HIMACHAL PRADESH TECHNICAL UNIVERSITY
HAMIRPUR

Syllabus

for

B.Tech. First Year

(Common to all Branches)

As per National Education Policy (NEP-2020)

(w.e.f. the Academic Year 2023-2024)

Dean -Academic
H.P. Technical University
Hamirpur - 177 001, HP

S. No.	Group	Branches
1	Group-A	Civil Engineering Computer Science and Engineering Computer Science and Engineering (AI-ML) Computer Science and Engineering (AI-DS) Information and Technology Electronics and Communication Engineering.
2	Group-B	Electrical Engineering Electrical and Electronics Engineering Mechanical Engineering Textile Engineering

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Hamirpur - 177 001, HP

Group A: Semester I

Sr. No.	Category	Subject Code	Subject	L	T	P/D	Credits	Evaluation Scheme (Marks)		
								IA	ESE	Subject Total
Theory:										
1	FC	PHY-111	Applied Physics	3	1	0	4	40	60	100
2	FC	HS-111	Communication Skills	3	0	0	3	40	60	100
3	FC	EE-111	Basic Electrical Engineering	3	1	0	4	40	60	100
4	FC	MA-111	Applied Mathematics-1	3	1	0	4	40	60	100
5	MC	EVS-111	Energy and Environment	2	1	0	3	40	60	100
	Labs:							**IA**	**ESVE**	**Sub. Total**
1	FC	PHY-111P	Applied Physics Lab	0	0	2	1	30	20	50
2	FC	HS-111P	Communication Skills Lab	0	0	2	1	30	20	50
3	FC	EE-111P	Basic Electrical Engineering Lab	0	0	2	1	30	20	50
4	FC	*WXX-111P	Workshop	0	0	4	2	30	20	50
			Total	**14**	**04**	**10**	**23**			**700**

Group A: Semester II

Sr. No.	Category	Subject Code	Subject	L	T	P/D	Credits	Evaluation Scheme (Marks)		
								IA	ESE	Subject Total
Theory:										
1	FC	CHM-111	Applied Chemistry	3	1	0	4	40	60	100
2	FC	CS-111	Computer Programming	3	0	0	3	40	60	100
3	FC	EC-111	Basic Electronics Engineering	3	1	0	4	40	60	100
4	FC	MA-121	Applied Mathematics-II	3	1	0	4	40	60	100
5	MC	UHV-111	Universal Human Values and Awareness About Himachal Pradesh	3	0	0	3	40	60	100
	Labs:							**IA**	**ESVE**	**Sub. Total**
1	FC	CHM-111P	Applied Chemistry Lab	0	0	2	1	30	20	50
2	FC	CS-111P	Computer Programming Lab	0	0	2	1	30	20	50
3	FC	EC-111P	Basic Electronics Engineering Lab	0	0	2	1	30	20	50
4	FC	ME-111P	Engineering Graphics and Design	0	0	4	2	30	20	50
5	MC	HS-122P	Holistic Health and Yoga	0	0	2	1	30	20	50
			Total	15	03	12	**24**			750

Legends: **L** - Lecture **ESE** - End Semester Examination

T - Tutorial **FW** - Documentation/ File work and presentation

P - Practical **LP** - Lab performance

CT - Class Test **ESVE** - End Semester Exam. / Viva-voce Exam.

IA - Internal Assessment **MC**-Mandatory Course

FC- Foundation Course

*WXX where XX is branch code- CE (Civil Engineering), CS (Computer Science & Engineering), IT (Information & Technology), EC (Elect. Comm. & Engineering)

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Group B: Semester I

Sr. No.	Category	Subject Code	Subject	L	T	P/D	Credits	Evaluation Scheme (Marks)		
								IA	ESE	Subject Total
Theory:										
1	FC	CHM-111	Applied Chemistry	3	1	0	4	40	60	100
2	FC	CS-111	Computer Programming	3	0	0	3	40	60	100
3	FC	EC-111	Basic Electronics Engineering	3	1	0	4	40	60	100
4	FC	MA-111	Applied Mathematics-1	3	1	0	4	40	60	100
5	MC	UHV-111	Universal Human Values and Awareness about Himachal Pradesh	3	0	0	3	40	60	100
	Labs:							**IA**	**ESVE**	**Sub. Total**
1	FC	CHM-111P	Applied Chemistry Lab	0	0	2	1	30	20	50
2	FC	CS-111P	Computer Programming Lab	0	0	2	1	30	20	50
3	FC	EC-111P	Basic Electronics Engineering Lab	0	0	2	1	30	20	50
4	FC	ME-111P	Engineering Graphics and Design	0	0	4	2	30	20	50
			Total	15	03	10	**23**			700

Group B: Semester II

Sr. No.	Category	Subject Code	Subject	L	T	P/D	Credits	Evaluation Scheme (Marks)		
								IA	ESE	Subject Total
Theory:										
1	FC	PHY-111	Applied Physics	3	1	0	4	40	60	100
2	FC	HS-111	Communication Skills	3	0	0	3	40	60	100
3	FC	EE-111	Basic Electrical Engineering	3	1	0	4	40	60	100
4	FC	MA-121	Applied Mathematics-II	3	1	0	4	40	60	100
5	MC	EVS-111	Energy and Environmental	2	1	0	3	40	60	100
Labs:										
1	FC	PHY-111P	Applied Physics Lab	0	0	2	1	30	20	50
2	FC	HS-111P	Communication Skills Lab	0	0	2	1	30	20	50
3	FC	EE-111P	Basic Electrical Engineering Lab	0	0	2	1	30	20	50
4	MC	HS-122P	Holistic Health and Yoga	0	0	2	1	30	20	50
5	FC	*WXX-111P	Workshop	0	0	4	2	30	20	50
			Total	14	04	12	**24**			750

Legends:

L - Lecture
T - Tutorial
P - Practical
CT - Class Test
IA - Internal Assessment
FC- Foundation Course
ESE - End Semester Examination
FW - Documentation/ File work and presentation
LP - Lab performance
ESVE - End Semester Exam. / Viva-voce Exam.
MC-Mandatory Course

* WXX where XX is branch code- EE (Electrical Engineering.), EEE (Electrical & Electronics Engineering.), ME (Mechanical Engineering). TE (Textile Engineering.)

Template for-Internal Assessment (IA Theory)

HIMACHAL PRADESH TECHNICAL UNIVERSITY

Award Sheet Theory Internal Assessment (IA)

<table>
<tr><td colspan="3">Name of the Institution:</td><td colspan="4">Distribution of Marks</td><td rowspan="3">Total Marks</td></tr>
<tr><td colspan="3">Programme:</td><td colspan="2" rowspan="2">Periodical Examinations</td><td rowspan="3">Teacher Assessment (Assignment discussion/ presentation/Quizzes/ Overall behavior)</td><td rowspan="3">Attendance</td></tr>
<tr><td colspan="3">Subject: Sub. Code:</td></tr>
<tr><td colspan="3">Branch: Semester:</td><td rowspan="2">1st Periodical Examination</td><td rowspan="2">2nd Periodical Examination</td><td rowspan="2"></td></tr>
<tr><td colspan="3">Max. Marks: Min. Marks:</td></tr>
<tr><td>Sr. No.</td><td>University Roll No.</td><td>Name of Student</td><td>10</td><td>10</td><td>15</td><td>05</td><td>40</td></tr>
<tr><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td></tr>
<tr><td colspan="8">Name of Internal Examiner
Signature……..……
Date……..……..…..

Head of Dept.
Signature…….....
Date……..</td></tr>
</table>

Note: The marks of the attendance (theory and practical) in Internal Assessment(IA) should be awarded on the basis of percentage of lectures attended as per the following details:

Sr. No	Percentage of Lecture Attended	Marks Awarded
1	From 75% to 79.9%	01
2	From 80% to 84.9%	02
3	From 85% to 89.9%	03
4	From 90% to 94.9%	04
5	Above 95%	05

Template for-Internal Assessment (Practical/Project/Seminar/Viva-Voce)

HIMACHAL PRADESH TECHNICAL UNIVERSITY

Award Sheet Practical Internal Assessment (IA)

(Practical/Project/Seminar/Workshop)

Name of the Institution:			**Distribution of Marks**				
Programme:			**Written/ Presentation/ Demonstration**	**Viva-voce**	**Teacher Assessment: Lab Work performance/ Report/ File Work**	**Attendance**	**Total Marks**
Subject:		**Sub. Code:**					
Branch:		**Semester:**					
Max. Marks:		**Min. Marks:**					
Sr. No.	**University Roll No.**	**Name of Student**	**05**	**05**	**15**	**05**	**30**

Name of Internal Examiner

Signature……..……

Date……..……..…...

Head of Dept.

Signature…….....

Date……..

Template for-External Assessment (Practical/Project/Seminar/Viva-Voce)

HIMACHAL PRADESH TECHNICAL UNIVERSITY

AWARD SHEET PRACTICAL (EXTERNAL ASSESSMENT)

(Practical/Project/Seminar/Workshop)

Name of the Institute: ……

Programme: ……

Subject Name: ……... …… **Subject Code:** ……..

Branch: ……... ……. **Semester** ……

Max Marks …….. **Min. Marks:** …….

Sr. No.	**University Roll No.**	**Name of Student**	**Marks in Figure**	**Marks in Words**

Name of Internal Examiner: ……

Signature……..……

Date……..……

Name of External Examiner…….

Signature…….....

Date……..……

Note: The distribution of marks would be on the basis of Task performance/written (10 marks) and viva-voce (10 marks), total=20 marks.

Syllabus

for

Semester-I (Group A&B)

and

Semester-II (Group-A&B)

PHY-111 Applied Physics							
Teaching Scheme			Credit	Marks Distribution			Duration of End Semester Examination
L	T	P		Internal Assessment	End Semester	Total	
3	1	0	4	Maximum Marks: 40	Maximum Marks: 60	100	3 Hours
				Minimum Marks: 16	Minimum Marks: 24	40	

Guidelines for setting Question Paper: Question paper of end semester examination will be of 60 marks. The question paper will consist of five sections A, B, C, D and E. Sections A, B, C and D will have 2 questions of 12 marks each and section E has short answer type questions consisting of six parts of 02 marks each. The candidates will attempt five questions in all, i.e. one question each from sections A, B, C, D and the compulsory question from section E. In the question paper, the questions available in sections A, B, C and D will be covered from Unit-I, Unit-II, Unit-III and Unit-IV respectively and Section-E will cover the whole syllabus.

Course Contents:

Unit-I:
Theory of Relativity: Inertial and non- inertial frames of reference, earth as an inertial frame of reference, Michelson and Morley experiment, Postulates of special theory of relativity, Galilean and Lorentz transformations, Time dilation and length contraction, Relativistic kinematics and mass-energy equivalence. **Laser:** Introduction, Characteristics of lasers, Spontaneous and stimulated emission of radiation Einstein's coefficients, Population inversion, Ruby laser, Helium -Neon lasers & Semiconductor Lasers Applications of laser in industry, Scientific and medical fields.
Unit–II:
Oscillations: Simple harmonic motion (SHM), Differential equation of SHM, Energy of SHM, Damped and Forced Oscillations, Relaxation Time, Quality Factor, Resonance, Sharpness of Resonance. **Fiber Optics:** Fundamental ideas about optical fiber, Propagation mechanism, Acceptance angle and acceptance cone, Numerical aperture, Propagation Mechanism and communication in fiber, Single and Multi-Mode Fibers, Step index and Graded index fiber, Attenuation and losses, Applications of optical fibers.
Unit–III
Quantum Mechanics: De Broglie waves, Phase and Group velocity concept, Uncertainty principle and its applications, Wave function, Postulates of quantum mechanics, Derivation of Schrodinger equation for time independent and time dependent cases and its applications viz. Particle in one dimensional box. **X-rays:** X-rays production, hard and soft x-rays, Continuous and characteristics x-rays, Bremsstrahlung effect
Unit-IV:
Electrodynamics: Equation of continuity, displacement current, Maxwell‘s equations, wave equation for electromagnetic radiation, electromagnetic wave propagation in free space and isotropic dielectric medium, Poynting vector & Poynting theorem. **Superconductivity:** Introduction and discovery of superconductivity, Meissner effect, Type-I and type-IIP superconductors, Isotope effect, BCS theory (qualitative), High temperature superconductors, Applications of superconductivity.

Textbooks:

- Engineering Physics, H.K Malik & A.K Singh, Tata McGraw-Hill.
- Ajoy Ghatak, Quantum Mechanics: Theory and Applications‖, Tata McGraw-Hill.
- Satya Prakash and Vibhav saluja, Engineering Physics‖, Pragti Prakashan Meerut.
- Applied Solid State Physics‖, Wiley India Pvt Ltd.

Reference Books:

- Ajoy Ghatak, ―Optics‖, Tata McGraw-Hill.
- N. Subrahmanyam, Brij Lal, M.N. Avadhanulu, ―Optics‖, S. Chand & Co. Ltd.
- Anuradha De, ―Fiber optics and laser Principles and Applications‖, New Age International.
- Arthur Beiser, ―Concepts of Modern Physics‖, Tata McGraw-Hill.
- David J Griffiths, ―Introduction to electrodynamics‖, Prentice Hall of India, New Delhi

HS-111 Communication Skills							
Teaching Scheme			Credit	Marks Distribution			Duration of End Semester Examination
L	T	P		Internal Assessment	End Semester	Total	
3	0	0	3	Maximum Marks: 40	Maximum Marks: 60	100	3 Hours
				Minimum Marks: 16	Minimum Marks: 24	40	

Guidelines for setting Question Paper: Question paper of end semester examination will be of 60 marks. The question paper will consist of five sections A, B, C, D and E. Sections A, B, C and D will have 2 questions of 12 marks each and section E has short answer type questions consisting of six parts of 02 marks each. The candidates will attempt five questions in all, i.e. one question each from sections A, B, C, D and the compulsory question from section E. In the question paper, the questions available in sections A, B, C and D will be covered from Unit-I, Unit-II, Unit-III and Unit-IV respectively and Section-E will cover the whole syllabus.

Course Contents:

Unit-I:
Essentials of communication: The meaning, types &process of communication, Barriers to communication and removal of these barriers, Shannon & weaver model of communication, Berlos' model of communication, The Seven Cs of Effective Communication - Completeness, Conciseness, Consideration, Concreteness, Clarity, Courtesy, Correctness, Types of information- order, advise, suggestion, motivation, persuasion, warning and education. Mass Communication –function of mass communication – Media of mass communication, Advantages and disadvantages ofsocial media.
Unit–II:
Essentials of Grammar: Types of sentences: Declarative Sentence, Imperative Sentence, Interrogative Sentence, Exclamatory Sentence, simple, compound & complex sentences, conversion of one type of sentence into other, Parts of speech, Tenses, articles and prepositions, Model Auxiliaries Types of diction, ways to improve diction, Paragraph writing.
Unit–III
Technical Communication: Report writing: Characteristics of a good report, parts & types of reports, drafting of reports. Business letters: planning a business letter, parts of a letter, classification of business letters – inviting and sending quotations, letter placing orders, letter of complaint, letter of adjustment, and letter of Job, letter negotiating a job offer and Resume writing, Drafting memorandum, notices, agenda and minutes of meeting, preparing effective e- mail messages and power-point presentations
Unit-IV:
Soft skills & personality development: Soft skills: Classification of soft skills, Delivering effective presentations, Capturing audience, Impromptu speech, speech initiators, telephone etiquette - Good practice when making and receiving a call; Becoming a good leader and team-player, Personal SWOT analysis., body language, Types of interviews, preparing for a job interview, Strategies for managing emotions & controlling Stress.

Textbooks:

- Communication Skills, Sanjay Kumar and Pushp Lata, Oxford University Press.
- Effective Communication and soft Skills, Nitin Bhatnagar and Mamta Bhatnagar, Pearson Publication.
- Communicative English for Engineers and professionals, Nitin Bhatnagar and Mamta Bhatnagar, Pearson Publication.
- Personality and Soft Skills by B. K. Mitra Oxford press.
- An Introduction to Professional English and Soft Skills: by Bikram K. Das, Kalyani Samantray, Cambridge Press.
- Business correspondence and Report Writing: by R. C. Sharma & Krishna Mohan

Reference Books:

- Business Communication: Theory and Application by R.W. Lesikar and John.D. Pettit , All India Traveller Bookseller.
- Speaking and Writing for Effective Business Communication by Francis Soundaraj Macmillan.
- Understanding Human Communication by Ronald B. Adler and George Rodman Oxford University

Press: New York.

- Communication Skills and soft skills- An integrated approach, Kumar, Pearson Publication
- K.K.Sinha, Business Communication, Galgotia Publishing Company, New Delhi, 1999.
- R.K.Bansal& J.B. Harrison, spoken English for India, Orient Longman.
- An Introduction to Linguistics: Language, Grammar and Semantics by Pushpinder Syal and D. V. Jindal (Author) Paperback
- Mastering Interviews and Group Discussions by Dinesh Mathur CBS
- English Conversation Practice by Grant Taylor
- Handbook of Practical Communication Skill by Chrissie Wright (Ed.) JAICO Books.
- English Conversation Practice by Grant Taylor
- Business correspondence and Report Writing: by R. C. Sharma & Krishna Mohan

EE-111 Basic Electrical Engineering							
Teaching Scheme			Credit	Marks Distribution			Duration of End Semester Examination
L	T	P		Internal Assessment	End Semester Examination	Total	
3	1	0	4	Maximum Marks: 40	Maximum Marks: 60	100	3 Hours
				Minimum Marks: 16	Minimum Marks: 24	40	

Guidelines for setting Question Paper: Question paper of end semester examination will be of 60 marks. The question paper will consist of five sections A, B, C, D and E. Sections A, B, C and D will have 2 questions of 12 marks each and section E has short answer type questions consisting of six parts of 02 marks each. The candidates will attempt five questions in all, i.e. one question each from sections A, B, C, D and the compulsory question from section E. In the question paper, the questions available in sections A, B, C and D will be covered from Unit-I, Unit-II, Unit-III and Unit-IV respectively and Section-E will cover the whole syllabus.

Course Contents:

Unit-I:
DC Circuits: Kirchhoff's voltage and current laws; power dissipation; Voltage source and current source; Mesh and Nodal analysis; Star-delta transformation; Superposition theorem. Thevenin's theorem; Norton's theorem; Maximum power transfer theorem; Millman's theorem and Reciprocity theorem; Transient response of series RL and RC circuits.
Unit–II:
Steady state analysis of DC Circuits: The ideal capacitor, permittivity; the multi- plate capacitor, variable capacitor; capacitor charging and discharging, current-voltage relationship, time-constant, rise-time, fall-time,inductor energization and de- energization, inductance current-voltage relationship, time-constant; Transient responseof RL, RC and RLC Circuits.
Unit–III
AC Circuits: Sinusoidal sources, RC, RL and RLC circuits, Concept of Phasors, Phasor representation of circuit elements, Complex notation representation, Single phase AC Series and parallel circuits, power dissipation in AC circuits, power factor correction, Resonance in series and parallel circuits, Balanced and unbalanced 3-phase circuit - voltage, current and power relations, 3-phase power measurement, Comparison of single phase and three phase supply systems. **Electromagnetism:** Electromagnetic induction, Dot convention, Equivalent inductance, Analysis of Magnetic circuits, AC excitation of magnetic circuit, Iron Losses, Fringing and stacking, applications: solenoids and relays.
Unit-IV:
Single Phase Transformers: Constructional features of transformer, operating principle and applications, equivalent circuit, phasor analysis and calculation of performance indices. **Motors and Generators:** DC motor operating principle, construction, energy transfer, speed torque relationship, conversion efficiency, applications, DC generator operating principle, reversal of energy transfer, EMF and speedrelationship, applications.

Textbooks:

- Ashfaq Husain and Harroon Ashfaq Fundamental of Electrical Engineering Dhanpat Rai & Co. (P) Limited; Fourth edition, 1 January 2016
- Nagrath I.J. and D. P. Kothari (2001), Basic Electrical Engineering, Tata McGraw Hill.
- Hayt and Kimberly, Engineering Circuit Analysis, Tata McGraw Hill.
- Ritu Sahdev (2019), Basic Electrical Engineering, Khanna Book Publishing Company
- Kulshreshtha D.C. (2009), Basic Electrical Engineering, Tata McGraw Hill.
- Rajendra Prasad (2009), Fundamentals of Electrical Engineering, Prentice Hall, India

Reference Books:

- Ajoy Ghatak, ―Optics‖, Tata McGraw-Hill.
- N. Subrahmanyam, Brij Lal, M.N. Avadhanulu, ―Optics‖, S. Chand & Co. Ltd.
- Anuradha De, ―Fiber optics and laser Principles and Applications‖, New Age International.
- Arthur Beiser, ―Concepts of Modern Physics‖, Tata McGraw-Hill.
- David J Griffiths, ―Introduction to electrodynamics‖, Prentice Hall of India, New Delhi

MA-111 Applied Mathematics-I							
Teaching Scheme			Credit	Marks Distribution			Duration of End Semester Examination
L	T	P		Internal Assessment	End Semester Examination	Total	
3	1	0	4	Maximum Marks: 40	Maximum Marks: 60	100	3 Hours
				Minimum Marks: 16	Minimum Marks: 24	40	

Guidelines for setting Question Paper: Question paper of end semester examination will be of 60 marks. The question paper will consist of five sections A, B, C, D and E. Sections A, B, C and D will have 2 questions of 12 marks each and section E has short answer type questions consisting of six parts of 02 marks each. The candidates will attempt five questions in all, i.e. one question each from sections A, B, C, D and the compulsory question from section E. In the question paper, the questions available in sections A, B, C and D will be covered from Unit-I, Unit-II, Unit-III and Unit-IV respectively and Section-E will cover the whole syllabus.

Course Contents:

Unit-I:
Sequences and Series: Introduction to sequences and Infinite series, Tests for convergence/divergence, Limit comparison test, Ratio test, Root test, Cauchy integral test, Alternating series, Absolute convergence and conditional convergence. **Series Expansions:** Power series, Taylor & Maclaurin's series, Convergence of Taylor series, Taylor & Maclaurin's Theorem, Error estimates (one variable)
Unit–II:
Calculus: Rolle's theorem, Lagrange's and Cauchy mean value theorem, Application of definite integral to evaluate areas of bounded region, Arc length of a plane curve, volume of solids, surface areas of a solid revolution (Cartesian coordinates), Improper integrals, Beta and Gamma functions
Unit–III
Partial Differentiation and applications: Functions of several variables, Limits and continuity ($\delta - \epsilon$ approach), Partial derivatives, Euler's theorem (Homogeneous functions), Chain rule, change of variables, Jacobian, Maxima and minima by using second order derivatives, Lagrange's method of multipliers, Taylor's & Maclaurin's Theorem, Error estimation.
Unit-IV:
Multiple Integrals and applications: Double integral, change of order of integration in double integral, Polar coordinates, graphing of polar curves, Change of variables (Cartesian to polar), Applications of double integrals to areas and volumes, evaluation of triple integral.

Textbooks:

- B. S. Grewal, Higher Engineering Mathematics by B. S. Grewal 43rd Edition (2015)
- N. P. Bali and Manish Goyal A Textbook Of Engineering Mathematics (2016)
- Thomas, G.B. and Finney, R.L., Calculus and Analytic Geometry, Pearson Education (2007),9thed.
- Stewart James, Essential Calculus; Thomson Publishers (2007), 6th ed.
- R.K. Jain and S.R.K. Iyengar, Advanced Engineering Mathematics (2003), 2nd ed.

Reference Books:

- Wider David V, Advanced Calculus: Early Transcendentals, Cengage Learning (2007).
- Apostol Tom M, Calculus, Vol I and II, John Wiley (2003).
- Erwin Kreyszig, Advanced Engineering Mathematics, John Wiley & Sons (2011) 9th Edition

EVS-111 Energy and Environment							
Teaching Scheme			Credit	Marks Distribution			Duration of End Semester Examination
L	T	P		Internal Assessment	End Semester Examination	Total	
2	1	0	3	Maximum Marks: 40	Maximum Marks: 60	100	3 Hours
				Minimum Marks: 16	Minimum Marks: 24	40	

Guidelines for setting Question Paper: Question paper of end semester examination will be of 60 marks. The question paper will consist of five sections A, B, C, D and E. Sections A, B, C and D will have 2 questions of 12 marks each and section E has short answer type questions consisting of six parts of 02 marks each. The candidates will attempt five questions in all, i.e. one question each from sections A, B, C, D and the compulsory question from section E. In the question paper, the questions available in sections A, B, C and D will be covered from Unit-I, Unit-II, Unit-III and Unit-IV respectively and Section-E will cover the whole syllabus.

Course Contents:

Unit-I:
Ecosystems: Structure and function of an ecosystem–ecological succession–primary and secondary succession - ecological pyramids – pyramid of number, pyramid of energy and pyramid of biomass. **Conventions on Climate Change:** Origin of Conference of Parties (COPs), United Nations Framework Convention on Climate Change (UNFCCC) and Intergovernmental Panel on Climate Change (IPCC); Kyoto Protocol, Montreal Action Plan; Paris Agreement and post-Paris scenario. **Environmental issues:** Global Environmental crisis, Current global environment issues, Global Warming, Greenhouse Effect, role of Carbon Dioxide and Methane, Ozone Problem, CFC_s and Alternatives, Causes of Climate change, Carbon footprint.
Unit–II:
Air Pollution: Origin, sources, adverse effects and preventive measures related to air pollution. Case study for air pollution (London smog, Photochemical smog, Bhopal gas tragedy). **Water Pollution:** Origin, sources, adverse effects and preventive measures related to water pollution. Case study forair pollution (Minamata tragedy, Arsenic pollution at Punjab/UP, The Ganga River pollution). **Noise Pollution:** Origin, sources, adverse effects and preventive measures related to noise pollution. **Nuclear pollution:** Origin, sources, adverse effects and preventive measures related to radioactive pollution, Casestudy. **Environmental protection acts:** Important environmental protection acts in India – water, air (prevention and controlof pollution) act, wild life conservation and forest act.
Unit–III
Renewable and non-renewable resources: Coal, Petroleum, Solar energy, wind energy, hydrothermal energy, nuclear energy, Tidal energy, Bioenergy etc. Role of individual in conservation of natural resources for sustainable life styles. Use and over exploitation of Forest resources, Deforestation, Timber extraction, Mining, Dams and their effects on forest and tribal people. Use and over exploitation of surface and ground water resources, Floods, Drought, Conflicts over water, Dams- benefits and problems. National green hydrogen mission. FAME India Scheme.
Unit-IV:
Environment and Disaster: Introduction: Principles of Disaster Management. Natural Disasters such as Earthquake, Floods, Fire, Landslides, Tornado, Cyclones, Tsunamis, Nuclear and Chemical Terrorism. Hazards, Risks and Vulnerabilities, Vulnerability of a location and vulnerable groups, National policy on disaster Management.

Textbooks:

- Moaveni, S., Energy, Environment and Sustainability, Cengage(2018)
- Down to Earth, Environment Reader for Universities, CSE Publication(2018)
- Chapman, J.L. and Reiss, M.J., Ecology Principles and Application, Cambridge University Press (LPE) (1999).
- Eastop, T.P. and Croft, D.R., Energy Efficiency for Engineers and Technologists, Longman and Harow (2006).
- O'Callagan, P.W., Energy Management, Mc Graw Hill Book Co. Ltd.(1993).
- Peavy H.S. and Rowe D.R. Environmental Engineering, McGraw Hill(2013)

WME-111P Workshop							
Teaching Scheme			**Credit**	**Marks Distribution**			**Duration of End Semester Examination**
L	**T**	**P**		**Internal Assessment**	**End Semester Examination**	**Total**	
0	**0**	**4**	**2**	**Maximum Marks: 30**	**Maximum Marks: 20**	**50**	**2 Hours**
				Minimum Marks: 12	**Minimum Marks: 8**	**20**	

Following is the list of experiments/ jobs. Minimum 08 number of practicals are to be performed from following list. The additional experiments may be performed by the respective institution depending on the infrastructure available.

1.	**Introduction:**
	Introduction to Need and importance of workshop, different materials to be utilized Applications of Ferrous and Non-Ferrous metals alloys.
2.	**Carpentry Shop:**
	To prepare half-lap corner joint, mortise & tennon joints
3.	**Fitting Shop:**
	To make a job involving fitting work -drilling, tapping or dieing
4.	**Smithy Shop:**
	To make a job by using smithy operations such as upsetting, drawing down, punching, bending, fullering & swaging.
5.	**Welding Shop:**
	To prepare a simple butt and Lap welded joints.
6.	**Sheet-metal Shop:**
	Fabrication of Funnel, tool-box, tray etc.
7.	**Machine Shop:**
	To make a job on lathe involving plane turning, step turning, taper turning and threading operations
8.	**Foundry Shop:**
	To prepare a Mould with the use of a core and cast it.

WCS:111P/WIT:111P Workshop							
Teaching Scheme			**Credit**	**Marks Distribution**			**Duration of End Semester Examination**
L	**T**	**P**		**Internal Assessment**	**End Semester Examination**	**Total**	
0	**0**	**4**	**2**	**Maximum Marks: 30**	**Maximum Marks: 20**	**50**	**2 Hours**
				Minimum Marks: 12	**Minimum Marks: 8**	**20**	

Following is the list of experiments/ jobs. Minimum 08 number of practicals are to be performed from following list. The additional experiments may be performed by the respective institution depending on the infrastructure available.

1.	Identification and study of peripherals of a PC and Laptop
2.	Assembling and disassembling the PC
3.	Identification and study the purpose of Networking concepts
4.	Study / Prepare a network cable: Straight Through Cables vs Crossover Cables
5.	Prepare a document/report using Microsoft Word, Power Point, Microsoft Excel
6.	Prepare professional pdf documents using LaTeX
7.	Develop the home page using HTML Consisting of your photo, name, address and education details as a table and your skill set as a list
8.	Operating System installation
9.	Virtual Machine setup
10.	Linux Operating System commands
11.	Enabling firewall and setting router as wireless access point in the system
12.	Study of AI based tools.

WEE-111P/WEEE-111P/ WEC-111P Workshop							
Teaching Scheme			Credit	Marks Distribution			Duration of End Semester Examination
L	T	P		Internal Assessment	End Semester Examination	Total	
0	0	4	2	Maximum Marks: 30	Maximum Marks: 20	50	2 Hours
				Minimum Marks: 12	Minimum Marks: 8	20	

Following is the list of experiments/ jobs. Minimum 08 number of practicals are to be performed from following list. The additional experiments may be performed by the respective institution depending on the infrastructure available.

Electrical Workshop	
1.	a) Demonstrate the precautionary steps adopted in case of Electrical shocks.
	b) Identify different types of cables, wires, switches, fuses, fuse carriers, MCB, ELCB and MCCB with ratings.
2.	Wiring of simple light circuit for controlling light/ fan point (PVC conduit wiring)
3.	Wiring of light/fan circuit using Two-way switches. (Staircase wiring)
4.	Wiring of Fluorescent lamps and light sockets (6A) with a power circuit for controlling power device. (16A socket)
5.	Wiring of power distribution arrangement using single phase MCB distribution board with ELCB, main switch and Energy meter.
6.	a) Identify different types of batteries with their specifications.
	b) Demonstrate the Pipe and Plate Earthing Schemes using Charts/Site Visit.
7.	Activity: Assemble the wooden/plastic boards, switches and sockets in form of extension boards with proper wiring and pin top.
Electronics Workshop	
8.	Familiarization/Identification of electronic components with specification (Functionality, type, size, colour coding, package, symbol, cost etc. [Active, Passive, Electrical, Electronic, Electro-mechanical, Wires, Cables, Connectors, Fuses, Switches, Relays, Crystals, Displays, Fasteners, Heat sink etc.)
9.	Drawing of electronic circuit diagrams using BIS/IEEE symbols and introduction to EDA tools (such as Orcad, MultiSim or XCircuit), Interpret data sheets of discrete components and IC's, Estimation and costing.
10.	Familiarization/Application of testing instruments and commonly used tools. [Multimeter, Function generator, Power supply, DSO etc.] [Soldering iron, Desoldering pump, Pliers, Cutters, Wire strippers, Screw drivers, Tweezers, Crimping tool, Hot air soldering and de- soldering station etc.]
11.	Testing of electronic components [Resistor, Capacitor, Diode, Transistor and JFET using multimeter.]
12.	Overview of Arduino: Hardware and Software IDE: Installation and live projects burning such as LED Blinking, Running LEDs, Sand Glass Filling of LEDs, Decoration LEDs/LED Patterns etc.
13.	Printed circuit boards (PCB) [Types, Single sided, Double sided, PTH, Processing methods, Design and fabrication of a single sided PCB for a simple circuit]
14.	Activity: Assembling of components of a basic mobile phone system and develop an ability to repair and formulate a basic Transmission and Receiving system.

WTE-111P Workshop for Textile Engineering							
Teaching Scheme			**Credit**	**Marks Distribution**			**Duration of End Semester Examination**
L	**T**	**P**		**Internal Assessment**	**End Semester Examination**	**Total**	
0	**0**	**4**	**2**	**Maximum Marks: 30**	**Maximum Marks: 20**	**50**	**2 Hours**
				Minimum Marks: 12	**Minimum Marks: 8**	**20**	

Following is the list of experiments/ jobs. Minimum 08 number of practicals are to be performed from following list. The additional experiments may be performed by the respective institution depending on the infrastructure available.

1	Identification of different natural fibers.
2	Identification of different synthetic fibers.
3	Determination of linear density of yarn.
4	Analysis of various yarns structure and their basic properties.
5	Structural analysis of woven fabrics.
6	Structural analysis of knitted fabrics.
7	Dyeing of cotton fabric with natural dyes.
8	Dyeing of cotton fabric with synthetic dyes.
9	To prepare fabric sample for printing.
10	Characterization of various technical textiles and study of their application fields.

WCE-111P Workshop for Civil Engineering							
Teaching Scheme			**Credit**	**Marks Distribution**			**Duration of End Semester Examination**
L	**T**	**P**		**Internal Assessment**	**End Semester Examination**	**Total**	
0	**0**	**4**	**2**	**Maximum Marks: 30**	**Maximum Marks: 20**	**50**	**2 Hours**
				Minimum Marks: 12	**Minimum Marks: 8**	**20**	

Following is the list of experiments/ jobs. Minimum 08 number of practicals are to be performed from following list. The additional experiments may be performed by the respective institution depending on the infrastructure available.

1	Preparation of Technical report/document, Presentation, Data analysis by using MS office
2	Preparation of simple butt and lap welded joint (metal or other)
3	Preparation of half lap corner joint, Mortise joint and tenon joint (metal or other)
4	Fabricate a furniture using any carpentry joints (Chair/Table/any furniture)
5	Fabricate any one bar bending models for any structural element
6	Fabricate Plumbing line model from source to distribution end
7	Construct a Masonry brick wall using any masonry Bond
8	Construct an arch using brick masonry
9	Sampling of latest/ advanced construction materials
10	Generating simple 3D models in CAD and 3D printing

PHY-111P Applied Physics Lab							
Teaching Scheme			**Credit**	**Marks Distribution**			**Duration of End Semester Examination**
L	**T**	**P**		**Internal Assessment**	**End Semester Examination**	**Total**	
0	**0**	**2**	**1**	**Maximum Marks: 30**	**Maximum Marks: 20**	**50**	**2 Hours**
				Minimum Marks: 12	**Minimum Marks: 8**	**20**	

Following is the list of experiments/ jobs. Minimum 08 number of practicals are to be performed from following list. The additional experiments may be performed by the respective institution depending on the infrastructure available.

Laboratory Work:

1. To determine the wavelength of monochromatic light by Newton‘s Ring.
2. To find the wavelength of light from a given source using Michelson‘s interferometer.
3. To determine the wavelength of spectral lines using plane transmission grating.
4. To find the value of Planck‘s constant.
5. To verify Stefan‘s law by electrical method.
6. To determine the numerical aperture of an optical fibre.
7. To determine the attenuation & propagation losses in optical fibre.
8. To determine the height of a tower with a Sextant.
9. To determine the refractive index of a liquid by Newton‘s ring.
10. To determine the hall co-efficient.
11. To determine the band gap of an intrinsic semiconductor by four prove method.
12. To study the LASER beam characteristics like wavelength using diffraction grating aperture & divergence.
13. To calculate the hysteresis loss by tracing a B-H curve for a given sample.
14. To compare the capacitances of two capacitors by De‘sauty Bridge.
15. To study the variation of magnetic field with distance by Stewart and Gee‘s apparatus.
16. To find the value of e/m for electron by helical method.

HS-111P Communication Lab							
Teaching Scheme			**Credit**	**Marks Distribution**			**Duration of End Semester Examination**
L	**T**	**P**		**Internal Assessment**	**End Semester Examination**	**Total**	
0	**0**	**2**	**1**	**Maximum Marks: 30**	**Maximum Marks: 20**	**50**	**2 Hours**
				Minimum Marks: 12	**Minimum Marks: 8**	**20**	

Following is the list of experiments/ jobs. Minimum 08 number of practicals are to be performed from following list. The additional experiments may be performed by the respective institution depending on the infrastructure available.

I	**Learning correct pronunciation**: Organs of speech, IPA symbols (consonant & vowel sounds), classification of consonants as per place & manner of articulation. finding out the correct pronunciation of words with the help of a dictionary, phonetic transcription of words presented orally, conversion of words presented through IPA symbols into normal orthography, syllable division and stress marking (in words presented in IPA form). Intonation (rising & falling tone).
II	**Listening Skills:** Listening with a focus on pronunciation (ear-training), stress and intonation; the students will be exposed, to the following varieties of English during listening practice: Standard Indian, British and American. Learning the differences between British & American pronunciation, Listening practice of the dialogues and speeches in British & American English.
III	**Speaking Skills:** Delivering impromptu speeches, reading aloud of dialogues, poems, excerpts from plays, Situational conversations: Introducing oneself, describing a person, place, situation and event, giving instructions, making inquiries – at a bank, post-office, air-port, hospital, reservation counter etc. Mock interviews and group discussions.
IV	**Writing Skills:** Identifying common mistakes made by students in written communication and improving them, writing emails: sending and responding to emails, preparing and delivering power -point presentations, answering comprehension, translation practice (Hindi to English & vice-versa).

EE-111P Basic Electrical Engineering Lab							
Teaching Scheme			**Credit**	**Marks Distribution**			**Duration of End Semester Examination**
L	**T**	**P**		**Internal Assessment**	**End Semester Examination**	**Total**	
0	**0**	**2**	**1**	**Maximum Marks: 30**	**Maximum Marks: 20**	**50**	**2 Hours**
				Minimum Marks: 12	**Minimum Marks: 8**	**20**	

Following is the list of experiments/ jobs. Minimum 08 number of practicals are to be performed from following list. The additional experiments may be performed by the respective institution depending on the infrastructure available.

List of Experiments:

1. To verify Kirchhoff's Current Law (KCL) and Kirchhoff's Voltage Law (KVL)
2. To study the V-I characteristics of an incandescent lamp.
3. Verification of Thevenin's theorem
4. Verification of Norton theorem
5. Verification of superposition and Maximum power theorem
6. To study series LCR circuit
7. To study parallel LCR circuit
8. Power consumption of a fluorescent lamp
9. Measurement of power and power factor by two wattmeter method.
10. To perform short circuit test on a single-phase transformer to calculate copper loss of the transformer.
11. To measure the single-phase power in a single phase a.c. circuit by using three ammeters.
12. To measure the single-phase power in a single phase a.c. circuit by using three voltmeters.

CHM-111 Applied Chemistry							
Teaching Scheme			Credit	Marks Distribution			Duration of End Semester Examination
L	T	P		Internal Assessment	End Semester Examination	Total	
3	1	0	4	Maximum Marks: 40	Maximum Marks: 60	100	3 Hours
				Minimum Marks: 16	Minimum Marks: 24	40	

Guidelines for setting Question Paper: Question paper of end semester examination will be of 60 marks. The question paper will consist of five sections A, B, C, D and E. Sections A, B, C and D will have 2 questions of 12 marks each and section E has short answer type questions consisting of six parts of 02 marks each. The candidates will attempt five questions in all, i.e. one question each from sections A, B, C, D and the compulsory question from section E. In the question paper, the questions available in sections A, B, C and D will be covered from Unit-I, Unit-II, Unit-III and Unit-IV respectively and Section-E will cover the whole syllabus.

Course Contents:

Unit-I:

Water Technology: Introduction, Sources, common impurities, Hardness, Degree of hardness and units, water quality parameters and their analysis-Turbidity, TDS, Hardness, Chlorine, Arsenic Test, BOD and COD, Water Softening-Zeolite and Ion-exchange process, Drinking water purification and domestic water purifiers.

Electrochemistry: Specific, equivalent and molar conductivity of electrolytic solutions, Reference Electrodes-Calomel electrode and Ag-AgCl electrode, Ion-selective electrode-Glass electrode, determination of pH of solution using glass electrode, Construction and working of Batteries-Lead acid storage battery, Ni-Cd storage cell, Lithium batteries, fuel cell and Solar cell.

Unit–II:

Corrosion Science: Introduction, Chemical and Electrochemical Corrosion, Theory of electrochemical corrosion, Types of Electrochemical Corrosion-Differential aeration corrosion, Pitting Corrosion. Stress Corrosion e.g., Caustic embrittlement. Factors affecting rate of corrosion-Related to metal & related to environment. Control of corrosion.

Spectroscopy Techniques:

UV-Visible Spectroscopy-principle, Lambert-Beer's Law, instrumentation, Electronic Transitions, Auxochromes, Chromophores, Effect of conjugation and solvents on transition of organic molecules, applications.

IR: - Principle, Instrumentation, Fundamental vibrations, Hooke's Law, effect of masses of atoms, bond strength, nature of substituent and hydrogen bonding on Vibrational frequency, applications.

Unit–III

Fuels: Classification of fuels, Calorific value - Definition, HCV, LCV, determination of calorific value of solid and liquid fuels using Bomb calorimeter, Ultimate analysis of coal and numerical problems, Petroleum cracking -fluidized bed catalytic cracking. Reformation of petrol, Quality of liquid fuels- Cetane and Octane number, power alcohol-manufacture, advantages and disadvantages, Concept of hydrogen as fuel- types, synthesis by water electrolysis and natural gas reforming.

Chemistry in ICT: Introduction and applications of metal and metal oxides like Si, Ge, Al,, Ti, Ni, Cu, SiO_2, La_2O_3 and ZrO_2 in communication and Display devices (liquid crystals based, LED, CRT, alumina-silicate glass based, touch screen). Disposal of harmful chemicals used in ICT; Hg, Pb, Cd and flame retardant materials.

Unit-IV:

Engineering Materials

Polymers: Introduction, Classification, Glass transition temperature, factors affecting Tg and its significances, Synthesis, properties and applications of PP, PVC, PMMA, polyurethanes, Epoxy resins, Silicon Rubber, PET, Lexan, Kevlar.

Conducting Polymers: Introduction-Definition, applications, Mechanism of conduction in polyacetylene.

Nano- Materials: Introduction, Properties of nanomaterials, Graphene, Fullerenes, Carbon nanotubes, nano wires, nano cones, Application of nano-materials.

Textbooks:

- Ramesh, S. and Vairam S. Engineering Chemistry, Wiley India.
- Puri, B.R., Sharma, L.R. and Pathania, M.S. Principles of Physical Chemistry, Vishal Publishing Co. (2008).
- Aggarwal, S. Engineering Chemistry: Fundamentals and Applications, Cambridge University Press(2015).

Reference Books:

- Brown, H., Chemistry for Engineering Students, Thompson.
- Sivasankar, B., Engineering Chemistry, Tata Mc Graw-Hill Pub. Co. Ltd, New Delhi(2008).
- Shulz, M. J. Engineering Chemistry, Cengage Learnings (2007).

CS-111 Computer Programming							
Teaching Scheme			Credit	Marks Distribution			Duration of End Semester Examination
L	T	P		Internal Assessment	End Semester Examination	Total	
3	0	0	3	Maximum Marks: 40	Maximum Marks: 60	100	3 Hours
				Minimum Marks: 16	Minimum Marks: 24	40	

Guidelines for setting Question Paper: Question paper of end semester examination will be of 60 marks. The question paper will consist of five sections A, B, C, D and E. Sections A, B, C and D will have 2 questions of 12 marks each and section E has short answer type questions consisting of six parts of 02 marks each. The candidates will attempt five questions in all, i.e. one question each from sections A, B, C, D and the compulsory question from section E. In the question paper, the questions available in sections A, B, C and D will be covered from Unit-I, Unit-II, Unit-III and Unit-IV respectively and Section-E will cover the whole syllabus.

Course Contents:

Unit-I:
Introduction to C++: C++ character set, C++ Tokens (Identifiers, Keywords, Constants, Operators,), Structure of a C++ Program (include files, main function), use of I/O operators (<>), Cascading of I/O operators, compilation, linking and execution. Concept of Data types: Built-in Data types: char, int, float and double; Constants: Integer Constants, Character constants - \n, \t, \b), Floating Point Constants, String Constants; Access modifier: const; Variables of built-in-data types, Declaration/Initialization of variables, Assignment statement, Type modifier: signed, unsigned, long Operator and Expressions: Operators: Arithmetic operators (-,+,*,/,%), Unary operator (-), Increment (++) and Decrement (--) Operators, Relation operator (>,>=,<=,=,!=), Logical operators (!,&&,‖), Conditional operator: ?; Precedence of Operators; Automatic type conversion in expressions, Type casting; C++ shorthands (+=,-=,*=,/=,%=) . Conditional statements: if else, Nested if, switch case default, use of conditional operator, Nested switch case, break statement; Loops: while, do - while, for and Nested loops. Defining a function; function prototype, Invoking/calling a function: call by value, call by reference, returning values from a function, scope rules of functions and variables local and global variables
Unit–II:
Array, Structure and Class: One Dimensional Array: Declaration/initialization of One-dimensional array, inputting array elements, accessing array elements, Two dimensional Array: Declaration/initialization of a two-dimensional array, inputting array elements accessing array elements, Defining a Structure, declaring structure variables, accessing members of structure, Defining a class, declaring object and accessing class members
Unit–III
Constructor and Destructor: Constructors, Parameterized Constructors, Constructors with default arguments, Friend function, and Friend classes **Inheritance:** Derived Class declaration, Public, Private and Protected Inheritance, friend function and Inheritance, Forms of inheritance, virtual base class, Abstract class, Advantage and disadvantage of Inheritance.
Unit-IV:
Polymorphism: Classification of Polymorphism, Compile time and Run time Polymorphism, Virtual function, Pure virtual functions **File Handling:** Defining and Opening a File, closing a File, reading from a File, Writing into a File. Templates: Need of template, Function templates Exception Handling: Exception handling mechanism, Catch Blocks, Catch Throw an exception,

Textbooks:

- The C++ Programming Language (4th Edition) By Bjarne Stroustrup
- Lippman, S.B. and Lajoie, J., C++Primer, Pearson Education (2005) 4th ed..
- Stroustrup, Bjarne, The C++ Programming Language, Pearson Education (2000)3rd ed.
- Kanetkar Y., Let Us C++, BPB Publications, 2nded.
- Balaguruswamy E., Object Oriented Programming with C++, McGraw Hill, 2013.

Reference Books:

- Ajoy Eills, Margaret A. and Stroustrup, Bjarne, The Annonated C++ Reference Manual, Pearson Education (2002).

- Rumbaugh, J.R., Premerlani, W. and Blaha, M., Object Oriented Modeling and Design with UML, Pearson Education (2005) 2nd ed.
- Kanetkar, Yashvant, Let us C++, Jones and Bartlett Publications (2008) 8th ed.
- Brian W. Kernighan, Dennis M. Ritchie, The C++ Programming Language, Prentice Hall)
- Schildt H., C++: The Complete Reference, Tata Mc Graw Hill, 2

EC-111 Basic Electronics Engineering							
Teaching Scheme			Credit	Marks Distribution			Duration of End Semester Examination
L	T	P		Internal Assessment	End Semester Examination	Total	
3	1	0	4	Maximum Marks: 40	Maximum Marks: 60	100	3 Hours
				Minimum Marks: 16	Minimum Marks: 24	40	

Guidelines for setting Question Paper: Question paper of end semester examination will be of 60 marks. The question paper will consist of five sections A, B, C, D and E. Sections A, B, C and D will have 2 questions of 12 marks each and section E has short answer type questions consisting of six parts of 02 marks each. The candidates will attempt five questions in all, i.e. one question each from sections A, B, C, D and the compulsory question from section E. In the question paper, the questions available in sections A, B, C and D will be covered from Unit-I, Unit-II, Unit-III and Unit-IV respectively and Section-E will cover the whole syllabus.

Course Contents:

Unit-I:

Semiconductors: Energy band concept of materials, difference between metal, Insulator and semiconductor, Intrinsic and extrinsic semiconductors (n- type & p- type), current conduction in semiconductor, Photo diode, photo-transistor, LED and seven- segment display.

Semiconductor Diodes: p- n junction diode, Depletion layer, Energy diagrams of p-n junction and depletion region, Biasing of diode and V-I Characteristics; Rectifiers - half- wave, full- wave and bridge rectifiers; Filters - L, C, LC and π filters; Zener diode, V-I Characteristics and Zener diode as voltage regulator.

Unit–II:

Bipolar Junction Transistors (BJT): Transistor operation and current components in p- n- p and n- p- n transistors, input/output characteristics of CB and CE configurations, Transistor as an Amplifier, transistor cutoff, saturation and active regions, Transistor biasing and bias stabilization: Operating point, Stability factor, Analysis of fixed bias, collector to base bias, Emitter resistance bias circuit and self bias circuit

Field Effect Transistors (FET): Basic construction, transistor action, concept of pinch off, maximum drain saturation current, input and transfer characteristics,

MOSFET: Depletion and enhancement type MOSFET- Construction, operation and characteristics.

Unit–III

Oscillators: Introduction, Criteria for oscillation, types of oscillators Hartley, Colpitt, RC Phase shift and Wein bridge oscillators.

Operational Amplifiers: Concept of ideal operational amplifiers, ideal operational amplifier parameters, inverting, non-inverting and unity gain amplifiers, adders and subtractor, Differentiator, integrator and Comparator operational Amplifiers

Unit-IV:

Number System and Logic Design: Number systems, Conversions and code, conversion of bases(decimal, binary, octal and hexadecimal numbers), addition and subtraction, Boolean algebra, logic gates (AND, OR, NAND, NOR, XOR, XNOR), concept of universal gate.

Electronic Instruments: Operation of CRO and its applications, Signal Generator, measurement of voltage, phase and frequency using CRO.

Textbooks:

- Boylestad, R. L. and Nashelsky, L., Electronic Devices & Circuit Theory, Pearson (2009).
- M. M. Mano and M. D. Ciletti, Digital Design, Pearson, Prentice Hall, 2013.

Reference Books:

- Milliman, J. and Halkias, C. C., Electronic Devices and Circuits, Tata McGraw Hill, 2007.
- Donald D Givone, Digital Principles and Design, McGraw-Hill, 2003.
- John F Wakerly, Digital Design: Principles and Practices, Pearson, (2000).
- N Storey, Electronics: A Systems Approach, Pearson, Prentice Hall, (2009).

MA-121 Applied Mathematics-II							
Teaching Scheme			Credit	Marks Distribution			Duration of End Semester Examination
L	T	P		Internal Assessment	End Semester Examination	Total	
3	1	0	4	Maximum Marks: 40	Maximum Marks: 60	100	3 Hours
				Minimum Marks: 16	Minimum Marks: 24	40	

Guidelines for setting Question Paper: Question paper of end semester examination will be of 60 marks. The question paper will consist of five sections A, B, C, D and E. Sections A, B, C and D will have 2 questions of 12 marks each and section E has short answer type questions consisting of six parts of 02 marks each. The candidates will attempt five questions in all, i.e. one question each from sections A, B, C, D and the compulsory question from section E. In the question paper, the questions available in sections A, B, C and D will be covered from Unit-I, Unit-II, Unit-III and Unit-IV respectively and Section-E will cover the whole syllabus.

Course Contents:

Unit-I:
Linear Algebra: Review of matrices, Row reduced echelon form, Inverse using Gauss Jordan method and rank of a matrix, Solution of system of linear equations, Linear spaces, Subspaces, Basis and dimension, rank-nullity theorem, Linear transformation and its matrix representation, Eigen values, Eigen vectors and Diagonalization, Cayley-Hamilton Theorem (without proof), and Quadratic form and Orthogonal transformation.
Unit–II:
Ordinary Differential Equations: Review of first order differential equations, Exact differential equations, Second and higher order linear differential equations with constant coefficients, Cauchy‘s & Legendre‘s homogeneous differential equations, Variation of parameters method, Cauchy - Euler equation, Method of undetermined coefficients, Engineering applications of differential equations.
Unit–III
Laplace Transform: Definition and existence of Laplace transforms and its properties, Inverse Laplace transforms using partial fraction, properties and convolution theorem (without proof), Laplace and inverse Laplace transforms of Unit step function and Impulse function, Applications to solve initial and boundary value problems.
Unit-IV:
Fourier Series: Introduction, Fourier series on arbitrary intervals, Even Odd functions, Half range expansions, Parseval‘s theorem, Complex Fourier series, Harmonic analysis. **Vector calculus:** Introduction to vectors, Vector addition and multiplication, Directional derivatives, gradient, divergence & curl with properties, Scalar line integrals, vector line integrals, scalar surface integrals, vector surface integrals, Green, Stokes and Gauss divergence theorem (without proof)

Textbooks:

- R.K. Jain and S.R.K. Iyengar, Advanced Engineering Mathematics (2003), 2nd ed.
- B.S. Grewal, ―Higher Engineering Mathematics‖, Khanna Publishers.
- H.K. Dass and Rama Verma, ―Engineering Mathematics‖, S. Chand Publications.

Reference Books:

- N.P. Bali and Manish Goel, ―Engineering Mathematics‖, Laxmi Publications
- B.V. Ramana, ―Higher Engineering Mathematics‖, Tata McGraw Hill Education Pvt. Ltd., New Delhi

UHV-111 Universal Human Values and Awareness about Himachal Pradesh							
Teaching Scheme			Credit	Marks Distribution			Duration of End Semester Examination
L	T	P		Internal Assessment	End Semester Examination	Total	
3	0	0	3	Maximum Marks: 40	Maximum Marks: 60	100	3 Hours
				Minimum Marks: 16	Minimum Marks: 24	40	

Guidelines for setting Question Paper: Question paper of end semester examination will be of 60 marks. The question paper will consist of five sections A, B, C, D and E. Sections A, B, C and D will have 2 questions of 12 marks each and section E has short answer type questions consisting of six parts of 02 marks each. The candidates will attempt five questions in all, i.e. one question each from sections A, B, C, D and the compulsory question from section E. In the question paper, the questions available in sections A, B, C and D will be covered from Unit-I, Unit-II, Unit-III and Unit-IV respectively and Section-E will cover the whole syllabus.

Course Contents:

Unit-I:
Introduction to Value Education: Difference between moral and human values. Five core human values: Truth, Righteous conduct, Peace, Love and Non-violence. Classification of moral values, Value crisis in contemporary Indian society at different levels: Individual, family, Society and culture. Values in Indian constitution: Justice, liberty, equality and fraternity, Fundamental Rights under Indian constitution: Fundamental duties of Indian citizens.
Unit–II:
Harmony with the self, family & society: Understanding Human being as the Co-existence of the Self and the Body, Program to ensure the health of the body Distinguishing between the Needs of the Self and the Body, living in harmony with the self, family & society, steps to achieve self-discipline. Noble Eightfold Path: Right Understanding, Thought, Speech, Action, Livelihood, Effort, Mindfulness, and Concentration.
Unit–III
Understanding Mental health & emotional well-being: Characteristics of a mentally healthy person, causes of mental-health issues in contemporary society, possible solutions to improve mental health. Emotional intelligence: elements of emotional intelligence, Advantages of higher emotional intelligence & improving emotional intelligence, Maslow's hierarchy of needs & self-actualization.
Unit-IV:
Awareness about Himachal Pradesh: General knowledge including the knowledge of different places of historic, national and cultural importance & tourist attraction, hydro power projects, industries, highways, educational and other institutions of the state, knowledge about the famous personalities from the state, currents affairs of Himachal Pradesh, history of Himachal- from medieval to present time, Geography-including the weather, borders, rivers, mountain-ranges , passes, peaks , knowledge of customs and culture of HP : including the costumes, customs, fairs and festivals etc.

Textbooks:

- The Textbook A Foundation Course in Human Values and Professional Ethics, R R Gaur, R Asthana, G P Bagaria, 2nd Revised Edition, Excel Books, New Delhi, 2019. ISBN 978-93-87034-47-1
- Human Values, A.N. Tripathi, New Age Intl. Publishers, New Delhi, 2004.
- The Wonderland Himachal Pradesh An Encyclopedia, Jag Mohan Balokhra, H. G. Publications New Delhi

Reference Books:

- Jeevan Vidya: Ek Parichaya, A Nagaraj, Jeevan Vidya Prakashan, Amarkantak, 1999.
- The Story of Stuff (Book).
- The Story of My Experiments with Truth - by Mohandas Karamchand Gandhi
- Slow is Beautiful - Cecile Andrews
- Economy of Permanence - J C Kumarappa
- Bharat Mein Angreji Raj – Pandit Sunderlal
- Rediscovering India - by Dharampal
- Hind Swaraj or Indian Home Rule - by Mohandas K. Gandhi
- India Wins Freedom - Maulana Abdul Kalam Azad
- Vivekananda - Romain Rolland (English)

ME-111P Engineering Graphics and Design							
Teaching Scheme			Credit	Marks Distribution			Duration of End Semester Examination
L	T	P		Internal Assessment	End Semester Examination	Total	
0	0	4	2	Maximum Marks: 30	Maximum Marks: 20	50	2 Hours
				Minimum Marks: 12	Minimum Marks: 8	20	

Following is the list of experiments/ jobs. Minimum 08 number of practicals are to be performed from following list. The additional experiments may be performed by the respective institution depending on the infrastructure available.

List of experiments:

Practical numbers 1-6 shall be perform in the drawing hall with the help of different drawing instruments/tools and practical numbers 7-10 shall be performed in the Auto CAD laboratory.

1. Introduction to different types of lines, lettering, dimensioning and scales.
2. To draw the projection of points and lines.
3. To draw the projection of planes.
4. To draw the projection of solids and section of solids.
5. To draw the projection of development of surfaces.
6. To draw the isometric projections.
7. Introduction to Auto CAD (History, exploring GUI, Workspace, Coordinate System, Snap, Grid and Ortho modes) and basic commands for 2D drawings.
8. Introduction to file management, drawing & drafting settings.
9. Perform dimensioning and annotations in drawing arc, lines, angle etc.
10. Use of drawing & modify tools to make simple shapes of different 2D- drawings of projection of points, line, plane, solids, section of solid, development of surfaces and isometric projections.

CHM-111P Applied Chemistry Lab							
Teaching Scheme			Credit	Marks Distribution			Duration of End Semester Examination
L	T	P		Internal Assessment	End Semester Examination	Total	
0	0	2	1	Maximum Marks: 30	Maximum Marks: 20	50	2 Hours
				Minimum Marks: 12	Minimum Marks: 8	20	

Following is the list of experiments/ jobs. Minimum 08 number of practicals are to be performed from following list. The additional experiments may be performed by the respective institution depending on the infrastructure available.

Laboratory Work:

1. To determine the pH and conductivity of five different water samples.
2. To determine total alkalinity in a given sample of water using standard acid.
3. To determine total hardness of water using complexometric titration method.
4. To determine the amount of Chlorine (residual) in given sample of water using N/20 Sodium thiosulphatesolution.
5. To determine the percentage of Chlorine in sample of bleaching powder, 10 g of which are dissolved in 500ml of water.
6. To determine the amount of Chromium in given sample of water.
7. To determine dissolved oxygen in given sample of water.
8. To determine the coefficient of viscosity of the given unknown liquids by using Ostwald‘s Viscometer
9. To determine the coefficient of viscosity of the given lubricating oil using Red Wood Viscometer.
10. To determine surface tension of given liquid by drop number method using Stalagmometer.
11. To determine % age of moisture, volatile matter, ash and fixed carbon in given sample of coal by proximateanalysis method.
12. To verify Beer's Law and apply it to find the concentration of given unknown solution by using UV-visiblespectra-photometer.
13. Estimation of Copper/Iron.
14. Preparation of any of the following polymers: Phenol formaldehyde resins/Urea formaldehyde resins /Biodegradable /conducting polymer.
15. To synthesize a polymer using synthetic monomer via free radical polymerization and characterize thepolymer using FTIR spectra-photometer.
16. To synthesize a semisynthetic polymer via grafting of monomer on polymeric backbone and characterize thepolymer using FTIR spectra-photometer.
17. Synthesis of nano-particles of Au/Ag/NiO/ZnO/Iron Oxide

CS-111P Computer Programming Lab							
Teaching Scheme			**Credit**	**Marks Distribution**			**Duration of End Semester Examination**
L	**T**	**P**		**Internal Assessment**	**End Semester Examination**	**Total**	
0	**0**	**2**	**1**	**Maximum Marks: 30**	**Maximum Marks: 20**	**50**	**2 Hours**
				Minimum Marks: 12	**Minimum Marks: 8**	**20**	

Following is the list of experiments/ jobs. Minimum 08 number of practicals are to be performed from following list. The additional experiments may be performed by the respective institution depending on the infrastructure available.

Laboratory work:

1. WAP for basic input/output statement and various control statements.
2. WAP to create for function and function calling methods
3. WAP to take input and display elements of 1D and 2D array.
4. WAP for structures and display the values of structure members using structure variable.
5. WAP for creating class, defining member in class and accessing member.
6. WAP using various string functions in C++.
7. WAP for constructor and Destructor.
8. WAP for inheritance.
9. WAP for friend function and friend class.
10. WAP for polymorphism.
11. WAP for exception handling in C++.
12. WAP using template concept.
13. WAP to create function and use function calling methods.

EC-111P Basic Electronics Engineering Lab

Teaching Scheme			Credit	Marks Distribution			Duration of End Semester Examination
L	T	P		Internal Assessment	End Semester Examination	Total	
0	0	2	1	Maximum Marks: 30	Maximum Marks: 20	50	2 Hours
				Minimum Marks: 12	Minimum Marks: 8	20	

Following is the list of experiments/ jobs. Minimum 08 number of practicals are to be performed from following list. The additional experiments may be performed by the respective institution depending on the infrastructure available.

Laboratory Work:

1. Familiarization with electronics equipment (multimeters, CROs, power supply and function generators)
2. Study of the characteristics of P- N junction diode.
3. Study of the characteristics of Zener diode
4. Study of truth tables of different logic gates (AND, OR, NAND, NOR, XOR, XNOR).
5. Familiarization with CRO.
6. DSO and Electronic Components.
7. Diodes characteristics - Input- Output and Switching.
8. BJT and MOSFET Characteristics.
9. Zener diode as voltage regulator, Rectifiers.
10. Construction of an un regulated DC power supply (using a transformer, a full wave rectifier and a capacitor filter) and study of its output waveform by CRO.
11. Study of inverting and non-inverting amplifiers using op-amp
12. Study of the frequency response of any one oscillator.

HS-122P Holistic Health & Yoga							
Teaching Scheme			Credit	Marks Distribution			Duration of End Semester Examination
L	T	P		Internal Assessment	End SemesterExamination	Total	
0	0	2	1	Maximum Marks: 30	Maximum Marks: 20	50	3 Hours
				Minimum Marks: 12	Minimum Marks: 8	20	

Following is the list of experiments/ jobs. Minimum 08 number of practicals are to be performed from following list. The additional experiments may be performed by the respective institution depending on the infrastructure available.

List of Experiments:

1. Introduction of Yoga, Different Definitions of Yoga. General Guidelines for Yogic Practices
2. Traditional Schools of Yoga: Bhakti yoga, karma yoga, Gyana yoga, Hatha yoga, Mantra yoga, Laya yoga, Raja yoga) Ashtanga Yoga of Sage Patanjali.
3. Concept of Shatkriyas: Dhauti, Basti, Neti, Nauli, Trataka and Kapalbhati. Shatkriyas (Cleansing Process): Jala neti, Sutra neti. Kunjala, Vastra Dhauti, Danda Dhauti, kapalbhati, Surya namaskar.
4. Concept of Surya namaskar: Introduction, Technique, benefit, precaution.
5. Concept of Asanas Introduction, Types, Technique, benefit, precaution, Asanas: Standing Poses: Tadasana, Kati chakrasana, tiryak tadasana, vrikshasana, veer bhadrasana, garudasana, trikonsana, Sitting Poses: Padmasana, Swastikasana, Vajrasana, Bhadrasana, Gomukhasana, Mandukasana, Singhasana.
6. Concept of Pranayama: Introduction, Types, Technique, benefit, precaution.
7. Meditation: Concept, technique, benefit, and precaution. Dhyana: Sthoola Dhyana, Jyoti Dhyana, Sukshama Dhyana, (According to Gheranda Samhita). Mantra Chanting- Omkar (Pranav Jaap), Gayatri Mantra, Maha Mrityunjaya Mantra, Shanti Mantr
8. Lying Down Poses: Spine Position: uttanpadasana, Pawan muktasana, Naukasana, markatasana, halasana, sarvangasana, matsyasana, setubandhasana, chakarasana and shavasana. Prone Position: Bhujangasana, Shalabhasana, Dhanurasana, Vipreet naukasana

Textbooks:

- BKS Iyengar (2012), Light on Yoga
- Basvaraddi & S.P.Pathak (2016), Yogic Suksham Vyayam Evem Sthula
- Vyayam Swami Satyananda Saraswati (2012), Asana Pranayama Mudra
- Modern Trends and Physical Education by Prof. Ajmer Singh.

Himachal Pradesh Technical University, Hamirpur (H.P.)

CURRICULUM(CBCS)

MECHANICAL ENGINEERING

(3rd to 8th Semester)

Teaching and Examination Scheme

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SCHEME OF TEACHING AND EXAMINATION
B.TECH MECHANICAL ENGINEERING

SEMESTER – III

S. N.	Cat.	Course Code	Subject	Teaching Hours Per Weak			Credits	Examination		
				L	T	P/D		I.A Marks	ESE Marks	Total Marks
1	FC	MA-301	Probability and Statistics	2	2	0	3	40	60	100
2	FC	HS – 305	Industrial Economics and Management	3	0	0	3	40	60	100
3	PC	ME-301	Strength of Materials-I	3	1	0	4	40	60	100
4	PC	ME-302	Fluid Mechanics	3	1	0	4	40	60	100
5	PC	ME-303	Engineering Thermodynamics	3	0	0	3	40	60	100
6	PC	ME-304	Machine Drawing	2	0	3	3	40	60	100
7	OE	-	Open Elective-I	2	0	0	2	40	60	100
Labs:										
1	PC	ME-305	Strength of Materials Lab	0	0	2	1	30	20	50
2	PC	ME-306	Fluid Mechanics Lab	0	0	2	1	30	20	50
3	MC	ME-307	Computer Aided Design(CAD) Lab	0	0	3	2	30	20	50
			Total	16	4	10	24+2			

OPEN ELECTIVE – I

S. N.	Cat.	Subject Code	Title	Teaching Hours Per Weak			Credits	Examination		
				L	T	P/D		I.A Marks	ESE Marks	Total Marks
1	OE	HS-306	Sociology & Elements of Indian History for Engineers	2	0	0	2	40	60	100
2	OE	HS-307	German Language - I	2	0	0	2	40	60	100
3	OE	HS-308	French Language - I	2	0	0	2	40	60	100

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SCHEME OF TEACHING AND EXAMINATION
B.TECH MECHANICAL ENGINEERING

SEMESTER – IV

S. N.	Cat.	Course Code	Subject	Teaching Hours Per Weak			Credits	Examination		
				L	T	P/D		I.A Marks	ESE Marks	Total Marks
1	FC	MA-401	Optimization and Calculus of Variations	2	2	0	3	40	60	100
2	FC	HS-409	Human Values and Professional Ethics	2	2	0	3	40	60	100
3	PC	ME-401	Manufacturing Technology-I	3	0	0	3	40	60	100
4	PC	ME-402	Strength of Material-II	3	1	0	4	40	60	100
5	PC	ME-403	I.C Engines	3	0	0	3	40	60	100
6	PC	ME-404	Turbo Machines	3	1	0	4	40	60	100
7	OE	-	Open Elective-II	2	0	0	2	40	60	100
Labs:										
1	PC	ME-405	I.C. Engine Lab	0	0	2	1	30	20	50
2	PC	ME-406	Turbo Machines Lab	0	0	2	1	30	20	50
3	MC	ME-407	Manufacturing Practice Lab-I	0	0	3	2	30	20	50
			Total	16	6	7	24+2			

OPEN ELECTIVE – II

S. N.	Cat.	Subject Code	Title	Teaching Hours Per Weak			Credits	Examination		
				L	T	P/D		I.A Marks	ESE Marks	Total Marks
1	OE	HS-410	Law for Engineers	2	0	0	2	40	60	100
2	OE	HS-411	German Language – II	2	0	0	2	40	60	100
3	OE	HS-412	French Language – II	2	0	0	2	40	60	100

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SCHEME OF TEACHING AND EXAMINATION
B.TECH MECHANICAL ENGINEERING

SEMESTER – V

S. N.	Cat.	Course Code	Subject	Teaching Hours Per Weak			Credits	Examination		
				L	T	P/D		I.A Marks	ESE Marks	Total Marks
1	PC	ME-501	Kinematics of Machines	2	2	0	3	40	60	100
2	PC	ME-502	Manufacturing Technology-II	3	0	0	3	40	60	100
3	PC	ME-503	Heat Transfer	3	1	0	4	40	60	100
4	PC	ME-504	Machine Design-I	3	1	0	4	40	60	100
5	PC	ME-505	Automobile Engineering	3	0	0	3	40	60	100
6	PC	ME-506	Materials Technology	3	0	0	3	40	60	100
7	OE	-	Open Elective-III	2	0	0	2	40	60	100
Labs:										
1	MC	ME-511	Design and Simulation Lab	0	0	3	2	30	20	50
2	PC	ME-512	Manufacturing Practice Lab-II	0	0	2	1	30	20	50
3	PC	ME-513	Heat Transfer Lab	0	0	2	1	30	20	50
			Total	**17+2**	**4**	**7**	**24 +2**			

OPEN ELECTIVE – III (For Students of Other Departments)

S. N.	Cat.	Subject Code	Title	Teaching Hours Per Weak			Credits	Examination		
				L	T	P/D		I.A Marks	ESE Marks	Total Marks
1	OE	ME-508	Robotics	2	0	0	2	40	60	100
2	OE	ME-509	Automobile Technology	2	0	0	2	40	60	100
3	OE	ME-510	Value Engineering	2	0	0	2	40	60	100

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SCHEME OF TEACHING AND EXAMINATION
B.TECH MECHANICAL ENGINEERING

SEMESTER – VI

S. N.	Cat.	Course Code	Subject	Teaching Hours Per Weak			Credits	Examination		
				L	T	P/D		I. A Marks	ESE Marks	Total Marks
1	PC	ME-601	Computer Aided Design and Manufacturing (CAD/CAM)	3	1	0	4	40	60	100
2	PC	ME-602	Measurement and Control	3	0	0	3	40	60	100
3	PC	ME-603	Machine Design-II	3	1	0	4	40	60	100
4	PC	ME-604	Operation research	2	2	0	3	40	60	100
5	PC	ME-605	Thermal Engineering	2	2	0	3	40	60	100
6.	PC	ME-606	Dynamics of Machinery	3	0	0	3	40	60	100
7	PE	-	Programme Elective-I	3	0	0	3	40	60	100
Labs:										
1	PC	ME-611	Computer Aided Design and Manufacturing (CAD/CAM) Lab	0	0	2	1	30	20	50
2	PC	ME-612	Theory of Machine Lab	0	0	2	1	30	20	50
3	MC	ME-613	Seminar	0	0	3	2	50	50	100
			Total	**16+3**	**6**	**7**	**24+3**			

PROGRAM ELECTIVE –I

S. N.	Cat.	Subject Code	Title	Teaching Hours Per Weak			Credits	Examination		
				L	T	P/D		I.A Marks	ESE Marks	Total Marks
1	PE	ME-608	Modern Manufacturing processes	3	0	0	3	40	60	100
2	PE	ME-609	Maintenance and Reliability	3	0	0	3	40	60	100
3	PE	ME-610	Composite Materials	3	0	0	3	40	60	100

Note: Industrial /Practical Training after VI Semester of six weeks duration

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SCHEME OF TEACHING AND EXAMINATION
B.TECH MECHANICAL ENGINEERING

SEMESTER – VII

S. N.	Cat.	Course Code	Subject	Teaching Hours Per Weak			Credits	Examination		
				L	T	P/D		I. A Marks	ESE Marks	Total Marks
1	PC	ME-701	Industrial automation and Robotics	3	0	0	3	40	60	100
2	PC	ME-702	Refrigeration & Air Conditioning	3	1	0	4	40	60	100
3	PC	ME-703	Power Plant Engineering	3	0	0	3	40	60	100
4	PC	ME-704	Industrial Engineering & Production Management	2	2	0	3	40	60	100
5	PE	-	Programme Elective-II	3	0	0	3	40	60	100
Labs:										
1	MC	ME-711	Project Work -I	0	0	4	2	50	50	100
2	MC	ME-712	Automation and Robotics Lab	0	0	3	2	30	20	50
3	PC	ME-713	Thermal Engineering Lab	0	0	2	1	30	20	50
4	PC	ME-714	Industrial /Practical Training(Viva-Voce)	0	0	0	2	50	50	100
			Total	**11+3**	**3**	**9**	**20+3**			

PROGRAM ELECTIVE –II

S. N.	Cat.	Subject Code	Title	Teaching Hours Per Weak			Credits	Examination		
				L	T	P/D		I.A Marks	ESE Marks	Total Marks
1	PE	ME-708	Material handling and Plant layout	3	0	0	3	40	60	100
2	PE	ME-709	Industrial Tribology	3	0	0	3	40	60	100
3	PE	ME-710	Finite Element Method	3	0	0	3	40	60	100

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SCHEME OF TEACHING AND EXAMINATION
B.TECH MECHANICAL ENGINEERING

SEMESTER – VIII

S. N.	Cat.	Course Code	Subject	Teaching Hours Per Weak			Credits	Examination		
				L	T	P/D		I. A Marks	ESE Marks	Total Marks
1	PE		Programme Elective - III	3	0	0	3	40	60	100
2	PE		Programme Elective - IV	3	0	0	3	40	60	100
3	MC	ME-807	Project Work - II	0	0	16	8	50	50	100
			Total	**6**	**0**	**16**	**8+6**			
OR										
4	MC	ME-808	Industrial Project	0	0	16	8	50	50	100
			Total	**0**	**0**	**16**	**8**			

PROGRAM ELECTIVE –III

S. N.	Cat.	Subject Code	Title	Teaching Hours Per Weak			Credits	Examination		
				L	T	P/D		I.A Marks	ESE Marks	Total Marks
1	PE	ME-801	Total Quality Management (TQM)	3	0	0	3	40	60	100
2	PE	ME-802	Non-Conventional Energy resources	3	0	0	3	40	60	100
3	PE	ME-803	Production Planning and control	3	0	0	3	40	60	100

PROGRAM ELECTIVE –IV

S. N.	Cat.	Subject Code	Title	Teaching Hours Per Weak			Credits	Examination		
				L	T	P/D		I.A Marks	ESE Marks	Total Marks
1	PE	ME-804	Mechatronics	3	0	0	3	40	60	100
2	PE	ME-805	Gas Dynamics	3	0	0	3	40	60	100
3	PE	ME-806	Vibrations	3	0	0	3	40	60	100

Note: Industrial Project (ME-808) of Four months duration is to be carried out by the student **"exclusively in industry"** under the joint supervision of faculty advisers from institution as well as from the industry.

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SEMESTER-III

MA-301: PROBABILITY AND STATISTICS

Teaching Scheme			Credits	Marks			Duration of End Semester Examination
L	T	P/D	C	Sessional	End Semester Exam	Total	
2	2	0	3	40	60	100	3 hrs

COURSE CONTENT:

UNIT	CONTENT	No. of Hrs.
I	**Probability and Random Variables:** Introduction, Basic concepts–Sample space, Events, Counting sample space, Conditional Probability and Independence, Permutations and Combinations, Rules of Probability, Bayes' Theorem. Random Variables – Concept of Random Variable, Percentiles, Probability Distributions – Discrete & Continuous, Mean, Variance and Covariance of Random Variables, Chebychev's inequality.	**6**
II	**Standard Probability Distributions:** Discrete distributions - Uniform, Binomial, Multinomial, Hyper geometric, Poisson, Negative Binomial, Poission; Continuous distributions - Normal, Exponential, Gamma, Weibull and Beta distributions and their properties -Function of Random variables.	**6**
III	**Sampling Distributions:** Random sampling, Sampling Distributions of Means, Estimation, Properties of point estimators, Confidence interval, Maximum likelihood and Bayes estimators, Prediction intervals.	**6**
IV	**Testing of Hypothesis:** Sampling distributions – testing of hypothesis for mean, variance, proportions and differences using Normal, t, Chi-square and F distributions, tests for independence of attributes and Goodness of fit. **Linear Correlation and Regression Analysis:** Introduction, Linear Regression model, Regression coefficient, Lines of correlation, Rank correlation	**6**

Text Books:

1. Gupta, S.C, and Kapur, J.N., ***"Fundamentals of Mathematical Statistics***", Sultan Chand, Ninth Edition, New Delhi.
2. Johnson. R. A., ***"Miller & Freund's Probability and Statistics for Engineers",*** Sixth Edition, Pearson Education, Delhi.
3. Douglas C. Montgomery and George C. Runger, "***Applied Statistics and Probability for Engineers",*** 5th Edition.

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Reference books:

1. Walpole, R. E., Myers, R. H. Myers R. S. L. and Ye. K, ***"Probability and Statistics for Engineers and Scientists",*** Seventh Edition, Pearson Education, Delhi.
2. Lipschutz. S and Schiller. J, ***"Schaum's outlines - Introduction to Probability and Statistics"***, McGraw-Hill, New Delhi.
3. S. M. Ross, "***Introduction to Probability and Statistics for Engineers and Scientists***" 4th edition.

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HS-305: INDUSTRIAL ECONOMICS AND MANAGEMENT

Teaching Scheme			Credits	Marks			Duration of End Semester Examination
L	T	P/D	C	Sessional	End Semester Exam	Total	
3	0	0	3	40	60	100	3 hrs

COURSE CONTENT:

UNIT	CONTENT	No. of Hrs.
I	**Introduction to Engineering Economics** - Technical efficiency, economic efficiency - cost concepts: elements of costs, opportunity cost, sunk cost, private and social cost, marginal cost, marginal revenue and profit maximization. **Supply and Demand:** Determinants of demand, law of demand, determinants of supply, law of supply, market equilibrium - elasticity of demand - types of elasticity, factors affecting the price elasticity of demand **National Income Concepts:** GDP and GNP, per capita income, methods of measuring national income. Inflation and deflation:	8
II	**Value Analysis** - Time value of money - interest formulae and their applications: single-payment compound amount factor, single-payment present worth factor, equal-payment series compound amount factor, equal-payment series sinking fund factor, equal-payment series present worth factor, equal-payment series capital recovery factor, effective interest rate. **Investment Analysis:** Payback period—average annual rate of return, net present value; Internal rate of return criteria, price changes, risk and uncertainty.	8
III	**Principles of Management:** Evolution of management theory and functions of management organizational structure - principle and types - decision making - strategic, tactical & operational decisions, decision making under certainty, risk & uncertainty and multistage decisions & decision tree. **Human Resource Management:** Basic concepts of job analysis, job evaluation, merit rating, wages, incentives, recruitment, training and industrial relations.	8
IV	**Financial Management**: Time value of money and comparison of alternative methods; costing – elements& components of cost, allocation of overheads, preparation of cost sheet, break even analysis - basics of accounting - principles of accounting, basic concepts of journal, ledger, trade, profit & loss account and balance sheet. **Marketing Management:** Basic concepts of marketing environment, marketing mix, advertising and sales promotion. **Project Management:** Phases, organization, planning, estimating, planning	8

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	using PERT & CPM.	

Text Books:

1. PanneerSelvam, R, **"*Engineering Economics***", Prentice Hall of India Ltd, New Delhi.
2. Dwivedi, D.N**., "*Managerial Economics**, 7/E"***, Vikas Publishing House.

Reference Books:

1. Sullivan, W.G, Wicks, M.W., and Koelling. C.P., **"*Engg. Economy 15/E*"**,Prentice Hall, New York, 2011.
2. Chan S. Park, **"*Contemporary Engineering Economics***", Prentice Hall of India, 2002.
3. F. Mazda, ***Engg.Management***, Addison Wesley, Longman Ltd., 1998.
4. O. P. Khanna***, Industrial Engg.and Management,***DhanpatRai and Sons, Delhi, 2003.
5. P. Kotler, ***Marketing Management, Analysis, Planning, Implementation and Control***, Prentice Hall, New Jersey, 2001.
6. VenkataRatnam C.S & Srivastva B.K, ***Personnel Management and Human Resources,*** Tata McGraw Hill.
7. Prasanna Chandra, ***Financial Management****: Theory and Practice*, Tata McGraw Hill.
8. Bhattacharya A.K., ***Principles and Practice of Cost Accounting***, Wheeler Publishing.
9. Weist and Levy, ***A Management guide to PERT and CPM***, Prantice Hall of India.
10. Koontz H.,O'Donnel C.,&Weihrich H, ***Essentials of Management***, McGraw Hill.

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ME-301: STRENGTH OF MATERIALS-I

Teaching Scheme			Credit	Marks			Duration of End semester Examination
L	T	P/D	C	Sessional	End Semesteter	Total	
3	1	0	4	40	60	10	3Hrs

COURSE CONTENT:

UNIT	CONTENT	No. of Hrs.
I	**Simple Stresses and Strains:** Stress & Strain, Types of stresses and strains, elastic limit, Hooke's law, Stress-Strain diagram for ductile and brittle, Factor of Safety, Poisson's ratio, Elastic constants, Young's Modulus, Shear Modulus, and Bulk Modulus, Relationship between elastic constants. Introduction to thermal stresses and strains. **Compound stresses & strains**: Concept of surface and volumetric strains, two – dimensional stress system, complementary shear stresses at a point on a plane. Principal stresses & strains and principal planes. Mohr's circle of stresses, Numerical problems.	9
II	**Bending Stresses in Beams:** Bending stresses in Beams with derivation of Bending equation and its application to beams of circular, rectangular, I & T sections, Composite Beams. **Torsion of Circular Shaft:** Theory of Pure Torsion, Derivation of Torsion equation for a circular shaft subjected to torsion, assumptions, derivation of maximum torque transmitted by a solid shaft, and hollow shaft.	8
III	**Shear and combined stresses in beams**: Shear stresses in beams with derivation of shear stress in rectangular I, T, circular and hollow circular sections. Combined bending, torsion & axial loading of beams. Numerical problems. **Slope & Deflection**: Relationship between bending moment, slope & deflection, Method of integration, Macaulay's method, Mohr's theorem-moment area method, ,. Calculations for slope &deflection of (1) cantilevers and (2) simply supported beams with or without overhang, under concentrated loads, uniformly distributed loads, uniformly distributed loads, or combination of any two or all of these types of loads. distributed loads. Numerical problems.	9
IV	**Theories of Elastic Failure**: Various theories of elastic failure with derivations and graphical representations, applications to problems of two-dimensional stress systems with (i) Combined direct loading and bending and (ii) combined torsional and direct loading. Numerical problems. **Strain Energy & Impact Loading**: Definitions, expressions for strain energy stored in a body when load is applied (i) gradually, (ii) suddenly and (iii) with impact. Strain energy of beams in bending, beam deflections. Strain energy of shafts in twisting. Energy methods in determining spring deflection, Castigliano's	8

	& Maxwell's theorems, Numerical problems	

Text Books :

1. ***Mechanics of Materials***-Vol.-1, & Vol. 2, E.J. Hearn, Elsevier Publications.
2. ***Strengths of Materials*** – R.K. Rajput, S.Chand& Sons.
3. ***Strength of Materials***- R.K. Bansal, Laxmi Publications.

Reference Books:

1. ***Mechanics of Materials***-R.C.Hibbeler, Pearson India.
2. ***Mechanics of Solids***-James Goodno, Thomson Publishers.
3. ***Strength of Materials***-Popov , PHI, New Delhi.
4. ***Strength of Materials***-G.H. Ryder- Third Edition in S.I. units 1969 Macmillan India.

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ME-302: FLUID MECHANICS

Teaching Scheme			Credit	Marks			Duration of End semester Examination
L	T	P/D	C	Sessional	End Semester	Total	
3	1	0	4	40	60	100	3Hrs

COURSE CONTENT:

UNIT	CONTENT	No. of Hrs.
I	**Introduction:** Fluid Definition and properties, Newton's law of viscosity concept of continuum, Classification of fluids. **Fluid Statics:** Definition of body and surface forces, Pascal's law, Basic hydrostatic equation, Forces on surfaces due to hydrostatic pressure, Buoyancy and Archimedes' principle, Meta center, stability of floating and submerged bodies.	8
II	**Fluid Kinematics:** Eulerian and Lagrangian approach to solutions; Velocity and acceleration in an Eulerian flow field; Definition of streamlines, path lines and streak lines; Definition of steady/unsteady, uniform/non-uniform, one-two and three dimensional flows; Definition of control volume and control surface, stream function, velocity potential function , irrotational flows; Definition and equations for source, sink, irrotational vortex, circulation. **Fluid Dynamics I :**Integral equations for the control volume: Reynold's Transport theorem, equations for conservation of mass, energy and momentum, Momentum and Energy correction factors, Bernoulli's equation and its application in flow measurement, mouth pieces , pitot tube, venture, orifice and nozzle meters.	9
III	**Fluid Dynamics II:** Differential equations for the control volume: Mass conservation in 2 and 3 dimension in rectangular and cylindrical co-ordinates, Euler's equations in 2,3dimensions and subsequent derivation of Bernoulli's equation; Navier-Stokes equations, Couette flow, plane Poiseuille flow **Real fluid flows:** Definition of Reynold's number, Laminar flow through a pipe (Hagen Poiseuille flow), velocity profile and head loss; Prandtl mixing length theory; velocity profiles for turbulent flows, Velocity profiles for smooth and rough pipes Darcy's equation for head loss in pipe, Moody's diagram, pipes in series and parallel, major and minor losses in pipes	9
IV	**Boundary Layer Flows:** Concept of boundary layer and definition of boundary layer thickness, displacement, momentum and energy thickness; laminar and turbulent boundary layers, laminar sub-layer; Von Karman Momentum Integral equation for boundary layers, analysis of laminar and	8

	turbulent boundary layers, drag, boundary layer separation and methods to control it, streamlined and bluff bodies. **Dimensional analysis**: Buckingham's Pi theorem, Non – dimensional numbers and their application, similitude, scale effects	

Text Books:

1. ***Introduction to Fluid Mechanics and Machines***, S. K Som , McGraw Hill
2. P.N.Modi and S.M.Seth (1999), ***Hydraulics and Fluid Mechanics including Hydraulic Machines,*** Standard Book House, Naisarak, Delhi

Reference Books:

1. ***Fluid Mechanics***: F.M.White, McGraw Hill
2. ***Fluid Mechanics***: Cengel and Cimbala
3. ***Fluid Mechanics and Fluid Power Engineering*** – D.S.Kumar, S.K.Kataria and Sons.
4. ***Mechanics of Fluids***: Irving Shames

ME-303: ENGINEERING THERMODYNAMICS

Teaching Scheme			Credit	Marks			Duration of End semester Examination
L	T	P/D	C	Sessional	End Semester	Total	
3	0	0	3	40	60	100	3Hrs

COURSE CONTENT:

UNIT	CONTENT	No. of Hrs.
I	**Introduction and Basic Concepts:** Application areas of thermodynamics, Systems and Control volumes, Properties of system, Continuum, State and equilibrium, Processes and cycles, Temperature and Zeroth law of thermodynamics, Heat and thermodynamic, concept of work. **First Law of Thermodynamics:** Statement, Heat and work calculations, Application of first law to non-flow and flow systems, steady flow energy equation as applied to boiler, condenser, throttle, nozzle and turbine	8
II	**Second Law of Thermodynamics:** Statements and their equivalence, thermal energy reservoirs, concept of heat engine, refrigerator, heat pump and perpetual motion machines, Carnot cycle and principles. **Entropy:** Concept of entropy, Temperature- entropy plot, Clausius inequality theorem, Principle of Increase of entropy, entropy balance, entropy generation in daily life, first and second law combined, entropy changes of an ideal gas during reversible processes, Available and unavailable energy, Irreversibility, second law efficiency	8
III	**Property Relations:** Introduction to Maxwell relations, Clausius-Clapeyron equation, volume expansivity and isothermal compressibility, Mayer relation, Joule-Thomson coefficient. **Properties of Steam:** Dryness fraction, enthalpy, internal energy and entropy, steam table, polynomial form of steam equations and Mollier chart, First law applied to steam processes	8
IV	**Power Cycles:** Vapor power Cycles: Carnot vapour cycle, Rankine cycle, Ideal reheat Rankine cycle, Introduction to co-generation. Gas Power Cycles**:** Air standard assumptions, Otto cycle, Diesel cycle, dual cycle, Stirling cycle, Ericsson cycle, Brayton cycle **Reactive Systems:** Combustion, theoretical and actual combustion processes, enthalpy of formation and enthalpy of combustion, adiabatic flame temperature, first law analysis of reactive system	8

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Text Books

1. ***Thermodynamics*** by P K Nag, TMH, 5TH Edition
2. ***Fundamentals of Classical Thermodynamics*** by Van Wylen G.H. & Sonntag R.E., John Wiley & Sons.

Reference Books:

1. ***Thermodynamics: An Engineering Approach***, Yunus A. Cengel and Michael A Boles, 7e, TMH.
2. ***Thermodynamics and Heat Engines*** by R Yadav, Central Publishing house.
3. Holman, J.P. ***Thermodynamics***. McGraw- Hill
4. ***Thermal Engineering*** by Mahesh Rathod, McGrawHill Publications
5. ***Engineering Thermodynamics- A Generalized Approach*** by P L Dhar, ELSEVIER
6. ***Fundamentals of Thermodynamics*** by Moran & Shapiro.
7. Schaum's Outlines: ***Thermodynamics for Engineers*** by Merle C. Potter

ME-304: MACHINE DRAWING

Teaching Scheme			Credit	Marks			Duration of End semester Examination
L	T	P/D	C	Sessional	End Semester	Total	
2	0	3	3	40	60	100	3Hrs

COURSE CONTENT:

UNIT	CONTENT	No. of Hrs.
I	**Introduction:** Introduction to BIS Specification sp: 46- 1988 Code of engineering drawing – Limits. Fits and Tolerance (dimensional and Geometrical tolerance), Surface finish representation.	7
II	**Gear:** Gear terminology. I.S convention of assembly of spur gears, helical gear, bevel gears, worm and worm wheel. **Fasteners:** Drawings of various views of Screw threads, metric and BSW threads, Square thread and multi start threads. Nut bolts, Washers, Setscrew, Locknuts and foundation bolts.	7
III	**Orthographic view:** Orthographic view from isometric views of machine parts / components. Dimensioning- Sectioning. Exercises on coupling, crankshaft, pulley, piston and connecting rod, cotter and knuckle joints. Riveted joints and Welded joints.	7
IV	**Assembly drawing:** Assembly drawings with sectioning and bill of materials from given detail drawings of assemblies: Lathe tail stock, machine vice, pedestal bearing, Steam stop valve, drill jigs and milling fixture.	7

Text Books:

1. ***Machine Drawing***: N D Bhat and V M Panchal, Pub: Charotar Publishing House.
2. ***A text book of machine drawing***: PS Gill, Pub: S.K.Kataria& Sons.

Reference Books:

1. ***A text books of machine Drawing***: Laxminarayana and Mathur, Pub: M/S Jain Brother. New Delhi.
2. ***Machine Drawing***: N Sidheshwar, P Kannaieh, V S Sastry, Pub: Tata McGraw Hill.

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HS 306: SOCIOLOGY AND ELEMENTS OF INDIAN HISTORY FOR ENGINEERS

Teaching Scheme			Credits	Marks			Duration of End Semester Examination
L	T	P/D	C	Sessional	End Semester Exam	Total	
2	0	0	2	40	60	100	3 hrs

COURSE OBJECTIVE:

- To familiarize the students with elements of Indian history and sociological concepts and theories by which they could understand contemporary issues andproblems in Indian society.
- The enable the students to analyse critically the social processes of globalization, modernization and social change.
- To help the students imbibe such skills that will enable them to be better citizens and human beings.

COURSE CONTENT:

UNIT	CONTENT	No. of Hrs.
I	**Introduction to sociological concepts** - structure, system, organization, social institution, Culture social stratification (caste, class, gender, power). **Understanding social structure and social processes -** Perspectives of Marx and Weber.	6
II	**Political economy of Indian society** - Industrial, Urban, Agrarian and Tribal society. **Social change in contemporary India** - Modernization and globalization, Secularism and communalism.	6
III	**Introduction to Elements of Indian History -** What is history? ; History Sources - Archaeology, Numismatics, Epigraphy and Archival research. **Indian history and periodization -** evolution of urbanization process: first, second and third phase of urbanization.	6
IV	**From feudalism to colonialism -**the coming of British; Modernity and struggle for independence. **Issues and concerns in post-colonial India (upto 1991) -** Issues and concerns in post-colonial India 2ndphase (LPG decade post 1991)	6

Text Books:

1. Desai, A.R. (2005), ***Social Background of Indian Nationalism***, Popular Prakashan.
2. Giddens, A (2009), ***Sociology, Polity***, 6thEdition.

3. Chandoke, Neera & Praveen Priyadarshi(2009), ***contemporary India: Economy, Society and Politics***, Pearson.

Reference Books:

1. Guha, Ramachandra(2007), ***India After Gandhi***, Pan Macmillan.
2. Haralambos M, RM Heald, M Holborn (2000), ***Sociology, Collins***.
3. Sharma R. S..(1965), ***Indian feudalism***, Macmillan.
4. Gadgil, Madhab&RamchandraGuha(1999) - ***This Fissured Land: An Ecological Histry of India,*** OU Press.

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HS-307: GERMAN LANGUAGE – I

Teaching Scheme			Credits	Marks			Duration of End Semester Examination
L	T	P/D	C	Sessional	End Semester Exam	Total	
2	0	0	2	40	60	100	3 hrs

COURSE OBJECTIVES:

- To read and write short, simple texts.
- To understand a dialogue between two native speakers and also take part in short, simple conversations using the skills acquired.
- To offers opportunities for students of engineering for higher studies, research and employment in Germany.

COURSE CONTENT:

UNIT	CONTENT	No. of Hrs.
I	**Wichtige Sprachhandlungen:** Phonetics – SichbegrüßenSich und anderevorstellenformell / informell - Zahlen von 1 bis 1 Milliarde - verstehen&sprechen. **Grammatik:** regelmäßigeVerbenimPräsens - "sein" und habenimPräsens - PersonalpronomenimNominativ	6
II	**Wichtige Sprachhandlungen:** Telefon Nummernverstehen und sprechen Uhrzeitenverstehen und sagenVerneinung "nicht und kein" (formell und informell). **Grammatik**: Wortstellung – Aussagesatz – W-Frage und Satzfrage (Ja/NeinFrage) Nomenbuchstabieren und notierenbestimmter und unbestimmter Artikelund Negativartikelim Nom. &Akkusativ	6
III	**Wichtige Sprachhandlungen:** Tageszeitenverstehen und über Terminesprechen-Verabredungenverstehen – Aufgabenim Haushaltverstehen. **Grammatik:** PersonalpronomenimAkkusativ und Dativ - W-Fragen "wie, wer, wohin,wo, was usw.-Genitivbei Personennamen - ModalverbenimPräsens "können, müssen,möchten"	6
IV	**Wichtige Sprachhandlungen:** Sichaustauschen, was man kann, muss – BezeichnungenLebensmittel – Mengenangabenverstehen – PreiseverstehenundEinkaufzettelschreiben **Grammatik:**Wortstellung in SätzenmitModalverben – Konnektor "und" – "noch"-kein-------mehr – "wieviel, wieviele, wie alt, wielange" – PossessivartikelimNominativ	6
V	**Wichtige Sprachhandlungen:** Freizeitanzeigenverstehen – HobbysundSportarten Anzeigenfür Freizeitpartnerschreibenbzw. daraufantworten	6

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	–Vorlieben und Abneigungenausdrucken **Grammatik:**Verbenmit Vokalwechselim Präsens – ModalverbenimPräsens“dürfen, wollen und mögen - “haben und sein” imPräteritum – regelmäßigeVerbenimPerfekt – Konnektoren “denn, oder, aber.	

Text Book

1. Studio d A1. Deutsch alsFremdsprache with CD.(Kursbuch und Sprachtraining).

References

1. German for Dummies
2. Schulz Griesbach

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HS-308: FRENCH LANGUAGE - I

Teaching Scheme			Credits	Marks			Duration of End Semester Examination
L	T	P/D	C	Sessional	End Semester Exam	Total	
2	0	0	2	40	60	100	3 hrs

COURSE OBJECTIVES:

- To read and write short, simple texts.
- To understand a dialogue between two native speakers and also take part in short, simple conversations using the skills acquired.
- To offers opportunities for students of engineering for higher studies, research and employment in French.

COURSE CONTENT:

UNIT	CONTENT	No. of Hrs.
I	**Grammar and Vocabulary:** Usage of the French verb "se presenter", a verb of self- introduction and how to greet a person- "saluer". **Listening and Speaking:** The authentic sounds of the letters of the Frenchalphabet and the accents that play a vital role in the pronunciation of thewords. **Writing:** Correct spellings of French scientific and technical vocabulary. **Reading:** Reading of the text and comprehension – answering questions.	**6**
II	**Grammar and Vocabulary:** Definite articles, "prepositions de lieu" subjectpronouns. **Listening and Speaking:** Pronunciation of words like Isabelle, presentezandla liaison – vousetes, vousappelez and role play of introducing each other –group activity. **Writing:** Particulars in filling an enrolment / registration form. **Reading Comprehension:** reading a text of a famous scientist and answeringquestions.	**6**
III	**Grammar and Vocabulary:** Verb of possession "avoir' and 1st group verbs"er", possessive adjectives and pronouns of insistence- moi, lui..and numbers from 0 to 20. **Listening and Speaking: N**asal sounds of the words like feminine, ceinture,parfum and how to ask simple questions on one's name, age, nationality,address mail id and telephone number. **Writing:** Conjugations of first group verbs and paragraph writing on self – introduction and introducing a third person. **Reading Comprehension:** reading a text that speaks of one's profile and answering questions	**6**
IV	**Grammar and Vocabulary:** Negative sentences, numbers from 20 to 69, verb"aimer"and seasons of the year and leisure activities. **Listening and Speaking:** To express one's likes and dislikes and to talk ofone's	**6**

	pastime activities (sports activities), je fais du ping-pong and nasalsounds of words – janvier, champagne. **Writing-**Conjugations of the irregular verbs: faire and savoir and their usage.Paragraph writing on one's leisure activity- (passé temps favori). **Reading:** a text on seasons and leisure activities – answering questions.	
V	**Grammar and Vocabulary:** les verbes de direction- to ask one's way and togive directions, verbes- pouvoir and vouloir and 2nd group verbs, a droite, lapremiere a gauche and vocabulary relating to accommodation. **Listening and Speaking:**To read and understand the metro map and henceto give one directions – dialogue between two people. **Writing:**Paragraph writing describing the accommodation using the differentprepositions like en face de, derriere- to locate. **Reading Comprehension:**A text / a dialogue between two on location anddirections- ouest la poste/ la pharmacie, la bibliotheque?.....	**6**

Text Book

1. Tech French

References

1. French for Dummies.
2. French made easy-Goyal publishers
3. Panorama

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ME-305: STRENGTH OF MATERIALS LAB.

Teaching Scheme			Credits	Marks			Duration End Semester Examination
L	T	P/D	C	I.A.	ESE	Total	
0	0	2	1	30	20	50	3 hrs

Experiments as per the topics in the syllabus for the course 'Analog Electronics Lab' will be conducted in the laboratory class. Following is the list of experiments out of which 8-9 experiments must be performed during the semester:

LIST OF EXPERIMENTS:

1. To study the Brinell and Rockwell hardness testing machine & compare hardness of at least two types of materials/alloys,
2. To study the Vickers hardness testing machine & perform Vickers hardness test& compare hardness of at least two types of materials/alloys,
3. To study the Impact Testing Machine and perform the Impact tests (Izod & Charpy),
4. To study the Universal testing machine and perform the tensile test for comparing graphs of at least two types of materials/alloys,
5. To perform compression test on UTM,
6. To perform bending/shear test on UTM,
7. To perform the torsion test on mild steel/aluminium alloy,
8. To perform fatigue test on mild steel/aluminium alloy,
9. To find Young's Modulus of a beam (rectangular/triangular/circular section) using deflection of beam apparatus,
10. To find Modulus of Rigidity of a specimen using Searl's Apparatus

ME-306: FLUID MECHANICS LAB

Teaching Scheme			Credits	Marks			Duration End Semester Examination
L	T	P/D	C	I.A.	ESE	Total	
0	0	2	1	30	20	50	3 hrs

Experiments as per the topics in the syllabus for the course 'Analog Electronics Lab' will be conducted in the laboratory class. Following is the list of experiments out of which 8-9 experiments must be performed during the semester:

List of Experiments:

1. To determine the coefficient of impact for vanes.
2. To determine the coefficient of discharge of Notch (V and Rectangular types)
3. To determine the friction factor for the pipes.
4. To determine the coefficient of discharge of venturimeter /orifice meterpitot tube.
5. To determine the coefficient of discharge, contraction & velocity of an orifice.
6. To find critical Reynolds number for a pipe flow.
7. To study the effect of pressure surge in pipes.
8. To determine the minor losses due to sudden enlargement, sudden contraction and bends.
9. To show the velocity and pressure variation with radius in a forced vertex flow
10. To determine lift and drag of an aerofoil.
11. To determine the static pressure and dynamic pressure distribution around an aerofoil using wind tunnel apparatus
12. To determine the meta-centric height of a floating body
13. To perform the calibration of pressure gauge

ME-307: COMPUTER AIDED DESIGN (CAD) LAB

Teaching Scheme			Credits	Marks			Duration End Semester Examination
L	T	P/D	C	I.A.	ESE	Total	
0	0	3	2	30	20	50	3 hrs

Experiments as per the topics in the syllabus for the course 'Analog Electronics Lab' will be conducted in the laboratory class. Following is the list of experiments out of which 8-9 experiments must be performed during the semester:

LIST OF EXPERIMENTS:

1. Setting up of drawing environment by setting drawing limits, drawing units, naming the drawing naming layers, setting line types for different layers using various type of lines in Engineering drawing, saving the file with dwg. extension.

2. Layout drawing of a building using different layer and line colors indicating all Building details name the details using text commands, Make a title Block.

3. To Draw Orthographic projection drawings (Front, Top and side) of boiler safety valve giving name the components of the valve.

4. Make an Isometric dimensioned drawing of a connecting Rod using Isometric grid and snap.

5. Draw quarter sectional isometric view of a cotter joint.

6. Draw different types of bolts and nuts with internal and external threading in Acme and square threading standards. Save the bolts and nuts as blocks suitable for insertion.

7. Draw a 3D model of a machine component using 3D primitives and using commands like Union. Subtraction, Revolve, Slice, Rotate 3D etc. Calculate surface Area, Mass, Centre of Gravity and Mass moment of inertia using inquiry commands render the figure made and attach a material to the figure.

8. Draw 3D model of protected type flange coupling.

9. Draw a spiral by extruding a circle.

10. Draw an assembly of Jigs & Fixture in 3D.

SEMESTER-IV

MA-401: OPTIMIZATION AND CALCULUS OF VARIATIONS

Teaching Scheme			Credits	Marks			Duration of End Semester Examination
L	T	P/D	C	Sessional	End Semester Exam	Total	
2	2	0	3	40	60	100	3 hrs

COURSE OBJECTIVES:

The objective of this course is to present different methods of solving optimization problems in the three areas of linear programming, nonlinear programming, and classical calculus of variations. In addition to theoretical treatments, there will be some introduction to numerical methods for optimization problems.

COURSE CONTENT:

UNIT	CONTENT	No. of Hrs.
I	**Introduction:** A survey of some simplified examples of common real world situations leading to optimization problems, basic formulation and theory of optimization problems. **Linear programming:** Linear programming (optimization of linear functions subject to linear constraints): basic theory; simplex method; duality, practical techniques.	6
II	**Linear programming:** Basic LPP - solution techniques (Simplex, Artificial Basis), Complimentary Slackness Theorem,Fundamental theorem of Duality,degenerate solutions, cycling; Applications - elements of dynamic programming includingHamiltonian, Bellman'soptimality principle. **Transportation and Assignment Problems:** Solution of a balanced transportation problem, degeneracy in transportation problems and alternate solutions, Mathematical problems in formulation of assignment problems.	7
III	**Nonlinear programming:** Nonlinear programming (optimization of nonlinear functionssubject to constraints) with Lagrange multipliers, Karush-Kuhn-Tucker optimality conditions,convexity, duality. **Approximation methods for nonlinear programming:** Line search methods, gradientmethods, conjugate gradient methods; Networkingtechniques – PERT and CPM.	6
IV	**Calculus of Variations:**Basic definitions -functionals, extremum, variations, function spaces; Necessary conditions for an extremum, Euler-Lagrange Equation, convexity and it's role in minimization, minimization under constraints;	6

	Existence and nonexistence of minimizers;Applications - Isoperimetric problems, Geodesics on the surface.	

Text Books:

1. C. B. Gupta, ***"Optimization Techniques in Operation Research,"*** I. K. InternationalPublishing House Pvt. Ltd.
2. A. S. Gupta, ***Calculus of Variations and Applications***, PHI Prantice hall India.
3. Mukesh Kumar Singh, ***"Calculus Of Variations"***, Krishna Prakashan Media (P) Ltd.
4. J. K. Sharma, ***Operations Research – Problems and Solutions***, Macmillian Pub.

Reference books:

1. I. M.Gelf and S. V. Fomin, ***"Calculus of Variations"*** Dover Publications IncMineola,New York.
2. Purna Chand Biswal, ***"Optimization in Engineering***, Scitech Publications India Pvt. Ltd.
3. B. S. GREWAL, ***Higher Engineering Mathematics***, Krishna Publications.
4. G. Hadly, ***Linear Programming***, Narosa Publishing House.
5. KantiSwarup, P. K. Gupta and Manmohan, ***"Operations Research,"*** Sultan Chand & Sons.

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HS-409: HUMAN VALUES AND PROFESSIONAL ETHICS

Teaching Scheme			Credits	Marks			Duration of End Semester Examination
L	T	P/D	C	Sessional	End Semester Exam	Total	
2	2	0	3	40	60	100	3 hrs

COURSE OBJECTIVES:

- To enable students to explore the purpose of value education.
- To understand the purpose of harmony with oneself, family, society and nature.

COURSE CONTENT:

UNIT	CONTENT	No. of Hrs.
I	**Introduction –Need and Basic Guidelines** 1. Understanding the need , basic guidelines, content and process of value Education 2. Self-Exploration – purpose, content and process, 'Natural Acceptance' and Experiential Validation – as the mechanism for self-explanation.	6
II	**Process for Value Education** 1. Continuous Happiness and Prosperity – A look at basic Human Aspirations. 2. Right Understanding, Relationship and Physical Facilities – basic requirements for fulfillment of aspirations of every human being with their correct priority 3. Understanding Happiness and prosperity – A critical appraisal of the current scenario. 4. Method to fulfill the human aspirations; understanding and living in harmony at various levels	7
III	**Harmony in Human Beings** 1. Understanding human being as a co-existence of the self and the body. 2. Understanding the needs of Self ('I') and 'Body' – Sukh and Suvidha. 3. Understanding the Body as an instrument of 'I' (I being the doer, seer and enjoyer)	7
IV	**Harmony in Myself and body** 1. Understanding the characteristics and activities of 'I' and harmony in 'I' **2.** Understanding the harmony of I with the Body: Sanyam and Swasthya: correct appraisal of Physical needs, meaning of Prosperity in detail.	6
V	**Harmony in Family, Society and Nature**	6

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	1. Understanding harmony in the family, society and nature. 2. Understanding values in human relationship; meaning of Nyaya and Program for its fulfillment to ensure Ubhay-tripti. 3. Trust (Vishwas) and Respect (Samman) as the foundational values of relationship.	

Text Books

1. R R Gaur, RSangal and GP Bagaria, ***A Foundation Course in value Education***, Published by Excel Books (2009).
2. R R Gaur, R Sangal and G P Bagaria, ***Teacher's Manual (English),*** 2009.

Reference Books

1. E.F. Schumacher, ***Small is Beautiful; a study of economics as if people mattered***, Blond & Briggs, Bratain, 1973.
2. PL Dhar, RR Gaur, ***Science and Humanism***, common wealth publishers, 1990.
3. A.N. Tripathy, ***Human values,*** New Age International Publishers, 2003.
4. E.G. Seebauer& Robert, L BERRY, ***Foundational of Ethics for Scientists &Engineers***, Oxford University Press, 2000.
5. M. Govindrajran, S.Natrajan& V.S. Senthi Kumar, ***Engineering Ethics (including human Values),*** Eastern Economy Edition, Prentice hall of India Ltd.
6. B.L. Bajpai, 2004, ***Indian Ethos and Modern Management***, New Royal book Co; Lucknow, 2004, Reprinted 2008.

ME-401: MANUFACTURING TECHNOLOGY-I

Teaching Scheme			Credit	Marks			Duration of End semester Examination
L	T	P/D	C	Sessional	End Semester	Total	
3	0	0	3	40	60	100	3Hrs

COURSE CONTENT:

UNIT	CONTENT	No. of Hrs.
I	**Introduction to** Manufacturing and Manufacturing Processes, Classification of Manufacturing Processes, Metal Casting Processes: Introduction, Basic steps in Casting Processes, Advantage and limitations, sand mold making procedure, Patterns and Cores. Pattern materials, pattern allowances, types of pattern, colour coding,Moulding material, Moulding sand composition, and preparation, sand properties and testing type of sand moulds. Types of cores, core prints, chaplets, chills. Gating systems and Casting Defects, Gates and gaiting systems risers, melting practice, Cupola, charge calculations. **Casting cleaning and casting defects** Fettling, defects in castings and their remedies, methods of testing of castings for their soundness. **Special Casting Processes:** Shell molding, precision investment casting, permanent mold casting, die casting, centrifugal casting, and continuous casting.	**9**
II	**Metal forming Processes:** Introduction to Forming, Nature of plastic deformation, hot working and cold working. Principles of rolling roll passes roll pass sequences. Forging: Forging operations, smith forging, drop forging, press forging, forging defects. **Extrusion and other processes:** Extrusion principle, hot extrusion, cold extrusion, wire drawing, swaging, tube making, **Sheet metal operation**: Press tool operations, shearing action, drawing dies, spinning, punching, piercing, bending, stretch forming, embossing and coining.	**8**
III	**Welding and Welding Defects:** Introduction to Welding, Gas and Arc Welding, Classification: Oxyacetylene welding equipment and techniques. Electric arc welding: Electrodes, Tungsten inert gas welding (TIG), metal inert gas welding (MIG), submerged arc welding (SAW), Resistance Welding: Principle & types, Welding Defects and Remedies. **Other Joining Processes:** Thermit welding, electro slag welding, electron beam welding, forge welding, friction welding, diffusion welding, brazing and soldering and Mechanical joining,Joining Plastic	**9**
IV	**Plastic Manufacturing Processes** Classification of plastic materials, Manufacturing of plastic products, casting, compression moulding, transfer moulding, Injection Moulding, Extrusion, calendering, blow moulding, forming shaping methods, laminating methods, reinforced plastic moulding.	**8**

	Powder Metallurgy: Introduction, Operation in powder metallurgy, Production of Metal powders, Properties of metal powder, Blending of metal powders, Compaction of metal powders, Sintering and secondary operation, Application of powder Metallurgy	

Text Books:

1. ***Materials and Manufacturing Processes***–KalpakJain-Pearson Publication
2. ***Manufacturing Science*** – Ghosh A., Malik A.K. Affiliated East-West Press Pvt. Ltd., New Delhi.
3. ***Manufacturing Processes***-J.P.Kaushish PHI Publication

Reference Books:

1. ***Production Technology***: R.K.Jain, Khanna Publishers.
2. ***Manufacturing Technology***: Vol I &Vol II, P.N.Rao, Tata McGraw Hill.
3. ***Manufacturing Technology***: R.K. Rajput, Laxmi Publications.
4. ***Welding and Welding Technology***: Richard L.Little, Tata McGraw Hill.
5. ***Principle of Metal casting***- Rosenthal, Tata McGraw Hill.
6. ***Manufacturing Processes and Systems:*** Ostwald Phillip F., Munoz Jairo, John Wiley & Sons (Asia) Pvt. Ltd.

ME-402: STRENGTH OF MATERIALS-II

Teaching Scheme			Credit	Marks			Duration of End semester Examination
L	T	P/D	C	Sessional	End Semester	Total	
3	1	0	4	40	60	100	3Hrs

COURSE CONTENT:

UNIT	CONTENT	No. of Hrs.
I	**Thin Walled Vessels**: Derivation of Hoop & Longitudinal stresses & strains in cylindrical & spherical vessels under internal pressure. Change in volume of vessel under pressure, Numerical problems. **Thick Cylinders & Spheres**: Derivation of equations for radial & hoop stresses and strains in thickcylinders and spherical shells. Compound cylinders and spherical shells subjected to internal fluidpressure only, hub shrunk on solid shaft. Wire-wound cylinders. Numerical problems.	9
II	**Rotating Rims, Discs & Cylinders**: Stresses and strains in (i) rotating rims, neglecting the effect ofspokes, (ii) rotating discs, including disc of uniform strength and disc shrunk on hub (iii) rotatingcylinders (solid & hollow). Numerical problems.	8
III	**Columns & Struts**: Columns under axial load, concept of instability and buckling, slendernessratio. Derivation of Euler's formulae for the elastic buckling load. Euler's, Rankine Gordon'sformulae ,Johnson's empirical formula for axial loading of columns and their applications,eccentric compression of a short strut of rectangular & circular sections, Numerical problems. **Springs**: Stresses in closed and open coiled helical springs subjected to axial loads and twistingcouples. Leaf springs, flat spiral springs. Numerical Problems.	9
IV	**Bending of Curved Bars**: Stresses in bars of initial large radius of curvature, bars of initial smallradius of curvature. Stresses in crane hooks, rings and chain links of circular & trapezoidal sections.Numerical Problems. **Unsymmetrical bending:** Introduction to unsymmetrical bending, Shear Center, Numerical problems.	9

Text books :

1. ***Mechanics of Materials***-Vol.-1, & Vol. 2, E.J. Hearn, Elsevier Publications.
2. ***Strengths of Materials*** – R.K. Rajput, S.Chand& Sons.
3. ***Strength of Materials***- R.K. Bansal, Laxmi Publications.

Reference Books:

1. ***Mechanics of Materials***-R.C.Hibbeler, Pearson India (9th Edition).
2. ***Mechanics of Solids***-James Goodno, Thomson Publishers.
3. ***Strength of Materials***-Popov , PHI, New Delhi.
4. ***Strength of Materials***-G.H. Ryder- Third Edition in S.I. units 1969 Macmillan India.

ME -403: I.C. ENGINES

Teaching Scheme			Credit	Marks			Duration of End semester Examination
L	T	P/D	C	Sessional	End Semester	Total	
3	0	0	3	40	60	100	3Hrs

COURSE CONTENT:

UNIT	CONTENT	No. of Hrs.
I	**Introduction** Heat engines; Internal and external combustion engines; Classification of I.C. Engines; Cycle of operations in four strokes and two-stroke IC engines and their comparative study; Fuels**:** SI and CI engine fuels, Rating of fuels, Scavenging and scavenging blowers, Air standard cycles and Fuel air cycles, Variable specific heat and its effects, Dissociation and other losses, Actual cycles, Deviation of actual engine cycle from ideal cycle, TDC, BDC, Torque, Power. **Compression Ignition Engines** Combustion phenomenon in C I engines, Stages of combustion, Delay period, Knocking, Pressure-Crank angle diagram, Factors affecting combustion and knocking, Types of combustion chambers. **Spark Ignition Engines**Combustion**:** Combustion phenomenon in SI Engines, Ignition delay, Flame propagation, Pressure-Crank angle diagram, Abnormal combustion, Auto ignition, Detonation and Knocking, Factors affecting combustion and detonation, Types of combustion chambers	9
II	**Fuel System – SI Engines: Theory** of carburetion, Simple carburettor, Essential parts of modern carburettor, Types of carburettors, Types of fuel injection systems in SI engines, Continuous injection system, Timed injection system, Electronic Fuel Injection systems (EFIs)/MPFi, Working of Sensors, Functions of ECU in Petrol Engine. Spark Plug and its requirements, Battery, Magneto, Electronic ignition systems. GDI Technology, Turbo in Petrol Engines. **Fuel System – CI Engines:** Fuel Injection Systems**:**Unit Pump, Inline Pump, Rotary Pump, Engine Governors: necessity and characteristics, Types of nozzle, Electronic Diesel Control, CRDi Technology, System Layout, Function of ECU in diesel engine, Working of Sensors, Turbocharger and its types, VGT, Twin-turbo.	9
III	**Engine lubrication:** Types of lubricants and their properties, SAE rating of lubricants, Types of lubrication systems, Engine Cooling**:** Necessity of engine cooling, disadvantages of overcooling, Cooling systems and their comparison: Air cooling, Liquid cooling, Supercharging/Turbo-charging**:** Objectives, Effects on power output and engine efficiency **Engine Testing and Performance:** Measurement of Break Horse Power,	9

	Indicated Power, Fuel Consumption, Air flow, BMEP, Performance characteristic of SI and CI Engines, Effect of load and Speed on mechanical, indicated thermal, break thermal and volumetric efficiencies, Heat balance sheet	
IV	**After-treatment technologies: -**Working of Catalytic Converter & its types, SCR, DPF, DOC, POC, LNT.**Exhaust Emissions:**Homologation, Emission Standards, Applicable Standards in India, Future Norms, and Significance of Fuel in meeting emissions. Classification of Segments, Emission Test Cycles, COP, Emission Measurement Techniques, On board Diagnosis, OBDI, OBDII. **Alternate Fuels:** Alcohol - Hydrogen - Natural Gas and Liquefied Petroleum Gas – Biodiesel- Biogas Properties - Suitability - Engine Modifications - Merits and Demerits as fuels.	**9**

Text Books

1. Ganesan V., (1999), ***Internal Combustion Engines***, Tata McGraw Hill.
2. John B. Heywood, (2000), ***Internal Combustion Engine Fundamentals***, McGraw Hill.

Reference Books

1. Rowland S.Benson and N.D.Whitehouse, (2000) ***Internal combustion Engines***, Vol. I and II, Pergamon Press.
2. Colin R.Feriguson, and Allan.T.Kirkpatrik, (2000), ***I.C.engines Applied Thermosciences***
3. Richard.L.Bechfold, ***Alternative Fuels Guide Book***, SAEInternational Warrendale,1997.
4. ***"Alcohols as motor fuels progress in technology***" - Series No.19 - SAE Publication USE - 1980.

5.Heisler Heinz, ***Advanced Engine Technology***, Hodder & Stoughton Ltd

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ME-404: TURBO MACHINES

Teaching Scheme			Credit	Marks			Duration of End semester Examination
L	T	P/D	C	Sessional	End Semester	Total	
3	1	0	4	40	60	100	3Hrs

COURSE CONTENT:

UNIT	CONTENT	No. of Hrs.
I	**Impact of Jets and Water Turbines** Impact of jet on flat and curved plates Types of hydro turbines - impulse and reaction, definition of various turbine parameters like gross head, discharge, work done, input power, output power, efficiencies etc., Euler's equation applied to a turbine, turbine velocities and velocity triangles, expression for work done. **Pelton Turbine:** Components of Pelton turbine, definition of design parameters like speed ratio, jet ratio, and estimation of various parameters like head, discharge, and efficiency etc., determination of number of buckets, Performance Characteristic curves.	9
II	**Reaction Turbines:** Types of reaction turbines – Francis Turbine, Kaplan Turbine, inward and outward flow, radial mixed and axial; elements of the turbine, estimation of various working and design parameters, Performance Characteristic curves of reaction turbines **Similarity relations in turbines**: definition of unit quantities and specific quantities, selection of turbines, Cavitation in turbines - causes, effects and remedies, Thomas cavitation parameter, specific speed graphs, Determination of safe height of installation for the turbine, Draft Tube, types of draft tube, governing of turbines.	9
III	**Centrifugal Pumps**: Classification, velocity vector diagrams and work done, hydraulic and manometricefficiency, vane shape, head capacity relationship and pump losses, pressure rise impeller, minimumstarting speed, multi-stage pumps, Similarity relations and specific speed, net positive suction head, cavitation and maximum suctions lift, performance characteristics. **Reciprocating Pumps:** Construction and operational details, discharge coefficient, volumetric efficiency and slip, work and power input, effect of acceleration and friction on indicator diagram (pressure – stroke length plot) air vessels and their utility. Centrifugal v/s reciprocating pumps.	9
IV	**Centrifugal fans - Blowers and Compressors** - construction details - Inducers – Backward and Radial blades - Diffuser - volute casing stage work - Stage pressure rise – Stage pressure co-efficient - Stage efficiency - Degree of reaction - Various slip factors H-S diagram for centrifugal compressor.	9

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	Axial flow Fans and Compressors –Construction detail - Stage velocity triangles - Blade loading and flow coefficient - Static pressure rise - H-S diagram - Degree of reaction - Work done factors -Free and Forced Vortex flow performance - Stalling and Surging	

Text Books:

1. ***Fluid Mechanics and Fluid Power Engineering*** – D.S.Kumar, S.K.Kataria and Sons.
2. ***Fluid Mechanics and Hydraulic Machinery***, Modi and Seth, Standard Book House

Reference Books

1. Turbines, ***Compressors & Fans***, S M Yahya, TMH
2. ***Thermal Engineering***, R K. Rajput, Laxmi Publication
3. ***Steam and gas turbine***, R Yadav
4. ***Hydraulic Machinery***, JagdishLal

HS-410: LAW FOR ENGINEERS

Teaching Scheme			Credits	Marks			Duration of End Semester Examination
L	T	P/D	C	Sessional	End Semester Exam	Total	
2	0	0	2	40	60	100	3 hrs

COURSE OBJECTIVE:

- To familiarize students (Prospective engineers) with elementary knowledge of laws that would be of utility in their profession.
- To familiarize students with the constitution of India and laws in new areas viz. IPR, ADR, Human Rights, Right to Information, Corporate law, Law relating Elections and Gender Studies.

COURSE CONTENT:

UNIT	CONTENT	No. of Hrs.
I	**Constitutional Law:** Nature of Indian Constitution (features), fundamental rights, duties and directive Principles of State Policy (DPSP's), forms of Governments, structure of Government of India, role and responsibility of executive, legislature/parliament and judiciary, nature of Indian federal system, center state and relations. Basic structure of the Indian constitution, basic features of the Indian, constitutional amendments - GolakNath, KeshwanandaBharti, Maneka Gandhi (1978) and S.R. Bommai case (1994), (floor test).	6
II	**Law of contract:** General principles of Indian Contract Act, 1862, kinds of Government contracts and dispute settlement, standard and printed form of contract, essential elements of valid contract proposal, acceptance communication and revocation thereof, relevance of time in contractual obligation. Main objectives of Arbitrates and Conciliation Act-1996, tort and law of tort, general principles of tort law, classifications of torts: property vs. person.	6
III	**Administrative Law:** Evolution, nature and its scope, conceptual objection against growth of administrative rule of law and separation of power, clarification of administrative actions, judicial review of administrative actions, exclusion of judicial review and concept of "Ombudsman";Right to Information Act, 2005 (Sub Section 1 - 20) **Environmental Law:** Definition, meaning and its nature, environmental (Protection) Act-1986, Water (Preservation and Control of Pollution) Act-1974, Air (Prevention and Control of Pollution) Act-1981; Environmental pollution, overall remedies and procedures.	8
IV	**Human Rights:** Legality of human rights, universal declaration of human rights, 1948, difference between civil and political rights, individual and human rights -	6

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	human rights of child, weaker section of society, prisoners, and refugees, International Human Rights Commission.	

Text Books:

1. D.D. Basu, ***Shorter Constitution of India***, Prentice Hall of India, (1996)
2. MeenaRao, ***Fundamental concepts in Law of Contract***, 3rd Edn. Professional Offset, (2006)
3. H.O.Agarwal, ***International Law and Human Rights***, Central Law Publications, (2008)

Reference Books:

1. H.M. Seervai, ***Constitutional Law of India***, Tripathi Publications, (1993).
2. S.K. Kapur, ***Human Rights under International Law and Indian Law,*** Central Law Agency, (2001)
3. NeelimaChandiramani, ***The Law of Contract: An Outline***, 2nd Edn. Avinash Publications Mum, (2000)
4. Avtarsingh, ***Law of Contract***, Eastern Book Co., (2002).
5. Anson W.R.(1979), ***Law of Contract***, Oxford University Press

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HS-411: GERMAN LANGUAGE – II

Teaching Scheme			Credits	Marks			Duration of End Semester Examination
L	T	P/D	C	Sessional	End Semester Exam	Total	
2	0	0	2	40	60	100	3 hrs
Prerequisite							
HS 302: GERMAN LANGUAGE - I							

COURSE OBJECTIVES:

- To enable the students to speak and understand about most of the activitiesin the day to day life.
- The students will be able to narrate their experiences in Past Tense.
- The students will be able to understand and communicate even with German Nationals.
- By the end of Phase – II the students will have a reasonable level of conversational skills.

COURSE CONTENT:

UNIT	CONTENT	No. of Hrs.
I	**Wichtige Sprachhandlungen:** Zimmersuche, Möbel **Grammatik**: Verbenmittrennbaren Vorsilbenim Präsens und Perfekt. Verbenmittrennbaren Vorsilben und Modalverbenim Präsens. Verbenmituntrennbaren Vorsilbenim Perfekt.Unregelmäßige undgemischteVerbenimPerfekt.	6
II	**Wichtige Sprachhandlungen**: Kleidung ,Farben, Materialien. **Grammatik:** formelle Imperativsätzemit "Sie" informelle Imperativsätze Vorschlägemit "wir" – "sollen/wollenwir" - Sollich? Modalpartikeln "doch""mal" "doch mal.	6
III	**Wichtige Sprachhandlungen:** Sehenswürdigkeite (Prater, BrandenburgerTör, Kolossium, Eifeltürm). **Grammatik:** Ortsangabenmit Akk. Und Dativ "alle","man" Indefinitepronomen"etwas", "nichts".	6
IV	**Wichtige Sprachhandlungen:** Essen und TrinkenimRestaurant, Partyvorbereitung und Feier. **Grammatik:** NomenausAdjektivennach "etwas"und "nichts" NomenausdemInfinitiv von Verben, zusammegesetzteNomen und ihreArtikel.	6

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	Adjektiveim Nom.undAkk.nachunbestimmten Artikel, Negativartikel und Possessivartikel	

Text Books

1. Studio d A1. Deutsch alsFremdsprache with CD.(KursbuchundSprachtraining).

References

1. German for Dummies
2. Schulz Griesbach

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HS-412: FRENCH LANGUAGE - II

Teaching Scheme			Credits	Marks			Duration of End Semester Examination
L	T	P/D	C	Sessional	End Semester Exam	Total	
2	0	0	2	40	60	100	3 hrs
Prerequisite							
HS 303: FRENCH LANGUAGE - I							

COURSE OBJECTIVES:

- To enable the students communicate effectively with any French speaker
- To enable students to access information on the internet, send e mails, pass level 1 exam conducted by Alliance Française de Madras.
- To enable students to enhance their lexical and technical competence and have a competitive edge in the international market.By the end of Phase – II the students will have a reasonable level of conversational skills.

COURSE CONTENT:

UNIT	CONTENT	No. of Hrs.
I	**Grammar and Vocabulary:** The second group verbs: Finir, rougir, grossir,grandir. "Les preposition de temps": à, en, le, de 7h à 8h, jusqu' à, vers. Listening and Speaking – the semi- vowels: Voilà, pollutant. Writing - thedays of the week,months, technical subjects, time, "les spécialitésscientifiques et l' annéeuniversitaire, paragraph writing about time table. Reading: Reading of the text and comprehension – answering questions.	6
II	Grammar and Vocabulary – The adjectives, the nationality, feminine &masculinenoun forms "les métiersscientifiques". Listening and Speaking – Vowels: soirée, année, près de, très. Writing: Countries name, nationality, "les métiersscientifiques", numbers from:69 to infitive and some measures of unit.Reading Comprehension: reading a text.	6
III	Grammar and Vocabulary – near future, The demonstrative adjectives, Expressthe aim by using the verb, Listening and Speaking –"La liaison interdite – enhaut". Writing – some scientific terms, French expressions to accept an invitation.Sentence framing. Reading Comprehension – reading a text.	6
IV	Grammar and Vocabulary –the verbs: manger, boire, the partitive articles Listening and Speaking – "le 'e' caduc Writing- the food, the ingredients, fruits,vegetables, expression of quantity, paragraph writing about food habits. Reading –reading a text.	6

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Text Books

1. Tech French

References

1. French for Dummies.
2. French made easy: Goyal publishers.
3. Panorama.

ME-405: I.C. ENGINE LAB

Teaching Scheme			Credits	Marks			Duration End Semester Examination
L	T	P/D	C	I.A.	ESE	Total	
0	0	2	1	30	20	50	3 hrs

Experiments as per the topics in the syllabus for the course 'Analog Electronics Lab' will be conducted in the laboratory class. Following is the list of experiments out of which 8-9 experiments must be performed during the semester:

List of Experiments:

1. To study the construction details of 2 Stroke and 4 Stroke Engines.
2. To study the valve timing diagram of engine. (4 stroke petrol/diesel engine)
3. To perform Morse Test on engine(4 stroke petrol/diesel engine)
4. To perform Speed Test on engine (4 stroke petrol/diesel engine)
5. To perform Load Test(Rope Brake/Eddy Current/hydraulic dynamometer) on engine (4 stroke petrol/diesel engine)
6. To perform Heat Balance test on engine (4 stroke petrol/diesel engine)
7. To perform experimental determination of Air fuel ratio and volumetric efficiency of the engine (4 stroke petrol/diesel engine)
8. To study the effects of Supercharging/turbo charging on Performance Characteristics of an engine (4 stroke petrol/diesel engine)
10. To study the difference between Carburettors based fuel system & EFI.
11. To study the difference between Inline Pump, Rotary Pump &CRDi System for a four cylinder diesel engine.
11. To study the effect of Injection Timing & Pressure on Single Cylinder Diesel Engine using Open ECU & perform Exhaust Gas/Smoke analysis of engine.
12. To study the effect of Spark Timing & Lambda on Single Cylinder Petrol Engine using Open ECU & perform Exhaust Gas/Smoke analysis of engine.
13. To study the construction details of Ignition system (Battery, Magneto, Electronic).

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ME-406: TURBO MACHINES LAB

Teaching Scheme			Credits	Marks			Duration End Semester Examination
L	T	P/D	C	I.A.	ESE	Total	
0	0	2	1	30	20	50	3 hrs

Experiments as per the topics in the syllabus for the course 'Analog Electronics Lab' will be conducted in the laboratory class. Following is the list of experiments out of which 8-9 experiments must be performed during the semester:

LIST OF EXPERIMENTS:

1. To study the constructional details of a Pelton turbine and draw its fluid flow circuit.
2. To draw the performance characteristics of Pelton turbine constant head, constant speed and constant efficiency.
3. To study the constructional details of a Francis turbine and draw its fluid flow circuit.
4. To draw the constant head, constant speed and constant efficiency performance characteristics of Francis turbine.
5. To study the constructional details of a Kaplan turbine and draw its fluid flow circuit.
6. To draw the constant head, speed and efficiency curves for a Kaplan turbine.
7. To study the constructional details of a Centrifugal Pump (rated variable speed) and draw its characteristic curves.
8. To study the constructional details of a Reciprocating Pump and draw its characteristic curves.
9. To study the constructional details of a Hydraulic Ram and determine its various efficiencies.
10. To study the constructional details of a Centrifugal compressor.
11. To study the constructional details of a submersible Pump and draw its characteristic curves.

ME-407: MANUFACTURING PRACTICE LAB-I

Teaching Scheme			Credits	Marks			Duration End Semester Examination
L	T	P/D	C	I.A.	ESE	Total	
0	0	3	2	30	20	50	3 hrs

Experiments as per the topics in the syllabus for the course 'Analog Electronics Lab' will be conducted in the laboratory class. Following is the list of experiments out of which 8-9 experiments must be performed during the semester:

LIST OF EXPERIMENTS:

1. To make a pattern for a given casting with all the necessary allowances, parting line, running system details. Prepare the mould and make the casting. Investigate the casting defects and suggest the remedial measures.

2. To prepare the Aluminium Metal Matrix Composites using permanent mould casting and study the physical, mechanical characteristics and microstructure using metallurgical Microscope.

3. To prepare the Aluminium Metal Matrix Composites using centrifugal casting and study the physical, mechanical characteristics and microstructure using metallurgical Microscope.

4. To study design for welding and make a component involving horizontal and vertical welding and study the welding defects and suggests their remedies.

5. To make a component involving horizontal /vertical welding and determine the weld quality using destructive testing such as tension test/ bend test/fracture toughness test.

6. To make a component involving horizontal and vertical welding and determine the weld quality using Non-destructive testing such as liquid-penetrant/Ultrasonic testing/magnetic particles/radiographic tests.

7. To study design for brazing, soldering and perform the soldering and brazing operations of metals.

8. To perform the MIG/TIG operation on metals and determining the strength of weld using UTM.

9. To study design for mechanical fastening and perform joining of sheet metal by riveting.

10. Development and manufacturing of complex sheet metal components such as funnel etc.

11. To prepare the plastic composites using hand layup technique and study of physical, mechanical characteristics and microstructure.

SEMESTER-V

ME-501: KINEMATICS OF MACHINES

Teaching and Examination Scheme:

Teaching Scheme			Credits	Marks			Duration of End Semester Examination
L	T	P/D	C	Sessional	End Semester Exam	Total	
2	2	0	3	40	60	100	3 hrs.

COURSE CONTENT:

UNIT	CONTENT	No. of Hrs.
I	**Introduction:** Mechanism and machines, kinematics links, kinematic pairs, kinematic chains, plane and space mechanism, kinematic inversion, equivalent linkages, four link planar mechanisms, straight line mechanisms, steering mechanisms, pantograph. **Kinematic Analysis of Plane Mechanisms:** Displacement analysis, general plane motion, instantaneous center of velocity, graphical and analytical methods of velocity and acceleration analysis.	6
II	**Cams:** Classification of cams and followers, disc cam nomenclature, construction of displacement, velocity and acceleration diagrams for different types of follower motions, analysis of follower motions, determination of basic dimension, synthesis of cam profile by graphical approach, cams with specified contours, tangent and circular arc cams.	6
III	**Belt, Rope and Chain drives**: Introduction to belts, ropes, law of belting, design of belt drives, flat & v-belt drives, conditions for transmission of max. Power **Gears:** Introduction, terminology, various types of gears and applications, fundamental law of gearing, Gear profile, involute, cycloidal, interference and undercutting. Spur gear: Path of contact, arc of contact, minimum teeth to avoid interference, introduction to helical, spiral bevel and worm gears. Synthesis of simple, compound and reverted gear trains, analysis of epicyclic gear trains.	6
IV	**Kinematic synthesis of Mechanisms:** Type, number and dimensional synthesis, function generation, path generation and body guidance two and three position synthesis of four bar and slider crank by graphical and analytical methods, Freudenstein's equation precision position, structural error, Chebychev spacing, transmission angle.	6

Text Books:

1. V.P. Singh, "***Theory of Machines"***, Dhanpat Rai Publications, New Delhi, 2016**.**
2. Amitabha Ghosh, Ashok Kumar Mallik, ***Theory of Mechanisms and Machines,*** Third Edition Affiliated East West Press.
3. S.S. Rattan, "***Theory of Machines",*** McGraw Hill, (4th edition), 2014

Reference Books:

1. J.S.Rao, R.K. Dukkipati, **"*Mechanism and Machine Theory",*** Second Edition, New age International.
2. Gordon R. Pennock, Joseph E. Shigley, John J. Uicker , **"*Theory of Machines and Mechanisms",*** Oxford University Press, 2014.

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ME-502: MANUFACTURING TECHNOLOGY-II

Teaching and Examination Scheme:

Teaching Scheme			Credits	Marks			Duration of End Semester Examination
L	T	P/D	C	Sessional	End Semester Exam	Total	
3	0	0	3	40	60	100	3 hrs.

COURSE CONTENT:

UNIT	CONTENT	No. of Hrs.
I	**Metal Cutting & Tool Forces:** Introduction, basic tool geometry, single point tool nomenclature, mechanism of metal cutting: deformation of metal during machining, mechanics of chip formation, built-up edges, mechanics of orthogonal and oblique cutting, merchant cutting force circle and shear angle relationship in orthogonal cutting, surface finish, factors affecting tool forces. **Relationships and Economics of Machining:** Relationship of velocity, forces, and power consumption, cutting speed, feed, and depth of cut. Temperature distribution at tool chip interface. Economics of metal machining, introduction, elements of machining cost, tooling economics, machining, optimization, numericals.	9
II	**Cutting Tool Materials & Tool Life:** Characteristics of tool materials, various types of cutting tool materials, coated tools, cutting tool selection, tool life relationship-taylor equation, types of tool wear, tool life, factors governing tool life, purpose and types of cutting fluids, basic actions of cutting fluids, selections of cutting fluid, effect of cutting fluid on tool life, definition of machinability and its and evaluation, economics of machining, numericals. **Gear Manufacturing:** Introduction, methods of manufacturing, gear generation and forming: gear cutting by milling, single point form tool, gear hobbing and shaping, gear finishing operations: gear shaving, gear burnishing, gear grinding, lapping.	8
III	**Jigs & Fixtures**: Principles of locations, locating and clamping devices, jigs, bushes, drilling jigs, milling fixtures, turning fixtures, boring and broaching fixtures, welding fixtures, different materials for jigs and fixtures, economics of jigs and fixtures. **Press Working Tools & Dynamometry**: Introduction, classifications of presses and dies, shear action in die cutting operations, centre of pressure, mathematical calculation of centre of pressure, clearances, cutting forces, punch dimensioning. need for measuring forces, basic	9

	requirements of measuring techniques, design requirements of dynamometers, 3-divisional turning dynamometer and its calibration, drill dynamometers.	
IV	**Abrasive Processes:** Introduction, grinding wheel-designation and selection, types of grinding machines, grinding processes, grinding processes parameters, creep feed grinding, honing, lapping, other finishing processes. other machine tools: sawing, broaching. **Unconventional Machining Processes:** Need for unconventional processes, types of unconventional machining processes, usm: ultrasonic machining, ecm: electrochemical machining, edm : electrical discharge machining, lbm: laser beam machining their process parameters, principle of metal removal, applications, advantages, and limitations.	**8**

Text Books:

1. R.K. Rajput, **"*Manufacturing Technology",*** Laxmi Publications, 2016.
1. Amitabha Ghosh, A.K. Mallik, **"*Manufacturing Science",*** East West Press, 2010
2. P.N. Rao, **"*Manufacturing Technology, Vol.-II"*** , McGraw Hill Education, 2013.

Reference Books:

2. Milton C. Shaw, **"*Metal Cutting Principles",*** Oxford University Press.
3. G.C. Sen, A.Bhattacharya, "***Principles of Machine Tools",***New Central Book Agency, 2nd Revised edition, 2009
4. P.C. Pandey, H.S. Shan, "***Modern Machining Processes",*** Tata McGraw Hill.
5. M.H.A Kempster, ***"Introduction to Jig and Tool Design"***, Butterworth-Heinemann Ltd, 3rdRevised edition edition

ME-503: HEAT TRANSFER

Teaching and Examination Scheme:

Teaching Scheme			Credits	Marks			Duration of End Semester Examination
L	T	P/D	C	Sessional	End Semester Exam	Total	
3	1	0	4	40	60	100	3 hrs.

COURSE CONTENT:

UNIT	CONTENT	No. of Hrs.
I	**Steady State Heat Conduction:** Introduction, 1-dimensional heat conduction through a plane wall, long hollow cylinder, hollow sphere, conduction equation in cartesian, polar and spherical co-ordinate systems. steady state conduction with heat generation: introduction, 1 – dimensional heat conduction with heat sources, extended surfaces (fins), fin effectiveness 2-dimensional heat conduction.	8
II	**Transient Heat Conduction:** systems with negligible internal resistance, biot number, transient heat conduction in plane wall, cylinders, spheres with convective boundary conditions, hiesler chart solution, relaxation method. **Convection:** Forced convection – Thermal and hydro-dynamic boundary layers, equation of continuity, momentum and energy equations, flow over a flat plate and flow through tube, fluid friction and heat transfer (colburn analogy), free convection from a vertical flat plate, empirical relations for free convection from vertical and horizontal of planes and cylinders.	9
II	**Thermal Radiation:** Introduction, Stefan-Boltzmann law, Wien Displacement Law, Kirchoff's Law, concept of black body and grey body, black body radiation, shape factors and their relationships, heat exchange between non-black bodies, equivalent electrical network for radiative exchange in an enclosure of two or three gray bodies, radiation shields.	9
IV	**Heat Exchangers:** Introduction, classification, fouling factor, overall heat transfer coefficient, analysis of a parallel/counter flow heat exchanger, heat exchanger effectiveness, LMTD, NTU effectiveness method.	8

Text Books:

1. F.P. Incropera, & D.P. Dewitt, "***Fundamentals of Heat and Mass Transfer"***, Wiley 2013
2. Yunus A. Cengel,Afsin J. Ghajar, "***Heat and Mass Transfer: Fundamental and Applications",*** McGraw Hill Education.

Reference Books:

1. J.P. Holman, "***Heat Transfer",*** McGraw-Hill Higher Education
2. D.S. Kumar, "***Heat and Mass Transfer",*** Kataria& Sons, Delhi.
3. S.K. Som, "***Introduction to Heat Transfer",*** Prentice Hall India Learning Private Limited, 2008.

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ME-504: MACHINE DESIGN-I

Teaching and Examination Scheme:

Teaching Scheme			Credits	Marks			Duration of End Semester Examination
L	T	P/D	C	Sessional	End Semester Exam	Total	
3	1	0	4	40	60	100	3 hrs.

Note:

(1) ***Design Data Book Compiled by PSG College of Engineering & Technology, Coimbatore***, is permitted to be used during the Examination.

COURSE CONTENT:

UNIT	CONTENT	No. of Hrs.
I	**Introduction:** To machine design, design process and design creativity, types of design, design synthesis, principles of design in aesthetics and ergonomics, standards in design, concurrent engineering, mechanical properties of the commonly used engg. materials, basic criteria of selection of materials, factor of safety under different loading conditions, concept of tearing, shearing, crushing, bending etc. **Principles of design:** B.I.S. system of designation of steel, B.I.S System of designation of C.I. B.I.S system of fits &tolerances, standardization and inter-changeability, design considerations of casting, forging and machining, different types of fluctuating / variable stresses, study of stress concentration, concept of fatigue and endurance strength, fatigue design for finite and infinite life against combined variable stress using Goodman and Soderberg's criterion, design for static loading, design for manufacture and assembly (DFMA).	**9**
II	**Shafts and Keys :** Design of shafts subjected to twisting moment, bending moment and combined bending and twisting, shafts subjected to fluctuating loads, design of shafts on basis of rigidity, design of hollow shafts, flexible shafts, critical speed of shafts, design of different types of keys, splines.	**8**
III	**Riveted joints:** Methods of riveting, rivet materials, caulking and fullering, design of rivets for boiler joints, eccentrically loaded riveted joints, **Welded joints:** weld, design for various loading conditions in torsion, shear or direct load, eccentrically loaded welded joints.	**8**
IV	**Cotter and knuckle joints:** comparison between keys and cotters, design of socket and spigot cotter joint, gib and its use, gib and cotter joint, design procedure for knuckle joint.	**9**

	Pipe joints: Introduction, stresses in pipes, designing of pipes, hydraulic pipe joint for high pressures, steam pipes, steam pipe fittings, oil piping.	

Text Books:

1. V.B.Bhandari, ***"Design of Machine Element"s,*** McGraw Hill Education (India) Pvt. Ltd., 4th edition.
2. R.S.Khurmi, J.K. Gupta, "***Machine Design",*** S. Chand & Sons, 2014.

Reference Books:

1. P.C. Sharma and D.K. Aggarwal, "***Machine design"***, S K Kataria& Sons.
2. Joseph EShigley, Charles Mischke, Richard Budynas, Keith Nisbett, "***Mechanical Engg. Design*** (Metric Editions)", McGraw Hill Book Co.
3. Steven R. Schmid, Bernard J. Hamrock, Bo Jacobson, "***Fundamentals of Machine Elements"***, McGraw Hill Higher Education.

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ME-505: AUTOMOBILE ENGINEERING

Teaching and Examination Scheme:

Teaching Scheme			Credits	Marks			Duration of End Semester Examination
L	T	P/D	C	Sessional	End Semester Exam	Total	
3	0	0	3	40	60	100	3 hrs.

COURSE CONTENT:

UNIT	CONTENT	No. of Hrs.
I	**Introduction to Automobiles:** Classification, components, requirements of automobile body: vehicle frame. types, front engine rear drive & front engine front drive vehicles, four wheel drive vehicles. **Clutches:** Introduction to clutches, requirement of clutches – principle of friction clutch – wet type & dry types: single plate clutch, multi plate clutch, centrifugal clutches, clutch linkages.	8
II	**Power Transmission:** Object of the gear box, different types of gear boxes, sliding mesh, constant mesh, synchromesh gear boxes, drive lines, universal joint, propeller shaft, slip joint, front wheel drive, principle, function, construction & operation of differential, rear axles, types of load coming on rear axles, full floating, three quarter floating and semi floating rear axles.	9
III	**Suspension Systems:** Need of suspension systems, types of suspension, factors influencing ride comfort, leaf springs, shock absorber. **Steering System:** Front wheel geometry & wheel alignment viz. caster, camber, king pin inclination, toe-in/toe-out, conditions for true rolling motions of wheels during steering: different type of steering gear boxes, steering linkages and layout, rack & pinion power steering gear.	9
IV	**Automotive Brakes, Tyres & Wheels:** classification of brakes, principle and construction details of drum brakes, disc brakes, mechanical, hydraulic, pneumatic brakes, power assisted brakes, tyres of wheels, types of tyre & their constructional details, tyre rotation, excessive tyre wear & their causes. **Automotive Electricals:** Purpose & operation of lead acid battery, capacity rating. purpose and operations of the starting system, and charging system.	8

Text Books:

1. Dr. Kirpal Singh, "***Automobile Engineering (Vol. 1 & Vol. 2)"***, Standard Publishers Distributors, Delhi.

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2. William H. Crouse, "***Automotive Mechanics",*** McGraw-Hill Higher Education
3. S.K. Gupta, "***A Textbook of Automobile Engineering",*** S. Chand

Reference Books:

1. S. Srinivasan, "***Automotive Mechanics",*** McGraw Hill Education.
2. Joseph Heitner, "***Automotive Mechanics – Principles and Practices",*** CBS Publishers.
3. Anthony E. Schwaller, "***Motor Automotive Technology",*** S. Chand (G/L) & Company Ltd.
4. K Ramakrishana, "***Automobile Engineering",*** PHI Learning Private Limited.

ME-506: MATERIALS TECHNOLOGY

Teaching and Examination Scheme:

Teaching Scheme			Credits	Marks			Duration of End Semester Examination
L	T	P/D	C	Sessional	End Semester Exam	Total	
3	0	0	3	40	60	100	3 hrs.

COURSE CONTENT:

UNIT	CONTENT	No. of Hrs.
I	**Materials:** Resources and their implications, materials and their applications in engineering. **Solid Solutions and Phase diagram:** Introduction and types of solid solutions, importance and types of phase diagram, systems, phase and structural constituents, cooling curves, Gibb's phase rule, lever rule, definition of eutectic, eutectoid, peritectic and peritectoid systems, iron carbon equilibrium diagram and TTT diagram.	7
II	**Heat Treatment:** Purpose and classification of heat treatment processes, annealing normalizing, stress relieving, hardening, tempering, carburizing, nitriding, cyaniding, flame and induction hardening. properties of micro-constituents like austenite, ferrite, pearlite, martensite. **Deformation of Metals:** Elastic and plastic deformation, mechanism of plastic deformation, twining, conventional and true stress strain curves for polycrystalline materials, yield point phenomena, strain hardening, age hardening work hardening, Bauschinger effect, recovery, recrystallization and grain growth.	9
III	**Mechanical Behavior of Materials:** Types of polymers, ceramics, composites, and glasses, mechanical behavior of polymers, ceramics, composites, and glasses, mechanical testing of materials. **Alloys and alloying elements:** Effect of various alloying elements on the mechanical properties. properties of important alloys used in mechanical engineering practice.	9
IV	**Failures of metals**: Failure analysis, fracture- process & its types and their characteristics, brittle fracture theories, cleavage fracture, methods to improve fracture strength, fatigue and characteristics of fatigue. **Creep & Corrosion:** Definition and concept, creep curve, mechanism of creep, impact of time and temperature on creep, creep fracture, creep	9

	testing and prevention against creep. corrosion: introduction, types of corrosion, mechanism and effect of corrosion, prevention of corrosion.	

Text Books:

1. Lawrence H. Van Vlack, "***Elements of Material Science and Engineering",*** Pearson Education India.
2. V. Raghavan, "***Material Science & Engineering: A First Course",*** Prentice Hall of India Pvt. Ltd, New Delhi, 6th edition

Reference Books:

1. W.D. Callister Jr, "***Material Science and Engineering-An Introduction"***, Wiley India Pvt Ltd., 6th edition.
2. O.P. Khanna, "***A Text Book of Material Science & Metallurgy"***, Dhanpat Rai publications.
3. Kenneth G. Budinski, Michael K. Budinski, "***Engineering Materials (Properties and Selection)"***, Pearson, 6th edition.

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ME-511: DESIGN AND SIMULATION LAB

Teaching and Examination Scheme:

Teaching Scheme			Credits	Marks			Duration of End Semester Examination
L	T	P/D	C	Sessional	End Semester Exam	Total	
0	0	3	2	30	20	50	3 hrs.

Suggested List of Experiments

Software to be used (all latest versions): NX Siemens, and/or Solid Edge, and/or ANSYS, and/or FLUENT and/or Solid Works, and/or Pro-E(Creo), and/or open form software, etc.

1. **To Design** a pattern for a given casting with all the necessary allowances, parting line, running system details.
2. **To Simulate** the pouring of different metals and predict casting defects and suggest the remedial measures.
3. **To Design** a real life industrial component involving horizontal and vertical welding and compare the designs to suggest better design for production.
4. **To simulate** the material behaviour while cutting different types of external threads on different materials (ductile/brittle).
5. To **Design and Simulate** and assembly of a real life industrial unit consisting of 2 to 3 components to have the concept of tolerances and fits (shaft and bush assembly or shaft, key and bush assembly or any suitable assembly).
6. **To design** and show Dis-assembly and assembly of small parts such as tail stock, bench vice, screw jack etc.
7. **To design** various complex sheet metal components such as funnel etc.
8. **To simulate** the effects of using different tools, work piece materials, coolants, in turning operations on different materials.
9. **To simulate** the effects of using different tools, work piece materials, coolants, in Drilling operations,
10. **To simulate fluid behaviour and aerodynamic profile studies** through various types of real world applications like aircraft, aerofoil, car, etc.

ME-512: MANUFACTURING PRACTICE LAB-II

Teaching and Examination Scheme:

Teaching Scheme			Credits	Marks			Duration of End Semester Examination
L	T	P/D	C	Sessional	End Semester Exam	Total	
0	0	2	1	30	20	50	3 hrs.

Suggested List of Experiments (on conventional, and CNC machines):

1. To make a pattern for a given casting with all the necessary allowances, parting line, running system details. Prepare the mould and make the casting. Investigate the casting defects and suggest the remedial measures.
2. To make a component involving horizontal and vertical welding and study the welding defect and suggests their remedies.
3. To prepare a job on surface grinder/cylindrical grinder and measure the various parameters of the finished piece.
4. To cut external threads on a lathe/CNC machine
5. To create an assembly of a unit consisting of 2 to 3 components to have the concept of tolerances and fits (shaft and bush assembly or shaft, key and bush assembly or any suitable assembly).
6. Creating rectangular block of given size using shaper/milling, then creating gear teeth through indexing device on milling machine.
7. Levelling of machine tools and testing their accuracy.
8. Practising disassembly and assembly of small assemblies such as tail stock, bench vice, screw jack etc.
9. Development and manufacture of complex sheet metal components such as funnel etc.
10. Multi slot cutting on milling machine by indexing.
11. Drilling and boring of a bush on drilling machine/CNC.

ME-513: HEAT TRANSFER LAB

Teaching and Examination Scheme:

Teaching Scheme			Credits	Marks			Duration of End Semester Examination
L	T	P/D	C	Sessional	End Semester Exam	Total	
0	0	2	1	30	20	50	3 hrs.

Suggested List of Experiments

1. To determine the thermal conductivity of a metallic rod.
2. To determine the thermal conductivity of an insulating powder.
3. To determine the thermal conductivity of a solid by the guarded hot plate method.
4. To find the effectiveness of a pin fin in a rectangular duct natural convective condition and plot temperature distribution along its length.
5. To find the effectiveness of a pin fin in a rectangular duct under forced convective conditions and plot temperature distribution along its length.
6. To determine the surface heat transfer coefficient for a heated vertical tube under natural convection and plot the variation of local heat transfer coefficient along the length of the tube. Also compare the results with those of the correlations.
7. To determine the average heat transfer coefficient for an externally heated horizontal pipe under forced convection and plot Reynolds and Nusselt numbers along the length of pipe. Also compare the results with those of the correlations.
8. To measure the emissivity of the grey body (plate) at different temperature and plot the variation of emissivity with surface temperature.
9. To find overall heat transfer coefficient and effectiveness of a heat exchange under parallel and counter flow conditions. Also plot the temperature distribution in both the cases along the length of heat of heat exchanger.
10. To verify the Stefen-Boltzmann constant for thermal radiation.

Open Elective-III

ME-508: ROBOTICS

Teaching and Examination Scheme:

Teaching Scheme			Credits	Marks			Duration of End Semester Examination
L	T	P/D	C	Sessional	End Semester Exam	Total	
2	0	0	2	40	60	100	3 hrs.

COURSE CONTENT:

UNIT	CONTENT	No. of Hrs.
I	**Robotic manipulation:** Automation and robots classification – drive technologies work-envelope geometries, motion control method, application: robot specifications – no. of axes, capacity and speed, reach and stroke, tool orientation, repeatability, precision, accuracy, operating environment.	6
II	**Direct kinematics**: The arm equation homogenous co-ordinates – frames, translation and rotations, composite homogenous transformations, screw transformations, link co-ordinates, the arm equation, a five-axis articulated robot, a four-axis SCARA robot, a six-axis articulated robot. **Inverse kinematics:** Solving the arm equation: the inverse kinematics problem general properties of solutions, tool configuration, inverse kinematics of a five-axis articulated robot, four-axis SCARA robot, six-axis articulated robot and three-axis planer articulated robot.	6
III	**Work space analysis and trajectory planning:** work space analysis, work envelope of a five axis articulated robot, work envelope of a four axis SCARA robot, work space fixtures, The pick and place Operation, Continuous path motion, Interpolated motion, straight line motion. **Differential motion and statics:** the tool configuration Jacobian matrix, joint space singularities, generalised inverses, resolved motion rate control, n>6, rate control of redundant robots: n>6: rate control using (1)–inverse, the manipulator jacobian.	6
IV	**Manipulator dynamics**: Lagrange equation, kinetic & potential energy, generalized force, Lagrange-Euler dynamic model, dynamic model of a two axis planer articulated robot and a three axis SCARA robot, direct & inverse dynamic recursive Newton – Euler formulation, dynamic model of a one axis robot. **Robot control:** The control problem, state equations, constant solutions,	6

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	linear feedback system, single axis PID control, PD gravity control, computer – torque control, variable structure control, impedance control.	

Text Books:

1. Robert J. Schilling, "***Fundamental of Robotics (Analysis & Control)",*** Pearson.
2. John J.Craig, "***Introduction to Robotics (Mechanics & Control)",*** Pearsons Education India, 3rd edition.

Reference Books:

1. Wolfram Stadler, "***Analytical Robotics & Mechatronics"***, McGraw Hill Education (ISE Editions).
2. Mikell P Grover, Mitchell Weiss, Roger Nagel, "***Industrial Robotics – Technology Programming & Applications",*** McGraw Hill Education(ISE Editions)
3. Tsuneo Yashikawa, "***Foundations of Robotics: Analysis and Control",*** PHI learning Pvt Ltd.
4. R.K. Mittal, I J Nagrath, "***Robotics and control",*** McGraw Hill Education (India) Pvt. Ltd., India, 2003.

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Open Elective-III

ME-509: AUTOMOBILE TECHNOLOGY

Teaching and Examination Scheme:

Teaching Scheme			Credits	Marks			Duration of End Semester Examination
L	T	P/D	C	Sessional	End Semester Exam	Total	
2	0	0	2	40	60	100	3 hrs.

COURSE CONTENT:

UNIT	CONTENT	No. of Hrs.
I	**Introduction to Automobiles:** Classification, components, requirements of automobile body: vehicle frame. types, front engine rear drive & front engine front drive vehicles, four wheel drive vehicles. **Clutches:** Introduction to clutches, requirement of clutches – principle of friction clutch – wet type & dry types: single plate clutch, multi plate clutch, centrifugal clutches, clutch linkages.	6
II	**Power Transmission:** Object of the gear box, different types of gear boxes, sliding mesh, constant mesh, synchromesh gear boxes, drive lines, universal joint, propeller shaft, slip joint, front wheel drive, principle, function, construction & operation of differential, rear axles, types of load coming on rear axles, full floating, three quarter floating and semi floating rear axles.	6
III	**Suspension Systems:** Need of suspension systems, types of suspension, factors influencing ride comfort, leaf springs, shock absorber. **Steering System:** Front wheel geometry & wheel alignment viz. caster, camber, king pin inclination, toe-in/toe-out, conditions for true rolling motions of wheels during steering: different type of steering gear boxes, steering linkages and layout, rack & pinion power steering gear.	6
IV	**Automotive Brakes, Tyres & Wheels:** Classification of brakes, principle and construction details of drum brakes, disc brakes, mechanical, hydraulic, pneumatic brakes, power assisted brakes, tyres of wheels, types of tyre & their constructional details, tyre rotation, excessive tyre wear & their causes. **Automotive Electricals:** Purpose & operation of lead acid battery, capacity rating. purpose and operations of the starting system, and charging system.	6

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Text Books:

1. Dr.Kirpal Singh, "***Automobile Engineering (Vol. 1 & Vol. 2)"***, Standard Publishers Distributors, Delhi.
2. WilliamH.Crouse, "***Automotive Mechanics",*** McGraw-Hill Higher Education
3. S.K. Gupta, "***A Textbook of Automobile Engineering",*** S. Chand

Reference Books:

1. S.Srinivasan, "***Automotive Mechanics",*** McGraw Hill Education.
2. Joseph Heitner, "***Automotive Mechanics – Principles and Practices",*** CBS Publishers.
3. Anthony E. Schwaller, "***Motor Automotive Technology",*** S. Chand(G/L) & Company Ltd.
4. K Ramakrishana, "***Automobile Engineering",*** PHI Learning Private Limited.

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Open Elective-III

ME-510: VALUE ENGINEERING

Teaching and Examination Scheme:

Teaching Scheme			Credits	Marks			Duration of End Semester Examination
L	T	P/D	C	Sessional	End Semester Exam	Total	
2	0	0	2	40	60	100	3 hrs.

COURSE CONTENT:

UNIT	CONTENT	No. of Hrs.
I	**Value Engineering Concepts:** Advantages, applications in product development, process improvement, service improvement and system design, problem recognition, role in productivity, criteria for comparison, elements of choice.	6
II	**Analysis of Functions:** Anatomy of function, values: use, antique, cost, esteem and exchange, primary versus secondary versus tertiary/unnecessary functions, functional analysis: function analysis system technique and quantitative evaluation of ideas, case studies.	6
III	**Value Engineering Techniques:** Selecting products and operations for VE action, timing, VE programmes, determining and evaluating functions, assigning rupee equivalents, developing alternate means to required functions, decision making for optimum alternative, use of decision matrix, make or buy decisions, measuring profits, reporting results and follow up.	6
IV	**Implementation and Management of Value Engineering:** Action plan, record progress, report progress, review meetings, problems in implementation, human factors. Level of VE in the organization, size and skill of VE staff, small plant VE activity management supports, Audit of savings.	6

Text Books:

1. Lawrence D. Miles, "***Techniques of Value Analysis and Engineering",*** Eleanor Miles Walker, 1989
2. Richard Park, "***Value Engineering : A Plan for Invention"***, CRC Press
3. J.V. Michael, and W.P.Wood, "***Design to Cost",*** Wiley Interscience, 2004

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Reference Books:

1. H.G. Tufty, "***Compendium on Value Engineering",*** The Indo American Society 1983
2. G. Jagannathan, "***Getting More at Less Cost"***, Tata McGraw-Hill Education.

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SEMESTER-VI

ME-601: COMPUTER AIDED DESIGN AND MANUFACTURING (CAD/CAM)

Teaching and Examination Scheme:

Teaching Scheme			Credits	Marks			Duration of End Semester Examination
L	T	P/D	C	Sessional	End Semester Exam	Total	
3	1	0	4	40	60	100	3 hrs.

COURSE CONTENT:

UNIT	CONTENT	No. of Hrs.
I	**Introduction to CAD/CAM**: Historical development, industrial look at CAD/CAM, introduction to CIM, design process, introduction to CAM/ CIMS, Importance and Necessity of CAD, applications of CAD, hardware and software requirement of CAD **Geometric and Wire Frame Modeling:** Basic introduction of geometric and solid modeling coordinate systems. 2-D and 3-D wire frame models, hardware for drafting packages, command and menu driven software, features of a drafting package, drawing utilities, entities, edit commands, blocks and symbols, viewports.	**8**
II	**Curves, Surfaces and Solids:** Algebraic and geometric forms, tangents and normal, blending functions re-parametrization, straight lines, conics, cubic splines, Bezier curves and B-spline curves. Ruled surface, surface of revolution, tabulated cylinder, bi-cubic surface, Bezier surface, B-spline surface, **Transformations:** Introduction, transformation of points and line, 2-D rotation, reflection, scaling and combined transformation, homogeneous coordinates, 3-D scaling, shearing, rotation, reflection and translation, combined transformations.	**9**
III	**Solid Modeling:** Solid models and representation scheme, boundary representation, constructive solid geometry, sweep representation, cell decomposition. **Automation and Numerical Control:** Introduction, fixed, programmable and flexible automation, types of NC systems, MCU and other components, NC manual part programming, coordinate systems, G & M codes, part program for simple parts, computer assisted part programming.	**9**
IV	**Group Technology (GT):** Part families, part classification and coding,	**8**

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	production flow analysis, machine cell design, advantages of GT. **Flexible Manufacturing Systems & Computer aided process planning:** Introduction, FMS components, types of FMS, FMS layouts, planning for FMS, advantages and applications conventional process planning, types of CAPP, steps in variant process planning, planning for CAPP. finite element method: introduction, basic procedure.	

Text Books:

1. Mikell P. Groover and Emory W.Zimmers Jr., "***CAD/CAM"***, Prentice Hall of India.
2. P.Radhakrishnan and G.P. Kothandaraman, "***CAD/CIM",*** Dhanpat Rai Publications.

Reference Books:

1. Ibrahim Zeid, "***CAD/CAM (Theory & Practice"),***McGraw Hill Education Pvt. Ltd.
2. Chris McMohan& Jimmie Browne, "***CAD/CAM (Principles, Practice & Manufacturing Management)",*** Addison – Wesley.
3. P.N. Rao, "***AutoCAD14 for Engg. Drawing Made Easy"***, McGraw Hill Education (India) Pvt. Ltd.
4. David F. Rogers and J. Alan Adams, "***Mathematical Elements for computer Graphics"***, McGraw Hill Education Pvt. Ltd.

ME-602: MEASUREMENT AND CONTROL

Teaching and Examination Scheme:

Teaching Scheme			Credits	Marks			Duration of End Semester Examination
L	T	P/D	C	Sessional	End Semester Exam	Total	
3	0	0	3	40	60	100	3 hrs.

COURSE CONTENT:

UNIT	CONTENT	No. of Hrs.
I	**General Concept:** Need and classification of measurements and instruments, basic and auxiliary functional elements of a measurement system, mechanical versus electrical/electronic instruments, primary, secondary and working standards. **Static and Dynamic characteristics of Instruments:** Range and span, accuracy and precision, calibration, hysteresis and dead zone, sensitivity and linearity, threshold and resolution: speed of response, lag, fidelity and dynamic error, dead time and dead zone. zero, first and second order systems and their response to step, ramp and sinusoidal input signals. error in measurement: sources of errors, systematic and random errors: statistical analysis of test data.	8
II	**Functional Elements:** Review of Electro-mechanical sensors and transducers – variable resistance, inductance and capacitive pickups, photo cells and piezo-electric transducers, and application of these elements for measurement of position/displacement, speed/velocity/acceleration, force and liquid level etc. **Strain Gauges:** Resistances strain gauges, gauge factor, bonded and unbonded gauges, surface preparation and bonding technique, signal conditioning and bridge circuits, temperature compensation, application of strain gauges for direct, bending and torsional loads.	9
III	**Pressure and Flow Measurement**: Bourdon tube, diaphragm and bellows, vacuum measurement – Mecleod gauge, thermal conductivity gauge and ionisation gauge, dead weight gauge tester. Electromagnetic flux meters, ultra-sonic flow meters and hot wire anemometer: Flow visualisation technique. **Temperature Measurement:** Thermal expansion methods – bimetallic thermometers, liquid-in-glass thermometer and filled-in-system thermometers, thermo-electric sensors-common thermo couples, reference junction considerations, special materials and configurations:	8

	metal resistance thermometers and thermistors, optical and radiation pyrometers, calibration, standards.	
IV	**Speed, Force, Torque and Shaft Lower Measurement:** Mechanical tachometers, vibration and tachometer and stroboscope, proving ring, hydraulic a pneumatic load cells, torque on rotating shafts, absorption, transmission and driving dynamometers. **Controls:** Control system-open and closed loop system, elements of a control system, servo mechanism process control and regulators, transfer function, block diagram and overall transfer function of a multi loop control system, signal flow graph and Mason's Rule system stability – Routh and Harwitz criteria stability, Time and frequency domain Nyquist plot for stability study.	**9**

Text Books:

1. Ernest O. Doebelin, "***Measurement system: Application and Design",*** McGraw Hill Higher Education.
2. D.S. Kumar, "***Mechanical Measurement and Control",*** Metropolitan Book Co. Pvt. Ltd., New Delhi.
3. Thomas G Beckwith, Roy D Marangoni, John H. Lienhard V , "***Mechanical Measurements"***, Pearson Education India

Reference Books:

1. J.P. Holman, "***Experimental Methods for Engineers"***, McGraw Hill Education.
2. Benjamin C. Kuo, Farid Golnaraghi, "***Automatic Control System"***, Wiley.

ME-603: MACHINE DESIGN-II

Teaching and Examination Scheme:

Teaching Scheme			Credits	Marks			Duration of End Semester Examination
L	T	P/D	C	Sessional	End Semester Exam	Total	
3	1	0	4	40	60	100	3 hrs.

Note:

(1) ***Design Data Book compiled by PSG College of Technology, Coimbatore***, India is permitted to be used during the Examination.

COURSE CONTENT:

UNIT	CONTENT	No. of Hrs.
I	**Sliding contact Bearings:** Functions, classification, Selection of bearing type, types of lubrication – boundary, mixed and hydrodynamic lubrication, properties of lubricants, oil grooves, hydrostatic bearings, gas bearings, bearing characteristic number, critical pressure and heat generation in journal bearing, design procedure of journal bearing, Reynolds's equation, design of pivot and collar bearing.	**8**
II	**Rolling contact bearings:** Classification, basic static load rating, basic dynamic load rating, static equivalent load, dynamic equivalent load, load life relationship, reliability, material and manufacture of ball and roller bearings, selection of bearing from manufacturer's catalogue, bearing failure, lubrication of rolling bearings.	**9**
III	**Gears:** beam and wear strength of gear tooth- Lewis equation, form or Lewis factor for gear tooth, causes of gear tooth failures, dynamic load on gear- Buckingham equation, force analysis and design of spur, helical, bevel & worm gears including the consideration for maximum power transmitting capacity, gear lubrication.	**8**
IV	**Springs:** Types of springs, design for helical springs against tension, compression and fluctuating loads, design of leaf springs, nipping, surging phenomenon in springs. **Design of IC engines parts and Crane Hook:** Design of cylinder, piston, connecting rod and crankshaft, design of crane hook.	**9**

Text Books:

1. V.B. Bhandari, "***Design of Machine Elements",*** McGraw Hill Education (India) Pvt. Ltd., 4th edition.
2. R.S. Khurmi, J.K. Gupta, "***Machine Design",*** S. Chand & Sons, 2014.

Reference Books:

1. P.C. Sharma and D.K. Aggarwal, "***Machine design"***, S K Kataria& Sons.
2. Joseph E Shigley, Charles Mischke, Richard Budynas, Keith Nisbett, "***Mechanical Engg. Design",*** (Metric Editions), McGraw Hill Book Co.
3. Steven R. Schmid, Bernard J. Hamrock, Bo Jacobson, "***Fundamentals of Machine Elements"***, McGraw Hill Higher Education.

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ME-604: OPERATIONS RESEARCH

Teaching and Examination Scheme:

Teaching Scheme			Credits	Marks			Duration of End Semester Examination
L	T	P/D	C	Sessional	End Semester Exam	Total	
2	2	0	3	40	60	100	3 hrs.

COURSE CONTENT:

UNIT	CONTENT	No. of Hrs.
I	**Definition and characteristics** of operations research (O.R.), Decision making, Scientific decision making, approach for scientific decision making in O.R., need and limitations of O.R. definition of models, classification of models, construction of models, approximations of O.R. models.	4
II	**Allocation Model:** Analysis of industrial situations to find characteristics like key decision objective, possible alternatives & restrictions – three categories of allocation type situation to be considered general mathematical formulation for linear programming feasible and optimal solutions. **Network Models:** Transportation models, methods of finding starting solution Vogel's approximation method to find feasible solution in transportation models, methods for finding optimal solution. assignment model, Hungarian method to find optimal solution in assignment models.	8
III	**Introduction to Queuing Theory:** Cyclic shortest route models, traveling salesman's problem and branch and bound method to solve it. a cyclic shortest route models and their solution by graphical methods. queuing theory, various types of queuing situations and their solutions. **Theory of games** introduction, Two-person zero-sum games, the maximum –minimax principle, games without saddle points – mixed strategies, 2 x n and m x 2 games – graphical solutions, dominance property, use of L.P. to games, algebraic solutions to rectangular games.	6
IV	**PERT & CPM:** Network situations where PERT & CPM can be applied, planning, scheduling & control, work-breakdown structure. **(a) PERT Networks:** Events and activities, construction of network, forward & backward planning, Fulkerson's rules, optimistic, pessimistic & most likely time estimates, frequency distribution, Mean, variance and standard deviation, expected time and latest occurrence time, definitions of slack and critical path.	6

	(b) CPM Networks: Similarity and differences of CPM and PERT construction of network, earliest event time, float, total float, free float, independent float, contracting the network so as to find an optimum project schedule.	

Text Books:

1. Hamdy A Taha, "***Operations Research : An Introduction"***, Pearson Education India
2. Prem Kumar Gupta, D.S.Hira, "***Operations Research"***, S.Chand Publications.

Reference Books:

1. KantiSwarup, P.K. Gupta, Man Mohan, "***Operations Research"***, Sultan Chand & Sons
2. K. Rajagopal, "***Operation Research"***, PHI Learning Private Limited.

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ME-605: THERMAL ENGINEERING

Teaching and Examination Scheme:

Teaching Scheme			Credits	Marks			Duration of End Semester Examination
L	T	P/D	C	Sessional	End Semester Exam	Total	
2	2	0	3	40	60	100	3 hrs.

COURSE CONTENT:

UNIT	CONTENT	No. of Hrs.
I	**Steam Boilers:** Boilers and their classification, comparison between fire tube and water tube boilers, essentials of a good boiler. constructional and operational details of locomotive, Babcock-Wilcox, and Lamont boilers, boiler mountings and accessories. **Draft type and Heat Balance Sheet:** Natural draft from chimney, height of chimney, maximum draft and chimney efficiency, forced draft and induced draft, boiler heat balance Sheet.	5
II	**Vapour Power Cycles:** Carnot and Rankine vapour cycles, effect of operating conditions on thermal efficiency of Rankine cycle, Rankine cycle with superheat, reheat cycle and regenerative feed heating cycle, binary vapour cycle. **Flow Through Nozzles**: Velocity and heat drop, mass discharge through a nozzle, critical pressure ratio and its significance, effect of friction and nozzle efficiency, supersaturated flow, nozzles off the design pressure ratio.	7
III	**Steam Turbines:** Classification, flow through impulse blades, velocity diagram, calculation of power output and efficiency, maximum blade efficiency of single stage impulse turbine, blade friction, compounding of impulse turbine. Flow through impulse reaction blades, degree of reaction, velocity diagram, calculations for power output, stage and overall efficiency, comparison of impulse and impulse reaction turbines. **Efficiency and Governing in Steam Turbines:** Losses in steam turbines, stage efficiency overall efficiency and reheat factor. Governing of steam turbines, throttle governing, nozzle control governing and by pass governing. Steam for heating and process work, back pressure turbines and pass out turbines.	7
IV	**Steam Condensers:** Elements of a condensing plant, types of condensers, comparison of jet and surface condensers. Condenser vacuum, air leakage and loss of vacuum, vacuum efficiency and condenser efficiency, Dalton's law and air vapour mixture, air pumps.	5

Text Books:

1. R. Yadav, "***Thermodynamics and Heat Engines, Vol-II"***, Central Publishing House, Allahabad.
2. R.S.Khurmi, "***A textbook of Thermal Engineering"***, S.Chand
3. P.L. Ballaney, "***Thermal Engineering"***, Khanna Publishers.

Reference Books:

1. T.D. Eastop& A McConkey, "***Applied Thermodynamics for Engineering Technologists"***, Pearson Education.
2. Yunus A. Cengel, Michael A. Boles, "***Thermodynamics – An Engineering Approach"***, McGraw – Hill Education.
3. R.K. Rajput, "**Thermal Engineering"**, Laxmi Publications.

ME-606: DYNAMICS OF MACHINERY

Teaching and Examination Scheme:

Teaching Scheme			Credits	Marks			Duration of End Semester Examination
L	T	P/D	C	Sessional	End Semester Exam	Total	
3	0	0	3	40	60	100	3 hrs.

COURSE CONTENT:

UNIT	CONTENT	No. of Hrs.
I	**Static and Dynamic Force Analysis:** Static force analysis of planar mechanisms, dynamic force analysis including inertia and frictional forces of planar mechanisms. **Balancing of Rotating Components:** Static balance, dynamic balance, balancing of rotating masses, two plane balancing, graphical and analytical methods, balancing machines.	**8**
II	**Dynamics of Reciprocating Engines:** Engine types, indicator diagrams, gas forces, equivalent masses, inertia forces, bearing loads in a single cylinder engine, crankshaft torque, engine shaking forces. **Balancing of Reciprocating Parts:** Balancing of single cylinder engine, balancing of multi cylinder, inline, radial and V type engines.	**9**
III	**Governors:** Introduction, types of governors, characteristics of centrifugal governors, gravity controlled and spring controlled centrifugal governors, hunting of centrifugal governors. **Flywheel & Dynamometers:** Introduction, coefficient of fluctuation of energy and speed, design of flywheel – solid disk and rimmed flywheels, types of dynamometers, prony brake, rope brake and band brake dynamometers, belt transmission dynamometer, torsion dynamometer, hydraulic dynamometer.	**10**
IV	**Gyroscope:** precession angular motion and gyroscopic couple and their effects on aeroplane, ship during steering, rolling and pitching. Stability of four wheel vehicles moving on curved paths. **Vibration:** Single degree of freedom system, free and forced vibrations, spring-mass system, spring-mass damper system, logarithmic decrement.	**7**

Text Books:

1. Amitabha Ghosh, Ashok Kumar Mallik, "***Theory of Mechanisms and Machines"***, 3rd Edition, Affiliated East West Press.
2. S.S. Rattan, "***Theory of Machines",*** McGraw Hill Education (India)Pvt. Ltd.
3. S.S. Rao, "***Mechanical Vibrations"***, Addison Wesley.

Reference Books:

1. Joseph Edward Shigley, John Joseph Uicker Jr., "***Theory of Machines and Mechanisms"***, McGraw Hill Education Pvt. Ltd.
2. J.S.Rao and R.V.Dukkipati, "***Mechanism and Machine Theory"***, New Age International.
3. V.P.Singh, "***Theory of Machines",*** Dhanpat Rai Publications.

ME-611: COMPUTER AIDED DESIGN AND MANUFACTURING (CAD/CAM) LAB

Teaching and Examination Scheme:

Teaching Scheme			Credits	Marks			Duration of End Semester Examination
L	T	P/D	C	Sessional	End Semester Exam	Total	
0	0	2	1	30	20	50	3 hrs.

Suggested List of Experiments:

1. To introduce the concept of calibration, scale in images, importing and exporting different CAD/CAM file types from one software to another software.
2. Manual part programming using G and M codes for Turning, Step turning, Taper turning, multiple turning, Facing, Multiple facing, thread cutting and radius turning on cylindrical components.
3 CNC Milling program involving linear motion and circular interpolation.
4. CNC Milling program involving contour motion and canned cycles.
5. CNC Milling program involving Pocket milling
6. Diagnosis and trouble shooting in CNC machine
7. CNC code generation using any CAM software.
8. Simulation of machining operations using any CAM software.
9. Route sheet generation using CAM software.
10. Study and practical demonstration of Modern Manufacturing Methods like Wire-Cut EDM, ECM, USM, AJT, LBM, etc.
11. Study and practical demonstration on Coordinate measuring machine,
12. Study and practical demonstration on Vertical Machining centre and Horizontal Machining centre
13. Study on Rapid Prototyping Technologies,

Note: At the end of laboratory work, student shall submit evidence of team work in the form of project /assignments with neat documentation as assigned by concerned lab incharge/faculty.

ME-612: THEORY OF MACHINES LAB.

Teaching and Examination Scheme:

Teaching Scheme			Credits	Marks			Duration of End Semester Examination
L	T	P/D	C	Sessional	End Semester Exam	Total	
0	0	2	1	30	20	50	3 hrs.

Suggested List of Experiments:

1. To study various types of kinematic links, Pairs, Chains and Mechanisms, to study inversions of 4 Bar Mechanisms, Single and Double slider crank mechanisms.
2. To plot slider displacement, velocity and acceleration against crank rotation for Single Slider Crank mechanism.
3. To find Coefficient of friction between Belt and Pulley.
4. To study various type of Cam and Follower arrangements.
5. To plot follower displacement Vs cam rotations for various Cam Follower systems.
6. To generate spur gear involute tooth profile using simulated gear shaping process/ to study various types of gears – Helical, worm & bevel gear.
7. To study various types of gear trains – simple, compound, reverted, epicyclic and differential.
8. To perform experiment on Watt/Porter, Proell, Hartnell Governors to prepare performance characteristic curves and to find stability and sensitivity.
9. To study gyroscopic effects through models and also to determine gyroscopic couple on motorized gryoscope.
10. To perform the experiment for static balancing on static balancing machine.
11. To perform the experiment for dynamic balancing on dynamic balancing machine.
12. Determine the moment of inertial of connecting rod by compound pendulum method

ME-613: SEMINAR

Teaching and Examination Scheme:

Teaching Scheme			Credits	Marks			Duration of End Semester Examination
L	T	P/D	C	Sessional	End Semester Exam	Total	
0	0	3	2	50	50	100	3 hrs.

Suggested List of Activities:

Current topics related to any advanced topics assigned by the faculty or any (or more) of the advances in engineering affecting society or topics focussed as per future needs of mankind as also envisaged in following areas but not limited to:

1. Effect of advances in engineering on industry and society,
2. Impact of Financial Regulatory bodies on manufacturing as well as GDP,
3. Modern practices in Telecom Industry, and its effect on human behaviour,
4. Impact of technology on sports, and its effect on human behaviour,
5. Agricultural management and production,
6. Space Technologies and Innovations by mankind,
7. Effect of Technology on Education and Engineering, and its effect on society,
8. Role of Innovations leading to real Product Development within India and Exports from country.
9. Development of indigenous technologies, and Status of Innovation in general.
10. Intellectual Property Rights, Patents, and their effect on Product Development and Prosperity of a Country,
11. Modernization and Monetary Policy and its effects on Economy,
12. Any Current Topic of relevance to India with local as well as global perspective.
13. Labour laws and industrial safety practices.
14. Environmental impact assessment.

Programme Elective-I

ME-608: MODERN MANUFACTURING PROCESSES

Teaching and Examination Scheme:

Teaching Scheme			Credits	Marks			Duration of End Semester Examination
L	T	P/D	C	Sessional	End Semester Exam	Total	
3	0	0	3	40	60	100	3 hrs.

COURSE CONTENT:

UNIT	CONTENT	No. of Hrs.
I	**Introduction:** Definition, classification of modern manufacturing processes, need of modern manufacturing processes vs. conventional manufacturing processes. **Ultrasonic Machining** – Elements of process, cutting tool system design, effect of parameters, economic considerations, applications, limitation of the process, advantages and disadvantages.	7
II	**Abrasive Jet Machining –** Variables in AJM, metal removal rate in AJM. water jet machining – jet cutting equipments, process details, advantages and applications. **Electrochemical and Chemical Metal Removal Processes:** Electrochemical machining – elements of ECM process, tool work gap, chemistry of the process, metal removal rate, accuracy, surface finish and other work material characteristics, economics, advantages, applications, limitations. electrochemical grinding – Material removal, surface finish, accuracy, advantages, applications**.**	9
III	**Electric Discharge Machining (EDM):** EDM of spark erosion machining processes, mechanism of metal removal, spark erosion generators, electrode feed control, dielectric fluids, flushing, electrodes for spark erosion, selection of electrode material, tool electrode design, surface finish, machining accuracy, machine tool selection, applications, wire cut EDM. **Laser beam machining (LBM)** – Apparatus, material removal, cutting speed and accuracy of cut, metallurgical effects, advantages and limitations.	9
IV	**Plasma arc Machining (PAM):** Plasma, Non- thermal generation of plasma, mechanism of metal removal, PAM parameters, equipments for D.C. plasma torch unit, safety precautions, economics, other applications of plasma jets. **Electron beam Machining (EBM):** Generations and control electron	9

	beam, theory of electronic beam machining, process capabilities and limitations.	

Text Books:

1. P.C. Pandey, H.S. Shan, "***Modern Machining Processes"***, McGraw Hill Education (India) Pvt. Ltd.
2. AmitabhaGhosh, Ashok Kumar Mallik, "***Machining Manufacturing Science"***, Affiliated East – West Press.

Reference Books:

1. G.F. Benedict, "***Non Traditional Manufacturing Processes"***, Marcel Dekker.
2. J.A. McGeongh, "***Advanced Methods of Machining"***, Chapman and Hall.

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Programme Elective-I

ME-609: MAINTENANCE AND RELIABILITY

Teaching and Examination Scheme:

Teaching Scheme			Credits	Marks			Duration of End Semester Examination
L	T	P/D	C	Sessional	End Semester Exam	Total	
3	0	0	3	40	60	100	3 hrs.

COURSE CONTENT:

UNIT	CONTENT	No. of Hrs.
I	**Introduction:** Evolution of maintenance, objective of maintenance, maintenance and philosophies, maintenance concept maintenance management & technology, relationship with other functional areas, importance of maintenance, elements of good maintenance economics of maintenance, training and safety aspects in maintenance. **Maintenance strategies**: classification of maintenance programs. Corrective, preventive and predictive maintenance, comparison of maintenance programs, preventive maintenance concept, functions, benefits, limitations.	8
II	**Condition based maintenance (CBM):** Objectives, what to monitor, when to monitor, principal of CBM, condition based maintenance techniques, manual inspections, performance monitoring, vibration monitoring, oil debris. Spectroscopy, thermography and corrosion, monitoring steps in implementation of CBM, benefits of CBM. **Reliability Centered maintenance (RCM):** RCM logic, maintenance and RCM, benefits of RCM, total productive maintenance (TPM), introduction, key supporting elements of TPM methodology, evaluation and benefits.	9
III	**Non-destructive Testing (NDT):** Purpose and challenges, techniques, visual aids, boroscopes, endoscopes, fiber optics scanner, magnetic particles inspection, liquid penetrants. Ultrasonic radiography, selection of NTD techniques, merits/demerits and application of various techniques. **Maintenance Planning and Control:** Basic ingredients, basic steps in maintenance management, maintenance planning and control system, documentation, maintenance productivity areas for improvement.	9
IV	**Reliability, maintenance & availability techniques:** Techniques for improvement of operation reliability, safety and availability of machines	8

	and production system, maintainability criteria, checklist to assess the maintainability improvement program, fault diagnosis, pareto principle, ishikawa diagram.	

Text Books:

1. L.R. Higgin, "***Maintenance Planning and Control"***, McGraw Hill Education Pvt. Ltd.
2. Kelley Anthony, "***Maintenance Planning and Control"***, East-West Press Pvt. Ltd.

Reference Books:

1. B.S. Blanchard, E.E. Lowey, "***Maintainability Principal and Practices",*** Mc Graw Hill Education Pvt. Ltd.
2. B. Raj, T. Jayakumar, K. Thavasimutyi, "***Practical NDT"***, Narosa Publishing House.
3. Nieble Benjamin W, "***Engineering Maintenance Management"***, Marcel Dekker.

Programme Elective-I

ME-610: COMPOSITE MATERIALS

Teaching and Examination Scheme:

Teaching Scheme			Credits	Marks			Duration of End Semester Examination
L	T	P/D	C	Sessional	End Semester Exam	Total	
3	0	0	3	40	60	100	3 hrs.

COURSE CONTENT:

UNIT	CONTENT	No. of Hrs.
I	**Introduction:** Modern materials in design, types, metals, polymers, ceramics, composites. Polymers-Classification thermo plastics and thermo setting plastics, applications, merits and demerits. **Classification of composites:** Types, Natural composites, Lamina, laminate and lamination theory, fiber types, forms and properties, Honey comb composites, advantages, applications. Matrix and their role, principal types of fibre and matrix materials, micro- and macro-mechanical analysis and properties, failure theories applicable on composite materials	8
II	**Various Processes to make Composites:** primary and secondary manufacturing – Layup and curing, open and closed mould processes, bag moulding, filament winding, pultrusion, pulforming, thermoforming, advantages and limitations of different processes. **Manufacturing Metal Matrix and Ceramic Matrix composites**: metal matrix and ceramic matrix composites, advantages, limitations and characteristics of ceramic and metal matrix composites, RTM, RIM, SRIM processes.	9
III	**Fabrication Processes**: Need of various material removal processes in composites, Machining, drilling, joining, routing, operations carried out on composites, etc. **Challenges in material removal or joining processes of composite materials** – Difficulties in turning, drilling, milling, welding, or other joining methods.	9
IV	**Applications:** Carbon – Carbon composites, applications in automobile, aerospace and general engineering. Composites as a alternative to existing engineering applications. Applications of metal matrix composites, ceramic matrix composites, components and processing techniques.	8

Text Books:

1. Autar K. Kaw, "***Mechanics of Composite Materials"***, CRC Press, NY, 1997.
2. B.D. Agarwal and L.J. Broutman, "***Analysis and Performance of Fibre Composites",*** John Wiley and Sons Inc, 1990.
3. F.L. Matthews and R.D. Rawlings, "***Composite Materials: Engineering and Science"***, Chapman and Hall, London, 1994.

Reference Books:

1. Ronald F Gibson, "***Principles of Composite Material Mechanics"***, McGraw Hill Education Pvt. Ltd., 1994.
2. Robert M Jones, "***Mechanics of Composite Materials"***, McGraw Hill Education Pvt. Ltd.
3. Terry Richardson, "***Composites - A Design Guide"***, Industrial Press Inc, NY, 1987.
4. Sanjay K Mazumdar, "***Composites Manufacturing"***, CRC Press, NY, 2003.

SEMESTER-VII

ME-701: INDUSTRIAL AUTOMATION AND ROBOTICS

Teaching and Examination Scheme:

Teaching Scheme			Credits	Marks			Duration of End Semester Examination
L	T	P/D	C	Sessional	End Semester Exam	Total	
3	0	0	3	40	60	100	3 hrs.

COURSE CONTENT:

UNIT	CONTENT	No. of Hrs.
I	**Basic principles of automation,** Hard automation, flexible automation extending the capabilities of conventional machines through improved devices and manipulators, transfer machines for assembly, multispindle automatics. **Introduction to Robotics:** Synthesis of elements with movability constraints, classification and specification of robots, laws of robotics, elements of robot anatomy, hydraulic, pneumatic and electrical manipulators, end-effectors and their design.	**8**
II	**Robotic manipulation:** automation and robots classification – drive technologies work-envelope geometries, motion control method, application: robot specifications – no. of axes, capacity and speed, reach and stroke, tool orientation, repeatability, precision, accuracy, operating environment.	**9**
III	**Direct kinematics**: the arm equation homogenous Co-ordinates – frames, translation and rotations, composite homogenous transformations, screw transformations, link Co-ordinates, the arm equation, a five-axis articulated robot, a four-axis SCARA robot, a six-axis articulated robot.	**8**
IV	**Inverse Kinematics:** Solving the arm equation: the inverse kinematics problem general properties of solutions, tool configuration, inverse kinematics of a five-axis articulated robot, four-axis SCARA robot, six-axis articulated robot and three-axis planer articulated robot. **Performance analysis of industrial robots:** Performance Analysis and their manufacturing applications, Economics of robotics.	**9**

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Text Books:

1. John J. Craig, "***Introduction to Robotics: Mechanics & Control"***, Pearson Eduaction India
2. R.K. Mittal, I J Nagrath, "***Robotics and control",*** McGraw Hill Education (India) Pvt. Ltd., India, 2003.
3. S. R Deb, S Deb, "***Robotics Technology and Flexible Automation"***, Tata McGraw Hill Education.

Reference Books:

1. Hodges, "***Industrial Robotics"***, Jaico Publications (India) Pvt. Ltd.
2. A. Bhattacharya and G. Sen, "***Principles of Machine Tools"***, New Central Book Agency, Kolkata.

ME-702: REFRIGERATION AND AIR CONDITIONING

Teaching and Examination Scheme:

Teaching Scheme			Credits	Marks			Duration of End Semester Examination
L	T	P/D	C	Sessional	End Semester Exam	Total	
3	1	0	4	40	60	100	3 hrs.

COURSE CONTENT:

UNIT	CONTENT	No. of Hrs.
I	**Introduction:** Definition of refrigeration & air conditioning, Necessity, Methods of refrigeration, Coefficient of performance (COP), fundamentals of air-conditioning system, refrigerants- classification, nomenclature, desirable properties, comparative study, secondary refrigerants, Introduction to eco-friendly refrigerants and cryogenics. **Air Refrigeration Systems:** Carnot refrigeration cycle, Brayton refrigeration or the Bell Coleman air refrigeration cycle, Air craft refrigeration systems, Simple cooling and Simple evaporative types, Boot strap and Boot strap evaporative types, Regenerative type and Reduced Ambient type system, Comparison of different systems.	7
II	**Vapour Compression (VC) Refrigeration Systems:** (a) Simple Vapour Compression (VC) refrigeration systems- limitations of reversed carnot cycle with vapour as the refrigerant, analysis of VC cycle considering degrees of sub cooling and superheating, , comparison of VC cycle with air refrigeration cycle. (b) multistage refrigeration systems- necessity of compound compression, compound VC cycle , intercooling with liquid sub –cooling and / or water inter cooler: multistage compression with flash intercooling and / or water inter-cooling, systems with individual or multiple expansion valves, Individual compression system with individual or multiple expansion valves, individual compression systems with individual or multiple expansion valves with and without intercoolers.	9
III	**Other Refrigeration Systems**: (a) Vapour Absorption Refrigeration (VCR) systems – basic systems, actual COP of the system, performance, relative merits and demerits, properties of aqua ammonia, Electrolux refrigeration. (b) Steam Jet Refrigerating (SJR) System- (c) Cascade refrigerating systems- necessity selection of pairs of refrigerants for the system, concept of cascade temperature, analysis, comparison with V.C. systems, applications.	9
IV	**Psychrometry of Air & Air Conditioning Processes:** Properties of moist air-Gibbs Dalton law, basic terminology, psychrometric chart,	9

	psychrometry of air-conditioning processes, mixing process, basic processes in conditioning of air. **Air- Conditioning Load Calculations:** Outside and inside design conditions, sources of heating load, sources of cooling load, heat transfer through structure, solar radiation, electrical applications, infiltration and ventilation, heat generation inside conditioned space, apparatus selection. **Air Conditioning Systems with Controls & Accessories**: Classifications, layout of plants, equipment selection, air distribution system, duct systems design, filters, refrigerant piping, design of summer air conditioning and winter air conditioning systems, temperature sensors, pressure sensors, humidity sensors, actuators, safety controls, accessories.	

Text Books:

1. C.P. Arora, "***Refrigeration & Air Conditioning",*** McGraw Hill Education (India) Pvt. Ltd.
2. Arora, Domukundwar, "***A course in Refrigeration & Air Conditioning",*** Dhanpat Rai Publications.
3. R.C. Jordan, G.B. Priester, "***Refrigeration & Air Conditioning"***, Prentice Hall of India.

Reference Books:

1. W.F. Stockerand, J.W. Jones, "***Refrigeration & Air Conditioning"***, McGraw Hill Higher Education.
2. Manohar Prasad, "***Refrigeration & Air Conditioning"***, New Age International Pvt. Ltd.

ME-703: POWER PLANT ENGINEERING

Teaching and Examination Scheme:

Teaching Scheme			Credits	Marks			Duration of End Semester Examination
L	T	P/D	C	Sessional	End Semester Exam	Total	
3	0	0	3	40	60	100	3 hrs.

COURSE CONTENT:

UNIT	CONTENT	No. of Hrs.
I	**Introduction:** Energy resources and their availability, Types of power plant, selection of the plants, review of basic thermodynamics cycles used in power plant. **Hydro Electric Power Plants:** Rainfall and run-off measurements and plotting of various curves for estimating power plants, design, construction and operation of different components of hydro-electric power plant, site selection, comparison of other types of power plants.	**8**
II	**Steam Power Plants:** Flow sheet and working of modern-thermal power plants, super critical pressure steam stations, site selection, coal storage, preparation, coal handling systems, feeding and burning of pulverized fuel, ash handling systems, dust collection-mechanical dust collector and electrostatic precipitator. **Gas Turbine Power Plants:** Types, open and closed gas turbine, work output & thermal efficiency, methods to improve thermal efficiency of gas turbine plant- reheating, inter- cooling regeneration & their combinations, advantage and disadvantages, comparison with steam power plant.	**9**
III	**Nuclear Power Plants:** Principles of nuclear energy, basic nuclear reactions, nuclear power station, trouble shooting and remedies. Power Plant Economics: Effect of plant type on costs, fixed elements, energy elements, customer elements and investor's profit, depreciation and replacement. Economics of power plants.	**9**
IV	**Non-Conventional Power Generation:** Solar radiation, solar energy collectors, OTEC, wind power plants, geothermal resources, direct energy conversion systems in fuel cell, MHD power generation-principle thermoelectric power generation, thermionic power generation.	**8**

Text Books:

1. P.K. Nag, "***Power Plant Engineering",*** McGraw Hill Education (India) Pvt. Ltd.
2. Bernhardt G.A. Skrotzki and William A. Vopat, "***Power Station Engineering and Economy",*** McGraw Hill Education.

Reference Books:

1. G.D. Rai, "***An Introduction to Power Plant Technology"***, Khanna Publishers.
2. Arora, Domkundwar, "***A Course in Power Plant Engineering"***, Dhanpat Rai Publications.
3. M.M. El-Wakil, "***Power Plant Engineering"***, McGraw Hill Education.
4. Gupta, "***Power Plant Engineering, Gupta",*** PHI Learning Private Limited.

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ME-704: INDUSTRIAL ENGINEERING AND PRODUCTION MANAGEMENT

Teaching and Examination Scheme:

Teaching Scheme			Credits	Marks			Duration of End Semester Examination
L	T	P/D	C	Sessional	End Semester Exam	Total	
2	2	0	3	40	60	100	3 hrs.

COURSE CONTENT:

UNIT	CONTENT	No. of Hrs.
I	**Introduction:** Principles of management - definition and significance of management, basic functions of management – planning, organizing, staffing, directing and controlling. evolution of ie. engineers and organizational environment – social, economic, technological and political. social responsibility of engineers. **Organizational behaviour and human resource management:** Significance of OB, Role of leadership, personality and motivation. attitudes, values and perceptions at work. HR - importance, objectives and functions, job analysis and recruitment, selection and placement, training and development – forms of business organization.	6
II	**Work study:** Productivity definition, means of increasing productivity, productivity and work study work study - definition, aims, procedure for method study, selection of jobs, recording techniques, micro motion study, therbligs, cyclograph and chrono-cyclo-graph, principles of motion economy, design of work place layout, analysis in the form of chart, operation chart, flow process chart, flow diagram, string diagram, man machine chart, two hand chart, SIMO chart. – time study equipment, performance rating, allowances, number of cycles to be studied, determination of standard time, predetermined motion time systems. **Job evaluation, wages, incentives and welfare**: Job evaluation, objectives of job evaluation, Methods of job evaluation, non quantitative and quantitative. – characteristics of a good wage or a incentive systems, methods of wage payments, concept of wage incentive schemes, financial and non financial, Halsey premium plan, Merric's multiple piece rate system. working condition, service facilities, legal legislation – factories act, 1948.	6
III	**Ergonomics:** Definition, human technological system, multidisciplinary engineering approach, Biostatic mechanics, statics of rigid bodies, biodynamic mechanics, human body kinematics, kinetics, impact and collision, bio-thermodynamics and bioenergetics.	6

	Marketing feasibility analysis: Qualitative forecasting methods, quantitative forecasting models – forecast accuracy, long range forecast, short range forecast.	
IV	**Facilities layout and plant location:** Manufacturing facility layouts, analyzing manufacturing facility layouts, service facility layout. – factors affecting location decisions, multi facility location problem, ware house location problem, minimax location, gravity location problem. **Inventory management and PPC:** Views of inventories, nature of inventories, fixed order quantity systems, fixed order period systems, other inventory models, production planning and control- loading, scheduling, dispatching.	**6**

Text books:

1. ILO, "***Introduction to work study"***, Universal Book Corporation, Bombay, 1986.
2. Norman Gaither, Greg Frazier, "***Operations Management : Concepts, Techniques & Applications"***, Cengage Learning.
3. Harold Koontz, Heinz Weihrich, "***Essentials of Management: An International and Leadership perspective"***, McGraw Hill Education, 9th edition 2012

Reference Books:

1. Marvin E. Mundel, David L. Danner, "***Motion and Time Study"***, Prentice Hall India.
2. Ralph M. Barnes, "***Motion and Time Study Design and Measurement of Work"***, Wiley.
3. Mark S. Sanders, "***Human Factors in Engineering and Design"***, McGraw Hill, New York, 1993.
4. Chandler Allen Phillips, "***Human Factors Engineering"***, John Wiley and Sons, New York, 2000.

Programme Elective-II

ME-708: MATERIAL HANDLING AND PLANT LAYOUT

Teaching and Examination Scheme:

Teaching Scheme			Credits	Marks			Duration of End Semester Examination
L	T	P/D	C	Sessional	End Semester Exam	Total	
3	0	0	3	40	60	100	3 hrs.

COURSE CONTENT:

UNIT	CONTENT	No. of Hrs.
I	**General:** Concepts and factors governing plant locations economics, rural economics, rural vs urban plant sites, case studies (i) selection of a site for software company (ii) selection of a site for XYZ Company: analysis of alternatives. **Plant Layout**: Introduction of plant layout, principles and objectives of effective layout, advantages of good layout, symptoms of bad layout. types of plant layout, their features. applications and comparison, introduction to group technology: its relevance, application and advantages.	8
II	**Planning the layout:** Factors influencing plant layout, material factors, machinery factors, man factors movement factors, waiting factors, service factors, change factors, building factors, workstation design methods of plants and factory layout, plant layout procedure, factory building , building equipments, common problems in plant layout, tool and techniques of layout, operation process chart, flow process chart, flow diagram, string diagram, evaluating alternate layout-various methods. **Line balancing:** Objective of line balancing problems, constraint in line balancing problem, terminology in assembly line, preventive measures to achieve a balanced production line. types of line balancing: (a) assembly line balancing (b) fabrication line balancing, heuristic and other method of line balancing, simple numerical problems in line balancing.	9
III	**Materials handing :** Objectives of material handling systems, material handling engineering survey, basic features of handling, types of material handling systems, material handling engineering survey, basic features of handling, various materials handling, considerations including combined handling, space for movements, analysis of handling methods, economical and technical considerations of handling equipment, cost analysis of material handling systems.	8

IV	**Material handling equipments:** Introduction, types of material handling equipment, selection and maintenance of material handling equipments, characteristics of material handling equipments such as conveyers, cranes, hoist, amount of equipments required and predicting in process inventory by graphical technique. **Travel Chart:** Procedure for travel charting, numerical problem on optimum arrangement of various departments of shops under given constraints and to check their effectiveness.	**9**

Text Books:

1. S.C. Sharma, "***Plant Layout and Material Handling"***, Jain Brothers .
2. Peters, "***Plant Design and Economics"***, McGraw Hill Education Pvt. Ltd.
3. B.K. Aggarwal, "***Plant Layout and Material Handling"***, Jain Brothers.

Reference Books:

1. James MacGregor Apple, "***Plant Layout and Material Handling"***, John Wiley & Sons.
2. Raymond A. Kulwiec, "***Material Handling Handbook"***, John Wiley & Sons.
3. James M. Moore, "***Plant Layout and Design"***, Collier McMillan Pvt. Ltd.

Programme Elective-II

ME-709: INDUSTRIAL TRIBOLOGY

Teaching and Examination Scheme:

Teaching Scheme			Credits	Marks			Duration of End Semester Examination
L	T	P/D	C	Sessional	End Semester Exam	Total	
3	0	0	3	40	60	100	3 hrs.

COURSE CONTENT:

UNIT	CONTENT	No. of Hrs.
I	**Introduction:** Tribology, contact of solids, nature of surfaces, surface topography, surface interactions and characterization, micro and nanotribology, surface roughness measurement techniques.	8
II	**Friction:** Types, laws, modern theories, dry sliding friction, temperature of sliding surfaces, mechanism of rolling friction, friction instabilities. **Wear:** Classification, theories of adhesive, abrasive, surface fatigue and corrosive wear, erosive wear, cavitation and fretting wear, wear models, wear of various machine components such as gears, plain bearings and rolling element bearing, ASTM standards for wear measurement, wear resistant materials, wear resistant components.	9
III	**Viscosity:** Basic definition, conversion, dynamic viscosity, measurement, variation with temperature, ASTM charts, viscosity index, grade of oil. **Lubricants:** Types of lubricants, selection of lubricants, properties and tests on lubricants, analysis of used oils/lubricants, particle counter, spectroscopic oil analysis, ferrography.	9
IV	**Lubrication theories:** Lubrication regimes, viscous flow and viscometry, Reynold's equation, energy equation, solution of reynolds equation, mechanism of pressure development in fluid film bearing, hydrodynamic lubrication, hydrostatic lubrication, elastohydrodynamic lubrication, lubrication between two contact bodies, Hertzian and non-hertzian contacts, phenomenon of starvation, boundary lubrication, squeeze films, turbulent lubrication	8

Text Books:

1. Bharat Bhushan, "***Introduction to Tribology"***, Wiley India Pvt. Ltd.
2. S.K. Basu, S.N. Sengupta, B.B. Ahuja, "***Fundamentals of Tribology"***, Pentice Hall of India Learning Pvt. Ltd.

Reference Books:

1. Kenneth C.Ludema, "***Friction Wear & Lubrication (A textbook in Tribology)"***, CRC Press.
2. Steven R. Schmid, Bernard J. Hamrock, Bo Jacobson, "***Fundamentals of Machine elements"***, CRC Press.

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Programme Elective-II

ME-710: FINITE ELEMENT METHOD

Teaching and Examination Scheme:

Teaching Scheme			Credits	Marks			Duration of End Semester Examination
L	T	P/D	C	Sessional	End Semester Exam	Total	
3	0	0	3	40	60	100	3 hrs.

COURSE CONTENT:

UNIT	CONTENT	No. of Hrs.
I	**Interpolation and Approximation** : Interpolation with unequal intervals-langrange's interpolation-Newton's divided difference interpolation-cubic splines, interpolation with equal intervals- Newton's forward and backward difference formulae **Numerical Differentiation and Integration:** Approximation of derivatives using interpolation polynomials- numerical integration using trapezoidal, Simpson's 1/3 rule, Romberg method-2 and 3 point Gaussian quadrature formula.	6
II	**Initial Value Problems for Ordinary Differential Equation:** Single Step methods- Taylor series method, Euler's method, modified Euler's method , Fourth order Runge Kutta method for solving first order equations - multi step methods - Milne's and Adam Bash fourth predictor corrector methods for solving first order equations.	6
III	**Finite Difference Method:** Finite difference methods for solving two-point linear boundary value problems – finite difference techniques for the solution of two dimensional Laplace's and Poisson's equations on rectangular domain – one dimensional heat flow equation by explicit and implicit (Crank Nicholson) methods – one dimensional wave equation by explicit method.	6
IV	**Finite Element Method:** Basic concepts of finite element method, boundary, initial and eigen value problems, Ritz Technique, one dimensional second order equations -discretization - element types - linear and higher order elements, derivation of shape functions and stiffness matrices and force vectors, assembly of matrices, solution of problems from solid mechanics and heat transfer.	6

Text Books:

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1. Tirupathi R. Chandrupatla, Ashok D. Belegundu, "***Introduction to Finite Elements in Engineering"***, Prentice Hall India.

2. J.N. Reddy, "*An Introduction to the Finite Element Method"*, McGraw Hill Education,
3. B S Grewal, "***Numerical Method in Engineering"***, Khanna Publishers.

Reference Books:

1. E Balaguruswamy, "***Numerical Methods"***, Tata McGraw Hill
2. Robert D. Cook, David S. Malkus, Michael E. Plesha, Robert J. Witt, "***Concepts and Applications of Finite Elements Analysis",*** Wiley, 2007.

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ME-711: PROJECT WORK-I.

Teaching and Examination Scheme:

Teaching Scheme			Credits	Marks			Duration of End Semester Examination
L	T	P/D	C	Sessional	End Semester Exam	Total	
0	0	4	2	50	50	100	3 hrs.

Suggested List of Activities/Projects :

Students are expected to complete a project in groups or alone as deemed fit by the faculty and department. They should work under supervision of Faculty member/s of department, or in collaboration with other departments, or preferably with Industry. The project should demonstrate application of the fundamentals learnt during the course of study and should also be innovative. Any of the following areas may be chosen for pursuing project work (but not limited to):

1. Development of ingenious and innovative products under guidance of supervisor and possibly involving industry,
2. Robotics and its utilization in manufacturing/day-to-day functioning of human life,
3. Computer Integrated Manufacturing,
4. Modernization in Production, and End product delivery,
5. Development of Bio-Mechanics related materials, mechanisms, contraptions, for patients, sports, normal human life functions,
6. Simulation studies of higher order to predict behaviour of materials,
7. Development of software modules for efficient functioning of an organization (MIS, ERP, etc.)
8. Mechanization modules development and application for increase of human comfort,
9. Inter-disciplinary work involving applications of electronics, computers, and other fields for the welfare of mankind,
10. Space Research related module development,
11. Any productive project involving application of engineering fundamentals in collaboration with industry, R&D institutes, institutes of international/national/state importance as deemed fit by the faculty members/concerned supervisor.

ME-712: AUTOMATION AND ROBOTICS LAB.

Teaching and Examination Scheme:

Teaching Scheme			Credits	Marks			Duration of End Semester Examination
L	**T**	**P/D**	**C**	**Sessional**	**End Semester Exam**	**Total**	
0	0	2	1	30	20	50	3 hrs.

Suggested List of Experiments/Activities:

1. To study complete automation system having the Linear conveyor
2. To study complete automation system having the Pick and place
3. To study complete automation system having the Rotary table
4. To study complete automation system having the Filling and packing
5. To study complete automation system having the Quality check
6. To study complete automation system having the Storage in warehouse
7. To program a robot for pick and place motion.

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ME-713: THERMAL ENGINEERING LAB.

Teaching and Examination Scheme:

Teaching Scheme			Credits	Marks			Duration of End Semester Examination
L	T	P/D	C	Sessional	End Semester Exam	Total	
0	0	2	1	30	20	50	3 hrs.

Suggestive List of Practicals

1. To study the vapor compression Refrigeration Systems, water cooler and/or ice plant, its working cycle and determine its C.O.P.
2. To determine the By-pass factor of Heating & Cooling coils, and to study the cut-sectional models of reciprocating and Rotary Refrigerant compressor.
3. To study humidification, heating, cooling and dehumidification processes, and the various controls used in Refrigerating & Air Conditioning System.
4. To study Desert cooler and/or Window Type Air Conditioner and its efficiency.
5. To study and prepare report on the constructional details, working principle and operation of the following (a) Single plate clutch/Multi plate clutch, (b) Coil Spring Clutch, Diaphragm Spring Clutch.
6. To study and prepare report on the Safety, Emissions (BS II, III, IV, and higher, etc) NVH, CAE, Materials Used, of up to 2000 cubic centimeter Engine vehicle for comparison with smaller as well as larger capacity commercially available vehicles.
7. To study and prepare report on working of industrial boilers.
8. To study and prepare report on working of condenser.
9. To study and prepare report on the constructional details, working principles and operation of the following automotive tyres & wheel: (a). Various types of bias and radial plies tyres (b). Various types of wheels.
10. To study and prepare report on the constructional details, working principles and operation of the following automotive brake systems: a. Hydraulic & pneumatic brake system b. Drum brake system c. Disk brake system b. Antilock brake system.

Note: It is expected that students will become aware of domain of Automotive Research Association of India, Central Pollution Control Board norms applicable on vehicular emissions, impact of various orders issued by National Green Tribunals and such govt. regulators, Traffic norms applicable in India and other countries, Bharat and Euro norms, and recent innovations in non-polluting vehicle technologies.

ME-714: INDUSTRIAL/PRACTICAL TRAINING

Teaching and Examination Scheme:

Teaching Scheme			Credits	Marks			Duration of End Semester Examination
L	T	P/D	C	Sessional	End Semester Exam	Total	
0	0	0	2	50	50	100	3 hrs.

Note: Industrial training of 6 weeks duration attended after 6th semester for 6 weeks during summer vacations, and evaluated in 7th semester. The training may be in any of the following fields (but not limited to) as also suggested for project work :

1. Development of ingenious and innovative products under guidance of supervisor and possibly involving industry,
2. Robotics and its utilization in manufacturing/day-to-day functioning of human life,
3. Computer Integrated Manufacturing,
4. Modernization in Production, and End product delivery,
5. Development of Bio-Mechanics related materials, mechanisms, contraptions, for patients, sports, normal human life functions,
6. Simulation studies of higher order to predict behaviour of materials,
7. Development of software modules for efficient functioning of an organization (MIS, ERP, etc.)
8. Mechanization modules development and application for increase of human comfort,
9. Inter-disciplinary work involving applications of electronics, computers, and other fields for the welfare of mankind,
10. Space Research related module development,
11. Any productive project involving application of engineering fundamentals in collaboration with industry, R&D institutes, institutes of international/national/state importance as deemed fit by the faculty members/concerned supervisor.

SEMESTER-VIII

Programme Elective-III

ME-801: Total Quality Management

Teaching and Examination Scheme:

Teaching Scheme			Credits	Marks			Duration of End Semester Examination
L	**T**	**P/D**	**C**	**Sessional**	**End Semester Exam**	**Total**	
3	0	0	3	40	60	100	3 hrs.

COURSE CONTENT:

UNIT	CONTENT	No. of Hrs.
I	**Introduction** - Need for quality, evolution of quality, definition of quality - dimensions of manufacturing and service quality - Basic concepts of TQM, Definition of TQM, TQM Framework, Contributions of Deming, Juran and Crosby – Barriers to TQM. **Quality Control and Improvement Tools**: Check Sheet, histogram, pareto chart, cause and effect diagram, scatter diagram, control chart, graph, affinity diagram, tree diagram, matrix diagram, process decision program chart, arrow diagram, acceptance sampling, process capability studies, zero defect program (POKA-YOKE).	**7**
II	**TQM PRINCIPLES:** Leadership – strategic quality planning, quality statements,customer focus, customer orientation, customer satisfaction, customer complaints, customer retention - employee involvement, motivation, empowerment, team and teamwork, recognition and reward, performance appraisal, continuous process improvement – PDSA cycle, 5s, Kaizen - supplier partnership – partnering, supplier selection, supplier rating.	**9**
III	**TQM TOOLS & TECHNIQUES**: The seven traditional tools of quality, new management tools, six-sigma concepts, methodology, applications to manufacturing, service sector including IT – bench marking – reason to bench mark, bench marking process – FMEA – Stages, Types. Quality circles – Quality Function Deployment (QFD) – Taguchi quality loss function – TPM – concepts, improvement needs – cost of quality – performance measures.	**9**
IV	**Quality Management System & Quality Audit**: Quality Systems, Quality management principles, ISO-9000:2000, ISO 9001 : 2000, ISO 14000, Future of quality system audit, Audit objectives, types of quality audit, Quality Auditor, Audit performance. Case studies of TQM implementation in manufacturing and service sectors including IT.	**9**

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Text Books:

1. Dale H. Besterfiled, "***Total Quality Management"***, Pearson Education Asia
2. Joel E. Ross, Susan Perry, "***Total Quality Management"***, Vanity Books International

Reference Books:

1. James R. Evans, William M. Lindsay, "***The Management and Control of Quality"***, SouthWestern (Thomson Learning).
2. J.S. Oakland, Les Pester, "***TQM – Text with Cases***", Butterworth – Heinemann Ltd.,
3. L Suganthi, Anand A Samuel, "***Total Quality Management"***, Prentice Hall (India)Pvt. Ltd.

Programme Elective-III

ME-802: NON-CONVETIONAL ENERGY RESOURCES

Teaching and Examination Scheme:

Teaching Scheme			Credits	Marks			Duration of End Semester Examination
L	T	P/D	C	Sessional	End Semester Exam	Total	
3	0	0	3	40	60	100	3 hrs.

COURSE CONTENT:

UNIT	CONTENT	No. of Hrs.
I	**Introduction:** Trends of energy consumption sources of energy conventional and renewable, fossil fuel – availability and limitations, need develop new energy sources. **Solar Energy:** Solar radiation characteristic, solar collectors, flat plate and concentrating types, their comparative study, design and material selection. efficiency, selective paints and surfaces. heating of air and water for building and other uses. thermal storages, solar ponds, solar pumps, solar cookers etc. direct conversion of solar energy to electricity and its various uses, materials, limitations and costs.	**8**
II	**Bio-conversion:** Generation of bio gas, digesters and then design, selection of material, feed to digester, paralytic gasification, production of hydrogen, algae production and the their uses. **Wind Energy:** Types of rotors, horizontal axis and vertical axis system, system design and site selection.	**10**
III	**Geo-thermal Energy:** Sites, potentiality and limitation, study of different conversion system. **Tidal Energy:** Sites potentiality and possibility of harnessing from site, limitations.	**8**
IV	**Ocean thermal energy**: Principal of utilization and its limitation, description of various systems. **Other non-conventional energy sources:** Fluidized bed combustions, heat from waste and other sources.	**8**

Text Books:

1. G.D. Rai, "***Solar Energy Utilization"***, Khanna Publishers,New Delhi
2. John A Duffie, William A Beckman , "***Solar Engineering of Thermal Processes",*** John Wiley & Sons

Reference Books:

1. M.M. EL Wakil, "***Power Plant Technology",*** McGraw Hill Education.
2. P.C. Sharma, "***Power Plant Engineering",*** S.K. Kataria and Sons.

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Programme Elective-III

ME-803: PRODUCTION PLANNING AND CONTROL

Teaching and Examination Scheme:

Teaching Scheme			Credits	Marks			Duration of End Semester Examination
L	T	P/D	C	Sessional	End Semester Exam	Total	
3	0	0	3	40	60	100	3 hrs.

COURSE CONTENT:

UNIT	CONTENT	No. of Hrs.
I	**PPC performance:** PPC – Requirements, benefits, factors influencing PPC performance, 3 types of decisions – 3 Phases of PPC – Aggregate and Disaggregate Planning, Master Production Schedule (MPS) – techniques & hour glass principle – Bill of Material (BOM) structuring	8
II	**MRP Material Requirements Planning (MRP):** MRP System, inputs, outputs, benefits, technical issues – MRP system nervousness – Manufacturing Resources Planning (MRP II), resource planning, Final assembly scheduling	9
III	**Capacity management**: Capacity Planning using overall factors (CPOF), Capacity Bills, Resource Profiles, Capacity requirements planning (CRP) – I/O Control - Shop floor control, Basic concepts, **Charts and rules:** Gantt Chart, Priority sequencing rules and Finite Loading – Inventory models.	8
IV	**Shop floor control**: Shop floor control – Just in time (JIT) – Key elements, techniques – JIT & PPC, pull & push systems – Kanban system-types, number of Kanban calculations, design, advantages and disadvantages. **ERP System** ERP systems – Components, modules, implementation, advantages and disadvantages - technical aspects of SAP - Supply Chain Management (SCM) – components, stages, decision phases – Supply chain macro processes in a firm	9

Text Books

1. S.K. Mukhopadhyay, "***Production planning and control – Text and Cases"***, PHI Learning Pvt. Ltd
2. T.E. Vollmann, D.C. Whybark, F R Jacobs, "***Manufacturing Planning and Control for Supply Chain Management"***, McGraw Hill Education

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Reference Books

1. Thomas A Curran, Gerhard Keller, "***SAP R/3 Business Blueprint: Understanding Enterprise Supply Chain Management",*** Prentice-Hall
2. Daniel Sipper, R.L. Bulfin, "***Production Planning, Control, and Integration"***, McGraw Hill Publishing Co.

Programme Elective-IV

ME-804: MECHATRONICS

Teaching and Examination Scheme:

Teaching Scheme			Credits	Marks			Duration of End Semester Examination
L	T	P/D	C	Sessional	End Semester Exam	Total	
3	0	0	3	40	60	100	3 hrs.

COURSE CONTENT:

UNIT	CONTENT	No. of Hrs.
I	**Introduction and Basics:** Definition of mechatronics, a measurement system with its constituent elements, open and closed loop system, sequential controllers, micro-processor based controller, the mechatronic approach	7
II	**Hardware of Measurement Systems:** Force fluid pressure, liquid flow, liquid level, temperature, light sensors along with performance terminology data presentation elements: magnetic recording, data acquisition system, testing & calibration. pneumatic, hydraulic, mechanical and electrical actuation system: pneumatic and hydraulic system, mechanical systems, types of motion, kinematic chains, cams, gear, trains, ratehe t& pawl. belt & chain drivers, bearings. mechanical aspect of motor selection, electrical systems, mechanical & solid state switches, solenoids, d.c. & a.c. motors, stepper motors.	10
III	**Digital Logic and Programmable Logic Controller:** A review of number system & logic gates, Boolean algebra, Kanaugh Maps, sequential logic, basic structure of programmable logic controller, input/ output processing, programming, timers, internal relays and counters, master & jump controls, data handling, analogue input/output, selection of a PLC.	8
IV	**Microprocessor and Input/Output System:** Control, microcomputer structure: microcontroller, applications, programming languages, instruction sets, assembly language program, subroutines, design and mechatronics: design process, traditional and mechatronics design: possible mechatronics design solutions for timed switch, wind screen wiper motion, bath room scale, a pick & place robot, automatic camera, engine management system & bar code recorder.	9

Text Books:

1. W. Bolton, "***Mechatronics:Electronic Control Systems in Mechanical and Electrical Engineering"***, Pearsons Education, 4th Edition.

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2. K.P. Ramachandran, G.K.Vijaraghavan, M.S. Balasundaram, "***Mechatronics: Integrated Mechanical Electronic Systems",*** Wiley India.

Reference Book:

1. David G. Alciation, Michal B. Histand, "***Introduction to Mechatronics and Measurement Systems"***, Tata McGraw Hill Higher Education

Programme Elective-IV

ME-805: GAS DYNAMICS

Teaching and Examination Scheme:

Teaching Scheme			Credits	Marks			Duration of End Semester Examination
L	T	P/D	C	Sessional	End Semester Exam	Total	
3	0	0	3	40	60	100	3 hrs.

COURSE CONTENT:

UNIT	CONTENT	No. of Hrs.
I	**Compressible flow – fundamentals:** The adiabatic energy equation, Energy and momentum equations for compressible fluid flows, various regions of flows, reference velocities, stagnation state, velocity of sound, critical states, Mach number, critical Mach number, types of waves, Mach cone, Mach angle, effect of Mach number on compressibility.	7
II	**Flow through variable area ducts :** Isentropic flow through variable area ducts, T-s and h-s diagrams for nozzle and diffuser flows, area ratio as a function of Mach number, mass flow rate through nozzles and diffusers, effect of friction in flow through nozzles. **Flow through constant area ducts:** Flow in constant area ducts with friction (Fanno flow) - Fanno curves and Fanno flow equation, variation of flow properties, variation of Mach number with duct length. Flow in constant area ducts with heat transfer (Rayleigh flow), Rayleigh line and Rayleigh flow equation, variation of flow properties, maximum heat transfer.	9
III	**Normal and oblique shock :** Governing equations, variation of flow parameters like static pressure, static temperature, density, stagnation pressure and entropy across the normal shock, Prandtl – Meyer equation, impossibility of shock in subsonic flows, flow in convergent and divergent nozzle with shock. **Flow with Oblique Shock** – Fundamental relations, Prandtl‟s equation, Variation of flow parameters	9
IV	**Propulsion:** Aircraft propulsion – types of jet engines – study of turbojet engine components – diffuser, compressor, combustion chamber, turbine and exhaust systems, performance of turbo jet engines – thrust, thrust power, propulsive and overall efficiencies, thrust augmentation in turbo jet engine, ram jet and pulse jet engines. **Rocket propulsion** – rocket engines thrust equation – effective jet velocity specific impulse –rocket engine performance, solid and liquid propellants.	9

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Text Books:

1. S.M. Yahya, "***Fundamental of compressible flow with Aircraft and Rocket propulsion"***, New Age International Pvt. Ltd., New Delhi,5th Edition
2. John D Anderson**, "*Modern Compressible Flow: with Historical Perspective",*** McGraw Hill Education, 3rd Edition
3. V. Ganesan, "***Gas Turbines"***, McGraw Hill Education, 3rd Edition

Reference Books:

1. H Cohen, G F C Rogers, HIH Sravanamutoo, "***Gas turbine theory"***, Dorling Kindersley (RS), 5th edition
2. E Rathakrishnan, "***Gas Dynamics"***, PHI Learning Pvt. Limited,5thEditiion

Programme Elective-IV

ME-806: VIBRATIONS

Teaching and Examination Scheme:

Teaching Scheme			Credits	Marks			Duration of End Semester Examination
L	T	P/D	C	Sessional	End Semester Exam	Total	
3	0	0	3	40	60	100	3 hrs.

COURSE CONTENT:

UNIT	CONTENT	No. of Hrs.
I	**Basic Concepts of Vibrations:** Importance and scope, definition and terminology, representation of harmonic motions, introduction to various types of vibrations and types of excitation.	7
II	**Single Degree of Freedom Systems:** a) Un-damped Free Vibrations: D Alembert's Principle, Energy method, Rayleigh method, simple applications of these methods, equivalent spring stiffness. b) Damped Free Vibrations: Introduction to different types of damping, viscous damping, subcritical, critical and over-damping, logarithmic decrement, frequency of damped oscillations. c) Forced Vibrations: Solution for simple harmonic excitation, steady state vibrations, base excitation, vibration isolation and transmissibility, vibration measuring instruments, whirling of shaft without friction.	10
III	**Two Degree of Freedom Systems:** a) Un-damped Fee Vibrations: Normal modes vibrations, natural frequencies, mode shapes, forced harmonic vibrations, torsional vibrations of two rotor system. b) Applications: Dynamic vibration absorber, centrifugal pendulum absorber, torsional vibration absorber, untuned vibration damper, gyroscopic effect on rotating shaft.	9
IV	**Multi-Degree of Freedom Systems:** Un-damped free vibrations: Reciprocity theorem, Rayleigh's and Dunkerley's method, three rotor and geared systems. **Continuous Systems:** Free vibration of the following for various end conditions: Vibration of a string, longitudinal vibrations of bar, transverse vibration of beam, torsion of vibrations of circular shaft.	8

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Text Books:

1. S.S. Rao, "***Mechanical Vibration"*** **,** Pearsons Education India, 4th edition
2. V.P Singh, "***Mechanical Vibration",*** Dhanpat Rai Publications.

Reference Books:

1. G.K. Grover, "***Mechanical Vibration"***, Nem Chand & Bros, 8th Edition
2. R.VDukkipati, "***Mechanical Vibration"***, Narosa Publishing House(2010)

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ME-807: PROJECT WORK-II

Teaching and Examination Scheme:

Teaching Scheme			Credits	Marks			Duration of End Semester Examination
L	T	P/D	C	Sessional	End Semester Exam	Total	
0	0	16	8	50	50	100	3 hrs.

Note: Project Work during last semester duration is to be carried out by the student under the joint supervision of faculty advisers from institution as well as from the industry. The work should demonstrate *higher (than previous semesters)* standards of design, analysis and fabrication capability of the student learnt during the course. The students may work in groups, as deemed fit by the faculty/supervisors.

Any of the following areas may be chosen for pursuing project work (but not limited to):

1. Development of ingenious and innovative products under guidance of supervisor and possibly involving industry,
2. Robotics and its utilization in manufacturing/day-to-day functioning of human life,
3. Computer Integrated Manufacturing,
4. Modernization in Production, and End product delivery,
5. Development of Bio-Mechanics related materials, mechanisms, contraptions, for patients, sports, normal human life functions,
6. Simulation studies of higher order to predict behaviour of materials,
7. Development of software modules for efficient functioning of an organization (MIS, ERP, etc.)
8. Mechanization modules development and application for increase of human comfort,
9. Inter-disciplinary work involving applications of electronics, computers, and other fields for the welfare of mankind,
10. Space Research related module development,
11. Any productive project involving application of engineering fundamentals in collaboration with industry, R&D institutes, institutes of international/national/state importance as deemed fit by the faculty members/concerned supervisor.

ME-808: INDUSTRIAL PROJECT

Teaching and Examination Scheme:

Teaching Scheme			Credits	Marks			Duration of End Semester Examination
L	**T**	**P/D**	**C**	**Sessional**	**End Semester Exam**	**Total**	
0	0	16	8	50	50	100	3 hrs.

Note: Industrial Project of Four months duration is to be carried out by the student in industry under the joint supervision of faculty advisers from institution as well as from the industry

Suggested List of projects:

1. Any productive project involving application of engineering fundamentals to solve problems encountered by human kind, in collaboration with industry, R&D institutes, institutes of international/national/state importance as deemed fit by the faculty members/concerned supervisor.

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