & Techniques for Building Great Tech Projects. Chris Hackett. Weldon Owen; 2018. ISBN-13: 978-1681884325.	

	In hours	

L	T	P	Credit
2	1	0	3

Course Code	HVE101					
Course Title	**Human Values and Ethics**					
Course Outcomes	On the completion of the course, the student will gain the following knowledge and skills: CO1: Development of a holistic perspective based on self – exploration about themselves (human being), family, society and nature/existence. CO2: Understanding (or developing clarity) of the harmony in the human being, family, society and nature/existence CO3: Strengthening of self-reflection. CO4: Development of commitment and courage to act.					
Examination Type	Theory + Practical					
Assessment Tools	Written Quiz	Assignment/Project Work	MSE	MSP	ESE	ESP	Attendance
Weightage	**10**	**10**	**25**		**50**		**5**
Examination Mode	Theory + Practical					
Syllabus	**Unit 1:** Course Introduction - Need, Basic Guidelines, Content and Process for Value Education and Understanding Harmony in the Human Being – Harmony in Myself, Purpose and motivation for the course, recapitulation from Universal Human 1, Values -1, Self – Exploration – what is it? – its content and process; 'Natural Acceptance' and Experiential Validation – as the process for self – exploration. Continuous Happiness and Prosperity – A look at basic Human Aspirations. Right understanding, Relationship and Physical Facility – the basic requirements for fulfilment of aspirations of every human being with their correct priority. Understanding the needs of Self ('I') and 'Body' – happiness and physical facility. Understanding the characteristics and activities of 'I' and harmony in 'I'. Understanding the harmony of I with the Body: Sanyam and Health; correct appraisal of Physical needs, meaning of Prosperity in detail.					CO1
	Unit 2: (14hours) Understanding Harmony in the Family and Society – Harmony in Human – Human Relationship: Understanding values in human- human relationship; meaning of Justice (nine universal values in relationships) and program for its fulfilment to ensure mutual happiness; Trust and Respect as the foundational values of relationship. Understanding the detailed meaning of Trust and Respect: Difference between intention and competence, Understanding the meaning of Respect, Difference between respect and differentiation; the other salient values in relationship. Understanding the harmony in the society (society being an extension of					CO2

	family): Resolution, Prosperity, fearlessness (trust) and co – existence as comprehensive Human Goals.	
	Unit 3: (14hours) Understanding Harmony in the Nature and Existence – Whole existence as Coexistence Understanding the harmony in the Nature. Understanding Existence as Co – existence of mutually interacting unitsin all- pervasive space. Holistic perception of harmony at all levels of existence. Include practice sessions to discuss human being as cause of imbalance in nature (film "Home" can be used), pollution, depletion of resources and role of technology etc.	CO3
	Unit 4: (12hours) Implications of the above Holistic Understanding of Harmony on Professional Ethics Basis for Humanistic Education, Humanistic Constitution and Humanistic Universal Order Competence in professional ethics: a. Ability to utilize the professional for competence for augmenting universal human order b. Ability to identify the scope and characteristics of people friendly and eco- friendly production systems, c. Ability to identify and develop appropriate technologies and management patterns for above production systems. Case studies of typical holistic technologies, management models and production systems.	CO4
Reference Books:	1. A Nagaraj, Jeeban Vidya: Ek Parichaya. Jeevan Vidya Prakashan, Amarkantak, 1999. 2. A.N. Tripathi, Human Values. New Age Intl. Publishers, New Delhi,2004. 3. Annie Leonard, The Story of Stuff. Free Press, Mumbai, latest edition. 4. Mohandas Karamchand Gandhi, The Story of My Experiments with Truth. Fingerprint publisher, New Delhi, latest edition. 5. E. F Schumacher, Small is Beautiful. Blond & Briggs and HarperCollins, latest edition. 6. Cecile Andrews, Slow is Beautiful. New Society publishers, Canada, latest edition. 7. J C Kumarappa, Economy of Permanence. Sarva Seva Sangh Prakashan, Varanasi, latest edition. 8. Pandit Sunder Lal, Bharat Mein Angreji Raj. Prabhat Prakashan, New Delhi, latest edition. 9. Dharampal, Rediscovering India. Biblia Impex, New Delhi, latest edition. 10. Mohandas K. Gandhi, Hind, Swaraj or Indian Home Rule. The International Printing Press Phoenix, Natal, latest edition. 11. Maulana Abdul Kalam Azad, India Wins Freedom. Orient Black swan, Hyderabad, latest edition. 12. Romain Rolland, Life of Vivekananda. Advaita Ashrama, Kolkata, Latest Edition. 13. Romain Rolland, Mahatma Gandhi. Srishti Publishers & Distributors, New Delhi, Latest Edition.	

In hours			
L	T	P	Credit
1	0	2	2

Course Code	**ENH111**
Course Title	**Cambridge English I**
Course Outcomes	On the completion of the course the student will be able to CO1: Develop effective listening skills to comprehend spoken English in various contexts and accents, employing strategies such as skimming, scanning, and understanding implicit meaning. CO2: Improve spoken communication skills by expressing ideas fluently, engaging in discussions, role-plays, and collaborative tasks, and applying effective communication strategies. CO3: Enhance reading comprehension abilities to understand and interpret diverse written materials using techniques like skimming, scanning, and critical reading to extract essential information. CO4: Develop writing proficiency to produce well-structured, coherent written pieces, demonstrating accurate grammar usage, vocabulary selection, and effective organization.
Examination Mode	Theory + Practical

Assessment Tools	Written Quiz	Assignment/Project Work	MSE	MSP	ESE	ESP	Attendance
Weightage	10			20	35	30	5

Examination Mode	Theory + Practical

Syllabus		CO Mapping
Unit 1	**Chapters 1-4**	
	Listening: Introduction to Listening I Listening to people talk about their past, listening to a description of a transportation system, listening to people talk about capsule hotels, etc.	CO1
	Speaking: Basic Conversation Skills I Introducing yourself; Talking about yourself; Exchanging personal information; Talking about transportation and transportation problems; Evaluating city services; Asking for and giving information; describing positive and negative features; Making comparisons; Expressing wishes; talking about food; Giving step-by-step instructions, etc.	CO2
	Reading: Introduction to Reading Skills and Comprehension Strategies I Reading about the life of a Mexican painter, reading about the happiest cities in the world, reading about living without money, Reading about the history of pizza, etc	CO3
	Writing: Introduction to Basics of Writing I Writing a paragraph about your childhood, writing an online post on a community message board about a local issue, writing an email comparing two living spaces, etc	CO4
	Grammar: An Introduction to the Fundamentals of English Grammar I	CO4

	Past tense; *used to* for habitual actions, Expressions of quantity with count and noncount nouns: *too many*, *too much*, *fewer*, *less*, *more*, *not enough*; indirect questions from Wh-questions, Evaluations and comparisons with adjectives: *not . . . enough*, *too*, *(not) as . . . as*; evaluations and comparisons with nouns: *not enough . . . , too much/many . . . , (not) as much/many . . . as*; *wish*.	
	Self-paced practice with Online Workbook (Units 1-4)	
Unit 2	***Chapters 5-8***	
	Listening: Listening For Basic Information Listening to travel advice, Listening to the results of a survey about family life, Listening to a radio program, listening to people give suggestions for using technology, Listening to a description of Carnival in Brazil, etc.	CO1
	Speaking: Vocabulary Development for Effective Conversation Speaking about vacation plans; giving travel advice; planning a vacation, Making requests; agreeing to and refusing requests; complaining; apologizing; giving excuses, giving instructions; giving suggestions, Talking about holidays, festivals, customs, and special events, etc.	CO2
	Reading: Introduction to Reading Skills and Comprehension Strategies II Reading about unusual vacations, Reading about unusual hotel requests, Reading about sharing economy, Reading about interesting New Year's customs, etc.	CO3
	Writing: Introduction to Basics of Writing II Writing a message making a request, Writing a message asking for specific favors, and Writing an entry on a travel website about a cultural custom, etc.	CO4
	Grammar: An Introduction to the Fundamentals of English Grammar II Future with *be going to* and *will*; modals for necessity and suggestion: *must*, *need to*, *(don't) have to*, *ought to*, *-'d better*, *should (not),* Two-part verbs; *will* for responding to requests; requests with modals and *Would you mind . . . ?*, Infinitives and gerunds for uses and purposes; imperatives and infinitives for giving suggestions,	CO4
	Self-paced practice with Online Workbook (Units 5-8)	
Unit 3	***Chapters 9-12***	

	Listening: Listening for Specific Information	CO1
	Listening to people talk about changes, Listening to people talk about their job preferences, Listening to descriptions of monuments, listening for information about a country, Listening to stories about unexpected experiences, etc.	
	Speaking: Descriptive Speaking I	CO2
	Talking about change; comparing time periods; describing possible consequences; describing abilities and skills; describing personality traits; talking about landmarks and monuments; describing countries; discussing facts, Describing recent past events and experiences, etc	CO3
	Reading: Introduction to Reading Skills and Comprehension Strategies III	
	Reading about a town's attempt to attract new residents, Reading about understanding cultural differences in an international company, Reading about unusual museums, Reading about an unusual rock band, etc	CO4
	Writing: Introduction to Basics of Writing III	
	Writing a paragraph describing a person's past, present, and possible future, Writing an online cover letter for a job application, Writing an introduction to an online city guide, Writing a description of a recent experience	CO4
	Grammar: An Introduction to the Fundamentals of English Grammar III	
	Time contrasts; conditional sentences with *if* clauses, Gerunds; short responses; clauses with *because,* Passive with *by* (simple past); passive without *by* (simple present); past continuous vs. simple past; present perfect continuous.	
	Self-paced practice with Online Workbook (Units 9-12)	
Unit 4	**Chapters 13-16**	

	Listening: Listening for Sequencing Listening for opinions; listening to a movie review; listening to people talk about the meaning of signs, Listening to people talk about predicaments; listening to a call-in radio show, etc.	CO1
	Speaking: Descriptive Speaking II	CO2
	Describing movies and books; talking about actors and actresses; asking for and giving reactions and opinions, Interpreting body language; explaining gestures and meanings; Speculating about past and future events; describing a predicament; giving advice and suggestions, Reporting what people said; making polite requests; making invitations and excuses, etc.	
	Reading: Introduction to Reading Skills and Comprehension Strategies IV	CO3
	Reading about unpleasant experiences actors put themselves through, Reading about idioms and their meaning, Reading an online advice forum, Reading about taking a sick day, etc	CO4
	Writing: Introduction to Basics of Writing IV	
	Writing a movie review, Writing a report about people's responses to a survey, etc	CO4
	Grammar: An Introduction to the Fundamentals of English Grammar IV	
	Participles as adjectives; relative pronouns for people and things, Modals and adverbs: *might*, *may*, *could*, *must*, *maybe*, *perhaps*, *probably*, *definitely*; permission, obligation, and prohibition, Unreal conditional sentences with *if* clauses; past modals, Reported speech: requests and statements	
	Self-paced practice with Online Workbook (Units 13-16)	
Text Books	*Interchange Level 2 - 5th edition* published by Cambridge University Press	

In hours			
L	**T**	**P**	**Credit**
3	1	0	4

Course Code	**MAT152**						
Course Title	**Engineering Mathematics-II**						
Course Outcomes	On the completion of the course the student will be able to CO1: Understand complex numbers and its applications, summation of trigonometric series. CO2: Understand double, triple integration to use in finding areas and volumes of curves. CO3: Understand vector calculus, del, gradient, divergence, and line and surface integrals. CO4: Understand Convergence, divergence, absolute convergence, uniform convergence and different tests to check convergence.						
Examination Type	Theory						
Assessment Tools	Written Quiz	Assignment/Project Work	MSE	MSP	ESE	ESP	Attendance
Weightage	**10**	**10**	**25**	**0**	**50**	**0**	**5**
Examination Mode	Theory						
Syllabus	**Unit 1: (11 hours)** **Functions of Complex Variables** Complex Numbers and elementary functions of complex variables. De-Moivre's theorem and its applications. Real and imaginary parts of exponential, logarithmic, circular, inverse circular, hyperbolic, inverse hyperbolic functions of complex variables. Summation of trigonometric series (C+iS method).						**CO1**
	Unit 2: (13 hours) **Integral Calculus** Rectification of standard curves, Areas bounded by standard curves, Volumes and surfaces of revolution of curves. Double and triple integral and their evaluation, change of order of integration, change of variables. Application of double and triple integration to find areas and volumes. Centre of gravity and Moment of inertia.						**CO2**
	Unit 3: (13 hours) **Vector Calculus and its applications** Scalar and vector fields, differentiation of vectors, velocity and acceleration. Del, Gradient, Divergence and Curl, their physical interpretations, Line, surface and volume integrals. Flux, Solenoidal and Irrotational vectors. Gauss Divergence theorem, Green's theorem in plane, Stoke's theorem (without proofs) and their applications.						**CO3**

	Unit 4: (11 hours) **Infinite Series** Convergence and divergence of series, tests of convergence (without proofs): comparison test, Integral test, ratio test. Raabe's test, logarithmic test, Cauchy's root test and Gauss test. Convergence and absolute convergence of alternating series. Uniform Convergence and power Series.	**CO4**
Reference Books:	1. Grewal, B.S. Higher Engineering Mathematics. New Delhi: Khanna Publication, 2009. 2. Jain, R K, and K Iyengar S R. Advanced Engineering Mathematics, New Delhi: Narosa Publishing House, 2003.Artificial Intelligence by Rich and Knight, The McGraw Hill, 2017. 3. Kreyszig, Erwin. Advanced Engineering Mathematics. New Delhi: Wiley Eastern Ltd., 2003. 4. Thomas, George B. and Finney Ross L. Calculus and Analytic Geometry. New Delhi Addison Wesley, 1995.	

In hours			
L	**T**	**P**	**Credit**
3	0	2	4

Course Code	**CHM151**
Course Title	**Chemistry**
Course Outcomes	On the completion of the course the student will be able to: CO1: Students will be able to understand the basic concept of spectroscopy (IR, UV, and NMR). CO2: Familiarize with the basic properties of water and its uses in industrial and domestic purposes and understand the basic knowledge about corrosion, their classification, different mechanism and understand the various factors influencing corrosion and various methods of corrosion control. CO3: To provide the basic knowledge about the classification of polymer. Familiarize students with a complete packet of information of mechanism of polymerization, the effect of molecular weight on the properties of polymers, and understand the basic concept of polymer reinforced composites. Understand the concept of chemistry in Nano science and nanotechnology. CO4: Apply the concept of physical properties of liquids, pH and to understand the basic objectives of experiments in engineering chemistry.
Examination Type	Theory + Practical

Assessment Tools	Written Quiz	Assignment/Project Work	MSE	MSP	ESE	ESP	Attendance
Weightage	**10**		**25**	**0**	**35**	**25**	**5**
Examination Mode	Theory + Practical						

Syllabus	**Unit 1: (12 hours)** Spectroscopy and its Applications General Introduction: Introduction, electromagnetic spectrum, absorption and emission spectrum, atomic and molecular spectroscopy, types of molecular spectra, experimental techniques, selection rules, width, and intensities of spectral lines. UV/Visible Spectroscopy: types of electronic Transitions, Chromophores, Auxochromes, Effect of conjugation on Chromophores, Factors affecting λmax and intensity of spectral lines, effect of solvent on λmax, isosbestic point, applications. IR Spectroscopy: Infrared region, fundamental modes of vibrations and types, theory of infrared spectra, vibrational frequency and energy levels, modes of vibrations of polyatomic molecules, characteristic signals of IR spectrum, fingerprint region, factors affecting vibrational frequency; applications. NMR Spectroscopy: Principle and instrumentation, proton magnetic resonance spectroscopy, number of signals, Chemical shift.	**CO1**
	Unit 2: (12 hours) Water and its treatment & Corrosion and its Prevention	**CO2**

	Introduction, hardness of water, degree of hardness, units of hardness, boiler feed water: specification, scales, and sludge formation; priming& foaming, boiler corrosion. Treatment of boiler feed water, internal treatment of water; softening of water by lime-soda, zeolite, and ion exchange methods. Introduction; different types of corrosion - wet and dry corrosion; mechanism of wet corrosion; comparison of dry and wet corrosion, Types of electrochemical corrosion. Galvanic corrosion, concentration cell corrosion or differential aeration corrosion, waterline corrosion, pitting corrosion, crevice corrosion, stress corrosion, intergranular corrosion. Passivity, galvanic series, factors influencing corrosion, various methods of corrosion control.	
	Unit 3: (14 hours) Polymers and Reinforce composites Introduction, monomer and repeating unit, degree of polymerization, functionality, and classification of polymers: based on origin, monomers, structure, method of synthesis, tacticity or configuration, action of heat, chemical composition, and ultimate form. Types of polymerization, specific features of polymers, regularity and irregularity, tacticity of polymers. Average molecular weights and size, determination of molecular weight by number average methods, effect of molecular weight on the properties of polymer. Introduction to polymer reinforced composites. Introduction to Nano composites, Materials self-assembly, self-assembling materials, two dimensional assemblies, Nano scale materials, future perspectives applications, nano composites, and its applications.	**CO3**
	Unit 4: (14 hours) **Practical** Preparation of a polymer phenol/urea formaldehyde resin. Determination of surface tension of given liquid by using Stalagmometer. Determination of the viscosity of given lubricating oil by using Redwood Viscometer. Determination of the strength of HCl solution by titrating against NaOH using pH meter. Determine the strength of HCl solution by titrating against NaOH solution conductometerically. Determination of total hardness of water (tap) using standard EDTA solution and Eriochrome black T indicator. Determination of residual chlorine in a water sample. Determination of dissolved oxygen present in given sample of water. Determination of alkalinity of water.	**CO4**

| Reference Books: | 1. William Kemp, Organic Spectroscopy, Palgrave Foundations, 199
2. D. A. Skoog, F. J. Holler and A. N. Timothy, Principle of Instrumental Analysis, 5th Edition., Saunders College Publishing, Philadelphia, 1998.
3. C. P. Poole, Jr., F. J. Owens, Introduction to Nanotechnology, Wiley Interscience, 2003.
4. L.E. Foster, Nanotechnology, Science Innovation & Opportunity, Pearson Education, 2007.
5. P. Ghosh, Polymer Science, and technology (2nd Edition), Tata McGraw Hill, 2008.
6. Wiley Engineering Chemistry, Second Edition, 2013. | |

In hours			
L	T	P	Credit
0	0	4	2

Course Code	MED102							
Course Title	**Manufacturing Practice**							
Course Outcomes	On the completion of the course the student will be able to: CO1: To Know basic workshop processes, Read, and interpret job drawing. CO2: Identify, select, and use various marking, measuring, holding, striking, and cutting tools & equipment's CO3: Operate and control different machines and equipment's. CO4: To provide exposure to the students with hands on experience on various basic engineering practices in Civil, Mechanical, Electrical and Electronics Engineering.							
Examination Mode	Practical (48hr)							
Assessment Tools	Continuous Assessment (CA)				MSE	MSP	ESE	ESP	Total
	Quiz	Assignment/ Project Work	Attendance	Lab Performance					
Weightage	-	-	-	20	-	30	-	50	100
Syllabus									**CO Mapping**
Unit 1	***Carpentry Shop and Welding shop***								12hr
	Introduction, Classification of wood, Seasoning of wood, Classification of carpentry tools, Joints and joining processes, Wood working machines and processes, safety precaution, Preparation of half lap joint, Preparation of Mortise and Tenon Joint, Preparation of a Dove & Tail joint, To prepare a White board duster. Introduction, Various welding processes with brief introduction, Electric Arc welding, Arc welding procedure, List of equipment for electric arc welding, Gas welding process and equipment, Preparation of Joint by Arc Welding, Preparation of Joint by using Gas Welding, Preparation of Joint by MIG/ TIG Welding, Preparation of Joint by Spot/ Seam Welding.									CO1
Unit 2	***Fitting shop and Foundry shop***								12hr
	Introduction, Tools used in fitting, measuring and marking tools, the process of making sawing, Filling, Tapping and die, Introduction to drills, Filing a dimensioned rectangular or square piece and prepare a sq. fitting, Preparation of T fitting male part, Preparation of U fitting Female part, Internal thread Cutting in Square piece and external thread cutting on a rod and assembling as a paper weight. Introduction, Basic terminology, Pattern, Types of patterns, Patterns allowances, Tools for hand Moulding, Moulding sand and Moulding process, Crucible furnace, Operation of cupola, Foundry containers, Casting defects, Safety precautions, To make a Mould of solid pattern, To prepare a mould of sleeve fitting using gating system, To make a Mould of Split Pattern using Cope & Drag, To check the Hardness of the Mould.									CO2
Unit 3	***Sheet- Metal Shop and Machine Shop***								12hr

	Introduction, Types of sheets (ferrous/non-ferrous), Standard sheet sizes and their measurement, Tools used in sheet metal. Preparation of a funnel from G.I. sheet, Preparation of a book rack stand from G.I. Sheet, Preparation of a leak proof tray with inclined edges from G.I. Sheet, Preparation of a square pen stand from G.I. Sheet with riveting at corners. Introduction, Classification of machine tools and cutting tolls, Basic operations on lathe, Drilling, Shaper, Milling, Cutting tool material, Work-holding devices, To make a job using step turning and grooving, To make a job using knurling and threading, To make a multi operation job on a Lathe machine, To make V – slot by using shaper machine	CO3
Unit 4	***Smithy Shop and Electrical Shop***	12hr
	Introduction, Types of forging, Equipment used in the smithy shop, Smithy tools, Black smith's hearth, Hand forging operations. To Forge the L – Hook, To Forge a Chisel, To Forge a Cube from a M.S Round, To forge a screw driver. Layout of electrical tube light wiring, Layout of stair case wiring using two-way switch, Testing and rectification of simulated faults in electrical appliances such as 'Electric Iron' Ceiling Fan. Electric kettle, To fabricate a circuit for the electrical wiring of Fan with regulator and Bulb through a main switch and its testing using a series lamp	CO4
Text Books	1. Johl, K. C. Mechanical Workshop Practice. Prentice Hall India, 1st Edition, 2010. Print. 2. Bawa, H.S. Workshop Technology. New Delhi: Tata McGraw Hill, 7th Edition, 2004. Print. 3 Amrinder Singh, Manufacturing Practice. Mahalakshmi Publication, New Delhi.	
Reference Books	1. Kalpakjian S. And Steven S. Schmid, "Manufacturing Engineering and Technology", 4th edition, Pearson Education India Edition, 2002. 2. Gowri P. Hariharan and A. Suresh Babu," Manufacturing Technology – I" Pearson Education, 2008. 3. Roy A. Lindberg, "Processes and Materials of Manufacture", 4th edition, Prentice Hall India, 1998.	

	In hours			
	L	**T**	**P**	**Credit**
	3	0	0	3

Course Code	CST100
Course Title	**Programming for Problem Solving**
Course Outcomes	On the completion of the course the student will be able to CO1: Develop and translate the algorithms to programs & execution CO2: Implement conditional branching and iteration. CO3: Use arrays, strings and decompose a problem into functions CO4: Use pointers and structures to formulate algorithms and programs and to use files to perform read and write operations.
Examination Mode	Theory

Assessment Tools	Quiz	Assignment	Attendance	MSE	ESE	Total
Weightage	10	10	5	25	50	100

Syllabus		**CO Mapping**
Unit 1	**Introduction to Programming(11hours)**	
•	Introduction to Programming: Computer system, components of a computer system, computing environments, computer languages, creating and running programs, Algorithms, flowcharts. Introduction to C language: History of C, basic structure of C programs, process of compiling and running a C program, C tokens, keywords, identifiers, constants, strings, special symbols, variables, data types, I/O statements.	CO1
Unit 2	**Operators, Expressions and Control Structures(12hours)**	
•	Operators and expressions: Operators, arithmetic, relational and logical, assignment operators, increment and decrement operators, bitwise and conditional operators, special operators, operator precedence and associativity, evaluation of expressions, type conversions in expressions. Control structures: Decision statements; if and switch statement; Loop control statements: while, for and do while loops, jump statements, break, continue, goto statements.	CO2
Unit 3	**Arrays, strings and functions(12hours)**	
•	Arrays: Concepts, One dimensional array, declaration and initialization of one dimensional arrays, two dimensional arrays, initialization and accessing, multi-dimensional arrays. Functions: User defined and built-in Functions, storage classes, Parameter passing in functions, call by value, Passing arrays to functions: idea of call by reference, Recursion Strings: Arrays of characters, variable length character strings, inputting character strings, character library functions, string handling functions.	CO3
Unit 4	**Pointers, Structures and File Handling(11hours)**	
•	Pointers: Pointer basics, pointer arithmetic, pointers to pointers, generic pointers, array of pointers, functions returning pointers, Dynamic memory allocation.	CO4

	Structures and unions: Structure definition, initialization, accessing structures, nested structures, arrays of structures, structures and functions, unions, typedef, enumerations. File handling: command line arguments, File modes, basic file operations read, write and append,	
Text Books	1. Computer Concepts and Programming in C, E Balaguruswami, McGraw Hill 2. Programming for Problem Solving, R.S. Salaria, Khanna Book Publishing Co., Delhi.	
Reference Book/s	1. Problem Solving and Program Design in C, by Jeri R. Hanly, Elliot B. Koffman, Pearson 2. The C programming by Kernighan Brain W. and Ritchie Dennis M., Pearson Education. 3. Computer Science- A Structured Programming Approach Using C, by Behrouz A. Forouzan, Richard F. Gilberg, Thomson, Third Edition, Cengage Learning - 2007. 4. Let Us C By Yashwant P. Kanetkar.	

In hours			
L	**T**	**P**	**Credit**
0	0	4	2

Course Code	CST102					
Course Title	**Programming for Problem Solving Laboratory**					
Course Outcomes	On the completion of the course the student will be able to CO1: Develop and translate the algorithms to programs & execution CO2: Implement conditional branching and iteration. CO3: Use arrays, strings and decompose a problem into functions CO4: Use pointers and structures to formulate algorithms and programs and to use files to perform read and write operations.					
Examination Mode	Theory					
Assessment Tools	Quiz	Lab Performance	ATTENDANCE	MSP	ESP	Total
Weightage	-	20	-	30	50	100
Syllabus						**CO Mapping**
Unit 1	**Introduction to Programming(10hours)**					
•	WAP that accepts the marks of 5 subjects and finds the sum and percentage marks obtained by the student. WAP that calculates the Simple Interest and Compound Interest. The Principal, Amount, Rate of Interest and Time are entered through the keyboard. WAP to calculate the area and circumference of a circle. WAP that accepts the temperature in Centigrade and converts into Fahrenheit using the formula C/5=(F32)/9. WAP that swaps values of two variables using a third variable.					CO1
Unit 2	**Operators, Expressions and Control Structures(11hours)**					
•	WAP that checks whether the two numbers entered by the user are equal or not. WAP to find the greatest of three numbers. WAP that finds whether a given number is even or odd. WAP that tells whether a given year is a leap year or not. WAP that accepts marks of five subjects and finds percentage and prints grades according to the following criteria: Between 90-100--------------Print 'A' 80-90--------------------------Print 'B' 60-80--------------------------Print 'C' Below 60----------------------Print 'D' WAP that takes two operands and one operator from the user and perform the operation and prints the result by using Switch statement. WAP to print the sum of all numbers up to a given number. WAP to find the factorial of a given number. WAP to print sum of even and odd numbers from 1 to N numbers. WAP to print the Fibonacci series. WAP to check whether the entered number is prime or not. WAP to find the reverse of a number.					CO2

	WAP to print Armstrong numbers from 1 to 100.	
Unit 3	**Arrays, strings and functions(12hours)**	
•	WAP that simply takes elements of the array from the user and finds the sum of these elements. WAP to find the minimum and maximum element of the array. WAP to search an element in a array using Linear Search. WAP to add and multiply two matrices of order nxn. WAP to implement strlen (), strcat (),strcpy () using the concept of Functions.	CO3
Unit 4	**Pointers, Structures and File Handling(12hours)**	
•	WAP to implement the concept of Structures and Union WAP to swap two elements using the concept of pointers. WAP to compare the contents of two files and determine whether they are same or not. WAP to check whether a given word exists in a file or not. If yes then find the number of times it occurs.	CO4
Text Books	1. Computer Concepts and Programming in C, E Balaguruswami, McGraw Hill 2. Programming for Problem Solving, R.S. Salaria, Khanna Book Publishing Co., Delhi.	
Reference Book/s	1. Problem Solving and Program Design in C, by Jeri R. Hanly, Elliot B. Koffman, Pearson 2. The C programming by Kernighan Brain W. and Ritchie Dennis M., Pearson Education . 3. Computer Science- A Structured Programming Approach Using C, by Behrouz A. Forouzan, Richard F. Gilberg, Thomson, Third Edition , Cengage Learning - 2007. 4. Let Us C By Yashwant P. Kanetkar.	

Note: This is only the suggested list of practical. Instructor may frame additional practicals relevant to the course contents.

		In hours	
L	**T**	**P**	**Credit**
2	0	2	3

Course Code	**EVS104**
Course Title	**Environment Studies**
Course Outcomes	On the completion of the course, the student will gain the following knowledge and skills: CO1: To Understand the interconnected and interdisciplinary nature of environmental studies and develops critical thinking skills in relation to environmental affairs. Acquire knowledge about the depletion of the root cause of natural resources and their effective management. CO2: To aware about the ecosystems, biodiversity and its importance to mankind. Interpret and propose solutions to various environmental pollution, solid waste and disaster management. CO3: Expand awareness of self in a global society and effectively engage diverse perspectives, values, and cultures, ranging from local to global in dealing with environmental and social issues. Awareness about effect of population increase on humans itself. Causes of spread of different diseases in society. How Indian government is supporting women and children that considered weakest section of society. CO4: Field visits and practical applications will help the students to enhance their skills for the betterment of environment.
Examination Type	Theory + Practical

Assessment Tools	Written Quiz	Assignment/Project Work	MSE	MSP	ESE	ESP	Attendance
Weightage	**10**	**0**	**25**	**0**	**35**	**25**	**5**

Examination Mode	Theory + Practical	
Syllabus	**Unit 1: (11hours)** **Introduction to Environmental Studies, Natural Resources and Ecosystem** • The multidisciplinary nature of environmental studies • Natural Resources: Renewable and non-renewable resources. • Forest resources: Use and over-exploitation • Water resources: Over-utilization of surface and ground water • Mineral resources: Use and exploitation, environmental effects of mining • Food resources: Effects of modern agriculture on environment • Energy resources: renewable and non-renewable energy sources. • Land resources: Uses and land degradation, soil erosion • Ecosystem: Structure and function of an ecosystem. Producers, consumers and decomposers	CO1

	• Energy flow in the ecosystem, Ecological succession • Food chains, food webs, ecological pyramids	
	Unit 2: (11hours) **Biodiversity and Environmental Pollution** • Biodiversity definition. Genetic, species and ecosystem diversity. Bio-geographical classification of India. • Value of biodiversity. India as mega-diversity nation. Hot-spots of biodiversity. • Threats to biodiversity. Man wildlife conflicts. In-situ and Ex-situ conservation of biodiversity. • Environmental Pollution: Definition, causes, effects and control measures of: Air pollution, water pollution, soil pollution, marine pollution, noise pollution, thermal pollution, nuclear pollution • Solid waste management and techniques. • Disaster management: floods, earthquake, cyclone and landslides.	CO2
	Unit 3: (11hours) **Social Issues, Human Population and Environment** • Sustainable Development: From unsustainable to sustainable development. Urban problems related to energy. • Water conservation: Rain water harvesting and watershed management. Resettlement and rehabilitation of people • Environmental Issues: Climate change, global warming, acid rain, ozone depletion, nuclear accidents and holocaust. • Wasteland reclamation. Consumerism and waste products. • Environmental Laws: The Environment Protection Act, 1986; The Air Act, 1981; The Water Act, 1974; The Wildlife Protection Act, 1972; Forest Conservation Act, 1980. • Human Population and Environment: Population growth and population explosion, causes and effects • HIV/ AIDS • Women and child welfare programmes in India • Role of IT in environment and human health.	CO3
	Unit 4: (12hours) **Practical's and field study** • Visit to sewage treatment plant and rain water harvesting system • Solid waste management by vermi-composting and biogas plant • Visit to incineration plant of your area. • A visit to pond, river and lake ecosystem • Visit to different industries with respect to pollution • Testing of water parameters: Hardness, pH, Conductivity, Total dissolved solids, Total suspended solids, BOD and DO	CO4

	• Study of plants in their natural habitat
Reference Books:	1. Garg, S. K. Sewage Disposal and Air Pollution Engineering. Khanna Publishers, Delhi, 2003.
	2. Botkin, D.B. and Kodler, E.A. Environmental Studies: The Earth as a living planet. New York: John Wiley and Sons Inc., 2000.
	3. Odum, E.P. Basic Ecology. Japan: Halt Saundurs, 1983.
	4. Oliver, S. O. and Daniel, D. C. Natural Resource Conservation: Management for a Sustainable future. Prentice Hall International, New Jersey, 1990.
	5. Rai, G. D. Non-Conventional Energy Sources, Khanna Publishers, Delhi, 1993.
	6. Sharma, P. D. Ecology and Environment. Meerut Rastogi Publications, 2004.
	7. Singh, J.S., Singh, S.P. and Gupta, S. R. Ecology, Environment and Resource Conservation. New Delhi: Anamaya Publishers, 2006.
	8. Smith, R.L.Ecology and Field Biology, Harper Collins, New York, 1996.
	9. Alloway, B. J. and Ayres, D.C. Chemical Principles of Environmental Pollution. Blackie Academic and Professional, London, 1997.
	10. Chapman, J. L. and Reiss, M. J. Ecology: Principles and Applications. Cambridge University Press, UK, 1998.
	11. De, A.K. Environmental Chemistry. New Delhi: Wiley Eastern Ltd., 1990.
	12. Muller-Dombols, D. and Ellenberg, H. Aims and Methods of Vegetation Ecology, Wiley, New York, 1974.
	13. Singh, J. S. Restoration of Degraded Land: Concepts and Strategies. Rastogi Publications, Meerut, 1993.
	14. Wright, R. T. and Nebel, B. J. Environmental Science, 8th Ed. Prentice Hall India Ltd., 2004.

	In hours			
	L	**T**	**P**	**Credit**
	1	0	2	2

Course Code	**ENH112**						
Course Title	**Cambridge English-II**						
Course Outcomes	On the completion of the course the student will be able to CO1: Proficiently handle diverse communication situations, including listening to complaints, news stories, and podcasts; discussing careers and experiences; expressing emotions and cultural expectations; and writing critical online reviews. CO2: Consolidate advanced grammar and vocabulary knowledge for accurate and appropriate language usage. CO3: Utilize comprehensive audio and video resources to develop effective language comprehension and production. CO4: Effective Communication in Diverse Contexts: Demonstrate fluency, coherence, and confidence in expressing complex ideas, drawing conclusions, discussing hypothetical situations, and describing qualities for success.						
Examination Mode	Theory + Practical						
	Written Quiz	Assignment/Project Work	MSE	MSP	ESE	ESP	Attendance
Weightage	**10**	**0**	**0**	**20**	**35**	**30**	**5**
Syllabus							CO Mapping
Unit 1	**Unit 1: (10 hours)** **Listening: Advanced Listening I** Listening for descriptions of people; listening for opinions; listening to people making, accepting, and declining requests; listening to messages and a podcast.						CO1
	Speaking – Advanced Speaking I Describing personalities; expressing likes and dislikes; agreeing and disagreeing; complaining; talking about possible careers; deciding between two jobs, Making direct and indirect requests; accepting and declining requests, Narrating a story						CO1 CO1
	Writing / Reading – Advanced Reading/ Writing I Writing a description of a good friend, Reading about unusual social networking sites, Writing about two career choices, Reading about different types of workplaces, Writing a message with requests, Writing a personal account, Reading about the reliability of online content topics						CO2
	Grammar – Advanced English Grammar I Relative pronouns as subjects and objects; it clauses + adverbial clauses with when; Gerund phrases as subjects and objects; comparisons with adjectives, nouns, verbs, and past participles, Requests with modals, if clauses, and gerunds; indirect requests, Past continuous vs. simple past; past perfect;						
Unit 2	**Unit 2: (10 hours)** **Advanced Communication II** **Listening – ADVANCED LISTENING II** Listening for information about living abroad; listening to opinions about customs, Listening to complaints; listening to people exchange things in a						CO1

	store; listening to a conversation about a "throwaway culture," Listening to environmental problems; listening for solutions, Listening to a conversation with a guidance counselor; listening for additional information	
	Speaking – ADVANCED SPEAKING II	CO1
	Talking about moving abroad; expressing emotions; describing cultural expectations; giving advice; describing problems; making complaints; explaining something that needs to be done; identifying and describing problems; coming up with solutions; asking about preferences; discussing different skills to be learned	CO4
	Writing/ Reading – ADVANCED READING/ WRITING II	
	Writing a pamphlet for tourists, Reading about moving to another country, Writing a critical online review, Reading about a problem with a ride-sharing service, Writing a post on a community website, Reading about a creative solution to lionfish on St. Lucia, Writing about a skill, Reading about different studying styles	CO2
	Grammar - ADVANCED GRAMMAR II	
	Noun phrases containing relative clauses; expectations: *the custom to*, (*not*) *supposed to*, *expected to*, (*not*) *acceptable to; d*escribing problems with past participles as adjectives and with nouns; describing problems with *need* + gerund, *need* + passive infinitive, and *keep* + gerund, Passive in the present continuous and present perfect; prepositions of cause; infinitive clauses and phrases, *Would rather* and *would prefer*; *by* + gerund to describe how to do things	
Unit 3	**Unit 3: (10 hours)**	
	Listening – ADVANCED LISTENING III	
	Listening to New Year's resolutions, Listening for dates and time periods; listening to predictions, Listening to descriptions of important events; listening to regrets and explanations, Listening for features and slogans	CO1
	Speaking – ADVANCED SPEAKING II	CO2
	Talking about moving abroad; expressing emotions; describing cultural expectations; giving advice; describing problems; making complaints; explaining something that needs to be done; identifying and describing problems; coming up with solutions; asking about preferences; discussing different skills to be learned.	CO3
	Writing / Reading – ADVANCED READING/ WRITING III	
	Writing a message of advice, Reading about young scientist Jack Andraka, Writing a biography, Reading about futurists and their predictions for the year 2050, Writing a message of apology, Reading about a conflict with a friend and advice on how to fix it, Writing a TV or web commercial, Reading about what makes some advertisements memorable,	CO2
	Grammar – ADVANCED GRAMMAR III	
	Get or have something done; making suggestions with modals + verbs, gerunds, negative questions, and infinitives; referring to time in the past with adverbs and prepositions: *during*, *in*, *ago*, *from…to*, *for*, *since*; predicting the future with *will*, future continuous, and future perfect, Time clauses: *before*, *after*, *once*, *the moment*, *as soon as*, *until*, *by the time*; expressing regret with *should* (*not*) *have* + past participle; describing hypothetical situations with *if* clauses + past perfect and *would/could have* + past participle	
Unit 4	**Unit 4: (10 hours)**	
	Listening – ADVANCED LISTENING IV	

	Listening to explanations; listening for the best solution, Listening for parts of a movie, Listening for solutions to everyday annoyances; listening to issues and Opinions, Listening to past obstacles and how they were overcome, listening for people's goals for the future	CO3
		CO4
	Speaking – ADVANCED SPEAKING IV	
	Drawing conclusions, offering explanations; describing hypothetical events; giving advice for complicated situations, Describing how something is done or made; describing careers in film, TV, publishing, gaming, and music, Giving opinions for and against controversial topics; offering a different opinion; agreeing and disagreeing, Giving opinions about inspirational sayings; talking about the past and the future.	CO3
	Writing/ Reading – ADVANCED READING/ WRITING II	
	Writing a pamphlet for tourists, Reading about moving to another country, Writing a critical online review, Reading about a problem with a ride-sharing service, Writing a post on a community website, Reading about a creative solution to Lion fish on St. Lucia, Writing about a skill, Reading about different studying styles	CO2
	Grammar - ADVANCED GRAMMAR IV	
	Past modals for degrees of certainty: must (not) have, may (not) have, might (not) have, could (not) have; past modals for judgments and suggestions: should (not) have, could (not) have, would (not) have, The passive to describe process with *is/are* + past participle and modal + *be* + past participle; defining and non-defining relative clauses, Giving recommendations and opinions with passive modals: *should be*, *ought to be*, *must be*, *has to be*, *has got to be*; tag questions for opinions, Accomplishments with the simple past and present perfect; goals with the future perfect and *would like to have* + past participle	
Text Books	*Interchange Level 3 - 5th edition* published by Cambridge University Press	

In hours			
L	T	P	Credit
3	1	0	4

Course Code	MED201						
Course Title	**Applied Thermodynamics**						
Course Outcomes	On the completion of the course the student will be able to: CO1: To identify and formulate power production based on the fundamental's laws of Thermal engineering. CO2: Analyze the performance of vapour power cycles cycle and steam nozzles CO3: Describe the various cooling, lubrication, ignition & fuel supply systems and evaluate the performance parameters of internal combustion engines CO4: Analyze the performance of air compressors and steam turbine solve numerical related to the performance of single stage and multi stage.						
Examination Mode	Theory						
Assessment Tools	Written Quiz	Assignment/ Project Work	MSE	MTP	ESE	EPR	ABL/PBL
Weightage	10%	10%	25%	-	50%	-	5%
Syllabus							**CO Mapping**
Unit 1	**Introduction to basic of thermodynamics**						
	Introduction to solid, liquid and gaseous fuels–Stoichiometry, exhaust gas analysis- First law analysis of combustion reactions- Heat calculations using enthalpy tables- Adiabatic flame temperature Chemical equilibrium and equilibrium composition calculations using free energy. Compressible flow in diffusers, efficiency of nozzle and diffuser.						CO1
Unit 2	**Vapor power cycles**						
	Vapor power cycles Rankine cycle with superheat, reheat and regeneration, energy analysis. Supercritical and ultra-super-critical Rankine cycle- Gas power cycles, Air standard Otto, Diesel and Dual Cycles-Air standard Brayton cycle, effect of reheat, regeneration and intercooling- Combined gas and vapor power cycles- Vapor compression refrigeration cycles, refrigerants and their properties. Properties of dry and wet air, use of psychometric chart, processes involving heating/cooling and humidification/dehumidification, dew point.						CO2
Unit 3	**Compressible flow**						
	Basics of compressible flow. Stagnation properties, Isentropic flow of a perfect gas through a nozzle, choked flow, subsonic and supersonic flows- normal shocks- use of ideal gas tables for isentropic flow and normal shock flow- Flow of steam and refrigerant through nozzle, super saturation.						CO3
Unit 4	**Compressor and Steam turbine**						
	Reciprocating compressors, staging of reciprocating compressors, optimal stage pressure ratio, effect of intercooling, minimum work for multistage reciprocating compressors. Analysis of steam turbines, velocity and pressure compounding of steam turbines.						CO4

| Text Books | 1. Y. A. Cengel, M. A. Boles; Thermodynamics – An Engineering Approach; Tata McGraw Hill Education Pvt. Ltd. New Delhi.4th Ed; 2012.
2. P. K Nag; Engineering Thermodynamics; Tata McGraw Hill Education Pvt. Ltd.; New Delhi.4th Ed.; 2008.
3. P. W Gill, J. H. Smith., E. J. Ziurys; Fundamentals of Combustion Engines; Oxford & IBH Publishing Co. Pvt. Ltd.; 4th revised Ed.;1967.
4. G. V. Wylen; R. Sonntag, C. Borgnakke; Fundamentals of Classical Thermodynamics; John Wiley & Sons, 4th Ed.; 1996.
5. G. Rogers, Y. Mayhew; Engineering Thermodynamics-Work and Heat Transfer; Pearson Education Ltd., 7th Ed.; 2012.
6. J. B. Jones, R. E. Dungan; Engineering Thermodynamics; Prentice Hall of India Pvt. Ltd., New Delhi, Eastern Economy Ed.; 1996. | |
| Reference Books | 1. Sonntag, R. E, Borgnakke, C. and Van Wylen, G. J., 2003, 6th Edition, Fundamentals of Thermodynamics, John Wiley and Sons.
2. Jones, J. B. and Duggan, R. E., 1996, Engineering Thermodynamics, Prentice-Hall of India
3. Moran, M. J. and Shapiro, H. N., 1999, Fundamentals of Engineering Thermodynamics, John Wiley and Sons.
https://archive.nptel.ac.in/courses/112/106/112106314/ | |

In hours			
L	T	P	Credit
3	0	2	4

Course Code	MED202						
Course Title	**Kinematics & Dynamics of Machines**						
Course Outcomes	On the completion of the course the student will be able to: CO1: To provide the basic concepts of forces in mechanisms. CO2: To learn about the various types of cam & followers. CO3: To provide the information of balancing of machines. CO4: To learn the concept of flywheels.						
Examination Mode	Theory						
Assessment Tools	Written Quiz	Assignment/ Project Work	MSE	MTP	ESE	EPR	ABL/PBL
Weightage	10%	-	25%	-	35%	25%	5%
Syllabus							**CO Mapping**
Unit 1	**Mechanisms**						
	Definition and types of joints; Lower and higher pairs; Classification of mechanisms based on function and constraints; Common mechanisms such as slider crank and 4-bar mechanisms and their inversions; Quick return mechanism, Straight line generators, rocker mechanisms, universal joints, steering mechanisms, etc. Degree of freedom and Grübler's formula; Grashof's rule and rotatability limits; Mechanical advantage; Transmission angle; Limit positions.						CO1
Unit 2	**Cams and Followers**						
	Classification of cams and followers, disc cam nomenclature, construction of displacement, velocity and acceleration diagrams for different types of follower motions, determination of basic dimension, synthesis of cam profile by graphical methods with various motions, cams with specified contours, problems.						CO2
Unit 3	**Balancing of Rotating Components and Reciprocating Parts**						
	Static balance, dynamic balance, balancing of rotating masses, two plane balancing, graphical and analytical methods, balancing of rotors, balancing machines, field balancing. Balancing of single cylinder engine, balancing of multi cylinder; inline, radial and V type engines, firing order.						CO3
Unit 4	**Flywheels**						
	Turning moment and crank effort diagrams for reciprocating machines' Fluctuations of speed, coefficient of fluctuation of speed and energy, Determination of mass and dimensions of flywheel used for engines and punching machines.						CO4
Text Books	Rattan, S.S. Theory of Machines. New Delhi: Tata McGraw-Hill Publishing Company Ltd. Print. Singh, V.P. Theory of Machines. New Delhi: Dhanpat Rai & Co. Print. Ballaney, P.L.Theory of Machines and Mechanism, New Delhi:Khanna Publishers, 2015.Print.						
Reference Books	Shigley, J.E. and Uicker,J.J.Theory of Machines and echanisms. New Delhi:Oxford University Press, 2015. Print. Ghosh, A. and Mallick, A.K.Theory of Mechanisms and Machines. New Delhi: Affiliated East-West Pvt. Ltd., 2009. Print.						

In hours			
L	**T**	**P**	**Credit**
3	1	0	4

Course Code	MED203
Course Title	**Engineering Mechanics**
Course Outcomes	On the completion of the course the student will be able to: CO1: To understand the concepts of force and free body diagram. CO2: To gain knowledge of force system in trusses, cables and beams. CO3: To apply Methods of virtual work and stationary Potential Energy in engineering applications. CO4: To understand the Kinematics of a Particle-simple Relative Motion
Examination Mode	Theory

Assessment Tools	Written Quiz	Assignment/ Project Work	MSE	MTP	ESE	EPR	ABL/PBL
Weightage	10%	10%	25%	-	50%	-	5%

Syllabus		**CO Mapping**
Unit 1	**Introduction to Mechanics**	
	Forces in Nature; Newton's laws and its completeness in describing particle motion; Form invariance of Newton's Second Law; Solving Newton's equations of motion in polar coordinates; Problems including constraints and friction; Extension to cylindrical and spherical coordinates. Position Vector, Moment of a Force about a Point, Moment of a Force about an Axis, The Couple and Couple Moment, Addition and Subtraction of Couple Moment of a Couple About a Line, The Free-body Diagram, Free Bodies Involving Interior Sections, Looking Ahead-Control Volumes General Equations of Equilibrium.	CO1
Unit 2	**Introduction to structural Mechanics and Friction Forces**	
	Potential energy function; $F = -$ Grad V, equipotential surfaces and meaning of gradient; Conservative and non-conservative forces, curl of a force field; Part A: Trusses: The Structural Model, The Simple Truss Solution of Simple Trusses, Method of Joints, Method of Sections, Looking Ahead-Deflection of a Simple, Linearly Elastic Truss, Part B: Section Forces in Beams: Introduction, Shear Force, Axial Force, and Bending Moment, Differential Relations for Equilibrium Part C: Chains and Cables: Introduction, Coplanar Cables; Loading is a Function, Coplanar Cables: Loading is the Weight of the Cable Itself, Friction Forces: Introduction, Laws of Coulomb Friction, A Comment Concerning the Use of Coulomb'.: Law, Simple Contact Friction Problems, Belt Friction, The Square Screw Thread, Rolling Resistance.	CO2
Unit 3	**Methods of virtual work and stationary Potential Energy**	
	Part A: Method of Virtual Work: Principle of Virtual Work for a Particle, Principle of Virtual Work for Rigid Bodies, Degrees of Freedom and the Solution of Problems, Looking Ahead-Deformable Solids. **Part B: Method of Total Potential Energy**: Conservative Systems, Condition of Equilibrium for a Conservative System, Stability, Looking Ahead-More on Total Potential Energy.	CO3
Unit 4	**Kinematics of a Particle-simple Relative Motion**	

	Part A: General Notions: Introduction, Differentiation of a Vector with Respect to Time, **Part B: Velocity and Acceleration Calculations:** Introductory Remark, Rectangular Components, Velocity and Acceleration in Terms of Path Variables, Cylindrical Coordinates. **Part C: Simple Kinematical Relations and Applications**: Simple Relative Motion, Motion of a Particle Relative to a Pair of Translating Axes.	CO4
Text Books	1. Irving H. Shames, "Engineering Mechanics Statics and Dynamics", Prentice Hall Publications 2. An Introduction to Mechanics — D Kleppner & R Kolenkow 3. Engineering Mechanics - Dynamics, 7th ed. - JL Meriam	
Reference Books	1. Boresi. P, "Engineering Mechanics Statics and Dynamics", Cengage Publishers. 2.Hibbler. H. C., "Engineering Mechanics", Pearson publishers.	

In hours			
L	**T**	**P**	**Credit**
0	0	8	4

Course Code	MED204
Course Title	**Machine Drawing**
Course Outcomes	On the completion of the course the student will be able to: CO1To make the students understand the principles and requirements of production drawings. CO2To provide the students a clear understanding of assembly and disassembly of important mechanical parts used in major engineering applications. CO3To learn various boiler mountings, IC Engines Parts. CO4 To Learn different types of bearings.
Examination Mode	Practical (48hr)

Assessment Tools	Continuous Assessment (CA)				MSE	MSP	ESE	ESP	Total
	Quiz	Assignment/ Project Work	Attendance	Lab Performance					
Weightage	-	-	-	20	-	30	-	50	100

Syllabus		CO Mapping
Unit 1	**Requirements of Production Drawing**	
	Types of Machine Drawing, Requirements of Production Drawing, Conventional representation of materials, Dimensioning, Limits, Fits & Tolerances, Symbols of standard tolerances, Machining & Welding Symbol. **Fasteners** : Introduction, Temporary & Permanent Fasteners; Types of Rivet Head, Riveting Process, Types of Riveted joints, Various types of screw threads, Types of nuts and bolts, Assembly of Nut, Bolt and Washer.	CO1
Unit 2		
	Keys, Cotter & Knuckle Joint: Types of keys, Saddle Key, Sunk Key, Gib Head Key; Socket & Spigot cotter joint, Sleeve and cotter joint, Gib and Cotter Joint, Knuckle Joint, Pipe joints and Pipe fittings. **Couplings**: Solid or Rigid Coupling, Protected and Unprotected Type Flange coupling, Pin type flexible coupling, muff coupling, Oldham's & Universal coupling.	CO2
Unit 3		
	Boiler Mountings: Steam stop valve, feed check valve, safety valve, blow off cock valve. **IC Engine Parts:** Piston, connecting rod, Crankshaft.	CO3
Unit 4		
	Bearings: Bushed bearing, Plummer block, footstep bearing, Swivel bearing. Miscellaneous: Screw Jack, Tool Post, Tail Stock, Drilling jig, Machine vice, Bench Vice, cross head, Eccentric Solution of few problems using computer design software.	CO4
Text Books	1. Gill, P.S. Machine Drawing. New Delhi: S. K. Kataria& Sons, 2013. Print. 2. Dhawan, R.K. Machine Drawing. New Delhi: S. Chand & Sons, 2014. Print.	

	3. Narayana, K. L., Kannaiah, P. and Reddy, K. V. Machine Drawing. New Delhi: New AgeInternational Publishers, 2009. Print	
Reference Books	1. Sidheshwar, N., Kannaieh, P., Sastry V.V.S. Machine Drawing. New Delhi: Tata McGraw Hill, 2010. Print.	

In hours			
L	T	P	Credit
0	0	2	1

Course Code	MED205
Course Title	**Swachh Bharat**
Course Outcomes	On the completion of the course the student will be able to: CO1: Understanding the significance of the Swachh Bharat Abhiyan CO2: Ability to analyse and predict the sanitation challenges of India CO3: Determine the link between sanitation and development. CO4: Contribute to the Swachh Bharat Abhiyan through real time projects/fieldwork.
Examination Mode	Practical (30hr)

Assessment Tools	Continuous Assessment (CA)				MSE	MSP	ESE	ESP	Total	
	Quiz	Assignment/ Project Work	Attendance	Lab Performance						
Weightage	-	-	-	20	-	30	-	50	100	

Syllabus		CO Mapping
Unit 1	**Introduction to Swachh Bharat Abhiyan**	
	Gandhian philosophy of Cleanlinesst Swachh Bharat Abhiyan {SBA} Hygiene, Sanitation & Sustainable Waste Management Agencies and nodal Ministries for SBA Different phases of the SBA and its evaluation Citizens' Responsibilities: Role of Swacchagrahi	CO1
Unit 2	**Swachh Bharat: Rural and Urban Facets**	

	• Indicators for Swachh Bharat
	 • Rural
	     i. Sanitation coverage across households (2014 vs. 2022)
	     ii. Open Defecation Free (ODF} Villages: Parameters
	     iii. ODF plus model: Key indicators
	 • Urban
	     i. Sustainable sanitation
	     ii. Waste/water and solid waste management
	     iii. Garbage Free Cities
		CO2

Unit 3	***Prospects and Challenges***	
	Attitudes and Perceptions Operational and Financial issues Monitoring & Supervision Community Mobilization	CO3
Unit 4	**List of activities to be undertaken**	
	Identify plastic and e-waste in and around the institution and suggest innovative technologies to minimize wastage. Identify events/fests that generate maximum waste and ways to minimize it. Visit canteen/shops and track the lifecycle of wet/dry waste in and around the institution and document the findings in the form of a Project Report. Conduct interviews of stakeholders to understand the level of awareness.	CO4

	Conduct a Clean Audit of the Institution and identify areas for action. Conduct cleanliness drives. Organise Swachhata Pakhwada meetings, rallies, and mobilization camps within the identified communities. Students may participate in the Swachh Bharat Internship programme. If required students can share their experiences in the form of a Project Report. Any other Practical/Practice as decided from time to time	
Text Books	"Swachh Bharat Mission - Gramin, Department of Drinking Water and Sanitation, Ministry of Jal Shakti" India 2021, Ministry of Information & Broadcasting http://swachhbharatmission.gov.in/SBMCMS/swachhta-pakhwada.htm https://swachhbharatm ission.gov.in/SBMCMS/a bout-us.html https://www.communityledtotalsanitation.org/sites/communityledtota!sanitation.org/files/ODF _verification_checklist.pdf https://sbm.gov.in/phase2dashboard/PhaseII/NationDashboard.aspx https://www.niti.gov.in/sites/default/files/2019-08/Report%20of%20SubGroup%20of%20Chief%20Min isters%20on%20Swachh%20%20Bharat%20Anhiyaan.pdf	
Reference Books	https://swachh bha ratm ission.gov. in/SBM CMS/writereaddata/Porta1/1mages/pd/brochure/Greywatermanagement.pdf https://swachhbharatmission.gov.in/SBMCMS/writereaddata/Portal/lmages/p df/brochure/PWMBS 28th June.pdf Gol {2020). Swachh Bharat Mission (Grameen) Phase 2: Operational guidelines. Department of Drinking Water and Sanitation, Ministry of Jalshakti. MoHUA (2017). Guidelines for Swachh Bharat Mission - Urban (PDF). Ministry of Housing and Urban Affairs, Government of India.	

In hours			
L	**T**	**P**	**Credit**
1	0	2	2

Course Code	CEC103
Course Title	**Community Engagement Course**
Course Outcomes	On the completion of the course the student will be able to: CO1: Gain and understanding of rural life, culture and social realities. CO2: Develop a sense of empathy and bonds of mutuality with local community CO3: Appreciate significant contribution of local communities to Indian society and economy CO4: Learn to value the local knowledge and wisdom of the community CO5: Identify opportunities for contributing to community's socio-economic improvements
Examination Mode	Theory+Practical

Assessment Tools	Written Quiz	Assignment/ Project Work	MSE	MTP	ESE	EPR	ABL/PBL
Weightage	10%	-	-	20%	35%	30%	5%

Syllabus		**CO Mapping**
Unit 1	Appreciation of Rural Society	
	Appreciation of Rural Society: Rural life style, rural society, caste and gender relations, rural values with respect to community, nature and resources, elaboration of "soul of India lies in villages'(Gandhi),rural infrastructure. Teaching Methodology: Classroom Discussions • Assignment: Prepare a map (physical, visual or digital) of the village you visited and write an essay a boutinter-family relations in that village. Mode of Assignment Submission: Written Assignment	CO1
Unit 2	Understanding Rural Economy& livelihood	
	Understanding rural economy & livelihood: Agriculture, farming, land ownership, water management, animal husbandry, non-farm livelihoods and artisans, rural entrepreneurs, rural markets Teaching Methodology: Group Discussions in Class Assignment: Describe your analysis of rural household economy, its challenges and possible pathways to address them. Mode of Assignment Submission: Written Assignment	CO2
Unit 3	*Rural Institutions*	
	Rural Institutions: Traditional rural organisations, Self-help Groups, Panchayatiraj institutions (Gram Sabha, Gram Panchayat, Standing Committees), local civilsociety,local administration. Teaching Methodology: Classroom Discussions • Assignment: How effectively are Panchayati raj institutions functioning in thevillage? What would you suggest to improve their effectiveness? Present a casestudy(written oraudio-visual). Mode of Assignment Submission: Group presentations of Assignment	CO3
Unit 4	**Rural Developmental Programmes**	
	Rural Developmental Programmes:History of rural development in India, current national programmes: Sarva Shiksha Abhiyan, Beti Bachao, Beti Padhao, Ayushman Bharat, Swatchh Bharat, PM Awaas Yojana, Skill India, Grampanchayat Decentralised Planning, NRLM, MNREGA, etc.	CO4

	Teaching Methodology: Classroom Discussions • Assignment: Describe the benefits received and challenges faced in the deliveryof one of these programmes in the rural community; give suggestions about improving implementation of the programme for the rural poor. ModeofAssignmentSubmission: WrittenAssignment	
Text Books	1. Singh, Katar, Rural Development: Principles, Policies and Management, New Delhi; Sage Publications, , 2015. 2. A Hand book on Village Panchayat Administration, Rajiv Gandhi Chair for Panchayati Raj Studies, 2002. 3. United Nations, Sustainable Development Goals,2015un.org/sdgs/ 4. M.P.Boraian, Best Practices in Rural Development, Shanlax Publishers, 2016.	
Reference	1. Journals of Rural development, (published by NIRD&PR Hyderabad) 2. Indian Journal of Social Work,(by TISS, Bombay) 3. Indian Journal of Extension Education(by Indian Society of Extension Education) 4. Journal of Extension Education (by Extension Education Society) 5. Fostering Social Responsibility & Community Engagement in Higher Education Institutions in India 6. Kurukshetra(Ministry of Rural Development, GoI) 7. Yojana (Ministry of Information and Broadcasting, GoI)	
	The students are required to spend a total of 30 hours in field and select any 5 activities from among the following: • Interaction with SHG women members, and study of their functions and challenges; planning for their skill building and livelihood activities • Visit MGNREGS project sites, interact with beneficiaries and interview functionaries at the worksite • Field visit to Swachh Bharat project sites, conduct analysis and initiate problem solving measures • Conduct Mission An tyoday a surveys to support under Gram Panchayat Development Plan (GPDP) • Interactive community exercise with local leaders, panchayat functionaries, grass-root officials and local institutions regarding village development plan preparation and resource mobilization • Visit Rural Schools /mid- day meal centres, study Academic and infrastructural resources and gaps • Participate in Gram Sabha meetings, and study community participation • Associate with Social audit exercises at the Gram Panchayat level, and interact with programme beneficiaries • Attend Parent Teacher Association meetings, and interview school dropouts Fostering Social Responsibility & Community Engagement in Higher Education Institutions in India • Visit local Anganwadi Centre and observe the services being provided • Visit local NGOs, civil society organizations and interact with the staff and beneficiaries, • Organize awareness programmes, health camps, Disability camps and cleanliness camps	

| | • Conducts oil health test, drinking water analysis, energy use and fuel efficiency surveys
• Raise understanding of people's impacts of climate change, building up community's disaster preparedness
• Organise orientation programmes for farmers regarding organic cultivation, rational use of irrigation and fertilizers and promotion of traditional species of crops and plants
• Formation of committees for common property resource management, village pond maintenance and fishing. | |

In hours			
L	T	P	Credit
3	0	2	4

Course Code	MED251
Course Title	**Heat and Mass Transfer**
Course Outcomes	On the completion of the course the student will be able to: CO1: To understand the fundamental principles and mathematical basis underlying the balance equations for heat transfer. CO2: To analyses problems involving steady and unsteady heat conduction, convection and radiation heat transfer in different geometries. CO3: To solve real life engineering problems such as heat transfer enhancement through extended surfaces, lumped heat capacity systems, heat exchangers, boiling and condensation, and calculating radiation view factor in different geometries. CO4: Design heat and mass transfer equipment like Heat Exchanger, condenser, steam turbine etc.
Examination Mode	Theory

Assessment Tools	Written Quiz	Assignment/ Project Work	MSE	MTP	ESE	EPR	ABL/PBL
Weightage	10%	10%	25%	-	35%	25	5%

Syllabus		**CO Mapping**
Unit 1	*Introduction and Conduction Heat Transfer*	
	Introduction Three modes of heat transfer; Examples of equipment (like air conditioner and air cooler) involving heat transfer; Derivation of heat balance equation. Conduction Heat Transfer Steady 1D solution for conduction heat transfer in Cartesian, cylindrical and spherical geometry; Concept of conduction and film resistances; Critical insulation thickness; Lumped system approximation and Biot number; Heat transfer through pin fins; 2D conduction solutions for steady and unsteady heat transfer.	CO1
Unit 2	**Convection Heat Transfer**	
	Convection Heat Transfer Basic equations; Boundary layers; Forced convection; External and internal flows; Natural convective heat transfer; Dimensionless parameters for forced and free convection heat transfer; Correlations for forced and free convection; Approximate solutions to laminar boundary layer equations for internal and external flow; Estimating heat transfer rates in laminar and turbulent flow situations using appropriate correlations for free and forced convection.	CO2
Unit 3	*Radiation Heat Transfer and Heat Exchanger Design*	
	Radiation Heat Transfer Interaction of radiation with materials; Definitions of radiative properties; Stefan Boltzmann's law; Black and grey body radiation; Calculation of radiation heat transfer between surfaces using radiative properties; View factors and the radiosity method; Examples for two-body enclosures; Radiation shield. Heat Exchanger Design Function, classification and configuration of heat exchangers; Evaluation of mean temperature difference; Heat exchanger effectiveness; Analysis, design and selection of heat exchangers.	CO3

Unit 4	*Boiling and Condensation heat transfer*	
	Boiling and Condensation heat transfer Pool boiling; Flow boiling; Film and drop wise condensation, Introduction to mass transfer, Analogy between heat and mass transfer; Mass diffusion; Fick's Law; Steady and transient mass diffusion; Simultaneous heat and mass transfer.	CO4
Text Books	1. Holman, J.P., "Heat and Mass Transfer", Tata McGraw Hill, 2000 2. Yunus A. Cengel, "Heat Transfer A Practical Approach", Tata McGraw Hill, 5th Edition 2015.	
Reference Books	1. A. Bejan, "Heat Transfer," John Wiley, 1993. 2 J.P. Holman and S. Bhattacharyya, "Heat Transfer," McGraw Hill, 2017. 3 F.P. Incropera, and D.P. Dewitt, "Fundamentals of Heat and Mass Transfer," John Wiley, 2019. 4 Massoud Kaviany, "Principles of Heat Transfer," John Wiley, 2002. 5 Yunus A Cengel, "Heat Transfer: A Practical Approach," McGraw Hill, 2002	
Online Resources:	1 https://onlinecourses.nptel.ac.in/noc22_ch65/preview	

In hours			
L	T	P	Credit
3	0	2	4

Course Code	MED252
Course Title	**FLUID MECHANICS AND HYDRAULIC MACHINES**
Course Outcomes	On the completion of the course the student will be able to: CO1: To understand the fundamental principles of fluid mechanics. CO2: To give basic understanding of boundary layer concept and analyze different types of losses and measurement of flow. CO3: To analyze a variety of practical fluid flow and measuring devices and utilize Fluid Mechanics principles in design. CO4: To become familiar about different types of turbines & able to analyze their performance characteristics of various turbines.
Examination Mode	Theory

Assessment Tools	Written Quiz	Assignment/ Project Work	MSE	MTP	ESE	EPR	ABL/PBL
Weightage	10%	10%	25%	-	50%	-	5%

Syllabus		CO Mapping
Unit 1	***Introduction to Fluid***	
	Properties of Fluid: Definition of fluid; Newton's law of viscosity; Units and dimensions; Physical properties of fluids; Control volume; Fluid Statics: Pressure-density-height relationships, Manometers and Mechanical gauges, Force on plane and curved surfaces, Centre of pressure, Buoyancy, Stability of immersed and floating bodies.	CO1
Unit 2	**Fluid Kinematics**	
	Different approaches; Reynolds transport theorem; Flow visualization; Types of flow; Strain rate, stream line, streak line, path lines and stream tubes; Continuity equation in Cartesian coordinates in 3D forms; Velocity and acceleration of fluid particles; Velocity potential function and stream function. Dimensional Analysis: Dimensionally homogeneous equations; Buckingham Pi Theorem; Calculation of dimensionless parameters. Similitude and complete similarity; Model scales; Basic boundary layer theory and analysis.	CO2
Unit 3	***Fluid Dynamics and Flow Measuring Device***	
	Momentum Equation: Momentum equation; Nervier Stoke equation; Development of Euler's equation; Bernoulli's equation and application; Steady and unsteady flow through orifice; Orifice placed in pipe; Venturimeter; Flow over triangular and rectangular notches; Pitot tube. Laminar and Turbulent Flow: Viscous/Laminar flow – Plane Poiseuille flow and Coutte flow; Laminar flow through circular pipes; Loss of head and power absorbed in viscous flow; Turbulent flow – Reynolds experiment; Frictional losses in pipe flow; Shear stress in turbulent flow; Major and minor losses (Darcy's and Chezy's equation); Flow through siphon pipes; Branching pipes and equivalent pipe.	CO3
Unit 4	***Hydraulic Machines***	

	Rotodynamic Machines: Euler's equation; Theory of Rotodynamic machines; Various efficiencies; Velocity components at entry and exit of the rotor; Velocity triangles; Centrifugal pumps – working principle, work done by the impeller and performance curves; Cavitation in pumps; Reciprocating pump – working principle. Hydraulic Turbines: Classification of water turbines; Heads and efficiencies; Velocity triangles; Axial, radial and mixed flow turbines; Pelton wheel, Francis turbine and Kaplan turbines – working and design principles.	CO4
Text Books	1. S.S. Rattan, Fluid Mechanics & Hydraulic Machines, Khanna Book Publishing, 2019. 2. R. K. Rajput, "A Textbook of Fluid Mechanics and Hydraulic Machines," S Chand Publication, 2014. 3. P.J. Pritchard, A.T. McDonald and R.W. Fox, "Introduction to Fluid Mechanics," Wiley India, 2012.	
Reference Books	1. S. K. Som, G. Biswas and S. Chakraborty, "Introduction to Fluid Mechanics and Fluid Machines, Tata McGraw Hill, 2017. 2. F.M. White, "Fluid Mechanics," Tata McGraw Hill, 2011 3. Mechanics of Fluids, Shames, McGraw Hill Book Co., New Delhi, 1988	
Online Resources:	https://onlinecourses.nptel.ac.in/noc22_ce85/preview	

In hours			
L	T	P	Credit
3	0	2	4

Course Code	MED253						
Course Title	**Mechanics of Deformable Solids**						
Course Outcomes	On the completion of the course the student will be able to: CO1: To understand the concepts of Stresses produced in rigid body because of different loading conditions. CO2: To calculate slope and deflection in beams. CO3: To calculate load for failure of columns and shafts. CO4: To calculate hoop and radial stresses in pressure vessels.						
Examination Mode	Theory						
Assessment Tools	Written Quiz	Assignment/ Project Work	MSE	MTP	ESE	EPR	ABL/PBL
Weightage	10%	10%	25%	-	50%	-	5%
Syllabus							**CO Mapping**
Unit 1	*Concept of Stress and Strain*						
	Deformation of bars: Hooke's law, stress, strain, and elongation; Tensile, compressive and shear stresses in 2D solids; Elastic constants and their relations; Volumetric, linear and shear strains; Temperature Stresses Principal stresses and strain; Principal planes; Mohr's circle						CO1
Unit 2	**Mechanics of Beams and their deflection**						
	Transverse loading on beams, point and distributed loads; Shear force and bend moment diagrams; Types of beam supports – simply supported, over-hanging, cantilevers, fixed and guided beams; Static determinacy and indeterminacy; Theory of bending of beams, pure bending stress distribution and neutral plane, second moment of area; Different cross-sections of beams; Shear stress distribution. Deflection of a beam using the double integration method; Computation of slopes and deflection in beams; Myosotis method for computing deflections and slopes.						CO2
Unit 3	*Column Buckling and torsion of Shafts*						
	Critical loads using Euler's theory; Different boundary conditions; Eccentric columns Torsion stresses and deformation of circular and hollow shafts; Polar moment of area, stepped shafts; Deflection of shafts fixed at both ends; Stresses and deflection of helical springs.						CO3
Unit 4	*Resilience and pressure vessels*						
	Principle of virtual work; Minimum potential energy theorem; Castigliano's theorems; Maxwell reciprocity theorem. Axial and hoop stresses in cylinders subjected to internal pressure; Deformation of thin and thick cylinders; Deformation in spherical shells subjected to internal pressure; Combined thermo mechanical stress; Examples and case studies (boilers).						CO4
Text Books	1. Lehri. R. S, "Strength of Materials", Kataria and son's publications 2. Bansal. R.K "Strength of Materials" Laxmi Publications 3. Hibbler. H. C "Mechanics of Materials" - Pearson publishers						

Reference Books	1. Boresi. P, "Engineering Mechanics Statics and Dynamics", Cengage Publishers.	
	2.Gere, "Mechanics of Materials", Cengage publishers.	

In hours			
L	**T**	**P**	**Credit**
3	1	0	4

Course Code	MED254					
Course Title	**Engineering Materials and Applications**					
Course Outcomes	On the completion of the course the student will be able to: CO1: Know the range of engineering materials, their mechanical properties and applications CO2: Know various methods to measure the mechanical properties of materials. CO3: Learn how to improve the properties of ferrous alloys through various heat treatments CO4: To learn about the polymer Electrical and Magnetic Materials					
Examination Mode	Theory					
Assessment Tools	Written Quiz	Assignment/ Project Work	MSE	MTP	ESE	EPR	ABL/PBL
Weightage	10%	10%	25%	-	50%	-	5%
Syllabus						**CO Mapping**
Unit 1	***Engineering Materials and Classification***					
	Metals, plastics, ceramics and composites; Relevant properties (physical, mechanical, thermal, electrical, chemical), cost; Range of applications; Material designation and standards; Ashby diagrams; Selection criteria and process. **Mechanical Properties and Testing**: Tensile, compression, torsion, fatigue, fracture and wear tests; Young's modulus; Relations between true and engineering stress-strain curves; Generalized Hooke's law; Yielding and yield strength; ductility, resilience, toughness and elastic recovery; Hardness measurement their relation to strength; SN curve, endurance and fatigue limits; Introduction to non-destructive testing (NDT).					CO1
Unit 2	***Metal and Alloys***					
	Iron and steel; Stainless steel and tool steels; Copper & its alloys – brass, bronze & cupro-nickel; Aluminium & Al-Cu-Mg alloys; Nickel based superalloys & Titanium alloys; Phase diagrams and interpretation of microstructure; Iron Iron-carbide phase diagram and cooling (TTT) diagrams. Heat Treatment: Heat treatment of Steel; Annealing, tempering, normalizing, spheroidising, austempering, martempering, case hardening, carburizing, nitriding, cyaniding, carbo-nitriding, flame and induction hardening, vacuum and plasma hardening					CO2
Unit 3	***Polymers, Ceramics and Composites***					
	Polymers – Classification and applications; Polymerization techniques; *Ceramics* – Oxide ceramics, ceramic insulators, bio-ceramics and Glasses; *Composites* –Reinforcement, matrix, metal matrix composites, ceramic composites, polymer composites; Other Advanced materials – biomaterials, optical materials, high temperature materials, energy materials, and nanomaterials.					CO3
Unit 4	***Electrical and Magnetic Materials***					

	Conducting and resisting materials – types, properties and applications; Semiconducting materials – properties and applications; Magnetic materials – Soft and hard magnetic materials and applications; Superconductors and dielectric materials – properties and applications; Smart materials; Sensors and actuators; Piezoelectric, magneto strictive and electro strictive materials.	CO4
Text Books	1. V. Raghavan, "Material Science and Engineering', PHI India, 2015. 2. K. G. Budinski and M.K. Budinski, "Engineering Materials", PHI India, 2002.	
Reference Books	1. W. D. Callister, "Materials Science & Engineering," Wiley India, 2014. 2. U. C. Jindal, "Engineering Materials and Metallurgy", Pearson, 2011. 3. M.F. Ashby and D.R.H. Jones, Engineering Materials 1 - An Introduction to Properties, Applications and Design, Butterworth-Heinemann, USA, 2011	
Online Resources	https://onlinecourses.nptel.ac.in/noc22_me90/preview	

In hours			
L	**T**	**P**	**Credit**
0	0	4	2

Course Code	MED255						
Course Title	**Mechanical Engineering Laboratory-I (Fluid Mechanics & Hydraulic Machines)**						
Course Outcomes	On the completion of the course the student will be able to: **CO1:** To provide the knowledge of different pressure measuring devices. **CO2:** To provide the knowledge of different types of head losses in flow **CO3:** To study the pumps operating and main characteristic curves and familiar with pump station **CO4:** To study the fluid machines and fluid power						
Examination Mode	Practical						
Assessment Tools	Written Quiz	Project Work/Lab Performance	MSE	MTP	ESE	EPR	ABL/PBL
Weightage	-	20%	-	30%		50%	-
Syllabus							**CO Mapping**
Content	*List of experiments*						
	1) To Find Coefficient of Discharge of Venturimeter and Orifice Meter. 2) To Find Coefficient of Discharge of Pitot Tube 3) To Find Cd, Cv& Cc of an Orifice 4) To Find Friction Factor of Pipes of Different material & Diameter. 5) To Find Minor Losses with Sudden Enlargement & Contraction. 6) To Find Metacentric Height of Floating Vessel. 7) To Find Reynolds Number. 8) To Find Coefficient of Discharge of Different Notches. 9) To Prove Bernoulli's Theorem. 10) To study Free & Forced Vertex. 11) Experiment on Laminar & Turbulent Flow 12) To determine critical Reynolds' numbers for flow through commercial pipes. 13) To study development of boundary layer over a flat plate. 1. To study the performance characteristics of Pelton turbine and draw constant head, constant speed and constant efficiency curves. 2. To draw the constant head, constant speed and constant efficiency performance characteristics of Francis turbine. 3. To draw the constant head, speed and efficiency curves for a Kaplan turbine. 4. To study the constructional details of a Centrifugal Pump and draw its characteristic curves. 5. To study the constructional details of a Reciprocating Pump and draw its characteristics curves.						

6. To study the construction details of a Gear oil pump and its performance curves. 7. To study the constructional details of a Hydraulic Ram and determine its various efficiencies. 8. To study the model of Hydro power plant and draw its layout. 9. Study and perform test on a Torque Convertor	

In hours			
L	**T**	**P**	**Credit**
3	1	0	4

Course Code	MED301					
Course Title	**Machine Element and system design**					
Course Outcomes	On the completion of the course the student will be able to: CO1: Principles of machine elements and how they can be combined to function as a system CO2: Failure analysis of machine elements CO3: An overview of codes, standards and design guidelines for different elements CO4: Ability to analyse mechanical systems					
Examination Mode	Theory					
Assessment Tools	Written Quiz	Assignment/ Project Work	MSE	MTP	ESE	EPR	ABL/PBL
Weightage	10%	10%	25%	-	50%	-	5%
Syllabus						**CO Mapping**
Unit 1	***Introduction***					
	Anatomy of machines; Functional dissection of motorcycle, washing machine, sewing machine, etc. into machine elements including gears, rack and pinions, cams, chains, belts, pulleys, flywheels, bearings, shafts, keys, brakes, etc.; Design considerations – Limits, fits and standardization; Friction and lubrication. **Free-body Diagrams** Force analysis of machine elements and machine systems; Application to power screws and couplings, clutches, and brakes.					CO1
Unit 2	***Failure Theories***					
	Static failure theories including normal stress theory, shear stress theory, distortion energy theory; von Mises stress; Factor of safety; Stress concentration factors; Fatigue failure theories: mean and alternating stresses, yield, ultimate, and endurance strength; Goodman, Gerber, and Soderberg lines.					CO2
Unit 3	***Design of Machine Elements***					
	Springs – Helical compression, tension, torsional and leaf springs; Fasteners – threaded fasteners, bolted joints, preloaded bolts, rivets and welded joints; Shafts – shafts under static and fatigue loadings; Keys; Sliding and rolling contact bearings; Transmission elements – transmission ratio and efficiency of spur, helical, bevel and worm gears; belt and chain drives; Flywheels.					CO3
Unit 4	***Vibrations of Machine Elements***					
	Single degree-of-freedom systems; Natural frequency and critical damping; Forced vibration; Resonance; Balancing of reciprocating and rotating masses; Torsional vibration and critical speeds of shafts. **Mechanical Systems** Case studies on automobile suspensions, automatic transmissions, material conveyor systems, construction machinery, etc.					CO4
Text Books	1. Shigley, J.E. and Mischke, C.R., "Mechanical Engineering Design," McGraw-Hill, 1989.					

	2. Deutschman, D., & Wilson, C.E., "Machine Design Theory & Practice," Macmillan, 1992 3. Juvinal, R.C., "Fundamentals of Machine Component Design," John Wiley, 1994.	81 | P a g e
Reference Books	1. Spottes, M.F., "Design of Machine elements," Prentice-Hall India, 1994. 2. R. L. Norton, "Mechanical Design – An Integrated Approach," Prentice Hall, 2009. 3.Sadhu Singh, "Machine Design", Khanna Book Publishing, 2021. 4. Sadhu Singh, "Machine Design Data Book", Khanna Book Publishing, 2022.	
Online Resources	https://archive.nptel.ac.in/courses/112/105/112105124/	

In hours			
L	**T**	**P**	**Credit**
3	0	2	4

Course Code	MED302
Course Title	**Mechatronics, Robotics & Control**
Course Outcomes	On the completion of the course the student will be able to: CO1: To understand the concept of Robot, Sensors and End effectors. CO2: To know the concepts of the fluid power and various control valves. CO3: To give understanding about the robotics and its programming. CO4: To apply the concept of robotics in industrial applications.
Examination Mode	Theory

Assessment Tools	Written Quiz	Assignment/ Project Work	MSE	MTP	ESE	EPR	ABL/PBL
Weightage	10%	-	25%	-	35%	25%	5%

Syllabus		CO Mapping
Unit 1	**Introduction to Robot, Sensors and End Effectors**	
	Introduction, terminology, laws of robotics, classification based on geometry, machine vision, robot components, degree of freedom, coordinators, reference frames. Types of Sensors in robots, exteroceptors, proprioceptors, tactile, proximity, range, velocity and machine vision sensors, robot end-effectors, classification, gripper, gripper mechanism, type of gripper.	CO1
Unit 2	**Fluid Power and Fluidics**	
	Fluid power control elements, Construction and performance of fluid power generators; Hydraulic and pneumatic cylinders - construction, design and mounting; Hydraulic and pneumatic valves for pressure, flow and direction control. Boolean algebra; Truth tables; Conda effect.	CO2
Unit 3	**Robot Programming and Control**	
	Robot programming, techniques of programming, robot languages, requirement for a standard robot language, types of languages.	CO3
Unit 4	**Industrial and Mechatronic applications**	
	Applications of robots in welding, machine loading, fabrication, spray painting, assembly and unusual applications.	CO4
Text Books	1. Deb, S.R. *Robotics and Flexible Automation*. New Delhi: Tata McGraw-Hill Publishing Company Ltd. 2010. Print. 2. Majumdar, S.R. *Pneumatic Systems.* New Delhi: Tata McGraw-Hill Publishing Company Ltd. Sixteenth reprint 2006. Print.	
Reference Books	1. Asfahl, C.R. *Robotics and Manufacturing Automation.* Wiley India. 1992. Print. 2. Niku, S.B. *Introduction to Robotic Analysis systems and applications.* Wiley India. 2001. Print.	

In hours			
L	**T**	**P**	**Credit**
3	1	0	4

Course Code	MED303						
Course Title	**Manufacturing Processes**						
Course Outcomes	On the completion of the course the student will be able to: CO1: To understand the fundamental principles of materials, processes and manufacturing. CO2: To gain knowledge of various material shaping and removal manufacturing processes CO3: Application of various advanced manufacturing processes in engineering applications. CO4: selection of material joining or fabrication processes.						
Examination Mode	Theory						
Assessment Tools	Written Quiz	Assignment/ Project Work	MSE	MTP	ESE	EPR	ABL/PBL
Weightage	10%	-	25%	-	35%	25%	5%
Syllabus							**CO Mapping**
Unit 1	***Manufacturing Processes and Classification***						
	Additive, subtractive and shaping processes; Relative advantages and limitations; Inter-dependency of geometry, material and process; Effect on product quality and cost; Part design for manufacturability; Process selection criteria.						CO1
Unit 2	***Material Shaping & Removal Processes***						
	Metal casting (sand, die and investment casting), Bulk forming (forging, rolling, extrusion, drawing) and sheet forming (shearing, deep drawing, bending); Thermoplastic and thermoset plastic processes (ex. injection and blow molding); Powder metallurgy; Metal injection molding; Glass and composite processes (layup). Turning, Drilling, Milling, Grinding and other finishing processes; Single and multi-point cutting tools; Cutting tool materials; Cutting fluids; Material removal rates, surface finish, accuracy, integrity and machinability						CO2
Unit 3	***Unconventional & Additive Manufacturing Processes***						
	Abrasive Jet Machining, Water Jet Machining; Ultrasonic Machining; Electrical Discharge Machining, Wire EDM; Electro Chemical Machining; Laser Beam Machining, Plasma Arc Machining and Electron Beam Machining; Micro and nano manufacturing. Extrusion; vat polymerization, powder bed fusion; material jetting, binder jetting; direct energy deposition and lamination processes						CO3
Unit 4	***Joining and Fastening Processes and Process Modeling***						
	Arc welding, gas welding, shielded metal arc welding; GMAW (MIG) and GTAW (TIG); Brazing and soldering; Solid state joining; Adhesive bonding. Casting – metal flow, solidification and cooling; application to design of gating and feeding systems for quality and yield optimization; **OR** Forming – Plastic deformation and yield criteria; load estimation; OR Machining – Orthogonal cutting, various force components; Chip formation, Tool wear and tool life.						CO4

Text Books	1. Amitabha Ghosh and A.K. Mallick, Manufacturing Science. Affiliated East-West Press Pvt. Ltd. 2010. 2. Kalpakjian and Schmid, Manufacturing Processes for Engineering Materials, Pearson India, 2014 3. M. P. Groover, Fundamentals of Modern Manufacturing: Materials, Processes, and Systems.
Reference Books	1. Lindberg R.A, "Processes and Materials of Manufacture", Prentice Hall of India (P) Ltd.,1996 2. Degarmo, Black & Kohser, Materials and Processes in Manufacturing 3.William F. Hosford and Robert M. Caddel, "Metal forming", PrenticeHall Publishing Co., 1990.Shaw, "Principles of Metal cutting", Oxford I.B.H.

In hours			
L	**T**	**P**	**Credit**
3	0	2	4

Course Code	MED304
Course Title	Measurement & Metrology
Course Outcomes	1. To provide basic knowledge about errors in measurement systems. To learn about measuring mechanical quantities like surface roughness, and speed. To learn about various sensors and transducers used for the measurement of mechanical quantities. To learn about the measurement of pressure and temperature measuring devices.
Examination Mode	**Theory**

Assessment Tools	Written Quiz	Assignment/ Project Work	MSE	MTP	ESE	EPR	ABL/PBL
Weightage	10%		25%		35%	25%	5%

Syllabus	CO Mapping

Unit 1	
Introduction: Measurement, Significance, method of measurement definitions and concept of accuracy, precision, range, resolution, calibration, threshold, sensitivity, hysteresis, repeatability, linearity, loading effect, system response times delay, Factor in the selection of measuring instruments. **Errors in measuring instruments:** Classifications of error, sources of error, temperature problem, static & dynamic characteristics of measuring instruments, calibration, error.	CO1

Unit 2	
Metrology: Standards of measurements- Line, end and wavelength; linear measurements - Vernier calipers, Vernier height gauge, and depth gauge and micrometer; Angular measurements - sine bar, clinometer, angle gauge; Measurement of major diameter, minor diameter, effective diameter, pitch, angle and form of threads for internal and external threads; comparators - their types, relative merits, and limitations; surface roughness - specifications and measurement, concept, and measurement of straightness and flatness by interferometry. **Speed**:, Force, Torque and Shaft Power Measurement Mechanical tachometers, vibration reed tachometer and stroboscope; proving ring, hydraulic and pneumatic load cells, torque on rotating shafts; Absorption, transmission and driving dynamo meters.	CO2

Unit 3	
Sensors and transducers: Introduction to sensors and transducers, types of sensors, review of electro-mechanical sensors and transducers - variable resistance, inductance and capacitive pickups, photo cells and piezoelectric transducers and application of these elements for measurement of position/displacement, speed/velocity / acceleration, force and liquid level. Resistance strain gauges, gauge factor, bonded and unbounded gauges, surface preparation and bonding technique	CO3

	signal conditioning and bridge circuits, temperature compensation, application of strain gauges for direct, bending and torsional loads. Introduction to amplifying, transmitting and recording devices.	
Unit 4		
	Pressure and Flow Measurement: Bourdon tube, diaphragm and bellows, vacuum measurement - Mcleod gauge, thermal conductivity gauge and ionization gauge; Dead weight gauge tester. Electromagnetic flux meters, ultra-sonic flow meters and hot wire anemometer: flow visualization techniques. **Temperature Measurement**: Thermal expansion methods - bimetallic thermometers, liquid-in-glass thermeter and filled-insystem thermometers; thermo-electric sensors - common thermo couples, reference junction considerations, special materials and configurations; metal resistance thermometers and thermistors; optical and total radiation pyrometers; calibration standards.	CO4
Text Books	1. Thomas G. Beckwith, Roy D. Marangoni, John H. Lienhard V, Mechanical Measurements (6th Edition) 6th Edition, Pearson Education India, 2007.	
Reference Books	1. Instrumentation and control systems by W. Bolton, 2nd edition, Newnes, 200 2. Gregory K. McMillan, Process/Industrial Instruments and Controls Handbook, Fifth Edition, McGraw-Hill: New York,1999. 3. A Textbook of Measurements & Metrology by Er. R.K. Rajput, 1st Edition 2012, S.K. Kataria & Sons	

Program Elective 1- As per basket.

In hours			
L	**T**	**P**	**Credit**
0	0	4	2

Course Code	MED305						
Course Title	**Mechanical Engineering Laboratory-II (Design)**						
Course Outcomes	On the completion of the course the student will be able to: CO1: To understand the measurement of mechanical properties of materials. CO2: To understand the deformation behavior of materials. CO3: To understand the kinematic characteristics of mechanical devices. CO4: To understand the dynamic characteristics of mechanical devices.						
Examination Mode	Practical						
Assessment Tools	Written Quiz	Project Work/Lab Performance	MSE	MTP	ESE	EPR	ABL/PBL
Weightage	-	20%	-	30%		50%	-
Syllabus							**CO Mapping**
Content	*List of experiments*						
	1. Uniaxial tension test on mild steel rod 2. Torsion test on mild steel rod 3. Impact test on a metallic specimen 4. Brinnell and Rockwell hardness tests on metallic specimen 5. Bending deflection test on beams 6. Strain measurement using Rosette strain gauge 7. Microscopic examination of heat-treated and untreated metallic samples 8. Velocity ratios of simple, compound, epicyclic and differential gear trains 9. Kinematics of four bar, slider crank, crank rocker, double crank, double rocker, and oscillating cylinder mechanisms 10. Cam & follower and motion studies 11. Single degree of freedom Spring-mass-damper system, determination of natural frequency and damping coefficient 12. Determination of torsional natural frequency of single and double rotor systems- undamped and damped natural frequencies						

Industrial Training (MED306)- As per guidelines

	In hours			
	L	**T**	**P**	**Credit**
	3	0	2	4

Course Code	MED351
Course Title	**CAD & Analysis**
Course Outcomes	On the completion of the course the student will be able to: CO1: To understand the fundamental of CAD. CO2: To gain knowledge of various concepts of geometric modelling. CO3: To provide basic knowledge of NC/CNC/DNC systems. CO4: To apply the concept in CAPP.
Examination Mode	Theory

Assessment Tools	Written Quiz	Assignment/ Project Work	MSE	MTP	ESE	EPR	ABL/PBL
Weightage	10%	-	25%	-	35%	25	5%

Syllabus		CO Mapping
Unit 1	**Fundamentals of CAD and Geometric Transformations**	
	Introduction, Design Process, Application of computers in design, Creating manufacturing database, benefits of CAD, Software configuration of a graphics system, functions of a graphics package, geometric modeling, Fundamentals of Computer Graphics, Visual realism- hidden line surface- solid removal algorithms, Product cycle, sequential and concurrent engineering. Mathematics preliminaries, matrix representation of 2 and 3 dimensional transformation, Concatenation of transformation matrices, Application of geometric transformations.	CO1
Unit 2	**Geometric modeling**	
	Need of Geometric Modeling, types of geometric modeling, geometric modeling representation, and geometric modeling techniques and uses, parametric representation of analytical and synthetic curves, parametric representation of surfaces, Coons and bicubic. Patches, Solid modeling, CSG and Boundary Representation, CAD standards- Graphical Kernel System (GKS), Data exchange standards- IGES, STEP	CO2
Unit 3	**Numerical Control**	
	Types of NC systems, MCU and other components, NC manual part programming, coordinate systems, G & M codes, Part program for simple parts, computer assisted part programming. Direct numerical control, Adaptive control in machining system, DNC/CNC systems	CO3
Unit 4	**Computer Aided Process Planning**	
	Introduction and benefits of CAPP, types of CAPP, Steps in variant process planning, planning for CAPP, machinability data selection systems in CAPP.	CO4
Text Books	1. Groover and Zimmer. CAD/ CAM. Prentice Hall. Print. 2010. 2. Zeid, I. CAD/ CAM Theory and Practice. McGraw Hill. 2009.	
Reference Books	1. Bedworth, D.D., Henderson, M.R. & Wolfe, P.M. Computer Integrated Design and Manufacturing. New Delhi: Tata McGraw Hill. 1991 2. W. M. Neumann and R.F. Sproul, Principles of Computer Graphics, McGraw Hill, 1989. 3. Mikell P. Groover, Automation, Production Systems, and Computer-integrated Manufacturing, prentice Hall, 2007	

In hours			
L	**T**	**P**	**Credit**
3	0	2	4

Course Code	MED352						
Course Title	**Manufacturing Automation**						
Course Outcomes	On the completion of the course the student will be able to: CO1: To understand the fundamental principles of automation. CO2: To gain knowledge of design of automated assembly systems. CO3: To understand the concept of group technology. CO4: To understand the application of automation in flexible manufacturing systems.						
Examination Mode	Theory						
Assessment Tools	Written Quiz	Assignment/ Project Work	MSE	MTP	ESE	EPR	ABL/PBL
Weightage	10%	-	25%	-	35%	25%	5%
Syllabus							**CO Mapping**
Unit 1	**Automation**						
	Types of automation, reasons for automating, automation strategies, Detroit-type automation: Automated flow lines, methods of work part transport, Transfer mechanisms, buffer storage, automation for machining operations. Mechanization. Factory Automation: Lean manufacturing, Automation scalability, Design and analysis of automated flow lines; Average production time, production rate, line efficiency; Analysis of transfer lines without storage; Partial and full automation.						CO1
Unit 2	**Automated assembly systems**						
	Design for automated assembly, types of automated assembly systems, part feeding devices, quantitative analysis of the delivery system operation, and analysis of a single-station assembly machine, numerical.						CO2
Unit 3	**Group Technology**						
	Part families, parts classification and coding, types of classification and coding systems, Machine cell design: The composite part concept, types of cell designs, determining the best machine arrangement, benefits of group technology.						CO3
Unit 4	**Flexible Manufacturing Systems**						
	Components of an FMS, types of systems, where to apply FMS technology, FMS work stations, Material handling and storage system: Functions of the handling system, FMS layout configurations. Material handling equipment, Computer control system: Computer function, FMS data file, system reports. Planning the FMS, analysis methods for FMS, applications and benefits						CO4
Text Books	1. Groover, M.P. Automation, Production Systems and computer Integrated Manufacturing. Prentice Hall of India, 2007. Print. 2. S. Kalpakjian and S. R. Schmid, Manufacturing – Engineering and Technology, Pearson.						
Reference Books	1. Yoram Koren, Computer Control of Manufacturing Systems, McGraw Hill, 2005 2. CAD/CAM Principles and Applications, P.N. Rao, Tata McGraw Hill, 2010.						

In hours			
L	T	P	Credit
3	1	0	4

Course Code	MED353
Course Title	Production & Operation Management
Course Outcomes	- To understand the role of Production and operations management and productivity in the overall business strategy of the organization. - To understand the functions of PPC. - To identify the key factors affecting the location and layout. - To understand the selection and function of Material Handling Equipment and the concept of repair and maintenance.
Examination Mode	**Theory**

Assessment Tools	Written Quiz	Assignment/ Project Work	MSE	MTP	ESE	EPR	ABL/PBL
Weightage	10%	10%	25%		50%		5%

Syllabus		CO Mapping
Unit 1	**Introduction**	
	Production Management, Service verses Goods, Objectives, Scope & Functions/Activities of Production and Operation Management, Decisions in Production and Operation Management, Production Management verses Industrial Engineering. **Production and Productivity** Introduction, Fabrication, Manufacturing and Production, **Production Systems**: Intermittent System, Project System, Job Order Production, Batch Production, Continuous Production and their characteristics, Process Life Cycle or Production Life Cycle, Productivity, Measurement of Productivity, Ways to improve Productivity, Productivity and Fatigue, Relationship between Productivity and Standard of living.	CO1
Unit 2	**Production Planning and Control**	
	Production, Planning, Control, Definition and Objectives of PPC, Functions of PPC, (Pre-Planning, Active Planning and Post Planning), Definition and Concept of forecasting, Importance and application for purpose of sales forecasts, Methods of Sales forecast, Routing (Routing Procedures, Route Sheet and Route Cards, Advantages of good Routing), Scheduling Loading (Objectives of Loading, Adjustment to Machine Overloading and under loading), Dispatching (Duties/Activities of a dispatcher, Centralized and Decentralized dispatching), Control(Need and Significance, Objectives), Follow up Phase(Progress Reporting, Corrective Action, Common reasons for Production delay, Method of taking corrective action), Advantage of better PPC, Principles of Sound PPC, Assembly line balancing; Aggregate production planning; Master production scheduling; MRP and MRP-II	CO2
Unit 3	**Factory Organization**	

	Concept and structure of an organization, Significance and Requirement of an organization structure, Types of Organization- Military or Line Organization, Functional Organization, Line and Staff Organization, Committees Organization. **Facility Location and Layout** Need for a suitable location, Factor Affecting Plant Location, Selection of actual site, Selection of Urban, Suburban or Rural area, Comparison between Urban and Rural area in connection with selection of site, Recent Trends in Location of Industries. Ideal Plant Layout, Objectives of plant layout, Factors affecting the plant layout decision, Principles of plant layout, Material Flow System, Different types of layouts viz. Product, Process, Combination, Static or Project and Group layouts and their suitability. Computer aided layout design techniques.	CO3
Unit 4	**Material Handling**	
	Introduction, Definition and Concept, Material Handling and Plant Layout, Benefits, Negative aspects of Material Handling, Objectives of Material Handling, Functions of Material Handling, Principles of economic Material Handling, Selection of Material Handling Equipment, Types of Material Handling Equipment's. **Repair and Maintenance** Objective and importance of Maintenance, Different type of maintenance, Predictive and Preventive Maintenance, Procedure of Preventive Maintenance, Schedules of Preventive Maintenance, Nature of maintenance problem	CO4
Text Books	1. Bansal, V.B. *Industrial Engineering and Production Management.* New Delhi: Kapson Publishers. 2015. Print 2. Raju, N.V.S. *Industrial Engineering and Management*. New Delhi: Cengage Learning. 2013. Print.	
Reference Books	1. Chunawala. *Production and Operation Management.* New Delhi: Himalaya Publication. 2013. Print. 2. Dalela, and Ali, Mansoor. *Industrial Engineering and Management Systems*. New Delhi: Standard Publishing Distributors. 2010. Print. 3. Hicks. *Industrial Engineering & Management-A new perspective*. New Delhi: Tata McGraw Hill. 2014. Print. 4. Shankar, Ravi. *Industrial Engineering and Management*. New Delhi: Galgotia Publishers. 2010. Print. 5. Jain and Agarwal. *Production Planning & Control.* New Delhi: Khanna Publishers. 2013. Print. 6. Verma, A.P. *Industrial Engineering and Management*. New Delhi: Katson Books. 2010. Print.	

In hours			
L	**T**	**P**	**Credit**
3	1	0	4

Course Code	MED354
Course Title	**Product Innovation & Entrepreneurship**
Course Outcomes	- To know about entrepreneurship and entrepreneurship Support System. - To know the different types of business, market opportunities and product innovation. - To identify the various components of management and the importance of the management process in business. - To impart knowledge of venture creation.
Examination Mode	**Theory**

Assessment Tools	Written Quiz	Assignment/ Project Work	MSE	MTP	ESE	EPR	ABL/PBL
Weightage	10%	10%	25%		50%		5%

Syllabus		CO Mapping
Unit 1		
	Entrepreneur and Entrepreneurship Introduction, Definition, Concept, Characteristics, Classification, Types, Functions and Competencies **Entrepreneurship** Definition, Concept, Need, Entrepreneurship as a career option **Entrepreneurship Support System** Concept and Need of entrepreneurship support system	CO1
Unit 2	**Business Ownership and its Features** Sole proprietorship, Partnership, Joint Stock Companies, Cooperative, Private Limited, Public Limited and PPP mode **Market Survey, Opportunity and Product Innovation** Introduction, Industry and its Classification, Small Scale Industries (SSI): Definition, Objectives, Features and importance, Steps for starting SSIs, Procedure for registration of SSIs, Understanding business opportunity, Consideration in product selection, Data collection for setting up small venture Creative design thinking for concept generation; Detailed design & prototyping; Functionality & manufacturability; Bill of materials & components supply chain; Manufacturing & assembly plan; Product testing & quality assurance	CO2
Unit 3	**Managerial Aspects of Small Business Management** Fayol's principles, Functions of management, Levels of Management, Organization Structure, Principles of marketing management, Marketing Strategies, Personnel Management, Training and Development, **Labour Welfare** Definition and Concept, Significance, Features, Labour welfare schemes	CO3
Unit 4	**Venture Creation** Sustainable business options & pathways; Business model & business canvas; Startup team & business partners; Startup ecosystem and	CO4

	stakeholders; Technology business incubators & parks; Proposal pitching & agreements; Startup company incorporation; Social impact & responsibility	
Text Books	1. Singh, A.K. *Entrepreneurship Development and Management,* New Delhi: Laxmi Publication. . Second Edition. 2009. Print. 2. Bansal. *Entrepreneurship Development and Management*, New Delhi: Kapson. Print.	
Reference Books	1. Negendra. *Entrepreneurship and Management,* New Delhi: Pearson.1995. Print. 2. Saravate, Dilip. *Entrepreneurship Development and Project Managemen, Pune:* **Everest** Publication. Print. 3. Sharma Pritosh. *Entrepreneurship Development and Management, New Delhi:* **Dhanpat Rai & Co** Print. 4. Lal, A. K. *Entrepreneurship Development and Management,* Vayu Education. Print. 5. Bill Aulet, "Technology Entrepreneurship", 4th ed., Tata McGraw Hill, 2014. 6. Peter F. Drucker, "Innovation and Entrepreneurship", 1st ed., Harper Business, 2006. 7. Chelat Bhuvanachandran, Innovision, Khanna Book Publishing, 2022. 8. Byers, Dorf, and Nelson, Technology Ventures: From Ideas to Enterprise, McGraw Hill, 2010 9. Steve Blank, "The Startup Owner's Manual" 10. T.V. Rao, "Entrepreneurship - A South Asian Perspective"	

Program Elective II: As per elective basket

In hours			
L	**T**	**P**	**Credit**
0	0	4	2

Course Code	MED355	
Course Title	**Mechanical Engineering Laboratory-III (Manufacturing)**	
Course Outcomes	On the completion of the course the student will be able to: CO1: To provide an understanding of advanced manufacturing methods. CO2: To get an idea of the dimensional & form accuracy of products. CO3: To perform some advanced manufacturing operations CO4: To evaluate the accuracy & tolerance of components produced.	
Examination Mode	Practical	

Assessment Tools	Written Quiz	Project Work/Lab Performance	MSE	MTP	ESE	EPR	ABL/PBL
Weightage	-	20%	-	30%		50%	-

Syllabus		**CO Mapping**
Content	*List of experiments*	
	1. Taper turning and external thread cutting using lathe 2. Contour milling using vertical milling machine 3. Spur gear cutting in milling machine 4. Measurement of cutting forces in Milling/ Turning process 5. CNC part programming 6. Drilling of a small hole using wire EDM 7. Microprocessor controlled pick & place robot 8. Use of Tool Maker's Microscope 9. Comparator and sine bar 10. Surface finish measurement equipment 11. Bore diameter measurement using micrometer and telescopic gauge 12. Use of Autocollimator.	

In hours			
L	**T**	**P**	**Credit**
0	0	4	2

Course Code	MED356	
Course Title	**Engineering Project-1 (Seminar)**	
Course Outcomes	On the completion of the course the student will be able to: CO1: To understand and gain knowledge in different areas. CO2: To understand the design process. CO3: To understand the selection of materials. CO4: To understand the fabrication or prototyping.	
Examination Mode	Practical	

Assessment Tools	Written Quiz	Project Work/Lab Performance	MSE	MTP	ESE	EPR	ABL/PBL
Weightage	-	20%	-	30%		50%	-

Syllabus		**CO Mapping**
Content		
	This course is aimed to provide more weightage for project work. The project work could be done in the form of a summer project or internship in the industry or even a minor practical project in the college. Participation in any technical event/ competition to fabricate and demonstrate an innovative machine or product could be encouraged under this course.	

Program Elective 3, 4 and open electives as per baskets

In hours			
L	**T**	**P**	**Credit**
0	0	10	5

Course Code	MED403						
Course Title	**Engineering Project-II (Design and Analysis)**						
Course Outcomes	On the completion of the course the student will be able to: CO1: To understand and gain knowledge in different areas. CO2: To understand the design process. CO3: To understand the selection of materials. CO4: To understand the fabrication or prototyping.						
Examination Mode	Practical						
Assessment Tools	Written Quiz	Project Work/Lab Performance	MSE	MTP	ESE	EPR	ABL/PBL
Weightage	-	20%	-	30%		50%	-
Syllabus							**CO Mapping**
Content							
	This course is aimed to provide more weightage for project work. The project work could be done in the form of a summer project or internship in the industry or even a minor practical project in the college. Participation in any technical event/ competition to fabricate and demonstrate an innovative machine or product could be encouraged under this course.						

In hours			
L	**T**	**P**	**Credit**
0	0	14	7

Course Code	MED451	
Course Title	**Engineering Project-III (Prototyping and Testing)**	
Course Outcomes	On the completion of the course the student will be able to: CO1: To understand and gain knowledge in different areas. CO2: To understand the design process. CO3: To understand the selection of materials. CO4: To understand the fabrication or prototyping.	
Examination Mode	Practical	

Assessment Tools	Written Quiz	Project Work/Lab Performance	MSE	MTP	ESE	EPR	ABL/PBL
Weightage	-	20%	-	30%		50%	-

Syllabus		**CO Mapping**
Content		
	This course is aimed to provide more weightage for project work. The project work could be done in the form of a summer project or internship in the industry or even a minor practical project in the college. Participation in any technical event/ competition to fabricate and demonstrate an innovative machine or product could be encouraged under this course.	

PROGRAM ELECTIVE

In hours			
L	**T**	**P**	**Credit**
3	0	0	3

Course Code	MED 311 (PROGRAM ELECTIVE I)						
Course Title	**Finite Element Method**						
Course Outcomes	On the completion of the course the student will be able to: CO1: Students will learn about the basic concepts of FEM. CO2: To provide the knowledge of one, two dimensional and axisymmetric Problems in FEM. CO3: To provide the information of static, scalar field and dynamic problems. CO4: To know about the dynamic considerations and computer implementations.						
Examination Mode	Theory						
Assessment Tools	Written Quiz	Assignment/Project Work	MSE	MTP	ESE	EPR	ABL/PBL
Weightage	10%	10%	25%	-	50%	-	5%
Syllabus							**CO Mapping**
Unit 1	***Introduction***						
	Introduction: Historical Background, Mathematical modeling of field problems in engineering, governing equations, discrete and continuous models, boundary and initial value problems, Weighted Residual Methods, Variational formulation of boundary value problems, Ritz technique, Basic concept of Finite Element Method.						CO1
Unit 2	***Dimensional Problems***						
	One Dimensional Problems: One dimensional second order equation, discretization, linear and higher order elements, derivation of shape functions, Stiffness matrix and force vectors, assembly of elemental matrices, solution of problems from solid mechanics. Two Dimensional Problem: Finite Element Modeling, Constant Strain Triangle (CST), problem modelling and boundary conditions. The Four Node Quadrilateral, Numerical Integration, Higher Order Elements; Nine Node Quadrilateral, Eight Node Quadrilaterals, Six Node Triangle.						CO2
Unit 3	***Beams***						
	Introduction, Finite element modelling formulation, load vector, boundary considerations, shear force and bending moment, beams on elastic supports. Scalar Field Problems: Introduction, Steady-state heat transfer, Torsion						CO3
Unit 4	***Dynamic Considerations***						
	Dynamic Considerations: Element Mass Matrices, Evaluation of Eigen Values and Eigen Vectors. Computer Implementation: Introduction; Computer Program Organization for Calculation of System Matrices, Introduction to FE software.						CO4
Text Books	1. Chandrupatla, T.R and Belegundu A.D, T.S. Introduction to Finite Elements in Engineering, New Delhi: Pearson Education: 2015. Print. 2. Alavala, C. R.Finite Element Methods, New Delhi: PHI Learning Pvt. Ltd.2015.Print. 3. Moaveni, S. Finite Element Analysis, New Delhi: PHI Learning Pvt. Ltd. 2015.Print.						

Reference Books	1. Seshu, P. Textbook of Finite Element Analysis, New Delhi: PHI Learning Pvt. Ltd. 2015.Print. 2. Reddy, J. N.An Introduction to the Finite Element Method, New Delhi: McGraw Hill Education.2015. Print	
Online Resources	http://nptel.ac.in/courses/112104116/	

In hours			
L	**T**	**P**	**Credit**
3	0	0	3

Course Code	MED312 (PROGRAM ELECTIVE I)						
Course Title	**Tool Design**						
Course Outcomes	On the completion of the course the student will be able to: CO1: To know about material geometry of cutting tools and thermal aspects in machining CO2: To analyze the mechanics of cutting and jigs, fixture design. CO3: To familiar with die design and tool failure. CO4: To know about tooling cost.						
Examination Mode	Theory						
Assessment Tools	Written Quiz	Assignment/ Project Work	MSE	MTP	ESE	EPR	ABL/PBL
Weightage	10%	10%	25%	-	50%	-	5%
Syllabus							**CO Mapping**
Unit 1	*Introduction*						
	Materials and Geometry of cutting tools: Introduction, Desirable Properties of Tool Materials, Characteristics of Cutting Tool Materials, cutting tool geometry, Chip flow direction, Tool angles specification systems, Cutting parameters and Tool geometry, Index able inserts, chip breakers, Tools of unusual geometry. **Thermal aspects in machining and cutting fluid:** Regions of heat generation; Heat in the Primary Shear Zone, Heat at the Tool/work Interface, Heat Flow at the Tool Clearance Face, Average shear plane temperature; Average chip - tool interface temperature; method of tool temperature measurement, temperature distribution in tool, Cutting Fluid: Types and composition of cutting fluids, selection of cutting fluid.						CO1
Unit 2							
	Mechanics of metal cutting: Merchant's circle diagram - determination of cutting and thrust forces; Coefficient of friction; shear plane angle, Velocity and force relationship, shear stress and strain and strain rate in orthogonal cutting, stress distribution along rake face, theories of Lee and Shaffer's, Oxley's, etc. Cutting force measuring techniques i.e. dynamometer **Jigs and Fixture:** Principles of jig and fixture design, Principle of degrees of freedoms, methods of locations and clamping, Various devices for location and clamping, indexing devices, Hydraulic and pneumatic actuation of clamping devices, jig bushes, use of standard parts of jig design, type of drilling jigs, milling fixtures, lathe fixture, grinding fixtures and their classification.						CO2
Unit 3	*Design*						
	Die Design: Components of die design, design of die blocks, punches and strippers, methods of holding punches, sketches of stock stops, Design procedure						CO3

	for progressive dies, compound dies and combination dies for press tool operation forging die design for drop and machine forging parts. **Tool Wear, Tool Life and Machinability:** Tool wear mechanisms, Types of tool damage during cutting, Wear and chipping characteristics of different tool materials, Tool wear equations, tool failure criteria, Tool life equations, Effect of process Parameters on Tool life, Tool life testing, Machinability, Surface finish and surface integrity.	
Unit 4	*Surface Finish*	
	Tooling Costs: Estimating cost of a product, estimating costs of tools, Economics of tooling, Breakeven point analysis, minimum cost analysis. **Surface Finish:** Elements of surface finish, Factors affecting surface finish, Effect of surface quality on Functional properties of machine parts, Evaluation of surface finish, Indian Standards on surface finish. Measurement of surface finish, Relationship of surface finish to the production methods, finishing operations like honing, lapping, buffing super finishing etc.	CO4
Text Books	1. Sharma P.C. A Textbook of Production Engineering, New Delhi: S. Chand Publication. Print. 2. N. K. Mehta: Machine Tool Design McGraw Hill Publishing 3. S.K, Basu Machine Tool Design Oxford and IBH Publishing.	
Reference Books	1. Acherkan Machine Tool Design Mir publishing. 2. F. Koenigsberger: Design Principles of Metal-Cutting Machine Tools. 3. ASTM, Fundamentals of Tool Design. 4. Donaldson C. Tool Design, McGraw Hill.	

In hours			
L	**T**	**P**	**Credit**
3	0	0	3

Course Code	MED313 (PROGRAM ELECTIVE I)
Course Title	**Total Quality Management**
Course Outcomes	• To equip the students with knowledge about statistical tools. • To provide knowledge about quality levels and different quality management tools. • To provide knowledge about six sigma and quality assurance and systems. • To provide information about different types of audits and the economics of product inspection.
Examination Mode	**Theory**

Assessment Tools	**Written Quiz**	**Assignment/ Project Work**	**MSE**	**MTP**	**ESE**	**EPR**	**ABL/PBL**
Weightage	10%	10%	25%		50%		5%

Syllabus		**CO Mapping**
Unit 1		
	Introduction to quality Introduction, need for quality, evolution for quality, the definition of quality, product quality and service quality, Basic concepts of TQM, review of statistical concepts, test of normality for a given data, causes of variation, chance and assignable causes, statistical basis for control charts, basic control charting principles. TPM- concepts, improvement needs, performance measures. TQM implementation in manufacturing and service sectors. Introduction to control charts for variables and attributes, Process capability analysis: Introduction, specification limits and control limits, process capability indices, the Cp index, upper and lower capability indices, the Cpk index.	CO1
Unit 2	**Total Quality Management and tools** Principles, leadership, strategic quality planning, Philosophies and frameworks, pillars of TQM: Leadership, Customer focus, Customer orientation and satisfaction, Customer complaints, Customer retention, Costs to quality, Quality Councils, Human Aspects in Management of Quality, Employee Involvement, motivation, Empowerment, team and teamwork, zero defects, quality circles, recognition and reward, Contribution of Deming, Continuous Process Improvement, PDCE cycle, 5S, Kaizen, Supplier partnership, Partnering, supplier rating and selection. TQM Tools: Benchmarking, Quality Function Deployment (QFD) – House of Quality, Taguchi Quality Loss Function, Juran and Crosby, Barriers to TQM, Seven traditional tool of quality, New management tools, PDCA methodology.	CO2
Unit 3	**Six Sigma** Statistical basis for six sigma, concepts of six sigma, DMAIC methodology, project selection for six sigma, tools and techniques, FMEA- stages and types. **Quality assurance and systems:**	CO3

	Definition, Activities associated with quality assurance, Quality statement, characteristics of quality assurance system Quality systems, need for ISO 9000, ISO 9001-2015, documentation requirement, guidelines for preparation of quality manual. Steps for certification, benefits of ISO –9000 implementation.	
Unit 4	**Audit** Quality audit: definition, internal audit, second party, third party audit, pre-assessment and compliance audit, procedure of auditing, audit planning, audit execution.	CO4
Text Books	1Bansal, V.B. *Industrial Engineering and Production Management.* New Delhi: Kapson Publishers. 2015. Print 2Raju, N.V.S. *Industrial Engineering and Management*. New Delhi: Cengage Learning. 2013. Print.	
Reference Books	1Chunawala. *Production and Operation Management.* New Delhi: Himalaya Publication. 2013. Print. 2Dalela, and Ali, Mansoor. *Industrial Engineering and Management Systems*. New Delhi: Standard Publishing Distributors. 2010. Print. 3Hicks. *Industrial Engineering & Management-A new perspective*. New Delhi: Tata McGraw Hill. 2014. Print. 4Shankar, Ravi. *Industrial Engineering and Management*. New Delhi: Galgotia Publishers. 2010. Print. 5Jain and Agarwal. *Production Planning & Control.* New Delhi: Khanna Publishers. 2013. Print. 6Verma, A.P. *Industrial Engineering and Management*. New Delhi: Katson Books. 2010. Print. 7Bill Aulet, "Technology Entrepreneurship", 4th ed., Tata McGraw Hill, 2014.	

In hours			
L	**T**	**P**	**Credit**
3	0	0	3

Course Code	MED314 (PROGRAM ELECTIVE I)	
Course Title	**Refrigeration and Air-Conditioning**	
Course Outcomes	On the completion of the course the student will be able to: CO1: Analyze the reversed Carnot cycle and vapour compression refrigeration cycle (VCR). CO2: Select the air-refrigeration systems for aircraft, and vapour absorption refrigeration system for rural and remote areas and select environmental friendly refrigerants considering the international standards. CO3: Identify the Psychometric processes for different applications and design the parameters of air-conditioning system as per standards. CO4: Estimate cooling load and heating load considering human comfort and optimize the air conditioning system as per requirements.	
Examination Mode	Theory	

Assessment Tools	Written Quiz	Assignment/ Project Work	MSE	MTP	ESE	EPR	ABL/PBL
Weightage	10%	10%	25%	-	50%	-	5%

Syllabus		CO Mapping
Unit 1	***Introduction to Refrigeration and Air-Conditioning***	
	Introduction: Basic Definitions of Refrigeration and Air-Conditioning; History of Refrigeration; Natural and Artificial Refrigeration Methods; Techniques to produce low temperatures; Applications of Refrigeration; Refrigerants- Classification, Nomenclature, Desirable Properties, Selection. Air Refrigeration: Air Refrigeration Cycles - reversed Carnot cycle; Bell-Coleman cycle analysis; various methods of Aircraft Refrigeration: Analysis, Merits and demerits. Vapor Compression Refrigeration System:	CO1
Unit 2	***Vapor Compression Refrigeration System***	
	Ideal VCR cycle (Working, Analysis and Limitations); Standard VCRS (Working and Analysis); Methods to improve performance of VCR; Multi-Stage VCRS; Cascade Refrigeration. Components of Refrigeration Systems: Compressors: Positive Displacement (Reciprocating and Rotary); Dynamic (Centrifugal and Axial) Compressors; Condensers and Evaporators (Both Natural and Forced Convection type); Expansion Devices and other components of the system.	CO2
Unit 3	***Vapor Absorption Systems***	
	Working and Analysis; Absorbent - Refrigerant combinations; WaterAmmonia Systems; Water-Lithium Bromide System; Modified Version of Aqua-Ammonia System with Rectifier and Analyzer Assembly. Other Refrigeration systems: Brief Discussion on (i) Steam-Jet refrigeration system; (ii) Vortex tube refrigeration; (iii) Thermoelectric refrigeration system; and (iv) Magnetic refrigeration.	CO3
Unit 4	***Psychrometry***	

	Classification of Air-Conditioning Systems; ASHRAE Nomenclature; Applications of Air-Conditioning; Psychrometry - Air-water vapor mixtures; Psychrometric Properties; Psychrometric or Air-Conditioning processes; Psychrometric Chart. Air-Conditioning Systems: Classification of Air-Conditioning Systems; Psychrometry of Air Conditioning Systems; Thermal Comfort (Definition and Psychrometric Properties for Thermal Comfort); Mathematical Analysis of Air-Conditioning Systems; Cooling and Heating Load Estimation; a brief discussion on Ventilation.	CO4
Text Books	1. A Text book of Refrigeration and Air conditioning" by Kurmi R S and J K Gupta 2. ASHRAE Handbook (Fundamentals)	
Reference Books	1. Manohar Prasad, Refrigeration and Air Conditioning, New Age International, 2004. 2. Dossat R.D., Principle of Refrigeration, 4th ed., Prentice-Hall, 1997. 3. Arora, C.P., Refrigeration and Air Conditioning, 2nd ed., Tata McGraw-Hill, 2000. Online Resources: 1 https://onlinecourses.nptel.ac.in/noc22_me135/preview	

	In hours		
L	**T**	**P**	**Credit**
3	0	0	3

Course Code	MED361 (PROGRAM ELECTIVE II)						
Course Title	**Mechanical Vibrations**						
Course Outcomes	On the completion of the course the student will be able to: CO1: This course will enable students to fully understand and appreciate the importance of vibration in mechanical design of machine parts that operate in vibratory conditions CO2: Students will able to write the differential equation of motion of vibratory systems CO3: This course will enable students to make free and forced (Periodic, non-periodic, harmonic etc.) vibration analysis of single and multi-degree of freedom linear systems CO4: To know about the continuous systems and Multi Degree Freedom Systems.						
Examination Mode	Theory						
Assessment Tools	Written Quiz	Assignment/Project Work	MSE	MTP	ESE	EPR	ABL/PBL
Weightage	10%	10%	25%	-	50%	-	5%
Syllabus						**CO Mapping**	
Unit 1	***Introduction***						
	Types of vibrations, Simple Harmonic Motion (S.H.M), principle of super position applied to Simple Harmonic Motions. Beats, Fourier theorem and simple problems Undamped Free Vibrations: Single degree of freedom systems, Mass Undamped free vibration-natural frequency of free vibration, stiffness of spring elements, effect of mass of spring, Compound Pendulum					CO1	
Unit 2	***Damped Free Vibrations***						
	Single degree freedom systems, different types of damping, concept of critical damping and its importance, study of response of viscous damped systems for cases of under damping, critical and over damping, Logarithmic decrement. Forced Vibrations: Single degree freedom systems, steady state solution with viscous damping due to harmonic force, Solution by Complex algebra, Reciprocating and rotating unbalance, vibration isolationtransmissibility ratio. Due to harmonic excitation and support motion					CO2	
Unit 3	***Vibration Measuring Instruments***						
	Whirling of shafts, Vibrometer meter and accelerometer, Whirling of shafts with and without air damping, Discussion of speeds above and below critical speeds, Combined with shear, strain energy under combined loading. Systems with Two Degrees of Freedom: Introduction, principle modes and Normal modes of vibration, co-ordinate coupling, generalized and principal co-ordinates, free vibration in terms of initial conditions. Geared systems, Forced Oscillations-Harmonic excitation Applications: a) Vehicle suspension b) Dynamic vibration absorber. c) Dynamics of reciprocating Engines.					CO3	
Unit 4	***Continuous systems***						

	Introduction, vibration of string, longitudinal vibration of rods, Torsional vibration of rods, Euler's equation for beams. Numerical Methods for Multi Degree Freedom Systems: Introduction, Influence coefficients, Maxwell reciprocal theorem, Dunkerley's equation, Orthogonality of principal modes, Method of matrix iteration- Method of determination of all the natural frequencies using sweeping matrix and Orthogonality principle, Holzer's method, Stodola method.	CO4
Text Books	1. Leonard, Meirovitch. Elements of Vibrations Analysis. , Tata McGraw Hill,1986. Print. 2. Rao, S.S. Mechanical Vibrations. Pearson Education, 2003. Print. 3. Kelly, S. G. Mechanical Vibrations: Schaum's Outline Series. New Delhi: Tata McGraw Hill,2007. Print	
Reference Books	1 Bhave, Shrikant.Mechanical Vibrations: Theory and Practice. Pearson Education, New Delhi. 2010. Print. 2. Venkatachalam R., Mechanical Vibrations.PHI Learning Pvt. Ltd. New Delhi. 2014. Print.	
Online Resources	http://nptel.ac.in/courses/112103111/	

In hours			
L	**T**	**P**	**Credit**
3	0	0	3

Course Code	MED362 (PROGRAM ELECTIVE II)
Course Title	**Flexible Manufacturing System**
Course Outcomes	On the completion of the course the student will be able to: CO1: To learn about manufacturing system. CO2: To learn about the automated assembly line, about the types of group technology, CO3: To about the types of robotic technology CO4: To about the types of robotic Programming.
Examination Mode	Theory

Assessment Tools	Written Quiz	Assignment/ Project Work	MSE	MTP	ESE	EPR	ABL/PBL
Weightage	10%	10%	25%	-	50%	-	5%

Syllabus		CO Mapping
Unit 1	***Introduction***	
	Components of an FMS, types of systems, where to apply FMS technology, FMS work stations, Material handling and storage system: Functions of the handling system, FMS layout configurations. Material handling equipment, Computer control system: Computer function, FMS data file, system reports. Planning the FMS, analysis methods for FMS, applications and Benefits Part families, parts classification and coding, types of classification and coding systems, Machine cell design: The composite part concept, types of cell designs, determining the best machine arrangement, benefits of group technology.	CO1
Unit 2	***Automation***	
	Types of automation, reasons for automating, automation strategies, Detroit-type automation: Automated flow lines, methods of work part transport, Transfer mechanisms, buffer storage, automation for machining operations. Design for automated assembly, types of automated assembly systems, part feeding devices, quantitative analysis of the delivery system operation, and analysis of a single-station assembly machine, numerical.	CO2
Unit 3	***Robotic Technology***	
	Joints and links, common robot configurations, work volume, types of robot control, accuracy and repeatability, other specifications, end effectors, sensors in robotics.	CO3
Unit 4	***Robot programming***	
	Types of programming, lead through programming, motion Programming, interlocks, advantages and disadvantages. Robot languages: Motion programming, simulation and off-line programming, work cell control.	CO4
Text Books	1. Groover, M.P. Automation, Production Systems and computer Integrated Manufacturing. Prentice Hall of India, 2007. Print. 2. Singh, Nanua. Approach to Computer Integrated Design and Manufacturing. John Wiley and Sons,2006. Print.	

Reference Books	1. Browne, J., Harhen, J. and Shivnan, J. Production Management Systems: A CIM Perspective. Addison Wesley,1989. Print.	
Online Resources	http://nptel.ac.in/courses/110106044	

In hours			
L	T	P	Credit
3	0	0	3

Course Code	MED363 (PROGRAM ELECTIVE II)						
Course Title	**Entrepreneurship Development and Management**						
Course Outcomes	• To know about entrepreneurship and entrepreneurship Support System. • To know the different types of business and market opportunities. • To identify the various components of management and the importance of management process in business. • To impart the knowledge and awareness about various rules, regulations and act concerned with business.						
Examination Mode	**Theory**						
Assessment Tools	**Written Quiz**	**Assignment/ Project Work**	**MSE**	**MTP**	**ESE**	**EPR**	**ABL/PBL**
Weightage	10	10	25		50		5
Syllabus							**CO Mapping**
Unit 1							
	Entrepreneur and Entrepreneurship Introduction, Definition, Concept, Characteristics, Classification, Types, Functions and Competencies **Entrepreneurship** Definition, Concept, Need, Entrepreneurship as a career option **Entrepreneurship Support System** Concept and Need of entrepreneurship support system						CO1
Unit 2	**Business Ownership and its Features** Sole proprietorship, Partnership, Joint Stock Companies, Cooperative, Private Limited, Public Limited and PPP mode **Market Survey and Opportunity** Introduction, Industry and its Classification, Small Scale Industries (SSI): Definition, Objectives, Features and importance, Steps for starting SSIs, Procedure for registration of SSIs, Understanding business opportunity, Consideration in product selection, Data collection for setting up small venture**.**						CO2
Unit 3	**Project Report Preparation** **Project:** Introduction, Definition and Concept **Project identification:** Introduction, Definition and Concept, Ways for selecting a project, Guidelines for selecting a project. **Project Report:** Definition and Concept, Need of project report, Contents of a project report, Salient features of a project report, Uses of the project report, Preliminary Project Report (PPR), Detailed Project Report (DPR) **Project Formulation:** Definition and Concept, Elements of project formulation **Project Appraisal:** Definition and Concept, Objectives, Need, Stages of project appraisal						CO3
Unit 4	**Wage Payment**						CO4

	Introduction, Wage, Type of wages, Wage differentials, Objective of good wage –incentive plan, Basis of good wage incentive plan, System of wage payment. **Industrial Legislation and Laws** Introduction, Need of industrial legislation, Types of taxes: Income tax, Sales tax, Excise duty, Provident fund, Legal aspects of small business, Factory Act, 1948, Payment of wages act, 1936, Workmen Compensation Act, 1947, Industrial dispute act, 1947, Employee state insurance act, 1948, Minimum wages act, 1948.	
Text Books	1Singh, A.K. *Entrepreneurship Development and Management,* New Delhi: Laxmi Publication. . Second Edition. 2009. Print. 2Bansal. *Entrepreneurship Development and Management*, New Delhi: Kapson. Print.	
Reference Books	1Negendra. *Entrepreneurship and Management,* New Delhi: Pearson.1995. Print. 2Saravate, Dilip. *Entrepreneurship Development and Project Managemen, Pune:* **Everest** Publication. Print. 3Sharma Pritosh. *Entrepreneurship Development and Management, New Delhi:* **Dhanpat Rai & Co** Print. 4Lal, A. K. *Entrepreneurship Development and Management,* Vayu Education. Print.	

In hours			
L	**T**	**P**	**Credit**
3	0	0	3

Course Code	MED364 (PROGRAM ELECTIVE II)	
Course Title	**Gas Dynamics**	
Course Outcomes	On the completion of the course the student will be able to: CO1: Apply the thermodynamics concepts in relation to compressible flows and derive relationships between various compressible flow parameters CO2: Understanding of isentropic compressible flows in variable area ducts and apply in design of static components like nozzles and diffusers CO3: Develop relationship for shocks and determine their characteristics under various conditions CO4: Analyse the performance of aircraft and rocket propulsion engines.	
Examination Mode	Theory	

Assessment Tools	Written Quiz	Assignment/ Project Work	MSE	MTP	ESE	EPR	ABL/PBL
Weightage	10%	10%	25%	-	50%	-	5%

Syllabus		**CO Mapping**
Unit 1	***Introduction to basic concept of gas dynamics***	
	Energy and momentum equations of compressible fluid flows – Stagnation states – Mach waves and Mach cone – Effect of Mach number on compressibility. Isentropic flows: Isentropic flow through variable area ducts.	CO1
Unit 2	***Isentropic Flow***	
	Nozzle and Diffusers, compressors and turbines – Use of Gas tables. Flow through ducts: Flow through constant area ducts with heat transfer (Rayleigh flow) and Friction (Fanno flow) – Variation of flow properties – Use of tables and charts – Generalized gas dynamics	CO2
Unit 3	***Normal and oblique shocks***	
	Governing equations – Variation of flow parameters across the normal and oblique shocks – Prandtl Meyer relations – Expansion of supersonic flow, Use of table and charts – Applications.	CO3
Unit 4	***Jet propulsion and Space propulsion***	
	Theory of jet propulsion – Thrust equation – Thrust power and propulsive efficiency – Operation principle – cycle analysis and use of stagnation state performance of ram jet, turbojet, turbofan and turbo-prop engines – Aircraft combustors. Types of rocket engines – Propellants – Ignition and combustion – Theory of rocket propulsion – Performance study – Staging – Terminal and characteristic velocity – Applications – Space flights	CO4
Text Books	1.Yahya S. M. "Fundamentals of Compressible Flow with aircraft and rocket propulsion", 5/e,New Age International publishers, 2016. 2. John D. Anderson Jr. "Modern Compressible Flow with historical perspective", 2/e, McGraw Hill Publishing company, International Edition, 1990.	

Reference Books	1. Balachandran P. "Fundamentals of Compressible Fluid Dynamics", PHI Learning India Private Ltd., 2009. 2. Shapiro A. H. "Dynamics and Thermodynamics of Compressible Fluid Flow – Volume I", John Wiley, New York, 1953. 3. Cohen. H., G.E.C. Rogers and Saravanamutto, "Gas Turbine Theory", Longman Group Ltd.,1980 4. Ganesan. V., "Gas Turbines", Tata McGraw Hill Publishing Co., New Delhi, 2010. 5. Shapiro. A.H.," Dynamics and Thermodynamics of Compressible fluid Flow", John wiley, New York, 1953. 6. Sutton. G.P., "Rocket Propulsion Elements", John wiley, New York,2010,. Zucrow. N.J., "Principles of Jet Propulsion and Gas Turbines", John Wiley, New York, 1970.	
Online Sources	https://archive.nptel.ac.in/courses/112/106/112106166/	

	In hours			
	L	**T**	**P**	**Credit**
	3	0	0	3

Course Code	MED411 (PROGRAM ELECTIVE III)						
Course Title	**Advanced Materials**						
Course Outcomes	On the completion of the course the student will be able to: CO1: Students will learn about the nano materials CO2: Students will learn about the Composite materials CO3: Students will learn about the Plastic materials CO4: Students will learn about the design and development of composite materials						
Examination Mode	Theory						
Assessment Tools	Written Quiz	Assignment/Project Work	MSE	MTP	ESE	EPR	ABL/PBL
Weightage	10%	10%	25%	-	50%	-	5%
Syllabus							**CO Mapping**
Unit 1	***Nano materials***						
	Carbon nanotubes, structure and properties, chemistry of carbon nanotubes, graphite whiskers, cones and polyhedral crystals, nano crystalline diamond, carbide derived carbon nanotubes in multifunctional polymer nano composites, nano structured materials for field emission devices, nano textured carbons for electrochemical energy storage.						CO1
Unit 2	***Composites***						
	Introduction, reinforcements, matrix materials, processing, interface, micromechanics, monotonic behaviour, cyclic fatigue, creep, wear, applications, shape memory alloys (SMAs), metallic foam, recemat metal foam etc.						CO2
Unit 3	***Plastics***						
	Introduction to plastics, polymeric materials (molecular viewpoint),microstructures in polymers, mechanical properties (macro view point) chemical and physical properties (macro view point), designing with plastics, thermoplastic materials (commodity plastics), thermoplastic materials(engineering plastics), thermo set materials, elastomeric (rubber) materials, extrusion, injection moulding, blow moulding, thermoforming, rotational moulding, casting, foaming, compression moulding, transfer moulding, and related processes, radiation, finishing, adhesion and assembly operations and management, Environmental aspects of plastics.						CO3
Unit 4	***Development of Advanced Composite Materials***						
	Micromechanical behaviour of a lamina, Mechanics of materials and elasticity approach to stiffness, Comparison of approaches, Mechanics of materials approach to strength. Fatigue behaviour in composites, Effect of holes in laminates, Fracture mechanics with reference to composites, transverse shear effects, Post curing shapes of un symmetric laminates, Environmental effects. Design of Composite Materials: Introduction to design of composite structures, structural design, material selection, configuration selection,						CO4

	laminate joints, Design requirements and design failures criteria, optimization concepts, design analysis philosophy for composite structures.	
Text Books	1Sehgal, Lindberg R.A. Materials, their Nature, Properties and Fabrication. New Delhi: S Chand. Print. 2Polmear, I. J. Light alloys: Metallurgy of Light Metals. Arnold. 3rd Edition. 1995. Print.	
Reference Books	1Robert, M. Mechanics of Composite Materials. Print.	

In hours			
L	T	P	Credit
3	0	0	3

Course Code	MED412 (PROGRAM ELECTIVE III)						
Course Title	**Non Destructive Testing**						
Course Outcomes	On the completion of the course the student will be able to: CO1: To aware the description of non-destructive methods. CO2: To know about liquid penetration testing methods. CO3: To know about magnetic particle testing. CO4: To know about eddy current testing.						
Examination Mode	Theory						
Assessment Tools	Written Quiz	Assignment/ Project Work	MSE	MTP	ESE	EPR	ABL/PBL
Weightage	10%	10%	25%	-	50%	-	5%
Syllabus							**CO Mapping**

Unit 1	*Introduction*	
	Non-destructive versus destructive testing, Overview of the Non Destructive Testing Methods for the detection of manufacturing defects as well as material characterization, applications in NDT. **Visual Inspection:** Introduction, basic terms associated with visual inspection, equipment and accessories used for visual inspection, Visual Detection of Discontinuities, Evaluation of test results, application, advantage and limitations.	CO1
Unit 2	*Liquid Penetration Testing*	
	Introduction, principle, equipment, characteristics of penetrants and their types, developer, hazards precautions, Evaluation of test results, application, advantage and limitations. **Radiographic Testing:** X-ray radiography principle, equipment & methodology-Type of industrial sources and application –Radiographic exposure factor and Technique-gamma ray and X-Ray equipment- Radiographic procedure, interpretation. Precautions against radiation hazards, application, advantage and limitations.	CO2
Unit 3	*Magnetic Particle Testing*	
	Principle of magnetic particle testing, basic terms associated with magnetic particle testing, different methods to generate fields, Magnetic particle testing equipment, Magnetic particle testing procedures, method of de- agnetization, magnetic particle medium, Evaluation of indication, application, advantage and limitations. **Ultrasonic Testing:** Introduction, principle of operation, basic terms associated with ultrasonic testing, type of ultrasonic propagation and probes, type of transducers, data representation, A-Scan, B-scan, C-scan, and Method for evaluating discontinuities, elastic studyof wood, application, advantage and limitations.	CO3
Unit 4	*Eddy Current Testing*	

	Introduction, principle of operation,basic terms associated with eddy current testing, Factor effecting eddy current-defect-frequency-geometry-conductivity-Proximity (Lift off & Fill Factor),eddy current flow characteristics, test equipment, types of probes, eddy current application and signal display, advantage and limitations.	CO4
Text Books	1. Davies, Troxell, and Hauck G.F.W.The testing of Engineering materials, New York: McGraw Hill. Print.	
Reference Books	1. Armstrong, W.H. Mechanical Inspection, New York: McGraw Hill. Print.	
Online Resources	http://nptel.ac.in/courses/113106070/	

	In hours			
	L	**T**	**P**	**Credit**
	3	0	0	3

Course Code	MED 413(PROGRAM ELECTIVE III)						
Course Title	Industrial Safety						
Course Outcomes	• To impart the valuable skills to plan and understand importance of Industrial Safety. • To know the socio-techno-economic aspects related to the Occupational health and safety. • To have the understanding about operational Safety.						
Examination Mode	**Theory**						
Assessment Tools	**Written Quiz**	**Assignment/ Project Work**	**MSE**	**MTP**	**ESE**	**EPR**	**ABL/PBL**
Weightage	10%	10%	25%		50%		5%
Syllabus							**CO Mapping**
Unit 1							
	Safety: Meaning & need for safety. Relationship of safety with plant design, equipment design and work environment. Industrial accidents, their nature, types and causes. Assessment of accident costs; prevention of accidents. Industrial hazards, Hazard identification techniques, Accident investigation, reporting and analysis. Safety and economics, safety and productivity. Employee's participation in safety. Safety legislation.						CO1
Unit 2	**Environment:** Environmental factors in industry. Effect of temperature, Illumination, humidity noise and vibrations on human body and mind. Physiology of heat regulation. Thermal environment and its measurement. Thermal comfort. Indices of heat stress. Thermal limits for comfort, efficiency and freedom from health risk. Natural ventilation. Mechanical ventilation. Air conditioning Process ventilation. Control of heat exposures, control at source, insulation, and local exhaust ventilation. Control of radiant heat, dilution ventilation. Local relief.						CO2
Unit 3	**Industrial Lighting:** Purpose of lighting, benefits of good illumination. Phenomenon of lighting and safety. Lighting and the work. Sources and types of artificial lighting. Principles of good illumination. Recommended optimum standards of illumination. Design of lighting installation. **Noise and Vibrations:** Continuous and impulse noise. The effect of noise on man. Noise measurement and evaluation of noise. Noise isolation. Noise absorption techniques. Silencers Vibrations: Effect, measurement and control measures.						CO2
Unit 4	**Operational Safety:** General safety considerations in material handling – manual and mechanical, safety in machine shop, safety in use of hand and portable (power) tools, safety in use of electricity, safety in welding and cutting, principles of guarding, safety in grinding, safety in heat treatment shop, safety in gas furnace operation.						CO3
Text Books	1. Krishnan N V, *"Safety management in Industry",* Jaico Publishing House, Delhi (1993).						

	2. Kocurek Dianna and Woodside Gayle, *"Environment, Safety, and Health Engineering"*, John Wiley and Sons, New York (1997).
Reference Books	1. McCormick J, *"Human Factors in Engineering and Design"*, Tata McGraw Hill Pub Company Limited, New Delhi (1979). 2. Willie Hammer, Dennis Price, "Occupational Safety Management and Engineering", 5th Ed., Pearson Edu (2000). 3. David Goetsch, "The Safety and Health Handbook", Pearson Education (1999).

1. McCormick J, *"Human Factors in Engineering and Design"*, Tata McGraw Hill Pub Company Limited, New Delhi (1979).

2. Willie Hammer, Dennis Price, "Occupational Safety Management and Engineering", 5th Ed., Pearson Edu (2000).

3. David Goetsch, "The Safety and Health Handbook", Pearson Education (1999).

In hours			
L	**T**	**P**	**Credit**
3	0	0	3

Course Code	MED414 (PROGRAM ELECTIVE III)
Course Title	**Non-Conventional Energy Sources**
Course Outcomes	On the completion of the course the student will be able to: CO1: Know the need of renewable energy resources, historical and latest developments. CO2: Describe the use of solar energy and the various components used in the energy production with respect to applications like-heating, cooling, desalination, power generation, drying, cooking etc. CO3: Appreciate the need of Wind Energy and the various components used in energy generation and know the classifications. CO4: Understand the concept of Biomass energy resources and their classification, types of biogas Plants- applications
Examination Mode	Theory

Assessment Tools	Written Quiz	Assignment/ Project Work	MSE	MTP	ESE	EPR	ABL/PBL
Weightage	10%	10%	25%	-	50%	-	5%

Syllabus		**CO Mapping**
Unit 1	***Solar Radiation***	
	Energy source, India's production and reserves of commercial energy sources, need for nonconventional energy sources, energy alternatives, solar, thermal, photovoltaic. Water power, wind biomass, ocean temperature difference, tidal and waves, geothermal, tar sands and oil shale, nuclear (Brief descriptions); advantages and disadvantages, comparison (Qualitative and Quantitative). Extra-Terrestrial radiation, spectral distribution of extra-terrestrial radiation, solar constant, solar radiation at the earth's surface, beam, diffuse and global radiation, solar radiation data. Measurement of Solar Radiation: Pyrometer, shading ring pyrheliometer, sunshine recorder, schematic diagrams and principle of working. Solar Radiation Geometry: Flux on a plane surface, latitude, declination angle, surface azimuth angle, hour angle, zenith angle, solar altitude angle expression for the angle between the incident beam and the normal to a plane surface (No derivation) local apparent time. Apparent motion of sum, day length, numerical examples. Beam, diffuse and reflected radiation, expression for flux on a tilted surface (no derivations) numerical examples.	CO1
Unit 2	***Performance Analysis of Liquid Flat Plate Collectors***	
	General description, collector geometry, selective surface (qualitative discussion) basic energy-balance equation, stagnation temperature, transmissivity of the cover system, transmissivity – absorptivity product, numerical examples. The overall loss coefficient, correlation for the top loss coefficient, bottom and side loss coefficient, problems (all correlations to be provided). Temperature distribution between the collector tubes, collector heat removal factor, collector efficiency factor	CO2

	and collector flow factor, mean plate temperature, instantaneous efficiency (all expressions to be provided). Effect of various parameters on the collector performance; collector orientation, selective surface, fluid inlet temperature, number covers, dust.	
Unit 3	***Wind Energy and Tidal Power***	
	Properties of wind, availability of wind energy in India, wind velocity and power from wind; major problems associated with wind power, wind machines; Types of wind machines and their characteristics, horizontal and vertical axis wind mills, elementary design principles; coefficient of performance of a wind mill rotor, aerodynamic considerations of wind mill design, numerical examples. Tidal Power: Tides and waves as energy suppliers and their mechanics; fundamental characteristics of tidal power, harnessing tidal energy, limitations.	CO3
Unit 4	***Geothermal Energy Conversion***	
	Principle of working, types of geothermal station with schematic diagram, geothermal plants in the world, problems associated with geothermal conversion, scope of geothermal energy. Energy from Bio Mass: Photosynthesis, photosynthetic oxygen production, energy plantation, bio gas production from organic wastes by anaerobic fermentation, description of bio-gas plants, transportation of bio-gas, problems involved with bio-gas production, application of bio-gas, application of bio-gas in engines, advantages.	CO4
Text Books	1 Non-Convention Energy Resources B H Khan McGraw Hill Education (India) Pvt. Ltd. 3rd Edition. 2 Solar energy Subhas P Sukhatme Tata McGraw Hill 2 nd Edition, 1996. 3 Non-Conventional Energy Sources G.D Rai Khanna Publishers 2003	
Reference Books	1 Renewable Energy Sources and Conversion Technology N.K.Bansal, Manfred Kleeman&MechaelMeliss Tata McGraw Hill. 2004 2 Renewable Energy Technologies Ramesh R & Kumar K U Narosa Publishing House New Delhi 3 Conventional Energy Systems K M, Non Wheeler Publishing Co. Ltd., New Delhi 2003 4 Non-Conventional Energy Ashok V Desai Wiley Eastern Ltd, New Delhi 2003 https://archive.nptel.ac.in/courses/121/106/121106014/	

In hours			
L	**T**	**P**	**Credit**
3	0	0	3

Course Code	MED461 (PROGRAM ELECTIVE IV)						
Course Title	**Mechanical Behaviour of Materials**						
Course Outcomes	On the completion of the course the student will be able to: CO1: Understand the mechanical behavior of ductile and brittle materials CO2: Analyze creep, fatigue and fracture mechanisms for various materials CO3: Develop fracture mechanism maps and analyze the reasons for failure of materials CO4: Select a characterization technique to evaluate the behavior of materials						
Examination Mode	Theory						
Assessment Tools	Written Quiz	Assignment/ Project Work	MSE	MTP	ESE	EPR	ABL/PBL
Weightage	10%	10%	25%	-	50%	-	5%
Syllabus							**CO Mapping**
Unit 1	***Introduction to mechanical behaviour:***						
	A brief review of elastic and plastic deformation, dislocations and their properties. Dislocations in FCC, BCC and HCP metals, interactions with point defects and other dislocations. Tensile behavior, evaluation of strength and ductility parameters, Effect of strain rate and temperature on tensile behavior, and Protevin Le-Chatelier effect. Types and mechanisms of creep deformation, Creep under combined stresses, deformation mechanism maps, Super plasticity, environmental effects, remaining life assessment.						CO1
Unit 2	***Fatigue Behaviour:***						
	High and low cycle fatigue, process of fatigue fracture, effect of mean stress, Cyclic stress/strain response of materials, establishment of cyclic stress/ strain curve, transition fatigue life, Coffin-Manson relationship, Evaluation of parameters, characterizing resistance against high cycle and Low cycle fatigue, Creep fatigue interaction, environmental effects, thermochemical fatigue.						CO2
Unit 3	***Fracture Mechanics & Failure analysis:***						
	Brief review of the basic concepts of linear elastic and elastic-plastic fracture mechanics, stress intensity parameter, J- integral and crack tip opening displacement as fracture criteria, standard procedures for experimental determination of these parameters. Analyzing Fractures, Micro mechanisms of brittle and ductile fracture, fracture mechanism maps, fractography, Visual Examination & Management of Applied Failure Analysis, Manage Failure Analysis.						CO3
Unit 4	***Materials characterization techniques:***						
	Optical microscopy techniques, Quantitative metallography, Scanning electron microscopy: Image formation methods in SEM. Applications.						CO4
Text Books	1. Mechanical Metallurgy, George E. Dieter, McGraw Hill, 2nd Edition, 2005. 2. Introduction to Fracture Mechanics, Hellan K, McGraw Hill, 2002. 3. Mechanical Behavior of Materials at Elevated Temperatures, J.E.Dorn, McGraw Hill, 2000.						

| Reference Books | 1. Engineering Materials I : Introduction to Properties, Applications and Design, M.F Ashby and David R H Jones :,2010.
2. Mechanical behaviour of Materials, Marc Andre Meyers and Krishna Kumar Chawla, 2009. | |

	In hours			
	L	**T**	**P**	**Credit**
	3	0	0	3

Course Code	MED462 (PROGRAM ELECTIVE IV)						
Course Title	**Product Design and Development**						
Course Outcomes	On the completion of the course the student will be able to: CO1: To aware the description of non-destructive methods. CO2: To know about liquid penetration testing methods. CO3: To know about magnetic particle testing. CO4: To know about eddy current testing.						
Examination Mode	Theory						
Assessment Tools	Written Quiz	Assignment/ Project Work	MSE	MTP	ESE	EPR	ABL/PBL
Weightage	10%	10%	25%	-	50%	-	5%
Syllabus							**CO Mapping**
Unit 1	***Introduction***						
	Introduction to product design, Significance of product design, product design and development process, sequential Engineering design method, the challenges of product development, Development Process and Organizations-Generic Development Process, Concept Development, Adapting the generic PD process flows, AMF development Process, Product Development Organizations, The AMF Organization. Product Planning Product Planning and Identifying Customer Needs-Product Planning process, Interpret raw data in terms of customers need, organize needs in hierarchy and establish the relative importance of needs, review of the process. Product Specifications-Establish target specifications, setting final specifications.						CO1
Unit 2	***Concept Consideration in Product Design***						
	Concept Generation-Activities of concept generation, clarifying problem, search both internally and externally, explore the output, Concept Selection-Overview, concept screening and concept scoring, methods of selection. Concept Testing-Elements of testing: qualitative and quantitative methods including survey, measurement of customers" response. ***Designing of product*** Product Architecture-Modular & Integral architecture, implications, establishing the architecture, Delayed differentiation, Platform Planning. Industrial Design-Assessing need for industrial design, Impact of industrial Design, Industrial design process, management of industrial design process, assessing quality of industrial design.						CO2
Unit 3	***Value Engineering and product Design***						
	Introduction, Historical perspective, what is value? Nature and Measurement of value, Maximum value, normal Degree of value, Importance of value, The value Analysis job plan, Creative, Steps to problem – solving and value Analysis, value Analysis Test, value						CO3

	Engineering Idea Study on Tap Switch Control Assembly, Material and process Selection in value Engineering. Designer contributes, Role of Aesthetics in product Design, Functional Design Practice. **Modern Approaches to Product Design** Concurrent Design, Quality Function Deployment (QFD)	
Unit 4	***Eddy Current Testing***	
	Human Engineering Considerations in Product Design Introduction, Human being as Applicator of Forces, Anthropometry: Man as occupant of Space, the Design of Controls, The Design of Displays, Man/Machine Information Exchange. Embodiment Design: Design for Manufacturing, prototyping. Robust Design. Intellectual Property and Environmental Guidelines-Intellectual Property: Elements and outline, patenting procedures, claim procedure, Environmental regulations from government, ISO system.	CO4
Text Books	1. Ulrich Karl T. &Epinger Steven D. Product Design & Development–Tata- McGraw Hill - 3 rd Edition, New Delhi, 2004 2. Jones Tim, Heinmam Butterworth, New product Development, Oxford - UIC, 1997	
Reference Books	1.EngeneKinetoviczRoland,New product Development: Design & Analysis, Wiley and Sons Inc., New York, 1990. 2.Hollins Bill, Pugh Stwout,Successful Product Design, Butterworth, London,1990 3. Otto Kevin and Wood Kristini. Product Design,Pearson India, New Delhi, 2004.	
Online Resources	http://nptel.ac.in/courses/112107217/	

In hours			
L	**T**	**P**	**Credit**
3	0	0	3

Course Code	MED463 (PROGRAM ELECTIVE IV)						
Course Title	Ergonomics and Workplace Design						
Course Outcomes	• To impart the knowledge of various principles of ergonomics. • To know various considerable factors of workplace design. • To understand the compatibility of man and machine. • To know various factors affecting life stress.						
Examination Mode	**Theory**						
Assessment Tools	**Written Quiz**	**Assignment/ Project Work**	**MSE**	**MTP**	**ESE**	**EPR**	**ABL/PBL**
Weightage	10	10	25		50		5
Syllabus							**CO Mapping**
Unit 1							
	Introduction to Human Factors Scope of human factors, Study of human factors as a science, Cost/benefit analysis of human factors contributions, Human factors in the product design lifecycle, User centered design, Sources for design work. **Front End Analysis** User analysis, Environmental analysis, Function and task analysis, Perform, Collect, Summarize and Analyse task data, Identify user preferences and requirements. **Iterative Design and Testing:** Providing input for system specifications, Organization design, Prototype, Heuristic evaluation, Usability testing, final test and evaluation						CO1
Unit 2	**Human Variability and Statistics:** Human variability, Statistical analysis **Anthropometric Data:** Measurement devices and methods, Civilian and Military data, Structural and functional data, Use of anthropometric data in design. **General Principles of Workspace Design:** Clearance requirements of the largest users, Reach requirements of the smallest users, Special requirement of maintenance people, Adjustability requirements, Visibility and normal line of sight, Component arrangement. **Design of Standing and Seated Work Areas:** Choice between standing and seated work areas, Work surface height, Work surface depth, Work surface inclination.						CO2
Unit 3	**Muscle Structure and Metabolism:** Muscle Structure, Aerobic and Anaerobic metabolism **Circulatory and Respiratory Systems:** The circulatory systems, the respiratory systems **Energy Cost of Work and Workload Assessment**: Energy cost of work, Measurement of Workload. **Physical Work Capacity and Whole-Body Fatigue:**						CO2

	Short term and Long term work capacity, Causes and Control of whole body fatigue, Static work and Local muscle fatigue	
Unit 4	**Environmental Stressors:** Motion, Thermal Stress, Air quality **Psychological Stressors:** Cognitive appraisal, Ethical issues, Level of arousal, Performance changes with over arousal, Remedial of psychological stress. **Life Stress** **Workload Overload:** Remediation, Mental workload measurement **Fatigue and Sleep Disruption:** Vigilance and under arousal, Sleep disruption and Performance effects, Remediation of sleep disruption. **Safety Accidents and Human Errors**	CO4
Text Books	1. Wickens and Lee. *An introduction to Human Factor Engineering*. New Delhi: PHI. 2014. Print.	
Reference Books	1. Murrell, K.F.H, Champan& Hall. *Ergonomics: Man in his working environment*. London. 2012.Print. 2. Alexander, D.C. *The Practice and Management of Industrial Ergonomics.* Prentice-Hall, Englewood Cliffs, NJ. 1986. Print. 3. Astrand, P.O. and Rhodahl, K. *Textbook of Work Physiology.* New York: McGraw-Hill. 2003. Print.	
Online Source	http://nptel.ac.in/courses/107103004	

In hours			
L	**T**	**P**	**Credit**
3	0		3

Course Code	MED464 (PROGRAM ELECTIVE IV)						
Course Title	**Power Plant Engineering**						
Course Outcomes	On the completion of the course the student will be able to: CO1: Analyze the reversed Carnot cycle and vapour compression refrigeration cycle (VCR). CO2: Select the air-refrigeration systems for aircraft, and vapour absorption refrigeration system for rural and remote areas and select environmental friendly refrigerants considering the international standards. CO3: Identify the Psychometric processes for different applications and design the parameters of air-conditioning system as per standards. CO4: Estimate cooling load and heating load considering human comfort and optimize the air conditioning system as per requirements.						
Examination Mode	Theory						
Assessment Tools	Written Quiz	Assignment/ Project Work	MSE	MTP	ESE	EPR	ABL/PBL
Weightage	10%	10%	25%	-	50%	-	5%
Syllabus							**CO Mapping**
Unit 1	***Introduction to Energy Sources***						
	Energy sources for generation of electric power, energy policy of India, present status and future trends, major power plants in India. Thermal Power Plants: Selection of site, general layout of the plant, major components- Boilers, Economisers, Super-heaters, Air pre-heaters, fuels, fuel and ash handling equipment's, High pressure Boilers, steam turbines, station heat balance and plant efficiency.						CO1
Unit 2	**Thermal Power and Hydro Power Plant**						
	Diesel Power Plant: Diesel engine, engine performance and operation, super charging, Diesel Electric power plant layout. Gas Turbine Power Plants: Gas turbine power plants, basic cycles, cycle calculation, the ideal and real operating cycles, components and layout. Hydro Power Plants: Classification of hydro-plants, selection of site, rain fall and run off, calculation of storage capacity, plant layout, estimation of power available, selection of hydraulic turbines and their governing.						CO2
Unit 3	***Nuclear Power Plants***						
	Introduction, Atomic structure and radio-activities nuclear reactions, binding energy, Nuclear Reactors, Types of reactors, Pressurized water reactors, boiling heater reactors, Heavy water-cooled and moderated (CANDU) reactor, Gas-cooled reactors, Liquid metal cooled reactors, Indian Nuclear power installations, comparison between Nuclear and Thermal plants. Non-Conventional Power Plants: Geothermal power plants, Tidal power plants, Wind power plants, solar power plants, M.H.D. Generators, OTEC						CO3
Unit 4	**Power Plant Economics & environmental aspect**						
	Plant investment costs, fixed charges, Operation cost, energy cost, depreciation and operating costs on the selection of equipment's,						CO4

	incremental cost, comparison of fixed and operating costs, greenhouse effect, thermal pollution, other pollutants.	
Text Books	1. A Course in Power Plant Engineering: / Arora and S. Domkundwar. 2. Power Plant Engineering – P.C.Sharma / S.K.Kataria Pub	
Reference Books	1. Nag P.K., Power Plant Engineering, 3rd ed., Tata McGraw Hill, 2008. 2. El Wakil M.M., Power Plant Technology, Tata McGraw Hill, 2010. 3. Elliot T.C., Chen K and Swanekamp R.C., Power Plant Engineering, 2nd ed., McGraw Hill, 1998.	
Online Resources:	https://onlinecourses.nptel.ac.in/noc22_me73/preview	

In hours			
L	**T**	**P**	**Credit**
3	0	0	3

Course Code	MEDXXX (PROGRAM ELECTIVE IV)(Open Elective)						
Course Title	**Automobile Engineering**						
Course Outcomes	On the completion of the course the student will be able to: CO1: To understand the construction and working principle of various parts of an automobile. CO2: To understand the Lubricating System, Cooling System, Chassis & Transmission CO3: To understand the steering and breaking systems of automobile CO4: To know about the resent advancements in automobiles.						
Examination Mode	Theory						
Assessment Tools	Written Quiz	Assignment/Project Work	MSE	MTP	ESE	EPR	ABL/PBL
Weightage	10%	10%	25%	-	50%	-	5%
Syllabus							**CO Mapping**
Unit 1	***Introduction***						
	Introduction: History of automobiles; Classification of automobiles; Power plant classification; Engine terminology; Types of cycles; Working principle of an IC engine; Advanced classification of engines and multi cylinder engines; Engine balance and firing order. **Fuel System, Ignition System and Electrical system**: *Spark Ignition engines* – fuel tank, fuel filter, fuel pump, air filter, carburetor, direct injection of petrol engines; *Compression Ignition engines* – fuel injection (air and solid), pressure charging, super charging and turbo charging; *Ignition systems* – components, battery ignition, magneto ignition, electronic ignition and ignition timing; *Main electrical circuits* – generating & starting circuit, lighting, indicating devices.						CO1
Unit 2	***Lubricating System and Cooling System, Chassis & Transmission***						
	Lubricating System and Cooling System: Functions & properties of lubricants, methods of lubrication; Oil filters, oil pumps, oil coolers; Characteristics of an effective cooling system; types of cooling systems; Radiator, thermostat, air cooling & water cooling. **Chassis & Transmission:** Parts of automobile body; Automobile frames – functions, constructions, sub frames, materials and defects; Transmission – axles, clutches, propeller shafts, differential, gear boxes, automatic transmission, electronic transmission control, functions and types of front and rear axles, types and functions of clutches, Hotchkiss drive torque tube drive, traction control.						CO2
Unit 3	***Steering, Braking and Suspension***						
	Steering, Braking and Suspension: Steering mechanism, steering gear box types, wheel geometry; Brakes – principle, functions, types, construction, operation and parking brake; Suspension - types of spring shock absorbers, objectives and types of suspension system, rear axle suspension, electronic control and proactive suspension system. **Automotive Air Conditioning:** Ventilation, heating, air condition, refrigerant, compressor and evaporator.						CO3
Unit 4	***Wheels and Tyres***						

	Wheel quality, assembly, types of wheels, wheel rims. Construction of tyres and tyre specifications. **Recent Trends:** E-vehicles; Satellite-based navigation; Automated steering; Environment effect and mitigation.	CO4
Text Books	1. A.K. Babu, S.C. Sharma, Automobile Mechanics, Khanna Book Publishing, 2019. 2. A.K. Babu, S.C. Sharma, Automobile Engines, Khanna Book Publishing, 2019. 3. Kirpal Singh, Automobile Engineering, 7th ed., Standard Publishers, New Delhi, 1997.	
Reference Books	1. Jain K.K. and Asthana R.B., Automobile Engineering, Tata McGraw Hill, New Delhi, 2002. 2. Heitner J., Automotive Mechanics, 2nd ed., East-West Press, 1999. 3. Heisler H., Advanced Engine Technology, SAE International Publ., USA, 1998.	
Online Resourses	https://archive.nptel.ac.in/courses/107/106/107106088/	

In hours			
L	**T**	**P**	**Credit**
3	0	0	3

Course Code	MEDXXX (PROGRAM ELECTIVE IV/Open elective)
Course Title	**Industrial Engineering Techniques**
Course Outcomes	• To impart the knowledge of Production and Productivity. • To provide the knowledge of PPC and facility location. • To conduct time and motion study to improve the methods/system and to increase productivity • To impart the valuable skills to plan and understand concepts of material management and Cost Estimation and Control.
Examination Mode	**Theory**

Assessment Tools	**Written Quiz**	**Assignment/ Project Work**	**MSE**	**MTP**	**ESE**	**EPR**	**ABL/PBL**
Weightage	10%	10%	25%		50%		5%

Syllabus		**CO Mapping**
Unit 1		
	Industrial Engineering Introduction, Definition and concept, Place of industrial engineer in an organization, Activities of Industrial Engineering, Industrial Engineering Approach, Objectives of Industrial Engineering, Functions of the Industrial Engineer, Techniques of Industrial Engineering, Industrial Engineering in Services Sector, Qualities of Industrial Engineer **Production and Productivity** Introduction, Production & Productivity Concept, Difference between production and productivity, Expectations from productivity, Tools of productivity, Reasons of low productivity, Productivity Measurement System, Technical Methods to Improve Productivity, Advantages from Increased Productivity.	CO1
Unit 2	**Production Planning and Control** Introduction, Key Terms - Production; Planning; Control, Production Planning and Control, Difference between production planning and production control, Objectives and Functional Elements of PPC, Types of Production System (Job, Batch and Continuous), Break even analysis **Plant Location and Layout** Introduction, Site Selection, Reasons for appropriate location selection, Factors to choose site of plant, Urban, Rural and Suburban areas, Economic survey of site selection, Plant Layout, Objectives and Principles of plant layout, Factors affecting plant layout, Plant layout procedure, Types of plant layout, Flow patterns, Symptoms of bad layout, Work Station Design.	CO2
Unit 3	**Work Study** Introduction, Work Study: Need, Applications, Advantages, Work Study Procedure **Method Study:** Definition, Objectives, Procedure, Charts, Diagrams, Motion and Film Analysis, Therbligs, Models, Principles of Motion Economy	CO2

	Work Measurement: Definition, Objectives, Procedure, Techniques of work measurement (Time Study, PMTS), Performance Rating, and Allowance.	
Unit 4	**Cost Estimation and Control** Introduction, Cost and Its Classification, Costing, Cost Estimation, Difference between Cost Estimation and Costing, Elements of Cost, Ladder of Cost, Overhead Expenses, Mathematical Formulae to Calculate Volume of Components, Densities of Metals, Depreciation, Cost Control **Material Management** Material Management (Functions, Advantages, Objectives), Purchasing (Functions, Objectives, VPR, Purchasing Procedure), Store Management (Functions and Duties, Location and Layout of Stores, Principles of efficient store layout, Approaches of store location, Types of store layouts,) Inventory (Inventory Control, Classification, Need, Benefits, Disadvantage, Objectives), Various levels of Inventory Control, Inventory Control Techniques, Introduction to JIT	CO4
Text Books	1. Bansal, V.B. *Industrial Engineering and Production Management.* New Delhi: Kapson Publishers. 2015. Print. 2. Raju, N.V.S. *Industrial Engineering and Management*. New Delhi: Cengage Learning. 2013. Print.	
Reference Books	1. Chunawala. *Production and Operation Management.* New Delhi: Himalaya Publication. 2013. Print. 2. Dalela, and Ali, Mansoor. *Industrial Engineering and Management Systems*. New Delhi: Standard Publishing Distributors. 2010. Print. 3. Hicks. *Industrial Engineering & Management-A new perspective*. New Delhi: Tata McGraw Hill. 2014. Print. 4. Shankar, Ravi. *Industrial Engineering and Management*. New Delhi: Galgotia Publishers. 2010. Print. 5. Jain and Agarwal. *Production Planning & Control.* New Delhi: Khanna Publishers. 2013. Print. 6. Verma, A.P. *Industrial Engineering and Management*. New Delhi: Katson Books. 2010. Print.	
Online Source	http://nptel.ac.in/courses/112107143/ http://nptel.ac.in/courses/112107142/	

Open elective course syllabus provided by other departments as passed in respective BOS meetings with L T P 3 0 0 3.

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