School of Engineering and Technology

GURU GHASIDAS VISHWAVIDYALAYA

(A CENTRAL UNIVERSITY ESTABLISHED BY THE UNIVERSITIES ACT,2009)

BILASPUR (C.G)

STUDENT"S HANDBOOK

2021-22

Bachelor of Technology Programme

Department of Mechanical Engineering

Preface

The School of Studies in Engineering & Tchnology, under Guru Ghasidas Vishwavidyalaya (now a Central University since 15th Jan., 2009), Bilaspur (C.G.), was set up in the year 1997 with an objective of making available the facilities of quality higher education in the field of Engineering and Technology to the students of, particularly, the Central region of country where the rural and tribal population still remain deprived of such facilities. The school, remaining fully conscious of its objectives and responsibilities, is growing towards the level of a centre of excellence for quality engineering education in the country. Especially, after up-gradation of the University as a Central University, there has been many fold enhancements in infrastructural facilities as well as faculty and staff. Today, the school has well equipped laboratories with latest equipment, a good library, adequate computational facilities and smart E-classrooms needed for ensuring quality in higher education and research. The mission of the Institute is to create an ambiance in which new ideas, research and scholarship flourish and to engender the leaders and innovators of tomorrow.

The University campus houses faculties like Arts, Science, Social Science, Humanities, Law and Management etc, our students get opportunities of studying varied nature of elective courses from other faculties, and are groomed to work not only with a group of technically trained people but also with persons having knowledge in different domains of education.

The school on an average, admits around 500 students annually for the 4 - year undergraduate B. Tech programme in seven branches. Admissions are made through Joint Entrance Examination-JEE (main) or the entrance examination conducted as per the directions of MHRD, Govt. of India. In School, M.Tech. programme is being run by all seven departments and the students who are Graduate Aptitude Test in Engineering (GATE) qualified get admitted. To keep pace with new developments and changes in the field of technology, the School revises its Undergraduate and Postgraduate Programmes syllabi from time to time. School follows semester system of teaching (odd- July - December and even- January – June).

Our school is a student-centric Institution and, therefore, the endeavor is always to ensure that students are offered the information on the existing Rules and Regulations governing the B.Tech. Programmes. The students and parents/ guardians are, therefore, advised in their own interest to get fully familiar with the academic system of the Institute and rules and regulations. Students' attention is particularly drawn to the attendance requirement, regular assessment procedures, conditions of promotion to higher semesters and grading system, etc.

Thank you for your interest in School of Studies in Engineering and Technology, Guru Ghasidas Vishwavidyalaya, Bilaspur. We wish all our students a very bright future and successful career.

Dean (SOS, Engg. & Tech.)

ABOUT THE DEPARTMENT

Department of Mechanical Engineering was established under, School of Studies of Engineering and Technology, in the year 2006. The department offers B.Tech. (Mechanical Engineering) and M.Tech. (Machine Design) programmes with intake of 75 and 23 respectively.

The department puts lots of emphasis on such training of students as can bring out their inner capabilities and lead to their full growth and development. Enough emphasis has put on their hands-in training for which department has well-equipped laboratories, theory of machines, strength of materials, heat & mass transfer, refrigeration and air conditioning and central workshop.

In M.Tech. Programme the students are admitted based on their GATE scores. The department offers Ph.D. program also in different streams of Mechanical Engineering like Thermal and Fluids Engineering, Design Engineering, and Manufacturing Engineering, etc. Our alumni are working at high positions in central government, state governments, public and private sectors all over the nation and abroad. Our graduated students from B.Tech. and M.Tech. Programmes are taking admissions for their higher studies in IITs, NITs and reputed foreign institutions

Students Achievements of Department:

A. Number of Students Qualified on Various Exams in academic year 2021-22:

Name of Exam	No. of Students
GATE	06
Placed in Company	13 { High Technext }
Mr. Madhav Mishra, Student of B.Tech - Mechanical Engineering 6th Semester, secured AIR 6th rank in All India Inter-University Boxing MW Championship 17th December'21 to 01st January'22	

B. Courses Intake:

S.No.	Course	Year	Annual Intake
1.	B.Tech.	4 Year	75
2.	M.Tech.	2 Year	23
3.	PhD.		

ACADEMIC CALENDAR

For Odd Semester :

B. Tech. Odd Semester (2021-2022)

S.N.	Academic Plans	III Semester(Course A/B), as per CBCS	V&VII Semester, as per CBCS
01	Registration/Admission/Orientation / Induction Programme	04.10.2021 (Monday) to 08.01.2021 (Friday)	26.07.2021 (Monday) to 30.07.2021 (Friday)
02	Commencement of Classes	04.10.2021 (Monday)	26.07.2021 (Monday)
03	Class Test-I/Class Test (Internal Assessment)	08.11.2021 (Monday) to 13.11.2021 (Saturday)	30.08.2021 (Monday) to 04.09.2021 (Saturday)
04	Class Test-II/Mid Semester Examination (MSE) (Internal Assessment)	13.12.2021 (Monday) to 20.12.2021 (Monday)	20.10.2021 (Wednesday) to 26.10.2021 (Tuesday)
05	Last date for submission of End Semester Examination (ESE) form	As per the University notification	
06	Last date of classes	07.01.2022 (Friday)	26.11.2021 (Friday)
07	Preparation leave	08.01.2022 (Saturday) to 09.01.2022 (Sunday)	27.11.2021 (Saturday) to 28.11.2021 (Sunday)
08	End Semester Examination (ESE)/Practical Examinations	10.01.2022 ((Monday) to 21.01.2022 (Friday)	29.11.2021 (Monday) to 10.12.2021 (Friday)
09	Declaration of End Semester Results	As per the University Notification	
10	Winter vacation	As per the University Notification	

Practical examination will be conducted prior to preparation leave.

*Only for students

For Even Semester:

B. Tech. Even Semester (2021-2022)

S.N.	Academic Plans	IV Semester(Course A/B), as per CBCS	VI&VIII Semester, as per CBCS
01	Registration/Admission/Orientation / Induction Programme	24.01.2022 (Monday) to 28.01.2022 (Friday)	13.12.2021 (Monday) to 17.12.2021 (Friday)
02	Commencement of Classes	24.01.2022 (Monday)	13.12.2021 (Monday)
03	Class Test-I/Class Test (Internal Assessment)	07.03.2022 (Monday) to 12.03.2022 (Saturday)	24.01.2022 (Monday) to 29.01.2022 (Saturday)
04	Class Test-II/Mid Semester Examination (MSE) (Internal Assessment)	18.04.2022 (Monday) to 23.04.2022 (Saturday)	14.03.2022 (Monday) to 19.03.2022 (Saturday)
05	Last date for submission of End Semester Examination (ESE) form	As per the University notification	
06	Last date of classes	13.05.2022 (Friday)	15.04.2022 (Friday)
07	Preparation leave	14.05.2022 (Saturday) to 18.05.2022 (Wednesday)	16.04.2022 (Saturday) to 20.04.2022 (Wednesday)
08	End Semester Examination (ESE)/Practical Examinations	19.05.2022 (Thursday) to 31.05.2022 (Tuesday)	21.04.2022 (Thursday) to 30.04.2022 (Saturday)
09	Declaration of End Semester Results	As per the University Notification	
10	Summer vacation	As per the University Notification	

✓ Sports/Cultural activity will be as per the University calendar.

FACULTY OF THE DEPARTMENT

Photo	Name	Qualification	Designation	Specialization
	Dr.T.V.Arjunan	Ph.D., M.E.	Professor	Thermal Engineering
	Dr. Rajesh Kumar Bhushan	Ph.D, M.Tech.	Associate Prof.	Production
	Dr. Pankaj Kumar Gupta	Ph.D., M.S.(Research)	Associate Professor	CFD
	Mrs. Poonam Ekka	M.Tech.	Assistant Professor	Thermal Engineering
	Mr. Prashant Jangde	M.Tech.	Assistant Professor	Thermal Engineering

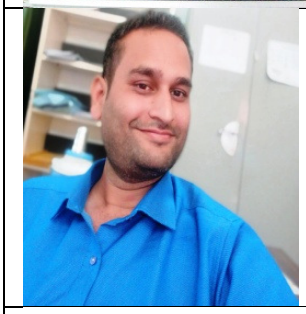
Photo	Name	Qualification	Designation	Specialization
	Ms. Shweta Singh	M.E.	Assistant Professor	Manufacturing System Engineering
	Mr. Manish Bhaskar	M.Tech	Assistant Professor	Thermal Engineering
	Mr. Prateek Gupta	M.Tech	Assistant Professor	Machine System Design
	Dr Anoop Kumar Sahu	M.tech, Ph.D, Post Doctorate	Assistant Professor	Industrial Engineering, Production Engineering
	Mr. Bhushan Singh Gautam	M.E.	Assistant Professor	Duct Acoustics; Automotive & Industrial Noise Control

Photo	Name	Qualification	Designation	Specialization
	Mr. Biplab Das	Ph.D (Pursuing)	Assistant Professor	Materials Engineering, Computer Assisted Manufacturing
	Mr. Pradeep Patanwar	M.Tech	Assistant Professor	Thermal & Fluid Engineering

B.TECH. ORDINANCE

Proposed Draft of
ORDINANCE No. -12
for
Bachelor of Technology (B.Tech.)
Under Choice Based Credit System(CBCS)
Governing the award for the Degree of Bachelor of Technology (B.Tech.)-4 years (8 Semester)
Degree Course

(Ordinance prepared as per the provisions given in Statute 28(1) (b) of
The Central Universities Act, 2009)

1.0 TITLE AND COMMENCEMENT

1.1. The Ordinance shall be called as Ordinance for four years (Eight Semesters) B.Tech. Degree programme.

1.2. The first degree of four years (Eight Semester) programme in Engineering & Technology, hereinafter called 4- year B. Tech degree course, shall be designated as 'Bachelor of Technology' in respective Branches. The conduct of the programme and the performance evaluation of B. Tech. programmes are on the basis of percentage of marks earned as well as credit system.

1.3. This ordinance will come into force from the Academic Session commencing after the date of notification issued by the University and shall replace the existing ordinance.

2.0 DEFINITION & KEY WORDS

2.1 "*Vishwavidyalaya"* or "*University*" means Guru Ghasidas Vishwavidyalaya (A Central University established by the Central Universities Act, 2009 No. 25 of 2009) located at Koni, Bilaspur, Chhattisgarh.

2.2 "*Student*" means one who has been admitted in the four years B.Tech. programme of this University through merit list of Joint Entrance Examination (JEE) (main) or any other procedure decided by Guru Ghasidas Vishwavidyalaya for Admission to B. Tech. degree course time to time.

2.3 The candidate shall be eligible for admission on the basis of the *"Academic Year" means t*wo consecutive (one odd and one even) semesters.

2.4 *"Choice Based Credit System (CBCS)"* means a program that provides choice for students to select from the prescribed courses (Basic Science, Humanities, Engineering Science, Mandatory Courses, Professional Core, Open Elective, Professional Elective, etc.) as per the guidelines issued by UGC / AICTE / regulatory bodies where ever applicable and as approved by the appropriate bodies of the University.

2.5 *"Course*" means "papers" through different modes of delivery and is a component of a programme as detailed out in the respective program structure.

2.6 *"Credit Point"* means the product of grade point and number of credits for a course.

2.7 *"Credit"* means a unit by which the course work is measured. It determines the number of hours of instructions required per week. One credit is equivalent to one hour of teaching(lecture, seminar or tutorial) per week or two hours of practical work/field work/project etc. per week. The number of credits for each course shall be defined in the respective examination scheme.

2.8 *"Cumulative Grade Point Average* (*CGPA*)" means a measure of overall cumulative performance of a student in all semesters. The CGPA is the ratio of total credit points secured by a student in various courses registered up to the semester concerned and the sum of the total credits points of all the registered courses in those semesters concerned. It is expressed up to two decimal places.

2.9 *"Grade Point"* means a numerical weight allotted to each letter grade on a 10 point scale or as prescribed by the AICTE/ University from time to time.

2.10 *"Letter Grade"* means an index of the performance of students in a course. Grades are denoted by letters O, A+, A, B+, B, C, P, and F.

2.11 *"Semester Grade Point Average* (*SGPA*)" means a measure of performance of a student in a particular semester. It is the ratio of total credit points secured by a student in various courses registered in a semester and the total credits of all courses in that semester. It shall be expressed up to two decimal places.

2.12 *"Semester"* means an academic session spread over 15-18 weeks of teaching work with minimum 90 teaching days. The odd semester may normally be scheduled from July to December and even semester from January to June.

2.13 *"Grade Card"* means a certificate based on the grades earned. Grade card shall be issued to all the students registered for the examination after every semester. The grade card will contain the course details (code, title, number of credits, grade secured) along with SGPA of the semester and CGPA earned till that semester. The final semester grade card shall also reflect the cumulative total of marks obtained by the student in all semesters out of maximum marks allocated for which the grades of the program were evaluated. However, the final result will be based on the grades/CGPA.

2.14 "*Transcript"* means a certificate issued to all enrolled students in a program after successful completion of the program. It contains the SGPA of all semesters and the CGPA;

2.15 "*Ex-student*" means a student who fails to clear in the supplementary examination all the backlogs of theory, practical / sessional subjects of the odd and even semesters, he/she will not be promoted to the odd semester of the next higher year, and such student shall be treated as ex-student.

2.16 *"Sessional"* means a subject which is practiced by student in a semester for which there is no end semester exam.

3.0 DURATION

The duration of undergraduate (U.G.) degree programmes leading to B. Tech. degree, shall be normally four years and the maximum duration shall be 7 years from the date of initial registration in First year B.Tech. course. If a candidate will not be able to complete the course in the maximum duration of 7 years then he / she will not be eligible to continue the course from that point of time itself and he / she will automatically exit from the program.

4.0 ADMISSION PROCEDURE AND ELIGIBILITY

The minimum qualification for admission to the first year B. Tech. shall be the passing of Higher Secondary School Certificate Examination (10+2) scheme with Physics, Chemistry and Mathematics conducted by Central Board of Secondary Education or any other equivalent examination from recognized Board or University. The candidate shall be eligible for admission on the basis of the merit list of Joint Entrance Examination (JEE) (main) or any other procedure decided by Guru Ghasidas Vishwavidyalaya for Admission to B. Tech. degree course time to time. In general the admission to B. Tech. degree course shall be governed by the rules of, MHRD, Government of India (GoI) and Guru Ghasidas Vishwavidyalaya. The reservations in admission, cancellation of admission and fee refund will be as per MHRD, GoI / GGV norms and notifications issued in this regard from time to time.

5.0 ENROLMENT IN THE UNIVERSITY

Every student admitted to the programme shall be enrolled before appearing in the first semester examination through the procedure prescribed by the competent authority from time to time.

6.0 TYPES OF COURSES

Basic Science, Humanities, Engineering Science, Mandatory Courses, Professional Core, Open Elective, Professional Elective, etc. as per the guidelines issued by AICTE / University where ever applicable and as approved by the appropriate bodies of the University.

7.0 ATTENDANCE AND ELIGIBILITY TO APEAR IN THE EXAMINATION

A Student shall be required to attend at least 75% of the classes actually held in the semester which may include theory class, seminars, sessionals, practicals, projects, as may be prescribed.

Provided that the Dean of the School of Engineering & Technology on the recommendations of the concerned Head of the Department may condone the shortage in attendance of those students who have secured at least 65% attendance. This condonation should not exceed 10% on the following satisfactory grounds.

a) Illness / Medical leave of the student certified by the University Medical Officer / Government Doctor.
b) Unforeseen miss happening with parents.
c) For participating in the extra and co-curricular events with prior approval from the university authority.
d) For participating in the sports activity with prior approval from the university authority.
e) For attending in interviews with valid proof and prior permission of the concerned head of department.
f) Natural calamities.

The application must be supported by such documents as considered to be fit for granting such condonation.

7.1. A student who does not satisfy the requirement of attendance as per clause above, he/she will be detained due to shortage of attendance in a particular semester and he/she will have to repeat the same semester taking re-admission as a regular student in the next commencing academic session by paying fee as per the University norms.

8.0 EXTRA ORDINARY LONG ABSENCE

If a student does not participate in the academic activities of the School of Studies of Engineering and Technology of this Vishwavidyalaya for a period exceeding two years for reasons of ill health or medical grounds only, he / she shall neither be permitted to appear in any subsequent examinations nor shall be admitted or promoted to any semester and he / she shall cease to be a student of B. Tech. Degree Course. Here participation in academic activity means attending Lectures, Tutorials, Practicals/Sessionals and such other activities declared as academic activities.

9.0 MEDIUM OF INSTRUCTION/EXAMINATION

Medium of instruction and examination shall be English only.

10.0 EXAMINATION AND EVALUTION

10.1 Practical/ Sessional Work – The student shall be required to complete the Laboratory / Drawing / Design / Job preparation and other academic work assigned for that semester in the session.

10.2 There shall be a full End Semester Examination at the end of each semester consisting of theory papers, practicals/ sessionals.

10.3 There shall be one End Semester Examination (ESE) at the end of each semester conducted by Guru Ghasidas Vishwavidyalaya. Only those students, who will satisfy the attendance requirement to be eligible to appear at the End Semester Examination as per clause 7.0, will be permitted to appear in the End Semester Examination. The examination will consist of theory papers, laboratory practical/sessional and viva-voce as per the scheme of examination of that semester. These examinations shall be designated as follows.

(a). During First year - I & II sem. B. Tech. Examination
(b). During Second year - III & IV sem. B. Tech Examination
(c). During Third year - V & VI sem. B. Tech. Examination
(d). During Fourth year - VII & VIII sem. B. Tech. Examination

10.4 The semester examination will normally be held in the month of November-December and April – May in every academic session, or as decided by the University from time to time.

10.5 Supplementary examination will be held only once in a year (for both even and odd semesters) normally in the month of June/July or as decided by the University from time to time.

10.6 End Semester Examination time table shall be declared by the Controller of Examination before the commencement of examination.

10.7 Basis of Subjects Evaluation

10.7.1 For passing in a subject (theory / practical/sessional) the performance of the candidate in each semester shall be evaluated subject wise. There shall be continuous assessment throughout the semester by conducting class tests, called as Internal Assessment (I.A.) carrying 30% weightage, and End Semester Examination (E.S.E.) carrying 70% weightage. A student has to secure minimum 35% (24 marks) in the particular theory subject and minimum 40% marks in a particular practical subject to pass that subject in the end semester examination. For each practical/sessional subject 60% weightage will be given to the actual practicals /sessionals performed during the semester I.A. and 40% weightage will be given to the End Semester Examination (ESE).

10.7.2 For evaluation of end semester practical/sessional examination of a subject, there shall be two examiners, one internal examiner who has conducted the practical in that semester and other external examiner to be appointed by the Head of the Department from amongst faculty members of the department concerned.

10.7.3 To allot the marks of Internal Assessment (IA), there shall be two Class Tests (CT) I & II each of 15 marks.

10.7.4 For passing a subject the student is required to fulfill the following conditions:

a) Student has to secure minimum 35% (24 marks) in a particular theory subject to pass that subject in the end semester examination.
b) Student has to secure minimum 40% marks in a particular practical / sessional subject to pass that subject (practical / sessional) in the end semester examination.
c) Must have secured minimum 40% marks (Marks of Internal Assessment + Marks of End Semester Examination) for each theory subject.
d) Must have secured minimum 50% marks (Marks of Internal Assessment + Marks of End Semester Examination) for each project/practical/sessional subject.
e) Must have scored minimum SGPA of 5.0 in the semester. If a student has cleared all the failed to secure SGPA of 5.0 in the semester or and semesters of a year then he/she will be allowed to re-appear in the supplementary Examination in those

subjects in which the student's Grade Points less than 5. If the student fails to secure SGPA of 5.0 even in the supplementary examination, he/she will not be promoted to the odd semester of the next higher year, and such student shall be treated as an ex-student. Other condition of

f) promotion of the ex-student will be applicable as per Clause 11.
g) (f) If a student has passed a semester examination in all the subjects as per clause 10.7.4 (ae), he/she shall not be permitted to reappear in that examination for improvement in
h) grades/division.

10.7.5 **Basis of Credits-** Credit of a theory or practical/sessional subject is decided by:
Credit = (L+ T+P/2),
Where; L = Lecture periods per week,
T = Tutorial period per week,
P = Practical/Sessional periods per week.
Credit in a subject will be an integer, not in a fractional number. If a credit in a subject turns out in fraction, it will be taken as next integer number.

10.7.6 **For Theory Subjects-**For the assessment of performance of students in a semester, continuous evaluation system will be followed with two components: Internal Assessment (IA), carrying 30% weightage and End Semester Examination (ESE), carrying 70% weightage. There will be two class tests each of 15 Marks, in each theory subject in a semester forming the part of Internal Assessment (IA).

10.7.7 **ForProjects/Practical/ Sessional Subjects-** Evaluation of project/practical/sessional during the semester will carry 60% weightage for Internal Assessment (IA) and the End Semester Examination (ESE) will carry 40% weightage. The internal assessment will carry equal weightage of attendance (20% weightage), practical records (20% weightage) and internal viva – voice examination (20% weightage). The marks for attendance shall be awarded in project/practical/sessional subject as per the following Table.

Percentage of attendance	65 - ≤ 75	> 75 - ≤ 80	>80- ≤ 85	>85- ≤ 90	>90- ≤ 95	>95-≤ 100
Percent weightage of Marks	10	12	14	16	18	20

10.7.8 **Grading System-** Percentage as well as absolute grading system will be followed, in every subject, theory or practical/sessional. A student will be awarded a **Letter Grade**, based on his combined performance of Internal Assessment (IA) and End Semester Examination (ESE). These grades will be described by letters indicating a qualitative assessment of the student's performance through a number equivalent called "Grade Point" (GP) as given below. The following is the **Grade Point** pattern. Grade 'F' indicates not clearing (passing) of the subject.

Letter Grade (LG)	O	A+	A	B+	B	C	P	F	Ab
Grade Point	10	9	8	7	6	5	4	0	0

The Letter Grades are O (Outstanding), A+ (Excellent), A (Very Good), B+ (Good), B(Above Average), C (Average), P (Pass), F(Fail) and Ab (Absent in end semester examination). Grades will be awarded for every theory and practical/sessional subject separately.

10.7.9 Absolute Grading System

(a) The Absolute Grading System as explained below will be adopted for theory andproject/practical/sessional subjects.

GRADE	Percentage of Marks Obtained	
	THEORY	PRACTICAL/SESSIONAL/PROJECT
O (Outstanding)	>90- ≤100	>90-≤ 100
A'(Excellent)	>80 - ≤ 90	>80-≤ 90
A (Very Good)	>70 - ≤ 80	>70 - ≤ 80
B'(Good)	>60 -≤ 70	>60- ≤ 70
B (Above Average)	>50- ≤ 60	>55- ≤ 60
C (Average)	>40-≤ 50	>50-≤ 55
P (Pass)	=40	=50
F (Fail)	00 - <40	0 - < 50

(b) 01 Grace Mark shall be given only once at the time of award of the degree to improve the Grade in overall result.

10.7.10 **Semester Grade Point Average (SGPA)-** Performance of a student in i_{th} semester is expressed by $[SGPA]_i$ which is a weighed average of course grade points obtained by a student in the semester, and is expressed by

$$[SGPA]_i = \frac{[C_1G_1 + C_2G_2 + \ldots\ldots\ldots]_i}{[C_1 + C_2 + \ldots\ldots\ldots]_i} = \frac{[\sum C_jG_j]_i}{[\sum C_j]_i} = \frac{N_i}{D_i}$$

Where C_j stands for Credit and G_j stands for Grade points corresponding to j_{th} subject in a semester. SGPAs will be calculated up to two places of decimal without rounding off. SGPA will be calculated only when a student clears a semester without failing in any subject, theory or practical/sessional/project.

10.7.11 **Cumulative Grade Point Average (CGPA)-** This is a weighed average of course grade points obtained by a student for all the courses taken, since his / her admission. Thus, CGPA in the i_{th} semester with "i ≥2" will be calculated as follows:

$$[CGPA]_t = \frac{\sum_{k=1}^{k=l} N_k}{\sum_{k=1}^{k=l} D_k}$$

If a student repeats a course or is declared fail in a subject, then only the grade points earned in the attempt when he / she cleared the course (subject) are counted towards CGPA. CGPA will be calculated in every semester along with SGPA, so that a student knows his / her latest CGPA.

11 PROMOTION TO NEXT YEAR AND SEMESTER

11.1 Those students who have cleared all the registered theory, practical/sessional subjects prescribed for the B.Tech. first year shall be promoted to the B.Tech. second year. Those students who have cleared all the registered theory, practical/sessional subjects prescribed for the B.Tech. second year shall be promoted to the B.Tech. third year. Those students
who have cleared all the registered theory, practical/sessional subjects prescribed for the
B.Tech. third year shall be promoted to the B.Tech. fourth year.

11.2 Supplementary examinations will be held only once in a year (for both even and odd semesters) normally in the month of July after declaration of results of even semester examination of the incumbent session, or as decided by the University time to time.

11.3 Those students who would have backlogs in registered theory and/ or practical/ sessional subjects in the odd and or even semesters of any academic year will be allowed to appear in the supplementary examinations of the same year.

11.4 Those B.Tech. students who are allowed to appear the supplementary examination (of odd or even or both semester**),** may be allowed to attend the classes provisionally of the next higher odd semester of the next year. However, such provisionally permitted students will get their regular admission only after passing in all their backlog papers in supplementary examination, if eligible otherwise. The percentage of attendance shall be counted from the date of commencement of the semester classes.

11.5 If a student fails to clear in the supplementary examination all the backlogs of theory, practical/sessional subjects of the odd and even semesters, he/she will not be promoted to the odd semester of the next higher year, and such student shall be treated as ex-student.

11.6 Ex-students, {as per clause 10.7.4(e)}, shall be required to clear their backlog papers (theory and or practical/sessional subjects), in the end semester examination of the corresponding semesters (odd and even) and supplementary examination to be conducted next year (in the following academic session). Such ex-students will be required to depositthe examination fees only.

11.7 If a student fails to appear in the internal assessment / sessional of a semester due to

unforeseen incident, a makeup test/examination may be conducted, if required, strictly on the recommendation of the concerned Head of the Department, and approval of the Dean (Engineering & Technology).

12 AWARD OF CLASS OR DIVISION

12.1 The class/division awarded to a student with B. Tech. Degree shall be determined by the student's CGPA after clearing all the subjects of all the eight semesters, as given below:

- First Division with Distinction or **Honours** : 7.5 ≤CGPA ≤ 10.0
- First Division : 6.5 ≤CGPA< 7.5
- Second Division : 5.0 ≤ CGPA< 6.5

12.2 Division shall be awarded to a student only after clearing all the eight semesters successfully, and having earned at least total credit of **160** for the award of B.Tech. degree.It shall be based on the integrated performance of the candidate for all the eight semestersas per clause 10.3.

12.3 No student shall be declared to have passed the final B.Tech. course unless he/she has fully passed all the eight semesters. The results of the eighth semester of those students, who have not passed examination in any previous semester, will be withheld. Such students shall be deemed to have passed the final B.Tech. examination in the year in which they pass / clear all the subjects of all the eight semesters, within the limit of the prescribed period of the whole course.

13 TRANSCRIPT

Based on the Letter grades, grade points and SGPA and CGPA, the Vishwavidyalaya shall issue the transcript for each semester and a consolidated transcript indicating the performance in all semesters.

14 CONVERSION OF CGPA / SGPA IN PERCENTAGE

There is no equivalence between the CGPA/SGPA scale and percentage. However notionally,
Percentage of particular semester = (SGPA) × 10
Percentage of B.Tech. Degree = (CGPA) × 10

15 RANKING

Only such candidates who complete successfully all courses in the programme in single attempt shall be considered for declaration of ranks, medals etc declared and notified by the university, if any.

16 DISCIPLINE

- Every student is required to observe discipline and decorous behavior both inside and outside the campus and not to indulge in any activity which will tend to bring down the prestige of the Institute.

- Any act of indiscipline of a student reported to the concerned Head / Dean (Engineering & Technology), will be investigated and necessary action will be taken as per university rules from time to time.
- Ragging of any dimension is a criminal and non-bailable offence in our country. The current State and Central legislations provide for stringent punishment, including imprisonment. Once the involvement of a student is established in ragging, the offending student will be dismissed from the University and will not be admitted into any other Institution. Avenues also exist for collective punishment, if individuals can not be identified in this inhuman act. Every senior student, along with the parent, shall give an undertaking every year in this regard and this should be submitted at the time of admission / registration.

17 REGISTRATION REQUIREMENTS

- Every student is required to be present and register at the commencement of each semester on the day(s) fixed for and notified in the Academic Calendar from time to time.
- Late registration will be permitted with a fine as decided from time to time up to three weeks from the date of commencement of each semester as notified in the Academic Calendar from time to time. If the student does not register in the specified time he / she has to be registered in the next year in the same semester.
- Percentage attendance for all students will be counted from the date of commencement of the semester, irrespective of his/her date of registration. However, in case of first year first semester, attendance will be counted from date of admission into the School or date of commencement of class work, whichever is later.
- Minimum 4 weeks Industrial training/Internship in during summer break is compulsory after end semester examination of sixth semester. The student has to submit the industrial training / Internship report to the concerned department at the time of registration in the seventh semester and required to defend his/her industrial training/Internship during seventh semester in the department.
- If a student finds his/her academic/course load heavy in any semester, or for any other valid reason, he/she may drop courses within 15 instructional days from the commencement of the semester with the recommendation of his/her Head of Department and approval of the Dean, Engineering & Technology.
- The curriculum for any semester, except for the final semester will normally carry credits between 21 to 29.
- Minimum number of credits that a student can register in any given semester (excepting for final semester) is 15. Maximum number of credits that can be registered in a semester is 29. However, in the final semester, a student may earn less than 15 credits if it is sufficient for him/ her to fulfill the requirements for the award of the degree.
- A student who has successfully secured ***CGPA*** equal and more than 7.0 in his/her First Year courses, can be registered for non credit courses in other departments of the university for

his/her higher semesters of study. The registration in non credit courses will be done after recommendation of Head of the Department and approval of the Dean, Engineering & Technology followed by the same of the Head of the Department concerned of the non credit course offered in. The student has to attend the classes of the non credit courses in addition to the fulfilling the requirements of registered regular subjects in his/her department prescribed by the Head of Department. For non credit courses "Satisfactory" or "Unsatisfactory" shall be indicated instead of the letter grade and this will not be counted for the computation of SGPA/CGPA.

18 TRANSFER OF CREDITS

With due approval the courses studied through on line / off line like Massive Open online Courses (MOOCS) through National Programme on Technology Enhanced Learning (NPTEL) under Study Webs of Active –Learning for Young Aspiring Minds (SWYAM) in Indian/ Foreign University/Institutions by the students during their study period at GGV Bilaspur (C.G.) may count towards the credit requirements for the award of B.Tech. degree. The credit transferred will reduce the number of courses to be registered by the student at GGV. The guidelines for such transfer of credits are as follows.

- On successful completion of the courses opted by students under SWYAM, the credits earned by them shall be included in their Grade card.
- Credits transferred will not be used for SGPA/CGPA computations except SWYAM. However, credits transferred will be considered for overall credits requirements of the programme.
- Students can earn credits only from other department of the University (GGV) / IISC/IITs/NITs/Central Universities and other Indian and Foreign Institutions/Universities with which GGV has an MOU (and that MOU must have specific clauses for provisions of credit transfer by students).
- Credit transfer can only be considered for the courses at same level (i.e., UG, PG, etc.).

19 INTERPRETATION OF REGULATION

In case of any dispute in the matter of interpretation of this Ordinance, the decision of the Vice-Chancellor of the University shall be final and binding on the students.

20 POWER TO MODIFY

Notwithstanding all that has been stated above, the Academic Council of the University has the right to propose any modifications or amendments to the Executive Council for final decision of the above regulations and further actions from time to time.

21 Matters not covered in this Ordinance shall be governed by the relevant ordinance of the University.

Draft Ordinance
for Governing the award for the Degree of Bachelor of Technology (B.Tech.)-4 years (8 Semester) Degree Course as per Choice Based Credit System
(Old-CBCS)

1.0 GENERAL

The first degree of four years (Eight Semester) Course in Technology, hereinafter called 4- year B.Tech degree course, shall be designated as 'BACHELOR OF TECHNOLOGY' inrespective Branches. The conduct of the programme and the performance evaluation of B. Tech. courses are on the basis of percentage of marks earned as well as credit system.

2.0 ADMISSION

The minimum qualification for admission to the first year B. Tech. shall be the passing of Higher Secondary School Certificate Examination (10+2) scheme with Physics, Chemistry and Mathematics conducted by Central Board of Secondary Education or any other equivalent examination from recognized Board or University. The candidate shall be eligible for admission on the basis of the merit list of Joint Entrance Examination (JEE) (main) or any other entrance examination decided by Guru Ghasidas Vishwavidyalaya for Admission to B. Tech. degree course time to time. In general the admission to B. Tech. degree course shall be governed by the rules of, MHRD, Govrenment of India (GoI) and Guru Ghasidas Vishwavidyalaya.
The reservations in admission, cancellation of admission and fee refund will be as per MHRD, GoI norms and notifications issued from time to time.

3.0 ATTENDANCE REQUIREMENT

3.1 A Student shall be required to attend at least 75% of the classes actually held in the semester which may include theory class, seminars, sessionals / practicals/projects, as may be prescribed.

Provided that the Dean of the School of Engineering & Technology on the recommendations of the concerned Head of the Department may condone the shortage in attendance of those students who have secured 65% attendance. This condonation should not exceed 10% on the following satisfactory grounds.

(a) Illness / Medical leave of the student.

(b) Unforseen mishappening with parents.

(c) For participating in the extra co-curricular events with prior approval from the university authority.

(d) For participating in the sports activity with prior approval from the university authority

(e) For attending in interviews with valid proof and prior permission of the concerned head of department.

3.2 A student who does not satisfy the requirement of attendance as per clause 3.1, he/she will be detained due to shortage of attendance in a particular semester and he/she will have to repeat the same semester taking re-admission as a regular student in the next commencing academic session.

4.0 DURATION

The duration of undergraduate (U.G.) degree programmes leading to B. Tech. degree, shall be normally four years and the maximum duration shall be 8 years from the date of initial registration in First year B.Tech. course. If a candidate will not be able to complete the course in the maximum duration of 8 years then he / she will not be eligible to continue the course from that point of time itself.

5.0 EXTRA ORDINARY LONG ABSENCE

If a student does not participate in the academic activities of the School of Studies of Engineering and Technology of this Vishwavidyalaya for a period exceeding two years for reasons of ill health or medical grounds only, he / she shall neither be permitted to appear in any subsequent examinations nor shall be admitted or promoted to any semester and he / she shall cease to be a student of B. Tech. Degree Course. Here participation in academic activity means attending Lectures, Tutorials, Practicals/Sessionals and such other activities declared as academic activities.

6.0 DISCIPLINE

- Every student is required to observe discipline and decorous behavior both inside and outside the campus and not to indulge in any activity which will tend to bring down the prestige of the Institute.

- Any act of indiscipline of a student reported to the concerned Head /Dean (Engineering & Technology), will be investigated and necessary action will betaken as per university rules from time to time.

- Ragging of any dimension is a criminal and nonbailable offence in our country. The current State and Central legislations provide for stringent punishment, including imprisonment. Once the involvement of a student is established in ragging, the offending student will be dismissed from the University and will not be admitted into any other

Institution. Avenues also exist for collective punishment, if individuals can not be identified in this inhuman act. Every senior student, along with the parent, shall give an undertaking every year in this regard and this should be submitted at the time of admission / registration.

7.0 REGISTRATION REQUIREMENTS

- Every student is required to be present and register / enroll at the commencement of each semester on the day(s) fixed for and notified in the Academic Calendar from time to time.

- Late registration will be permitted with a fine as decided from time to time up to three weeks from the date of commencement of each semester as notified in the Academic Calendar from time to time. If the student does not register in the specified time he / she has to be registered in the next year in the same semester.

- Percentage attendance for all students will be counted from the date of commencement of the semester, irrespective of his/her date of registration. However, in case of first year, first semester, attendance will be counted from date of admission into the Institute or date of commencement of class work, whichever is later.

- Minimum 4 weeks Industrial training during summer break is complsary after end semester examination of six semester. The student has to submit the industrial training report to the concerned head of department at the time of registration in the seventh

  semester.
- If a student finds his / her academic / course load heavy in any semester, or for any other valid reason, he/she may drop courses within 15 instructional days from the commencement of the semester with the recommendation of his / her Head of Department and approval of the Dean, Engineering & Technology.

- The curriculum for any semester, except for the final semester will normally carry credits between 21 to 29.

- Minimum number of credits that a student can register in any given semester (excepting for final semester) is 15. Maximum number of credits that can be registered in a semester is 29. However, in the final semester, a student may earn less than 15 credits if it is sufficient for him/ her to fulfill the requirements for the award of the degree.

- A student who has successfully secured ***Cumulative Performance Index (CPI)*** equal and more than 7.0 in his / her First Year courses, can be registered for non credit courses in other departments of the university for his / her higher semesters of study. The registration

in non credit courses will be done after recommendation of Head of the Department and approval of the Dean, Engineering & Technology and with the permission of the concerned subject teacher. The student has to attend the classes of the non credit courses in addition to the fulfilling the requirements of registered regular subjects in the his/her department prescribed by the Head of Department. For non credit courses "Satisfactory" or "Unsatisfactory" shall be indicated instead of the letter grade and this will not be counted for the computation of Semester Performance Index (SPI) / CPI.

8.0 EXAMINATIONS

8.1. Medium of Instruction/Examination – Medium of instruction and examination shall be English only.

8.2. Practical/ Sessional Work – The student shall be required to complete the Laboratory / Drawing / Design / Job preparation and other academic work assigned for that semester in the session.

8.3. There shall be a full End Semester Examination at the end of each semester consisting of theory papers, practicals/ sessionals.

8.4. There shall be one End Semester Examination (ESE) at the end of each semester conducted by Guru Ghasidas Vishwavidyalaya. Only those students, who will satisfy the attendance requirement to be eligible to appear at the End Semester Examination as per clause 3.0, will be permitted to appear in the End Semester Examination. The examination will consist of theory papers, laboratory practical/sessional and viva-voce as per the scheme of examination of that semester. These examinations shall be designated as follows.

(a). During First year - I & II sem. B. Tech. Examination

(b). During Second year - III & IV sem. B. Tech Examination

(c). During Third year - V & VI sem. B. Tech. Examination

(d). During Fourth year - VII & VIII sem. B. Tech. Examination

8.5. The semester examination will normally be held in the month of November-December and April – May in every academic session, or as decided by the University time to time.

8.6. Supplementary examination will be held only once in a year (for both even and odd semesters) normally in the month of July.

8.7. End Semester Examination time table shall be declared by the Controller of Examination before the commencement of examination.

9.0 PASSING OF EXAMINATION

9.1 Basis of Subjects Evaluation

9.1.1. For passing in a subject (theory / practical/sessional) the performance of the candidate in each semester shall be evaluated subject wise. There shall be continuous assessment throughout the semester by conducting quizzes / class tests / surprise test / assignments / seminar, etc. and mid semester examination, called as Internal Assessment (I.A.) carrying 40% weightage, and End Semester Examination (E.S.E.) carrying 60% weightage. A student has to secure minimum 35% marks in the particular theory subject and minimum 40% marks in a particular practical subject to pass that subject in the end semester examination. For each practical / sessional subject 60% weightage will be given to the actual practicals/sessionals performed during the semester I.A. and 40% weightage will be given to the End Semester Examination(ESE).

9.1.2. For evaluation of end semester practical / sessional examination of a subject, there shall be a panel of three examiners appointed by Head of the Department. All the three examiners shall be internal from the concerned department of the Institute of Technology, or external examiners may also be appointed.

9.1.3. To allot the marks of Internal Assessment (IA), there will be one Mid Semester Examination (MSE) in each theory subject of that semester, apart from one Class Tests (CT) and surprise test / assignments / quize.

9.2 Passing Marks in a Subject

For passing a subject the student is required to fulfill the following conditions:

(a) Student has to secure minimum 35% marks in a particular theory subject to pass that subject in the end semester examination.

(b) Student has to secure minimum 40% marks in a particular practical / sessional subject to pass that subject (practical / sessional) in the end semester examination.

(c) Must have secured minimum 40% marks (Marks of Internal Assessment + Marks of End Semester Examination) for each theory subject.

(d) Must have secured minimum 50% marks (Marks of Internal Assessment + Marks of End Semester Examination) for each project/practical/sessional subject.

(e) Must have scored minimum Semester Performance Index (SPI) of 5.0 in the semester.

If a student has cleared all the Theory and Practical/Sessional subjects of one or and both semesters of a year, but has failed to secure SPI of 5.0 in the semester or and semesters of ayear then he/she will be allowed to re-appear in the supplementary Examination in those subjects in which the student's Grade Point is less than 5. If the student fails to secure SPI of 5.0 even in the supplementary examination, he/she will not be promoted to the odd semester of the next higher year, and such student shall be treated as an ex- student. Other condition of promotion of the ex-student will be applicable as per Clause 12.

(f) If a student has passed a semester examination in all the subjects as per clause 9.2 (a-e), he/she shall not be permitted to reappear in that examination for improvement in grades/division.

9.3 Basis of Credits

Credit of a theory or practical/sessional subject is decided by:

Credit = {L+ (T+P)/2}, where L = Lecture periods per week, T = Tutorial period per week, P = Practical/Sessional periods per week. Credit in a subject will be an integer, not in a fractional number. If a credit in a subject turns out in fraction, it will be taken as next integer number.

10.0 ASSESSMENT AND GRADING

10.1. Mode of Assessment and Evaluation

10.1.1 For Theory Subjects

For the assessment of performance of students in a semester, continuous evaluation system will be followed with two components : Internal Assessment (IA), carrying 40% weightage and End Semester Examination(ESE), carrying 60% weightage. There will be one class tests (10 marks), one mid semester examination (20 marks) and teacher assesment (05 marks for attendance and 05 marks on surprise test / assignmrents /quizes etc.) in each theory subject in a semester forming the part of Internal Assessment (IA). The marks for attendance shall be awarded in a theory subject as per the following Table.

Percentage of attendance	65 - ≤ 75	> 75 - ≤ 80	>80 - ≤ 85	>85- ≤ 90	>90- ≤ 95	>95- ≤ 100
Marks to be awarded	NIL	01	02	03	04	05

10.1.2. For Projects/Practical/ Sessional Subjects

Evaluation of project/practical/sessional during the semester will carry 60% weightage for Internal Assessment (IA) and the End Semester Examination (ESE) will carry 40% weightage. The internal assessment will carry equal weitage of attendance (20% weightage), practical records (20% weightage) and internal viva – voice examination (20% weightage). The marks for attendance shall be awarded in a projects/practical/sessional subject as per the following Table.

Percentage of attendance	65 - ≤ 75	> 75 - ≤ 80	>80- ≤ 85	>85- ≤ 90	>90- ≤ 95	>95- ≤ 100
Percent weightage of Marks	10	12	14	16	18	20

10.1.3. Grading System

Percentage as well as absolute grading system will be followed, in everysubject, theory or practical/sessional. Astudent will be awarded a **Letter Grade**,based on his combined performance of Internal Assessment (IA) and End Semester Examination (ESE). These grades will be described by letters indicating a qualitative assessment of the student's performance through a number equivalentcalled "Grade Point" (GP) as given below. The following is the **Grade Point** pattern. Grade 'F' indicates not clearing (passing) of the subject.

Letter Grade (LG)	O	A+	A	B+	B	C	P	F	Ab
Grade Point	10	9	8	7	6	5	4	0	0

The Letter Grades are O (Outstanding), A+ (Excellent), A (Very Good), B+ (Good), B (Above Average), C (Average), P (Pass), F (Fail) and Ab (Absent in end semester examination).
Grades will be awarded for every theory and practical/sessional subject separately.

10.2. Absolute Grading System

(a) The Absolute Grading System as explained below will be adoptedfor theory and project/practical/sessional subjects.

GRADE	Percentage of Marks Obtained	
	THEORY	PRACTICAL/SESSIONAL/PROJECT
O (Outstanding)	90 ≤ 100	90 ≤ 100
A^+ (Excellent)	80 - < 90	80 - < 90
A (Very Good)	70 - < 80	70 - < 80
B^+ (Good)	60 - < 70	60 - < 70
B (Above Average)	55 - < 60	55 - < 60
C (Average)	50 - < 55	50 - < 55
P (Pass)	= 40	= 50
F (Fail)	0 - < 40	0 - < 50

(b) 01 Grace marks shall be given only once at the time of award of the degree to improve the Grade in overall result.

10.3. Semester Performance Index (SPI)

Performance of a student in i^{th} semester is expressed by $[SPI]_i$ which is aweighted average of course grade points obtained by a student in thesemester, and is expressed by

$$[SPI] = \frac{[C_1G_1 + C_2G_2 + \ldots]}{[C_1 + C_2 + \ldots]} = \frac{[\sum C_jG_j]}{[\sum C_j]} = \frac{N}{D}$$

Where C_j stands for Credit and G_j stands for Grade points corresponding to j^{th} subject in a semester. SPIs will becalculated up to two places of decimal without rounding off. SPI will becalculated only when a student clears a semester without failing in any subject, theory or practical/sessional.

10.4. Cumulative Performance Index (CPI)

This is a weighted average of course grade points obtained by a student forall the courses

taken, since his / her admission. Thus, CPI in the i^{th} semester with "i" greater than 2 will be calculated as follows

$$[CPI] = \frac{\sum_{i=1}^{i=n} N_i}{\sum_{i=1}^{i=n} D_i}$$

If a student repeats a course or is declared fail in a subject, then only thegrade points earned in the attempt when he / she cleared the course / subject are counted towards CPI. CPI will be calculated in every semester along with SPI, so that a student knows his / her latest CPI.

10.5. Award of Class or Division

10.5.1. The class/division awarded to a student with B. Tech.Degree shall be determined

by the student's CPI after clearing all the subjects of all the eight semesters, as given below:

- First Division with Distinction or **Honours** : 7.5 ≤CPI ≤ 10.0
- First Division : 6.5 ≤ CPI < 7.5
- Second Division : 5.0 ≤ CPI < 6.5

10.5.2. Division shall be awarded to a student only after clearing all the eight semesters successfully, and having earned at least a total credit of **190** for the award of B.Tech. degree. It shall be based on the integrated performance of the candidate for all the eight semesters as per clause 10.5.1.

10.5.3. No student shall be declared to have passed the final B.Tech. course unless he/she has fully passed all the eight semesters. The results of the eighth semester of those students, who have not passed examination in any previous semester, will be withheld. Such students shall be deemed to have passed the final B.Tech. examination in the year in which they pass / clear all the subjects of all the eight semesters, within the limit of the prescribed period of the whole course.

10.6. Conversion of CPI / SPI in Percentage

There is no equivalence between the CPI/SPI scale and percentage. However notionally,

Percentage of particular semester = (SPI)× 10

Percentage of B.Tech. Degree = (CPI)× 10

11.0 TRANSFER OF CREDITS

The courses credited in Indian or Foreign University/Institutions by students during their study period at GGV Bilaspur (C.G.) may count towards the credit requirements for the award of B.Tech. degree. The credit transferred will reduce the number of courses to be registered by the student at GGV. The guidelines for such transfer of credits are as follows.

- B.Tech students with consistent academic performance and CPI greater than 7.5 can credit courses approved by the Dean, Engineering & Technology, in other Institutions during 3rd and 4th year and during summer breaks.

- Credits transferred will not be used for SPI/CPI computations. However, credits transferred will be considered for overall credits requirements of the programme.

- Students can earn credits only from other department of the University (GGV) / IISC/IITs/NITs/Central Universities and other Indian and Foreign Institutions/Universities with which GGV has an MOU (and that MOU must have specific clauses for provisions of credit transfer by students).

- Credit transfer can only be considered for the courses at same level (i.e., UG, PG, etc.).

- The maximum number of credits that can be transferred by a student shall be limited to 15.

- A student has to get minimum passing grades/ marks for such courses for which the credits transfer are to be made.

- The credits / grades indicated in the grade sheet obtained from the university in which the student has completed the courses should be used by the student as part of his/her transcripts.

- The GGV transcripts will only indicate the courses, credits and grades completed at GGV and the total no. of credits earned in other Universities in a particular semester.

12.0 PROMOTION TO HIGHER YEAR AND HIGHER SEMESTER

12.1. Those students who have cleared all the registered theory, practical/sessional subjects

prescribed for the B.Tech. first year shall be promoted to the B.Tech. second year. Those students who have cleared all the registered theory, practical/sessional subjects prescribed for the B.Tech. second year shall be promoted to the B.Tech. thired year. Those students who have cleared all the registered theory, practical/sessional subjects prescribed for the B.Tech. third year shall be promoted to the B.Tech. fourth year-

12.2. Supplementary examinations will be held only once in a year (for both even and odd semesters) normally in the month of July after declaration of results of even semester examination of the incumbent session, or as decided by the University time to time.

12.3. Those students who would have backlogs in registered theory and/ or practical/ sessional subjects in the odd and or even semesters of any year will be allowed to appear in the supplementary examinations of the same year.

12.4. Those B.Tech. students who are allowed to appear the supplementary examination (of odd or even or both semester**),** may be provisionally admitted to attend the classes of the next higher odd semester of the next year. However, such provisionally admitted students will become regular only after passing in all their backlog papers in supplementary examination, if eligible otherwise.

12.5. If a student fails to clear in the supplementary examination all the backlogs of theory, practical/sessional subjects of the odd and even semesters, he/she will not be promoted to the odd semester of the next higher year, and such student shall be treated as ex-student.

12.6. Ex-students, (as per clause 12.5), shall be required to clear their backlog papers (theory and or practical/sessional subjects), in the end semester examination of the corresponding semesters (odd and even) and suplimentry examination to be conducted next year (in the following academic session). Such ex-students will be required to deposit the examination fees only.

12.7. If a student fails to appear in the practical/sessional examination of a semester due to unforeseen incident, a makeup end semester practical/sessional examination may be conducted,if required, strictly on the recommendation of the concerned Head of the Department, and approval of the Dean (Engineering & Technology).

13.0 BRANCH CHANGE AFTER FIRST YEAR RESULT

Students admitted in First Year B. Tech. course of the Institute of Technology having CPI of 08 or above at the end of their First Year course, are allowed to change their branch according to merit and subject to the seat availability in the branch where students want to shift. Only those students

will be considered for the branch change who would have cleared all the subjects of First and Second semesters in the first attempt itself in the End Semester Examination.

14.0 TRANSCRIPT

Transcript will be provided to the students as per the University norms.

15.0 INTERPRETATION

In case of any dispute in the matter of interpretation of this Ordinance, the decision of the Vice-Chanceller of the University shall be final and binding on the students.

16.0 POWER TO MODIFY

Not withstanding all that has been stated above, the Academic Council of the University has the right to propose any modifications or amendments to the Executive Council for final decision of the above regulations and further actions from time to time.

17.0 Matters not covered in this Ordinance shall be governed by the relevant ordinance of the University.

CODE OF CONDUCT FOR STUDENTS

CODE OF CONDUCT FOR STUDENTS

The students are admitted to Guru Ghasidas Vishwavidyalaya to achieve excellence and shape their character to become responsible citizens. They must realize their responsibility towards the Vishwavidyalaya and to its components like faculty, staff and fellow students. Failure to maintain a good standard of conduct shall result in disciplinary action.

Attendance: 75% attendance is compulsory in each subject.

Misconduct: Any of the following activities (but not limited to these only) will be treated as misconduct.

1. Disruption of teaching activities or disturbing the learning process of other students on the campus.
2. Any act on the part of the students, which disrupts functioning of the university, endangers health and safety of campus residents and da mages Vishwavidyalaya properties.
3. Cheating in examination and supplying of false documents / information in order to seek any consideration / favour from the University.
4. Possession or consumption of intoxicating beverages on the campus.
5. Failure to return back loaned material, settle University dues.
6. Possession of weapons.
7. Use of unparliamentarily language while in conversation with Vishwavidyalaya Staff and fellow students.

Disciplinary Actions:

Failure to adhere to good conduct may result in disciplinary actions like:

1. A warning by the authorities.
2. Suspension from a particular class.
3. Suspension / expulsion from the University.
4. Suspension of campus privileges e.g. hostel, accommodation etc.
5. Withholding of examination result or withdrawal of awarded diploma / degree certificate.
6. Any other disciplinary action deemed appropriate by the University authorities.

DISCIPLINE AMONG STUDENTS
IN
UNIVERSITY EXAMINATIONS

DISCIPLINE AMONG STUDENTS IN UNIVERSITY EXAMINATIONS

I UNIVERSITY END SEMESTER EXAMINATIONS

1. The end –semester examination shall be held under the general supervision of the Head of Department by the faculty member concerned. He/she shall be responsible for the fair and orderly conduct of the examination
2. In case of detection of unfair means (as specified in clause 1 of General Guidelines below), the same shall be brought to the notice of the head of the department concerned for further action specified under clause 5 of the General Guidelines below

II ENTRANCE EXAMINATIONS

1. During an entrance examination the candidates shall be under the disciplinary control of the chief Superintendent of the centre who shall issue the necessary instructions. If a candidate disobeys instructions or misbehaves with any member of the supervisory staff or with any of the invigilators at the centre, he/she may be expelled from the examination for that session.
2. The Chief Superintendent shall immediately report the facts of such a case with full details of evidence to the Controller of Examinations who will refer the matter to the Examination Discipline Committee in terms of clause 4 of General Guidelines below. The committee will make recommendations for disciplinary action as it may deem fit to the Vice-Chancellor as provided under clause 7
3. Everybody, before an examination begins, the invigilators shall call upon all the candidates to search their persons, tables, desks, etc. and ask them to hand over all papers, books, notes or other reference material which they are not allowed to have in their possession or accessible to them in the examination hall. Where a late-comer is admitted this warning shall be repeated to him at the time of entrance to the examination hall. They are also to see that each candidate has his/her identification card and hall ticket with him/her.

III GENERAL GUIDELINES

1. Use of Unfair means:

A candidate shall not use means in connection with any examination. The following shall be deemed to unfair means:

a. Found in possession of incriminating material related/unrelated to the subject of the examination concerned.
b. Found copying either from the possessed material or from a neighbor.
c. Inter-changing of answer scripts.
d. Change of seat for copying.

e.Trying to help others candidates.
f. Found consulting neighbours
g.Exchange of answer sheets or relevant materilas.
h. Writing some other candidate's register number in the main answer paper.
i. Insertion of pre-written answer sheets (Main sheets or Additional sheets)
j. Threatening the invigilator or insubordinate behavior as reported by the Chief Superintendent and / or Hall Superintendent.
k.Consulting the invigilator for answering the questions in the examination.
l. Cases of impersonation
m. Mass copying
n. Using electronic devices for the purpose of malpractice.

The Executive Council may declare any other act of omission or commission to be unfair means in respect of any or all the examination.

2. If the Vice-Chancellor is satisfied that there has been mass-scale copying or use or unfair means on a mass-scale at particular center(s), he may cancel the examination of all the candidates concerned and order re-examination.
3. Where the invigilator incharge is satisfied that one third (1/3) or more students were involved in using unfair-means or copying in a particular Examination Hall. It shall be deemed to be a case of mass copying.

a) The Chief Superintendent of the examination centre shall report to the Controller of Examinations without delay and on the day of the occurrence if possible, each case where use of unfair means in the examination is suspected or discovered with full details of the evidence in support thereof and the statement of the candidate concerned, if any, on the forms supplied by the Controller of Examination for the purpose.

b) A candidate shall not be forced to give a statement but the fact of his /her having refused to make a statement shall be recorded by the Chief Superintendent and shall be got attested by two other members of the supervisory staff on duty at the time of occurrence of the incident.

c) A candidate detected or suspected of using unfair means in the examination may be permitted to answer the question paper, but on separate answer-book. The answer-book in which the use of unfair means is suspected shall be seized by the Chief Superintendent, who shall send both the answer-books to the Controller of Exami9nation with his report. This will not affect the concerned candidate appearing in the rest of the examinations.

d) All cases of use of unfair means shall be reported immediately to the Controller of the Examination by the Centre Superintendent, examiner, paper-setter, evaluator, moderator, tabulator or the person connected with the University examination as the case may be, with all the relevant material.

4. Examination Discipline Committee

a) All the cases of alleged use of unfair means shall be referred to a committee called the Examination Discipline Committee to be appointed by the Vice-Chancellor.

b) The Committee shall consists of five members drawn from amongst the teachers and officers of the university. One member will be nominated as Chairman from amongstthem by the Vice Chancellor.

c) A member shall be appointed for a term of two years, and shall be eligible for re-appointment.

d) Three members present shall constitute the quorum.

e) Ordinarily, all decisions shall be taken by the Committee by simple majority. If the members cannot reach a consensus, the case shall be referred to the Vice-Chancellor, whose decision shall be final.

f) All decisions taken by the examination discipline committee will be placed before the Vice-Chancellor for approval

g) A candidate within one month of the receipt of the decision of the university may appeal to the Vice-Chancellor, in writing for a review of the case. If the Vice-Chancellor is satisfied that the representation merits consideration, he/she may refer the case back to the Examination Discipline Committee for reconsideration.

5 The Examination Discipline Committee may recommend one of the following punishments for cases of unfair means

Nature of unfair means	Scale of Punishment
If the candidate has used unfair means specified in sub-clause (a) to (g) of clause 3	Cancel all the University Examinations registered by the candidate in that session.
If the candidate has repeated the unfair means shown at 3(a) to (g) a second time	Cancel the University Examination of all subjects registered by the candidate in that session and debar him/her for the next examination session (i.e. all university Examinations in the subsequent session)
If the candidate has repeated the unfair means shown at 3(a) to (g) third time	Cancel the University Examination of all subjects registered by the candidate for that session and debar him/her for two years from registering and appearing for the university Examination
If the candidate has used unfair means	Cancel the University Examination of all subjects registered by the candidate during that semester only.

specified in sub-clause (h) of clause	
If the candidate has used unfair means specified in sub-clause (i) of clause	Cancel the University Examination of all subjects registered by the candidate for that session and debar him/her for two subsequent Examination sessions.
If the candidate has used unfair means specified in sub-clause (j) of clause 3	Cancel the University Examination of all subjects registered by the candidate for that session and debar him/her for two years from registering and appearing for the university Examination
If the candidate has used unfair means specified in sub-clause (k) of clause	Cancel the University Examination of all subjects registered by the candidate for that session
If the candidate has used unfair means specified in sub-clause (l) of clause	Cancel the University Examination of all subjects registered by the candidate for that session and debar him/her for two years from registering and appearing for the examination sessions. Moreover, relevant legal action shall be initiated if an outsider is involved.
If the candidate used unfair means in sub-clause (m) of clause 3	ix) a) In the single Hall: Cancel the relevant examination taken by the students of that Hall. Debar the concerned Hall superintendent and other involved directly or indirectly from the examination work such as invigilation, question paper-setting, valuation, etc. for the next six examination sessions. b) In a Centre: Cancel the relevant examination taken by the students of the center. Debare the Hall Superintendents and the Chief Superintendent and other involved directly or indirectly from the examination work such as invigilation, question paper-setting, valuation, etc. for the next six examination sessions and cancel the examination center for two years

Regulation for the Disposal of cases of "Use or attempt to use Unfair Means" and Disorderly conduct at an examination by a candidate. {Statue 14(d), Draft Ordinance 26(36)}

1. A candidate shall not use unfair means or behave disorderly in any manner, in connection with any examinations of the University.

2. In every case (Except cases of Internal/Practical examinations) where a candidate appearing for an examination is found using or attempting to use unfair means at the examination or behaving in a disorderly manner, a report accompanied with the candidate's answer books and such documents and articles as were found in his possession and as constitute primafacie evidence of the use of unfair means/disorderly behavior shall be sent immediately to the Controller of Examinations. Provided that in case of Internal/Practical examinations, if any kind of unfair means detected during such examinations, the same shall be brought to the notice of the Head of the Department concerned, who shall submit a full report of the same to the Dean concerned and the Dean concerned shall have full power to decide the case in consultation with Head of the Department concerned at School of Studies / Departmental level only. If an examinee disobeys instructions or misbehaves with any member of the supervisory staff or with any of the invigilators during the examinations, he/she may be expelled by the Dean/HoD from that session of the examination.

3. The Chief Superintendent/Superintendent of the examination centre shall report to the Controller of Examinations without delay and on the day of the occurrence if possible, each case where use of unfair means in the examination conduct ed by the Univer sit y is suspected or discovered with full details of the evidence in support thereof and the statement of the candidate concerned, if any, on the forms supplied by the University for the purpose.

4. A candidate shall not be forced to give a statement but the fact of his/ her having refused to make a statement shall be recorded by the Chief Superintendent/ Superintendent and shall be got attested by two other members of the supervisory staff on duty at the time of occurrence of the incident.

5. A candidate detected or suspected of using unfair means in the examination conducted by the University may be permitted to answer the question paper, but on separate answer-book. The answer-book in which the use of unfair means is suspected shall be seized by the Chief Superintendent/ superintendent, who shall send both the answer- books to the Controller of Examinations with his report. This will be not affecting the concerned candidate appearing in the rest of the examinations

6. All cases of use of unfair means(Except cases of Internal/Practical examinations) during the examinations conducted by the University, shall be reported immediately to the

Controller of Examinations by the Centre Superintendent/ Superintendent, examiner, paper-setter, evaluator, moderator, tabulator or any other person connected with the University examination as the case may be, with all the relevant material.

7. If the Vice-Chancellor is satisfied that there has been mass-scale copying or use of unfair means on a mass-scale at particular center(s)/Building/Hall, he or she may cancel the examination of all the candidates concerned and order re-examination.

8. Where the invigilator in charge is satisfied that one third (1/3) or more students were involved in using unfair-means or copying in a particular Examination Hall, it shall be deemed to be a case of mass copying.

9. UNFAIR MEANS COMMITTEE

a) All the cases of alleged use of unfair means shall be referred to a Committee called the Unfair Means Committee to be appointed by the Vice-Chancellor as prescribed in Ordinance 26(36).

b) Ordinarily, all decisions shall be taken by the Committee by simple majority. If the members cannot reach a consensus, the case shall be referred to the Vice-Chancellor, whose decision shall be final.

c) All decisions taken by the Unfair Means Committee will be placed before the Vice-Chancellor for approval.

d) A candidate, within 10 days of the receipt of the decision of the University, may appeal to the Vice-Chancellor, in writing for a review of his/her case. If the Vice-Chancellor is satisfied that the representation merits consideration, he/she may either decide himself/herself the case finally or may refer the case back to the Unfair Means Committee for reconsideration of the same within next 10 days.

10. The Unfair Means Committee may recommend one of the following punishments for below mentioned cases of unfair means.

	Nature of unfair means	Scale of Punishment
(I)	Found in possession of incriminating material (Like book(s), notes, papers, electronic gadgets or any other like material, in any form.	
(A)	Recovered material not related to the subject or found writing something on the question paper, which is not the answer to the questions being asked on his question paper.	No punishment be imposed on the basis of examiner's report showing irrelevancy of material but a warning be issued for not to repeat the same.
(B)	The Material is relevant to the subject but not used.	Paper be cancelled, examinee be permitted to appear in ATKT / Supp. Exams., if eligible for the same.
(C)	The Material is relevant to the subject and used.	Concerned semester Examination and subsequent semester examination (if any) of the same session be cancelled, examinee be permitted to appear in the next full examination of concerned semester with all subject in next session.
(D)	The Material is relevant to the subject or paper (used/ not used) and the examinee showed indecent Behavior. **OR** The Material is relevant to the subject or paper and used and the examinee was again found using unfair means subsequently.	Concerned semester Examination and subsequent semester examination (if any) of the same session be cancelled and the examinee be debarred from appearing at all the semester examinations of next full session.
(E)	The Material is relevant to the subject or paper, used and the examinee showed gross indiscipline such as abusing / threatening the invigilators **OR** using abusive/derogatory language orally or in writing in the Answer Sheet against the Centre Superintendent / Examiner / Invigilator **OR** threatening / using violence towards Centre Superintendent or other persons connected with the conduct of the examinations **OR** any other form of gross insubordinate behavior as reported by the Chief Superintendent and / or Hall Superintendent **OR** found using unfair means in the two or more subsequent papers, found destroying evidence or not depositing the examination answer books .	Concerned semester Examination and subsequent semester examination (if any) of the same session be cancelled and the examinee be debarred from appearing at all the semester examinations of next two full session.

(II)	If an examinee / candidate is found carrying a weapon capable of inflicting injury in the examination rooms / halls. (Note-The Chief Superintendent and / or Centre Superintendent / Hall Superintendent in such a case should ask for seizure of the weapon and report the matter to the concern police station)	Concerned semester Examination and subsequent semester examination (if any) of the same session be cancelled and the examinee be debarred from appearing at all the semester examinations of next three full session.
(III)	If a report is received that an examinee has physically assaulted any person connected with the University Examinations.	Concerned semester Examination and subsequent semester examination (if any) of the same session be cancelled and the examinee be debarred from appearing at all the semester examinations of next four full session.
(IV) (a)	Found receiving or giving assistance in copying from or to other examinees during the course of the examination. **OR** Trying to help other candidates. **OR** Found consulting neighbors for the purpose of copying **OR** Writing questions and answers on any additional paper other than the Answer Sheet.	Paper be cancelled, examinee be permitted to appear in ATKT/ Supp. Exams., if eligible for the same.
(b)	Inter-changing of answer scripts or other relevant material. **OR** Change of seat for copying including found sitting in a room or at a seat other than the allotted one without permission of the Centre Superintendent. **OR** Writing some other candidate's register number, intentionally, in the answer sheet.	Concerned semester Examination and subsequent semester examination (if any) of the same session be cancelled.
(c)	If the candidate has repeated the unfair means shown at clause **IV (b)** above a **second time.**	Concerned semester Examination and subsequent semester examination (if any) of the same session be cancelled and the examinee be debarred from appearing at all the semester examinations of next full session.
(d)	Insertion of pre- written answer sheets (Main sheets or Additional Sheets) including smuggling in or out of the examination hall of Answer Sheet in whole or part or tampering with it in any way. **OR** Replacement of Answer Sheet, exchange of Answer Sheet with other student, addition of extra pages in the Answer Sheet, smuggling of Answer Sheet/pages. **OR** Candidate is	Concerned semester Examination and subsequent semester examination (if any) of the same session be cancelled and the examinee be debarred from appearing at all the semester examinations of next full session.

	caught with a material which he has chewed or swallowed or torn into pieces and the candidate refuses to sign the documents and also misbehave with the invigilation staff.	
(e)	Consulting the invigilator for answering the questions in the examination or communicating with the examiner or any other person connected with the examination for favor.	Cancel the Examination of that Paper for which the examinee was found consulting the invigilator or Cancel the Examinations of all subjects/Papers registered by the candidate for concerned semester for which he was found communicating with the examiner /examiners or any other person connected with the examination for favor.
(f)	Cases of impersonation i.e. sending some other person to take the examination.	Cancel the University Examinations of all subjects registered by the candidate for concerned semester and subsequent semesters (if any) of the same session and debar him/her from all semester examinations for immediate next session. **Moreover, relevant legal action shall be initiated if an outsider is involved.**
(V)	**Cases not covered under any of the above clauses.**	The Committee may recommend appropriate action/decision in each case.
(VI)	**Mass copying: -**	
a)	In the Single Building /Hall/Room: -	Cancel the relevant examination taken by the students of that Building /Hall/Room. Debar the concerned Building /Hall Superintendent and other involved directly or indirectly from the examination work such as invigilation, question paper setting, valuation, etc. for the next six sessions (Three Years) of semester examinations.
b)	In a Centre/Building.	Cancel the relevant examination taken by the students of the Centre/Building. Debar the Superintendents and the Chief Superintendent and other involved directly or indirectly from the examination work such as invigilation, question paper setting, valuation etc. for the next six examination sessions (Three Years) **and cancel the examination center for two years.**
(VII) Unfair Means cases in Internal/Sessional and Practical Examinations -: If any kind of unfair means detected during the **Internal/Sessional** and /or Practical Examinations the same shall be brought to the notice of the Head of the Department concerned, who shall submit a full report to the Dean, School of Studies concerned. The		

Dean concerned, in consultation with the Head of Department, shall have full power to decide the case at School of Study / Departmental level only.

The maximum penalty for using unfair means in Internal/Sessional and Practical Examinations shall be as follows :-

If the examinee found using any kind of the unfair means during any **Internal/Sessional** or **Practical examination**, the Dean in consultation with Head of the Department and on the basis of the report of the Head of the Department concerned, the Dean or Under the Order/Instruction of the Dean concerned, the Head of the Department **shall expel the examinee from the Internal/Sessional or Practical Examination.**

If an examinee disobeys instructions or misbehaves with any member of the supervisory staff or with any of the invigilators during such examinations, he/she may be expelled by the Dean/HoD from that session of the examination.

If the examinee repeated the use of unfair means second time in any subsequent **Internal/Sessional** Examination or **Practical Examination,** the Dean concerned, in consultation with Head of the Department, shall cancel the admission of the examinee in the concerned Department for that session for which he was found using unfair means second time.

Appeal: - A candidate, **within 10 days of the receipt of the decision of the Dean/Head of the Department,** may appeal to the Vice-Chancellor, in writing for a review of his/her case. If the Vice-Chancellor is satisfied that the representation merits consideration, he/she may either decide himself/herself the case finally or may refer the case back to the Dean/Head of the Department , as the case may be, for reconsideration **of the same within next 10 days.**

11. INTERPRETATION OF REGULATION

In any matter of interpretation of the provisions of this regulation, the matter shall be referred to Vice-Chancellor who in the capacity of the chairman of Academic Council and Executive Council shall decide the concerned matter finally.

12. POWER TO REMOVE DIFFICULTIES

If any question arises related to the matters not covered in these provisions, the relevant provisions made in appropriate Act / Statute / Ordinance / Regulations / Rules / Notifications issued by the university shall prevail. In addition to above the Executive Council, on the recommendations of Academic Council, may declare any other act of omission or commission to be unfair means in respect of any or all the examination.

ABOUT ANTI RAGGING

ABOUT ANTI RAGGING

UGC DRAFT REGULATIONS ON CURBING THE MENACE OF RAGGING IN HIGHER EDUCATIONAL INSTITUTIONS, 2009

In exercise of the power conferred by Clause (g) of Sub-Section (1) of Section 26 of the University Grants Commission Act, 1956, the University Grants Commission hereby makes the following Regulations, namely-

1. Title, commencement and applicability:-

1.1. These regulations shall be called the "UGC Regulations on Curbing the Menace of Ragging in Higher Educational Institutions, 2009".

1.2. They shall come into force with immediate effect.

1.3. They shall apply to all the universities established or incorporated by or under a Central Act, a Provincial Act or a State Act, to all institutions deemed to be university under Section 3 of the UGC Act, 1956, to all other higher educational institutions, including the departments, constituent units and hall the premises (academic, residential, sports, canteen, etc) of such universities, deemed universities and other higher educational institutions, whether located within the campus or outside, and to all means of transportation of students whether public or private.

2. Objective:-

To root out ragging in all its forms from universities, colleges and other educational institutions in the country by prohibiting it by law, preventing its occurrence by following the provisions of these Regulations and punishing those who indulge in ragging in spite of prohibition and prevention as provided for in these Regulations and the appropriate law in force.

3. Definitions:-

For the purposes of these Regulations:-

3.1 "college" means any institution, whether known as such or by any other name, which provides for a programme of study beyond 12 years of schooling for obtaining any qualifi cation from a university and which, in accordance with the rules and regulations of such university, is recognized as competent to provide for such programmes of study and present students undergoing such programmes of study for the examination for the award of such qualifi cation.

3.2 "Head of the institution" means the 'Vice-Chancellor' in case of a university/deemed to be university, 'Principal' in case of a college, 'Director' in case of an institute.

3.3 "institution" means a higher educational institution (HEI), like a university, a college, an institute, etc. imparting higher education beyond 12 years of schooling leading to a degree (graduate, postgraduate and/or higher level).

3.4 Ragging" means the following: Any disorderly conduct whether by words spoken or written or by an act which has the effect of teasing, treating or handling with rudeness any other student, indulging in rowdy or undisciplined activities which causes or is likely to cause annoyance, hardship or psychological harm or to raise fear or apprehension thereof in a fresher or a junior student or asking the students to do any act or perform something which such student will not in the ordinary course and which has the effect of causing or generating a sense of shame or embarrassment so as to adversely affect the physique or psyche of a fresher or a junior student.

3.5 "University" means a university established or incorporated by or under a Central Act, a Provincial Act or a State Act, an institution deemed to be university under Section 3 of the UGC Act, 1956, or an institution specially empowered by an Act of Parliament to confer or grant degrees

4 Punishable ingredients of Ragging:-

- Abetment to ragging;
- Criminal conspiracy to rag;
- Unlawful assembly and rioting while ragging;
- Public nuisance created during ragging;
- Violation of decency and morals through ragging;
- Injury to body, causing hurt or grievous hurt;
- Wrongful restraint;
- Wrongful confinement;
- Use of criminal force;
- Assault as well as sexual offences or even unnatural offences;
- Extortion;
- Criminal trespass;
- Offences against property;
- Criminal intimidation;
- Attempts to commit any or all of the above mentioned offences against the victim(s);
- All other offences following from the defi nition of "Ragging".

5 Measures for prohibition of ragging at the institution level:-

5.1 The institution shall strictly observe the provisions of the Act of the Central Government and the State Governments, if any, or if enacted, considering ragging as a cognizable offence under the law on a par with rape and other atrocities against women and ill- treatment of persons belonging to the SC/ST, and prohibiting ragging in all its forms in all institutions.

5.2 Ragging in all its forms shall be totally banned in the entire institution, including its departments, constituent units, all its premises (academic, residential, sports, canteen, etc) whether located within the campus or outside and in all means of transportation of students whether public or private.

5.3 The institution shall take strict action against those found guilty of ragging and/or of abetting ragging.

6 Measures for prevention of ragging at the institution level:-

6.1 Before admissions:-

6.1.1 The advertisement for admissions shall clearly mention that ragging is totally banned in the institution, and anyone found guilty of ragging and/or abetting ragging is liable to be punished Appropriately (for punishments, ref. section 8 below).

6.1.2 The brochure of admission/instruction booklet for candidates shall print in block letters these Regulations in full (including Annexures).

6.1.3 The 'Prospectus' and other admission related documents shall incorporate all directions of the Supreme Court and / or the Central or State Governments as applicable, so that the candidates and their parents/ guardians are sensitized in respect of the prohibition and consequences of ragging. If the institution is an affi liating university, it shall make it mandatory for the institutions under it to compulsorily incorporate such information in their 'Prospectus'.

6.1.4 The application form for admission/ enrolment shall have a printed undertaking, preferably both in English/Hindi and in one of the regional languages known to the institution and the applicant (English version given in Annexure I, Part I), to be filled up and signed by the candidate to the effect that he/she is aware of the law regarding prohibition of ragging as well as the punishments, and that he/she, if found guilty of the offence of ragging and/or abetting ragging, is liable to be punished appropriately.

6.1.5 The application form shall also contain printed undertaking, preferably both in English/Hindi and in one of the regional languages known to the institution and the parent/ guardian (English version given in Annexure I, Part II), to be signed by the parent/ guardian of the applicant to the effect that he/ she is also aware of the law in this regard and agrees to abide by the punishment meted out to his/her ward in case the latter is found guilty of ragging and/or abetting ragging.

6.1.6 The application for admission shall be accompanied by a document in respect of the School Leaving Certificate/ Character Certificate which shall include a report on the behavioral pattern of the applicant, so that the institution can thereafter keep intense watch upon a student who has a negative entry in this regard.

6.1.7 A student seeking admission to the hostel shall have to submit another undertaking in the form of Annexure I (both Parts) along with his/ her application for hostel accommodation.

6.1.8 At the commencement of the academic session the Head of the Institution shall convene and address a meeting of various functionaries/agencies, like Wardens, representatives of students, parents/ guardians, faculty, district administration including police, to discuss the measures to be taken to prevent ragging in the Institution and steps to be taken to identify the offenders and punish them suitably.

6.1.9 To make the community at large and the students in particular aware of the dehumanizing effect of ragging, and the approach of the institution towards those indulging in ragging, big posters (preferably multicolored with different colours for the provisions of law, punishments, etc.) shall be prominently displayed on all Notice Boards of all departments, hostels and other buildings as well as at vulnerable places. Some of such posters shall be of permanent nature in certain vulnerable places.

6.1.10 The institution shall request the media to give adequate publicity to the law prohibiting ragging and the negative aspects of ragging and the institution's resolve to ban ragging and punish those found guilty without fear or favour.

6.1.11 The institution shall identify, properly illuminate and man all vulnerable locations.

6.1.12 The institution shall tighten security in its premises, especially at the vulnerable places. If necessary, intense policing shall be resorted to at such points at odd hours during the early monthsof the academic session.

6.1.13 The institution shall utilize the vacation period before the start of the new academic year to launch wide publicity campaign against ragging through posters, leafl ets. seminars, street plays, etc.

6.1.14 The faculties/ departments/ units of the institution shall have induction arrangements (including those which anticipate, identify and plan to meet any special needs of any specific section of students) in place well in advance of the beginning of the academic year with a clear sense of the main aims and objectives of the induction process.

6.2 On admission:-

6.2.1Every fresher admitted to the institution shall be given a printed leafl et detailing when and to whom he/she has to turn to for help and guidance for various purposes (including Wardens, Head of the institution, members of the anti-ragging committees, relevant district and police authorities), addresses and telephone numbers of such persons/ authorities, etc., so that the fresher need not look up to the seniors for help in such matters and get indebted to them and

start doing things, right or wrong, at their be hest. Such a step will reduce the fresher's dependence on their seniors .

6.2.2 The institution through the leaflet mentioned above shall explain to the new entrants the arrangements for their induction and orientation which promote efficient and effective means of integrating them fully as students.

6.2.3 The leaflet mentioned above shall also tell the fresher's about their rights as bonafide students of the institution and clearly instructing them that they should desist from doing anything against their will even if ordered by the seniors, and that they have nothing to fear as the institution cares for them and shall not tolerate any atrocities against them.

6.2.4 The leaflet mentioned above shall contain a calendar of events and activities laid down by the institution to facilitate and complement familiarization of juniors with the academic environment of the institution.

6.2.5 The institution shall also organize joint sensitization programmes of 'freshers' and seniors.

6.2.6 Fresher shall be encouraged to report incidents of ragging, either as victims, or even as witnesses.

6.3 At the end of the academic year:-

6.3.1 At the end of every academic year the Vice-Chancellor/ Dean of Students Welfare/ Director/ Principal shall send a letter to the parents/ guardians who are completing the first year informing them about the law regarding ragging and the punishments, and appealing to them to impress upon their wards to desist from indulging in ragging when they come back at the beginning of the next academic session.

6.3.2 At the end of every academic year the institution shall form a 'Mentoring Cell' consisting of Mentors for the succeeding academic year. There shall be as many levels or tiers of Mentors as the number of batches in the institution, at the rate of 1 Mentor for 10 freshers and 1 Mentor of a higher level for 10 Mentors of the lower level.

6.4 Setting up of Committees and their functions:-

6.4.1The Anti-Ragging Committee:- The Anti-Ragging Committee shall be headed by the Head of the institution and shall consist of representatives of faculty members, parents, students belonging to the freshers' category as well as seniors and non-teaching staff. It shall consider the recommendations of the Anti-Ragging Squad and take appropriate decisions, including spelling out suitable punishments to those found guilty.

6.4.2 The Anti-Ragging Squad:- The Anti-Ragging Squad shall be nominated by the Head of the institution with such representation as considered necessary and shall consist of members belonging to the various sections of the campus community. The Squad will have vigil, oversight and patrolling functions. It shall be kept mobile, alert and active at all times and shall be empowered to inspect places of potential ragging and make surprise raids on hostels and other

hot spots. The Squad shall investigate incidentsof ragging and make recommendations to the Anti-Ragging Committee and shall work under the overall guidance of the said Committee.

6.4.3 Monitoring Cell on Ragging:- If the institution is an affi liating university, it shall have aMonitoring Cell on Ragging to coordinate with the institutions affi liated to it by calling for reports from the Heads of such institutions regarding the activities of the Anti-Ragging Committees, Squads, and Mentoring Cells, regarding compliance with the instructions on conducting orientation programmes, counseling sessions, etc., and regarding the incidents of ragging, the problems faced by wardens and other offi cials, etc. This Cell shall also review the efforts made by such institutions topublicize anti-ragging measures, cross-verify the receipt of undertakings from candidates/students and their parents/guardians every year, and shall be the prime mover for initiating action by the university authorities to suitably amendthe Statutes or Ordinances or Bye-laws to facilitate the implementation of anti ragging measures at the level ofthe institution.

6.5 Other measures:-

6.5.1 The Annexure mentioned in 6.1.4, 6.1.5 and 6.1.7 shall be furnished at the beginning of each academic year by every student, that is, by freshers as well as seniors.

6.5.2 The institution shall arrange for regular and periodic psychological counseling and orientation for students (for freshers separately, as well as jointly with seniors) by professional counselors during the first three months of the new academic year. This shall be done at the institution and department/ course levels. Parents and teachers shall also be involved in such sessions.

6.5.3 Apart from placing posters mentioned in 6.1.9 above at strategic places, the institution shall undertake measures for extensive publicity against ragging by means of audio-visual aids, by holding counseling sessions, workshops,painting and design competitions among students and other methods as it deems fit.

6.5.4 If the institution has B.Ed. and other Teacher training programmes, these courses shall be mandated to provide for anti-ragging and the relevant human rights appreciation inputs, as well as topics on sensitization against corporal punishments and checking of bullying amongst students, so that every teacher is equipped to handle at least the rudiments of the counseling approach.

6.5.5 Wardens shall be appointed as per the eligibility criteria laid down for the post refl ecting both the command and control aspects of maintaining discipline, as well as the softer skills of counseling and communicating with the youth outside the class-room situations. Wardens shall be accessible at all hours and shall be provided with mobile phones. The institution shall review and suitably enhance the powers and perquisites of Wardens and authorities involved in curbing the menace of ragging.

6.5.6 The security personnel posted in hostels shall be under the direct control of the Wardens and assessed by them.

6.5.7 Private commercially managed lodges and hostels shall be registered with the local police authorities, and this shall be done necessarily on the recommendation of the Head of the institution. Local police, local administration and the institutional authorities shall ensure vigil on incidents that may come within the definition of ragging and shall be responsible for action in the event of ragging in such premises, just as they would be for incidents within the campus. Managements of such private hostels shall be responsible for not reporting cases of ragging in their premises.

6.5.8 The Head of the institution shall take immediate action on receipt of the recommendations of the Anti-Ragging Squad. He/ She shall also take action suo motto if the circumstances so warrant.

6.5.9 Freshers who do not report the incidents of ragging either as victims or as witnesses shall also be punished suitably.

6.5.10 Anonymous random surveys shall be conducted across the 1st year batch of students (freshers) every fortnight during the first three months of the academic year to verify and cross-check whether the campus is indeed free of ragging or not. The institution may design its own methodology of conducting such surveys.

6.5.11 The burden of proof shall lie on the perpetrator of ragging and not on the victim.

6.5.12 The institution shall fi le an FIR with the police / local authorities whenever a case of ragging is reported, but continue with its own enquiry and other measures without waiting for action on the part of the police/ local civil authorities. Remedial action shall be initiated and completed within the one week of the incident itself.

6.5.13 The Migration / Transfer Certificate issued to the student by the institution shall have an entry, apart from those relating to general conduct and behaviour, whether the student has been punished for the offence of committing or abetting ragging, or not, as also whether the student has displayed persistent violent or aggressive behaviour or any desire to harm others.

6.5.14 Preventing or acting against ragging shall be the collective responsibility of all levels and sections of authorities or functionaries in the institution, including faculty, and not merely that of the specifi c body/ committee constituted for prevention of ragging.

6.5.15 The Heads of institutions other than universities shall submit weekly reports to the Vice-chancellor of the university the institution is affiliated to or recognized by, during the first three months of new academic year and thereafter each month on the status of compliance with anti-ragging measures. The Vice Chancellor of each university shall submit fortnightly reports of the university, including those of the Monitoring Cell on Ragging in case of an affiliating university, to the Chancellor.

6.5.16 Access to mobile phones and public phones shall be unrestricted in hostels and campuses, except in class-rooms, seminar halls, library etc. where jammers shall be installed to restrict the use of mobile phones.

6.6 Measures for encouraging healthy interaction between freshers and seniors:-

6.6.1 The institution shall set up appropriate committees including the course-in-charge, student advisor, Warden and some senior students to actively monitor, promote and regulate healthy interaction between the freshers and senior students.

6.6.2 Freshers' welcome parties shall be organized in each department by the senior students and the faculty together soon after admissions, preferably within the fi rst two weeks of the beginning of the academic session, for proper introduction to one another and where the talents of the freshers are brought out properly in the presence of the faculty, thus helping them to shed their inferiority complex, if any, and remove their inhibitions.

6.6.3 The institution shall enhance the student-faculty interaction by involving the students in all matters of the institution, except those relating to the actual processes of evaluation and of faculty appointments, so that the students shall feel that they are responsible partners in managing the affairs of the institution and consequently the credit due to the institution for good work/ performance is due to them as well.

6.7 Measures at the UGC/ Statutory/ Regulatory bodies' level:-

6.7.1 The UGC and other Statutory /Regulatory bodies shall make it mandatory for the institutions to compulsorily incorporate in their 'Prospectus' the directions of the Supreme Court and/or the Central or State Governments with regard to prohibition and consequences of ragging, and that noncompliance with the directives against ragging in any manner whatsoever shall be considered as lowering of academic standards by the erring institution making it liable for appropriate action.

6.7.2 The UGC (including NAAC and UGC Expert Committees visiting institutions for various purposes) and similar Committees of other Statutory/Regulatory bodies shall cross-verify that the institutions strictly comply with the requirement of getting the undertakings from the students and their parents/ guardians as envisaged under these Regulations.

6.7.3 The UGC and other funding bodies shall make it one of the conditions in the Utilization Certificate for sanctioning any financial assistance or aid to the institution under any of the general or special schemes that the institution has strictly complied with the anti-ragging measures and has a blemishless record in terms of there being no incidents of ragging during the period pertaining to the Utilization Certificate.

6.7.4 The NAAC and other accrediting bodies shall factor in any incident ofragging in the institution while assessing the institution in different grades.

6.7.5 The UGC shall constitute a Board for Coordination consisting of representatives of the AICTE, the IITs, the NITs, the IIMs, the MCI, the DCI, the NCI, the ICAR and such other bodies which have to deal with higher education to coordinate and monitor the anti-ragging movement across the country and to make certain policy decisions. The said Board shall meet once in a year in the normal course.

6.7.6 The UGC shall have an Anti-Ragging Cell within the Commission as an institutional mechanism to provide secretarial support for collection of information and monitoring, and to coordinate with the State level and university level Committees for effective implementation of anti-ragging measures.

6.7.7 If an institution fails to curb ragging, the UGC/ the Statutory/ Regulatory body concerned may stop financial assistance to such an institution or take such action within its powers as it may deem fi t and impose such other penalties as provided till such time as the institution achieves the objective of curbing ragging.

7 Incentives for curbing ragging:-

7.1 The UGC shall consider providing special/ additional annual financial grants-inaid to those eligible institutions which report a blemish-less record in terms of there being no incidents of ragging.

7.2 The UGC shall also consider instituting another category of fi nancial awards or incentives for those eligible institutions which take stringent action against those responsible for incidents of ragging.

7.3 The UGC shall lay down the necessary incentive for the post of Warden in order to attract the right type of eligible candidates, and motivate the incumbent.

8 Punishments:-

8.1 At the institution level:

Depending upon the nature and gravity of the offence as established by the Anti-Ragging Committee of the institution, the possible punishments for those found guilty of ragging at the institution level shall be any one or any combination of the following:

8.1.1 Cancellation of admission

8.1.2 Suspension from attending classes

8.1.3 Withholding/ withdrawing scholarship/ fellowship and other benefi ts

8.1.4 Debarring from appearing in any test/ examination or other evaluation process

8.1.5 Withholding results

8.1.6 Debarring from representing the institution in any regional, national or international meet, tournament, youth festival, etc.

8.1.7 Suspension/ expulsion from the hostel

8.1.8 Rustication from the institution for period ranging from 1 to 4 semesters

8.1.9 Expulsion from the institution and consequent debarring from admission to any other institution

8.1.10 Fine of Rupees 25,000/-

8.1.11 Collective punishment: When the persons committing or abetting the crime of ragging are not identifi ed, the institution shall resort to collective punishment as a deterrent to ensure community pressure on the potential raggers.

8.2 At the university level in respect of institutions under it:

If an institution under a university (being constituent of, affi liated to or recognized by it) fails to comply with any of the provisions of these Regulations and fails to curb ragging effectively, the university may impose any or all of the following penalties on it:

8.2.1 Withdrawal of affi liation/ recognition or other privileges conferred on it

8.2.2Prohibiting such institution from presenting any students then undergoing any programme of study therein for the award of any degree/diploma of the university

8.2.3 Withholding any grants allocated to it by the university

8.2.4 Any other appropriate penalty within the powers of the university.

8.3 At the UGC level:

If an institution fails to curb ragging, the UGC may impose any or all of the following penalties on it:

8.3.1 Delisting the institution from section 2(f) and /or section 12B of the UGC Act

8.3.2 Withholding any grants allocated to it

8.3.3 Declaring institutions which are not covered under section 2(f) and or 12B as ineligible for any assistance like that for Major/ Minor Research Project, etc.

8.3.4 Declaring the institution ineligible for consideration under any of the special assistance programmes like CPE (College with potential for Excellence), UPE (University with Potential for Excellence) CPEPA (Centre with Potential for Excellence in a Particular Area), etc.

8.3.5Declaring that the institution does not have the minimum academic standards and warning the potential candidates for admission accordingly through public notice and posting on the UGC Website.

TELEPHONE DIRECTORY

Important Contacts:

S.No.	POSITION	NAME	PHONE NO. (07752)
01.	**Vice Chancellor**	Prof. Alok Chakrawal	260283, 260353
02.	**Registrar**	Prof. Shailendra Kumar	260209
03.	**Dean, Student and Welfare**	Dr. Madhvendra Nath Tripathi	260204
4.	**Dean, SoS(Engg. & Tech.)**	Dr. T.V.ARJUNAN	09894332446
5.	**HOD (Computer Science and Engineering)**	Dr. Alok Kumar Singh Kushwaha	8090631394
6.	**HOD (Industrial & Production Engineering)**	Prof. Sharad Chandra Srivastava	09431382634
7.	**HOD (Chemical Engineering)**	Dr. Anil Kumar Chandrakar	9300105586
8.	**HOD (Mechanical Engineering)**	Dr. T.V.ARJUNAN	9894332446
9.	**HOD (Civil Engineering)**	Dr. M. Chakradhara Rao	09039522447
10	**HOD (Information Technology)**	Dr. Rohit Raja	7000559696
11	**HOD (Electronics & Comm. Engineering)**	Mrs. Anita Khanna	9425280114

Department Contacts:

Name	Designation	Telephone Number	E-mail ID
Dr. T.V.Arjunan	Professor	9894332446	arjun_nivi@yahoo.com
Dr. Rajesh Kumar Bhushan	Associate Professor	8602403633	rkbggv@gmail.com
Dr. Pankaj Kumar Gupta	Associate Professor	8821020709	pankajk.gupta@ggu.ac.in
Dr. Anoop Kumar Sahu	Assistant Professor	8871329479	anoop17212@gmail.com
Dr. Jasinta Poonam Ekka	Assistant Professor	9826723548	ekkajasinta@rediffmail.com
Mr. Prashant Kumar Jangde	Assistant Professor	9098116702	jangde5@gmail.com
Mrs. Shweta Singh	Assistant Professor	9111999698	ssv.bit@gmail.com
Mr. Manish Bhaskar	Assistant Professor	9098407370	manish.bhaskar@ggu.ac.in
Mr. Bhushan Singh Gautam	Assistant Professor	9632884177	bhushan.iisc@gmail.com
Mr. Biplab Das	Assistant Professor	8011256630	das21_biplab@yahoo.co.in
Mr.Pradeep Patanwar	Assistant Professor	7906098789	pradeep.patanwar@ggu.ac.in
Mr. Prateek Kumar Gupta	Assistant Professor	9425532990	prateek.olbsp@gmail.com

Staff Contacts:

Name	Designation	Telephone/Mobile No.
Mr. Vikas Talalwar	Daily Wages Employee (JOA)	9907512505
Mr. Ramesh Singh Bargah	TA	9685852639
Mr. Kumar Dongre	MTS	

COURSE STRUCTURE AND SYLLABUS

(AICTE-COURSE)

CBCS

SCHOOL OF STUDIES OF ENGINEERING & TECHNOLOGY
GURU GHASIDAS VISHWAVIDYALAYA (A CENTRAL UNIVERSITY)
CBCS-NEW, STUDY & EVALUATION SCHEME
PROPOSED W.E.F. SESSION 2020-2021

B.Tech. I Year (SEMESTER I)

(Common for CSE, ECE and IT)

SN	Course No.	SUBJECT	PERIODS			EVALUATION SCHEME			CREDITS
			L	T	P	IA	ESE	SUB-TOTAL	
1.	MA201TBS01	MATHEMATICS-I	3	1	-	30	70	100	4
2.	PH201TBS02	PHYSICS	3	1	-	30	70	100	4
3.	EC201TES01	BASIC ELECTRICAL & ELECTRONICS ENGINEERING	3	1	-	30	70	100	4
4.	IT201TES02	INTRODUCTION TO INFORMATION TECHNOLOGIES	2	0	0	30	70	100	2
5.	EN201THS01	ENGLISH COMMUNICATION	3	0	-	30	70	100	3
		Total	**14**	**3**	**0**	**150**	**350**	**500**	**17**
PRACTICALS									
1.	PH201PBS01	PHYSICS LAB	-	-	2	30	20	50	1
2.	ME201PES01	ENGINEERING GRAPHICS	1	-	3	30	20	50	3
3.	ME201PES02	WORKSHOP TECHNOLOGY & PRACTICES	1	-	2	30	20	50	1
4.	EC201PES03	BASIC ELECTRICAL ENGINEERING LAB	-	-	2	30	20	50	1
		Total	**2**	**-**	**9**	**120**	**80**	**200**	**7**
GRAND TOTAL			**16**	**3**	**9**	**270**	**430**	**700**	**24**

Total Credits	:	**24**
Total Contact Hour	:	**28**
Total Marks	:	**700**

*INTERNAL ASSESSMENT- Two Class Test of 15 Marks each will be conducted.
L-LECTURE, T-TUTORIAL, P-PRACTICAL, ESE –END SEMESTER EXAMINATION

SCHOOL OF STUDIES OF ENGINEERING & TECHNOLOGY
GURU GHASIDAS VISHWAVIDYALAYA (A CENTRAL UNIVERSITY)
CBCS-NEW, STUDY & EVALUATION SCHEME
PROPOSED W.E.F. SESSION 2020-2021
B.Tech. I Year (SEMESTER II)
(Common for CSE, ECE and IT)

SN	Course No.	SUBJECT	PERIODS			EVALUATION SCHEME			CREDITS
			L	T	P	IA	ESE	SUB-TOTAL	
1.	MA202TBS03	MATHEMATICS-II	3	1	-	30	70	100	4
2.	CY202TBS04	CHEMISTRY	3	1	-	30	70	100	4
3.	CE202TES03	ENGINEERING MECHANICS	3	1	-	30	70	100	4
4.	CS202TES04	COMPUTER PROGRAMMING	3	0	-	30	70	100	3
5.	CM202TES05	BASIC CIVIL & MECHANICAL ENGINEERING	3	0	0	30	70	100	3
6.	LW202TMC01	INDIAN CONSTITUTION	2	0	0	-	-	-	-
		Total	**17**	**3**	**0**	**150**	**350**	**500**	**18**
PRACTICALS									
1.	CY202PBS02	CHEMISTRY LAB	-	-	2	30	20	50	1
2.	CE202PES04	ENGINEERING MECHANICS LAB	-	-	2	30	20	50	1
3.	CS202PES05	COMPUTER PROGRAMMING LAB	-	-	2	30	20	50	1
		Total	**-**	**-**	**6**	**90**	**60**	**150**	**3**
GRAND TOTAL			**17**	**3**	**6**	**240**	**410**	**650**	**21**

Total Credits : **21**
Total Contact Hour : **26**
Total Marks : **650**

*INTERNAL ASSESSMENT- Two Class Test of 15 Marks each will be conducted.
L-LECTURE, T-TUTORIAL, P-PRACTICAL, ESE –END SEMESTER EXAMINATION

SYLLABUS	(SEMESTER-I)	Periods/ Week			Internal Assessment (IA)			ESE	Grand Total	Credits
Subject Code:	MA201TBS01	L	T	P	CT-I	CT-II	TOTAL	70	100	04
Subject:	MATHEMATICS-I	3	1	–	15	15	30			

Course Content

Calculus (Single Variable)

UNIT 1: Calculus: Evolutes and involutes; Evaluation of definite and improper integrals; Beta and Gamma functions and their properties; Applications of definite integrals to evaluate surface areas and volumes of revolutions. Asymptotes: definition, properties and problems.

Rolle's Theorem, Mean value theorems, Taylor's and Maclaurin theorems with remainders; Indeterminate forms and L' Hospital's rule; Maxima and minima.

UNIT 2: Sequences and series: Convergence of sequence and series, tests for convergence, power series, and Taylor's series. Series for exponential, trigonometric and logarithmic functions; Fourier series: Half range sine and cosine series, Parseval's theorem.

UNIT-3: (A): **Multi variable Calculus (Differentiation):** Limit, continuity and partial derivatives, directional Derivatives, total Derivative; Tangent plane and normal line; Maxima, minima and saddle points; Method of Lagrange multipliers; Gradient, curl and divergence.

(B): ***Multivariable Calculus (Integration):*** Multiple Integration: double and triple integrals (Cartesian and polar), change of order of integration in double integrals, Change of variables (Cartesian to polar), Applications: areas and volumes by (double integration) Center of mass and Gravity (constant and variable densities). Theorems of Green, Gauss and Stokes, orthogonal curvilinear coordinates, Simple applications involving cubes, sphere and rectangular parallelepipeds.

UNIT – 4 (A): Matrices (in case vector spaces is not to be taught): Algebra of matrices, Inverse and rank of a matrix, rank-nullity theorem; System of linear equations; Symmetric, skew-symmetric and orthogonal matrices; Determinants; Eigenvalues and eigenvectors; Diagonalization of matrices; CayleyHamilton Theorem, Orthogonal transformation and quadratic to canonical forms.

(B) Matrices (in case vector spaces is to be taught): Matrices, vectors: addition and scalar multiplication, matrix multiplication; linear systems of Equations, linear Independence, rank of a matrix, determinants, Cramer's Rule, inverse of a matrix, Gauss elimination and Gauss-Jordan elimination.

UNIT-5 (A): Vector spaces: Vector Space, linear dependence of vectors, basis, dimension; Linear transformations (maps), range and kernel of a linear map, rank and nullity, Inverse of a linear transformation, rank nullity theorem, composition of linear maps, Matrix associated with a linear map.

(B) Vector spaces: Eigenvalues, eigenvectors, symmetric, skew-symmetric, and orthogonal Matrices, eigenbasis. Diagonalization; Inner product spaces, Gram-Schmidt orthogonalization.

Textbooks/References:

1. G.B. Thomas and R.L. Finney, Calculus and Analytic geometry, 9th Edition, Pearson, Reprint, 2002.
2. Veerarajan T., Engineering Mathematics for first year, Tata McGraw-Hill, New Delhi, 2008.
3. Ramana B.V., Higher Engineering Mathematics, Tata McGraw Hill New Delhi, 11 Reprint, 2010.
4. N.P. Bali and Manish Goyal, A text book of Engineering Mathematics, Laxmi Publications, Reprint, 2010.
5. B.S. Grewal, Higher Engineering Mathematics, Khanna Publishers, 35th Edition, 2000.
6. D. Poole, Linear Algebra: A Modern Introduction, 2nd Edition, Brooks Cole, 2005.
7. V. Krishnamurthy, V.P. Mainra and J.L. Arora, An introduction to Linear Algebra, Affiliated East–West press, Reprint 2005.
8. Erwin Kreyszig, Advanced Engineering Mathematics, 9th Edition, John Wiley & Sons, 2006.

SYLLABUS	(SEMESTER-I)	Periods/ Week			Internal Assessment (IA)			ESE	Grand Total	Credits
Subject Code:	CY201TBS02/ CY202TBS04	L	T	P	CT-I	CT-II	TOTAL	70	100	04
Subject:	CHEMISTRY	3	1	-	15	15	30			

Course Learning Objectives:

The objective of this Course is to:

- To make aware and enrich the the students about the basic concept and understanding of chemical concepts of basic Chemistry and spectroscopic techniques.

Course Content:

UNIT-1: Concept of Quantum Energy and Spectroscopy: Quantization of Energy, Regions of spectrum. Electronic Spectroscopy: Electronic Transition, Woodward Fieser rules for calculating λ_{max} of conjugated dienes & α, β-unsaturated carbonyl compound, various shifts in λ_{max} and intensities. Infra-Red Spectroscopy: Conditions for Infra-Red Spectroscopy, Molecular vibrations & factors affecting Infra-Red frequencies**.**

UNIT-2: Chemical Bonding in Molecules: Introduction of chemical bonding, VSEPER Theory, V. B. Theory and Molecular Orbital Theory. Energy level diagrams of diatomic molecules and ions.

UNIT-3: Concept of Chirality, Enantiomers, Diastereomers, Meso-compounds and Racemic mixtures. Conformation of Acyclic hydrocarbons (Ethane, Propane & n-Butane) and cyclic hydrocarbon (Cyclohexane), Plane of symmetry, Centre of symmetry, Absolute and Relative Configuration (R &S, D & L and E & Z).

UNIT -4: Reactivity of Organic Molecules, Factors influencing acidity, basicity and nucleophilicity of molecules, kinetic vs thermodynamic control of reactions.

UNIT -5: Strategy for Synthesis of Organic Compounds: Reaction intermediates: Stability of Free Radicle, Carbocation and Carbanion. Introduction to reaction involving Addition, Elimination, Substitution and Ring opening and Cyclization.

Textbooks/References:

1. Engineering Chemistry by Jain and Jain; Dhanpat Rai Publication Co.
2. Engineering Chemistry by Shikha Agarwal; Cambridge University Press, 2015 edition.
3. Engineering Chemistry of Wiley India Pvt. Ltd., Vairam and others, 2014 edition (second).
4. Engineering Chemistry by Prasanth Rath, Cengage Learning, 2015 edition.
5. A textbook of Engineering Chemistry by S. S. Dara; S. Chand & Co Ltd., Latest Edition

6. Applied Chemistry by H.D. Gesser, Springer Publishers.
7. Textbook of Nano-science and nanotechnology by B.S. Murthy, P. Shankar and others, University Press, IIM
8. B. Siva Shankar, "Engineering Chemistry", Tata Mc Graw Hill Publishing Limited, 3rd Edition, 2015.
9. S. S. Dara, Mukkanti, "Text of Engineering Chemistry", S. Chand & Co, New Delhi, 12th Edition, 2006.
10. C. V. Agarwal, C. P. Murthy, A. Naidu, "Chemistry of Engineering Materials", Wiley India, 5th Edition, 2013.
11. R. P. Mani, K. N. Mishra, "Chemistry of Engineering Materials", Cengage Learning, 3rd Edition, 2015.

Course Outcomes- At the end of the course the students will be able to understand and solve the practical problems of their higher Engineering classes on the basis of understanding of Chemistry developed in their B. Tech. I sem classes.

SYLLABUS	(SEMESTER-I)	Periods/ Week			Internal Assessment (IA)			ESE	Grand Total	Credits
Subject Code:	CE201TES01 / CE202TES03	L	T	P	CT-I	CT-II	TOTAL	70	100	04
Subject:	ENGINEERING MECHANICS	3	1	–	15	15	30			

Course Learning Objectives:

To learn about

- The concepts Force systems, free body diagrams, resultant of forces and equations of equilibrium, Supports and support reactions and calculation of Centroid
- The Concept of moment of inertia of plane figures, Laws and applications of friction
- The Analysis of the truss and determination of axial forces by Method of Joints
- Motion of a body and their relationships and application of D Alembert's principle in rectilinear and curvilinear motions

Course Content:

UNIT- 1: Introduction to Engineering Mechanics covering, Force Systems Basic concepts, Particle equilibrium in 2-D & 3-D; Rigid Body equilibrium; System of Forces, Coplanar Concurrent Forces, Components in Space – Resultant- Moment of Forces and its Application; Couples and Resultant of Force System, Equilibrium of System of Forces, Free body diagrams, Equations of Equilibrium of Coplanar Systems and Spatial Systems

UNIT-2: Friction covering, Types of friction, Limiting friction, Laws of Friction, Static and Dynamic Friction; Motion of Bodies.
Basic Structural Analysis covering, Equilibrium in three dimensions; Method of Sections; Method of Joints; Simple Trusses; Zero force members.

UNIT 3: Centroid and Centre of Gravity covering, Centroid of simple figures from first principle, centroid of composite sections; Centre of Gravity and its implications; Area moment of inertia- Definition, Moment of inertia of plane sections from first principles, Theorems of moment of inertia, Moment of inertia of standard sections and composite sections.

UNIT-4: Virtual Work and Energy Method-Virtual displacements, principle of virtual work for particle and ideal system of rigid bodies, degrees of freedom. Active force diagram, systems with friction, mechanical efficiency.

Review of particle dynamics- Rectilinear motion; Newton's 2nd law (rectangular, path, and polar coordinates). Work-kinetic energy, power, potential energy. Impulse-momentum (linear, angular); Impact (Direct and oblique).

UNIT-5: Introduction to Kinetics of Rigid Bodies covering, Basic terms, general principles in dynamics; Types of motion, Instantaneous centre of rotation in plane motion and simple problems; D'Alembert's principle and its applications in plane motion and connected bodies; Work energy principle and its application in plane motion of connected bodies; Kinetics of rigid body rotation

Textbooks/References:

1. Irving H. Shames (2006), Engineering Mechanics, 4th Edition, Prentice Hall
2. F. P. Beer and E. R. Johnston (2011), Vector Mechanics for Engineers, Vol I - Statics, Vol II, – Dynamics, 9th Ed, Tata McGraw Hill
3. Andy Ruina and Rudra Pratap (2011), Introduction to Statics and Dynamics, Oxford University Press
4. Shanes and Rao (2006), Engineering Mechanics, Pearson Education,
5. Hibler and Gupta (2010), Engineering Mechanics (Statics, Dynamics) by Pearson Education
6. 6. Bansal R.K. (2010), A Text Book of Engineering Mechanics, Laxmi Publications
7. Khurmi R.S. (2010), Engineering Mechanics, S. Chand & Co.
8. Tayal A.K. (2010), Engineering Mechanics, Umesh Publications

Course Outcomes- On successful completion of teaching-learning and evaluation activities, a student would be able to

- Identify and analyze the problems by applying the fundamental principles of engineering mechanics
- and to proceed to research, design and development of the mechanical systems.
- Construct free body diagrams and use appropriate equilibrium equations, Calculate unknown forces in
- a plane by resolution of force and equilibrium equations
- Locate Centroid of composite figures and determine moment of plane figures
- Analyze the systems with friction
- Determine the axial forces in the members of determinate truss.
- Calculation of acceleration, velocity and displacement and forces
- Calculation of angular displacement, velocity and angular acceleration of rotational bodies

SYLLABUS	(SEMESTER-I)	Periods/ Week			Internal Assessment (IA)			ESE	Grand Total	Credits
Subject Code:	CS201TES02 / CS202TES04	L	T	P	CT-I	CT-II	TOTAL	70	100	03
Subject:	COMPUTER PROGRAMMING	3	0	-	15	15	30			

Course Learning Objectives:

- To understand the basic of Idea of Algorithm.
- To understand the programing concept of Arithmetic expressions and Basic Algorithms •
- To learn the Functions and Structure of array.

Course Content:

UNIT-1: Introduction to Programming

Introduction to components of a computer system (disks, memory, processor, where a program is stored and executed, operating system, compilers etc.) -

Idea of Algorithm: steps to solve logical and numerical problems. Representation of Algorithm: Flowchart/Pseudo code with examples. From algorithms to programs; source code, variables (with data types) variables and memory locations, Syntax and Logical Errors in compilation, object and executable code.

UNIT-2: **Arithmetic expressions and precedence**

Conditional Branching and Loops, Writing and evaluation of conditionals and consequent branching Iteration and loops, **Arrays** (1-D, 2-D),Character arrays and strings

UNIT-3: Basic Algorithms

Searching, concept of binary search etc, Basic Sorting Algorithms Bubble sort etc, Finding roots of equations, introduction of Algorithm complexity

UNIT-4: Function

Functions (including using built in libraries), Parameter passing in functions, call by value, passing arrays to functions: idea of call by reference binary search etc. **Recursion**

functions Recursion, as a different way of solving problems. Example programs, such as, Finding Factorial, Fibonacci series, etc.

UNIT -5: Structure

Structures, Defining structures and Array of Structures

Pointers Idea of pointers, defining pointers, Use of Pointers in self-referential structures, notion of linked list (no implementation)

Textbooks/References:

1. Byron Gottfried, Schaum's Outline of Programming with C, McGraw-Hill
2. E. Balaguruswamy, Programming in ANSI C, Tata McGraw-Hill
3. Brian W. Kernighan and Dennis M. Ritchie, the C Programming Language, Prentice Hall of India

Course Outcomes- At the end of the course students will be able to

- Develop the algorithm and programmers for various applications using Arithmetic expressions, arrays, pointers and Functions.

SYLLABUS	(SEMESTER-I)	Periods/ Week			Internal Assessment (IA)			ESE	Grand Total	Credits
Subject Code:	CM201TES03 / CM202TES05	L	T	P	CT-I	CT-II	TOTAL	70	100	03
Subject:	BASIC CIVIL & MECHANICAL ENGINEERING	3	0	-	15	15	30			

Course Learning Objectives:

- To study the properties and uses of basic civil engineering materials.
- To study the importance of NBC, IS Codes (materials), types of buildings and foundations, basic requirements of foundations.
- To study the basic types of surveys, linear and angular measurements, and GPS measurements
- To familiarize with the fundamentals of heat and work interactions, heat transfer mechanisms and energy conversion processes.
- To provide exposure to various engineering materials and processes of manufacturing.
- To impart basic knowledge of the interdisciplinary nature of engineering systems.

Course Content:

UNIT 1: Civil Engineering Materials: Properties & Uses of Stones, Bricks, Cement, Aggregates, Steel, Concretequality of good concrete, strength, curing and grade of concrete, standard tests on concrete. IS Codes and classification

UNIT 2: National Building Code (NBC), Salient features, Classification of Building as per NBC(India), Site selection for buildings - Components of building, Foundations-Introduction, Types of Foundations & its Suitability, Basic requirements and purpose of foundation on different soils. Brief description about: Brick & stone masonry, Plastering, Lintels; Doors & Windows, Beams & columns, Formwork, Roofs.

UNIT 3: Surveying: Objects, uses, Basic principle, Classification, Plans & Maps, Scales, Units of measurement, Conventional symbols, Different survey equipment. Measurements – Linear & Angular, levelling, Determination of Area & Volume, Introduction to Triangulation and GPS

UNIT 4: Materials and Manufacturing, Introduction to engineering materials – metals, alloys, composites, smart materials, phase-change materials; Introduction to various processes of manufacturing – conventional machine tools – lathe and its types, shaping, milling and related operations – turning, threading, knurling, etc., unconventional methods.

UNIT 5: Automobile and Refrigeration and Air conditioning, Theoretical thermodynamic cycles and working principle of Petrol and Diesel Engines – Hybrid and Electric Vehicle - Turbines, Pumps, Compressors. Principle of vapour compression and absorption refrigeration system–Layout of typical domestic refrigerator–Window and Split type room Air conditioner. Introduction to renewable energy utilization and technology.

Textbooks/References:

1. Punmia, B.C, Ashok Kumar Jain, Arun Kumar Jain, Basic Civil Engineering, Lakshmi Publishers, 2012.
2. Satheesh Gopi, Basic Civil Engineering, Pearson Publishers, 2009.
3. Rangwala, S.C, Building materials, Charotar Publishing House, Pvt. Limited, Edition 27, 2009.
4. Palanichamy, M.S, Basic Civil Engineering, Tata McGraw Hill, 2000.
5. Elements of Workshop Technology Vol. 1 – S.K. Hajra Choudhary, A.K. Hajra Choudhary – Media promoters & Publishers Pvt. Ltd.
6. Basic Automobile Engineering – R.B. Gupta, Satya Prakashan.
7. Shanmugam, G and Palanichamy, M S, Basic Civil and Mechanical Engineering, Tata McGraw Hill
8. National Building Code (NBC) – Bureau of Indian Standards
9. Bureau of Indian Standard Codes for Civil Engineering Materials

Course outcome

At the end of the course, the students will be

1. able to gain the knowledge on the basic civil engineering materials
2. able to know the importance of NBC and relevance of IS Codes to Civil engineering materials, site selection of a building and its components and materials
3. exposed to various types of surveys, linear and angular measurements and GPS measurements
4. Be able to relate with processes in various energy conversion devices involving heat and work.
5. Be able to identify and suggest various processes of manufacturing and materials involved.
6. Be able to appreciate the interdisciplinary existence between heat, work, fluid flow and manufacturing processes.

SYLLABUS	(SEMESTER-I)	Periods/ Week			Internal Assessment (IA)			ESE	Grand Total	Credits
Subject Code:	LW201TMC01	L	T	P	CT-I	CT-II	TOTAL	--	--	--
Subject:	INDIAN CONSTITUTION	2	0	-	-	-	-			

Course Learning Objectives:

- To the importance of preamble of the constitution of India.
- To understand the fundamental rights and duty as a citizen of India.
- To understand the functioning of union and state government and their inter-relationship.

Course Content:

UNIT 1: Introduction: Constitution-meaning of the term, Sources and constitutional theory, Features, Citizenship. Preamble**.**

UNIT 2: Fundamental Rights and Duties: Fundamental Rights, Fundamental Duties, Directive Principles of State Policy

UNIT 3: Union Government: Structure of Indian Union: Federalism, Centre-State relationship President: Role.

Power and position, Prime Minister and council of ministers, Cabinet and Central Secretariat, Lok Sabha. Rajya Sabha

UNIT 4: State Government: Governor: Role and position, Chief Minister and council of ministers, State Secretariat

UNIT 5: Relationship between Centre and States: Distribution of Legislative Powers, Administrative Relations, Coordination between States

Textbooks/References:

1. Constitution of India, V.N. Shukla
2. The Constitutional Law of India, J.N. Pandey
3. Indian Constitutional Law. M.P. Jain

Course Outcome: At the end of the course students will be able to:

- Describe the salient features of the Indian Constitution
- List the Fundamental Rights and Fundamental Duties of Indian citizens
- Describe the Directive Principles of State Policy and their significance

SYLLABUS	(SEMESTER-I)	Periods/ Week			INTERNAL ASSESSMENT (IA)			ESE	Grand total	Credits
Subject Code:	CY201PBS01 / CY202PBS02	L	T	P	IA	MSE	TOTAL	20	50	01
Subject:	CHEMISTRY LAB	0	0	2	30	-	30			

Course Learning Objectives:

The Lab sessions would help in learning:

- Application of iodometrically & titration in lab.
- Recognition of different chemical reaction.
- Advanced lab methods like Spectro photometry and chromatography

Course Content:

Group – A:

1. Standardization of sodium thiosulphate solution by standard potassium dichromate solution.
2. To determine the Normality and Strength (g/L) of given Ferrous Ammonium Sulphate solution 'A' using standard Ferrous Ammonium Sulphate (N/30) solution 'B' taking KMnO4 solution as an intermediate.
3. To determine the concentration of hypo solution ($Na_2S_2O_3.5H_2O$) iodometrically with given Iodine (N/50) solution.
4. Find out the Temporary hardness of given water sample using 0.01M EDTA solution, buffer solution (pH-10) and EBT as an indicator.
5. To determine chloride ion in a given water sample by Argentometric method (Mohr's method)

Group – B:

6. Preparation of Urea Formaldehyde resin.
7. Acetylation of Primary Amine: Preparation of Acetanilide.
8. Base Catalyzed Aldol Condensation: Synthesis of dibenzalpropanone.
9. [4+2] Cycloaddition Reaction: Diels-Alder reaction.
10. Preparation of aspirin and calculate its yield.

Group – C:

11. To calculate the λ_{max} of a given compound using UV-visible spectrophotometer.
12. To separate the metallic ions by paper chromatography.
13. To determine the surface tension of a liquid by stalagmometer.
14. To determine the percentage composition of the given mixture consisting of two liquids A and B (non- interacting system) by viscosity method.
15. To determine the relative viscosity of given liquids by Ostwald's viscometer.

Note: At least two Experiments from each group must be performed.

Course Outcomes- On completion of the course, the students will be able to handle the chemicals of synthesis as well as titration that will ultimately make them efficient and develop their future chemistry laboratory skills .

SYLLABUS	(SEMESTER-I)	Periods/ Week			INTERNAL ASSESSMENT (IA)			ESE	Grand total	Credits
Subject Code:	CS201PES02 / CS202PES05	L	T	P	IA	MSE	TOTAL	20	50	01
Subject:	COMPUTER PROGRAMMING LAB	-	-	2	30	--	30			
	LAB									

Course Learning objectives:

- To perform the practical giving basic understanding to fundamental principles of mechanics like parallelogram of forces, triangle of forces and polygon of forces by universal force table
- To perform the practical giving basic understanding to fundamental application of mechanics like screw jack, winch crab and simple wheel and axle

Course Content:

List of Experiments

1. Verification of law of parallelogram of forces.
2. Verification of law of triangle of forces.
3. Verification of law of polygon of forces by universal force table.
4. Verification of law of moment by parallel forces apparatus.
5. Practical verification of forces in the member of jib crane.
6. Practical verification of forces in the member of the truss.
7. Determination of coefficient of friction between two given surfaces by inclined plane method.
8. Determination of efficiency of simple screw jack.
9. Determination of efficiency of single purchase winch crab.
10. Determination of efficiency of double purchase winch crab.
11. Determination of efficiency of simple wheel and axle.

Course Outcome: At the end of the course students will be able to:

- Verify the fundamental principles of mechanics like parallelogram of forces, triangle of forces and polygon of forces by universal force table
- Analyze the friction coefficient between two surfaces
- Calculate the efficiency of screw jack, winch crab and wheel and axle

SYLLABUS	(SEMESTER-I)	Periods/ Week			INTERNAL ASSESSMENT (IA)			ESE	Grand total	Credits
Subject Code:	CS201PES02 / CS202PES05	L	T	P	IA	MSE	TOTAL			
Subject:	COMPUTER PROGRAMMING LAB	-	-	2	30	--	30	20	50	01

Course Learning Objectives:

To learn the Branching and logical expressions and Loops

- To learn the Arrays and Function
- To understand the Numerical methods and Recursion

Course Content:
The laboratory should be preceded or followed by a tutorial to explain the approach or Algorithm to be implemented for the problem given.]

Tutorial 1: Problem solving using computers:

Lab1: Familiarization with programming environment

Tutorial 2: Variable types and type conversions:

Lab 2: Simple computational problems using arithmetic expressions

Tutorial 3: Branching and logical expressions:

Lab 3: Problems involving if-then-else structures

Tutorial 4: Loops, while and for loops:

Lab 4: Iterative problems e.g., sum of series

Tutorial 5: 1D Arrays: searching, sorting:

Lab 5: 1D Array manipulation

Tutorial 6: 2D arrays and Strings

Lab 6: Matrix problems, String operations

Tutorial 7: Functions, call by value:

Lab 7: Simple functions

Tutorial 8 &9: Numerical methods (Root finding, numerical differentiation, numerical Integration):

Lab 8 and 9: Programming for solving Numerical methods problems

Tutorial 10: Recursion, structure of recursive calls

Lab 10: Recursive functions

Tutorial 11: Pointers, structures and dynamic memory allocation

Lab 11: Pointers and structures

Course Outcomes- At the end of the course students will be able to

- Utilization of Branching and logical expressions and Loops, Arrays and Function and Numerical methods and Recursion for writing the programmes for various engineering applications

SYLLABUS	Periods/	Periods/ Week			Internal Assessment (IA)			ESE	Grand Total	Credits
Subject Code:	MA202TBS03	L	T	P	CT-I	CT-II	TOTAL	70	100	4
Subject:	MATHEMATICS-II	3	1	-	15	15	30			

Course Content:

UNIT 1: First order ordinary differential equations: Exact, linear and Bernoulli's equations, Euler's equations, Equations not of first degree: equations solvable for p, equations solvable for y, equations solvable for x and Clairaut's type.

UNIT 2: Ordinary differential equations of higher orders (Prerequisite 2c, 4a) second order linear differential equations with variable coefficients, method of variation of parameters, Cauchy-Euler equation; Power series solutions; Legendre polynomials, Bessel functions of the first kind and their properties.

UNIT 3: Partial Differential Equations – First order (Prerequisite 5a-b): First order partial differential equations, solutions of first order linear and non-linear PDEs.

UNIT 4: Partial Differential Equations– Higher order (Prerequisite 5b-c) Solution to homogenous and nonhomogenous linear partial differential equations second and higher order by complimentary function and particular integral method. Flows, vibrations and diffusions, second-order linear equations and their classification, Initial and boundary conditions (with an informal description of well-posed problems).

UNIT 5: D'Alembert's solution of the wave equation; Duhamel's principle for one dimensional wave equation. Separation of variables method to simple problems in Cartesian coordinates. The Laplacian in plane, cylindrical and spherical polar coordinates, solutions with Bessel functions and Legendre functions. One dimensional diffusion equation and its solution by separation of variables. Boundary-value problems: Solution of boundary- value problems for various linear PDEs in various geometries.

Textbooks/References:

1. Erwin Kreyszig, Advanced Engineering Mathematics, 9th Edition, John Wiley &Sons, 2006.
2. W. E. Boyce and R. C. DiPrima, Elementary Differential Equations and Boundary Value Problems, 9th Edition, Wiley India, 2009.

3. S. L. Ross, Differential Equations, 3rd Ed., Wiley India, 1984.
4. E. A. Coddington, An Introduction to Ordinary Differential Equations, Prentice Hall India, 1995.
5. E. L. Ince, Ordinary Differential Equations, Dover Publications, 1958.
6. G.F. Simmons and S.G. Krantz, Differential Equations, Tata McGraw Hill, 2007.
7. S. J. Farlow, Partial Differential Equations for Scientists and Engineers, Dover Publications, 1993.
8. R. Haberman, Elementary Applied Partial Differential equations with Fourier Series and Boundary Value Problem, 4th Ed., Prentice Hall, 1998.
9. Ian Sneddon, Elements of Partial Differential Equations, McGraw Hill, 1964.
10. Manish Goyal and N.P. Bali, Transforms and Partial Differential Equations, University Science Press, Second Edition, 2010
11. Denian murry,defferential equations ,oxford publications

SYLLABUS	(SEMESTER-II)	Periods/ Week			Internal Assessment (IA)			ESE	Grand Total	Credits
Subject Code:	PH201TBS02 / PH202TBS04	L	T	P	CT-I	CT-II	TOTAL	70	100	04
Subject:	PHYSICS	3	1	-	15	15	30			

Course Learning Objectives:

- To know the basic principles, effects and applications such as physical, optical parameters used for engineering applications.
- To learn about various laws and applications of electromagnetic theory.
- To know the basic structure, working principles and applications of lasers and optical fibre communication.
- To know the basics of semiconductor physics, semiconductor materials and devices and its characterization for advance technological applications
- To familiarize the basis of quantum theory and to make students to solve the physical problems for advancement of the technology.

Course Content:

UNIT 1: Optics: Interference and Diffraction
Introduction, Young's experiment theory of interference, Coherent and non-coherent sources, Fresnel's Bi- prism and Newton's ring experiment. Diffraction of light, Fresnel and Fraunhofer's diffraction, diffraction due to plane diffraction grating.

UNIT 2: Electromagnetic Theory
Coulomb's law electrostatics field and potential, electric flux, Gauss' law, Poisson's and Laplace's equation. Equation of continuity for charge conservation, Ampere's and Faraday's laws, Maxwell's Electromagnetic equations.

UNIT 3: Laser and Fiber optics
Introduction, elementary idea of spontaneous and stimulated emission, active medium population inversion, Einstein's coefficients, Types of lasers and important applications of lasers. Introduction to optical fibers, basic principles of optical fiber, critical angle numerical aperture, maximum acceptance angle, classification of optical fiber.

UNIT 4: Semiconductor physics and Devices
Formation of energy in solids, Energy band gap of metals, insulators and semiconductors, classification of semiconductor: Intrinsic and Extrinsic semiconductors, Fermi levels in intrinsic and extrinsic semiconductors, Electrical conductivity in

conductors and semiconductors, working of P-N junction diodes and bipolar junction transistor.

UNIT 5: Introduction to Quantum Mechanics

Introduction to Quantum Mechanics, photoelectric effect, Compton effect, wave-particle duality, uncertainty principle, wave function, De-Broglie waves, phase and Group velocity, Davisson and Germer experiment, Schrodinger wave equation, particle in a box (I-Dimensional)

Textbooks/References:

1. Applied physics-I and II By Navneet Gupta, Dhanpat Rai & Co.
2. Engg. Physics by S. K. Srivastava and R.A. Yadav, New Age Pub. New Delhi
3. Engg. Physics by Uma Mukherjee, Narosa Publication.
4. Engg. Physics by M.N. Avadhanulu, S. Chand Pub.
5. Electricity and Magnetism by Rangwala and Mahajan, Tata McGraw Hill. 1998
6. Concepts of Physics Part-II by H. C. Verma, Bharati Bhawan (P&D), 1998
7. Modern physics by Beiser, McGraw Hill Inc. New York, Publication 1995
8. Modern physics by Mani and Mehta, East-West Press Pvt.Ltd.1998
9. Introduction to Electrodynamics, David Griffith
10. J. Singh, Semiconductor Optoelectronics: Physics and Technology, McGraw-Hill Inc.(1995).
11. B.E.A. Saleh and M.C. Teich, Fundamentals of Photonics, John Wiley & Sons. Inc.2007).
12. S.M. Sze, Semiconductor Devices: physics and Technology, Wiley (2008)
13. Yariv and p.yeh, Photonics Optical Electronics in Modern Communications, Oxford University press, New York (2007)
14. P. Bhattacharya, Semiconductor Optoelectronic Devices, prentice Hall of India (1997)
15. Online course: “Semiconductor Optoelectronics” by M. R. Shenoy on NPTEL.
16. Online course: “Optoelectronic Materials and Devices” by Monica Katiyar and Deepak on NPTEL.

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

- Student’s ability to understand the basic principles and applications of physical optics for physical parameters measurements such as length, thickness, aperture size etc.
- Student’s will be able to design, characterized the lasers and optical fibers and their effective utilization in optical communications, imaging etc.
- Students demonstrate appropriate competence and working knowledge of laws of electromagnetic theory and semiconductor physics and devices for their advance applications

SYLLABUS	(SEMESTER-II)	Periods/ Week			Internal Assessment (IA)			ESE	Grand Total	Credits
Subject Code:	EC201TES01 / EC202TES04	L	T	P	CT-I	CT-II	TOTAL	70	100	04
Subject:	BASIC ELECTRICAL AND ELECTRONICS ENGINEERING	3	1	-	15	15	30			

Course Learning Objectives:

- To impart a basic knowledge of electrical quantities such as current, voltage, power, energy and. To provide working knowledge for the analysis of basic DC circuits used in electrical and electronic devices.
- To provide working knowledge for the analysis of basic AC circuits used in electrical and electronic devices and measuring instruments
- To explain the working principle, construction, applications of Transformer, DC machines and AC machines.
- To make students understand basics of Diodes and Transistors. • To impart knowledge about basics of Digital Electronics

Course Content:

UNIT-1: DC circuits (8 hours)

Electrical circuit elements (R, L and C), voltage and current sources, Ohm's Law, Kirchoff's current and voltage laws, analysis of simple circuits with dc excitation. Superposition, Thevenin and Norton Theorems. Time-domain analysis of first-order RL and RC circuits. Mesh & nodal analysis, Star- Delta transformation and circuits.

UNIT-2: AC circuits (8 hours)

Representation of sinusoidal waveforms, average and rms values, phasor representation, real power, reactive power, apparent power, power factor. Analysis of single-phase ac circuits consisting of R, L, C, RL, RC, RLC combinations (series and parallel), resonance. Three-phase balanced circuits, voltage and current relations in star and delta connections. Three-phase power measurement- Two- Wattmeter method.

Construction and working principle of single-phase wattmeter and energy meter. Introduction to Sensors and Transducers.

UNIT-3: Electrical machines (8 hours)

Construction, classification, ideal and practical transformer, equivalent circuit, losses in transformers, tests, voltage regulation and efficiency.

Construction, Working Principle, losses and efficiency of DC Machines and three phase Induction Machine, DC motor.

UNIT-4: Semiconductor devices And application (8 hours)

Characteristics of PN Junction Diode – Zener Effect – Zener Diode and its Characteristics – Half wave and Full wave Rectifiers – Voltage Regulation. Bipolar Junction Transistor – CB, CE, CC Configurations and Characteristics.

UNIT 5: Digital Electronics (8 hours)

Binary Number System, Logic Gates, Combinational circuits, Boolean Algebra, De Morgan's Theorem, Half and Full Adders, Flip- Flops. Sequential circuits-Registers and Counters, A/D and D/A Conversion.

Suggested Text / Reference Books:

I. D. P. Kothari and I. J. Nagrath, "Basic Electrical Engineering", Tata McGraw Hill, 2010.
II. D. C. Kulshreshtha, "Basic Electrical Engineering", McGraw Hill, 2009.
III. B L Theraja and AK Theraja," A Textbook of Electrical Technology- Vol-I & II, S. CHAND &Co ltd, 2013.
IV. E. Hughes, "Electrical and Electronics Technology", Pearson, 2010.
V. Jacob Millman, Christos Halkias,, Chetan Parikh, "Millman's Integrated Electronics - Analog and Digital Circuit and Systems", 2nd Edition 2017
VI. Robert L Boylestad, Louis Nashlsky," Electronics devices and circuit theory", Pearson 11th edition 2013
VII. M. Morris Mano ," Digital Logic and Computer Design", Pearson, 2004.

Course Outcomes: At the end of the course students will be able to:

- To understand and revise concepts of DC circuits.
- To learn to solve single and three phase AC circuits and basics of sensors and measurements.
- To understand the theory, working principle and applications of Transformer and basic machines and analyse their parameters.
- To understand characteristics of diodes and transistors and to analyze basic circuits using diodes.
- To learn the basics of digital circuits and its importance.

SYLLAUS	(SEMESTER-II)	Periods/ Week			Internal Assessment (IA)			ESE	Grand Total	Credits
Subject Code:	IT201TES02 / IT202TES05	L	T	P	CT-I	CT-II	TOTAL	70	100	02
Subject:	INTRODUCTION TO INFORMATION TECHNOLOGIES	2	0	-	15	15	30			

Course Learning Objectives:

1. To illustrate the concepts of cyber security and familiar and aware with various cybercrimes attack and their prevention.
2. To describe the different services model of Cloud Computing and understand Understanding of different evaluating computer model of cloud computing.
3. To relate theoretical concepts with problem solving approach in IoT and assess the comparative advantages and disadvantages of Virtualization technology.
4. To provides the basic knowledge of use appropriate storage and access structures. the student must be able to analyse familiar with the machine learning algorithms and applications of various data science.
5. To integrate classroom learning into an everyday communicative activity in distributed system. Familiar with various web services activity.

Course Content:

UNIT 1: Cyber Security

Fundamentals Security Concepts: Authentication, Authorization, Non-repudiation, Confidentiality, Integrity, availability. Cyber Crimes and Criminals: Definition of cyber-crime, types of cyber-crimes and types of cybercriminals.

UNIT 2: **Cloud Computing Fundamentals**

Motivation for Cloud Computing, The Need for Cloud Computing, Defining Cloud Computing, Definition of

Cloud computing, Cloud Computing Is a Service, Cloud Computing Is a Platform, Principles of Cloud computing, Five Essential Characteristics, Four Cloud Deployment Models.

UNIT 3: Internet of Things

Definition and Characteristics of IoT, Physical Design of IoT – IoT Protocols, IoT communication models, IOT Communication APIs IoT enabled Technologies – Wireless Sensor Networks, Cloud Computing, Big data analytics, Communication protocols, Embedded Systems, IoT Levels and

Templates Domain Specific IoTs – Home, City, Environment, Energy, Retail, Logistics, Agriculture, Industry, health and Lifestyle.

UNIT 4: Data Science

Introduction and Importance of Data Science, Statistics, Information Visualisation, Data Mining, Data Structures, and Data Manipulation, Algorithms used in Machine Learning, Data Scientist Roles and Responsibilities. Data Acquisition and Data Science Life Cycle.

UNIT 5: Evaluation and Emergence of Web Services

Evaluation of Distributed Computing, Core Distributed Technologies, Challenges in Distributed System, and

Introduction to web services, Web Services Architecture, Basic steps of implementing web services

Textbooks/References:

1. Cyber Security: Understanding Cyber Crimes, Computer Forensics and Legal Perspectives, Nina Godbole and Sunil Belapure, Wiley INDIA.
2. Introduction to Cyber Security, Chwan-Hwa(john) Wu,J.David Irwin.CRC Press T&F Group
3. Cloud Computing Principles and Paradigm by Rajashekar Buyya, James Broberg, Andhrz M. Wiley 2011.
4. Internet of Things - A Hands-on Approach, Arshdeep Bahga and Vijay Madisetti, Universities Press, 2015, ISBN: 9788173719547.
5. Mining of Massive Datasets, by Leskovec, Rajaraman, and Ullman.
6. R. Nagappan, R.Scokzylas, R.P. Sriganesh, Developing Web Services, Wiley India.

Course Outcomes:

1. Ability to learn about cybercrimes and how they are planned.
2. Ability to understand the cloud computing concepts and services model.
3. Ability to understand Internet of Things –Definition and Characteristics of IoT.
4. Explain how data is collected, managed and stored for data science. Understand the key concepts in data science, including their real-world applications and the toolkit used by data scientists
5. Understand the details of web services Evolution of Distributed Computing.

SYLLABUS	(SEMESTER-II)	Periods/ Week			Internal Assessment (IA)			ESE	Grand Total	Credits
Subject Code:	EN202THS01	L	T	P	CT-I	CT-II	TOTAL	70	100	03
Subject:	ENGLISH COMMUNICATION	3	0	-	15	15	30			

Course Learning Objectives

• To build up word power, to brush up the knowledge of English grammar, to develop good writing and speaking skills in the students

Course Content:

UNIT 1: Vocabulary Building

The concept of Word Formation, Root words from foreign languages and their use in English, Acquaintance with prefixes and suffixes from foreign languages in English to form derivatives. Synonyms, antonyms, and standard abbreviations.

UNIT 2: Basic Writing Skills

Sentence Structures, Use of phrases and clauses in sentences, Importance of proper punctuation, Creating coherence, Organizing principles of paragraphs in documents, Techniques for writing precisely

UNIT 3: Identifying Common Errors in Writing

Subject-verb agreement, Noun-pronoun agreement, Misplaced modifiers, Articles, Prepositions, Redundancies, Clichés

Unit 4: Nature and Style of sensible Writing

Describing, Defining, Classifying, Providing examples or evidence, Writing introduction and conclusion.

UNIT 5: Writing Practices

Comprehension, Précis Writing, Essay Writing.

Oral Communication (This unit involves interactive practice sessions in Language Lab) Listening Comprehension

Pronunciation, Intonation, Stress and Rhythm

Common Everyday Situations: Conversations and Dialogues

Communication at Workplace

Interviews

Formal Presentations

Textbooks/References:

1. Practical English Usage. Michael Swan. OUP. 1995.
2. Remedial English Grammar. F.T. Wood. Macmillan.2007 (iii)On Writing Well. William Zinsser. Harper Resource Book. 2001
3. Study Writing. Liz Hamp-Lyons and Ben Heasly. Cambridge University Press. 2006.
4. Communication Skills. Sanjay Kumar and PushpLata. Oxford University Press. 2011.
5. Exercises in Spoken English. Parts. I-III. CIEFL, Hyderabad. Oxford University Press

Course Outcome:

At the end of the course students will be able learn a lot of new words. They also learnt the particularities and peculiarities of English grammar. As a result, they could speak and write English with the least possible error

SYLLABUS	(SEMESTER-II)	Periods/ Week			INTERNAL ASSESSMENT (IA)			ESE	Grand total	Credits
Subject Code:	PH201PBS01/ PH202PBS02	L	T	P	IA	MSE	TOTAL	20	50	01
Subject:	PHYSICS LAB	-	-	2	30	--	30			

Course Learning Objectives:

• To learn and perform the various practical related to optical components characterization, semiconductor material and devices characterization and know their applications in advance areas such as communication, industries, defence, navigation etc.

Course Content:

LIST OF PRACTICALS:

1. To determine the wavelength of sodium light with help of Fresnel's Bi-prism.
2. To determine the refractive index and dispersive power of the material of prism with the help of spectrometer.
3. To determine the sodium light by Newton's ring method.
4. To determine the wavelength of sodium light by plane diffraction grating using spectrometer.
5. To demonstrate the diffraction pattern and determine the wavelength of different colours of mercury (white) light using plane diffraction grating and spectrometer.
6. To determine the wavelength and number of line per cm on a diffraction grating using semiconductor laser diode.
7. To determine the specific rotation of sugar solution with the help of polarimeter.
8. Determine the width of the single slit and diameter of circular aperture using Fraunhofer diffraction pattern produced by semiconductor laser diode.
9. To determine the energy band gap (E_g) of a semiconductor material using P-N junction diode.
10. To determine the e/m ratio by the Thomson's method.
11. To study the P-N junction diode characteristics, in forwarded and reverse bias conditions.
12. To study the Zener diode characteristics.
13. To study the characteristics and gain of Transistor in C-B and C-E mode.
14. Determine the Planck's constant.

Course Outcomes: On completion of the course, the students would be able to:

- Know about basic optical facts and phenomenon, characterization of optical components and devices

- To know the basic semiconductor materials and devices and their applications
- To know how the performance of semiconductor devices can be improves.

SYLLABUS	SEMESTER-II	Periods/ Week			INTERNAL ASSESSMENT (IA)			ESE	Grand total	Credits
Subject Code:	ME201PE501/ ME202PE503	L	T	P	IA	MSE	TOTAL	20	50	3
Subject:	ENGINEERING GRAPHICS	1	0	3	30	--	30			

Course Learning Objectives:

- To learn the basic of Engineering Drawing and Orthographic Projections
- To learn the Sections and Sectional Views of Right Angular Solids
- To learn the Isometric Projections covering and overview of Computer Graphics

UNIT 1: Introduction Engineering Graphics and Engineering Curves: Principles of engineering graphics and their significance – drawing instruments and their use – conventions in drawing – lettering – BIS conventions. Dimensioning rules, geometrical construction. Engineering Curves - Conic Sections, Special Curves-Cycloids, Epicycloids, Hypocycloids, Involutes and trochoid.

UNIT 2: Projection of Points, Straight lines and Planes: Principles of orthographic projections – conventions – first and third angle projections. Projections of points and lines inclined to both the planes. Projections of regular planes, inclined to both planes

UNIT 3: Projections Solids: Introduction, Type of solid, Projections of solids in simple position, Projection of solids with axes inclined to one of the reference planes and parallel to the other, Projections of solids with axes inclined to both H.P. and the V.P.

UNIT 4: Section of Solids and Development of Surfaces: Sectioning of regular solids - Section planes perpendicular to one plane and parallel or inclined to other plane - Development of surfaces of right, regular solids – development of prisms, cylinders, pyramids, cones and their parts.

UNIT 5: Isometric Projections and Orthographic Views: Principles of Isometric Projections-Isometric Scale- Isometric Views Conventions-Plane Figures, Simple and Compound Solids. Conversion of isometric views to orthographic views. Conversion of orthographic views to isometric projections, vice-versa. Introduction to perspective projection.

Computer Aided Drafting: Introduction to computer aided drafting package to make 2-D drawings.

Demonstration purpose only - not to be included in examinations.

Textbooks/References:

1. Bhatt N.D., Panchal V.M. & Ingle P.R., (2014), Engineering Drawing, Charotar Publishing House
2. Shah, M.B. & Rana B.C. (2008), Engineering Drawing and Computer Graphics, PearsonEducation
3. Agrawal B. & Agrawal C. M. (2012), Engineering Graphics, TMH Publication
4. Narayana, K.L. & P Kannaiah (2008), Text book on Engineering Drawing, Scitech Publishers
5. CAD Software Theory and User Manuals

Course Outcomes:

1. At the end of the course, the student shall be able to
2. Draw engineering curves, orthographic projections of lines, planes and solids.
3. Draw sections of solids including cylinders, cones, prisms and pyramids. 4. Make development of surfaces, Orthographic and Isometric projections

5. Overview of Computer Graphics.

SYLLABUS	(SEMESTER-II)	Periods/ Week			INTERNAL ASSESSMENT (IA)			ESE	Grand total	Credits
Subject Code:	EC201PES07/ EC202PES05	L	T	P	IA	MSE	TOTAL			
Subject:	BASIC ELECTRICAL AND ELECTRONICS ENGINEERING LAB	-	-	2	30	--	30	20	50	1

Course Learning Objectives:

- To understand basic electrical wiring, measurements, errors and method.
- To practically provide the concept of different theorems.
- To have actually hands-on on machines like transformers, DC and AC machines to get better understanding.
- To get experimental knowledge of Diodes and Transistors
- To make students learn Digital logic design.

Course Content:
List of experiments/demonstrations:

1. Basic safety precautions. Introduction and use of measuring instruments – voltmeter, ammeter, multi-meter, oscilloscope. Real-life resistors, capacitors and inductors.
2. Measuring the steady-state and transient time-response of R-L, R-C, and R-L-C circuits to a step change in voltage (transient may be observed on a storage oscilloscope).
3. Sinusoidal steady state response of R-L, and R-C circuits – impedance calculation and Verification. Observation of phase differences between current and voltage. Resonance in R-L-C circuits.
4. Transformers: Polarity test, OC & SC tests. Loading of a transformer: measurement of primary and secondary voltages and currents and power.
5. Demonstration of cut-out sections of machines: dc machine (commutator-brush arrangement), induction machine (squirrel cage rotor), and single-phase induction machine.
6. Study of Diodes and transistors characteristics.
7. Study of full-wave and half-wave rectifier.
8. Verification of De Morgan's theorems.
9. Study of Logic gates.
10. Study of half and full adder.

Course Outcomes: At the end of the course students will be able to:

- Acquire knowledge about different types of meters and take readings and Construct circuits and measure different electrical quantities.
- Analyze Single Phase and Three phase AC Circuits, the representation of alternating quantities and determining the power in these circuits
- Work on machines like transformers
- Acquire knowledge about different types of diodes and transistors
- Design and understand digital logic circuits

SCHOOL OF STUDIES OF ENGINEERING & TECHNOLOGY
GURU GHASIDAS VISHWAVIDYALAYA(A CENTRAL UNIVERSITY)
CBCS-NEW, STUDY & EVALUATION SCHEME
PROPOSED W.E.F. SESSION 2021-2022
B.Tech. II Year (SEMESTER III)

SN	Course No.	SUBJECT	PERIODS			EVALUATION SCHEME			CREDITS
			L	T	P	IA	ESE	SUB-TOTAL	
1.	MA203TBS07	Statistical Methods	3	1	-	30	70	100	4
2.	ME203TPC01	Engineering Thermodynamics	3	1	-	30	70	100	4
3.	ME203TPC02	Fluid Mechanics	3	1	-	30	70	100	4
4.	ME203TPC03	Mechanics of Solids-I	3	1	-	30	70	100	4
5.	ME203TPC04	Manufacturing Processes	3	-	-	30	70	100	3
6.	ME203TMC02	Mandatory Course – Indian Knowledge System-I	1	-	-	-	-	-	-
		Total	**16**	**4**	**-**	**150**	**350**	**500**	**19**
PRACTICALS									
1.	ME203PPC01	Fluid Mechanics Lab	-	-	2	30	20	50	1
2.	ME203PPC02	Mechanics of Solids Lab	-	-	2	30	20	50	1
		Total	**-**	**-**	**4**	**60**	**40**	**100**	**2**
GRAND TOTAL			**16**	**4**	**4**	**210**	**390**	**600**	**21**

Total Credits : **21**
Total Contact Hour : **24**
Total Marks : **650**

*INTERNAL ASSESSMENT- Two Class Test of 15 Marks each will be conducted.
L-LECTURE, T-TUTORIAL, P-PRACTICAL, ESE –END SEMESTER EXAMINATION

ME203TBS01 – MATHEMATICS-III

Module I
Introduction to statistics , mathematical statistics , variable , frequency distribution , exclusive and inclusive class intervals type of series graphical representation histogram frequency polygon give measure of central tendency variation type of average, Mean median mode for grouped and un grouped data , geometric mean , harmonic mean , measure of description Skewness and Kurtosis.

Module II
Curve fitting and Method of least square – straight line parabola correlation – scatter cliagrem's Karl Pearson's coefficient of correlation. Limits for correlation coefficient.Coefficient of correlation for bivariate frequency distribution, rank correction.Regression linear regression, Equation to the line of Regression. Regression coefficient, Angle between two lines of Regression

Module III
Theory of Probability – Mathematical and statistical definition of probability Sample space finite sample space sample point, Events Theorem of total probability. Sample and compound event.Conditional probability.Theorem of compound probability. Boy's theorem. Use of binomial theorem.

Module IV
Theoretically Distribution – Binomial Distribution Mean, Standard deviation and Pearson's β and γ coefficient. Poisson distribution, mean, variance normal Distribution.
Random and simple sampling – mean and standard deviation in simple sampling of attribute test of significance for large sample test of significance based on Chi square, T, F, and Z Distribution Degree of freedom, condition for applying

Module_V
Simulation Basic concept of simulation, applications of simulation, merits and demerits of simulation, Monte Carlo simulation, simulation of Inventory system, simulation of Queuing system.

Text book:

1. Mathematical Statistics by M. Ray
2. S. C. Gupta and Kapoor – Fundamental of Mathematical Statistic
3. A.A. AFFI – Statistic Analysis
4. Probability & Statistics by Biswal, PHI

ME203TPC01 – ENGINEERING THERMODYNAMICS

1.	**Department/Center proposing the course**	Mechanical Engineering
2.	**Course title**	**Engineering Thermodynamics**
3.	**L-T-P Structure**	3-1-0
4.	**Credits**	4
5.	**Course number**	ME203TPC01
6.	**Status (Category for program)**	**Professional Core**

7.	**Pre-requisites**	Nil

8.	Status vis-à-vis other courses (Give Course number/title)	
8.1.	Overlap with any UG/PG course of the Dept./Centre	No
8.2.	Overlap with any UG/PG course of other Dept./Centre	No
8.3.	Super cedes any existing course	No

9.	Not allowed for **(indicate program names)**	

10.	Frequency of offering	☐ Every sem ☐ 1st Sem ☐ 2nd Sem ☐ Either Sem: **3th sem**

11.	**Faculty who will teach the course**	Expertise or specialization in the Fluid Thermal sciences

12.	**Will the course require any visiting faculty**	No.

13.	**Course contents***(about 100 words) (include laboratory/design activities)*: First and Second laws of thermodynamics, Entropy, Availability, Properties of gases and mixtures, Thermodynamic relations

14. **Lecture outline***(with topics and number of lectures)*

Module No.	Topics	No. of hours
1	Introduction, thermodynamic properties, equilibrium, zeroth and first laws of thermodynamics, work and heat transfer interactions	11

2	First law for closed system, first law for open system, second law of thermodynamics	12
3	Entropy, Availability, exergy and irreversibility	11
4	Thermodynamic relations, equilibrium and third law	11
5	Properties of Gases and Mixtures	11
TOTAL HOURS (including Tutorials)		56

15. Brief description of tutorial activities

Tutorial classes are for application-based problem solving

16. Suggested texts and reference materials

Text Books:

- Engineering Thermodynamics – P.K. Nag, McGraw Hill
- Basic and Applied Thermodynamics – P.K. Nag, McGraw Hill

Reference Books:

- Fundamentals of Thermodynamics – Sonntag, Borgnakke, Van Wylen, Wiley
- Thermodynamics-An engineering approach – Cengel and Boles, McGraw Hill

ME203TPC02 – FLUID MECHANICS

1.	**Department/Center proposing the course**	Mechanical Engineering
2.	**Course title**	**Fluid Mechanics**
3.	**L-T-P Structure**	3-1-0
4.	**Credits**	4
5.	**Course number**	ME203TPC01
6.	**Status (Category for program)**	**Professional Core**

7.	**Pre-requisites**	Nil

8.	Status vis-à-vis other courses (Give Course number/title)	
8.1.	Overlap with any UG/PG course of the Dept./Centre	No
8.2.	Overlap with any UG/PG course of other Dept./Centre	No
8.3.	Super cedes any existing course	No

9.	Not allowed for **(indicate program names)**	

10.	Frequency of offering	☐ Every sem ☐ 1st Sem ☐ 2nd Sem ☐ Either Sem: **3th sem**

11.	**Faculty who will teach the course**	Expertise or specialization in the Fluid Thermal sciences

12.	**Will the course require any visiting faculty**	No.

13.	**Course contents***(about 100 words) (include laboratory/design activities)*: Introduction and basic concepts, properties of fluids, fluid statics, kinematics, Bernoulli and energy equations, momentum analysis, flow in pipes, dimensional analysis, differential analysis of fluid flow, flow over bodies

14. **Lecture outline***(with topics and number of lectures)*

Module No.	Topics	No. of hours
1	Introduction and basic concepts, properties of fluids, pressures and fluid statics	11
2	Fluid kinematics, fundamentals of flow visualization, vorticity	12

	and rotationality, Reynolds transport theorem, mass conservation, Bernoulli's and energy equations	
3	Flow in pipes, laminar and turbulent flow in pipes, minor and major losses, piping networks, flow measurements	11
4	Momentum analysis of fluid flow, linear and angular momentum, dimensional analysis and similitude	11
5	Differential analysis of fluid flow, mass continuity and momentum equations, Navier-Stokes equations, Flow over bodies – drag and lift for flat plates, cylinders and spheres	11
TOTAL HOURS (including Tutorials)		56

15. Brief description of tutorial activities

Tutorial classes are for application-based problem solving

16. Suggested texts and reference materials

Text Books:

- Fluid Mechanics-Fundamentals and Applications – Cengel&Cimbala, McGraw Hill
- An Introduction to Fluid Mechanics & Fluid Machines –Som& Biswas, McGraw Hill

Reference Books:

- Fluid Mechanics – FM White, McGraw Hill
- Engineering Fluid Mechanics – K.L. Kumar, S.Chand& Co.

ME203TPC03 – MECHANICS OF SOLIDS – I

1.	**Department/Center proposing the course**	Mechanical Engineering
2.	**Course title**	**Mechanics of Solids -I**
3.	**L-T-P Structure**	3-1-0
4.	**Credits**	4
5.	**Course number**	ME203TPC03
6.	**Status (Category for program)**	**Professional Core**

7.	**Pre-requisites**	Engineering Mechanics

8.	Status vis-à-vis other courses (Give Course number/title)	
8.1.	Overlap with any UG/PG course of the Dept./Centre	No
8.2.	Overlap with any UG/PG course of other Dept./Centre	No
8.3.	Super cedes any existing course	No

9.	Not allowed for **(indicate program names)**	

10.	Frequency of offering	☐ Every sem ☐ 1st Sem ☐ 2nd Sem ☐ Either Sem: **3th sem**

11.	**Faculty who will teach the course**	Expertise or specialization in the Design

12.	**Will the course require any visiting faculty**	No.

13.	**Course contents***(about 100 words) (include laboratory/design activities)*: Introduction to stress, strains, properties of materials, Beams , stresses and deflection in beams, torsional stresses in shafts, combined stresses due to different types of loads

14. **Lecture outline***(with topics and number of lectures)*

Module No.	Topics	No. of hours
1	Basic of Stress & Strain, elastic constants, stress – strain diagram, Hooke's law, Poisson's ratio, shear stresses, stresses in the components subjected to multi-axial forces, thermal stresses,	11

	statically indeterminate systems	
2	**(**A) **Beams:** Introduction of Beams, Various type of Beams, Various type of Supports, Reactions at supports, Shear force and bending moment at any section of a beam, Relation between Shear Force and Bending Moment, Point of contra-flexure. (B) **Bending of beams:** Bending of beams with symmetric section, boundary conditions, pure bending, and bending equation problems of simple bending	12
3	**Deflection of beam:** Relation between slope deflection and radius of curvature, solution of beam deflection, problem by Macaulay's method, Direct integration method, Moment Area Method, Conjugate Beam method	11
4	Deformation in circular shaft due to torsion, basic assumptions, torsion equations, stresses in elastic range, angular deflection, hollow & stepped circular shaft, analysis of closed coil helical spring.	11
5	**(A) Principal stresses and strain**: Transformation of plane stresses, Principal stresses, Maximum shear stresses, Mohr's circle for plane stresses, Plain strain and its Mohr's circle representation, Principal strains, Maximum shear strain. **(B) Combined Loading**: Components subjected to bending, torsion & axial loads	11
TOTAL HOURS (including Tutorials)		56

15. Brief description of tutorial activities

Tutorial classes are for application-based problem solving

16. Suggested texts and reference materials

Text Books:

1. Elements of Strength of Material – S.P. Timoshenko & D.H. Young- AEWP .
2. Strength of Materials by Sadhu Singh.

Reference books:

1. An Introduction of mechanics of solid by Crandall, Dahl &Lardnee Tata McGraw Hill.
2. Advance Strength of Materials by L.S. Srinath
3. Mechanics of material by F.P. Beer & E.R. Johnson Jr. Tata McGraw Hil.
4. Engineering Mechanics of solids by Egor P. Popov., PHI
5. Introduction of solid mechanics by I. H. Shames

ME203TPC04 – MANUFACTURING TECHNOLOGY

1.	**Department/Center proposing the course**	Mechanical Engineering
2.	**Course title**	**Manufacturing Technology**
3.	**L-T-P Structure**	3-0-0
4.	**Credits**	3
5.	**Course number**	ME203TPC04
6.	**Status (Category for program)**	**Professional Core**

7.	**Pre-requisites**	Nil

8.	Status vis-à-vis other courses (Give Course number/title)	
8.1.	Overlap with any UG/PG course of the Dept./Centre	No
8.2.	Overlap with any UG/PG course of other Dept./Centre	No
8.3.	Super cedes any existing course	No

9.	Not allowed for **(indicate program names)**	

10.	Frequency of offering	☐ Every sem ☐ 1st Sem ☒ 2nd Sem ☐ Either Sem: **3th sem**	

11.	**Faculty who will teach the course**	Expertise or specialization in the Manufacturing or Production domain

12.	**Will the course require any visiting faculty**	Visiting faculties or professional persons from manufacturing industries are required.

13.	**Course contents***(about 100 words) (include laboratory/design activities)*: The significant contents to be address under MS is depicted below: The welding, resistance welding, foundry, melting furnaces & practices, casting, forming, rolling, extrusion and sheet-metal working.

14. **Lecture outline***(with topics and number of lectures)*

Module No.	Topics	No. of hours
1.	**Introduction and classification of manufacturing and type of current**	

	manufacturing processes. **Welding:** Classification of welding process, basic principal & scope of application, Principle of Gas and electric arc welding, TIG& MIG processes and their parameters, characteristics of power sources, Polarity, soldering, brazing, electrodes, types & coatings, welding defects and remedies, Principle, equipments& types of Resistance welding:.	9
2	**Foundry:** Moulding methods and materials, sand-clay-water system, additives, types of moulding sand and their properties, pattern making and types, pattern allowances and design considerations, core making. **Melting furnaces and practices:** Melting cast iron, steel and non ferrous material, cupola, open furnaces, converter and crucible furnaces, electric, direct arc furnace and inductive furnace.	8
3	**Casting:** Elements of gating system-top gating, bottom gating, types of risers, solidification of casting, casting defects, clearing of casting, principle of die casting- gravity and pressure die casting, shell moulding, Centrifugal and investment casting, **Plastic processing:** injection, compression & blow moulding.	8
4	**Forming:** mechanism of forming process, elastic and plastic deformation. **Rolling:** classification, theories of Hot & Cold rolling, rolling mills & its types, calculation of rolling parameter & rolling defect, roll pass sequence. **Forging:** Basic operations and their classification and defects. **Extrusion:** Classification and principle of extrusion process, analysis of processes, drawing of rods, wire tube-analyses of wire drawing, tube drawing, defects in extrusion & drawing	9
5	**Sheet-metal working:** Role of sheet metal Components, description of cutting processes-blanking, piercing, stripper and stock guide, description of forming processes like bending, cup drawing, coining, embossing. **Basic elements of press**- classification, punch and die clearances, elements of die and punches, clearance, compound ,combination, progressive and inverted dies and their operations	8
TOTAL HOURS		42

15. Brief description of tutorial activities

NA

16. Suggested texts and reference materials

Reference Books:

- *R. A.Lindberg (1990), Processes and Materials of Manufacture, 4th Edition, PHI learning Publication.*
- *Ghosh (2010), Manufacturing Science, second edition, East-West Press Pvt LTD.*
- *Manufacturing Science.*
- *5. A. Mubeen and M. Parvez (2012), Manufacturing Science, Edition: 1st, Publisher-asian books private limited, ISBN: 818412167-9*

- *P.N. Rao (2017), Manufacturing Technology, Vol.1 , 4th Edition, Vol. 1, McGraw Hill Education.*
- *P. N. Rao (2018), Manufacturing Technology-Foundry, Farming and Welding , 5th Edition, Vol. 1, McGraw Hill Education.*
- *S. Kalpakjian and S. R. Schmid (2018), Manufacturing Engineering and Technology, SI Edition, Pearson publisher.*

ME203PPC01 – FLUID MECHANICS LAB

List of Experiments:

1. To determine the meta-centric height of a ship model.
2. To verify Bernoulli's Theorem.
3. To verify Impulse Momentum Principle.
4. To calibrate a Venturimeter and study the variation of coefficient of discharge.
5. To calibrate an orifice-meter.
6. Experimental determination of critical velocity in pipe.
7. To determine of head loss in various pipe fittings.
8. Flow measurement using Pitot tube.
9. To study the transition from laminar to turbulent flow and to determine the lower critical Reynolds's number.
10. To determine the hydraulic coefficients (Cc, Cd and Cv) of an orifice.
11. To determine the coefficient of discharge of a mouth piece.
12. To obtain the surface profile and the total head distribution of a forced vortex.
13. To study the velocity distribution in pipe and to compute the discharge by integrating velocity profile.
14. To study the variation of friction factor for pipe flow.
15. To determine the roughness coefficient of an open channel.

List of Equipment/Instruments/Machines/Software Required:

- Apparatus for determination of metacentric height
- Bernoulli's apparatus
- Impact of jet apparatus
- Venturimeter
- Orificemeter
- Pipe friction apparatus
- Orifice apparatus
- Mouth Piece apparatus with the provision for determination of hydraulic coefficient Cc, Cd &Cv
- Vortex flow apparatus
- Apparatus of head loss in various pipe fittings.
- Reynold's apparatus
- Complete setup for flow measurement using Pitot tube
- Complete set for open channel apparatus

ME203PPC02 – MECHANICS OF SOLIDS LAB

List of Experiments:

1. To study the Universal Testing Machine.
2. To perform the Tensile Test of Mild Steel on U.T.M and To Draw Stress–Strain Curve.
3. To study the Impact Testing Machine and test specimen of Izod and Charpy.
4. To determine Izod and Charpy Value of the given mild steel specimen.
5. To study the Torsion Testing Machine
6. To determine ultimate shear stress and modulus of rigidity under Torsion.
7. To study the Rockwell Hardness Testing Machine and to determine the Rockwell Hardness of the given material.
8. To study the Brinell Hardness Machine and to determine the Brinell hardness of the given material.
9. To study the Vickers Hardness Machine and to conduct a hardness test on the machine.

List of Equipment/Instruments/Machines/Software Required:

- Universal Testing Machine
- Impact Testing Machine
- Fatigue Testing Machine
- Torsion Testing Machine
- Rockwell Hardness Testing Machine
- Brinell Hardness Machine
- Vickers Hardness Machine

SCHOOL OF STUDIES OF ENGINEERING & TECHNOLOGY
GURU GHASIDAS VISHWAVIDYALAYA(A CENTRAL UNIVERSITY)
CBCS-NEW, STUDY & EVALUATION SCHEME
PROPOSED W.E.F. SESSION 2021-2022
B.Tech. II Year (SEMESTER IV)

SN	Course No.	SUBJECT	PERIODS			EVALUATION SCHEME			CREDITS
			L	T	P	IA	ESE	SUB-TOTAL	
1.	MA204TBS09	Numerical Analysis & Computer Programming	3	1	-	30	70	100	4
2.	ME204TPC05	Applied Thermodynamics	2	1	-	30	70	100	3
3.	ME204TPC06	Kinematics Of Machinery	2	1	-	30	70	100	3
4.	ME204TPC07	Mechanics Of Solid-II	3	1	-	30	70	100	4
5.	ME204TPC08	Machine Tool Technology	3	-	-	30	70	100	3
6.	ME204TPC09	Materials Science & Metallurgy	3	-	-	30	70	100	3
		Total	**16**	**4**	**-**	**180**	**420**	**600**	**20**
PRACTICALS									
1.	ME204PPC01	Manufacturing Tech. Lab	-	-	2	30	20	50	1
2.	ME204PPC02	Computer Aided Machine Drawing	2	-	2	30	20	50	3
		Total	**2**	**-**	**4**	**60**	**40**	**100**	**4**
GRAND TOTAL			**18**	**4**	**4**	**240**	**460**	**700**	**24**

Total Credits : **24**
Total Contact Hour : **26**
Total Marks : **700**

*INTERNAL ASSESSMENT- Two Class Test of 15 Marks each will be conducted.
L-LECTURE,T-TUTORIAL,P-PRACTICAL, ESE –END SEMESTER EXAMINATION

MA204TBS04 – NUMERICAL ANALYSIS & COMPUTER PROGRAMMING

Module-I

Approximation and errors in ComputationApproximation and round of errors, truncation errors and Taylor series, Determination of roots ofpolynomials and transcendental equations by Graphical methods and Bisection, Regula-falsi, secantand Newton-Raphon methods, solution of Linear simultaneous, linear algebraic equations bygauss Elimination Gauss-Jordan and Gauss-Siedel iteration method.

Module-II

Empirical Laws, Curve Fitting & InterpolationCurve fitting linear and non-linear regression analysis (Method of group average and leastsquares) finite differences, backward, forward and central difference relation and their use inNumerical differentiation and integration and their application in interpolation.

Module-III

Numerical Solution of Ordinary Differential EquationsNumerical Integration by Trapezoidal rule, Simpson's (1/3rd & 3/8th) rule and its errorestimation. Application of difference relations in the solution of partial differential equations.Numerical solution of ordinary differential equations by Taylor's series, Euler, modified Euler, Runge-Kutta and Predictor-Corrector method.

Module-IV

Numerical Solutions of partial differential EquationsDepartment of Mechanical Engineering, School of Engineering & Technology, GGV, Bilaspur (C.G.)Introduction, classification of second order equations, finite difference approximations to partialderivatives, elliptic equations, solution of Laplace equation, solution by Poisson's equation,solution of elliptic equations by relaxation method, parabolic equations, solution of onedimensionalheat equation, solution of two-dimensional heat equation, Hyperbolic equations,solution of wave equation.

Module-V

Computer ProgrammingI/O Statement, Mathematical Relational & Conditional statement & Expressions. Switch Loops andControl Statement. Introduction to one dimensional array and two dimensional arrays. Basic of I/Ofile Handling. C-Programming indicating numerical methods.

Text Books:

1. Numerical Methods in Engineering & Science-Dr.B.S.Grewal-Khanna Publishers, 6th Edn.2004.
2. Numerical Methods-P.Kandasamy,K.Thilagavathy& K. Gunavathy-S Chand& Co.,2Nd Rev. Edn.-2003
3. Let us C-Yashwantkanitkar
4. Introductory Methods of Numerical Analyisi-S.S.Sastry,3rdEdn.-PHI-New Delhi,2003
5. Numerical Methods Analysis-James B.Scarborough, 6th Edn. Oxford & IBH Publishing Co.-New Delhi.

ME204TPC05 – APPLIED THERMODYNAMICS

1.	**Department/Center proposing the course**	Mechanical Engineering
2.	**Course title**	**Applied Thermodynamics**
3.	**L-T-P Structure**	2-1-0
4.	**Credits**	3
5.	**Course number**	ME204TPC06
6.	**Status (Category for program)**	**Professional Core**

7.	**Pre-requisites**	Engineering Thermodynamics

8.	Status vis-à-vis other courses (Give Course number/title)	
8.1.	Overlap with any UG/PG course of the Dept./Centre	Yes
8.2.	Overlap with any UG/PG course of other Dept./Centre	No
8.3.	Super cedes any existing course	Yes

9.	Not allowed for **(indicate program names)**	

10.	Frequency of offering	☐ Every sem ☐ 1st Sem ☐ 2nd Sem ☐ Either Sem: **4th sem**

11.	**Faculty who will teach the course**	Expertise or specialization in the Fluid Thermal sciences

12.	**Will the course require any visiting faculty**	No

13.	**Course contents***(about 100 words) (include laboratory/design activities)*: Properties of Pure substances, Vapour power cycles, Gas power cycles, Refrigeration Cycles, Compressible fluid flow, Kinetic theory of gases

14. **Lecture outline***(with topics and number of lectures)*

Module No.	Topics	No. of hours
1	Gas power cycles – Carnot, Stirling Ericsson, Air standard, Otto, Diesel, Dual Brayton cycles, Aircraft propulsion	9
2	Properties of pure substances, thermodynamic processes for pure substance, steam tables, charts of thermodynamic properties	8
3	Vaopur Power cycles, Rankine cycle, regenerative cycle, exergy analysis of vapor power cycles binary vapor cycles	9
4	Refrigeration cycles – reverses heat engine cycle, vapor compression, vapor absorption, gas refrigeration cycle, production of solid ice, Psychrometrics	8
5	Compressible fluid flow – stagnation properties, one dimensional steady isentropic flow, critical properties, shocks, introduction to kinetic theory of gases	8
TOTAL HOURS (including Tutorials)		42

15. Brief description of tutorial activities

Tutorial classes are for application-based problem solving

16. Suggested texts and reference materials

Text Books:

- Engineering Thermodynamics – P.K. Nag, McGraw Hill
- Basic and Applied Thermodynamics – P.K. Nag, McGraw Hill

Reference Books:

- Fundamentals of Thermodynamics – Sonntag, Borgnakke, Van Wylen, Wiley
- Thermodynamics-An engineering approach – Cengel and Boles, McGraw Hill

ME204TPC06 – KINEMATICS OF MACHINERY

1.	**Department/Center proposing the course**	Mechanical Engineering
2.	**Course title**	**Kinematics of machinery**
3.	**L-T-P Structure**	2-1-0
4.	**Credits**	3
5.	**Course number**	**ME204TPC06**
6.	**Status (Category for program)**	**Professional Core**

7.	**Pre-requisites**	Engg. Mechanics

8.	Status vis-à-vis other courses (Give Course number/title)	
8.1.	Overlap with any UG/PG course of the Dept./Centre	No
8.2.	Overlap with any UG/PG course of other Dept./Centre	Yes (TOM)
8.3.	Super cedes any existing course	No

9.	Not allowed for **(indicate program names)**	

10.	Frequency of offering	☐ Every sem ☐ 1st Sem ☐ 2nd Sem ☐ Either Sem: **4th sem**

11.	**Faculty who will teach the course**	Expertise or specialization in the Design

12.	**Will the course require any visiting faculty**	No.

13.	**Course contents***(about 100 words) (include laboratory/design activities)*: Introduction and basic concepts, Mechanisms, Velocity & Acceleration Analysis, Gears & Gear Trains, cam and follower, Clutch,Brakes

14. **Lecture outline***(with topics and number of lectures)*

Module No.	Topics	No. of hours
1	Introduction and basic concepts, Mechanism and Machines, Links, kinematics pair, kinematics chain, degree of freedom & constrained motion, inversion of slider crank mechanism, four bar chain etc. equivalent linkage, mechanism with lower pairs,	9

	pantograph.	
2	Plane motion, absolute and relative motion, velocity and acceleration of a point, velocity and acceleration of a mechanism by relative velocity diagram, Coriolis components.	9
3	Classification of gears, conjugate action, law of gearing, involutes and cycloidal tooth's profiles, interference and under cutting, contact ratio, gear train	8
4	Classification of cam and follower, types of follower motion, uniform, simple harmonic, parabolic, cycloid, Cam's profile by graphical method.	8
5	Clutch: Calculations on single plate and multi plate clutch, cone clutch Brakes: Analysis of simple brakes assuming uniform pressure and uniform wear, band brake, block brake, internal shoe brake.	8
TOTAL HOURS (including Tutorials)		42

15. Brief description of tutorial activities

Tutorial classes are for application-based problem solving

16. Suggested texts and reference materials

Text Books:

- Mechanism of machines By Ghosh and Mallick East West Press
- Theory of machine By S.S. Ratan TMGH

Reference Books:

- Theory of Machine ByThomosBeven, C.B.S. Publications

ME204TPC07 – MECHANICS OF SOLIDS – II

17.	**Department/Center proposing the course**	Mechanical Engineering
18.	**Course title**	**Mechanics of Solids -II**
19.	**L-T-P Structure**	3-1-0
20.	**Credits**	4
21.	**Course number**	ME204TPC07
22.	**Status (Category for program)**	**Professional Core**

23.	**Pre-requisites**	Engineering Mechanics & Mechanics of Solids – I

24.	Status vis-à-vis other courses (Give Course number/title)	
24.1	Overlap with any UG/PG course of the Dept./Centre	No
24.2	Overlap with any UG/PG course of other Dept./Centre	No
24.3	Super cedes any existing course	No

25.	Not allowed for **(indicate program names)**	

26.	Frequency of offering	☐ Every sem ☐ 1st Sem ☐ 2nd Sem ☐ Either Sem: **3th sem**

27.	**Faculty who will teach the course**	Expertise or specialization in the Design

28.	**Will the course require any visiting faculty**	No.

29.	**Course contents***(about 100 words) (include laboratory/design activities)*: Introduction to stress, strains, properties of materials, Beams , stresses and deflection in beams, torsional stresses in shafts, combined stresses due to different types of loads

30. **Lecture outline***(with topics and number of lectures)*

Module No.	Topics	No. of hours
1	**Energy Methods**: Introduction, Strain energy, Elastic strain energy in tension, compression, bending and torsion. Impact	12

	loading in tension and bending, Theorem of Castigliano and its applications, Reciprocal relations, Maxwell -Betti theorem.	
2	**Fixed Beams:** Fixed beam subjected to different types of loads and couples, Calculations of fixing moments and reactions at supports, deflection. Effect of sinking of support. **Continuous beams**: Continuous beams subjected to different type of loads and couples, beams with overhang, beams with one end fixed, Clapeyron's theorem. Effect of sinking of supports.	11
3	**Bending of curved bars:** Bending of curved bars in plane of loading, Winkler- Bach theory, crane hooks, chain links, bending of circular bars subjected to symmetric loading, bending of circular rings, stresses in circular rings	11
4	**Unsymmetrical Bending**: Introduction to unsymmetrical bending, Stresses and deflection in unsymmetric bending, Shear center for angle, Channel and I-sections. **Columns:** Struts and Columns, Stability of columns, Euler's formula for different end conditions, Equivalent load, Eccentric loading, Rankine's formula	11
5	**Thin Pressure Vessel:** Thin Pressure Vessels, Circumferential and longitudinal stresses in thin cylindrical shells and thin spherical shell under internal pressure **Thick Pressure Vessel**: Introduction, Lames Theorem, Thick Pressure vessels subjected to internal pressure, External Pressure & both, compound cylinders.	11
TOTAL HOURS (including Tutorials)		56

31. Brief description of tutorial activities

Tutorial classes are for application-based problem solving

32. Suggested texts and reference materials

1. **Text Books:**
   1. Mechanics of Material – J. M. Gere and S. P. Timoshenko – CBS publisher
   2. Strength of Materials by Sadhu Singh.

Reference books:

1. An Introduction of mechanics of solid by Crandall, Dahl &Lardnee Tata McGraw Hill.
2. Advance Strength of Materials by L.S. Srinath
3. Mechanics of material by F.P. Beer & E.R. Johnson Jr. Tata McGraw Hil.
4. Engineering Mechanics of solids by Egor P. Popov., PHI
5. Introduction of solid mechanics by I. H. Shames
6. Elements of Strength of Material – S.P. Timoshenko & D.H. Young- AEWP

ME204TPE01 – MACHINE TOOL TECHNOLOGY

1.	**Department/Center proposing the course**	Mechanical Engineering
2.	**Course title**	**Machine Tool Technology**
3.	**L-T-P Structure**	3-0-0
4.	**Credits**	3
5.	**Course number**	**ME204TPC08**
6.	**Status (Category for program)**	**Professional Elective-01**

7.	**Pre-requisites**	Knowledge of Workshop and Machine operations.

8.	Status vis-à-vis other courses (Give Course number/title)	
8.1.	Overlap with any UG/PG course of the Dept./Centre	No
8.2.	Overlap with any UG/PG course of other Dept./Centre	No
8.3.	Super cedes any existing course	No

9.	Not allowed for **(indicate program names)**	

10.	Frequency of offering	☐ Every sem ☐ 1st Sem ☐ 2nd Sem ☐ Either Sem: **4th sem**

11.	**Faculty who will teach the course**	Expertise or specialization in the Manufacturing Engineering

12.	**Will the course require any visiting faculty**	No.

13.	**Course contents***(about 100 words) (include laboratory/design activities)*: Introduction to manufacturing and machining,Manufacturing need and concepts,Machining purpose principle and definition, Function of machine tool and machining requirements,

14. **Lecture outline***(with topics and number of lectures)*

Module No.	Topics	No. of hours
1	General purpose machine tools, mechanics, tools, geometry and	9

	chip formation, surface finish and machinability.	
2	Machine tool: Generation and machining principles, setting and operations on machines: lathe, milling, shaping, slotting, planning, drilling, boring, broaching, grinding, gear cutting.	8
3	Tooling: Jigs and Fixtures, principles of location, clamping, indexing and design of simple jigs and fixtures.	8
4	Batch production: NC Part programming. CNC machines, Finishing: Micro finishing, Introduction to 3D and 4D printing	8
5	Non-conventional machining: EDM, LBM, EBM, ECM, USM, AJM, Rapid prototyping	9
TOTAL HOURS		42

15. Brief description of tutorial activities

Tutorial classes are for application-based problem solving

16. Suggested texts and reference materials

Text Books and reference books:

1. Manufacturing technology (Vol.-I & II) by P.N. Rao Tata McGraw Hill Publishers.
2. Manufacturing Engg. And technology by S. Kalpakjian& S.R. Schmid, Addision Wesley Longman, New Delhi
3. Manufacturing science By A. Ghosh& A.K. Mallik East West Press Pvt. Ltd New Delhi
4. Manufacturing Process by O P Khanna Dhanpat Rai Publication
5. A Textbook of Production Engineering by Dr P C Sharma S Chand Publications
6. Metal Working Technology Narayanaswamy. R, , PHI

ME204TPE02 –MATERIAL SCIENCE & METALLURGY

1.	**Department/Center proposing the course**	Mechanical Engineering
2.	**Course title**	**Material Science & Metallurgy**
3.	**L-T-P Structure**	3-0-0
4.	**Credits**	3
5.	**Course number**	**ME204TPC09**
6.	**Status (Category for program)**	**Professional Elective-02**

7.	**Pre-requisites**	Nil

8.	Status vis-à-vis other courses (Give Course number/title)	
8.1.	Overlap with any UG/PG course of the Dept./Centre	No
8.2.	Overlap with any UG/PG course of other Dept./Centre	No
8.3.	Super cedes any existing course	No

9.	Not allowed for **(indicate program names)**	

10.	Frequency of offering	☐ Every sem ☐ 1st Sem ☐ 2nd Sem ☐ Either Sem: **4th sem**

11.	**Faculty who will teach the course**	Expertise or specialization in the Materials, Design or Chemistry

12.	**Will the course require any visiting faculty**	No.

13.	**Course contents***(about 100 words) (include laboratory/design activities)*: Introduction and basic structure of materials, Mechanicalproperties of different materials,behavior of metals and alloys in different phases at different, application of materials.

14. **Lecture outline***(with topics and number of lectures)*

Module No.	Topics	No. of hours
1	Introduction and basic structure of materials, properties of materials , Material deformation and its control	9

2	Engineering Materials Metals,alloys,ceramics, polymers and their applications	8
3	Behavior of Metals and their properties in different Phase ,TTT Diagram, Heat Treatment processes	9
4	Mechanism of Corrosion and creep and there remedies	8
5	Advanced Engineering Materials composites, Nano Materials intermetallic, and biomedical materials and their applications	8
TOTAL HOURS		42

15. Brief description of tutorial activities

NA

16. Suggested texts and reference materials

Text Books:

1. Material Science &Engg. – A first course – V. Raghavan – PHI (P) Ltd., Delhi,2003
2. A Text Book of Material Science & Science &Metallurgy,O.P. Khanna ,Dhanpat Rai & Sons, New Delhi

Reference Books:

1. Elements of Material Science &Engg. – Van Vlack. – Addison – Wesley Longman, 6th Edn., New York
2. Physical Metallurgy – Clark & Varney, East West Edn., New Delhi

COMPUTER AIDED MACHINE DRAWING Lab

1.	**Department/Center proposing the course**	Mechanical Engineering
2.	**Course title**	**COMPUTER AIDED MACHINE RAWING LAB**
3.	**L-T-P Structure**	2-0-2
4.	**Credits**	3
5.	**Course number**	ME204PPC02
6.	**Status (Category for program)**	**Professional Core Lab**

7.	**Pre-requisites**	Nil

8.	Status vis-à-vis other courses (Give Course number/title)	
8.1.	Overlap with any UG/PG course of the Dept./Centre	No
8.2.	Overlap with any UG/PG course of other Dept./Centre	No
8.3.	Super cedes any existing course	No

9.	Not allowed for **(indicate program names)**	

10.	Frequency of offering	☐ Every sem ☐ 1st Sem ☐ 2nd Sem ☐ Either Sem: **4th sem**

11.	**Faculty who will teach the course**	Expertise or specialization in the Basic Engineering Graphics, Machine Drawing and Auto CAD software

12.	**Will the course require any visiting faculty**	No.

13.	**Course contents***(about 100 words) (include laboratory/design activities)*: Introduction to basic elements of machines , drawing of assembly parts ,there representation with standard and tolerances , use of CAD software to draw 2D and 3D drawing of machine elements , different views, dimensions and lay outs of machine drawing

14. **Lecture outline***(with topics and number of lectures)*

Module No.	Topics	No. of hours

1	Introduction and basic Machining symbols and Drawing conventions,representation of geometrical tolerances on drawings	11
2	Riveted, Welded joints ,Screw Threads and fasteners application and representation	11
3	Sectional Views and its drawing for mechanical joints and elements	11
4	Assembly drawing for matting parts	12
5	Introduction of CAD Software, Drawing 2D and 3D drawing with use of CAD Software	11
TOTAL HOURS		56

15. Brief description of tutorial activities

NA

16. Suggested texts and reference materials

Text Books:

1. Machine Drawing, N.D. Bhatt, Charotar Book Stall, Anand
2. A Text Book of Machine Drawing, P.S.Gill, S.K.Kataria, Delhi

Reference Books:

1. Machine Drawing, R.K.Dhawan,S,Chand,Delhi
2. Textbook of Machine Drawing, K.C. John,PHI,Delhi

SCHOOL OF STUDIES OF ENGINEERING & TECHNOLOGY
GURU GHASIDAS VISHWAVIDHALAYA(A CENTRAL UNIVERSITY)
DEPARTMENT OF MECHANICAL ENGINEERING
CBCS-NEW, STUDY & EVALUATION SCHEME
W.E.F. SESSION 2020-2021

Year: B.Tech. 3rdyear

SEMESTER- V

SN	Course No.	SUBJECT	PERIODS			EVALUATION SCHEME			CREDITS
			L	T	P	INTERNAL ASSESSMENT	ESE	SUB-TOTAL	
1.	ME05TPC07	**Fluid & Turbo Machinery**	3	0	-	30	70	100	3
2.	ME05TPC08	Internal Combustion Engine	3	0	-	30	70	100	3
3.	ME05TPC09	Machine Design – I	3	1	-	30	70	100	4
4.	ME05TPC10	Mechanics of Solid-II	3	1	-	30	70	100	4
5.	ME05TPE02	Professional Elective-02	3	0	-	30	70	100	3
		Total	**15**	**2**	**-**	**150**	**350**	**500**	**17**
PRACTICALS									
1.	ME05PPC05	Fluid Machinery lab	-	-	2	30	20	50	1
2.	ME05PPC06	Internal Combustion Engine Lab	-	-	2	30	20	50	1
3	ME05PPE01	CAD / CAM Lab			2	30	20	50	1
Total			**0**	**0**	**4**	**90**	**60**	**150**	**3**

Total Credits: 20
Total Contact Hour: 21
Total Marks: 650
*INTERNAL ASSESSMENT- Two Class Test of 15 Marks each will be conducted.
L-LECTURE,T-TUTORIAL,P-PRACTICAL, ESE –END SEMESTER EXAMINATION

ME05TPE02 Professional Elective-02	
ME05TPE21 Innovation and Technology Management	
ME05TPE22 Innovation and Entrepreneurial Skills	
ME05TPE23 **CAD/CAM**	

COURSE TEMPLATE

1.	**Department/Centre proposing the course**	Mechanical Engineering
2.	**Course Title**	Fluid and Turbo Machinery
3.	**L-T-P structure**	3-1-0
4.	**Credits**	4
5.	**Course number**	**ME5TPC07**
6.	**Status** (*category* for *program*)	

7.	**Pre-requisites** (course no./title)	Thermodynamics, Fluid Mechanics
8.	**Status vis-à-vis other courses***(give course number/title)*	
8.1	Overlap with any UG/PG course of the Dept./Centre	No
8.2	Overlap with any UG/PG course of other Dept./Centre	No
8.3	Supercedes any existing course	No

9		

10	**Frequency of offering**	Every sem☒ 1st sem☒ 2nd sem☒ Either sem☒
11	**Faculty who will teach the course**	
12	**Will the course require any visiting faculty?**	

13	**Course objective:** • The course aims at giving an overview of different types of fluid machines used for energy transformation, such as hydraulic and steam turbines, gas turbines, compressors, and pumps. • It focuses on applications in power generation, transport, refrigeration. • The main purpose of implementing this course in the curriculum is to learn about how the power is transferred in a turbomachine.

14	**Course contents:** **Unit-1** **Fundamentals:** Classification, Applications of turbomachines, Performance

	parameters, Specific speed, Basic laws and equations, Velocity triangles. **Unit-2** **Hydraulic turbines:** Specific applications, types, construction, working, and performance of various types of hydraulic turbines (Pelton, Francis, and Kaplan turbines), Cavitation in turbines, and water hammer effects, Draft tube: Types, applications, and performance analysis. **Unit -3** **Centrifugal pumps:** Theory, types, components, and working characteristics, Cavitation, NPSH,Priming, Axial flow pumps, Practical problems, and remedies. **Unit-4** **Thermal turbines:** Steam turbine basic cycles, impulse and reaction turbines, Multistage turbines,Governing systems, Effects of reheating and regeneration, Application of Mollier diagram, Gas turbine basic cycle, Application of intercooling, reheating and regeneration, Introduction to wind turbines, Power and efficiency calculations. **Unit-5** **Air compressors:** Radial and axial compressors, Construction and performance analysis, Surging and stalling, Slip.

15. Lecture Outline *(with topics and number oflectures)*

Module no.	Topic	No. of hours
1.	Introduction to turbomachinery, Basic principles, Classification, Impulse and Reaction type, Fundamental equations, Euler's equation, Introduction to hydro-electric power plants, major components, Surge tanks, etc.	05
2.	Hydraulic Turbines: Classification of Turbine, Impulse Turbine, Pelton wheel, Construction and working, Work done, Head efficiency and Design aspects, Governing of Impulse turbine.	06
3.	Radial flow reaction turbine, Francis turbine: Construction and working, Work done, efficiency, Design aspect, Advantages and disadvantages over Pelton wheel.	05
4.	Propeller and Kaplan turbine, Bulb or Tubular turbine, Draft tube, Specific speed, Unit quantities, Cavitation, Degree of reaction, Performance characteristics, Surge tanks, Governing of Reaction turbine.	05
5.	Classification of Pumps, Centrifugal Pump, Construction, Working, Work Done, Heads, Efficiencies, Multistage Centrifugal Pump, Pump in Series and Parallel, Specific Speed, Characteristic, Net Positive Suction Head, Cavitation.	06
6.	Steam Turbines:Classification, Single-stage impulse turbine, condition for maximum blade efficiency, stage efficiency, Need and methods of compounding, Multi-stage impulse turbine, Problems.Parson's turbine, condition for efficiency, reaction staging, Problems.	7
7.	Gas turbine: components, fuels, materials, Different cycle, analysis, Optimum pressure ratio for maximum specific output, the effect of modification on efficiency and output, Ideal and actual cycle.	05

8.	Centrifugal Compressors: Stage velocity triangles, slip factor, power input factor, Stage work,Pressure developed, stage efficiency and surging, and problems.	05
9.	Axial flow Compressors: Expression for pressure ratio developed in a stage, work done factor, efficiencies and stalling. Problems.	05
	COURSE TOTAL	49

16. Brief description of tutorial activities

Primarily numerical problem solving on different topics covered in the lectures.

17. Brief description of laboratoryactivities

Module no.	Experiment description	No. of hours
1	Study of Pelton wheel turbine	03
2	Study of Francis turbine	03
3	Study of the Kaplan turbine	03
4	Study of centrifugal pump	03
5	Study of Velocity triangles for impulse steam turbine	02
6	Study of Velocity triangles for reaction steam turbine	02
7	Study of Velocity triangles for axial flow compressor	02
8	Study of Velocity triangles for centrifugal air compressor	02
9	Study of open cycle gas turbine	02
10	Study of open cycle gas turbine with reheat, regeneration	02
COURSE TOTAL		**12**

18. Suggested texts and reference materials

1. Jagdish Lal, Hydraulic Machines, S. K. Kataria& Sons
2. S. K. Som& G. Biswas, Introduction to Fluid Mechanics and Fluid Machines, TMH
3. C. P. Kotharaman& R. Rudramoorthy, Fluid Mechanics & machinery, New Age Pub
4. R. Yadav, Steam and Gas Turbine, C.P.H. Publication, Allahabad
5. S.M. Yahya,Turbine, Compressors and Fans,TMH.
6. P.K. Nag, Power Plant Engineering,3rd edition, Tata McGraw Hill.
7. V. Ganeshan, Gas Turbine, TMH.
8. D. G. Shepherd, Principle of Turbo Machinery, McMillan.

19. Resources required for the course *(itemized & student access requirements, if any)*

19.1	Software	MATLAB
19.2	Hardware	
19.3	Teaching aids (videos, etc.)	
19.4	Laboratory	Fluid Machine Labs
19.5	Equipment	Various types of turbine and pumps
19.6	Classroom infrastructure	
19.7	Site visits	Thermal and Hydropower projects

20. Designcontentofthecourse *(Percentofstudenttimewithexamples,ifpossible)*

20.1	Design-type problems	10%
20.2	Open-ended problems	

20.3	Project-type activity	
20.4	Open-ended laboratory work	
20.5	Others (please specify)	

COURSE TEMPLATE

1.	**Department/Centre proposing the course**	Mechanical Engineering
2.	**Course Title**	**INTERNAL COMBUSTION ENGINES**
3.	**L-T-P structure**	3-0-0
4.	**Credits**	3
5.	**Course number**	**ME5TPC08**
6.	**Status** (*category* for *program*)	CORE

7.	**Pre-requisites** (course no./title)	Thermodynamics
8.	**Status vis-à-vis other courses** *(give course number/title)*	
8.1	Overlap with any UG/PG course of the Dept./Centre	No
8.2	Overlap with any UG/PG course of other Dept./Centre	No
8.3	Supercedes any existing course	No

9		

10	**Frequency of offering**	Every sem☒ 1st sem☒ 2nd sem☒ Either sem☒
11	**Faculty who will teach the course**	
12	**Will the course require any visiting faculty?**	**No**

13 **Course objective:**

- To familiarize with the terminology associated with IC engines.
- To understand the basics of IC engines.
- To understand combustion and various variables affecting it in various types of IC engines.
- To learn about various devices used in IC engines and the type of IC engine required for various applications.

Course Outcome:

- At the end of this course, the students will be able to understand the working of an I. C. Engines (i.e. S. I. and C. I. engine) and their applications.
- To understand the combustion process in I. C engines and different type's fuels, their stoichiometric compositions.
- To understand and identify various systems (ignition, injection, and cooling and lubrication system) of an I.C. Engine.

	• To understand and analyze the performance characteristics of an I. C engine and their emissions from of I. C. engines.

14	**Course contents** **Unit 1** **Introduction of internal combustion engines**: Engine classification, Air standard cycles, Otto cycle, Diesel cycle, Dual cycle, Comparison of Otto, Diesel, and Dual cycles. Stirling cycle, Ericsson cycles, Two and four-stroke engines, SI and CI engines, Valve timing diagram, Fuel air cycle, factors affecting it, Actual cycle analysis, Actual Cycle. **Unit 2** **SI Engines -** Combustion in SI engine, Flame speed, Ignition delay, Abnormal combustion and it's control, Combustion chamber design for SI engines, Carburetion, Mixture requirements, Carburetor types, Theory of carburetor, MPFI, Ignition system requirements, Magneto and battery ignition systems, Ignition timing and sparkplug, Electronic ignition, Scavenging in 2 Stroke engines, Supercharging and its effect. **Unit 3** **CI Engine - Combustion** in CI engines, Ignition delay, Knock and it's control, Combustion chamber design of CI engines. **Fuel injection** in CI engines, Requirements, Types of injection systems, Fuel pumps, Fuel injectors, Injection timings. **Unit 4** **Engine Cooling -** Different cooling systems, Radiators, and cooling fans. **Lubrication -** Engine friction, Lubrication principle, Type of lubrication, Lubrication oils, Crankcase ventilation, **Fuels -**Fuels for SI and CI engine, Important qualities of SI and CI engine fuels, Rating of SI engine and CI engine fuels, Dopes, Additives, Gaseous fuels, LPG, CNG, Biogas, Producer gas, Alternative fuels for IC engines. **Unit 5** **Testing and Performance -** Performance parameters, Basic measurements, Blow by measurement, Testing of SI, and CI engines. **Emission and Pollution:** S. I. Engine and C. I. Engine emissions and its control and comparison. Effect of pollution on Human health and biosphere.

15. Lecture Outline*(with topics and number oflectures)*

Module no.	Topic	No. of hours
1	**Introduction to I.C Engines** - Engine classification, Air standard	09

	cycles, Otto cycle, Diesel cycle, Dual cycle, Comparison of Otto, Diesel and Dual cycles, Stirling cycle, Ericsson cycles, Actual cycle analysis, Two and four-stroke engines, SI and CI engines, Valve timing diagram, Fuel air cycle factors affecting it, Actual Cycle	
2	**SI Engines** - Combustion in SI engine, Flame speed, Ignition delay, Abnormal combustion and it's control, Combustion chamber design for SI engines, Carburetion, Mixture requirements, Carburetor types, Theory of carburetor, MPFI, Ignition system requirements, Magneto and battery ignition systems, Ignition timing and sparkplug, Electronic ignition, Scavenging in 2 Stroke engines, pollution and it's control, Supercharging and its effect.	12
3	**CI Engine - Combustion** in CI engines, Ignition delay, Knock and it's control, Combustion chamber design of CI engines, **Fuel injection** in CI engines, Requirements, Types of injection systems, Fuel pumps, Fuel injectors, Injection timings.	06
4	**Engine Cooling -** Different cooling systems, Radiators and cooling fans, **Lubrication -** Engine friction, Lubrication principle, Type of lubrication, Lubrication oils, Crankcase ventilation, **Fuels -** Fuels for SI and CI engine, Important qualities of SI and CI engine fuels, Rating of SI engine and CI engine fuels, Dopes, Additives, Gaseous fuels, LPG, CNG, Biogas, Producer gas, Alternative fuels for IC engines.	06
5	**Testing and Performance -** Performance parameters, Basic measurements, Blow by measurement, Testing of SI and CI engines, S. I. Engine and C. I. Engine emissions and its control, S. I. Engine and C. I. Engine emissions comparison, Effect of pollution on Human health, Effect of pollution on biosphere.	07
	COURSE TOTAL	**40**

16. Brief description of tutorial activities

17. Brief description of laboratoryactivities

Module no.	Experiment description	No. of hours
1	To study the cut models of I.C.Engine.	3
2	To study the actual valve timing diagram of 4-stroke petrol engine	3
3	To study the actual valve timing diagram of 4-stroke diesel engine.	3
4	To determine the calorific value of diesel by bomb calorimeter.	3
5	To prepare the heat balance sheet by conducting performance test on a single-cylinder 4-stroke diesel engine(with electrical brake dynamometer)	3
6	To determine the load test on a single-cylinder 4-stroke diesel	3

	engine(with rope brake dynamometer)	
7	To determine the morse test on a multi cylinder petrol engine.	3
COURSE TOTAL		21

18. Suggested texts and reference materials

Text Books:

1. Ganesan, I.C Engine, Tata McGraw Hill Publishers,4th edition, 2012 .
2. H.N. Gupta, Fundamentals of Internal Combustion Engines, Prentice Hall of India,PHI Learning Pvt. Ltd., 2nd edition, 2012.

Reference Books:

1. M.L. Mathur& R.P. Sharma, A Course in IC Engines, January 2014.
2. G.F.Taylor, Internal Combustion Engines, Theory, and Practice, Vol. 1 - 2nd Edition.
3. Stone & Richard, Introduction to IC Engine, 3rd Edition.
4. John B. Heywood, Internal combustion engine fundamentals,1 July 2017.

19. Resources required for the course *(itemized & student access requirements, if any)*

19.1	Software	
19.2	Hardware	
19.3	Teaching aids (videos, etc.)	Video Projector Required for Explanation
19.4	Laboratory	ICE Laboratory Required
19.5	Equipment	1. Single-cylinder two-stroke petrol engine test rig. 2. Single-cylinder four-stroke petrol engine test rig. 3. Four strokes four-cylinder petrol engine test rig with the morse test. 4. MPFI multicylinder four-stroke petrol engine test rig 5. A variable compression ratio of petrol/diesel engine test rig. 6. Single-cylinder four-stroke diesel engine test rig. 7. Single-cylinder four-stroke water-cooled slow-speed diesel engine test rig (Kirloskar) with mechanical brake (rope brake) loading. 8. Two cylinders four-stroke diesel engine test rig. 9. Three cylinders four-stroke petrol engine test rig with morse test.
19.6	Classroom infrastructure	
19.7	Site visits	

20. Designcontentofthecourse *(Percentofstudenttimewithexamples,ifpossible)*

20.1	Design-type problems	15% Numerical
20.2	Open-ended problems	
20.3	Project-type activity	
20.4	Open-ended laboratory work	
20.5	Others (please specify)	85 % Derivation and theory

COURSE TEMPLATE

1.	**Department/Centre proposing the course**	Mechanical Engineering
2.	**Course Title**	**Machine Design –I**
3.	**L-T-P structure**	4-0-0
4.	**Credits**	4
5.	**Course number**	ME05TPC09
6.	**Status** (*category* for *program*)	CORE

7.	**Pre-requisites** (course no./title)	Engg. Mechanics Mechanics of Solid-1
8.	**Status vis-à-vis other courses** *(give course number/title)*	
8.1	Overlap with any UG/PG course of the Dept./Centre	NA
8.2	Overlap with any UG/PG course of other Dept./Centre	NA
8.3	Supercedes any existing course	NO

9.	**Not allowed for** (indicate program names)	
10.	**Frequency of offering**	EveryOdd Sem
11.	**Will the course require any visiting faculty?**	NO
12.	**Courseobjective***(about50words)***:** Provide students with the ability to apply design procedure with specificdesign tools representing empirical, semi-empirical and analytical approaches. Usinganalytical and computer aided design with real world problems.The detailed design of mechanical systems considers realistic examples from the mechanical Laboratories/workshop. Design a mechanical power transmission system given the power tobe transmitted, speed ratio, orientation and center distance of the shafts. Failure analysis, factor of safety, types of loading, selection of appropriate materials,lubrication, design for manufacturing, fits and tolerance will also be covered for the use in allthe above case based designs.	
13.	**Course Outcome:** At the end of this course, the students will be able to 1. Apply the various stress based theories to design machine components 2. Select appropriate design data from Design data book. 3. Design basic machine elements like Keys, joints, coupling and shafts. 4. Design and select power transmission systems- belt and chain drives. 5. Design various types of joints-threaded, riveted and welded.	

	6. Design different types of power screws- lead screw, screw jack and power screw.
14.	**Course contents** *(about 100 words) (Include laboratory/design activities)***:** **UNIT – I General Considerations:** Selection of Materials, Design Stress, Factor of Safety, Stress concentration factor in tension, bending and torsion, Theories of failures. Notch sensitivity, Design for variable and repeated loadings, Fatigue stress concentration factor, Endurance diagrams, Introduction to fracture mechanics. **UNIT – II Basic Elements Design:** Types of keys and Splines, Design of Socket-Spigot, Cotter joint, Sleeve and Cotter joint, Gib and Cotter joint, Design of Knuckle joint, Design of Splines. **Couplings:** Types of couplings, Design of flange and flexible couplings, Compression coupling, Muff coupling. **Shaft and Axles:** Transmission shaft, Design against static load, Design for strength, Rigidity and stiffness, Design under continuous loading for fatigue. **UNIT- III Threaded fasteners:** Geometry of thread forms, Terminology of screw threads and thread standards, Specifications of steel bolts, Initial tension, Relation between bolt tension and torque, Design of statically loaded tension joints, Design of bolted joints due to eccentric loading. **Power Screws:** Power screws, Force analysis for square and trapezoidal threads, Collar friction, Stresses in screw, Coefficient of friction, Efficiency of thread, Design of power Screw. **UNIT – IV** **Riveted Joints:** Types of rivet heads, Types of riveted joints, Failure of riveted joint, Strength of rivet joint, Efficiency of riveted joint, Design of riveted joint, eccentrically loaded riveted joint. **Welded joint:** Types of welded joints, Stresses in butt and fillet welds, Strength of welded joints, Location and dimension of weld design, Eccentrically loaded joint, Welded joint subjected to bending moment, Design procedure, Fillet welds under varying loads, Stress relieving techniques. **UNIT – V Pulley & Flywheel:** Flywheel Inertia, Stresses in Flywheel and pulleys, failure criterion. **Chain Drives:** Chain drives, Roller chains, Geometric relationships, Dimensions of chain components, Polygonal effect, Power rating of roller chains, Selection of Chain drives. **Belt & Rope Drive:** Design of Flat and Round belt drives, V-Belt, Timing belt, Wire Rope.

15. Lecture Outline *(with topics and number oflectures)*

Module no.	Topic	No. of hours
1	Selection of Materials, Design Stress, Factor of Safety, Stress concentration factor in tension, bending and torsion, Theories of failures.	3
2	Notch sensitivity, Design for variable and repeated loadings, Fatigue stress concentration factor, Endurance diagrams, Introduction to fracture mechanics.	5
3	Types of keys and Splines, Design of Socket-Spigot,	3
4	Cotter joint, Sleeve and Cotter joint, Gib and Cotter joint, Design of Knuckle joint, Design of Splines.	4
5	Couplings , Shaft and Axles	4
6	Threaded Fasteners	4
7	Power Screw	2

8	Riveted Joints	3
9	Welded Joints	5
10	Flywheel Inertia, Stresses in Flywheel and pulleys, failure criterion.	2
11	Chain Drive	4
12	Design of Flat and Round belt drives, V-Belt, Timing belt, Wire Rope.	3
COURSE TOTAL		42

16. Brief description of tutorialactivities

NA

17. Brief description of laboratoryactivities

Module no.	Experiment description	No. of hours

18. Suggested texts and reference materials

STYLE: Book Title, Author name and initials, Edition, Publisher

Text Books:

1. Machine Design by-J. E. Shigley -McGraw Hill Publications.
2. Design of Machine Elements from V. B. Bhandari, TMH Publications.

Reference Books:

3. Machine Design, Spott, TMH Publications.

4. Machine Design, Khurmi& Gupta, Khanna Publisher

19. Resourcesrequiredforthecourse*(itemized&studentaccessrequirements,ifany)*

19.1	Software	
19.2	Hardware	
19.3	Teaching aides (videos, etc.)	
19.4	Laboratory	
19.5	Equipment	
19.6	Classroom infrastructure	LCD , OHP projectors
19.7	Site visits	

20. Designcontentofthecourse*(Percentofstudenttimewithexamples,ifpossible)*

20.1	Design-type problems	
20.2	Open-ended problems	
20.3	Project-type activity	
20.4	Open-ended laboratory work	
20.5	Others (please specify)	

COURSE
TEMPLATE

1.	**Department/Centre proposing the course**	Mechanical Engineering
2.	**Course Title**	Mechanics of Solid-II
3.	**L-T-P structure**	3-1-0
4.	**Credits**	4
5.	**Course number**	ME05TPC10
6.	**Status** (*category* for *program*)	CORE

7.	**Pre-requisites** (course no./title)	Engg. Mechanics Mechanics of Solid-1
8.	**Status vis-à-vis other courses** *(give course number/title)*	
8.1	Overlap with any UG/PG course of the Dept./Centre	NA
8.2	Overlap with any UG/PG course of other Dept./Centre	NA
8.3	Supercedes any existing course	NO

9.	**Not allowed for** (indicate program names)	
10.	**Frequency of offering**	☐ Every sem ☐ 1st sem ☐ 2nd sem ☒ Either sem
11.	**Will the course require any visiting faculty?**	NO
12.	**Course objective** *(about 50 words)***:** Mechanical behaviour of the body by determining the stresses, strains and deflections produced by the different types of loads and couple. Fundamental concepts related to deformation, strain energy, moment of inertia, and load carrying capacity, slope and deflection of beams, shear forces, bending moments, torsional moments, column and struts, principal stresses and strains and theories of failure.	
13.	**Course Outcome:** At the end of this course, the students will be able to 1. Visualize and apply mathematics to obtain analytical solutions in solid mechanics. 2. Interpret the principle of superposition, energy methods of determining the reaction and their applications for solving statically indeterminate structures. 3. Apply the basic concepts of stress and strain in dealing problems related to	

	unsymmetrical bending, fixed beams, continuous beams, curved beams, thick and thin pressure vessels. 4. Discover principles of solid mechanics by solving engineering problems. 5. Develop appropriate models for practical situations to formulate solutions.
14.	**Course contents** *(about 100 words) (Include laboratory/design activities)***:** **UNIT - I Energy Methods**: Introduction, Principles of superposition, Strain energy, Reciprocal relations, Maxwell Betti theorem, Elastic strain energy in tension and compression, Strain energy in beams subjected to bending and shafts to torsion. Impact loading in tension and bending, first and second theorem of Castigliano and its applications. **UNIT - II Fixed Beams:** Fixed beam subjected to different types of loads and couples, Calculations of fixing moments and reactions at supports, deflection. Effect of sinking of support. **Continuous beams**: Continuous beams subjected to different type of loads and couples, beams with overhang, beams with one end fixed, Clapeyron's theorem. Effect of sinking of supports. **UNIT – III Bending of curved bars:** Stresses in bars of small initial curvature, Winkler-Bach theory, Stresses in bars of large initial curvature, Deflection of Crane hooks, Chain links, circular rings, stresses in circular rings. **UNIT – IV Unsymmetrical Bending:** Introduction to unsymmetrical bending, Stresses and deflection in unsymmetrical bending, Shear center for angle, Channel and I-sections. **Columns:** Struts and Columns, Stability of columns, Euler's formula for different end conditions,, Equivalent load, Eccentric loading, Rankine's formula. **UNIT – V Thin Pressure Vessel:** Thin Pressure Vessels, Circumferential and longitudinal stresses in thin cylindrical shells and thin spherical shell under internal pressure, **Thick Pressure Vessel:** Stresses in thick and compound cylinders.

15. Lecture Outline *(with topics and number of lectures)*

S. No.	Topic	No. of hours
1	Introduction, Principles of superposition, Strain energy	2
2	Reciprocal relations, Maxwell Betti theorem	2
3	Elastic strain energy in tension and compression	2
4	Strain energy in beams subjected to bending and shafts to torsion.	2
5	Impact loading in tension and bending, first and second theorem of Castigliano and its applications	2
6	Fixed Beams	4
7	Continuous Beams	4
8	Bending of Curved Beams	5
9	Unsymmetrical Bending	5
10	Columns	2
11	Thin Pressure Vessel	4
12	Thick Pressure Vessel	4
COURSE TOTAL		38

16. Brief description of tutorial activities

NA

17. Brief description of laboratory activities

Module no.	Experiment description	No. of hours

18. Suggested texts and reference materials

STYLE: Book Title, Author name and initials, Edition, Publisher

Text Books:

1. Mechanics of Material – J. M. Gere and S. P. Timoshenko – CBS publisher
2. 4. Strength of Material – Dr. Sadhu Singh – Khanna Publishers

Reference Books:

1. Advanced Mechanics of Materials–A. P. Boresi and O. M. Sidebottom–John Wiley & Sons
2. Strength of Materials – R. K. Rajput – S. Chand & Company
3. Mechanics of Material – F. P. Beer and E. E. Johnston – McGraw Hill
4. Strength of Material, Vol. I and II – S. P. Timoshenko – EWP Press
5. Strength of Materials – G.H. Rider – Macmillan

19. Resources required for the course *(itemized & student access requirements, if any)*

19.1	Software	
19.2	Hardware	
19.3	Teaching aides (videos, etc.)	
19.4	Laboratory	
19.5	Equipment	
19.6	Classroom infrastructure	LCD , OHP projectors
19.7	Site visits	

20. Design content of the course *(Percent of student time with examples, if possible)*

20.1	Design-type problems	10
20.2	Open-ended problems	10
20.3	Project-type activity	
20.4	Open-ended laboratory work	
20.5	Others (please specify)	

COURSE
TEMPLATE

1.	**Department/Centre proposing the course**	Mechanical Engg
2.	**Course Title**	Computer Aided Design & Manufacturing (CAD-CAM)
3.	**L-T-P structure**	3-0-0
4.	**Credits**	3
5.	**Course number**	ME06TPE23
6.	**Status** (*category* for *program*)	Professional Elective

7.	**Pre-requisites** (course no./title)	Engineering Graphics Machine Drawing
8.	**Status vis-à-vis other courses** *(give course number/title)*	
8.1	Overlap with any UG/PG course of the Dept./Centre	Nil
8.2	Overlap with any UG/PG course of other Dept./Centre	Nil
8.3	Supercedes any existing course	No

9.	**Not allowed for** (indicate program names)	
10.	**Frequency of offering**	Every even semesters
11.	**Will the course require any visiting faculty?**	No
12.	**Course objective** *(about 50 words)***:** • To introduce the student to CAD terminology & its capabilities. • To become familiar with CAD software, Graphical user interface & basic tools. • To recognize geometric and graphical elements of engineering design problems • To apply a "hands-on" understanding of the basic concepts of computer-aided manufacturing and prototyping through group and individual projects.	
13.	**Course Outcome** Upon completing the course, the student will be able to: 1. Perceive the concepts of CAD/CAM as well as be able to model analytic and synthetic curves, surfaces and solid models. 2. Compile the NC system and various part programming techniques. 3. Demonstrate group technology and data base management system. 4. Acquire the concepts of design and synthesis of planer mechanisms using computer based applications.	
14.	**Course content** **Basics of CAD**: Basics fundamental of Computer Graphics, Principle of computer graphics, Product life cycle, Concept of Computer Aided Design (CAD) and architecture, Hardware and software, Color management, Raster graphics, Graphics standard, Graphic primitives,	

	lines, and Circle Drawing algorithms, Software documentations, CAD standards GKS, OpenGL, Data exchange standards- IGES, STEP, CALS etc, Communication standards. Standards for vexchange images. **Geometric Modeling of Curves, Surface and Solid**: Basics representation of curves, Parametric and nonparametric curves, Mathematical representation of curves, Hermite curves, Bezier curves, B-spline curves and rational curves. Basic of Surface, Techniques of surface modelling, Plane surface, Rule surface, Surface of revolution and sweep, Coons and bi-cubic patches, concept of Bezier and B-spline surfaces, Basic concept of solid modelling technique, CSG and B-rep method for solid generation. **Geometric Transformation**: Computer Aided Design (CAD) methodology, Coordinate systems, Theory and applications, 2D and 3D geometric transformation, Homogeneous transformation, Concatenation, Assembly modelling, interferences of positions and orientation, tolerance analysis, mass property calculations, Visual realism- hidden line-surface-solid removal algorithms, shading, coloring, computer animation, Concurrent Engineering. **Basics of CAM**: Basic concept of numerical control (NC) System, NC coordinate system, NC motion control, Application of NC, concepts of computer numeric control(CNC) system, problems with conventional, NC, CNC. **Part Programming**: Introduction to NC part programming, manual part programming, Computer assisted part programming, Automatically Programming Tool (APT) language, statements and code of APT, programming methods, advantages of CAD/CAM programming.

15. Lecture Outline *(with topics and number of lectures)*

S.No	Topic	No. of hours
1	**Basics of CAD**	7
2	Basics representation of curves, Parametric and nonparametric curves, Mathematical representation of curves, Hermite curves, Bezier curves, B-spline curves and rational curves.	6
3	Basic of Surface, Techniques of surface modelling, Plane surface, Rule surface, Surface of revolution and sweep, Coons and bi-cubic patches, concept of Bezier and B-spline surfaces	6
4	Basic concept of solid modelling technique, CSG and B-rep method for solid generation.	5
5	Computer Aided Design (CAD) methodology, Coordinate systems, Theory and applications, 2D and 3D geometric transformation, Homogeneous transformation, Concatenation,	5
6	Assembly modelling, interferences of positions and orientation, tolerance analysis, mass property calculations, Visual realism- hidden line-surface-solid removal algorithms, shading, coloring, computer animation, Concurrent Engineering.	6
7	Basics of CAM	5
8	Part Programming	5
COURSE TOTAL		45

16. Brief description of tutorial activities

NA

17. Brief description of laboratory activities

Module no.	Experiment description	No. of hours

19. Suggested texts and reference materials

STYLE: Book Title, Author name and initials, Edition, Publisher

Text Book:

1. CAD/CAM Theory and Practice-Ibrahim Zeid-Tata McGraw Hill Publications.

2. CAD/CAM-Milkell P. Groover, Emory W. Zimmer-Pearson Education.

Reference book:

20. **Resources required for the course** *(itemized & student access requirements, if any)*

18.1	Software	Modeling software CATIA/Pro-E etc
18.2	Hardware	Desktops or personal laptops
18.3	Teaching aides (videos, etc.)	Videos, images and animations
18.4	Laboratory	CAD Lab
18.5	Equipment	
18.6	Classroom infrastructure	
18.7	Site visits	

21. **Design content of the course** *(Percent of student time with examples, if possible)*

20.1	Design-type problems	
20.2	Open-ended problems	
20.3	Project-type activity	Modeling in any professional software:30
20.4	Open-ended laboratory work	
20.5	Others (please specify)	Theory-70

SCHOOL OF ENGINEERING & TECHNOLOGY
GURU GHASIDAS VISHWAVIDHALAYA(A CENTRAL UNIVERSITY)
DEPARTMENT OF MECHANICAL ENGINEERING
CBCS-NEW, STUDY & EVALUATION SCHEME
W.E.F. SESSION 2020-2021

Year: B.Tech. 3rd year

SEMESTER- VI

SN	Course No.	SUBJECT	PERIODS			EVALUATION SCHEME			CREDITS
			L	T	P	INTERNAL ASSESSMENT	ESE	SUB-TOTAL	
1.	ME06TPC11	Heat and Mass Transfer	3	1	-	30	70	100	4
2.	ME06TPC12	Manufacturing Science-II	3	0	-	30	70	100	3
3.	ME06TPE03	Professional Elective-03	3	0	-	30	70	100	3
4.	ME06TOE01	Open Elective-01	3	0	-	30	70	100	3
5.	ME06TOE02	Open Elective-02	3	1	-	30	70	100	4
6.	ME06TMC03	Essence of Traditional Knowledge	3	0	-	-	-	-	-
		Total	**18**	**2**	**-**	**150**	**350**	**500**	**17**
PRACTICALS									
1.	ME06PPC07	Heat and Mass Transfer Lab	-	-	3	30	20	50	1.5
2.	ME06PSC01	Seminar	-	-	2	50	-	50	1
3	ME06PPC08	Manufacturing Science Lab	-	-	3	30	20	50	1.5
Total			**0**	**0**	**6**	**110**	**40**	**150**	**4**

Total Credits: 21
Total Contact Hour: 26
Total Marks: 650
*INTERNAL ASSESSMENT- Two Class Test of 15 Marks each will be conducted.
L-LECTURE,T-TUTORIAL,P-PRACTICAL, ESE –END SEMESTER EXAMINATION

ME06TPE03 Professional Elective-03	**ME06TOE01 Open Elective-01**
ME06TPE31 Measurement Metrology and Control	ME06TOE11 Enterprise Resource Planning
ME06TPE32 Industrial Automation	ME06TOE12 Decision Support and Executive Information System
ME06TPE33 Advanced Manufacturing System	**ME06TOE13 Operations Research**
ME06TOE02 Open Elective-02	
ME06TOE21 Machine Design-II	
ME06TOE22 Mechatronics	
ME06TOE23Robotics and Robot Applications	

Course Template

1.	**Department/Center proposing the course**	Mechanical Engineering
2.	**Course title**	**Heat & Mass Transfer**
3.	**L-T-P Structure**	3-1-0
4.	**Credits**	4
5.	**Course number**	ME06TPC11
6.	**Status (Category for program)**	Program Core

7.	**Pre-requisites**	Engineering Thermodynamics, Fluid Mechanics, Basics of Electrical Circuits (Ohm's Law)

7.1.	Overlap with any UG/PG course of the Dept./Centre	No
7.2.	Overlap with any UG/PG course of other Dept./Centre	Yes, Industrial & Production Engineering (IP6TPE53), Chemical Engineering (**CHPG1101,** **CH5TPC06**)
7.3.	Super cedes any existing course	No

8.	Not allowed for **(indicate program names)**	

9.	Frequency of offering	Odd Semester	
10.	**Faculty who can teach the course**	Fluid-Thermal Group	

11.	**Will the course require any visiting faculty**	No

12.	**Course objectives** *(about 50 words):* • To introduce students to fundamentals of heat and mass transfer processes with adequate application examples

13.	**Course outcomes** *(about 50 words):* • Graduates shall be able to apply, analyze and solve elementary problems of engineering interest involving heat transfer mechanisms

14.	**Course contents***(about 100 words) (include laboratory/design activities)*: • **Module-1**: Introduction to modes and mechanisms of heat transfer, Fourier's law, Electrical analogy, Overall heat transfer coefficient, Conduction heat transfer in rectangular, cylindrical and spherical solids, 1-D steady state heat transfer with & without heat generation, critical radius of insulation, Unified view of momentum, heat and mass transfer • **Module-2:** 1-D steady state heat conduction in Extended surfaces, Lumped Capacitance and 1-D transient models, Semi-infinite wall, Error in Temperature measurement, Diffusion mass transfer in 1-D steady state • **Module-3:** Convection: Forced and free convection - mass, momentum and energy conservation equations, scaling analysis and significance of non-dimensional numbers, velocity & thermal boundary layers, heat transfer in external and internal laminar and turbulent flows, and use of correlations, • **Module-**4: Convective mass transfer; Boiling and Condensation: physical phenomena and correlations; Heat Exchanger types and analysis: LMTD and Effectiveness-NTU method • **Module-**5: Radiation heat transfer: Properties, laws, configuration factors, radiation shields, three-surface network of diffuse gray surfaces

15. **Lecture outline***(with topics and number of lectures)*

Module No.	Topics	No. of hours
1	General Introduction: One dimensional	10
	Heat conduction; Introduction to mass transfer	
2	Introduction to extended surfaces	7
	1-D transient heat conduction analysis	
3	Velocity and thermal boundary layer concepts	12
	Forced and Free convection, correlations	

4	Boiling and condensation, convective mass transfer	7
	Heat exchangers	
5	Radiation heat transfer	9
COURSE TOTAL		45

16. Brief description of tutorial activities

The tutorial problems are associated with individual units.

17. Brief description of laboratory activities

Module No.	**Experiment description**	**No. of hours**
	Heat conduction apparatus: plane slab	03
	Conduction in cylindrical pipe	03
	Critical radius of insulation	03
	Pin fin apparatus	03
	Forced convection	03
	Free convection	03
	Unsteady state heat transfer	03
	Stefan Boltzmann apparatus	03
	Emissivity of test plate	03

18. Suggested texts and reference materials

Text Books:

1. Heat Transfer, Cengel, McGraw Hill
2. Heat & Mass Transfer, DS Kumar, Katsons

Reference Books:

1. Heat Transfer, JP Holman, McGraw Hill
2. Heat Transfer, SP Sukhatme, Tata McGraw Hill
3. Heat & Mass Transfer, SC Sachadeva, EEE

19. Resources required for the course (*itemized and student access requirements, if any*)

19.1.	Software	**MATLAB, SCILAB**
19.2.	Hardware	**Nil**
19.3.	Teaching aides (videos,etc)	**Videos**
19.4.	Laboratory	
19.5.	Equipment	
19.6.	Classroom infrastructure	**LCD**
19.7.	Site visits	

20. Design content of the course (*Percent of student time with examples, if possible*)

20.1.	Design-type problems	**10%**
20.2.	Open-ended problems	
20.3.	Project-type activity	**10%**
20.4.	Open-ended laboratory work	
20.5.	Others (please specify)	

COURSETEMPLATE

1.	**Department/Centreproposingthecourse**	Mechanical Engineering
2.	**CourseTitle**(<45characters)	**MANUFACTURING SCIENCE-II**
3.	**L-T-Pstructure**	3-0-0
4.	**Credits**	3
5.	**Coursenumber**	**ME6TPC12**
6.	**Status** (categoryforprogram)	CORE

7.	**Prerequisites**(course no./title)	Knowledge of Workshop and Machine Operations
8.	**Statusvis-à-visothercourses**(givecoursenumber/title)	
8.1	Overlap with anyUG/PGcourseof theDept./Centre	No
8.2	Overlap with anyUG/PGcourseof other Dept./Centre	No
8.3	Supercedesany existingcourse	No

10.	**Frequencyofoffering**	☐ Every sem ☐ 1st sem ☐ 2nd sem ☐ 6th sem
11.	**FacultywhowillteachthecourseMr. Manish Bhaskar**	
12.	**Willthecourserequireanyvisitingfaculty ?**	No
13.	**Courseobjective**(about50words)**:**	

1. To understand grinding and other surface finishing operations.
2. To understand the design considerations of Jigs and Fixtures.
3. To understand various non-conventional machining processes and their applications.
4. To understand the process of Gear Shaping and Gear Hobbing.

14. **Coursecontents**(about100words)(Includelaboratory/designactivities)**:**

Unit-I

General purpose machine tools: Constructional details of lathe, drilling, milling, shaping, planning machines. Tooling, attachment and operation performed, selection of cutting parameters, calculation of forces and time for machining. Broaching operation. Capston and turret lathes, single and multiple spindle automates, operation planning and tool layout.

Jigs and Fixtures; Degree of freedom, principles of location and clamping, locating,clamping and indexing devices, principles of design, design of simple jigs and fixtures.

Unit-II

Mechanics of metal cutting: Classification of metal removal process and machines, geometry of single point cutting tool and tool angles. Tool nomenclature in ASA, ORS& NRS and interrelationship. Mechanism of chip formation and types of chips, chip brakers. Orthogonal and oblique cutting. Cutting forces and power required, theories of metal cutting, thermal aspects of machining and measurement of chip tool interface temperature. Friction in metal cutting.

Unit-III

Machinability: Concept & evaluation of Machinability, tool life and mechanisms of toolfailure, cutting parameter, Machinability index, factors effecting Machinability. Cutting Fluids-Types, selection and application methods. Cutting tool material-Requirement of tool material, classification of tool material and their properties.

Unit-IV

Grinding Processes & Gear Cutting: Abrasives: natural and synthetic, Manufacturingnomenclature, Selection of grinding wheels, wheel mounting and dressing ,surface and cylindrical grinding, their constructional detail and processes. Principle of gear generation, gear cutting by milling machines, gear shaping and gear hobbing machines processes.

Unit-V

Non-Conventional Machining: Mechanism of material removal, tooling and equipment, process parameter, surface finishing obtained by EDM, LBM, EBM, ECM, USM, AJM processes, benefits, generation application and survey of non-conventional machining process.

15.LectureOutline (withtopicsandnumberoflectures)

Moduleno.	Topic	No.ofhours
1	**General purpose machine tools -** Constructional details of lathe	1
	Drilling, milling, shaping, planning machines.	1
	Comparison of Otto, Diesel and Dual cycles	1
	Tooling, attachment and operation performed, selection of cutting parameters	2
	calculation of forces and time for machining	1
	Broaching operation. Capston and turret lathes, single and multiple spindle automates	1
	Operation planning and tool layout.	1
	Jigs and Fixtures: Degree of freedom, principles of location and clamping	1
	locating, clamping and indexing devices, principles of design	2
	design of simple jigs and fixtures	1
2	**Mechanics of metal cutting:** Classification of metal removal process and machines	1
	geometry of single point cutting tool and tool angles	1
	Tool nomenclature in ASA, ORS & NRS and interrelationship	1
	Mechanism of chip formation and types of chips, chip brakers	1
	Orthogonal and oblique cutting. Cutting forces and power required	1
	theories of metal cutting and measurement of chip tool interface temperature	1
3	**Machinability:** Concept & evaluation of Machinability	1
	tool life and mechanisms of tool failure, cutting parameter	2
	Machinability index, factors effecting Machinability	1
	Cutting Fluids-Types, selection and application methods	2
	Cutting tool material-Requirement of tool material	1
	classification of tool material and their properties	2
4	**Grinding Processes & Gear Cutting:** Abrasives: natural and synthetic	1

	Manufacturing nomenclature, Selection of grinding wheels	1
	wheel mounting and dressing	1
	surface and cylindrical grinding, their constructional detail and processes	1
	Principle of gear generation	2
	gear cutting by milling machines, gear shaping	1
	gear hobbing machines processes	2
5	**Non-Conventional Machining:** Mechanism of material removal, tooling and equipment	2
	Basic measurements, Blow by measurement	1
	process parameter, surface finishing obtained by EDM processes	1
	LBM, EBM processes	1
	ECM, USM, AJM processes	2
	Benefits, generation application and survey of non-conventional machining process.	1
	COUSE TOTAL	45

16. Briefdescriptionoftutorialactivities

- Visiting of Workshop to Explain Cutting and Tooling of Machines

17. Briefdescriptionoflaboratoryactivities

- Not Applicable

18. Suggestedtextsandreferencematerials

1. Manufacturing technology (Vol.-I & II) by P.N. Rao Tata McGraw Hill Publishers.
2. Manufacturing Engg. And technology by S. Kalpakjian& S.R. Schmid, Addision Wesley Longman, New Delhi
3. Manufacturing science By A. Ghosh& A.K. Mallik East West Press Pvt. Ltd New Delhi
4. Manufacturing Process by O P Khanna Dhanpat Rai Publication
5. A Textbook of Production Engineering by Dr P C Sharma S Chand Publications
6. Metal Working Technology Narayanaswamy. R, , PHI

19. Resourcesrequiredforthecourse(itemized&studentaccessrequirements,ifany)

19.1	Software	NA
19.2	Hardware	Machines and tools for Demonstration
19.3	Teaching aides (videos, etc.)	Video Projector Required for Explanation
19.4	Laboratory	Workshop

19.5	Equipment	• Lathe Machine • Drilling Machines • Milling, Shaping Planning Machines • Tools, Cooling oils • Grinding Wheels • Work piece
19.6	Classroominfrastructure	Regular Classroom
19.7	Site visits	Any Manufacturing workshops

20. Designcontentofthecourse (Percentofstudenttimewithexamples,ifpossible)

20.1	Design-type problems	15% Numerical
20.2	Open-ended problems	10% Current Technology used
20.3	Project-type activity	15% Preparing and Hands on Practice on Machines
20.4	Open-ended laboratorywork	
20.5	Others (pleasespecify)	60 % theory and Principle of Operations

COURSE TEMPLATE

1.	**Department/Centreproposingtheco urse**	Mechanical Engineering
2.	**CourseTitle**(<45characters)	**MEASUREMENT, METROLOGY AND CONTROL**
3.	**L-T-Pstructure**	3-0-0
4.	**Credits**	3
5.	**Coursenumber**	**ME6TPE31**
6.	**Status** (categoryforprogram)	Theory (Professional Elective)

7.	**Prerequisites**(courseno./titl e)	Knowledge of Measuring instruments and Scale
8.	**Statusvis-à-visothercourses**(givecoursenumber/title)	
8.	Overlap with anyUG/PGcourseof theDept./Centre	No
8.	Overlap with anyUG/PGcourseof other Dept./Centre	No
8.	Supercedesany existingcourse	No

10.	**Frequencyofoffering**	☐ Every sem ☐ 1st sem ☐ 2nd sem ☐ 6th sem
11.	**FacultywhowillteachthecourseMr. Manish Bhaskar**	
12.	**Willthecourserequireanyvisitingfaculty?**	No
13.	**Courseobjective**(about50words)**:** 5. To understand the concepts in measurement and metrology. 6. To be familiar with different sensors and transducers. 7. To build suitable measurement technique. 8. To have the confidence to apply automation solutions for given industrial applications. 9. To demonstrate the ability to design and conduct experiments, interpret and analyze data, and report results. 10. To familiarize with various standards and calibration methods used in industry.	

14. **Coursecontents**(about100words)(Includelaboratory/designactivities)**:**

UNIT-I

Introduction to Measurement and Measuring Instruments: Generalized Measuring Systems and Functional Element, Static & Dynamic Performance Characteristic of Measurement Devices, Calibration, Concept of Error, Sources of Error, and Analysis of Error. Transducers: Types of Transducers and Their Characteristics, Measurement of Strain, Strain Gauges and Their Working, Gauge Factor, Strain Gauge Circuits, Strain Rosettes.

UNIT-II

Measurement of Pressure: Pressure Measuring Transducers, Elastic Diaphragms, Measurement of Vacuum and Low Pressure, Various Low Pressure Gauges. Measurement of Fluid Flow: Various Methods of Flow Measurement and Devices Temperature Measurement: Bi-Metallic Thermometers, Thermocouples, Thermistors and Pyrometers.

UNIT-III

Metrology : Standards of Linear Measurement ,Line and End Standards System of Limit and Fits, Limit Gauges and Their Design, Measurement of Geometric Forms Like Straightness, Flatness, Roundness and Circularity ,Measurement of Surface Textures, Quantitative Evaluation of Surface Roughness and Its Measurement, Introduction of CMM, Its Working and Application.

UNIT-IV

Interferometry: Principle and Uses of Interferometry, Types of Interferometers Comparators: Classification, Working Principle and Magnification Range of Mechanical, Electrical, Optical, Electronic, Pneumatic Comparators, Measurement of Screw Threads & Gears, Two Wire and Three Wire Method

UNIT-V

Fundamentals of Control System: Control system concepts, classification of control systems, mathematical representation of system equations, hydraulic, pneumatic, thermal and mechanical system and their mathematical modelling, response characteristics of components and systems through classical solution.

15.LectureOutline (withtopicsandnumberoflectures)

Moduleno.	Topic	No.ofhours
1	**Introduction to Measurement and Measuring Instruments:** Generalized Measuring Systems and Functional Element	2
	Static & Dynamic Performance Characteristic of Measurement Devices	1
	Calibration, Concept of Error, Sources of Error, Analysis of Error	2
	Transducers: Types of Transducers and Their Characteristics	1
	Measurement of Strain, Strain Gauges and Their Working	1
	Gauge Factor, Strain Gauge Circuits, Strain Rosettes	2
2	**Measurement of Pressure:** Pressure Measuring Transducers, Elastic Diaphragms	1
	geometry of single point cutting tool and tool angles	1
	Measurement of Vacuum and Low Pressure, Various Low Pressure Gauges	2
	Measurement of Fluid Flow	1
	Various Methods of Flow Measurement and Devices	2
	Temperature Measurement: Bi-Metallic Thermometers, Thermocouples	1
	Thermistors and Pyrometers	
3	**Metrology :**Standards of Linear Measurement ,Line and End Standards	2
	System of Limit and Fits	1
	Limit Gauges and Their Design	1
	Measurement of Geometric Forms Like Straightness, Flatness, Roundness and Circularity	2
	Measurement of Surface Textures	1
	Quantitative Evaluation of Surface Roughness and Its Measurement	1
	Introduction of CMM, Its Working and Application.	1
4	**Interferometry:**Principle and Uses of Interferometry	1
	Types of Interferometers Comparators	1
	Classification, Working Principle and Magnification Range of Mechanical, Electrical Comparators	2
	Optical, Electronic, Pneumatic Comparators	2

	Measurement of Screw Threads & Gears	2
	Two Wire and Three Wire Method	1
5	**Fundamentals of Control System:**Control system concepts, classification of control systems	1
	mathematical representation of system equations	1
	hydraulic, pneumatic, thermal and mechanical system and their mathematical modelling	2
	Response characteristics of components and systems through classical solution.	2
	COUSE TOTAL	**41**

16. Briefdescriptionoftutorialactivities

- By Showing Measuring Instruments and there calibration process

17. Briefdescriptionoflaboratoryactivities

- Not Applicable

18. Suggestedtextsandreferencematerials

7. Mechanical Measurementby Beckwith &BuchPearson Education.
8. Automatic Control Engineeringby H Raven McGraw Hill.
9. Instrumentation Measurement & Analysis by Nakra&ChoudharyTMH Education. Ltd New Delhi
10. A Textbook of Measurement and Metrology by A K Sawhney& M MahajanDhanpatRai Publication
11. Metrology and Measurement, AnandBewoor&Vinay Kulkarni McGraw-Hill
12. Mechanical Measurement & Control by D.S. KumarKhanna Publisher

19. Resourcesrequiredforthecourse(itemized&studentaccessrequirements,ifany)

19.1	Software		NA
19.2	Hardware		Measuring Instruments
19.3	Teaching aides (videos,		Video Projector Required for Explanation
19.4	Laboratory		Workshop
19.5	Equipment		• Transducers • Gauges • Thermocouples • Digital Recorders • Comparators
19.6	Classroominfrastructure		Regular Classroom
19.7	Site visits		Any Quality Check Centre

20. Designcontentofthecourse (Percentofstudenttimewithexamples,ifpossible)

20.1	Design-type problems	15% Numerical
20.2	Open-ended problems	10% Current Technology used
20.3	Project-type activity	15% Hands on Measurement Practice through instruments
20.4	Open-ended laboratorywork	-
20.5	Others (pleasespecify)	60 % theory and Principle of Operations

COURSE TEMPLATE

1.	**Department/Centre proposing the course**	Mechanical Engineering
2.	**Course Title**	Operations Research
3.	**L-T-P structure**	3-0-0
4.	**Credits**	3
5.	**Course number**	ME06TOE13
6.	**Status** (*category* for *program*)	Open Elective

7.	**Pre-requisites** (course no./title)	
8.	**Status vis-à-vis other courses** *(give course number/title)*	
8.1	Overlap with any UG/PG course of the Dept./Centre	NA
8.2	Overlap with any UG/PG course of other Dept./Centre	NA
8.3	Supercedes any existing course	NO

9.	**Not allowed for** (indicate program names)	☐ ☐ ☐
10.	**Frequency of offering**	Every sem 1st sem 2nd sem ☒Either sem
11.	**Will the course require any visiting faculty?**	NO
12.	**Course objective** *(about 50 words)*: Knowledge and understanding - Be able to understand the characteristics of different types of decision-making environments and the appropriate decision making approaches and tools to be used in each type. Cognitive skills (thinking and analysis) - Be able to build and solve Transportation Models and Assignment Models. Communication skills (personal and academic). - Be able to design new simple models, like: CPM, MSPT to improve decision – making and develop critical thinking and objective analysis of decision problems. Practical and subject specific skills (Transferable Skills). - Be able to implement practical cases, by using TORA, WinQSB.	
13.	**Course Outcome** At the end of this course, the students will be able to	

	1. Visualize and apply mathematics to obtain analytical solutions in solid mechanics. 2. Interpret the principle of superposition, energy methods of determining the reaction and their applications for solving statically indeterminate structures. 3. Apply the basic concepts of stress and strain in dealing problems related to unsymmetrical bending, fixed beams, continuous beams, curved beams, thick and thin pressure vessels.. 4. Discover principles of solid mechanics by solving engineering problems. 5. Develop appropriate models for practical situations to formulate solutions.
14.	**Course contents** *(about 100 words) (Include laboratory/design activities)***:** **UNIT I** Introduction to linear programming: Graphically solution to linear programming problem, solving linear problem by simplex method, optimization problem, maximization & minimization function with or without constraints, sack surplus & artificial, variable method, degeneracy problem. **UNITII** Mathematical statement of the transportation problem: The transportation model, method for basic feasible solution, Degeneracy & unbalance problem, Mathematical statement of the assignment problem, solution of assignment problem, travelling sales-man problem. **UNIT III** Game theory: Rule of game, Method of solving game , graphically & Arithmetic , saddle point &without saddle point , dominance method, mixed strategies 2 X 2game , 2 X N game , M X 2 game , 3 X 3game (Method of matrix's, method of linear programming etc). Inventory: Introduction, classification, function, level, control techniques, models, and various costs associated, EOQ, optimum lot sizing. **UNITIV** Introduction of queuing theory: Elements of queuing system ,operating characteristics of a queuing system, Poisson arrivals & exponential service time , waiting time & idle time cost, single channel queuing theory. Replacement problems: Requirement policy, replacement of items, machinery various themes, group replacement policy, MAPI methods. **UNITV** Network analysis: Introduction of PERT & CPM, computation of PERT, Time estimation, measure of deviation &variation, probability of completing project, Arrow diagram &critical path method, Scheduling, cost analysis & crushing of network.

15. Lecture Outline *(with topics and number of lectures)*

S. No.	Topic	No. of hours
1	Linear Programming, Graphical solution	3
2	Simplex method, Optimization Problem	4
3	Transportation problem	5
4	Assignment problem	4
5	Game theory: Rule of game, Method of solving game , graphically &	3

	Arithmetic , saddle point &without saddle point	
6	dominance method, Inventory: Introduction, classification, function, level, control techniques, models, and various costs associated, EOQ, optimum lot sizing	5
7	Queuing Theory	5
8	Replacement Problems	4
9	Network Analysis: PERT	4
10	CPM, Scheduling, cost analysis & crushing of network	4
COURSE TOTAL		42

16. Brief description of tutorial activities

NA

17. Brief description of laboratory activities

Module no.	Experiment description	No. of hours

18. Suggested texts and reference materials

STYLE: Book Title, Author name and initials, Edition, Publisher

Text Book: 1. Operation Research– Hira& Gupta – S. Chand & Co.

2. Sharma & S D Kedarnath - Operation Reasearch, Ramnath& Co Meerut

Reference Book: 1. Operation Research, SasienYaspan

2. Operation Research – N. D. Vohra – TMH Publication

3. Operation Research – H. Gillette – TMH, New Delhi

19. Resources required for the course *(itemized & student access requirements, if any)*

19.1	Software	
19.2	Hardware	
19.3	Teaching aides (videos, etc.)	
19.4	Laboratory	
19.5	Equipment	
19.6	Classroom infrastructure	LCD , OHP projectors
19.7	Site visits	

20. Design content of the course *(Percent of student time with examples, if possible)*

20.1	Design-type problems	10
20.2	Open-ended problems	10
20.3	Project-type activity	
20.4	Open-ended laboratory work	
20.5	Others (please specify)	

COURSE TEMPLATE

1.	**Department/Centre proposing the course**	Mechanical Engineering
2.	**Course Title**	**Machine Design- II**
3.	**L-T-P structure**	4-0-0
4.	**Credits**	4
5.	**Course number**	ME06TOE21
6.	**Status**(*category* for *program*)	OPEN ELECTIVE

7.	**Pre-requisites** (course no./title)	Machine Design -I Mechanics Of Solids-I Engineering Mechanics
8.	**Status vis-à-vis other courses** *(give course number/title)*	
8.1	Overlap with any UG/PG course of the Dept./Centre	Nil
8.2	Overlap with any UG/PG course of other Dept./Centre	Nil
8.3	Supercedes any existing course	No

9.	**Not allowed for** (indicate program names)	
10.	**Frequency of offering**	Every even semesters
11.	**Will the course require any visiting faculty?**	No
12.	**CourseObjective***(about50words)***:** To apply the concepts of stress analysis, theories of failure and material science toanalyse, design and/or select commonly used machine components. To illustrate to students the variety of mechanical components available and emphasizethe need to continue learning. To teach students how to apply mechanical engineering design theory to identify and quantify machine elements in the design of commonly usedmechanical systems.	
13.	**Course Outcomes:** At the end of this course, students will be able to Design springs under static and fluctuating loading conditions Design brakes and clutches Perform design and selection of transmission elements Design and suggest selection of bearings.	
14.	**Course content** **UNIT-I:** **Springs**: Spring Materials and Their Mechanical Properties, Equation for Stress AndDeflection, Helical Coil Springs of Circular Section for Tension, Compression and Torsion, Dynamic Loading, Fatigue Loading, Wahl Line, Leaf Spring and Laminated Spring. **UNIT-II:**	

	Gears : Spur Gears ,Gear Drives, Classification of Gears, Selection of Type of Gears,Lawof Gearing, Force Analysis, Gear Tooth Failures, Selection of Material, Number of Teeth, Face Width, Beam Strength of Gear Tooth, Effective Load on Gear Tooth,Estimation of Module Based on Wear Strength, Lewis equation, Gear Design for Maximum Power Transmitting Capacity, Gear Lubrication.Design of gear trains. **UNIT-III:** **Helical Gears**, Terminology of Helical Gears, Virtual Number of Teeth,Tooth Proportions, Force Analysis, Beam Strength of Helical Gears, Effective Load on Gear Tooth, Wear Strength of Helical Gears. **Bevel Gears**, Terminology of Bevel Gears, Force Analysis, Beam strength of Bevel Gears, Wear Strength of Bevel Gears, Effective Load on Gear Tooth. **UNIT-IV:** **Rolling Contact Bearings**, Types of Ball and Roller Bearings, Selection ofBearing for Radial and Axial Load, Bearing Life, Mounting and Lubrication, ShaftScales – Contact Type and Clearance Type. **Journal Bearings:** Types of Lubrication, Viscosity, Hydrodynamic Theory of Lubrication,Sommerfield Number, Heat Balance, Self-contained Bearings, Bearing Materials. **UNIT V:** **Clutches and Brakes**: Friction Clutches, Friction Materials, Torque TransmittingCapacity,Single& Multiple Plate Clutch, Centrifugal Clutches. Band and Block Brakes. **Belt Drive**:Flat and V-belts, Belt Constructions, Geometrical Relationships for Length oftheBelt,Analysis of Belt Tensions, Condition for Maximum Power, Selection of Flat & V-Belts,Adjustment of Belt Tensions.Pulleys for Flat & V-Belts, Wire rope and stress in wire ropes. **Chain Drives**:Chain drives, roller chains, geometric relationships, dimensions ofchaincomponents polygonal effect, power rating of roller chains, sprocket wheels.

15. Lecture Outline *(with topics and number oflectures)*

S.No	Topic	No. of hours
1	Springs: Spring Materials and Their Mechanical Properties, Equation for Stress and Deflection.	1
2	Helical Coil Springs of Circular Section for Tension, Compression and Torsion, Dynamic Loading, Fatigue Loading, Wahl Line, Leaf Spring and Laminated Spring.	4
3	Spur Gears ,Gear Drives, Classification of Gears, Selection of Type of Gears.	2
4	Lawof Gearing, Force Analysis, Gear Tooth Failures, Selection of Material, Number of Teeth, Face Width, Beam Strength of Gear Tooth, Effective Load on Gear Tooth,Estimation of Module Based on Wear Strength, Lewis equation, Gear Design for Maximum Power Transmitting Capacity, Gear Lubrication.Design of gear trains.	4
5	Helical Gears, Terminology of Helical Gears, Virtual Number of Teeth,Tooth	4

	Proportions, Force Analysis, Beam Strength of Helical Gears, Effective Load on Gear Tooth, Wear Strength of Helical Gears	
6	Bevel Gears, Terminology of Bevel Gears, Force Analysis, Beam strength of Bevel Gears, Wear Strength of Bevel Gears, Effective Load on Gear Tooth	3
7	Rolling Contact Bearings, Types of Ball and Roller Bearings, Selection ofBearing for Radial and Axial Load, Bearing Life, Mounting and Lubrication, ShaftScales – Contact Type and Clearance Type.	5
8	Journal Bearings: Types of Lubrication, Viscosity, Hydrodynamic Theory of Lubrication,Sommerfield Number, Heat Balance, Self-contained Bearings, Bearing	4
9	Clutches and Brakes: Friction Clutches, Friction Materials, Torque TransmittingCapacity,Single& Multiple Plate Clutch, Centrifugal Clutches. Band and Block Brakes.	5
10	Belt Drive:Flat and V-belts, Belt Constructions, Geometrical relationships for length ofthe Belt,Analysis of Belt Tensions, Condition for Maximum Power, Selection of Flat & V-Belts,Adjustment of Belt Tensions.Pulleys for Flat & V-Belts, Wire rope and stress in wire ropes	5
11	Chain Drives:Chain drives, roller chains, geometric relationships, dimensions ofchaincomponents polygonal effect, power rating of roller chains, sprocket wheels.	5
COURSE TOTAL		42

16. Brief description of tutorialactivities

NA

17. Brief description of laboratoryactivities

Module no.	Experiment description	No. of hours
NA	NA	NA

18. Suggested texts and reference materials

STYLE: Book Title, Author name and initials, Edition, Publisher

Text Books:

1. Design of Machine Elements, V.B. Bhandari, TMH Publications.

2. Machine Design, Shigley,McGraw Hill Pub.

Reference Books:

1. Principles of Mechanical Design, R. Phelan, McGraw Hill Pub.

19. Resourcesrequiredforthecourse*(itemized&studentaccessrequirements,ifany)*

19.1	Software	
19.2	Hardware	

19.3	Teaching aides (videos, etc.)	Videos, images and animations
19.4	Laboratory	
19.5	Equipment	
19.6	Classroom infrastructure	
19.7	Site visits	

20. Designcontentofthecourse*(Percentofstudenttimewithexamples,ifpossible)*

20.1	Design-type problems	
20.2	Open-ended problems	
20.3	Project-type activity	
20.4	Open-ended laboratory work	
20.5	Others (please specify)	

Date: (Signature of the Head of the Department)

SCHOOL OF STUDIES OF ENGINEERING & TECHNOLOGY
GURU GHASIDAS VISHWAVIDHALAYA, (A CENTRAL UNIVERSITY)
DEPARTMENT OF MECHANICAL ENGINEERING
CBCS-NEW, STUDY & EVALUATION SCHEME
W.E.F. SESSION 2021-2022

Year: B.Tech. 4thyear

SEMESTER- VII

SN	Course No.	SUBJECT	PERIODS			EVALUATION SCHEME			CREDITS
			L	T	P	INTERNAL ASSESSMENT	ESE	SUB-TOTAL	
1.	ME07TPC12	Refrigeration and Air Conditioning	3	1	-	30	70	100	4
2.	ME07TPE04	Professional Elective-04	3	0	-	30	70	100	3
3.	ME07TPE05	Professional Elective-05	3	0	-	30	70	100	3
4.	ME07TOE04	Open Elective-04	3	0	-	30	70	100	3
5.	ME07TMC04	Indian Constitution	3	0	-	-	-	-	-
		Total	**15**	**1**	**-**	**120**	**280**	**400**	**13**
PRACTICALS									
1.	ME07LPC08	Refrigeration and Air Conditioning Lab	-	-	2	30	20	50	1
2.	ME07LSC02	Seminar on Summer Training	-	-	3	50	-	50	1.5
3.	ME07LMP01	Minor Project	-	-	8	100	-	100	4
Total			**0**	**0**	**13**	**60**	**40**	**200**	**6.5**

Total Credits: 19.5
Total Contact Hour: 29
Total Marks: 600
*INTERNAL ASSESSMENT- Two Class Test of 15 Marks each will be conducted.
L-LECTURE,T-TUTORIAL,P-PRACTICAL, ESE –END SEMESTER EXAMINATION

ME07TPE04 Professional Elective-04	**ME07TPE05 Professional Elective-05**
ME07TPE41 Finite Element Method	ME07TPE51 Power Plant Engineering
ME07TPE42 Theory of Vibration	ME07TPE52 Maintenance Management
ME07TPE43 Modeling and Simulation	ME07TPE53 Gas Dynamics and Jet Propulsion

ME07TOE03 Open Elective-04
ME07TOE41 Production Planning and Control
ME07TOE42 Optimization in Engineering Design
ME07TOE43 Manufacturing Automation

REFRIGERATION & AIR CONDITIONING

1.	**Department/Centre proposing the course**	Mechanical Engineering
2.	**Course Title**	**REFRIGERATION & AIR CONDITIONING**
3.	**L-T-P structure**	3-1-0
4.	**Credits**	4
5.	**Course number**	**ME07TPC12**
6.	**Status** (*category* for *program*)	Theory (Compulsory)

7.	**Pre-requisites** (course no./title)	Thermodynamics, Heat Transfer
8.	**Status vis-à-vis other courses***(give course number/title)*	
8.1	Overlap with any UG/PG course of the Dept./Centre	No
8.2	Overlap with any UG/PG course of other Dept./Centre	No
8.3	Supercedes any existing course	No

9		

10	**Frequency of offering**	Every sem☒ 1st sem☒ 2nd sem☒ Either sem☒
11	**Faculty who will teach the course**	
12	**Will the course require any visiting faculty?**	No

13	**Course objectives:** • Learning the fundamental principles and different methods of refrigeration and airconditioning. • Study of various refrigeration cycles and evaluate performance using P-h chartsand/ or refrigerant property tables. • Comparative study of different refrigerants with respect to properties, applicationsand environmental issues. • Understand the basic air conditioning processes on psychometric charts, calculatecooling load for its applications in comfort and industrial air conditioning. • Study of the various equipment-operating principles, operating and safety controlsemployed in refrigeration air conditioning systems

	Course Outcomes: • Obtain cooling capacity and coefficient of performance by conducting test on vapour compression refrigeration systems. • Present the properties, applications and environmental issues of different refrigerants. • Calculate cooling load for air conditioning systems used for various applications

14	**Course contents:** **Unit 1** Refrigeration: Introduction to refrigeration system, Methods of refrigeration, Carnot refrigeration cycle, Unit of refrigeration, Refrigeration effect & C.O.P. Air Refrigeration cycle: Open and closed air refrigeration cycles, Reversed Carnot cycle, Bell Coleman or Reversed Joule air refrigeration cycle, Aircraft refrigeration system, Classification of aircraft refrigeration system. Boot strap refrigeration, Regenerative, Reduced ambient, Dry air rated temperature (DART). **Unit 2** **Vapor compression refrigeration:**Single stage system, Analysis of vapour compression cycle, Use of T-S and P-H charts, Effect of change in suction and discharge pressures on C.O.P, Effect of sub cooling of condensate & superheating of refrigerant vapour on C.O.P of the cycle, Actual vapour compression refrigeration cycle, Multistage vapour compression system requirement, Removal of flash gas, Intercooling, Different configuration of multistage system. **Unit 3** **Vapor absorption refrigeration systems:** Simple cycle. Actual cycle of ammonia water and lithium-bromide water systems, Electrolux system. Classification of refrigerants, Nomenclature, Desirable properties of refrigerants, Common refrigerants, Secondary refrigerants and CFC free refrigerants. Ozone layer depletion and global warming considerations of refrigerants **Production of low temperature -** cascade system, Joule Thomson effect & liquefaction of gases, liquefaction of hydrogen & helium, application of cryogenics. **Nonconventional refrigeration system**-thermo-electric refrigeration, vortextube, steam jet refrigeration system. **Unit 4** **Refrigeration system components:** water- and air-cooled condensers, evaporative condensers, expansion devices - capillary tube,expansion valve - thermostatic expansion valve, float valve and solenoid valve evaporators, natural convection coils, flooded evaporators direct expansion coils. Reciprocating compressors - single stage and multistage compressors, optimum pressure ratio, effect of inter-cooling, volumetric efficiency, isothermal and adiabatic efficiency, Rotodynamic compressors -screw and vane type compressors, principle of operation, hermetic, semi-hermetic and open type refrigeration compressors. **Unit 5** **Principles of air conditioning:** Psychrometry and psychrometric chart, human comfort, effective temperature comfort chart. Thermal analysis of human body, Effective temperature and comfort chart, Cooling and heating load calculations, Selection of inside & outside design conditions, Heat transfer through walls & roofs,

	Infiltration & ventilation, Internal heat gain, Sensible heat factor (SHF), By pass factor, Grand Sensible heat factor (GSHF), Apparatus dew point (ADP). Air Washers, Cooling towers & humidifying efficiency.

15. Lecture Outline *(with topics and number oflectures)*

Module no.	Topic	No. of hours
1	Introduction to the refrigeration system, Methods of refrigeration, Carnot refrigeration cycle, Unit of refrigeration, Refrigeration effect & C.O.P, Open and closed air refrigeration cycles, Reversed Carnot cycle, Bell Coleman or Reversed Joule air refrigeration cycle, Aircraft refrigeration system, Classification of an aircraft refrigeration system. Bootstrap refrigeration, Regenerative, Reduced ambient, Dry air rated temperature (DART).	07
2	Single-stage system, Analysis of vapour compression cycle, Use of T-S and P-H charts, Effect of change in suction and discharge pressures on C.O.P, Effect of subcooling of condensate & superheating of refrigerant vapour on C.O.P of the cycle, Actual vapour compression refrigeration cycle, Multistage vapour compression system requirement, Removal of flash gas, Intercooling, Different configuration of a multistage system	06
3	Simple cycle. Actual cycle of ammonia water and lithium-bromide water systems, Electrolux system. Classification of refrigerants, Nomenclature, Desirable properties of refrigerants, Common refrigerants, Secondary refrigerants, and CFC free refrigerants. Ozone layer depletion and global warming considerations of refrigerants, cascade system, Joule Thomson effect & liquefaction of gases, liquefaction of hydrogen & helium, application of cryogenics. Nonconventional refrigeration system-thermo-electric refrigeration, vortex tube, steam jet refrigeration system	11
4	Water- and air-cooled condensers, evaporative condensers, expansion devices - capillary tube, expansion valve - thermostatic expansion valve, float valve and solenoid valve evaporators, natural convection coils, flooded evaporators direct expansion coils, Reciprocating compressors - single-stage and multistage compressors, optimum pressure ratio, the effect of inter-cooling, volumetric efficiency, isothermal and adiabatic efficiency, Rotodynamic compressors -screw and vane type compressors, principle of operation, hermetic, semi-hermetic and open type refrigeration compressors.	08
5	Psychrometry and psychrometric chart, human comfort, effective temperature comfort chart. Thermal analysis of human body, Effective temperature and comfort chart, Cooling and heating load calculations, Selection of inside & outside design conditions, Heat transfer through walls & roofs, Infiltration & ventilation, Internal heat gain, Sensible	08

	heat factor (SHF), Bypass factor, Grand Sensible heat factor (GSHF), Apparatus dew point (ADP). Air Washers, Cooling towers & humidifying efficiency.	
	COURSE TOTAL	40

16. Brief description of tutorial activities

- Numerical on the COP of different air refrigeration system
- Numerical on VCRs and its COP
- Numerical on COP of VARs
- Numerical on Air Conditioning LOAD Calculation
- Numerical on Psychometric Chart

17. Brief description of laboratory activities

Module no.	Experiment description	No. of hours
1	Determination of C.O. P on vapour compression system	3
2	Determination of C.O. P on Cascade Refrigeration system	3
3	Performance test on Air conditioning test rig (Window type)	3
4	Performance test on Air conditioning test rig (Duct type)	3
5	Determination of C.O.P of ice plant	3
6	Determination of C.O.P of Water –water Heat Pump	3
7	Determination of C.O.P of Air –water Heat Pump	3
8	Performance analysis in an experimental cooling tower.	3
COURSE TOTAL		21

18. Suggested texts and reference materials

1. Refrigeration and Air Conditioning C. P. Arora - TMH.
2. Refrigeration and Air Conditioning – P.L. Ballaney – Khanna Pub
3. A course in refrigeration and air conditioning -SC Arora &Domkundwar-Dhanpatrai
4. Principals of refrigeration-Dossat-Pearson education
5. Refrigeration and air conditioning- Manohar Prasad- New age.
6. Refrigeration and air conditioning - Ahmadul amen - PHI

19. Resources required for the course *(itemized & student access requirements, if any)*

19.1	Software	
19.2	Hardware	
19.3	Teaching aids (videos, etc.)	
19.4	Laboratory	RAC Laboratory Required
19.5	Equipment	Basic Refrigeration And Air Conditioning Training System AC Test Rig VCRs Test Rig Cooling Tower Cut Section of Window Type AC and Split Type AC

		Heat Pump Test Rig VARS Test Rig ICE Plant Test Rig
19.6	Classroom infrastructure	
19.7	Site visits	Cold storage plant

20. Designcontentofthecourse *(Percentofstudenttimewithexamples,ifpossible)*

20.1	Design-type problems	40% Numerical
20.2	Open-ended problems	
20.3	Project-type activity	
20.4	Open-ended laboratory work	
20.5	Others (please specify)	60 % Derivation and theory

Date: (Signature of the Head of theDepartment)

Finite Element Method

1.	**Department/Center proposing the course**	Mechanical Engineering
2.	**Course title**	**Finite Element Method**
3.	**L-T-P Structure**	3-0-0
4.	**Credits**	3
5.	**Course number**	ME07TPE41
6.	**Status (Category for program)**	Professional Elective

7.	**Pre-requisites**	NACP, Math-1, Math-2, Math-3, Fluid Mechanics, Solid Mechanics, Heat Transfer

7.1.	Overlap with any UG/PG course of the Dept./Centre	No
7.2.	Overlap with any UG/PG course of other Dept./Centre	Yes, PG Course in ME Dept.
7.3.	Super cedes any existing course	Yes (Previous course on FEA)

8.	Not allowed for **(indicate program names)**	

9.	Frequency of offering	Odd Semester
10.	**Faculty who can teach the course**	Fluid-Thermal/Design/Manufacturing Group

11.	**Will the course require any visiting faculty**	No

12. **Course objectives** *(about 50 words):*

- The course intends to impart understanding and application of finite element methods to problems in engineering domain
- To learn the basic concepts of various finite element techniques such as direct stiffness method, weighted residual methods and Variational methods
- To study about various element types, their properties, application and usage in engineering problems
- To apply numerical integration techniques in evaluating element stiffness matrices and load vector
- To study and analyze one- and two-dimensional problems using suitable finite elements
- To learn to interpret and evaluate the quality of the results and be aware of the limitations of the FEM

13.	**Course outcomes** *(about 50 words):* • ***Describe*** the finite element formulation of engineering problems, especially on structural mechanics, fluid flow and thermal science • ***Analyze*** given problem on structural mechanics, fluid flow and heat transfer using appropriate finite element methodology • ***Evaluate*** and obtain solution to simple problems by hand calculations using matrix algebra and numerical integration techniques • ***Design*** specific purpose computer programs to analyze and solve simple problems using Direct Stiffness method • ***Interpret*** the results and evaluate the quality of FE solutions • ***Equipped*** with the limitations and merits of FEM

14.	**Course contents***(about 100 words) (include laboratory/design activities)*: • Introduction, Review of basic elasticity and matrix algebra, element types, nodes, shape functions, strain displacement relations, Galerkin weighted residual approach, Principle of minimum potential energy, isoparametric formulation, numerical integration, element stiffness matrices, finite element analysis of bar, beam, frame using 1-d elements, finite element analysis of plates/shells, plane stress and plane strain analysis, fluid flow and heat transfer applications

15. **Lecture outline***(with topics and number of lectures)*

Module No.	Topics	No. of hours
1	**Introduction**	5
	Introduction to FEM, history, applications, advantages, review of basic elasticity, matrix algebra, element types, nodes, nodal unknowns	
2	**Finite Element (FE) Formulation using Weighted Residual approach**	10
	Weighted residual method (WRM), FE formulation from governing differential equations, Galerkin WRM, Weak form of GWRM, Single continuous and piecewise continuous trial functions	
3	**Finite Element Formulation using Potential Energy approach**	5
	Direct approach, Castigliano's First theorem, Principle of Stationary Total Potential (PSTP), Rayleigh-Ritz method, Simple problems of one-dimensional analysis	
4	**One Dimensional FE analysis**	10
	Shape functions, Serendipity and Lagrange elements, Hermite polynomials, one-dimensional using bar element, beam element, one-dimensional heat transfer analysis	
5	**Two Dimensional FE analysis**	10
	Two-dimensional elements, nodes and shape functions, Serendipity and Lagrange polynomials, Isoparametric formulation, numerical integration, two-dimensional analysis examples, problems on	

	plane stress and plane strain	
COURSE TOTAL		40

16. Brief description of tutorial activities - NIL

17. Brief description of laboratory activities - NIL

Module No.	Experiment description	No. of hours

18. Suggested texts and reference materials

Text Books:

1. Finite Element Analysis, SS Bhavikatti, New Age International publishers
2. A text book of Finite Element Analysis,, P. Seshu, PHI publishers

Reference Books:

1. Fundamentals of Finite Element Analysis, David V. Hutton, McGraw Hill
2. Introduction to Finite Elements in Engineering, T.R. Chandrupatla & A.D. Belegundu, PHI

19. Resources required for the course (*itemized and student access requirements, if any*)

Software	
Hardware	
Teaching aides (videos,etc)	**Videos, NPTEL**
Laboratory	
Equipment	
Classroom infrastructure	**LCD**
Site visits	

20. Design content of the course (*Percent of student time with examples, if possible*)

Design-type problems	**5%**
Open-ended problems	**Nil**
Project-type activity	**5%**
Open-ended laboratory work	**nil**
Others : Fundamentals	**90%**

Date: **(Signature of the Head of the Department)**

Theory of Vibrations

1.	**Department/Centre proposing the course**	Mechanical Engg
2.	**Course Title**	**Theory of Vibrations**
3.	**L-T-P structure**	2-2-0
4.	**Credits**	3
5.	**Course number**	ME07TPE42
6.	**Status**(*category* for *program*)	Professional Elective

7.	**Pre-requisites** (course no./title)	Engineering Mathematics
8.	**Status vis-à-vis other courses** *(give course number/title)*	
8.1	Overlap with any UG/PG course of the Dept./Centre	Nil
8.2	Overlap with any UG/PG course of other Dept./Centre	Nil
8.3	Supercedes any existing course	No

9.	**Not allowed for** (indicate program names)	
10.	**Frequency of offering**	Every Odd semesters {if elected by students}
11.	**Will the course require any visiting faculty?**	No
12.	**Courseobjective***(about50words)***:** • To understand the fundamentals of Vibration. • To be able to mathematically model real-world mechanical vibration problems.	
13	**Course Outcome:** • Ability to apply Newton's equation of motion and energy methods to model basic vibrating mechanical systems. • Ability to model reciprocating and oscillatory motions of mechanical systems. • Ability to model undamped and damped mechanical systems. • Ability to model free and forced vibrations. • Ability to model single- and multi-degree of freedom systems. • Ability to analyze of discrete vibrating systems.	
14.	**Course content** Element of vibration system: lumped mass, stiffness and damping, simple harmonic motion, vector representation. Single degree of freedom system: equation of motion by energy method & Newton law of motion, general solution, free and forced vibration. Damped and undamped motion- Equation of motion for single and two degree of freedom equivalent damping, logarithmic decrement. Damping measurement, rotating and reciprocating unbalance, vibration absorber, Seismic instruments. Transient vibration: - impulse response, Convolution integral, Fourier analysis. Multi degree freedom system: Equation of motion, co-ordinate coupling, undamped forced vibration, principal modes, generalized co-ordinates, semi definite system, orthogonality of	

	modes, modal analysis, Lagrange's equation. Natural frequency numerical solution: Rayleigh`s method Continuous system: Vibration of stretched cord, torsional vibration, longitudinal vibration of slender rod, lateral vibration of beams, Shear deformation and rotary inertia effect, Rayleigh`s quotient, Rayleigh`s-Ritz method.

15. Lecture Outline *(with topics and number oflectures)*

S.No	Topic	No. of hours
1	Element of vibration system: lumped mass, stiffness and damping, simple harmonic motion, vector representation. Single degree of freedom system: equation of motion by energy method & Newton law of motion, general solution, free and forced vibration.	5+2
2	Damped and undamped motion- Equation of motion for single and two degree of freedom equivalent damping, logarithmic decrement. Damping measurement, rotating and reciprocating unbalance, vibration absorber, Seismic instruments.	4+2
3	Transient vibration: - impulse response, Convolution integral, Fourier analysis.	4+2
4	Multi degree freedom system: Equation of motion, co-ordinate coupling, undamped forced vibration, principal modes, generalized co-ordinates, semi definite system, orthogonality of modes, modal analysis, Lagrange's equation.	3+4
5	Natural frequency numerical solution: Rayleigh`s method.	4+4
6	Continuous system: Vibration of stretched cord, torsional vibration, longitudinal vibration of slender rod, lateral vibration of beams, Shear deformation and rotary inertia effect, Rayleigh`s quotient, Rayleigh`s-Ritz method.	4+2
COURSE TOTAL		42

16. Brief description of tutorialactivities

Reproducing results and graphical solutions using Matlab, Additional time mentioned in lecture hours to discuss tutorials.

17. Brief description of laboratoryactivities

Module no.	Experiment description	No. of hours
NA	NA	NA

18. Suggested texts and reference materials

STYLE: Book Title, Author name and initials, Edition, Publisher

1. "Mechanical vibrations theory and applications' Tse.S,Morse R Rolland T . Hinkle. Ivan E. Published by Alllyn and Bacon ,Tne
2. "Theory of vibrations with applications" Thomson T. William ,Prentice Hall of India
3. "Mechanical vibrations" ,HartogDen , J.P. Tata McGraw Hills, 4th edition 1954.

19. Resourcesrequiredforthecourse*(itemized&studentaccessrequirements,ifany)*

18.1	Software	MATLAB
18.2	Hardware	Desktops or personal laptops
18.3	Teaching aides (videos, etc.)	

18.4	Laboratory	
18.5	Equipment	
18.6	Classroom infrastructure	
18.7	Site visits	

20. Designcontentofthecourse*(Percentofstudenttimewithexamples,ifpossible)*

19.1		Design-type problems	
19.2		Open-ended problems	
19.3		Project-type activity	Coding: 20%
19.4		Open-ended laboratory work	
19.5		Others (please specify)	Theory+ practice problems: 80%

Date: (Signature of the Head of theDepartment)

Modeling and Simulation

1.	**Department/Center proposing the course**	Mechanical Engineering
2.	**Course title**	**Modeling and Simulation**
3.	**L-T-P Structure**	3-0-0
4.	**Credits**	3
5.	**Course number**	ME07TOE41
6.	**Status (Category for program)**	Open Elective

7.	**Pre-requisites**	NACP

7.1.	Overlap with any UG/PG course of the Dept./Centre	No
7.2.	Overlap with any UG/PG course of other Dept./Centre	
7.3.	Super cedes any existing course	No

8.	Not allowed for **(indicate program names)**	

9.	Frequency of offering	Odd Semester
10.	**Faculty who can teach the course**	Fluid-Thermal/Design/Manufacturing Group

11.	**Will the course require any visiting faculty**	No

12.	**Course objectives** *(about 50 words):* • To introduce students to computer applications of engineering problem solving on topics ranging from mechanics, design, thermal and manufacturing

13.	**Course outcomes** *(about 50 words):* • Graduates shall be able to apply the fundamentals of various courses and solve elementary engineering problems using computers

14.	**Course contents***(about 100 words) (include laboratory/design activities)*: • **Unit-1**: Introduction to high-level languages, MATLAB/SCILAB, data types, arrays, loops and basic programming features, Graphical User Interface • **Unit-2:** Application of programming to solving problems on solid mechanics • **Unit-3:** Application of programming to solving problem on Fluid and thermal sciences

	• **Unit-**4: Application of programming to solving problems on design and manufacturing • **Unit-**5: Application of programming to solving problems on refrigeration, air-conditioning and heat transfer

15. **Lecture outline***(with topics and number of lectures)*

Module No.	Topics	No. of hours
	Unit-1	15
	Introduction to high-level languages, MATLAB/SCILAB, data types, arrays, loops and basic programming features, Graphical User Interface	
	Unit – 2	6
	Application of programming to solving problems on solid mechanics	
	Unit -3	6
	Application of programming to solving problem on Fluid and thermal sciences	
	Unit – 4	6
	Application of programming to solving problems on design and manufacturing	
	Unit – 5	7
	Application of programming to solving problems on refrigeration, air-conditioning and heat transfer	
COURSE TOTAL		40

16. Brief description of tutorial activities

17. Brief description of laboratory activities

Module No.	Experiment description	No. of hours

18. Suggested texts and reference materials

Text Books:

1. An Engineer's Guide to MATLAB, EB Magrab, GC Walsh, Prentice Hall
2. MATLAB for Engineers, H Moore, Pearson

Reference Books:

1. Creating GUI in MATLAB, Mathworks
2. **MathWorks**

19. Resources required for the course (*itemized and student access requirements, if any*)

19.1.	Software	**MATLAB, SCILAB**
19.2.	Hardware	**PCs**
19.3.	Teaching aides (videos,etc)	
19.4.	Laboratory	

19.5.	Equipment	
19.6.	Classroom infrastructure	**LCD**
19.7.	Site visits	

20. Design content of the course (*Percent of student time with examples, if possible*)

20.1.	Design-type problems	**20%**
20.2.	Open-ended problems	**10%**
20.3.	Project-type activity	**50%**
20.4.	Open-ended laboratory work	**nil**
20.5.	Others : Fundamentals	**20%**

Date: **(Signature of the Head of the Department)**

Power Plant Engineering

1.	**Department/Center proposing the course**	Mechanical Engineering
2.	**Course title**	**Power Plant Engineering**
3.	**L-T-P Structure**	3-0-0
4.	**Credits**	3
5.	**Course number**	ME07TPE51
6.	**Status (Category for program)**	Professional Elective

7.	**Pre-requisites**	Thermal Engineering

7.1.	Overlap with any UG/PG course of the Dept./Centre	No
7.2.	Overlap with any UG/PG course of other Dept./Centre	No
7.3.	Super cedes any existing course	No

8.	Not allowed for **(indicate program names)**	NA

9.	Frequency of offering	Odd Semester
10.	**Faculty who can teach the course**	Fluid-Thermal

11.	**Will the course require any visiting faculty**	No

12.	**Course objectives** *(about 50 words):* • To impart knowledge on sources of energy and types of power plants • To understand construction and working of Steam Power Plants, Hydro Electric power station, diesel power station, and Nuclear Power Station. • To impart knowledge about various performance characteristics and analysis of power plants. • To impart knowledge about energy, economic and environmental factors associated with power plants.

13.	**Course outcomes** *(about 50 words):* • Demonstrate a basic understanding of various types of power plants. • Acquire knowledge in the design and development of mechanical systems associated with power plants. • Compare different energy resources and choose the most appropriate based on local conditions

	• Perform simple techno-economical assessments of energy resources • Design power plant that meet specific energy demands, that are economically feasible and have a minimal impact on the environment

14.	**Course contents***(about 100 words) (include laboratory/design activities)*: **UNIT-I**: Coal based thermal power plants, basic Rankine cycle and its modifications, layout of modern coal power plant, super critical boilers, FBC boilers, turbines, condensers, steam and heating rates, subsystems of thermal power plants, fuel and ash handling, draught system, feed water treatment, binary cycles and cogeneration systems **UNIT-II:** Gas turbine and combined cycle power plants, Brayton cycle analysis and optimization, components of gas turbine power plants, combined cycle power plants, Integrated Gasifier based Combined Cycle (IGCC) systems. **UNIT-III:** Basics of nuclear energy conversion, Layout and subsystems of nuclear power plants, Boiling Water Reactor (BWR), Pressurized Water Reactor (PWR), CANDU Reactor, Pressurized Heavy Water Reactor (PHWR), Fast Breeder Reactors (FBR), gas cooled and liquid metal cooled reactors, safety measures for nuclear power plants. **UNIT-IV:** Hydroelectric power plants, classification, typical layout and components, principles of wind, tidal, solar PV and solar thermal, geothermal, biogas and fuel cell power systems **UNIT-V:** Energy, economic and environmental issues, power tariffs, load distribution parameters, load curve, capital and operating cost of different power plants, pollution control technologies including waste disposal options for coal and nuclear plants.

15. **Lecture outline***(with topics and number of lectures)*

Module No.	Topics	No. of hours
	Unit-1	9
	Coal based thermal power plants, basic Rankine cycle and its modifications, layout of modern coal power plant, super critical boilers, FBC boilers, turbines, condensers, steam and heating rates, subsystems of thermal power plants, fuel and ash handling, draught system, feed water treatment, binary cycles and cogeneration systems	
	Unit – 2	9
	Gas turbine and combined cycle power plants, Brayton cycle analysis and optimization, components of gas turbine power plants, combined cycle power plants, Integrated Gasifier based Combined Cycle (IGCC) systems	
	Unit -3	9
	Basics of nuclear energy conversion, Layout and subsystems of nuclear power plants, Boiling Water Reactor (BWR), Pressurized	

	Water Reactor (PWR), CANDU Reactor, Pressurized Heavy Water Reactor (PHWR), Fast Breeder Reactors (FBR), gas cooled and liquid metal cooled reactors, safety measures for nuclear power plants	
	Unit – 4	9
	Hydroelectric power plants, classification, typical layout and components, principles of wind, tidal, solar PV and solar thermal, geothermal, biogas and fuel cell power systems	
	Unit – 5	9
	Energy, economic and environmental issues, power tariffs, load distribution parameters, load curve, capital and operating cost of different power plants, pollution control technologies including waste disposal options for coal and nuclear plants	
COURSE TOTAL		45

16. Brief description of tutorial activities

17. Brief description of laboratory activities

Module No.	**Experiment description**	**No. of hours**

18. Suggested texts and reference materials

Text 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.

Reference Books:

1. Elliot T.C., Chen K and Swanekamp R.C., Power Plant Engineering, 2nd ed., McGraw Hill,1998.

19. Resources required for the course (*itemized and student access requirements, if any*)

19.1.	Software	
19.2.	Hardware	
19.3.	Teaching aides (videos,etc)	
19.4.	Laboratory	
19.5.	Equipment	
19.6.	Classroom infrastructure	**LCD**
19.7.	Site visits	**Nearby Power plants**

20. Design content of the course (*Percent of student time with examples, if possible*)

20.1.	Design-type problems	
20.2.	Open-ended problems	
20.3.	Project-type activity	
20.4.	Open-ended laboratory work	
20.5.	Others : Fundamentals	

Date: **(Signature of the Head of the Department)**

Maintenance Management

1.	**Department/Center proposing the course**	Mechanical Engineering
2.	**Course title**	**Maintenance Management**
3.	**L-T-P Structure**	3-0-0
4.	**Credits**	3
5.	**Course number**	**ME07TPE52**
6.	**Status (Category for program)**	**Professional Elective-05 (ME07TPE05)**

7.	**Pre-requisites**	Nil

8.	Status vis-à-vis other courses (Give Course number/title)	
8.1.	Overlap with any UG/PG course of the Dept./Centre	No
8.2.	Overlap with any UG/PG course of other Dept./Centre	No
8.3.	Super cedes any existing course	No

9.	Not allowed for **(indicate program names)**	

10.	Frequency of offering	☐ Every sem ☐ 1st Sem ☒ × 2nd Sem ☐ Either Sem: 7th sem

11.	**Faculty who will teach the course**	Industrial Management

12.	**Will the course require any visiting faculty**	Visiting faculty from manufacturing industries

13.	**Course objectives:** • To understand the principles, functions and practices adapted in industry for the successful management of maintenance activities. • To provide the concept of various types of maintenance system and strategies used in industries. • To impart the knowledge to understand the aspects of tribology in maintenance management system. • To be familiar with the architectures of machine health monitoring as well as total productive maintenance. • To understand the reliability, availability and maintainability concepts and

	various aspects and formulate for reliability analysis of goods. **Course objectives***:* After studying this course, the students are able to: • Implement the principles, functions and practices adapted in industry for the successful management of maintenance activities. • Understand and exercise the concept of various types of maintenance system and strategies for managing industries. • Apply the various tribology techniques for maintenance management of machines or system. • Sensed the various architectures of machine health monitoring as well as total productive maintenance. • Calculate the reliability, availability and maintainability of goods.

14.	**Course contents***(about 100 words) (include laboratory/design activities)*: • Fundamentals & importance of maintenance engineering, inventory control, productivity, safety, pollution control, Safety regulations, pollution problems, human reliability, total quality management (TQM), total productivity maintenance (TPM), environmental issues in maintenance, ISO 9000. • Types of maintenance strategies, planned & un planned maintenance, breakdown, preventive & predictive maintenance. Advantages & limitations, computer aided maintenance, maintenance scheduling, spare part management, inventory control, organization of maintenance department. • Friction, wear & lubrication, wear mechanism, prevention of wear, types of lubrication mechanism & process. Types of lubricants, seals & packaging. • Condition based maintenance, signature analysis, oil analysis, vibration, noise & thermal signatures, online & off line techniques. Instrumentation & equipment used, signal processing, data acquisition & analysis, application of intelligent systems, data base design. TPM, Pillars of TPM, Terri technology. • Reliability, availability & maintainability (RAM) analysis: failure data analysis, failure distribution, Reliability of repairable & non-repairable systems, improvement in reliability, reliability testing, reliability prediction, utilization factor, System reliability by Monte Carlo simulation technique, FMECA.

15. **Lecture outline***(with topics and number of lectures)*

Module No.	Topics	No. of hours
1.	**Introduction:** Fundamentals of maintenance engineering, maintenance engineering its importance in material & energy conservation, inventory control, productivity, safety, pollution control etc. Safety regulations, pollution problems,	5

	human reliability, total quality management (TQM), total productivity maintenance (TPM), environmental issues in maintenance, ISO 9000.	
2	**Maintenance Management:** Types of maintenance strategies, planned & un-planned maintenance, breakdown, preventive & predictive maintenance. Their comparison, advantages & disadvantages. Limitations, computer aided maintenance, maintenance scheduling, spare part management, inventory control, organization of maintenance department.	5
3	**Tribology in Maintenance:**Frictionwear and lubrication, friction & wear mechanisms, prevention of wear, types of lubrication mechanisms, lubrication processes. Lubricants: Types, general 7 special purpose, additives, testing of lubricants, degradation of lubricants, seal & packaging's.	5
4	**Machine Health Monitoring:**Condition based maintenance, signature analysis, oil analysis, vibration, noise & thermal signatures, online & off line techniques. Instrumentation & equipment used in machine health monitoring. Instrumentation in maintenance, signal processing, data acquisition & analysis, application of intelligent systems, data base design. **TPM:**Introduction, history, components, Pillars of TPM, calculation of OEE, Terri technology.	8
5	**Reliability, availability & maintainability (RAM) analysis:** Introduction to RAM failure mechanism , failure data analysis, failure distribution, reliability of repairable & non-repairable systems, improvement in reliability, reliability testing, reliability prediction, utilization factor, System reliability by Monte Carlo simulation technique,	8

	FMECA.	
COURSE TOTAL		31

16. Brief description of tutorial activities

NA

17. Brief description of laboratory activities

Module No.	Experiment description	No. of hours

18. Suggested texts and reference materials

1. Lindley, H., Maintenance Engineering Handbook, , Mc-Graw Hill Education.
2. Gopalakrishnan, P. and Banerji, A.K., Maintenance and Spare Parts Management, PHI Learning Private Limited
3. Srivastava, S.K., Handbook of Industrial Maintenance Management, Chand & Co. Ltd
4. Rao, B.K.N., Handbook of Condition monitoring, Elsevier Advanced Technology.
5. Venkataraman, K., 2010, Maintenance Engineering and Management, pp. 1-248, ISBN: 9788120331303, Handbook, PHI Learning Publisher, New Delhi.
6. Mobley, R.K, MBB, CMRP, 2014, Maintenance Engineering Handbook, Eighth Edition, ISBN: 9780071826617, McGraw-Hill Education Publisher.
7. Gerardus B., 2021, Maintenance Management a Complete Guide-2020 Edition Paperback Publisher.

19. Resources required for the course (*itemized and student access requirements, if any*)

19.1.	Software	
19.2.	Hardware	
19.3.	Teaching aides (videos,etc)	**Req**
19.4.	Laboratory	
19.5.	Equipment	
19.6.	Classroom infrastructure	**Req**
19.7.	Site visits	

20. Design content of the course (*Percent of student time with examples, if possible*)

20.1.	Design-type problems	
20.2.	Open-ended problems	
20.3.	Project-type activity	
20.4.	Open-ended laboratory work	
20.5.	Others (please specify)	

Date: **(Signature of the Head of the Department)**

GAS DYNAMICS AND JET PROPULSION

1.	**Department/Centre proposing the course**	Mechanical Engineering
2.	**Course Title**	**GAS DYNAMICS AND JET PROPULSION**
3.	**L-T-P structure**	3-0-0
4.	**Credits**	3
5.	**Course number**	ME07TPE53
6.	**Status** (*category* for *program*)	

7.	**Pre-requisites** (course no./title)	Thermodynamics, Fluid Machinery
8.	**Status vis-à-vis other courses** *(give course number/title)*	
8.1	Overlap with any UG/PG course of the Dept./Centre	No
8.2	Overlap with any UG/PG course of other Dept./Centre	No
8.3	Supercedes any existing course	No

9		

10	**Frequency of offering**	Every sem☒ 1st sem☒ 2nd sem☒ Either sem☒
11	**Faculty who will teach the course**	
12	**Will the course require any visiting faculty?**	**NO**

13	**Course objective:** The main purpose of implementing this course in the curriculum is to know the basic concept and importance of gas dynamics and Interpret the flow pattern inflow and non-flow systems also identify the thrust equation and its usage in jet aircraft and rocket propulsion in an efficient way.

14	**Course contents:** **Unit-1** Compressible flow, definition, Mach waves, and Mach cone, stagnation states, Mass, momentum, and energy equations of one-dimensional flow. **Unit -2**

	Isentropic flow through variable area ducts, nozzles, and diffusers, subsonic and supersonic flow, variable area ducts, choked flow, Area-Mach number relations for isentropic flow. **Unit-3** Non-isentropic flow in constant area ducts, Rayleigh and Fanno flows, Normal shock relations, oblique shock relations, isentropic, and shock tables. **Unit-4** Theory of jet propulsion, thrust equation, thrust power, and propulsive efficiency, Operating principle and cycle analysis of ramjet, turbojet, turbofan and turboprop engines. **Unit-5** Types of rocket engines, propellants & feeding systems, ignition and combustion, a theory of rocket propulsion, performance study, staging, terminal and characteristic velocity, space flights.

15. Lecture Outline *(with topics and number oflectures)*

Module no.	Topic	No. of hours
1	Fundamentals of Compressible Flow: Basic equations of compressible flow, stagnation states, Mach wave, and Mach cones, the effect of Mach number on compressibility.	5
2	Flow-through variable area duct: One-dimensional isentropic flow in a duct of varying cross-sectional area; nozzles and diffusers; critical properties and choking.	10
3	Flow in constant area duct with friction (Fanno flow), Fanno flow equation and its solution, relation of flow properties with length, experimental coefficient of friction.	5
4	Flow in constant area duct with heat transfer (Rayleigh flow): Rayleigh flow equations, the variation of flow properties, maximum heat transfer.	5
5	Shock waves: Normal shock relations, oblique shock relations, isentropic, and shock tables.	5
6	Theory of jet propulsion: Operating principle of Propulsive systems; Propulsive, Thermal and Overall efficiency, specific fuel consumption, thrust equation, and cycle analysis; performance of ram jet, turbojet, turbofan and turboprop engines.	8
7	Theory of rocket propulsion: Types of rocket engines, propellants & feeding systems, ignition and combustion, performance study, staging, terminal and characteristic velocity, space flights.	**8**
	COURSE TOTAL	46

16. Brief description of tutorial activities

Primarily numerical problem solving on different topics covered in the lectures.

17. Brief description of laboratoryactivities

Module no.	Experiment description	No. of hours
COURSE TOTAL		

18. Suggested texts and reference materials

1. Fundamentals of Compressible Flow, S.M. Yahya, New Age International (P) Limited
2. Dynamics and Thermodynamics of Compressible fluid Flow, A.H. Shapiro, John Wiley
3. Aircraft and Missile Propulsion, vol.1 & II, N.J. Zucrow, John Wiley
4.Gas Dynamics and Jet Propulsion, S.Senthil, A.R.S. Publications.
5.Gas Turbines, V. Ganesan, Tata McGraw Hill Publishing Co., New Delhi
6.Gas Dynamics and Jet Propulsions, PR.S.L. Somasundaram, New Age International (P)
7. Fundamentals of Compressible fluid dynamics, P. Balachandran, PHI Learning, NewDelhi.

19. Resources required for the course *(itemized & student access requirements, if any)*

19.1	Software	
19.2	Hardware	
19.3	Teaching aids (videos, etc.)	
19.4	Laboratory	
19.5	Equipment	
19.6	Classroom infrastructure	
19.7	Site visits	

20. Designcontentofthecourse *(Percentofstudenttimewithexamples,ifpossible)*

20.1	Design-type problems	10%
20.2	Open-ended problems	
20.3	Project-type activity	
20.4	Open-ended laboratory work	
20.5	Others (please specify)	

Date: (Signature of the Head of theDepartment)

Production Planning & Control

1.	**Department/Centre proposing the course**	**Mechanical Engg**
2.	**Course Title** *(< 45 characters)*	**Production Planning & Control**
3.	**L-T-P structure**	3-0-0
4.	**Credits**	3
5.	**Course number**	**ME07TOE041**
6.	**Status** (*category* for *program*)	**Open Elective-04 (ME07TOE04)**
7	**Pre-requisites** (course no./title)	NA
8.	**Status vis-à-vis other courses** *(give course number/title)*	
8.1	Overlap with any UG/PG course of the Dept./Centre	No
8.2	Overlap with any UG/PG course of other Dept./Centre	No
8.3	Supercedes any existing course	No
9.		
10.	**Frequency of offering**	4^{th} year/7 sem
11.	**Faculty who will teach the course**	Specialized faculties of Management/Industrial realm
12.	**Will the course require any visiting faculty**	Yes (Faculty work in collaboration with AMS industries need to visit for optimizing knowledge of students)
13.	**Course objective and outcomes** *(about 50 words)***:**	**Course objectives** - Define objectives, functions, applications of PPC and forecasting techniques. - Explain the different MRP processes, charts and inventory control techniques. - Learns how to resolve many routing, scheduling and facility location problems. - Understand different type of layouts and its design procedures and basic supply chain management and network. - Elaborate maintenance management tools to control production without intervention. **Course outcomes** After studying this course, the students are able to: - Recognize the objectives, functions, applications of PPC and forecasting techniques.

		• Apply different MRP processes, charts and Inventory control techniques. • Solve many routing, scheduling and Facility location problems of industries. • Frame the different type of layouts for diverse production systems and supply chain management network. • Understand and apply maintenance Management tools to control production without intervention.
14.	**Course contents** *(about 100 words) (Include laboratory/design activities)***:**	**Introduction:** Introduction to various Types of Production System viz. Mass Production, Job Shop, Batch Production System, Continuous Production System, Concept of Production and Operation Management, Objective & functions of PPC. **Forecasting:** Time Series method, moving average, weighted average, Trend, Seasonality, Regression Technique, and Delphi Method. **Aggregate Planning:** Definition, Strategies, Pure Pure and mixed strategies, methods. Master Production, Schedule: objective and functions, Design of MPS, Bill of Materials. Material Requirement Planning: objectives, functions, MRP, MRP-II, limitations. Capacity Requirement Planning: Definition, Objectives, Process of CRP, Process Sheet, Rough Cut Capacity Planning, Loading, and Preparation of CRP chart. **Scheduling:** Types, Single Machine Scheduling, Job shop Scheduling, Flow Scheduling; Sequencing: various priority rules; Line of Balancing: Rank and positional weight method, Kilbridgewestner method. Facility location and facility location problems: Factors affecting plant locations, single facility locations problems and its methods. **Types of layout-** layouts design procedure such as CORELAP, CRAFT etc. Material handling system & their classification, principles, JIT & KANBAN, Depreciation& methods of depreciation. The objective, importance, decision phases, process view, performance management and measurement of supply chain, supply chain drivers and metrics and different network of supply chain. **Maintenance Management:** Types of maintenance strategies, Breakdown and Preventive Maintenance, Predictive and Total Productive Maintenance, Condition monitoring, Individual and group replacement policies. Make or Buy Decision, concept of original equipment effectiveness.

Lecture Outline *(with topics and number of lectures)*

Module no.	Topics	No of hours
	Unit-I	
1	**Introduction:** Introduction to various Types of Production System viz. Mass Production, Job Shop, Batch Production System, Continuous Production System, Concept of Production and Operation Management, Objective & functions of PPC.	4
2	Forecasting: Time Series method, moving average, weighted average, Trend, Seasonality, Regression Technique, and Delphi Method.	3
	Unit-II	
3	**Aggregate Planning:** Definition, Strategies, Pure and mixed strategies, methods. Master Production Schedule: objective and functions, Design of MPS, Bill of Materials. Material Requirement Planning: objectives, functions, MRP, MRP-II, limitations. Capacity Requirement Planning: Definition, Objectives, Process of CRP, Process Sheet, Rough Cut Capacity Planning, Loading, and Preparation of CRP chart.	8
	Unit-III	
4	**Scheduling:** Types, Single Machine Scheduling, Job shop Scheduling, Flow Scheduling; Sequencing: various priority rules; Line of Balancing: Rank and positional weight method, Kilbridgewestner method.	5
5	**Facility location and facility location problems:** Factors affecting plant locations, single facility locations problems and its methods.	3
	Unit-IV	
6	Types of layout- layouts design procedure such as CORELAP, CRAFT etc. Material handling system & their classification, principles, JIT&KANBAN, Depreciation& methods of depreciation. The objective, importance, decision phases, process view, performance management and measurement of supply chain, supply chain drivers and metrics and different network of supply chain.	6
	UNIT-V	
7.	**Maintenance Management:** Types of maintenance strategies, Breakdown and Preventive Maintenance, Predictive and Total Productive Maintenance, Condition monitoring, Individual and group replacement policies. Make or Buy Decision, concept of original equipment effectiveness.	7
Course Total		36

16. Brief description of tutorial activities

NA

17. Brief description of laboratory activities

Module no.	Experimental descriptions	No of hours

1	NA	
Course Total		

18. Suggested texts and reference materials

Style: Book Title, Author name and initials, Edition, Publisher

Text Books:

1. Production and operation management, O.Paneerselvem, TMH.
2. Production and operation management, Adem Ebert
3. Production and operation management, Charry S.N. TMH
4. Production and Operations management, R.B Khanna, PHI.
5. Production operations management S.N.Buffa, PHI.
6. Emerging Trends in Supply Chain Management: Ed.B.S.Sahay McMillan Publication.

19. Resources required for the course *(itemized & student access requirements, if any)*

19.1	Software	NA
19.2	Hardware	NA
19.3	Teaching aides (videos, etc.)	Projector assisted with computer to show industrial videos.
19.4	Laboratory	NA
19.5	Equipment	NA
19.6	Classroom infrastructure	Class room assisted with Projector with computer. (Smart class room)
19.7	Site visits	Yes, to make the students aware from real/actual practices.

20. Design content of the course *(Percent of student time with examples, if possible)*

20.1	Design-type problems	30%
20.2	Open-ended problems	
20.3	Project-type activity	30%
20.4	Open-ended laboratory work	
20.5	Others (please specify)	

Date: (Signature of the Head of the Department)

Optimization in Engineering Design

1.	**Department/Center proposing the course**	Mechanical Engineering
2.	**Course title**	**Optimization in Engineering Design**
3.	**L-T-P Structure**	3-0-0
4.	**Credits**	3
5.	**Course number**	ME07TOE42
6.	**Status (Category for program)**	Open Elective - 4

7.	**Pre-requisites**	Concept of variables, functions, Differential calculus etc.

8.	Status vis-à-vis other courses (Give Course number/title)	
8.1.	Overlap with any UG/PG course of the Dept./Centre	No
8.2.	Overlap with any UG/PG course of other Dept./Centre	No
8.3.	Super cedes any existing course	No

9.	Not allowed for **(indicate program names)**	

10.	Frequency of offering	☐ Every sem	1st Sem ☐	2nd Sem Either Sem

11.	**Faculty who will teach the course**	

12.	**Will the course require any visiting faculty**	

13.	**Course objective***(about 50 words):* • To learn the concept of formulation of an optimization problem. • To present tools and methodologies for performing system optimization. • To impart knowledge in the determination of optimum solution for a constrained and unconstrained optimization problems. • To get familiarize with conventional and non-conventional optimization algorithms.

14.	**Course outcome***(about 50 words):*

	• Graduates will gain a strong foundation in understanding and formulation of an optimization problem. • Identify and determine the optimum solution to constrained and unconstrained optimization problems. • Graduates will be able to demonstrate &simulate the optimization problem.

15.	**Course contents***(about 100 words) (include laboratory/design activities)*: • **Unit-1**, Optimal problem formulation, Single variable optimization algorithms including Interval halving, Golden section search, Newton-Raphson method, Bisection method. • **Unit-2**, Single variable and Multi variable optimization algorithms including Simplex search method, Cauchy's steepest descent method, Levenberg Marquardt's method. • **Unit-3**, Constrained optimization algorithms including Kuhn-Tucker conditions, transformation methods, direct search methods, liberalized search techniques, feasible direction method. Specialized algorithms including integer programming, geometric programming. Nontraditional optimization technique like genetic algorithm and simulated annealing technique. • **Unit-4**: Structural applications- design of simple truss members. Design application- design of simple axial, transverse loaded members for minimum cost, maximum weight. Design of shafts and torsion ally loaded members. Design of springs. Dynamic applications – optimum design of single, two-degree freedom system, vibration absorbers. Application in mechanism – Optimum design of simple linkage mechanism.

16. **Lecture outline***(with topics and number of lectures)*

Module No.	Topics	No. of hours
1.	Optimal problem formulation, Single variable optimization algorithms including Interval halving, Golden section search, Newton-Raphson method, Bisection method.	8
2	Single variable and Multi variable optimization algorithms including Simplex search method, Cauchy's steepest descent method, Levenberg Marquardt's method.	8
3	Constrained optimization algorithms including Kuhn-Tucker conditions, transformation methods, direct search methods, liberalized search techniques, feasible direction method. Specialized algorithms including integer programming, geometric programming.	12

	Nontraditional optimization technique like genetic algorithm and simulated annealing technique.	
4	Structural applications- design of simple truss members. Design application- design of simple axial, transverse loaded members for minimum cost, maximum weight. Design of shafts and torsion ally loaded members. Design of springs. Dynamic applications – optimum design of single, two-degree freedom system, vibration absorbers. Application in mechanism – Optimum design of simple linkage mechanism.	12
COURSE TOTAL		40

17. Brief description of tutorial activities

The tutorial problems are associated with individual units.

18. Brief description of laboratory activities

Module No.	**Experiment description**	**No. of hours**

19. Suggested texts and reference materials

1. Engineering Optimization, Theory and Practice, Third Edition, Singiresu S. Rao, New Age International Publishers.
2. Optimization for Engineering Design, Algorithms and Examples, Second Edition, Kalyanmoy Deb, PHI India.
3. Introduction to Optimum Design,Jasbir. Arora, Elsevier.
4. Optimum design of Mechanical Elements, Johnson Ray C., Wiley, John & Sons.
5. Genetic algorithms in Search, Optimization and Machine, Goldberg,D.E.Barnen, Addison-Wesley, New York.

20. Resources required for the course (*itemized and student access requirements, if any*)

20.1.	Software	**Req**
20.2.	Hardware	
20.3.	Teaching aides (videos,etc)	**Req**
20.4.	Laboratory	
20.5.	Equipment	
20.6.	Classroom infrastructure	**Req**
20.7.	Site visits	

21. Design content of the course (*Percent of student time with examples, if possible*)

21.1.	Design-type problems	
21.2.	Open-ended problems	
21.3.	Project-type activity	
21.4.	Open-ended laboratory work	
21.5.	Others (please specify)	

Date: **(Signature of the Head of the Department)**

Manufacturing Automation

1.	**Department/Center proposing the course**	Mechanical Engineering
2.	**Course title**	**Manufacturing Automation**
3.	**L-T-P Structure**	3-0-0
4.	**Credits**	3
5.	**Course number**	ME07TOE43
6.	**Status (Category for program)**	Open Elective 4

7.	**Pre-requisites**	

8.	Status vis-à-vis other courses (Give Course number/title)	
8.1.	Overlap with any UG/PG course of the Dept./Centre	No
8.2.	Overlap with any UG/PG course of other Dept./Centre	No
8.3.	Super cedes any existing course	No

9.	Not allowed for **(indicate program names)**	

10.	Frequency of offering	☐ Every sem	■ 1st Sem	☐ × 2nd Sem	Either Sem

11.	**Faculty who will teach the course**	

12.	**Will the course require any visiting faculty**	

13.	**Course objective***(about 50 words):* • To learn the concepts and principle of manufacturing automation. • To understand the various types of controls, components of automation and their practical use in manufacturing application. • To learn automation using pneumatic systems in various application areas. • To understand the automation using hydraulic systems. • To provide knowledge levels needed for PLC programming and automation.

14.	**Course outcome***(about 50 words):* • Graduates will be able to implement concepts of automation in machine tools and plant.

	• Students will understand the fundamentals of control in automation as they apply to manufacturing. • Acquire knowledge of designing of pneumatic and hydraulic circuit for manufacturing application. • Graduates will be able to apply PLC timers and counters for the control of industrial processes.

15.	**Course contents***(about 100 words) (include laboratory/design activities)*: • **Module-1**, Fundamentals of manufacturing, Production system facilities, Manufacturing support systems, Different types of manufacturing systems, Automation in production systems. • **Module-2**, Manufacturing operations, Product, Production relationships, Production concepts and mathematical models, Cost of manufacturing operations, Case studies. • **Module-3**, Automation principles & strategies, Concept of automation, Basic elements and types of automation, flexibility, degree, levels and yardstick of automation, Components of automation: sensors, actuators, ADC, DAC and input/output devices. • **Module-4**: Industrial control: Industrial control systems; Mechanical, Hydraulic, Pneumatic, Electrical, Electronic and hybrid systems; Concepts, features and parameters governing the selection of various components of industrial control systems. • **Module-5**: PLC: Discrete control using PLC and PLC network, Micro PLC, programming a PLC, Logic functions, Input and output modules, PLC processors, PLC instructors, Documenting a PLC system, Timer and counter instructions, Data handling instructions, Sequencing instructions, Mask data representation.

16. **Lecture outline***(with topics and number of lectures)*

Module No.	Topics	No. of hours
1.	Fundamentals of manufacturing, Production system facilities, Manufacturing support systems, Different types of manufacturing systems, Automation in production systems.	8
2	Manufacturing operations, Product, Production relationships, Production concepts and mathematical models, Cost of manufacturing operations, Case studies.	8
3	Automation principles & strategies, Concept of automation, Basic elements and types of automation, flexibility, degree, levels and yardstick of automation, Components of automation:	8

	sensors, actuators, ADC, DAC and input/output devices.	
4	Industrial control: Industrial control systems; Mechanical, Hydraulic, Pneumatic, Electrical, Electronic and hybrid systems; Concepts, features and parameters governing the selection of various components of industrial control systems.	8
5	PLC: Discrete control using PLC and PLC network, Micro PLC, programming a PLC, Logic functions, Input and output modules, PLC processors, PLC instructors, Documenting a PLC system, Timer and counter instructions, Data handling instructions, Sequencing instructions, Mask data representation.	8
COURSE TOTAL		40

17. Brief description of tutorial activities

The tutorial problems are associated with individual units.

18. Brief description of laboratory activities

Module No.	**Experiment description**	**No. of hours**

19. Suggested texts and reference materials

1. Automation, Production systems and Computer-Integrated Manufacturing, Mikell P. Grover, Pearson Education, New Delhi.
2. Hydraulic and Pneumatics, Andrew Parr, Butterworth-Heinemann.
3. Pneumatic and Hydraulic Systems,Bolton W., Elsevier Science and Technology Books.
4. Performance Modelling of Automated Manufacturing Systems,N. Viswanandham, Y. Narhari, Prentice-Hall.
5. Mechatronics: Electronic control systems in Mechanical and Electrical Engineering,W. Bolton, Prentice-Hall.
6. Fluid power with applications, Antony Esposito, Pearson Education India.
7. Process Control Instrumentation Technology, C.D.Johnson, Prentice hall of India, New Delhi.
8. Pneumatic System, S.R. Majumdar, Tata McGraw Hill.

20. Resources required for the course (*itemized and student access requirements, if any*)

20.1.	Software	

20.2.	Hardware	
20.3.	Teaching aides (videos,etc)	**Req**
20.4.	Laboratory	
20.5.	Equipment	
20.6.	Classroom infrastructure	**Req**
20.7.	Site visits	

21. Design content of the course (*Percent of student time with examples, if possible*)

21.1.	Design-type problems	
21.2.	Open-ended problems	
21.3.	Project-type activity	
21.4.	Open-ended laboratory work	
21.5.	Others (please specify)	

Date: **(Signature of the Head of the Department)**

SCHOOL OF STUDIES OF ENGINEERING & TECHNOLOGY
GURU GHASIDAS VISHWAVIDHALAYA, (A CENTRAL UNIVERSITY)
DEPARTMENT OF MECHANICAL ENGINEERING CBCS-NEW, STUDY & EVALUATION SCHEME W.E.F. SESSION 2021-2022

Year: B.Tech. 4thyear

SEMESTER- VIII

SN	Course No.	SUBJECT	PERIODS			EVALUATION SCHEME			CREDITS
			L	T	P	INTERNAL ASSESSMENT	ESE	SUB-TOTAL	
1.	ME08TPC13	Solar Energy	3	1	-	30	70	100	4
2.	ME08TPE06	Professional Elective-06	3	0	-	30	70	100	3
3.	ME08TOE05	Open Elective-05	3	0	-	30	70	100	3
4.	ME08THS04	Elective from Humanity Science HS-04	3	0	-	30	70	100	3
		Total	**12**	**1**	**-**	**120**	**280**	**400**	**13**
PRACTICALS									
1.	ME08LMP02	Major Project	-	-	14	120	80	200	7
Total			**0**	**0**	**14**	**120**	**80**	**200**	**7**

Total Credits: 20
Total Contact Hour: 27
Total Marks: 600
*INTERNAL ASSESSMENT- Two Class Test of 15 Marks each will be conducted.
L-LECTURE,T-TUTORIAL,P-PRACTICAL, ESE –END SEMESTER EXAMINATION

ME08TPE06 Professional Elective-06
ME08TPE61 Total Quality Management
ME08TPE62 Cryogenic Engineering
ME08TPE63 Additive Manufacturing
ME08TOE05 Open Elective-05
ME08TOE51 Automobile Engineering
ME08TOE52 Soft Computing
ME08TOE53 Intellectual Property Rights
ME08THS04 Elective from Humanity Science HS-04
ME08THS41 Supply Chain Management
ME08THS42 Management Information System
ME08THS43 **Principles of Management**

Course Template

1.	**Department/Center proposing the course**	Mechanical Engineering
2.	**Course title**	**Solar Energy**
3.	**L-T-P Structure**	3-1-0
4.	**Credits**	4
5.	**Course number**	
6.	**Status (Category for program)**	Professional Core

7.	**Pre-requisites**	Heat transfer

7.1.	Overlap with any UG/PG course of the Dept./Centre	No
7.2.	Overlap with any UG/PG course of other Dept./Centre	No
7.3.	Super cedes any existing course	No

8.	Not allowed for **(indicate program names)**	NA

9.	Frequency of offering	Odd Semester
10.	**Faculty who can teach the course**	Fluid-Thermal

11.	**Will the course require any visiting faculty**	No

12.	**Course objectives** *(about 50 words):* • To impart knowledge on solar energy and its conversion technologies • To understand construction and working of solar thermal collectors. • To impart knowledge about various solar thermal in domestic and industrial applications. • To understand the concept of direct conversion from solar radiation into electrical energy and developments of photovoltaic technologies. • To impart knowledge about the status of solar energy market, economic and policies in India.

13.	**Course outcomes** *(about 50 words):* • Demonstrate a basic understanding of solar energy and its conversion. • Acquire knowledge in the design and development of solar thermal collectors for domestic and industrial applications. • Acquire knowledge in design of solar photovoltaic power plant for small and medium scale requirements.

	• Perform simple techno-economical assessments of solar energy applications. • Understanding the policies related to Indian government initiatives to promote solar energy.

14.	**Course contents***(about 100 words) (include laboratory/design activities)*: Unit I - Solar Energy—Basic Concepts (8) The sun as source of energy - sun, earth radiation spectrum- measurement of solar radiation - solar time - solar radiation geometry - solar day length - empirical equations for estimating terrestrial solar radiation on horizontal surface - solar radiation on inclined plane surface. Unit II - Solar Thermal Collectors (9) Solar collectors – liquid flat plate collector - flat plate air heating collector - evacuated tube collector - thermal analysis of liquid flat plate and evacuated tube collector – solar PVT collectors - compound parabolic concentrator - cylindrical parabolic concentrator - linear fresnel lens collector - paraboloidal dish collector - central tower receiver. Unit III - Solar Thermal Applications (9) Solar water heater – Solar air heater - solar passive space heating and cooling systems - solar cooker - solar dryer - solar distillation – solar pond – solar refrigeration and air conditioning system- solar thermal power plant - solar industrial process heating systems. Unit IV - Solar Photovoltaic energy conversion (10) Solar cell fundamentals - solar cell characteristics –various generations of solar cell- classification – Si wafer-based pv technology - thin film amorphous si technologies - thin film crystalline si cell technologies - dye-sensitized solar cell technology - organic solar cell technology - quantum dot solar cell technology-Perovskite solar cells – Solar PV applications. Unit V - Solar energy: Indian markets, economics and policies (9) Current status of solar energy technologies and markets - The economics of solar energy - Barriers to the development and deployment of solar energy technologies - Government initiatives to promote solar energy - Major achievements in solar sector- Future prospects for solar energy.

15. **Lecture outline***(with topics and number of lectures)*

Module No.	Topics	No. of hours
	Unit-1	8
	The sun as source of energy - sun, earth radiation spectrum- measurement of solar radiation - solar time - solar radiation geometry - solar day length - empirical equations for estimating terrestrial solar radiation on horizontal surface - solar radiation on inclined plane surface	

	Unit – 2	9
	Solar collectors – liquid flat plate collector - flat plate air heating collector - evacuated tube collector - thermal analysis of liquid flat plate and evacuated tube collector compound parabolic concentrator - cylindrical parabolic concentrator - linear fresnel lens collector - paraboloidal dish collector - central tower receiver – PVT collector	
	Unit -3	9
	Solar water heater – Solar air heater - solar passive space heating and cooling systems - solar cooker - solar dryer - solar distillation – solar pond – solar refrigeration and air conditioning system- solar thermal power plant - solar industrial process heating systems	
	Unit – 4	10
	Solar cell fundamentals - solar cell characteristics –various generations of solar cell- classification – Si wafer-based pv technology - thin film amorphous si technologies - thin film crystalline si cell technologies - dye-sensitized solar cell technology - organic solar cell technology - quantum dot solar cell technology-Perovskite solar cells – Solar PV applications	
	Unit – 5	9
	Current status of solar energy technologies and markets - The economics of solar energy - Barriers to the development and deployment of solar energy technologies - Government initiatives to promote solar energy - Major achievements in solar sector- Future prospects for solar energy	
COURSE TOTAL		45

16. Brief description of tutorial activities

Numerical problems will be taught and practiced in the tutorial classes

17. Brief description of laboratory activities

Module No.	Experiment description	No. of hours

18. Suggested texts and reference materials

Text Books:

1. Garg H.P., Prakash J., Solar Energy – Fundamentals and Applications, Tata McGraw Hill,

2000.
2. Sukhatme S.P. and Nayak J.K., Solar Energy – Principles of Thermal Collection and Storage, Tata McGraw Hill, 2010.
3. Khan B.H., Non-Conventional Energy Resources, 3rd ed., McGraw Hill, 2017

Reference Books:

1. Napoleon Enteria and Aliakbar Akbarzadeh, Solar Energy Sciences and Engineering Applications, CRC press, 2014.
2. Robert Foster, Majid Ghassemi and Alma Cota, Solar Energy: renewable Energy and the Environment, CRC press, 2010.

Websites

1. https://www.sciencedirect.com/science/article/abs/pii/S1364032111004643

19. Resources required for the course (*itemized and student access requirements, if any*)

19.1.	Software	
19.2.	Hardware	
19.3.	Teaching aides (videos,etc)	
19.4.	Laboratory	
19.5.	Equipment	
19.6.	Classroom infrastructure	**LCD**
19.7.	Site visits	**Nearby Solar Power plants**

20. Design content of the course (*Percent of student time with examples, if possible*)

20.1.	Design-type problems	
20.2.	Open-ended problems	
20.3.	Project-type activity	
20.4.	Open-ended laboratory work	
20.5.	Others : Fundamentals	

Date: **(Signature of the Head of the Department)**

Course: Total Quality Management

1.	**Department/Centre proposing the course**	**Mechanical Engg**
2.	**Course Title** *(< 45 characters)*	**Total Quality Management**
3.	**L-T-P structure**	3-0-0
4.	**Credits**	3
5.	**Course number**	**ME08TPE061**
6.	**Status** (*category* for *program*)	**Professional Elective-06 (ME08TPE06)**
7	**Pre-requisites** (course no./title)	NA
8.	**Status vis-à-vis other courses** *(give course number/title)*	
8.1	Overlap with any UG/PG course of the Dept./Centre	No
8.2	Overlap with any UG/PG course of other Dept./Centre	No
8.3	Supercedes any existing course	NA
9.		
10.	**Frequency of offering**	4rd year/8sem
11.	**Faculty who will teach the course**	Specialized faculties of Management/Industrial area
12.	**Will the course require any visiting faculty**	NA
13.	**Course objective and outcomes** *(about 50 words)***:**	1. Describe the various characteristic of quality control and many Statistical Quality Control charts. 2. Explain the architectures of Quality Assurance and Acceptances Sampling schemes 3. Elaborate the philosophies of TQM gurus and their contribution to control quality. 4. Explain the various models of Introduction to ISO 9000 and QC tools 5. Discuss the fundamental aspects of Reliability and Reliability mapping system. After studying this course, the students will be able to: 1. Analysis the characteristic of quality control exploring Statistical Quality Control charts. 2. Explore Quality Assurance and Acceptances Sampling schemes in industries and social life. 3. Apply TQM philosophies in industries to control quality of goods. 4. Apply ISO 9000 system and QC tools to win trust of

		customers. 5. Analysis and apply to enhance the Reliability of manufacturing goods.
14.	**Course contents** *(about 100 words) (Include laboratory/design activities)***:**	Basic concepts of Quality: Inspection, quality control cost of quality, Value of quality, Statistical Quality Control, Need and advantages of SQC. Variables & attributes, quality characteristics, Theory of control charts, control chart for variable. Quality assurance Manual, Quality Circle, characteristics of quality circle. Acceptances Sampling: Concept of sampling, O-C curve & its construction, Sampling plans, single, doubles & multiple sampling plans. Juran Triology, Deming's 14 Points, P-D-C-A Wheel, Taguchi's philosophy, Design of experiment, old and new Seven QC Tool of Quality, Philip Crosby's zero defect, Quality function deployment. Introduction to ISO 9000, TQM and Six Sigma**,** Bench marking process.

Lecture Outline *(with topics and number of lectures)*

Module no.	Topics	No of hours
1	**Basic concepts of Quality:** Inspection, definition of quality, quality control cost of quality, Value of quality, Statistical Quality Control, Need and advantages of SQC.	2
2	**Frequency distribution:** Variables & attributes, quality characteristics, Theory of control charts, control chart for variable X & R chart, Control chart for attribution p, np, C, Chart & process capability.	4
3	**Quality Assurance:** Quality assurance Manual, Quality Circle, characteristics of quality circle and the process of operation of quality circle, quality Policy & procedure &objectives.	3
4	**Acceptances Sampling:** Concept of sampling, O-C curve & its construction, Sampling plans, single, doubles & multiple sampling plans.	3
5	**Contribution of Various Quality Management Gurus:** Juran Triology, Deming's 14 Points, P-D-C-A Wheel, Taguchi's philosophy, Design of experiment, old and new Seven QC Tool of Quality, Philip Crosby's zero defect, Quality function deployment.	8
6	**Introduction to ISO 9000:** Various models of ISO 9000, Clauses of 9000, Total Quality Control, Total Quality Management, Tools for TQC & 5's TQM, Kaizen. Seven types of waste, 6 sigma quality, procedure of six sigma, TQM and Six Sigma**,** Bench marking process.	8
7.	**Reliability:** Definitions, Bathtub curve, design for reliability, Failures& causes of failures, FMEA-stages, types, Maintainability & Availability, MTBF, and Reliability Models. System with components in series & in parallel, mixed arrangement, fault –tree-technique.	8
Course Total		36

16. Brief description of tutorial activities

NA

17. Brief description of laboratory activities

Module no.	Experimental descriptions	No of hours
1	NA	
Course Total		

18. Suggested texts and reference materials

Style: Book Title, Author name and initials, Edition, Publisher

1. SQC by Grant & Livingsworth - Tata Mc. Hill
2. Quality Planning & Analysis by Juran&Gryna - Tata Mc. Hill
3. Total Quality Control By a Feigenbaum - Mcgraw Hill
4. SQC by M.Mahajan-Dhanpatrai publication
5. Total quality management-Besterfield Tata Mc. Hill)
6. Total quality management-Purnimacharantimath (Low Pearson Education
7. Total Quality Management- Krishnaiya-PHI
8. Total Quality Management – Suganthi&Sannuel-PHI
9. Total Quality Management-James R. Evans and James W. Dean. 2002, South Western Educational Publishing.
10. Total Quality Management (TQM)-Besterfield Dale H, Besterfield Carol, Besterfield Glen. H, Besterfield Mary, Urdhwareshe Hemant, Urdhwareshe Rashmi, 2018, 5E-Pearson Paperback.

19. Resources required for the course *(itemized & student access requirements, if any)*

19.1	Software	NA
19.2	Hardware	NA
19.3	Teaching aides (videos, etc.)	NA
19.4	Laboratory	NA
19.5	Equipment	NA
19.6	Classroom infrastructure	NA
19.7	Site visits	NA

20. Design content of the course *(Percent of student time with examples, if possible)*

20.1	Design-type problems	
20.2	Open-ended problems	
20.3	Project-type activity	30%
20.4	Open-ended laboratory work	
20.5	Others (please specify)	

Date: (Signature of the Head of the Department)

COURSE TEMPLATE

1.	**Department/Centre proposing the course**	Mechanical Engineering
2.	**Course Title**	**CRYOGENIC ENGINEERING**
3.	**L-T-P structure**	3-0-0
4.	**Credits**	3
5.	**Course number**	**ME08TPE62**
6.	**Status** (*category* for *program*)	Theory (Professional Elective)

7.	**Pre-requisites** (course no./title)	Thermodynamics, Heat Transfer, Refrigeartion and air Conditioning
8.	**Status vis-à-vis other courses***(give course number/title)*	
8.1	Overlap with any UG/PG course of the Dept./Centre	No
8.2	Overlap with any UG/PG course of other Dept./Centre	No
8.3	Supercedes any existing course	No

9		

10	**Frequency of offering**	Every sem☒ 1st sem☒ 2nd sem☒ Eithersem☒
11	**Faculty who will teach the course**	
12	**Will the course require any visiting faculty?**	No

13 **Course objectives:**

- To provide the knowledge of evolution of low temperature science.
- To provide the knowledge of properties of materials at low temperatures.
- Know about various liquefaction systems.
- Know about various vacuum technologies used for cryogenics.
- Know the applications of cryogenics.

Course Outcomes:

- Understand methods of producing very low temperatures.
- Understand the properties of materials at low temperatures.
- Find applications of cryogenics
- Possess basic knowledge of gas liquefaction technologies.

14	**Course contents:** **Unit 1** **Introduction to Cryogenics:** Historical development, properties of cryogenic fluids like Oxygen, Nitrogen, Argon, Neon, Florin, Helium, Hydrogen, Low Temperature properties of Engineering Materials, Mechanical properties- Thermal properties- Electric and magnetic properties –Cryogenic fluids and their properties. **Unit 2** **Cryogenic refrigeration:** Principle and Methods of production of low temperature and their analysis: Joule Thomson Expansion, Linde -Hampson cycles, Claude and cascaded systems, magnetic cooling, Stirling Cycle Cryocoolers, Philips refrigerators, Gifford single volume refrigerator, Pulse tube refrigerators. Liquefaction systems- Liquefaction systems for Neon. Hydrogen and Helium –Critical components of Liquefaction systems **Unit 3** **Gas separation and purification:** Ideal gas, mixture characteristics composition diagrams, gas separation, principle of rectification, plate calculation, flash calculation rectification column analysis, separation of air, hydrogen and helium, gas purification methods. **Unit 4** **Cryogenic Fluid Storage Systems** Introduction, Basic Storage vessels, inner vessel, outer vessel design, piping, access manways, safety device. **Cryogenic insulations:** Vacuum insulation, gas filled powders and fibrous materials, solid foam, selection and comparison of insulations. Cryogenic fluid transfer systems. Transfer through uninsulated lines, vacuum insulated lines, porous insulated lines etc. **Unit 5** **Applications of Cryogenics:** Applications in space, Food Processing, super conductivity, Electrical Power, Biology, Medicine, Electronics and Cutting Tool Industry. Low temperature properties of engineering materials **Safety in cryogenic fluid handling, storage and use**. Safety against cryogen hazards like burns, frostbite, asphyxiation, hypothermia etc.

15. Lecture Outline*(with topics and number oflectures)*

Module no.	Topic	No. of hours
1	Introduction to Cryogenics: Historical development, properties of cryogenic fluids like Oxygen, Nitrogen, Argon, Neon, Florin, Helium, Hydrogen, Low Temperature properties of Engineering Materials, Mechanical properties- Thermal properties- Electric and magnetic properties –Cryogenic fluids and their properties.	10

2	Cryogenic refrigeration: Principle and Methods of production of low temperature and their analysis: Joule Thomson Expansion, Linde -Hampson cycles, Claude and cascaded systems, magnetic cooling, Stirling Cycle Cryocoolers, Philips refrigerators, Gifford single volume refrigerator, Pulse tube refrigerators. Liquefaction systems- Liquefaction systems for Neon. Hydrogen and Helium –Critical components of Liquefaction systems	10
3	Gas separation and purification: Ideal gas, mixture characteristics composition diagrams, gas separation, principle of rectification, plate calculation, flash calculation rectification column analysis, separation of air, hydrogen and helium, gas purification methods.	08
4	Cryogenic Fluid Storage Systems Introduction, Basic Storage vessels, inner vessel, outer vessel design, piping, access manways, safety device. Cryogenic insulations: Vacuum insulation, gas filled powders and fibrous materials, solid foam, selection and comparison of insulations. Cryogenic fluid transfer systems. Transfer through uninsulated lines, vacuum insulated lines, porous insulated lines etc.	08
5	Applications of Cryogenics: Applications in space, Food Processing, super conductivity, Electrical Power, Biology, Medicine, Electronics and Cutting Tool Industry. Low temperature properties of engineering materials Safety in cryogenic fluid handling, storage and use. Safety against cryogen hazards like burns, frostbite, asphyxiation, hypothermia etc.	08
	COURSE TOTAL	44

16. Brief description of tutorial activities

- Numerical on the COP of different air refrigeration system
- Numerical on VCRs and its COP
- Numerical on COP of VARs
- Numerical on Air Conditioning LOAD Calculation
- Numerical on Psychometric Chart

17. Brief description of laboratory activities

Module no.	Experiment description	No. of hours
	N.A.	
	COURSE TOTAL	

18. Suggested texts and reference materials

TEXT BOOKS:

1. Cryogenic Systems – R.F. Barron, Oxford University Press, New York, 1999
2. Cryogenic Engineering – R.B. Scott – D.Van Nostrand Company
3. Applied Cryogenic Engineering–R W Yance and WM Duke, John Willey.

REFERENCE BOOKS:

1. Cryogenic Process Engineering – K.D. Timmerhaus and T.M. Flynn, Plenum Press, New York, 1989
2. High Vacuum Technology – A. Guthree – New Age International Publication
3. Experimental Techniques in Low Temperature Physics – G.K. White – Oxford University Press, England, 1959
4. Cryogenic Engineering–T.M Flynn, Maxwell Dekker, 1997.
5. Cryogenic Engineering–Scoot, Van Nostrand Co. Inc. 1985.

19. Resources required for the course *(itemized & student access requirements, if any)*

19.1	Software	
19.2	Hardware	
19.3	Teaching aids (videos, etc.)	
19.4	Laboratory	Cryogenic Laboratory Required
19.5	Equipment	
19.6	Classroom infrastructure	
19.7	Site visits	Cryogenic plant.

20. Designcontentofthecourse*(Percentofstudenttimewithexamples,ifpossible)*

20.1	Design-type problems	20% Numerical
20.2	Open-ended problems	
20.3	Project-type activity	
20.4	Open-ended laboratory work	
20.5	Others (please specify)	80 % Derivation and theory

Date: (Signature of the Head of theDepartment)

Additive Manufacturing

1.	**Department/Center proposing the course**	Mechanical Engineering
2.	**Course title**	Additive Manufacturing
3.	**L-T-P Structure**	3-0-0
4.	**Credits**	3
5.	**Course number**	ME8TPC18
6.	**Status (Category for program)**	Elective

7.	**Pre-requisites**	Engineering Mechanics, Manufacturing Technology, CAD/CAM, Design of Machine Elements

8.	Status vis-à-vis other courses (Give Course number/title)	
8.1.	Overlap with any UG/PG course of the Dept./Centre	No
8.2.	Overlap with any UG/PG course of other Dept./Centre	No
8.3.	Super cedes any existing course	No

9.	Not allowed for **(indicate program names)**	

10.	Frequency of offering	☐ Every sem	☐ 1st Sem	× 2nd Sem ☐ Either Sem

11.	**Faculty who will teach the course**	

12.	**Will the course require any visiting faculty**	

13.	**Course objective***(about 50 words):* • To exploit technology used in additive manufacturing. • To understand importance of additive manufacturing in advance manufacturing process. • To acquire knowledge, techniques and skills to select relevant additive manufacturing process. • To explore the potential of additive manufacturing in different industrial sectors. • To apply 3D printing technology for additive manufacturing.

14.	**Course outcome***(about 50 words):* • Able to define the various process used in Additive Manufacturing • Able to analyse and select suitable process and materials used in Additive Manufacturing. • Able to identify, analyse and solve problems related to Additive Manufacturing. • Able to apply knowledge of additive manufacturing for various real-life applications. • Able to apply technique of CAD and reverse engineering for geometry transformation in Additive Manufacturing.
15.	**Course contents***(about 100 words) (include laboratory/design activities)*: **Unit-1Introduction** Overview, Basic principle need and advantages of additive manufacturing, Procedure of product development in additive manufacturing, Classification of additive manufacturing processes, Materials used in additive manufacturing, Challenges in Additive Manufacturing. **Unit-2Additive Manufacturing Processes** Z-Corporation 3D-printing, Stereolithography apparatus (SLA), Fused deposition modeling (FDM), Laminated Object Manufacturing (LOM), Selective deposition lamination (SDL), Ultrasonic consolidation, Selective laser sintering (SLS), Laser engineered net shaping (LENS), Electron beam free form fabrication (EBFFF), Electron beam melting (EBM), Plasma transferred arc additive manufacturing (PTAAM), Tungsten inert gas additive manufacturing (TIGAM), Metal inert gas additive manufacturing (MIGAM). **Unit-3Additive Manufacturing Machines and Systems** Axes, Linear motion guide ways, Ball screws, Motors, Bearings, Encoders/ Glass scales, Process Chamber, Safety interlocks, Sensors. Introduction to NC/CNC/DNC machine tools, CNC programming and introduction, Hardware Interpolators, Software Interpolators, Recent developments of CNC systems for additive manufacturing. **Unit-4Pre-Processing in Additive Manufacturing** Preparation of 3D-CAD model, Reverse engineering, Reconstruction of 3D-CAD model using reverse engineering, Part orientation and support generation, STL Conversion, STL error diagnostics, Slicing and Generation of codes for tool path, Surface preparation of materials. **Unit-5Post-Processing in Additive Manufacturing** Support material removal, surface texture improvement, accuracy improvement, aesthetic improvement, preparation for use as a pattern, property enhancements using non-thermal and thermal techniques, Brief information on characterization techniques used in additive manufacturing, Applications of

	additive manufacturing in rapid prototyping, rapid manufacturing, rapid tooling, repairing and coating.

16. **Lecture outline***(with topics and number of lectures)*

Module No.	Topics	No. of hours
1.	**Introduction** Overview, Basic principle need and advantages of additive manufacturing, Procedure of product development in additive manufacturing, Classification of additive manufacturing processes, Materials used in additive manufacturing, Challenges in Additive Manufacturing.	8
2	**Additive Manufacturing Processes** Z-Corporation 3D-printing, Stereolithography apparatus (SLA), Fused deposition modeling (FDM), Laminated Object Manufacturing (LOM), Selective deposition lamination (SDL), Ultrasonic consolidation, Selective laser sintering (SLS), Laser engineered net shaping (LENS), Electron beam free form fabrication (EBFFF), Electron beam melting (EBM), Plasma transferred arc additive manufacturing (PTAAM), Tungsten inert gas additive manufacturing (TIGAM), Metal inert gas additive manufacturing (MIGAM).	10
3	**Additive Manufacturing Machines and Systems** Axes, Linear motion guide ways, Ball screws, Motors, Bearings, Encoders/ Glass scales, Process Chamber, Safety interlocks, Sensors. Introduction to NC/CNC/DNC machine tools, CNC programming and introduction, Hardware Interpolators, Software Interpolators, Recent developments of CNC systems for additive manufacturing.	6
4	**Pre-Processing in Additive Manufacturing** Preparation of 3D-CAD model, Reverse engineering, Reconstruction of 3D-CAD model using reverse engineering, Part orientation and support generation, STL Conversion, STL error diagnostics, Slicing and Generation of codes for tool path, Surface preparation of materials.	6
5	**Post-Processing in Additive Manufacturing** Support material removal, surface texture improvement, accuracy improvement, aesthetic improvement, preparation for use as a pattern, property enhancements using non-thermal and thermal techniques, Brief information on characterization techniques used in additive manufacturing, Applications of additive manufacturing in rapid prototyping, rapid manufacturing, rapid tooling, repairing and coating.	10
COURSE TOTAL		40

17. Brief description of tutorial activities

The tutorial problems are associated with individual units.

18. Brief description of laboratory activities

Module No.	Experiment description	No. of hours

19. Suggested texts and reference materials

1. Gibson, I, Rosen, D W., and Stucker,B., Additive Manufacturing Methodologies: Rapid Prototyping to Direct Digital Manufacturing,Springer, 2010
2. Chua C.K., Leong K.F., and Lim C.S., "Rapid prototyping: Principles and applications", Third Edition, World Scientific Publishers, 2010
3. Chee Kai Chua, Kah Fai Leong, 3D Printing and Additive Manufacturing: Principles and Applications: Fourth Edition of Rapid Prototyping, World Scientific Publishers, 2014
4. Gebhardt A., "Rapid prototyping", Hanser Gardener Publications, 2003.

20. Resources required for the course (*itemized and student access requirements, if any*)

20.1.	Software	
20.2.	Hardware	
20.3.	Teaching aides (videos,etc)	**Req**
20.4.	Laboratory	
20.5.	Equipment	
20.6.	Classroom infrastructure	**Req**
20.7.	Site visits	

21. Design content of the course (*Percent of student time with examples, if possible*)

21.1.	Design-type problems	
21.2.	Open-ended problems	
21.3.	Project-type activity	
21.4.	Open-ended laboratory work	
21.5.	Others (please specify)	

Date: **(Signature of the Head of the Department)**

Course Template

1.	**Department/Center proposing the course**	Mechanical Engineering
2.	**Course title**	Automobile Engineering
3.	**L-T-P Structure**	3-0-0
4.	**Credits**	3
5.	**Course number**	ME08TOE51
6.	**Status (Category for program)**	Open Elective-5

7.	**Pre-requisites**	Engineering Mechanics, Theory of Machines, Internal Combustion Engine, Design of Machine Elements

8.	Status vis-à-vis other courses (Give Course number/title)	
8.1.	Overlap with any UG/PG course of the Dept./Centre	No
8.2.	Overlap with any UG/PG course of other Dept./Centre	No
8.3.	Super cedes any existing course	No

9.	Not allowed for **(indicate program names)**	

10.	Frequency of offering	☐ Every sem	☐ 1st Sem	■ × 2nd Sem	Either Sem

11.	**Faculty who will teach the course**	

12.	**Will the course require any visiting faculty**	

13.	**Course objective** *(about 50 words):* • To understand the basic structure of an automobile. • To provide the concept of various sub systems associated with automobiles. • To get an idea of different types of loads, resistances & safety features present in automobiles. • To understand the functions of individual components associated with vehicles. • To get knowledge on modern technology implemented in vehicles.

14.	**Course outcome** *(about 50 words):* • Graduates will gain a strong foundation in core automobile engineering, both in theoretical & applied concepts. • Acquire knowledge and hands-on competence in the design & development of an automobile. • Graduates will be able to demonstrate & get an idea in identifying the problems in automobile.

15.	**Course contents** *(about 100 words) (include laboratory/design activities)*: • **Unit-1**, Introduction: Introduction of an automobile, component & basic structure of automobile, classification, types of chassis layout with reference to prime mover location & drives. Vehicle frames: various types of frames, constructional details, materials, testing of vehicle frames, defects in frames, frameless construction & specifications, loads acting on the vehicle frame, chassis lubrication & calculation of stresses on sections. • **Unit-2**, Front axle & steering system: Types of front axles, construction details, materials. Front wheel geometry viz. castor, camber, king pin inclination, Toe-in. Condition for true rolling motion of wheels during steering. Steering geometry, Ackerman & Davis steering system. Constructional details of steering linkages, different types of steering gears. Power & power assisted steering. • **Unit-3**, Transmission system: Function of transmission system, types: Sliding mesh, constant mesh & synchromesh gear box. Torque converter: Principle of operation, construction, performance characteristics, multiphase & polyphaser torque converter. Automatic transmission: Epi-cyclic gear box, determination of gear ratios for the vehicles. Clutches. Hydrostatic drive system: Types, principles, advantage & limitation, construction & working. Electric drive: Principle of early & modified Ward Leonard control system, advantages & limitations. Continually Variable Transmission (CVT): Operating principle, basic layout & operation, advantages & disadvantages. • **Unit-4**: Braking system: Necessity of brake, stopping distance & time, brake efficiency, weight transfer, brake shoe, determination of braking torque. Braking systems: Mechanical, hydraulic, disc, drum, parking & emergency brakes. Power, servo & electrical brakes. Details of hydraulic system, mechanical system & components, master cylinder, factors influencing the operation of brakes such as: operating temperature, lining, brake clearance, pedal pressure, linkages etc. Different types of retarders: Eddy current & hydraulic retarders. Antilock braking system. • **Unit-5**: Driveline: Effect of driving thrust & torque reactions. Hotchkiss drive & torque tube drive, Propeller shaft, Universal joint, Constant velocity universal joint. Front wheel drive. • **Unit-6**: Final drive & differential: Different types of final drive: Worm & worm wheel, straight bevel gear, spiral bevel gear 7 hypoid gear final drives. Differential principles. Constructional details of differential unit. Non-slip differential.

	• **Unit-7**: Suspension & safety system: Need of suspension system, types of front & rear suspension system, constructional details & characteristics of leaf spring, coil spring & torsion bar. Telescopic type shock absorbers, pneumatic suspension system, air bags, crash resistance & passenger comfort. • **Unit-8**: Rear axles: Construction of rear axles, types of rear axles: full floating, three quarter floating & semi floating rear axles. Rear axle housing. Construction of different types of axle housing. Multi-axle vehicles, constructional details of multi-axle vehicles. • **Unit-9**: Wheels & tires: Types of wheels, construction, weird wheels, tires, construction, types: radial, bias & belted bias, slip angle, under & oversteering, tread patterns, tire specification, tubeless tire. • **Unit-10**: Modern vehicle technology: Fuel cells technology for vehicles: what is fuel cell? type of fuel cell, advantages, current state of the technology, potential & challenges. Stratified charged/learn burn engines-hydrogen engines, advantages & disadvantages of hydrogen fuel. Electrical & hybrid vehicles, magnetic track vehicle. Latest engine technology features: DTS-I, GDI, Variable valve timing, electromagnetic valves.

16. **Lecture outline** *(with topics and number of lectures)*

Module No.	Topics	No. of hours
1.	**Introduction:** Introduction of an automobile, component & basic structure of automobile, classification, types of chassis layout with reference to prime mover location & drives. Vehicle frames: various types of frames, constructional details, materials, testing of vehicle frames, defects in frames, frameless construction & specifications, loads acting on the vehicle frame, chassis lubrication & calculation of stresses on sections.	4
2	**Front axle & steering system:** Types of front axles, construction details, materials. Front wheel geometry viz. castor, camber, king pin inclination, Toe-in. Condition for true rolling motion of wheels during steering. Steering geometry, Ackerman & Davis steering system. Constructional details of steering linkages, different types of steering gears. Power & power assisted steering.	4
3	**Transmission system:** Function of transmission system, types: Sliding mesh, constant mesh & synchromesh gear box.	4

	Torque converter: Principle of operation, construction, performance characteristics, multiphase & polyphaser torque converter. Automatic transmission: Epi-cyclic gear box, determination of gear ratios for the vehicles. Clutches. Hydrostatic drive system: Types, principles, advantage & limitation, construction & working. Electric drive: Principle of early & modified Ward Leonard control system, advantages & limitations. Continually Variable Transmission (CVT): Operating principle, basic layout & operation, advantages & disadvantages.	
4	**Braking system:** Necessity of brake, stopping distance & time, brake efficiency, weight transfer, brake shoe, determination of braking torque. Braking systems: Mechanical, hydraulic, disc, drum, parking & emergency brakes. Power, servo & electrical brakes. Details of hydraulic system, mechanical system & components, master cylinder, factors influencing the operation of brakes such as: operating temperature, lining, brake clearance, pedal pressure, linkages etc. Different types of retarders: Eddy current & hydraulic retarders. Antilock braking system.	4
5	**Driveline:** Effect of driving thrust & torque reactions. Hotchkiss drive & torque tube drive, Propeller shaft, Universal joint, Constant velocity universal joint. Front wheel drive.	4
6	**Final drive & differential:** Different types of final drive: Worm & worm wheel, straight bevel gear, spiral bevel gear 7 hypoid gear final drives. Differential principles. Constructional details of differential unit. Non-slip differential.	4
7	**Suspension & safety system:** Need of suspension system, types of front & rear suspension system, constructional details & characteristics of leaf spring, coil spring & torsion bar. Telescopic type shock absorbers, pneumatic suspension system,	4

	air bags, crash resistance & passenger comfort.	
8	**Rear axles:** Construction of rear axles, types of rear axles: full floating, three quarter floating & semi floating rear axles. Rear axle housing. Construction of different types of axle housing. Multi-axle vehicles, constructional details of multi-axle vehicles.	4
9	**Wheels & tires:** Types of wheels, construction, weird wheels, tires, construction, types: radial, bias & belted bias, slip angle, under & oversteering, tread patterns, tire specification, tubeless tire.	4
10	**Modern vehicle technology:** Fuel cells technology for vehicles: what is fuel cell? type of fuel cell, advantages, current state of the technology, potential & challenges. Stratified charged/learn burn engines-hydrogen engines, advantages & disadvantages of hydrogen fuel. Electrical & hybrid vehicles, magnetic track vehicle. Latest engine technology features: DTS-I, GDI, Variable valve timing, electromagnetic valves.	4
COURSE TOTAL		40

17. Brief description of tutorial activities

The tutorial problems are associated with individual units.

18. Brief description of laboratory activities

Module No.	Experiment description	No. of hours

19. Suggested texts and reference materials

1. Automobile Engineering, K.K. Ramalingam, Scitech Publications Pvt Ltd.
2. Automobile Technology, Dr. N.K. Giri, Khanna Publishers.
3. Automobile Engineering, Prof. Amitosh De, Galgotia Publications Pvt Ltd.
4. Modern Transmission Systems, A.W.Judge, Chapman & Hall Ltd.
5. Automotive Mechanics-Principle & Practice, Josepe Heitner, East West Press.
6. Torque Converter, P.M.Heldt, Chilton Book Co.

20. Resources required for the course (*itemized and student access requirements, if any*)

20.1.	Software	
20.2.	Hardware	
20.3.	Teaching aides (videos,etc)	**Req**
20.4.	Laboratory	
20.5.	Equipment	
20.6.	Classroom infrastructure	**Req**
20.7.	Site visits	

21. Design content of the course (*Percent of student time with examples, if possible*)

21.1.	Design-type problems	
21.2.	Open-ended problems	
21.3.	Project-type activity	
21.4.	Open-ended laboratory work	
21.5.	Others (please specify)	

Date: **(Signature of the Head of the Department)**

Course Template

1.	**Department/Center proposing the course**	Mechanical Engineering
2.	**Course title**	Soft Computing
3.	**L-T-P Structure**	3-0-0
4.	**Credits**	3
5.	**Course number**	ME08TOE52
6.	**Status (Category for program)**	Open elective 5

7.	**Pre-requisites**	

8.	Status vis-à-vis other courses (Give Course number/title)	
8.1.	Overlap with any UG/PG course of the Dept./Centre	No
8.2.	Overlap with any UG/PG course of other Dept./Centre	No
8.3.	Super cedes any existing course	No

9.	Not allowed for **(indicate program names)**	

10.	Frequency of offering	☐ Every sem ☐ 1st Sem ☐ Sem	8 th Sem Either

11.	**Faculty who will teach the course**	

12.	**Will the course require any visiting faculty**	

13.	**Course objective** *(about 50 words):* CO 1 Understand the fuzzy logic and the concept of fuzziness in various systems and fuzzy set theory. CO 2 Know the concepts of fuzzy sets, knowledge representation using fuzzy rules, approximate reasoning, fuzzy inference systems, and fuzzy logic CO 3 Define through genetic algorithms and other random search measures suitable while seeking global optimum in self learning circumstances. CO 4 Recognize suitable learning rules for individual of the architectures and acquire numerous neural network models and its applications. CO 5 Develop some understanding with recent research problems and research methods in Soft Computing Techniques.

14.	**Course outcome** *(about 50 words):* • Graduates will gain a strong foundation in Soft Computing both in theoretical & applied concepts. • Obtain knowledge and hands-on capability in the fuzzy logic and the concept of fuzziness • Graduates will be able to solve application based recent research problems and research methods in Soft Computing Techniques.

15	• **Unit I** Introduction to Soft Computing, ARTIFICIAL NEURAL NETWORKS Basic concepts - Single layer perception - Multilayer Perception - Supervised and Unsupervised learning – Back propagation networks - Kohnen's self-organizing networks - Hopfield network.
	• **Unit II** FUZZY SYSTEMS Fuzzy sets, Fuzzy Relations and Fuzzy reasoning, Fuzzy functions - Decomposition - Fuzzy automata and languages - Fuzzy control methods - Fuzzy decision making.
	• **Unit III** NEURO - FUZZY MODELING Adaptive networks based Fuzzy interface systems - Classification and Regression Trees - Data clustering algorithms - Rule based structure identification - Neuro-Fuzzy controls - Simulated annealing – Evolutionary computation
	• **Unit IV** GENETIC ALGORITHMS Survival of the Fittest - Fitness Computations - Cross over - Mutation - Reproduction - Rank method - Rank space method.
	• **Unit V** APPLICATION OF SOFT COMPUTING Optimization of traveling salesman problem using Genetic Algorithm, Genetic algorithm-based Internet Search Techniques, Soft computing based hybrid fuzzy controller, Introduction to MATLAB Environment for Soft computing Techniques.

16. Lecture outline *(with topics and number of lectures)*

Module No.	Topics	No. of hours
1	Introduction to Soft Computing, ARTIFICIAL NEURAL NETWORKS Basic concepts - Single layer perception - Multilayer Perception - Supervised and Unsupervised learning – Back propagation networks - Kohnen's self-organizing networks - Hopfield network.	08
2	FUZZY SYSTEMS Fuzzy sets, Fuzzy Relations and Fuzzy reasoning, Fuzzy functions - Decomposition - Fuzzy automata and languages - Fuzzy control methods - Fuzzy decision making.	08
3	NEURO - FUZZY MODELING Adaptive networks based Fuzzy interface systems - Classification and Regression Trees - Data clustering	08

	algorithms - Rule based structure identification - Neuro-Fuzzy controls - Simulated annealing – Evolutionary computation	
4	GENETIC ALGORITHMS Survival of the Fittest - Fitness Computations - Cross over - Mutation - Reproduction - Rank method - Rank space method.	08
5	APPLICATION OF SOFT COMPUTING Optimization of traveling salesman problem using Genetic Algorithm, Genetic algorithm based Internet Search Techniques, Soft computing based hybrid fuzzy controller, Introduction to MATLAB Environment for Soft computing Techniques.	08

17. Brief description of tutorial activities

The tutorial problems are associated with individual units.

18. Brief description of laboratory activities

Module No.	**Experiment description**	**No. of hours**

19. Suggested texts and reference materials

Text books:

1. An Introduction to Genetic Algorithm Melanic Mitchell (MIT Press)
2.Evolutionary Algorithm for Solving Multi-objective, Optimization Problems (2nd Edition), Collelo, Lament, Veldhnizer (Springer)
3.Fuzzy Logic with Engineering Applications Timothy J. Ross (Wiley)
4.Neural Networks and Learning Machines Simon Haykin (PHI)
5.Sivanandam, Deepa, “Principles of Soft Computing”, Wiley
6.Jang J.S.R, Sun C.T. and Mizutani E, "Neuro-Fuzzy and Soft computing", Prentice Hall
7.Timothy J. Ross, "Fuzzy Logic with Engineering Applications", McGraw Hill
8.Laurene Fausett, "Fundamentals of Neural Networks", Prentice Hall
9.D.E. Goldberg, "Genetic Algorithms: Search, Optimization and Machine Learning", Addison Wesley
10.Wang, “Fuzzy Logic”, Springer

20. Resources required for the course (*itemized and student access requirements, if any*)

a.	Software	
b.	Hardware	
c.	Teaching aides (videos,etc)	**Req**
d.	Laboratory	
e.	Equipment	

f.	Classroom infrastructure	**Req**
g.	Site visits	

21. Design content of the course (*Percent of student time with examples, if possible*)

a.	Design-type problems	
b.	Open-ended problems	
c.	Project-type activity	
d.	Open-ended laboratory work	
e.	Others (please specify)	

Date: **(Signature of the Head of the Department)**

COURSE TEMPLATE

1.	**Department/Centre proposing the course**	Mechanical Engineering
2.	**Course Title**	Intellectual Property Rights (IPR)
3.	**L-T-P structure**	3-0-0
4.	**Credits**	3
5.	**Course number**	
6.	**Status** (*category*for *program*)	

7.	**Pre-requisites** (course no./title)	
8.	**Status vis-à-vis other courses***(give course number/title)*	
8.1	Overlap with any UG/PG course of the Dept./Centre	No
8.2	Overlap with any UG/PG course of other Dept./Centre	No
8.3	Supercedes any existing course	No

9		

10	**Frequency of offering**	Every sem ☒ 1st sem ☒ 2nd sem ☒ Eithersem ☒
11	**Faculty who will teach the course**	
12	**Will the course require any visiting faculty?**	**Yes**

13	**Course objective:** It will create consciousness for Intellectual Property Rights and its constituents. Learners will be able to perform documentation and administrative procedures relating to IPR in India as well as abroad.

14	**Course contents:** **Unit I** Introduction to Intellectual property: Introduction, types of intellectual property, international organizations, agencies and treaties, importance of intellectual property rights.

Unit II

Trade Marks: Purpose and function of trademarks, acquisition of trade mark rights, protectable matter, selecting, and evaluating trade mark, trade mark registration processes.

UNIT III

Law of copy rights: Fundamental of copy right law, originality of material, rights of reproduction, rights to perform the work publicly, copy right ownership issues, copy right registration, notice of copy right, international copy right law. Law of patents: Foundation of patent law, patent searching process, ownership rights and transfer

Unit IV

Trade Secrets: Trade secrete law, determination of trade secrete status, liability for misappropriations of trade secrets, protection for submission, trade secrete litigation. Unfair competition: Misappropriation right of publicity, false advertising.

Unit V

New development of intellectual property: new developments in trade mark law; copy right law, patent law, intellectual property audits. International overview on intellectual property, international – trade mark law, copy right law, international patent law, and international development in trade secrets law.

15. Suggested texts and reference materials

1. Intellectual property right, Deborah. E. Bouchoux, Cengage learning.
2. Intellectual property right – Unleashing the knowledge economy, prabuddhaganguli, Tata McGraw Hill Publishing company ltd.
3. "Intellectual Property in New Technological Age",Robert P. Merges, Peter S. Menell, Mark A. Lemley, 2016.
4. "Intellectual Property Rights Under WTO",T. Ramappa, S. Chand, 2008.

Course: SCM

1.	**Department/Centre proposing the course**	**Mechanical Engg**
2.	**Course Title** *(< 45 characters)*	Supply Chain Management
3.	**L-T-P structure**	3-0-0
4.	**Credits**	3
5.	**Course number**	ME08THS41
6.	**Status** (*category* for *program*)	**ME08THS04 Elective from Humanity Science HS-04**
7	**Pre-requisites** (course no./title)	NA
8.	**Status vis-à-vis other courses** *(give course number/title)*	
8.1	Overlap with any UG/PG course of the Dept./Centre	No
8.2	Overlap with any UG/PG course of other Dept./Centre	No
8.3	Supercedes any existing course	No
9.		
10.	**Frequency of offering**	4^{th} year/8sem
11.	**Faculty who will teach the course**	Specialized faculties of Management/Industrial realm
12.	**Will the course require any visiting faculty**	Yes (Faculty work in collaboration with AMS industries need to visit for optimizing knowledge of students)
13.	**Course objective and outcomes** *(about 50 words)***:**	**Course Objectives:** 1. **Describes the strategic framework to analyze supply chains** 2. **Define the supply chain network distribution networks and applications to e-business.** 3. **Explain the planning, demand forecasting and aggregate planning a supply chain.** 4. **Define the planning and inventories, uncertainty management in a supply chain.** 5. **Understand the designing and planning transportation networks in a supply chain.** **Course outcomes:** **After studying course, the students are able to** **1 Build the strategic framework to analyze supply chains**

		2 Define the supply chain network distribution networks and applications to e-business. **3 Construct the planning, demand forecasting and aggregate planning a supply chain.** **4 Apply the planning and inventories, uncertainty management in a supply chain.** **5 Solve the designing and planning transportation networks in a Supply Chain.**
14.	**Course contents** *(about 100 words) (Include laboratory/design activities)***:**	**Building a Strategic Framework to Analyze Supply Chains:** What Is a Supply Chain. The Objective of a Supply Chain ,The Importance of Supply Chain Decisions, Decision Phases in a Supply Chain, Process View of a Supply Chain, Examples of Supply Chains. Supply Chain Performance: Achieving Strategic Fit and Scope ,Competitive and Supply Chain Strategies ,Achieving Strategic Fit ,Expanding Strategic Scope, Supply Chain Drivers and Metrics, Drivers of Supply Chain Performance, Framework for Structuring Drivers, Facilities ,Inventory ,Transportation ,Information ,Sourcing ,Pricing. Planning Demand and Supply in a Supply Chain Demand Forecasting in a Supply Chain: The Planning Supply and Demand in a Supply Chain: Managing Predictable Variability Planning Demand and Supply in a Supply Chain Demand Forecasting in a Supply Chain: Aggregate Planning in a Supply Chain.

Lecture Outline *(with topics and number of lectures)*

Module no.	Topics	No of hours
1	**UNIT I** **Building a Strategic Framework to Analyze Supply Chains:** What Is a Supply Chain. The Objective of a Supply Chain ,The Importance of Supply Chain Decisions, Decision Phases in a Supply Chain, Process View of a Supply Chain, Examples of Supply Chains.	4

2	Supply Chain Performance: Achieving Strategic Fit and Scope ,Competitive and Supply Chain Strategies ,Achieving Strategic Fit ,Expanding Strategic Scope, Supply Chain Drivers and Metrics, Drivers of Supply Chain Performance, Framework for Structuring Drivers, Facilities ,Inventory ,Transportation ,Information ,Sourcing ,Pricing.	3
	Unit-II	
3	**UNIT II** **Designing the Supply Chain Network Designing Distribution Networks and Applications to e-Business:** The Role of Distribution in the Supply Chain, Factors Influencing Distribution Network Design Options for a Distribution Network, e-Business and the Distribution Network, Distribution Networks in Practice. **Network Design in the Supply Chain:** The Role of Network Design in the Supply Chain, Factors Influencing Network Design Decisions Framework for Network Design Decisions, Models for Facility Location and Capacity Allocation, The role of IT in Network Design, Making Network Design Decisions in Practice **Network Design in an Uncertain Environment:** The Impact of Uncertainty on Network Design, Discounted Cash Flow Analysis ,Representations of Uncertainty ,Evaluating Network Design Decisions Using Decision Trees ,AM Tires: Evaluation of Supply, Chain Design Decisions Under Uncertainty ,Risk Management and Network Design 175,Making Supply Chain Decisions Under Uncertainty in Practice.	8
	Unit-III	
4	**Planning Demand and Supply in a Supply Chain Demand Forecasting in a Supply Chain:** The Role of Forecasting in a Supply Chain ,Characteristics of Forecasts ,Components of a Forecast and Forecasting Methods ,Basic Approach to Demand Forecast1ng ,Time-Series Forecasting Methods ,Measures of Forecast Error ,Forecasting Demand at Tahoe Salt ,The Role of IT in Forecasting, Risk Management in Forecasting ,Forecasting in Practice.	5
5	**Planning Supply and Demand in a Supply Chain: Managing Predictable Variability Planning Demand and Supply in a Supply Chain Demand Forecasting in a Supply Chain: Aggregate Planning in a Supply Chain:** The Role of Aggregate Planning in a Supply Chain, the Aggregate Planning Problem, Aggregate	3

	Planning Strategies, Aggregate Planning Using Linear Programming, Aggregate Planning in Excel, The Role of IT in Aggregate Planning, Implementing Aggregate Planning in Practice **Planning Supply and Demand in a Supply Chain: Managing Predictable Variability:** Responding to Predictable Variability in a Supply Chain, Managing Supply, Managing Demand Implementing Solutions to Predictable Variability in Practice	
	Unit-IV	
6	**Planning and Managing Inventories in a Supply Chain Managing Economies of Scale in a Supply Chain:** **Cycle Inventory:** The Role of Cycle Inventory in a Supply Chain, Economies of Scale to Exploit Fixed Costs, Economies of Scale to Exploit Quantity Discounts, Short-Term Discounting: Trade romotions, Managing Multiechelon Cycle Inventory, Estimating Cycle Inventory- Related Costs in Practice **Managing Uncertainty in a Supply Chain:** Safety Inventory: The Role of Safety Inventory in a Supply Chain ,Determining Appropriate Level of Safety Inventory Impact of Supply Uncertainty on Safety Inventory ,Impact of Aggregation on Safety Inventory ,Impact of Replenishment Policies on Safety Inventory ,Managing Safety Inventory in a Multiechelon Supply Chain ,The Role of IT in Inventory Management, Estimating and Managing Safety Inventory in Practice. **Determining the Optimal Level of Product Availability:** The Importance of the Level of Product Availability, Factors Affecting Optimal Level of Product Availability Managerial Levers to Improve Supply Chain Profitability, Setting Product Availability for Multiple Products under Capacity Constraints, Setting Optimal Levels of Product Availability in Practice	6
	UNIT-V	
7.	**Designing and Planning Transportation Networks Transportation in a Supply Chain:** The Role of Transportation in a Supply Chain, Modes of Transportation and Their Performance Characteristics, Transportation Infrastructure and Policies, Design Options for a Transportation Network Trade-Offs in Transportation Design, Tailored Transportation, The Role of IT in Transportation Risk Management in Transportation, Making Transportation Decisions in Practice	7

	Managing Cross-Functional Drivers in a Supply Chain Sourcing Decisions in a Supply Chain: The Role of Sourcing in a Supply Chain, In-House or Outsource, Third- and Fourth-Party Logistics Providers, Supplier Scoring and Assessment, Supplier Selection-Auctions and Negotiations Contracts and Supply Chain Performance ,Design Collaboration ,The Procurement Process ,Sourcing Planning and Analysis ,The Role of IT in Sourcing ,Risk Management in Sourcing ,Making Sourcing Decisions in Practice	
Course Total		36

- **Brief description of tutorial activities**

NA

- **Brief description of laboratory activities**

Module no.	Experimental descriptions	No of hours
1	NA	
Course Total		

1. **Suggested texts and reference materials**
   Style: Book Title, Author name and initials, Edition, Publisher

Text Books:

1. Supply Chain Management: Janat Shah, Pearson Publications.
2. Supply Chain Management: Sunil Chopra and Mein del, Fourth Edition, PHI.
3. Supply Chain Management: A.S.Altekar PHI Second Ed.
4. Logistics Management: James Stock and Douglas Lambert. McGraw Hill International Ed.
5. Supply Chain Management for Global Competitiveness: Ed.B.S.Sahay McMillan Publication
6. Emerging Trends in Supply Chain Management: Ed.B.S.Sahay McMillan Publication.
7. Logistics Management: Bowersox TMH.

1. **Resources required for the course** *(itemized & student access requirements, if any)*

19.1	Software	NA
19.2	Hardware	NA
19.3	Teaching aides (videos, etc.)	Projector assisted with computer to show industrial SC videos.
19.4	Laboratory	NA
19.5	Equipment	NA
19.6	Classroom infrastructure	Class room assisted with Projector with computer. (Smart class room)
19.7	Site visits	Yes, to make the students aware from real/actual

		practices of supply chain management.

3. Design content of the course *(Percent of student time with examples, if possible)*

20.1	Design-type problems	30%
20.2	Open-ended problems	
20.3	Project-type activity	30%
20.4	Open-ended laboratory work	
20.5	Others (please specify)	

Date: (Signature of the Head of the Department)

Course Template

1.	**Department/Center proposing the course**	Mechanical Engineering
2.	**Course title**	Management Information System
3.	**L-T-P Structure**	3-0-0
4.	**Credits**	3
5.	**Course number**	ME08THS42
6.	**Status (Category for program)**	Elective from Humanity Science HS-04

7.	**Pre-requisites**	Project Management

8.	Status vis-à-vis other courses (Give Course number/title)	
8.1.	Overlap with any UG/PG course of the Dept./Centre	No
8.2.	Overlap with any UG/PG course of other Dept./Centre	No
8.3.	Super cedes any existing course	No

9.	Not allowed for **(indicate program names)**	

10.	Frequency of offering	☐ Every sem	☐ 1st Sem	☐ 2nd Sem	Either Sem

11.	**Faculty who will teach the course**	

12.	**Will the course require any visiting faculty**	

13.	**Course objective***(about 50 words):* • Analyze systems development and project management methodologies. • Combine analytical thinking, creativity and business-problem-solving as applied to ongoing MIS challenges, future trends, and relevant case studies. • Express ethical awareness and moral reasoning applied to a MIS problem, issue or case study. Analyze systems development and project management methodologies. • Combine analytical thinking, creativity and business-problem-solving as applied to ongoing MIS challenges, future trends, and relevant case studies. • Express ethical awareness and moral reasoning applied to a MIS problem, issue or case study.

14.	**Course outcome***(about 50 words):* • **Critical Thinking:** Students will be required to evaluate techniques and processes to think differently and to solve and resolve problems by using technology, making informed decisions. • **Communication:** Through written and oral analyses of cases, students will further strengthen and enhance their skills in effective communication. All assignments and presentations will be prepared in professional language and format. • **Team Work:** Students will work collaboratively, demonstrating courtesy, using appropriate etiquette, in preparing and presenting presentations. • **Problem Solving:** Students will be required to not only identify problems but also generate solutions and make recommendations based on a logical and thorough analysis of the alternatives.

15.	**Course contents***(about 100 words) (include laboratory/design activities)*: • **Unit-1**, **Information for Decision Making:** Decision Making, Conceptual Foundations of Information Systems, Information Resources Management • **Unit-2**, **System Development:** Overview of Systems Analysis & Design, System Development Life Cycle, Designing On Line & Distributed Environments-Design Consideration, Implementation and Control of Projects • **Unit-3**, **Computer Networks & Data Communications:** Trends in Information Technology-Hardware, Software, Data Communication Concepts, Computer Networks • **Unit-4**: **Managing Corporate Data Resources:** Organizing Data, Relational Data Base Management Systems, Query Languages Including DSS, Applications and Illustrations • **Unit-5**: **Socio-Legal Aspects Of Computerization:** Social Dimensions of Computerization, Computer Viruses, Legal Dimensions of Computerization

16. **Lecture outline***(with topics and number of lectures)*

Module No.	Topics	No. of hours
1.	Definition of MIS- Data Processing , Decision Support Systems – Information Resources Management	4
2.	Decision Making Process – Problem Formulation - Programmed Vs Non Programmed Decision – Criteria for Decision Making	4
2	Classical Economical Model – Administrative Model – Resolution of Conflict – Uncertainty Avoidance – Problematic Search – Incremental Decision Making	4

3	Definition of Information – Redundancy – Sending and Receiving efficiency – utility of information – Errors and Bias -Value of Information and Sensitivity Analysis - Information system design.	4
4	Types of system – Subsystem- Preventing System entropy – System Stress – Organizational efficiency and effectiveness	4
5	Use of subsystems in information System Design – Decoupling of information systems – Project Management.	4
6	Logical Data Concepts , Sequencing of Data , Types of Files , Data Bases .Serial Access and Direct Access devices.	4
7	Sequential, Hashed and indexed File Organization – Data Base Organization – single flat File – Hierarchical , Network, Relational DB Structures. Transaction Processing – Control and Retrieval .	4
8	Social Dimensions of Computerization, Computer Viruses, Legal Dimensions of Computerization	4
9	Word and Text Processing . Document Filing Computer Graphics , Composition and Reproduction.	4
10	Document Distribution, Facsimile Transmission, Message Systems, Information Processing Control- Availability Controls.	4
COURSE TOTAL		40

17. Brief description of tutorial activities

The tutorial problems are associated with individual units.

18. Brief description of laboratory activities

Module No.	Experiment description	No. of hours

19. Suggested texts and reference materials

1. Kenneth C. Laudon,Management information systems: managing the digital firm.
2. Effy Oz, Management information systems, Course Technology India.
3. S. Sadagopan, Management information systems , PHI Learning Pvt. Ltd. 1998 Edition, PHI ISBN 81-20311809.
4. Gordon B. Davis And Maggrethe H . Olson , Management Information Systems , Mc Graw Hill International Edition - Second Edition , 1998.
5. Rober G . Mudrick , Joel E . Ross And James R . ClAGGET , Information Systems For Modern Management , 33rd Edition , 1992 , Prentice Hall Of India (P) Ltd ., Eastern Economy Edition.
6. Jerome Kanter Management Information Systems, 3rd Edition , 1990 . Prentice Hall Of India Ltd. , Eastern Economy Edition.
7. Murdick. G.R., Information systems for modern management", 2nd Edition. PHI.
8. Management Information systems- managing information technology in the internet worked enterprise- jams. A OBrien – Tata McGraw Hill publishing company limited, 2002.
9. Laaudon and Laudon, Management Information Systems", PHI ISBN 81-203-1282-1.1998.

20. Resources required for the course (*itemized and student access requirements, if any*)

20.1.	Software	
20.2.	Hardware	
20.3.	Teaching aides (videos,etc)	**Req**
20.4.	Laboratory	
20.5.	Equipment	
20.6.	Classroom infrastructure	**Req**
20.7.	Site visits	

21. Design content of the course (*Percent of student time with examples, if possible*)

21.1.	Design-type problems	
21.2.	Open-ended problems	
21.3.	Project-type activity	
21.4.	Open-ended laboratory work	
21.5.	Others (please specify)	

Date: **(Signature of the Head of the Department)**

Course: Principles of Management

1.	**Department/Centre proposing the course**	**Mechanical Engg**
2.	**Course Title** *(< 45 characters)*	**Principles of Management**
3.	**L-T-P structure**	3-0-0
4.	**Credits**	3
5.	**Course number**	**ME08THS43**
6.	**Status** (*category* for *program*)	**ME08THS04 Elective from Humanity Science HS-04**
7	**Pre-requisites** (course no./title)	NA
8.	**Status vis-à-vis other courses** *(give course number/title)*	
8.1	Overlap with any UG/PG course of the Dept./Centre	No
8.2	Overlap with any UG/PG course of other Dept./Centre	No
8.3	Supercedes any existing course	No
9.		
10.	**Frequency of offering**	4^{th} year/8 sem
11.	**Faculty who will teach the course**	Specialized faculties of Management
12.	**Will the course require any visiting faculty**	Yes (Faculty work in collaboration with industries need to visit for showing how those principles work)
13.	**Course objective and outcomes** *(about 50 words)***:**	**Course Objectives:** 1. Understand the skills, functions of managers and organization's types cum environments. 2. Nature, purpose and process of planning. 3. Understand the various motivation and leadership styles. 4. Recognize the various types of organizational structure and basic of job design. 5. Understand the various types of controlling processes. **Course Outcomes:** After studying this course, the students would be able to 1. Use the skills, functions of managers in controlling environment of many organizations. 2. Construct planning sheet and apply it. 3. Understand and apply the various motivation and leadership styles.

		4. Design the various types of organizational structure and job design schemes. 5. Solve the various types of controlling processes.
14.	**Course contents** *(about 100 words) (Include laboratory/design activities)***:**	Definition of management, science or art, manager vs entrepreneur; Types of managers managerial roles and skills; Evolution of management- scientific, human relations, system and contingency approaches; Types of Business Organizations, sole proprietorship, partnership, company, public and private enterprises; Organization culture and environment; Current trends and issues in management. Nature and purpose of Planning, types of Planning, objectives, setting objectives, policies, Strategic Management, Planning Tools and Techniques, Decision making steps & processes. Nature and purpose of Organizing, formal and informal organization, organization structure, types, line and staff authority, departmentalization, delegation of authority, centralization and decentralization, job design, human resource management, HR planning, Recruitment selection, Training & Development, Performance Management, Career planning and Management. Directing, individual and group behavior, motivation, motivation theories, motivational techniques, job satisfaction, job enrichment, leadership, types & theories of leadership, effective communication. Controlling, system and process of controlling, budgetary and non-budgetary control techniques, use of computers and IT in management control, productivity problems and management, control and performance, direct and preventive control, reporting.

Lecture Outline *(with topics and number of lectures)*

Module no.	Topics	No of hours
	Unit-I	
1	Definition of management, science or art, manager vs entrepreneur; Types of managers managerial roles and skills; Evolution of management- scientific, human relations, system and contingency approaches; Types of Business Organizations, sole proprietorship, partnership, company, public and private enterprises; Organization culture and environment; Current trends and issues in management.	7
	Unit-II	
2	Nature and purpose of Planning, types of Planning, objectives, setting objectives, policies, Strategic Management, Planning Tools and Techniques, Decision making steps & processes.	6
	Unit-III	
3	Nature and purpose of Organizing, formal and informal organization, organization structure, types, line and staff authority, departmentalization, delegation of authority, centralization and decentralization, job design, human	9

	resource management, HR planning, Recruitment selection, Training & Development, Performance Management, Career planning and Management.	
	Unit-IV	
4	Directing, individual and group behavior, motivation, motivation theories, motivational techniques, job satisfaction, job enrichment, leadership, types & theories of leadership, effective communication.	6
	Unit-V	
5	Controlling, system and process of controlling, budgetary and non-budgetary control techniques, use of computers and IT in management control, productivity problems and management, control and performance, direct and preventive control, reporting.	8
Course Total		36

16. Brief description of tutorial activities

NA

17. Brief description of laboratory activities

Module no.	Experimental descriptions	No of hours
1	NA	
Course Total		

18. Suggested texts and reference materials

Style: Book Title, Author name and initials, Edition, Publisher

Text Books:

Text Books:

1. Robins S.P. and Couiter M., Management, Prentice Hall India, 10th ed., 2009.
2. Stoner JAF, Freeman RE and Gilbert DR, Management, 6th ed., Pearson Education, 2004.
3. Tripathy PC & Reddy PN, Principles of Management, Tata McGraw Hill, 1999.
4. Dipak B, Principles of Management, Pearson Education, 2011.
5. Mitra J.K, Principles of Management, First Edition, Oxford university press, india, 2018, pp. 1-216.

19. Resources required for the course *(itemized & student access requirements, if any)*

19.1	Software	NA
19.2	Hardware	NA
19.3	Teaching aides (videos, etc.)	NA
19.4	Laboratory	NA
19.5	Equipment	NA
19.6	Classroom infrastructure	Class room assisted with Projector with computer.

		(Smart class room)
19.7	Site visits	Yes, to make the students aware how executives using and applying 14 principles of management to manage their firms

20. Design content of the course *(Percent of student time with examples, if possible)*

20.1	Design-type problems	10%
20.2	Open-ended problems	
20.3	Project-type activity	30%
20.4	Open-ended laboratory work	
20.5	Others (please specify)	

Date: (Signature of the Head of the Department)