H.P. TECHNICAL UNIVERSITY HAMIRPUR (HP)

Syllabus

[Effective from the Session: 2012-13]

B. Tech. (Automobile Engineering)

B. Tech. (Automobile Engineering)
Group B

1st Semester- Scheme and Distribution of Marks

Course No.	Subject	L	T	P/ D	Hours	Exam Schedule		Practical Schedule		Total
						Ext.	Int.		Int.	
NS-101	Engineering Mathematics – I	3	1	0	4	100	50	--	--	150
NS-102	Engineering Physics-I	3	1	0	4	100	50	--	--	150
HS-101	Disaster Management and Environmental Science	3	1	0	4	100	50	--	--	150
BE-101	Basic Electrical and Electronics Engineering	3	1	0	4	100	50	--	--	150
BE-103	Engineering Drawing and Graphics	1	0	5	6	100	50	--	--	150
BE-105	Engineering Mechanics	3	1	0	4	100	50	--	--	150
(Practicals / Drawing / Design)										
NS-105 (P)	Engineering Physics Lab	0	0	2	2	--	--	25	25	50
BE-101a (P)	Basic Electrical Engineering Lab	0	0	2	2	--	--	25	25	50
BE-101b (P)	Basic Electronics Engineering Lab	0	0	2	2	--	--	25	25	50
WS-101	Workshop Practice-I	0	0	3	3	--	--	25	25	50
Total					**35**	**600**	**300**	**100**	**100**	**1100**

1

2nd Semester- Scheme and Distribution of Marks

Course No.	Subject	L	T	P/D	Hours	Exam Schedule		Practical Schedule		Total
						Ext.	Int.	Ext.	Int.	
NS-104	Engineering Mathematics-II	3	1	0	4	100	50	--	--	150
NS-105	Engineering Physics-II	3	1	0	4	100	50	--	--	150
NS-103	Engineering Chemistry	3	1	0	4	100	50	--	--	150
HS-102	Communication & Professional Skills in English	3	1	0	4	100	50	--	--	150
BE-102	Basic Mechanical Engineering	3	1	0	4	100	50	--	--	150
BE-104	Principles of Computer Programming & C^{++}	3	1	0	4	100	50	--	--	150
(Practicals / Drawing / Design)										
NS-103 (P)	Engineering Chemistry Laboratory	0	0	2	2	--	--	25	25	50
HS-102 (P)	Communication & Professional Skills Lab-I	0	0	2	2	--	--	25	25	50
BE-104 (P)	Computer Programming Laboratory	0	0	2	2	--	--	25	25	50
WS-102	Workshop Practice-II	0	0	3	3	--	--	25	25	50
Total					33	600	300	100	100	1100

3rd Semester – Scheme and Distribution of Marks

Course No.	Subject	L	T	P/ D	Hou rs	Exam Schedule		Practical Schedule		Total
						Ext.	Int.	Ext.	Int.	
HS-201	Engineering Economics	3	0	0	3	100	50	--	--	150
NS-206	Engg. Mathematics-III	3	1	0	4	100	50	--	--	150
ME-211	Strength of Materials -I	4	1	0	5	100	50	--	--	150
ME-212	Applied Thermodynamics	4	1	0	5	100	50	--	--	150
ME-213	Machine Drawing	1	0	4	5	100	50	--	--	150
AU-211	Elements of Automobile Engineering	4	1	0	5	100	50	--	--	150
(Practicals / Drawing / Design)										
ME-211 (P)	Strength of Materials Laboratory	0	0	2	2	--	--	25	25	50
AU-211 (P)	Elements of Automobile Engg. Lab.	0	0	2	2	--	--	25	25	50
ME-213(P)	AutoCAD Lab.	0	0	2	2	--	--	25	25	50
Total					**33**	**600**	**300**	**75**	**75**	**1050**

4th Semester – Scheme and Distribution of Marks

Course No.	Subject	L	T	P/ D	Hou rs	Exam Schedule		Practical Schedule		Total Int.
						Ext.	Int.	Ext.	Ext.	
HS-203	Human Values and Professional Ethics	2	0	2	4	100	50	--	--	150
NS-207	Numerical Methods for Engineers	3	1	0	4	100	50	--	--	150
AU-221	Auto fuel and lubrication	3	1	0	4	100	50	--	--	150
AU-222	Manufacturing process	3	1	0	4	100	50	--	--	150
ME-223	Strength of Materials -II	4	1	0	5	100	50	--	--	150
ME-224	Kinematics of Machines	3	1	0	4	100	50	--	--	150
(Practicals / Drawing / Design)										
HS-222 (P)	Oral and Written Communication Skills Lab-II	0	0	2	2	--	--	25	25	50
AU-221 (P)	Auto fuel and lubrication lab.	0	0	2	2	--	--	25	25	50
ME-224(P)	Kinematics of Machines Laboratory	0	0	2	2	--	--	25	25	50
ECA-201	Extra Curricular Activity	0	0	2	2	--	--	25	25	50
Total					33	600	300	100	100	1100

Field Visit shall be compulsory to all students of 2nd year once in a year during or after 4th semester.

Community Project of minimum four (4) weeks duration shall be conducted **after 4th Semester** for Automobile Engineering students, and to be **evaluated in the 5th Semester**.

5th Semester– Scheme and Distribution of Marks

Course No.	Subject	L	T	P/ D	Hou rs	Exam Schedule		Practical Schedule		Total
						Ext.	Int.	Ext.	Int.	
HS-301	Principles of Management and Critical Thinking	3	0	2	5	100	50	--	--	150
AU-311	Fluid Mechanics & Fluid Machines	3	1	0	4	100	50	--	--	150
AU-312	Automotive Electricals & Electronics	3	1	0	4	100	50	--	--	150
ME-313	Heat Transfer	3	1	0	4	100	50	--	--	150
AU-313	Design of Automobile Component-I	4	1	0	5	100	50	--	--	150
ME-315	Dynamics of Machines	3	1	0	4	100	50	--	--	150
(Practicals / Drawing / Design)										
AU-311 (P)	Fluid Mechanics & Fluid Machines Lab.	0	0	2	2	--	--	25	25	50
AU-312 (P)	Automotive Electricals & Electronics lab	0	0	2	2	--	--	25	25	50
ME-313 (P)	Heat Transfer lab	0	0	2	2	--	--	25	25	50
ME-315(P)	Dynamics of Machines lab.	0	0	2	2	--	--	25	25	50
HS-300	Community Project	0	0	0	0	--	--	25	25	50
Total					**34**	**600**	**300**	**125**	**125**	**1150**

6th Semester – Scheme and Distribution of Marks

Course No.	Subject	L	T	P/D	Hrs.	Exam Schedule		Practical Schedule		Total
						Ext.	Int.	Ext..	Int.	
**-300	*Open Elective*	3	0	0	3	100	50	--	--	150
ME-322	Measurement and Control	3	1	0	4	100	50	--	--	150
AU-322	Automotive Pollution & Control	3	1	0	4	100	50	--	--	150
AU-323	Design of Automobile Component-2	4	1	0	5	100	50	--	--	150
ME-325	I.C. Engines	3	1	0	4	100	50	--	--	150
ME-326	Materials Technology	4	0	0	4	100	50	--	--	150
(Practicals / Drawing / Design)										
ME-322(P)	Measurement and Control Lab.	0	0	2	2	--	--	25	25	50
ME-325(P)	I.C. Engines Lab.	0	0	2	2	--	--	25	25	50
AU-322(P)	Automotive Pollution & Control Lab.	0	0	2	2	--	--	25	25	50
AU-324	Seminar and Group Discussion	0	0	2	2	--	--	--	50	50
	Total				32	600	300	75	125	1100

$$ - Industrial Training of 8 weeks duration after 6th Semester

Open Elective to be opted from list below but one which is not offered by his Department

Sr. No.	Open Elective	Sub. Code
1.	Energy Assessment and Auditing	EE-300
2.	Total Quality Management	ME-300
3.	Optimization methods for Engineering System	NS-300
4.	Remote Sensing & GIS	CE-300
5.	Operating Systems	CS-300

7th Semester – Scheme and Distribution of Marks

Course No.	Subject	L	T	P/D	Hrs.	Exam Schedule		Practical Schedule		Total
						Ext.	Int.	Ext.	Int.	
AU-411*	*Departmental Elective-I*	3	0	0	3	100	50	--	--	150
ME-412	Mechanical Vibrations	3	1	0	4	100	50	--	--	150
AU-412	Vehicle Maintenance	4	0	0	4	100	50	--	--	150
AU-413	Automotive Transmissions	4	1	0	5	100	50	--	--	150
ME-415	Operations Research	4	1	0	5	100	50	--	--	150
(Practicals / Drawing / Design)										
AU-412 (P)	Vehicle Maintenance lab	0	0	2	2	--	--	25	25	50
AU-413 (P)	Automotive Transmission Lab	0	0	2	2	--	--	25	25	50
AU-414	Project-I	0	0	6	6	--	--	100	100	200
AU-415	Industrial Training Viva	0	0	0	0	--	--	50	50	100
Total					31	500	250	200	200	1150

During winter break there shall be a ***field visit*** compulsory to all students of 7th semester, 4th year.

Departmental Elective-I

Sr. No.	Departmental Elective-I	Subject Code
1.	Automotive Chassis & Suspensions	AU-411 (a)
2.	Aerodynamics of Automobile Vehicles	AU-411 (b)
3.	Vehicle Body Engineering	AU-411 (c)
4.	Robotics	AU-411 (d)
5.	Total Quality Control	AU-411 (e)

8th Semester– Scheme and Distribution of Marks

Course No.	Subject	L	T	P/D	Hrs.	Exam Schedule		Practical Schedule		Total
						Ext.	Int.	Ext.	Int.	
AU-421*	*Departmental Elective-II*	3	0	0	3	100	50	--	--	150
ME-422	Computer Aided Design and Manufacturing (CAD/CAM)	4	1	0	5	100	50	--	--	150
AU-422	Transport Management	3	1	0	4	100	50	--	--	150
ME-424	Mechatronics	3	1	0	4	100	50	--	--	150
(Practicals / Drawing / Design)										
ME-422 (P)	Computer Aided Design (CAD) lab.	0	0	2	2	--	--	25	25	50
AU-423	Project-II	0	0	6	6	--	--	150	150	300
AU-424	General Proficiency	0	0	0	0	--	--	100	--	100
Total					**24**	**400**	**200**	**275**	**175**	**1050**

Note: Marking of General Proficiency to be done at the end of 8th semester, through viva-voce covering all the subject areas of Under Graduate Automobile Engineering program.

Departmental Elective-II

Sr. No.	Departmental Elective-II	Subject Code
1.	Emerging Automotive Technologies	AU-421 (a)
2.	Earth Moving Equipments	AU-421 (b)
3.	Alternative Fuels	AU-421 (c)
4.	Advance IC Engines	AU-421 (d)
5.	Advanced Operations Research	AU-421 (e)

Semester-I
ENGINEERING MATHEMATICS-I (NS-101)

Course Code	**NS-101**	L-3, T-1, P-0	
Name of the Course	**Engineering Mathematics-I**		
Lectures to be delivered	**52 (1 Hr Each) (L = 39, T = 13 for each semester)**		
Semester End Examination	**Max. Time: 3 hrs.**	**Max. Marks: 100**	**Min. Pass Marks: 40**
Continuous Assessment (based on sessional tests 50%, Tutorials/Assignments 30%, Quiz/Seminar 10%, Attendance 10%)	**Max. Marks: 50**		

Instructions
1. The question paper will consist of five sections A, B, C, D and E. Section E will be Compulsory, it will consist of a single question with 10-20 subparts of short answer type, which will cover the entire syllabus and will carry 20% of the total marks of the semester end examination for the course. Section A, B, C and D will have two questions from the respective sections of the syllabus and each question will carry 20% of the total marks of the semester end examination for the course.

2. Candidates are required to attempt five questions in all selecting one question from each of the section A, B, C and D of the question paper and all the subparts of the questions in section E. Use of non-programmable calculators are allowed.

Section-A
MATRICES: Matrices, Related matrices, Complex matrices (Hermitian and skew-Hermitian matrices, Unitary matrix), Consistency of linear system of equations, Rank of a matrix, Normal form of a matrix, Vectors, Linear dependence, Consistency of a linear system of equations, System of linear homogeneous equations, Linear and orthogonal transformations, Characteristic equation, Eigen values, Eigen vectors, Properties of Eigen values, Cayley-Hamilton theorem, Quadratic forms and its reduction to canonical form.

Section-B
DIFFERENTIAL CALCULUS: Indeterminate forms, Taylor's and Maclaurin's series, Partial Differentiation and its geometrical interpretation, Homogeneous functions, Euler's theorem and its extension, Total differentials, Composite function, Jacobian, Maxima and minima of functions of two variables, Method of undetermined multipliers.

Section-C
INTEGRAL CALCULUS: Reduction formulas, Quadrature, Rectification, Surface and Volume of revolution for simple curves, Double integrals and their applications, Change of order of integration, Change of variables, Triple integrals and their applications, Change of variable, Beta and Gamma functions and their relationship.

Section-D
COMPLEX NUMBERS: Applications of De Moivre's theorem, Root of a complex number, Exponential, Circular, Hyperbolic and Logarithmic functions of a complex variable, Inverse Hyperbolic functions, Real and imaginary parts of Circular and Hyperbolic functions, Summation of the series-'C+iS' method.

Text Books:

1. Advanced Engineering Mathematics: by Erwin Kreyszig, John Wiley and Sons, NC, New York.
2. Advanced Engineering Mathematics: by R. K. Jain & S. R. K Iyengar, Narosa Pub. House.

Reference Books:

1. Advanced Engineering Mathematics: by C. R. Wylie & L. C. Barrett, McGraw Hill
2. Differential & Integral Calculus: by N. Piskunov, MIR Publications.
3. Calculus and Analytic Geometry, by Thomes, G.B, Finney, R.L. Ninth Edition, Peason Education.
4. Advanced Engineering Mathematics, by Peter. V. O" Nil, Wordsworth Publishing Company.
5. Advanced Engineering Mathematics, by Jain, R.K and Lyengar, S.R.K., Narosa Publishing Company.
6. Higher Engineering Mathematics, by Grewal, B.S., Khanna Publishers, New Delhi.
7. Engineering Mathematics, by Taneja, H.C., Volume-I & Volume-II, I.K. Publisher.

Engineering Physics-I (NS-102)

Course Code	**NS-102**	L-3, T-1, P-0	
Name of the Course	**Engineering Physics – II**		
Lectures to be delivered	**52 (1 Hr Each) (L = 39, T = 13 for each semester)**		
Semester End Examination	**Max. Time: 3 hrs.**	**Max. Marks: 100**	**Min. Pass Marks: 40**
Continuous Assessment (based on sessional tests 50%, Tutorials/Assignments 30%, Quiz/Seminar 10%. Attendance 10%)	**Max. Marks: 50**		

Instructions

1. For Paper Setters: The question paper will consist of five sections A, B, C, D and E. Section E will be Compulsory, it will consist of a single question with 10-20 subparts of short answer type, which will cover the entire syllabus and will carry 20% of the total marks of the semester end examination for the course. Section A, B, C and D will have two questions from the respective sections of the syllabus and each question will carry 20% of the total marks of the semester end examination for the course.

2. For Candidates: Candidates are required to attempt five question in all selecting one question from each of the section A, B, C and D of the question paper and all the subparts of the questions in section E. Use of non-programmable calculators is allowed.

Section - A

Interference-Coherent Sources, Two Beam Interference by Division of Wavefront-Fresnel Biprism Interference by Division of Amplitude **-** Newton's Rings, Michelson Interferometer.

Diffraction-Fraunhoffer Diffraction, Diffraction through Single Slit, Plane Transmission Grating, Fresnel Diffraction, Fresnel Half Period Zone, the Zone Plate.

Polarization- Production of Polarized Light, Malus's Law, Double Refraction, Interference of polarized Light: Quarter Wave Plate and Half Wave Plate.

Section - B

Particle Properties of Waves: Electromagnetic Waves, Maxwell Equations, Blackbody radiations, Photoelectric Effect, Compton Effect, Pair Production,

Waves Properties of Particles: De Broglie waves, Phase velocity, group velocity and Particle velocity. Relation between phase velocity and group velocity. Relation between group velocity and particle velocity. Particle Diffraction, Heisenberg's uncertainty principle and its physical significance (no derivation). Application of uncertainty principle (Non-existence of electron in the nucleus).

Section - C

Quantum Mechanics: Postulates of quantum mechanics, The Wave Equation. Properties and Physical significance of a wave function. Probability density and Normalisation of wave function, Schrodinger's equation: Time-Dependent form, Expectation Values, Operators,

11

Schrodinger's equation: Steady-State form Eigen values and Eigen function, Application of Schrödinger wave equation –Particle in a box, Finite Potential well, Tunnel Effect, Harmonic oscillator.

Section - D

Nuclear Structure: Composition of nucleus, Nuclear Properties, Stable Nuclei, binding energy, Liquid Drop Model, Nuclear Forces.

Nuclear Reactions: Cross-section, Nuclear fission, moderators, nuclear reactors, nuclear fusion in Stars, Fusion Reactors

Elementary Particles: Leptons, Hadrons, Elementary particle quantum numbers, Quarks, Field Bosons,

Cosmology: The Big Bang Theory, Evolution of Stars.

Text Books:

1. A.Ghatak: Optics,Tata Mcgraw Hill, 3rd Edition.
2. Arthur Beiser, Concepts of Modern Physics ,6th Edition, Tata Mcgraw Hill.

Reference Books:

1. David J Griffith, Introduction to Electrodynamics, Pearson Prentice Hall.
2. Halliday, Resnick and Walker- Principles of Physics, Wiley India 9th Edition-2012

DISASTER MANAGEMENT AND ENVIRONMENTAL SCIENCE (HS-101)

Course Code	**HS-101**	L-3, T-1, P-0	
Name of the Course	**Disaster Management and Environmental Science**		
Lectures to be delivered	**52 (1 Hr Each) (L = 39, T = 13 for each semester)**		
Semester End Examination	**Max. Time: 3 hrs.**	**Max. Marks: 100**	**Min. Pass Marks: 40**
Continuous Assessment (based on sessional tests 50%, Tutorials/Assignments 30%, Quiz/Seminar 10%, Attendance 10%)	**Max. Marks: 50**		

Instructions

1. **For Paper Setters:** The question paper will consist of five sections A, B, C, D & E. Section E will be compulsory, it will consist of a single question with 10-20 subparts of short answer type, which will cover the entire syllabus and will carry 20% of the total marks of the semester end examination for the course. Section A, B, C & D will have two questions from the respective sections of the syllabus and each question will carry 20% of the total marks of the semester end examination for the course.

2. **For candidates:** Candidates are required to attempt five questions in all selecting one question from each of the sections A, B, C & D of the question paper and all the subparts of the questions in Section E. Use of non-programmable calculators is allowed.

Section-A

Principles of Disaster Management. Natural Disasters such as Earthquake, Floods, Fire, Landslides, Tornedo, Cyclones, Tsunamis, Nuclear, Chemical, Terrorism, Extra Terrestrial and other natural calamities. Hazards, Risks and Vulnerabilities. Assessment of Disaster Vulnerability of a location and vulnerable groups, National policy on disaster Management,

Section-B

Prevention, Preparedness and Mitigation measures for various Disasters, Post Disaster Relief & Logistics Management, Emergency Support Functions and their coordination mechanism, Resource & Material Management, Management of Relief Camp, Information systems & decision making tools, Voluntary Agencies & Community Participation at various stages of disaster, management, Integration of Rural Development Programmes with disaster reduction and mitigation activities.

Section-C

Renewable and non-renewable resources, 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. Causes, effects and control measures of Air pollution, Water pollution, soil pollution, Noise pollution, Thermal pollution, Nuclear hazards.

Section-D

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 Energy Use:past, present and future, Role of Engineers.

Text Books:

1. Disaster Management By G.K. Ghosh A.P.H. Publishing Corporation
2. Environmental Studies, R Rajgopalan, Oxford University Press

Reference Books:

1. Modern Encyclopaedia of Disaster and Hazard Management By B C Bose Rajat publications.
2. Disaster Management By R.B. Singh Rawat Publications.
3. Disaster Management By B Narayan A.P.H. Publishing Corporation.
4. Environmental Studies, Daniels, Wiley Publication
5. Environmental Studies, Basak, Pearson Publication

Basic Electrical & Electronics Engineering (BE-101)

Course Code	**BE-101**	L-3, T-1, P-0	
Name of the Course	**Basic Electrical & Electronics Engineering**		
Lectures to be delivered	**52 (1 Hr Each) (L = 39, P = 13 for each semester)**		
Semester End Examination	Max. Time = 3 hrs.	Max. Marks: 100	Min. Pass Marks: 40
Continuous Assessment (based on sessional tests (2)50%, Tutorials/Assignments 30%, Quiz/Seminar 10%, Attendance 10%)			**Max. Marks: 50**

Instrucations

1. **For Paper Setters:** The question paper will consist of five sections A, B, C, D & E. Section E will be compulsory, it will consist of a single question with 10-20 subparts of short answer type, which willcover the entire syllabus and will carry 20% of the total marks of the semester end examination for the course. Section A, B, C & D will have two questions from the respective sections of the syllabus andeach question will carry 20% of the total marks of the semester end examination for the course.

2. **For candidates:** Candidates are required to attempt five questions in all selecting one question from each of the sections A, B, C & D of the question paper and all the subparts of the questions in Section E. Use of non-programmable calculators is allowed.

Section-A

DC circuits: Ohm's law, resistance, receptivity, series & parallel connections, star delta transformation, power dissipation in resistance, effect of temperature on resistance. Kirchhoff's laws Mesh laws; Mesh & Nodal analysis.

AC circuits: Generation of alternating voltage &currents, Sinusoidal signals, instantaneous and peak values, R.M.S. &Average value, phase angle, polar and rectangular, exponential and trigonometric representations of RL and C components,

ElectricalInstruments and Devices: Voltmeter, Ammeter, Wattmeter, Energy meter, Inverters. Introduction to Domestic Electric Wiring

Section-B

Series and Parallel Circuits: A.C.Through resistance; inductance & capacitance. R-L; R-C & R-L-C series & parallel circuits, phasor diagrams. Power & power factor, series & parallel resonance. Problems by analytical as well as physical methods.

Three phase circuits: Three phase voltage & current generation, star & delta connections (balanced load), relationship between phase &line currents and voltages, phasor diagrams, measurement of power by two wattmeter methods.

A.C. And D.C. Machines: Principle, construction and working of transformer. Introduction to D.C and A.C. machines.

Section-C

Semiconductor Devices & Circuit: Classification of material; Energy band structure of conductors, insulators & semiconductor; Classification of Semiconductor Mobility and

15

conductivity, Intrinsic and extrinsic semiconductors and charge densities in semiconductors, current components insemiconductors, continuity equation. ; PN junction Characteristics& Analysis ;diode rating; Types of diodes – Zener diodes, Photodiodes, Light emitting diodes (LED's), Varactor diodes and tunnel diodes. Rectifiers and filter circuit: Half wave, full wave and Bridge rectifier circuits and their analysis, L, C and Pi filters, Basic regulator supply using zener diode.

Transistors: Construction and characteristics of bipolar junction, transistors (BJT's)-Comm. Base, Comm. emitter, Comm. Collector configuration.

Section-D

Field Effect Transistor: Construction and characteristics of JFET.MOSFET construction and characteristics.

Integrated Circuits: Classification of ICs; Monolithic ICs; OP Amp: Characterstics of Ideal OPAmp& application

Electronic Instruments: Role and importance of general purpose test Instruments, Electronic Millimeter, Cathode Ray Oscilloscope, Measurement of amplitude, Frequency and phase using CRO.

Text Books:-

1. Basic Electrical & Electronics Engineering – V Jegathesan , K Vinoth Kumar & R Saravanakumar
2. Basic Electrical & Electronics Engineering - B.L.Thereja

Reference Books:

1. Electronics devices and circuit theory by Robert Boylestad.
2. Electronics Devices and circuits by Millman&Halkias, TMH.
3. Basic Electronics by Debashis De, Pearson Education, 2010.
4. Electronics devices and circuit by Bhargava and Kulshtreshta, TTTI Series

ENGINEERING DRAWING AND GRAPHICS   (BE-103)

Course Code	**BE-103**	L-1, T-0, P-5
Name of the Course	**Engineering Drawing and Graphics**	
Lectures to be delivered	**78 (1 Hr Each) (L = 13, P = 65 for each semester)**	
Semester End Examination	**Max. Time = 3 hrs.**	**Max.Marks: 100 Min. Pass Marks: 40**
Continuous Assessment (based on sessional tests (2)50%, Tutorials/Assignments 30%, Quiz/Seminar 10%, Attendance 10%)		**Max. Marks: 50**

Instructions

1. **For Institutes:** There will be two sessions per week. 1st session will consist of one lecture and two hours of practice session. 2nd session will consist of three hours of practice session.

2. **For Paper Setters:** The question paper will consist of five sections A, B, C, D & E. Section E will be compulsory, it will consist of a single question with 10-20 subparts of short answer type, which will cover the entire syllabus and will carry 20% of the total marks of the semester end examination for the course. Section A, B, C & D will have two questions from the respective sections of the syllabus and each question will carry 20% of the total marks of the semester end examination for the course.

3. **For candidates:** Candidates are required to attempt five questions in all selecting one question from each of the sections A, B, C & D of the question paper and all the subparts of the questions in Section E. Use of non-programmable calculators is allowed.

Section-A
Drawing Techniques and Scales: Various type of lines, principal of dimensioning, size and location as per IS code of practice (SP-46) for general Engg. Drawing. Practice of drawing, various types of lines and dimensioning exercises. Drawing exercises pertaining to symbols.Conventions and Exercise of lettering techniques.Free hand printing of letters and numerals in 3, 5, 8 and 12 mm sizes, vertical and inclined at 75 degree.Instrumental lettering in single stroke.Linear scale, Diagonal scale &vernier scale.

Points, Lines and Planes: Projection of Points, Lines and Planes: Concept of horizontal and vertical planes. First and third angle projections: projections of point and lines, true length of lines and their horizontal and vertical traces, projection of planes and their traces. Auxiliary planes.

Section-B
Projections of Solids: Right regular solids of revolution and polyhedrons etc. and their auxiliary views.

Sectioning of Solids: Principal of sanctioning, types of sanctioning and their practice on projection of solids, sectioning by auxiliary planes.

Section-C
Development of Surfaces: Development of surfaces of cylinders, cones, pyramid, prism etc. exercises involving development of unique surfaces like Y-piece, hopper, tray, truncated pieces etc.

Intersection of Surfaces: Intersection of cylinders, cones and prisms with their axes being vertical, horizontal or inclines. Exercise on intersection of solids-cylinder and cylinder, cylinder and cone, prism and prism.

Section-D

Isometric Projection: Concept of isometric views: isometric scale and exercise on isometric views. Practice of Orthographic projections.

Simple Trusses: Graphical Method.

Text Books:

1.   Engineering Drawing &Engg. Graphics byP. S. Gill, Kataria and Sons Millennium Edition.
2.   Engineering Drawing Plane and Solid Geometry byN.D. Bhatt and V. M. Panchal, 44th Edition, 2002, Charotar Publishing House.

Reference Books:

1.   Engineering Drawingby Dhananjay A. Jolhe, Tata McGraw Hill.

ENGINEERING MECHANICS (BE-105)

Course Code	BE – 105	L-3, T-1, P-0	
Name of the Course	**Engineering Mechanics**		
Lectures to be delivered	**52 (1 Hr Each) (L = 39, T = 13, P=0 for each semester)**		
Semester End Examination	**Max. Time = 3 hrs.**	**Max. Marks: 100**	**Min. Pass Marks: 40**
Continuous Assessment (based on sessional tests (2) 50%, Tutorials/Assignments 30%, Quiz/Seminar 10%, Attendance 10%)			**Max. Marks: 50**

Insturctions

1. **For Paper Setters:** The question paper will consist of five sections A, B, C, D & E. Section E will be compulsory, it will consist of a single question with 10-20 subparts of short answer type, which will cover the entire syllabus and will carry 20% of the total marks of the semester end examination for the course. Section A, B, C & D will have two questions from the respective sections of the syllabus, and each question will carry 20% of the total marks of the semester end examination for the course.

2. **For candidates:** Candidates are required to attempt five questions in all selecting one question from each of the sections A, B, C & D of the question paper and all the subparts of the questions in Section E. Use of non-programmable calculators is allowed.

Section-A

Force, Moment, Center of gravity & Moment of Inertia: Idealization of Mechanics, Concept of Rigid Body and Elastic Body, Laws of Mechanics, Forces & System of Forces, Composition, Resolution & resultant of Forces, Laws of Forces, Lami's Theorem, Moment & Couples, Varignon's Theorem, Free Body Diagram, Centre of Gravity of a Lamina, Centroids of various Geometric Shapes, Moment of Inertia, Radius of Gyration, Parallel and Perpendicular Axis Theorem.

Frames and Trusses: Introduction, Perfect Frame, Redundant Frame, Reactions of Supports, Plane Trusses, Space Trusses, Method of Joints, Method of Section, Graphical Method- Maxwell Diagram.

Section-B

Simple Stresses and Strains: Stress & strain; Types of stresses and strains Elastic limit; Hooks law; Stress – strain diagram for ductile and brittle material, Factor of safety; Poisson's ratio; Elastic constants; Young's modulus, Shear modulus & Bulk modulus. Relationship between elastic constants. Thermal Stress & Strain.

Shear Force and Bending Moment: Introduction, concept of shear force and bending moment, Sign conventions, Types of load – concentrated, uniformly distributed, uniformly varying, Types of beams: Cantilever beam, simply supported beam, overhanging beam; Shear force and bending moment diagrams for the above beams subjected to different loadings and couples. Point of contra flexure, Relationship between load, Shear force and bending moment.

Section-C

Bending Stresses in Beams: Bending Stresses in Beams with derivation of Bending equation and its application to beams of circular, rectangular I & T Section, Composite beams.

Shearing Stresses in Beams: Shearing stress at a section in a loaded beam, Shear stress distribution over different sections.

Section-D

Torsion of Circular Shaft: Pure Torsion, Theory of Pure torsion, Derivation of Torsion equation for a circular shaft subject to torsion, assumptions, Maximum torque transmitted by a Solid shaft and hollow shaft derivations, Polar modulus, torsion rigidity, Comparison of hollow and solid shaft, Power transmitted by a shaft, Close coiled helical spring subjected to axial load and torque.

Introduction to Friction: Definition, Principles of friction, Friction between solid bodies, Coefficient of friction, Kinetic friction force, Definition & Determination of angle of friction, Laws of friction , Procedure for friction analysis, Equilibrium of rigid bodies subjected to frictional force of resistance, Friction at the ends of ladder, Wedge friction, Remedial measures in overcoming friction.

Text Books:

1.   Engineering Mechanics: Nelson, McGraw Hill
2.   Engineering Mechanics: Statics, Meriam, JohnWiley

Reference Books:

1.   Mechanics of Materials-E.J. Hearn, Elsevier
2.   Engineering Mechanics-Bhavikatti, New Age International
3.   Engineering Mechanics- JagatBabu, Pearson

Engineering Physics Lab (NS-105(P))

Course Code	NS-105(P)		L-0, T-0, P-2	
Name of the Course	Engineering Physics Lab			
Lectures to be Delivered	26 hours of Lab. work (2 hrs. per week)			
Semester End Examination	Max Marks: 25	Min Pass Marks: 10	Maximum Time: 3 hrs	
Continuous Assessment	Lab work 30%, Lab Record 25% Viva/ Hands on 25%, Attendance 20%			Max Marks: 25

Instructions for paper setter / candidates

Laboratory examination will consist of two parts: Performing a practical exercises assigned by the examiner. Viva-voce examination

Viva-voce examination will be related to the practicals performed / project executed by the candidate related to the paper during the course of the semester.

List of Experiments

1. To find the refractive index of a prism by using spectrometer.
2. To find the wavelength of sodium light by Newton's rings experiment.
3. To find the wavelength of sodium light by Michelson interferometer.
4. To study the laser beam characteristics like, wavelength using diffraction grating aperture & divergence.
5. To study the variation of magnetic field with distance and to find the radius of coil by Stewart and Gee's apparatus.
6. To find the value of e/m for electrons by helical method.
7. To compare the capacitances of two capacitors by De'sauty Bridge.
8. To find the value of Planck's constant by using a photoelectric cell.
9. To calculate the hysteresis loss by tracing a B-H curve for a given sample
10. To determine the Hall co-efficient
11. To determine the band gap of an intrinsic semiconductor by four probe method.
12. To find the velocity of ultrasound in liquid.
13. To find out polarizability of a dielectric substance.
14. To determine the numerical Aperture of an optical fibre.
15. To determine the attenuation & propagation losses in optical fibres.

Note: Each student is required to perform at least ten experiments. Books:

1. Practical Physics-S.L.Gupta&V.Kumar.
2. Advanced Practical Physics Vol. I & II – S.P. Singh

BASIC ELECTRICAL ENGINEERING LAB (BE– 101a (P))

Course Code	**BE– 101a(P)**		L-0, T-0, P-2
Name of the Course	**Basic Electrical Engineering Lab**		
Lectures to be Delivered	**26 hours of Lab. work (2 hrs. per week)**		
Semester End Examination	**Max Marks: 25**	**Min Pass Marks: 10**	**Maximum Time: 3 hrs**
Continuous Assessment	**Lab work30%, Lab Record 25% Viva/ Hands on 25%, Attendance 20%**		**Max Marks: 25**

Instructions for Paper setter/ Candidates

Laboratory examination will consist of two parts:
1. Performing a practical examination assigned by the examiner
2. Viva-voce examination
Viva-voce examination will be related to the practical's performed/projects executed by the candidate related to the paper during the course of the semester.

LIST OF EXPERIMENTS

1. To verify KCL and KVL.
2. To study various types of Electrical Meters.
3. To perform open circuit and short circuit test of Transformer.
4. Measurement of power by Three Voltmeter/Three Ammeter method.
5. Measurement of power in 3-phase system by two wattmeter method.
6. To perform direct load test of transformer and plot efficiency v/s load characteristics.
7. To perform direct load test of the DC shunt generator and plot load v/s current curve.
8. To study frequency response of series RLC circuit and determine resonance frequency and Q factor for various values of R, L, C.
9. To study frequency response of parallel RLC circuit and determine resonance frequency and Q factor for various values of R, L, C.

Note: All the practicals of Electrical should also be performed on breadboard.

BASIC ELECTRONICS ENGINEERING LAB (BE– 101b (P)

Course Code	**BE– 101b(P)**	**L-0, T-0, P-2**	
Name of the Course	**Basic Electronics Engineering Lab.**		
Lectures to be Delivered	**26 hours of Lab. work (2 hrs. per week)**		
Semester End Examination	**Max Marks: 25**	**Min Pass Marks: 10**	**Maximum Time: 3 hrs**
Continuous Assessment	**Lab work 30%, Lab Record 25% Viva/ Hands on 25% Attendance 20%**		**Max Marks: 25**

Instructions for Paper setter/ Candidates

Laboratory examination will consist of two parts:
1. Performing a practical examination assigned by the examiner
2. Viva-voce examination
Viva-voce examination will be related to the practicals performed/projects executed by the candidate related to the paper during the course of the semester.

LIST OF EXPERIMENTS

1. Familiarization with electronic components, and general purpose Laboratory equipment.
2. Use of CRO and function generator and calculation of amplitude, frequency, time period of different types of ac signals.
3. Verification of Junction Diode and Zener Diode characteristic and determination of static and dynamic resistance at the operating point
4. Verification of input and output characteristics of a Bipolar Junction Transistor and determination of the operating point on load line.
5. Verification of input and output characteristics of a Field Effect Transistor and determination of the operating point on load line.
6. Verification of Series and Parallel Resonance theory.
7. Operation of diode as different form of rectifier and effect of different types of passive filters on the output.
8. Determination of frequency response of a RC coupled amplifier and determination of bandwidth and signal handling capacity.
9. Use of OP-AMP as an inverting and non-inverting amplifier for different gains.
10. Verification of Uni-junction Transistor characteristics and relaxation oscillator
11. Rectifiers- Half wave, Full wave & Bridge rectifiers

Note: All the practical should be performed on breadboard.

WORKSHOP PRACTICE-I (WS-101)

Course Code	WS– 101	L-0, T-0, P-3	
Name of the Course	**Workshop Practice –I**		
Lectures to be delivered	**39 hours of Lab sessions in each semester**		
Semester End Examination	**Max. Marks: 25**		**Min. Pass Marks: 10**
Continuous Assessment	**Lab work 30%, Lab record 25%, Viva 25%, Attendance 20%**		**Max. Marks: 25**

INSTRUCTIONS:

Laboratory examination will consist of two parts:

(i)   Performing a practical exercises assigned by the examiner.

(ii)   (ii) Viva-voce examination

Viva-voce examination will be related to the practicals performed / project executed by the candidate related to the paper during the course of the semester.

List of Experiments: - Fitting Shop: -

Introduction to the tools used in Fitting Shop and various processes in Fitting shop.

1. To make a square piece of mild steel.

2. To make V-matching joint of mild steel.

3. To make a V-notch.

Machine Shop: -

Introduction to various machine tools and machine parts, such as Lathes, drilling achine, grinders etc.Cutting tools and operations.

1. Facing and turning on mild steel rod on Lathe Machine.

2. To make a groove on lathe machine.

3. Taper turning operation on Lathe Machine.

Carpentry and Pattern making Shop: -

Carpentry and Pattern Making Various types of timber and practice boards, defects in imber, seasoning of wood, tools, operations and joints. Introduction to the tools used in carpentry shop.

1. To make the 'T' lap joint.

2. To make 'T' Dove-tail joint.

3. To make Mortise &Tennon joint.

Welding Shop: -

Introduction to different welding methods, welding equipment, electrodes, welding joints, awareness of welding defects.

1. To make a lap joint.

2. To make a T joint.

3. To make a V-butt joint.

Smithy and Forging: -

Introduction to forging tools, equipments, and operations, Forgability of metals.

1. To make a ring of mild steel by cold forging process.

2. To make S-hook by hot forging process.

3. To make chisel by hot forging process.

Foundry Shop: -
Introduction to moulding materials, moulds, use of cores, melting furnaces, tools and equipment used in Foundry.
1. Make a single piece pattern mould.
2. To make spilt pattern mould.
3. To make mould and core and assemble it.

Electrical and Electronics Shop: -
Demonstration of tools, Introduction to electric wiring, Exercises preparation of PCBs, involving soldering of electrical & electronic application.
1. Fault rectification, disassembly and assembly of (any two) electrical appliances viz. electric iron, electric mixer, ceiling and table fan, tube light, blower and water heater.
2. Demonstration and use of flowing electronic instruments: multimeter, voltmeter, ammeter, energy meter, CRO.

Books:

1. Workshop Technology by Chapman.
2. Manufacturing Processes by Begman.
3. Manufacturing Materials and processes by JS Campbell.

Engineering Mathematics-II (NS-104)

Course Code	**NS-104**	L-3, T-1, P-0	
Name of the Course	**Engineering Mathematics – II**		
Lectures to be delivered	**52 (1 Hr Each) (L = 39, T = 13 for each semester)**		
Semester End Examination	**Max. Time: 3 hrs.**	**Max. Marks: 100**	**Min. Pass Marks:40**
Continuous Assessment (based on sessional tests 50%, Tutorials/Assignments 30%, Quiz/Seminar 10%, Attendance 10%)	**Max. Marks: 50**		

Instructions
1. The question paper will consist of five sections A, B, C, D and E. Section E will be Compulsory, it will consist of a single question with 10-20 subparts of short answer type, which will cover the entire syllabus and will carry 20% of the total marks of the semester end examination for the course. Section A, B, C and D will have two questions from the respective sections of the syllabus and each question will carry 20% of the total marks of the semester end examination for the course.

2. Candidates are required to attempt five questions in all selecting one question from each of the section A, B, C and D of the question paper and all the subparts of the questions in section E. Use of non-programmable calculators are allowed.

Section-A
INFINITE SERIES: Convergence and divergence of infinite series, Geometric series test, Positive term series, p-series test, [Comparison test, D'Alembert's ratio test, Cauchy's root test (Radical test), Integral test, Raabe's test, Logarithmic test, Gauss's test (without proofs), Alternating series and Leibnitz's rule, Power series, Radius and interval of convergence, absolute convergence and Conditional convergence.

Section-B
FOURIER SERIES: Euler's formula, Conditions for a Fourier expansion, Dirichlet's conditions, Functions having points of discontinuity, Change of interval, Odd and even periodic functions, Expansion of odd and even periodic functions, Half-range series, Typical wave-forms, Parseval's formula.

Section-C
LINEAR DIFFERENTIAL EQUATIONS: Brief review of first order ordinary differential equations, Exact equations, Equations reducible to exact equations, Equations of the first order and higher degree, Clairaut's equation, Linear differential equations with constant co-efficients, Complimentary functions and particular integral, Method of variation of parameters, Equations reducible to linear equations with constant co-efficients (Cauchy's and Legendre's linear equations).

Section-D
VECTOR CALCULUS: Curves in space, curvature and torsion, Scalar and vector point functions, Differentiation of vectors, Vector operator Del, gradient, divergence and curl with their physical interpretations, Formulae involving gradient, divergence and curl, Line, surface and volume integrals, Green's Theorems, Stokes and Gauss Theorems and their verifications and applications. Scalar potential, solenoidal and irrotational fields.

Text Books:

1. Advanced Engineering Mathematics by Erwin Kreyszig, John Wiley and Sons, N.C., New York.
2. Advanced Engineering Mathematics by R. K. Jain & S. R. K Iyengar, Narosa Publishing House.

Reference Books:

1. Advanced Engineering Mathematics: by C. R. Wylie & L. C. Barrett, McGraw Hill
2. Higher Engineering Mathematics byB S Grewal,Khanna Publishers, New Delhi.
3. Differential & Integral Calculus: by N. Piskunov, MIR Publications.
4. Calculus and Analytic Geometry by Thomes, G.B, Finney, R.L. Ninth Edition, Pearson Education.
5. Advanced Engineering Mathematics byPeter. V. ONil, Wordsworth Publishing Company.
6. Vector Calculus by C. E. Weatherburn. John Wiley and Sons, NC, New York.
7. Differential Equations by Shepley L. Ross, John Wiley & Sons, New York.

Engineering Physics– II (NS – 105)

Course Code	**NS-105**	L-3, T-1, P-0	
Name of the Course	**Engineering Physics – II**		
Lectures to be delivered	**52 (1 Hr Each) (L = 39, T = 13 for each semester)**		
Semester End Examination	**Max. Time: 3 hrs.**	**Max. Marks: 100**	**Min. Pass Marks:40**
Continuous Assessment (based on sessional tests 50%, Tutorials/Assignments 30%, Quiz/Seminar 10%, Attendance 10%)	**Max. Marks: 50**		

Instructions

1.**For Paper Setters:** The question paper will consist of five sections A, B, C, D & E. Section E will be compulsory, it will consist of a single question with 10-20 subparts of short answer type, which will cover the entire syllabus and will carry 20% of the total marks of the semester end examination for the course. Section A, B, C & D will have two questions from the respective sections of the syllabus and each question will carry 20% of the total marks of the semester end examination for the course.

2.**For candidates:** Candidates are required to attempt five questions in all selecting one question from each of the sections A, B, C & D of the question paper and all the subparts of the questions in Section E. Use of non-programmable calculators is allowed.

SECTION – A

Crystal Structure: Space lattice, Bravais lattice - unit cell, primitive cell. Lattice parameters. Crystal systems. Direction and planes in a crystal.Miller indices. Expression for inter-planar spacing.Co- ordination number. Atomic packing factor. Bragg's Law.Determination of crystal structure by Bragg's x-ray spectrometer. Crystal structures of NaCl, and diamond.

Free electron theory: Elements of classical free electron theory and its limitations. Quantum theory of free electrons, Fermi level, density of states, fermidirac distribution function, Thermionic emission, Richardson's equation.

SECTION – B

(10 Lectures) & (Text Book-1)
Band Theory of Solids: Origin of energy bands, Periodic Potential in a crystal, Wave function in a periodic potential, kronig, Penney Model (qualitative), E-K diagrams, Brillouin Zones, Effective mass of electron, Concept of negative effective mass and holes, Classification into metals, semiconductors and insulators, fermi energy and its variation with temperature.

SECTION – C

(9 Lectures) & (Text Book-1)
Dielectric and Magnetic Properties of Materials: Dielectric polarization, dielectric constant, types of polarization, electric field, electric displacement and dielectric polarization vector & relation between them, Gauss;s law in the presence of dielectric, Behavior of dielectric in alternating field- simple concepts, Atomic Magnetic Moments, Classification of magnetic materials, Dia, para, and ferromagnetic materials, domains, B-H graph in ferromagnetic materials Anti-ferromagnetism &ferrimagnetisms, . Soft and Hard magnetic materials. Ferrite and their applications.

Superconductivity: Temperature dependence of resistivity in superconducting materials. Effect of magnetic field (Meissner effect). Type I and Type II superconductors. BCS theory (qualitative), High temperature superconductors, Applications of superconductivity.

SECTION – D

(12 Lectures) & (Text Book-1)
Lasers: Spontaneous and stimulated emission, Einstein's Coefficients, Characteristics of Laser beam, Population inversion, Pumping Techniques, Components of a laser system, Ruby Laser and He-Ne Lasers

Fiber Optics: Basics of fiber optics, Total Internal Reflection, Acceptance angle, Numerical aperture, Single mode & Multimode fibres, Step index and Graded index fiber, pulse Dispersion in optical fibres, Attenuation in Optical Fibres, applications of optical fibres.
(8 Lectures) & (Text Book-2)

Text Books:

1. Rajnikant: Applied Solid State Physics, Wiley India Pvt. Ltd.

2. A.Ghatak: Optics,Tata Mcgraw Hill, 3rd edition.

Reference Books:

1. Charles Kittel: Introduction to Solid State Physics, John Wiley & sons Inc.
2. S.O.Kasap, Principle of Electronic materials and Devices.

ENGINEERING CHEMISTRY (NS – 103)

Course Code	**NS-103**	L-3, T-1, P-0	
Name of the Course	**Engineering Chemistry**		
Lectures to be delivered	**52 (1 Hr Each) (L = 39, T = 13 for each semester)**		
Semester End Examination	**Max. Time: 3 hrs.**	**Max. Marks: 100**	**Min. Pass Marks:40**
Continuous Assessment (based on sessional tests 50%, Tutorials/Assignments 30%, Quiz/Seminar 10%, Attendance 10%)	**Max. Marks: 50**		

Instructions

1. **For Paper Setters:** The question paper will consist of five sections A, B, C, D & E. Section E will be compulsory, it will consist of a single question with 10-20 subparts of short answer type, which will cover the entire syllabus and will carry 20% of the total marks of the semester end examination for the course. Section A, B, C & D will have two questions from the respective sections of the syllabus and each question will carry 20% of the total marks of the semester end examination for the course.

2. **For candidates:** Candidates are required to attempt five questions in all selecting one question from each of the sections A, B, C & D of the question paper and all the subparts of the questions in Section E.

SECTION –A

Electrochemistry: Electrical Conductance, Types of Electrolyte, Specific Conductance, Equivalent Conductance, Molar Conductance, Ionic Conductance (Kohlrausch Law), Factors Affecting Conductance, Transport Number, Interionic Attraction Theory of Conductance, Hydration of ions, Electrochemical Cell ,Electrode Potential, Standard Electrode Potential, Galvanic Cells, EMF of the Cell & Free Energy Change, Nernst Equation, Reference Electrodes (S.H.E,Calomel Electrode, Silver- Silver Electrode, Single, Eletrochemical Series, Glass Electrode, Concentration Cell, types & applications of Concentration Cell, Batteries(primary cell, Secondary storage cell, Metal- Air Batteries), Fuel cell, hydrogen-oxygen fuel cell.

Phase Rule: Introduction, One Component System (water system, sulpher system) Two components System (lead-silver & Zinc- magnesium system), thermal Analysis,

(**13 Lect**)

SECTION – B

Water Treatment: Introduction, Sources of water, Impurities, Hardness Analysis, Oxidations, (BOD & COD), Boiler Corrosion Sewage & Treatment.

Corrosion and its Controls: Introduction, Types of corrosions, Electrochemical Theory, Pitting, Water Line, Differential Aerations corrosions, Stress Corrosions, Factors affecting Corrosions, Preventive measures.

(**10Lect**)

Instrumental Methods of Analysis

SECTION – C

Introduction to spectroscopy; UV-Visible spectroscopy- Absorption laws ,Instrumentation, formation of absorption bands, Theory of electronic spectroscopy, Chromophore and auxochrome concept, fluorescence & phosphorescence, application of UV-Visible

spectroscopy; IR spectroscopy- Principle, theory of molecular vibrations, important features of IR spectroscopy and applications; NMR-Principle, relaxation processes, Instrumentation, shielding-desheilding effects, spin coupling, coupling constant, applications of NMR;

Fuel and Combustion: Introduction, class of fuels (Solid, Liquid and Gases) Coal and its origin, Analysis of Coals, Petroleum fuels, Cracking, Octane no, Cetane no, Gaseseous fuel, Water Gas, producer gas.

(9 Lect)

SECTION – D

Polymers Classification of polymers, types of polymerizations, plastics, some important commercial thermoplastics (polythene, polypropylene, polystyrene, polyvinylchloride, Teflon, plexiglass, polyurethanes), thermosetting (Bakelite, epoxy resin, Urea formaldehyde) Elastomers, synthetic rubbers, fiber.

Composite Materials

Introduction, Classification, constituents of composites, Fiber reinforced composites, unidirectional fibre reinforced composites, short fibre reinforced composites, particle reinforced composites, important and failures of fiber reinforced compostes, advantages and composties.

(10 Lect.)

Text Book:

1. Engineering Chemistry by Dr Ramesh Thakur and Dr.Subba Ramesh, Wiley India publisher
2. A Text Book of Engineering Chemistry by ShashiChawla, DhanpatRai& Sons.

Reference Books:
1. Engineering Chemistry by P C Jain & Monika Jain
2. Fundamental of organic spectroscopy by Y. R. Sharma
3. Spectroscopic methods by Williams and Fleming

Communication & Professional Skills in English (HS-102)

Course Code	**HS-102**	L-3, T-1, P-0	
Name of the Course	**Communication & Professional Skills in English**		
Lectures to be delivered	**52 (1 Hr Each) (L = 39, T = 13 for each semester)**		
Semester End Examination	**Max. Time: 3 hrs.**	**Max. Marks: 100**	**Min. Pass Marks: 40**
Continuous Assessment (based on sessional tests 50%, Tutorials/Assignments 30%, Quiz/Seminar 10%, Attendance 10%)	**Max. Marks: 50**		

Instructions

1.   For Paper Setters: The question paper will consist of five sections A, B, C, D and E. Section E will be Compulsory, it will consist of a single question with 10-20 subparts of short answer type, which will cover the entire syllabus and will carry 20% of the total marks of the semester end examination for the course. Section A, B, C and D will have two questions from the respective sections of the syllabus and each question will carry 20% of the total marks of the semester end examination for the course.

2.   For Candidates: Candidates are required to attempt five question in all selecting one question from each of the section A, B, C and D of the question paper and all the subparts of the questions in section E.

Section A

Essentials of communication:
The process of communication: communication competence, types and channels of communication, Importance of listening skills in communication: types of listening, barriers to listening, Barriers to communication and removal of these barriers, personal SWOT Analysis, Analyzing audience, role of emotions and body language in communication, non-verbal communication.

Section B

Written communication:
Enriching vocabulary, using vocabulary in different context, Essentials of strong writing skills, language and style of writing, characteristics of a good technical style, logical reasoning, Paragraph writing, Developing perspective: goals, objectives and principles of critical thinking.

Section C

Reading Comprehension:
Importance of reading: Eye movement, fixations, regression, visual wandering, right approach to reading, SQ3R method of reading, Precis writing, Comprehension, Essay writing.

Section D

Technical Communication:
Report writing: Importance, structure, drafting of reports, Business Writing: Sales letters, claim and adjustment letters, inviting/sending quotations, Tenders, Memorandum, Job Application letter, Preparing a personal resume, notices, agenda and minutes of meeting.

Text Books:
1. An Introduction to Professional English and Soft Skills: by Bikram K. Das, Kalyani Samantray, Cambridge Press.
2. Business correspondence and Report Writing: by R. C. Sharma & Krishna Mohan

Reference Books:

1. Communication Skills, Sanjay Kumar and PushpLata, Oxford University Press.
2. Chrissie Wright (Ed.); Handbook of Practical Communication Skills; JAICO Books
3. Effective Communication and soft Skills, Nitin Bhatnagar and Mamta Bhatnagar, Pearson Publication.
4. Communicative English for Engineers and professionals, Nitin Bhatnagar and Mamta Bhatnagar, Pearson Publication.
5. Communication Skills and soft skills- An integrated approach, Kumar, Pearson Publication
6. Communication Skills for Engineers, Mishra, Pearson Publication
7. K.K.Sinha, Business Communication, Galgotia Publishing Company, New Delhi,   1999.
8. R.K.Bansal& J.B. Harrison, spoken English for India, Orient Longman.

Recommended Readings:
1. Business @ The Speed of thought, Bill Gates.
2. My Experiments with Truth, M.K.Ghandhi
3. Wings of Fire, A.P.J. Kalam
4. An Autobiography, JwaharLal Nehru.

BASIC MECHANICAL ENGINEERING (BE-102)

Course Code	**BE-102**	L-3, T-1, P-0	
Name of the Course	**Basic Mechanical Engineering**		
Lectures to be delivered	**52 (1 Hr Each) (L = 39, T = 13 for each semester)**		
Semester End Examination	Max. Time = 3 hrs.	**Max. Marks: 100**	**Min. Pass Marks: 40**
Continuous Assessment (based on sessional tests (2) 50%, Tutorials/Assignments 30%, Quiz/Seminar 10%, Attendance 10%)			**Max. Marks: 50**

INSTRUCTIONS

1. **For Paper Setters:** The question paper will consist of five sections A, B, C, D & E. Section E will be compulsory, it will consist of a single question with 10-20 subparts of short answer type, which will cover the entire syllabus and will carry 20% of the total marks of the semester end examination for the course. Section A, B, C & D will have two questions from the respective sections of the syllabus, and each question will carry 20% of the total marks of the semester end examination for the course.

Note: The paper setter will be required to mention a note in the question paper that use of steam table, graphical plots are permitted.

2. **For candidates:** Candidates are required to attempt five questions in all selecting one question from each of the sections A, B, C & D of the question paper and all the subparts of the questions in Section E. Use of non-programmable calculators is allowed.

Section-A
Basic concept: Dimensions and units, thermodynamic systems, thermodynamic properties and process, thermodynamic equilibrium, energy-kinetic, potential and internal, heat and work, zeroth law, concept of temperature, definition of ideal gas, laws and properties of ideal gas.
First law of Thermodynamics: First law for control mass (closed system), internal energy as a property, enthalpy, specific heats, non-flow processes of ideal gases, cyclic process, first law for control volume (open system), applications of steady flow energy equation to engineering devices.

Section-B
Second law of Thermodynamics: Limitations of first law of thermodynamics, Kelvin-Planck and Clausius statements, their equivalence, application of statements of second law to heat engine, heat pump and refrigerator, reversible processes, reversible cycles, and carnot cycle, corollaries of the second law, thermodynamics temperature scale, Clausius inequality, entropy, principle of increase of entropy, availability and irreversibility.
Properties of Steam: Phase transformation, phase diagram, condition of steam- saturated steam, dry- saturated steam, wet steam, superheated steam, dryness fraction, property of steam, steam tables, use of Mollier charts , process of vapors and various process.

Section-C
Gas Power Cycles: Carnot, Diesel, Otto, Dual combustion, working of 2-stroke and 4-stroke engine, Air standard thermal efficiency, Concepts of mean effective pressure, indicated power and brake powerfor reciprocating engines.

Section-D

Introduction of Psychometry: The Gibbs Dalton law, Psychometric terms, Introduction of Psychometry Chart.

Introduction to Heat Transfer: Mechanisms – Conduction, Convection and Radiation, Introduction to Fourier's Law of heat conduction, Newton's law of cooling, Stefan-Boltzma

Introduction to Fluid Mechanics: Fluid, properties of fluid, viscosity, Newton's law of viscosity, surface tension, types of fluid, buoyancy.

TEXT BOOKS:

1.   Basic Mechanical Engineering by Basant Aggarwal and CM Aggarwal Wiley India.
2.   Fundamentals of Mechanical Sciences: Engineering Thermodynamics and Fluid Mechanics by Mukherjee and Paul, PHI Learning.

REFERENCE BOOKS:

1.   Thermodynamics – An Engineering Approach (SI Units) – Yunus. A. Cengel, Michael A. Boles, TMH New Delhi
2.   Fundamentals of Thermodynamics –Sonntag, Borgnakke Van Wylen – Wiley India.
3.   Engineering Thermodynamics by P.K. Nag, TMH, New Delhi
4.   Thermodynamics by C.P. Arora, TMH, New Delhi

Principle of Computer Programming & C++ (BE-104)

Course Code	**BE-104**	L-3, T-1, P-0	
Name of the Course	**Principle of Computer Programming & C++**		
Lectures to be delivered	**52 (1 Hr Each) (L = 39, T = 13 for each semester)**		
Semester End Examination	Max. Time = 3 hrs.	**Max. Marks: 100**	**Min. Pass Marks: 40**
Continuous Assessment (based on sessional tests (2)50%, Tutorials/Assignments 30%, Quiz/Seminar 10%, Attendance 10%)		**Max. Marks: 50**	

INSTRUCTIONS

1. **For Paper Setters:** The question paper will consist of five sections A, B, C, D & E. Section E will be compulsory, it will consist of a single question with 10-20 subparts of short answer type, which will cover the entire syllabus and will carry 20% of the total marks of the semester end examination for the course. Section A, B, C & D will have two questions from the respective sections of the syllabus, and each question will carry 20% of the total marks of the semester end examination for the course.

2. **For candidates:** Candidates are required to attempt five questions in all selecting one question from each of the sections A, B, C & D of the question paper and all the subparts of the questions in Section E. Use of non-programmable calculators is allowed.

SECTION-A

Introduction to Computer:-Definition, Characteristics, Generation of Computers, Capabilities and Limitations. Introduction to Operating System. Basic Components of a Computer System-Control Unit, ALU, Input/output functions and characteristics. Memory Introduction, Classifications- Volatile Memory and Non- Volatile, Memory, ROM, RAM.

Input, Output and storage Units:-Computer Keyboard, Pointing Devices: Mouse, Trackball, Touch Panel, and Joystick, Light Pen, Scanners, Various types of Monitors.

Hard Copy Devices: - Impact and Non- Impact Printers- Daisy Wheel, Dot Matrix, Line Printer, Chain Printer. Non Impact Printers- DeskJet, Laser Printer, Virus: General introduction of virus and anti-virus.

SECTION-B

High Level Language and Low Level Language, Software and its different types- System Software,
Application software. Compiler, Interpreter and Assembler. Introduction to algorithm and Flow chart:- Representation of an algorithm, flowchart symbols and flow chart, rules, advantage and limitations of flowchart and pseudo code. Testing and Debugging:-Definition of testing and debugging , types of program errors.

DOS : Internal and External Commands , Difference between External and Internal Commands.

SECTION-C

Introduction to C++ : Starting with C++, Features of C++ Procedure-oriented programming OOP vs. procedure-oriented programming Compiling, linking and running a C++ program.

Object-Oriented Programming Concepts: Abstraction , Inheritance, Polymorphism, Data Binding , Encapsulation., Classes and Objects Concept of a class ,Defining a class, Creating an object , Object Scope.

The Basics of C++: Basic Data Types, User-defined Data Types, Variable Declarations, Variable Names Constants and its types, Character Constants , String Constants, Standard input and standard output Formatted input–cin and Formatted output– cout.

Working with Operators and Expressions: Operators, Arithmetic Operators, Relational Operators, Assignment Operator, Logical Operators, Increment and Decrement Operators (++ and --), 'Operate- Assign' Operators (+=, =, ...).

Controlling the Program Flow
SECTION-D
Decision control: if, if – else, if - else if. Loop Control: while, do – while, for, break, continue Case Control switch, goto.

Functions/Procedures: function, Returning values from functions, Arguments Passed by Value Passing Addresses of Arguments, Concept of variable scope and scope rules, Global variables **Pointers and Arrays:** Pointers, Pointer Initialization, Pointer Operators, The & (and) Operator Understanding Arrays, Initializing Arrays.

Files: reading, writing text and binary files, pointers, character pointers, pointers to arrays, arrays of pointer to structures.

Text Books:
1. Introduction to Computer by Rajaraman, V., PHI Publication
2. Object oriented programming in C^{++} by Rajesh K. Shukla, Wiley India.

Reference Books:
1. The C++ programming language, BjarneStroustrup, Addison Wesley, 2000.
2. Basic Computer Engineering, Kogent learning solution Inc. Dreamtech Press.
3. Object oriented programming Principles and Fundamental, Gim Keogh and MarioGiannini, John Wiley.
4. Object oriented programming in turbo C^{++} ,RobbetLofre, 4 Ed Pearson Publication.
5. Programming with C^{++}, D. Ravichandern, TataMcgraw Hill 1996.
6. Object oriented programming in C++, Nicolai M Josuetis, John Wiley.

Engineering Chemistry Lab (NS-103(P))

Course Code	**NS-103(P)**	**L-0, T-0, P-2**	
Name of the Course	**Engineering Chemistry Lab**		
Lectures to be Delivered	**26 hours of Lab. work (2 hrs. per week)**		
Semester End Examination	**Max Marks: 25**	**Min Pass Marks: 10**	**Maximum Time: 3 hrs**
Continuous Assessment	Lab work 30% Lab Record 25% Viva/ Hands on 25% Attendance 20%	**Max Marks: 25**	

Instructions for paper setter / candidates

Laboratory examination will consist of two parts: Performing a practical exercises assigned by the examiner. Viva-voce examination Viva-voce examination will be related to the practicals performed / project executed by the candidate related to the paper during the course of the semester.

NOTE: At least 10 to 12 experiments to be performed. List of Experiments

1. To determine the surface tension of the given liquid by drop number method by using stalgmometer and identify the given liquid.

2. To determine the insoluble, soluble and total solids in given sample of sewage.

3. To determine the solid carbon, volatile matter, ash content and percentage of moisture in given sample of coal by proximate analysis method and classify the coal.

4. To determine the total alkalinity in a given sample of water using a standard acid. Ask for what you want

5. To determine the percentage of Chlorine in a given sample of $CaOCl_2$ which has been dissolved in one litre of solution.

6. To determine the surface tension of the two given unknown liquids by using Stalgmometer and identify the given liquid.

7. To determine the coefficient of viscosity of the given unknown liquids by using Ostwald's Viscometer and identify the given liquid.

8. To determine the coefficient of viscosity of the given lubricating oil using Red Wood Viscometer

9. To determine the coefficient of viscosity of the given lubricating oil using Seybolt Viscometer.

10. To determine the flash point and fire point of given sample of oil using Pens key Marten's apparatus.

11. To determine the amount of Chlorine in given sample of water approximate N/20 sodium Thiosulphate solution. Ask for your requirement

12. To determine the maximum wavelength of solution of cobalt chloride

13. To determine the Beer's Law and apply it to find the concentration of given unknown solution by spectra-photometer.

14. To determine the chemical oxygen demand of waste water.

15. To determine the half-life period of given radioactive sample using GM counter.

Communication & Professional Skills Lab-I (HS-102(P))

Course Code	HS-102 (P)	L-0, T-0, P-2	
Lectures to be Delivered	26 hours of Lab. work (2 hrs. per week)		
Semester End Examination	Max Marks: 25	Min Pass Marks: 10	Maximum Time: 3 hrs
Continuous Assessment	Lab work 30% Lab Record 25% Viva/ Hands on 25% Attendance20%		Max Marks: 25

Instructions for paper setter / candidates:
Laboratory examination will consist of two parts:
(i)Performing a practical exercises assigned by the examiner.
(ii)Viva-voce examination

Note: Each practical should be performed twice for effectiveness.

List of Practicals:

1. Word processing a document.
2. Power point presentations.
3. Resume / Biodata preparation.
4. Report writing.
5. Preparing notice, agenda and minutes of meeting.
6. Preparation of Quotation and tender document.
7. Note making based reading comprehension.
8. Précis Writing.

Recommended books:

1. English Conversation Practice by Grant Taylor.
2. Business correspondence and Report Writing: by R. C. Sharma & Krishna Mohan.
3. Chrissie Wright (Ed.); Handbook of Practical Communication Skills; JAICO Books.
4. Veena Kumar, The Sounds of English, Makaav Educational Software, New Delhi.

Computer Programming Laboratory (BE-104(P))

Course Code	BE-104 (P)		L-0, T-0, P-2
Name of the Course	**Computer Programming Laboratory**		
Lectures to be Delivered	**26 Hrs. of Lab work (2hrs. each per week)**		
Semester End Examination	**Max Marks: 25**	**Min Pass Marks: 10**	**Maximum Time: 3 hrs**
Continuous Assessment	**Lab work 30% Lab Record 25%, Viva 25% Attendance 20%**		**Max Marks: 25**

1.   Write a Program to find the sum, difference, product and quotient of two integers.
2.   Write a program C++ Program to output an integer, a floating point number and a character.
3.   Write a program to switch between different cases.
4.   Write a program to count the number of words and characters in a sentence.
5.   Program to find the roots of a quadratic equation.
6.
- Create a class rational which represent a numerical value by two double values numerator and
- Denominator include the following public members functions
- Constructor with no argument (default) Constructor with two agruments
- Void reduce () that reduce the rational number by eliminating the highest common factor between the numerator and the denominator
- Overload+ operator to add two rational
- Numbers Overload>> operator to enable
- Input through cin. Overload<< operator to
- enable input through cout.
7.   Write a program to convert days into years and weeks.
8.   Write a program to convert temperatures from Celsius to Fahrenheit and vice versa.
9.   Write a program to find the sum of either of the diagonals of a 4 x 4 matrix.
10.   Write a program to enter a sentence and output the number of uppercase & lowercase consonants, uppercase & lowercase vowels in sentence.
11.   Write a program to enter 10 integers in a single-dimension array and then print out the array in ascending order.
12.   Write a program to find the sum of each row & column of a matrix of size n x m and if matrix is square, find the sum of the diagonals also.
13.   Write a program to display fibonacci series upto n terms.
14.   Write a program for payroll system using inheritance.
15.   To calculate the total mark of a student using the concept of virtual base class.
16.   Program for Write File Operation Using C++ Programming.
17.   Write a program that creates a binary file by reading the data for the student for the terminal.The data of each student consist of roll number, name (a string of thirty or lesser number of characters) and marks.
18.   Write a program to read a number and display its square, square root, cube and cube root. Use a virtual function to display any one of the above.
19.   Write a program to read two matrix and find their product use operator overloading so that the statement for multiplying the matrix may be written as Z=x*y where x,y,z are matrices.

WORKSHOP PRACTICE-II (WS-101)

Course Code	WS– 101	L-0, T-0, P-3	
Name of the Course	Workshop Practice -II		
Lectures to be delivered	39 hours of Lab sessions in each semester		
Semester End Examination	Max. Marks: 25		Min. Pass Marks: 10
Continuous Assessment	Lab work 30%, Lab record 25%, Viva 25%, Attendance 20%	Max. Marks: 25	

INSTRUCTIONS:

Laboratory examination will consist of two parts:

(i)   Performing a practical exercises assigned by the examiner.

(ii)   Viva-voce examination

Viva-voce examination will be related to the practicals performed/project

executed by the candidate related to the paper during the course of the semester.

List of Experiments: - Fitting Shop: -

1. Drilling and Tapping in a M.S. piece.

2. To make a male-female joint (Taper type) of mild steel.

Machine Shop: -

1. To perform boring operation on lathe machine.

2. To perform knurling and threading operation on lathe machine.

3. Step turning operation on a lathe machine.

Carpentry and Pattern making Shop: -

1. To make a single piece pattern of connecting rod.

2. To make a self-cod pattern.

3. To make a split pattern.

Welding Shop: -

1. To make a V butt joint in horizontal position.

2. To make a V butt joint in vertical position.

3. To perform Gas welding operation.

Smithy and Forging: -

1. To make a cube from a circular bar.

2. To make a tong using hot forging operations.

3. To perform drawing down operation.

Foundry Shop: -

1. To make a mould and perform casting operation.

2. Study of casting defects and its remedies.

Sheet Metal Working Shop: -

Blanking and piercing die construction, press work materials, strip layout,

bending dies, forming dies, drawing operations, single and double action draw dies.

1. To make a Ring by Piercing.

2. To make a square shaped object by Bending and Forming Operation.

3. To Draw a Wire.

Books:

1. Workshop Technology by Chapman

2. Manufacturing Processes by Begman

3. Manufacturing Materials and Processes by J.S. Campbell

SEMESTER-III
ENGINEERING ECONOMICS   HS-201

Course Code	**HS-201**	L-3, T-0, P-0	
Name of the Course	**Engineering Economics**		
Lectures to be delivered	**39 (1 Hr Each) (L = 39, for each semester)**		
Semester End Examination Max. Time = 3 hrs.		**Max. Marks: 100**	**Min. Pass Marks: 40**
Continuous Assessment (based on sessional tests (2) 50%, Tutorials/Assignments 30%, Quiz/Seminar 10%, Attendance 10%)	**Max. Marks: 50**		

INSTRUCTIONS:

1.   **For Paper Setters:** The question paper will consist of five sections A, B, C, D & E. Section A, B, C & D will have two questions from the respective sections of the syllabus and each section will carry 20% of the total marks of the semester end examination for the course. Section E will be compulsory, it will consist of a single question with 10-20 subparts of short answer type, which will cover the entire syllabus and each question will carry 20% of the total marks of the semester end examination for the course.

2.   **For candidates:** Candidates are required to attempt five questions in all selecting one question from each of the sections A, B, C & D of the question paper and all the subparts of the questions in Section E. Use of non-programmable calculators is allowed.

Section-A

Economics: Definition, nature and scope of economics, need &significance of economics in Engineering, Economic Systems- Meaning of capitalism, socialism and mixed economy

Demand: Meaning, determinants of demand, demand curve, law of demand, exception to the law of demand, increase &decrease in demand, contraction &extension of demand, Elasticity of demand, Methods of measuring Elasticity of demand

Supply: Law of supply, extension &contraction of supply, increase & decrease in Supply, Elasticity of supply

Section-B

Cost of Production: Concept, types, Relation between average & marginal cost.

Theory of Production: Laws of returns- Law of variable proportions and law of returns to Scale, Break Even Analysis.

Price & Output Determination: Price determination under perfect competition, monopoly, monopolistic competition &oligopoly.

Section-C

Monetary policy- Meaning, objectives, methods, Fiscal policy- Meaning &Objectives of fiscal policy In a developing country like India, Functions of Reserve Bank of India and commercial banks.

Economics & Business Environment- Business/Trade Cycles- Meaning, Characteristics & classification, Inflation Effect, Foreign capital &economic development, Engineering Economics Analysis, Economics Analysis in the public and regulated sectors.

Section D

Indian Economy: - Characteristics of Indian economy, Planning in India, Development &Growth in India. Overall Economic policy since independence, Input & output analysis, Problem of unemployment in India. Concept of sustainable development &inclusive growth in India. Policy of globalizations, liberisation & privatization. Analysis of state &union budgets.

TEXT BOOKS:
1. Modern Micro Economics by Koutsoyannisa, MC Millen
2. Principles of Engineering Economics Analysis by John A. White, Kenneth E. Case and David B. Pratt Wiley India

REFERENCE BOOKS:
1. Business Economics by K. P. M. Sundharam, Sultan Chand &Sons
2. Elementary Economics Theory by K.K Dewett & J. D. Verma, S.Chand Publication

SEMESTER – III
ENGINEERING MATHEMATICS-III (NS-206)

Course Code	**NS-206**	L-3, T-1, P-0	
Name of the Course	**Engineering Mathematics**		
Lectures to be delivered	**52 (1 Hr Each) (L = 39, T = 13 for each semester)**		
Semester End Examination	**Max. Time = 3 hrs.**	**Max. Marks: 100**	**Min. Pass Marks: 40**
Continuous Assessment (based on sessional tests (2) 50%, Tutorials/Assignments 30%, Quiz/Seminar 10%, Attendance 10%)	**Max. Marks: 50**		

INSTRUCTIONS:

1.**For Paper Setters:** The question paper will consist of five sections A, B, C, D & E. Section A, B, C & D will have two questions from the respective sections of the syllabus and each section will carry 20% of the total marks of the semester end examination for the course. Section E will be compulsory, it will consist of a single question with 10-20 subparts of short answer type, which will cover the entire syllabus and each question will carry 20% of the total marks of the semester end examination for the course.

2.**For candidates:** Candidates are required to attempt five questions in all selecting one question from each of the sections A, B, C & D of the question paper and all the subparts of the questions in Section E. Use of non-programmable calculators is allowed.

Section-A
1. PARTIAL DIFFERENTIAL EQUATIONS

Formation and solutions of partial differential equations, Lagrange's linear equation of the first order, non linear equations of first order, charpit method, Homogenous linear partial differential equation with constant coefficients, rules for complementary function and particular integral, non-homogenous linear partial differential equations, Method of separation of variables, Solution of wave equations, Heat flow equations, Laplace's equations and their applications to engineering problems.

Section-B
2. SPECIAL FUNCTIONS:

Power series solution of differential equations, Frobenius method, Bessel's equation, Bessel functions of the first and second kind, Recurrence relations of Bessel functions, Generating functions, Orthogonality of Bessel functions, Legendre's equation, Legendre polynomial, Recurrence relations of Legendre's functions, Rodrigue's formula, Orthogonality of Legendre polynomials, Error function and its properties.

Section-C
3. INTEGRAL TRANSFORMS

Laplace Transforms of standard functions and their properties, Inverse Laplace Transforms, General Properties of inverse Laplace transforms and Convolution Theorem, Laplace Transforms of periodic functions, Laplace transform of Bessel functions and Error function, Dirac-delta Function, Heaviside's Unit Function, Applications to linear simultaneous differential equations. Fourier Integral, Fourier Transform, Fourier sine and cosine transforms, finite Fourier transform, Convolution theorem for Fourier Transform and Parseval's Identity for Fourier Transform.

Section-D

4. FUNCTIONS OF COMPLEX VARIABLE
Limit and derivative of complex functions, Cauchy-Riemann equations, Analytic functions, Entire functions and its applications, Conformal mapping and standard transformations, Complex integration, Cauchy's theorem and Cauchy's integral formula (without proof), Series of complex terms, Taylor's series and Laurent's series (without proof), Zeros of analytic functions, isolated singularity, removable singularity, Poles, essential singularity, Residue, Residue theorem and their applications

TEXT BOOKS
1. Advanced Engineering Mathematics: by Erwin Kreyszig . John Wiley and Sons, NC, New York.
2. Partial Differential Equation for Engineers and Scientists: by J.N. Sharma and Kehar Singh Narosa Publishing House, New Delhi/ Alpha Science Int. Ltd, UK.
3. Advanced Engineering Mathematics: by R. K. Jain & S. R. K Iyengar, Narosa Pub. House.
4. Complex Variables Theory and Applications: by HS Kasana, PHI Learning Private Limited New Delhi, (2008).

REFERENCE BOOKS
1. Advanced Engineering Mathematics: by C. R. Wylie & L. C. Barrett, McGraw Hill.
2. Elements of Partial Differential Equations: by Ian N. Sneddon, McGraw-Hill, Singapore.
3. Differential & Integral Calculus: by N. Piskunov, MIR Publications.
4. Calculus and Analytic Geometry, by Thomes, G.B, Finney, R.L. Ninth Edition, Peason Education.
5. Advanced Engineering Mathematics,by Peter. V. O. Nil, Wordsworth Publishing Company.
6. Advanced Engineering Mathematics, by Jain, R.K and Lyengar, S.R.K., Narosa Publishing Company.
7. Higher Engineering Mathematics, by Grewal, B.S., Khanna Publishers, New Delhi.
8. Engineering Mathematics, by Taneja, H.C., Volume-I & Volume-II, I.K. Publisher.
9. Differential Equations: by Shepley L. Ross, John Wiley & Sons, New York.

STRENGTH OF MATERIALS-I   ME-211

Course Code	**ME-211**	L-4, T-1, P-0	
Name of the Course	**Strength of Materials-I**		
Lectures to be delivered	**65 (1 Hr Each) (L = 52, T = 13 for each semester)**		
Semester End Examination	**Max. Time = 3 hrs.**	**Max. Marks: 100**	**Min. Pass Marks:40**
Continuous Assessment (based on sessional tests (2) 50%, Tutorials/Assignments 30%, Quiz/Seminar 10%, Attendance 10%)	**Max. Marks: 50**		

INSTRUCTIONS:

1.**For Paper Setters:** The question paper will consist of five sections A, B, C, D & E. Section A, B, C & D will have two questions from the respective sections of the syllabus and each section will carry 20% of the total marks of the semester end examination for the course. Section E will be compulsory, it will consist of a single question with 10-20 subparts of short answer type, which will cover the entire syllabus and each question will carry 20% of the total marks of the semester end examination for the course.

2.**For candidates:** Candidates are required to attempt five questions in all selecting one question from each of the sections A, B, C & D of the question paper and all the subparts of the questions in Section E. Use of non-programmable calculators is allowed.

SYLLABUS:
Section-A
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.

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.

Section-B
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 & Maxwell's theorems, Numerical problems.

Section-C
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.

Columns & Struts: Columns under axial load, concept of instability and buckling, slenderness ratio. Derivation of Euler's formulae for the elastic buckling load. Euler's, Rankine   Gordon's formulae ‚Johnson's empirical formula for axial loading of

columns and their applications, eccentric compression of a short strut of rectangular & circular sections, Numerical problems.

Section-D

Slope & Deflection: Relationship between bending moment, slope & deflection, Mohr's theorem, moment area method, method of integration, Macaulay's method. Calculations for slope &deflection of (1) cantilevers and (2) simply supported beams with or without overhang, under concentrated loads, uniformly distributed loads or combination of concentrated and uniformly distributed loads. Numerical problems.

Fixed Beams: Deflections, reactions and fixing moments. Calculations of deflection and S.F. & B.M. diagrams for fixed beams under (1) concentrated loads, (2) uniformly Distributed loads and (3) a combination of concentrated loads and uniformly distributed load.

Text Books:
1.   Mechanics of Materials-E.J. Hearn, Elsevier Publications.
2.   Mechanics of Materials-R.C.Hibbeler, Pearson India (9th Edition).

Reference Books:
1.   Strengths of Materials-Popov , PHI, New Delhi.
2.   Strength of Materials-G.H. Ryder- Third Edition in S.I. units 1969 Macmillan India.
3.   Strengths of Materials-Sadhu Singh, Khanna Publications.
4.   Strengths of Materials – R.K. Rajput, S.Chand & Sons.
5.   Fundamentals of Strength of Materials – Nag & Chanda, Wiley India.
6.   Mechanics of Materials- Dr. Kirpal Singh, Standard Publishers Distributors, New Delhi.

SEMESTER – III
APPLIED THERMODYNAMICS   ME - 212

Course Code	ME - 212	L-4, T-1, P-0	
Name of the Course	**Applied Thermodynamics**		
Lectures to be delivered	**65 (1 Hr Each) (L = 52, T = 13 for each semester)**		
Semester End Examination	**Max. Time=3 hrs.**	**Max. Marks: 100**	**Min. Pass Marks:40**
Continuous Assessment (based on sessional tests (2) 50%, Tutorials/Assignments 30%, Quiz/Seminar 10%, Attendance 10%)	**Max. Marks: 50**		

INSTRUCTIONS:

1.**For Paper Setters:** The question paper will consist of five sections A, B, C, D & E. Section A, B, C & D will have two questions from the respective sections of the syllabus and each section will carry 20% of the total marks of the semester end examination for the course. Section E will be compulsory, it will consist of a single question with 10-20 subparts of short answer type, which will cover the entire syllabus and each question will carry 20% of the total marks of the semester end examination for the course.

Note: The Paper setter will be required to mention a note in the question paper that the use of steam table, charts, graphical plots are permitted.

2.**For candidates:** Candidates are required to attempt five questions in all selecting one question from each of the sections A, B, C & D of the question paper and all the subparts of the questions in Section E. Use of non-programmable calculators is allowed.

SYLLABUS: **Section-A**

Steam Boiler: 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. Natural draft from chimney, height of chimney, maximum draft and chimney efficiency, forced draft and induced draft, Boiler Heat Balance Sheet.

Section-B

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.

Section-C

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, efficiency and blade height, 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.

Section-D

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.

Thermodynamic (pvt) Relations of Working Fluids: Equation of state for ideal gas, Behaviour of real gases and compressibility factor, Generalized, empirical and theoretical equations of state for real gases. Helmoltz and Gibbs functions, Maxwell's relations, Enthalpy, entropy, internal energy, and specific heat relations, Clausius- Clapeyron's equation. Joule Thompson coefficient.

Text Books:
1.   R. Yadav, "Thermodynamics and Heat Engines, Vol-II", Central Publishing House.
2.   R.S.Khurmi, "A textbook of Thermal Engineering, S.Chand & Sons.

Reference Books:
1. Bellany, P.L., "Thermal Engineering", Khanna Publishers.
2. T.D. Eastop & A McConkey, "Applied Thermodynamics for Engineering Technologists", Pearson Education.
3. V.P. Vasandani & D.S. Kumar, "Heat Engineering", Metropolitan Book Co. Pvt. Ltd.
4. Cengel, Y.A., & Boles, M.A.., "Thermodynamics – An Engineering Approach", McGraw – Hill Inc.
5. Rajput, R.K., "Thermal Engineering", Laxmi Publications.

SEMESTER – III
MACHINE –DRAWING   (ME-213)

Course Code	ME – 213	L-1, T-0, P-4	
Name of the Course	**Machine –Drawing**		
Lectures to be delivered	**65 (1 Hr Each, L = 13, T = 0, P=52 for each semester)**		
Semester End Examination	**Max. Time = 4 hrs.**	**Max. Marks: 100**	**Min. Pass Marks: 40**
Continuous Assessment (based on sessional tests (2) 50%, Tutorials/Assignments 30%, Quiz/Seminar 10%, Attendance 10%)	**Max. Marks: 50**		

INSTRUCTIONS:
1. In the semester examination, the examiner will set two questions from each section. The students have to attempt three questions taking one from each section.

2. The questions from Section-A and Section-B will carry 20 Marks each. Questions from Section-C will carry 60 Marks.

SYLLABUS:

Section-A
Introduction to BIS Specification sp: 46- 1988 Code of engineering drawing – Limits. Fits and Tolerance (dimensional and Geometrical tolerance), Surface finish representation. Gear: Gear terminology. I.S convention of assembly of spur gears, helical gear, bevel gears, worm and worm wheel.

Section-B
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.

Section-C
Assembly drawing 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.

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: Laxmi Narayana and Pub: M/S Jain Brother. New Delhi.
2.   Machine Drawing: N Sidheshwar, P Kannaieh, V V S Sastry, Pub: Tata McGraw Hill.

SEMESTER – III
ELEMENTS OF AUTOMOBILE ENGINEERING (AU – 211)

Course Code	**AU - 211**	L-4, T-1, P-0	
Name of the Course	**Elements of Automobile Engineering**		
Lectures to be delivered	**52 (1 Hr Each) (L = 52, for each semester)**		
Semester End Examination	**Max. Time: 3 hrs.**	**Max. Marks: 100**	**Min. Pass Marks:40**
Continuous Assessment (based on sessional tests 50%, Tutorials/Assignments 30%, Quiz/Seminar 10%, Attendance 10%)			**Max. Marks: 50**

INSTRUCTIONS:
1. For Paper Setters: The question paper will consist of five sections A, B, C, D & E. Section A, B, C & D will have two questions from the respective sections of the syllabus and each section will carry 20% of the total marks of the semester end examination for the course. Section E will be compulsory, it will consist of a single question with 10-20 subparts of short answer type, which will cover the entire syllabus and each question will carry 20% of the total marks of the semester end examination for the course.
2. For candidates: Candidates are required to attempt five questions in all selecting one question from each of the sections A, B, C & D of the question paper and all the subparts of the questions in Section E. Use of non-programmable calculators is allowed.

SYLLABUS:

Section-A

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.

Section-B

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.

Section-C

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.

Section-D

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.

Text Books:
1.   Automobile Engineering (Vol. 1 & Vol. 2) by Dr. Kirpal Singh, Standard Publishers Distributors.
2.   Automobile Engineering by Anil Chhikara, Satya Prakashan, New Delhi.

Reference Books:
1.   Automotive Mechanics – Crouse & Anglin, Tata McGraw Hill.
2.   Automotive Technology – H.M.Sethi, Tata McGraw Hill.
3.   Automotive Mechanics – S.Srinivasan, Tata McGraw Hill.
4.   Automotive Mechanics – Joseph Heitner, EWP.
5.   Motor Automotive Technology by Anthony E. Schwaller – Delmer Publishers. Inc.
6.   The Motor Vehicle – Newton steeds Garrett, Butterw

SEMESTER – III
STRENGTH OF MATERIALS – LAB   ME – 211 (P)

Course Code	ME – 211 (P)	L-0, T-0, P-2	
Name of the Course	**Strength of Materials Lab.**		
Lectures to be delivered	**26 hours of Lab sessions (2 Hrs per week)**		
Semester End Examination	**Max. Marks: 25**	**Min. Pass Marks: 10**	**Maximum Time: 3 Hrs**
Continuous Assessment	**Lab work 30%, Lab record 25%, Viva 25%, Attendance 20%**		**Max. Marks: 25**

INSTRUCTIONS FOR PAPER SETTER/CANDIDATES:

Laboratory examination will consist of two parts:
i)   Performing a practical examination assigned by the examiner.
ii)   Viva-voce examination.

Viva-voce examination will be related to the practicals performed/projects executed by the candidate related to the paper during the course of the semester.

LIST OF EXPERIMENTS:

1.   To study the Brinell hardness testing machine & perform Brinell hardness test

2.   To study the Rockwell hardness testing machine & perform the Rockwell hardness test.

3.   To study the Vickers hardness testing machine & perform Vickers hardness test

4.   To study Erichsen sheet metal testing machine & perform the Erichsen sheet metal test

5.   To study the Impact machine and perform the Impact tests (Izod & Charpy)

6.   To study the Universal testing machine and perform the tensile test.

7.   To perform compression test on UTM.

8.   To perform bending test on UTM.

9.   To perform the shear test on UTM.

10.   To study the torsion testing machine and perform the torsion test.

SEMESTER – III
ELEMENTS OF AUTOMOBILE ENGINEERING LAB   AU-211 (P)

Course Code	**AU-211 (P)** L-0, T-0, P-2		
Name of the Course	**Elements of Automobile Engineering Lab**		
Lectures to be delivered	**26 hours of Lab sessions (2 Hrs per week)**		
Semester End Examination	**Max. Marks: 25**	**Min. Pass Marks: 10**	**Maximum Time: 3 Hrs**
Continuous Assessment	**LLab work 30%, Lab record 25%, Viva 25%, Attendance 20%**	**Max. Marks: 25**	

INSTRUCTIONS FOR PAPER SETTER/CANDIDATES:

Laboratory examination will consist of two parts:

i)   Performing a practical examination assigned by the examiner.

ii)   Viva-voce examination.

Viva-voce examination will be related to the practical's performed/projects executed by the candidate related to the paper during the course of the semester.

LIST OF PRACTICALS/EXPERIMENTS:

1.   To study and prepare report on the constructional details, working principle and operation of the following

(a)   Single plate clutch. (b)   Multi plate clutch.

2.   To study and prepare report on the constructional details, working principles and operation of the following

(a)   Constant mesh Gear Box. (b) Synchromesh Gear Box.

3.   To study and prepare report on the constructional details, working principles and operation of the following

(a)   Rear Wheel Drive Line. (b) Front Wheel Drive Line. (c) Differentials

4.   To study and prepare report on the constructional details, working principles and operation of the following

(a)   Starting System. (b)   Ignition System.

5.   To study and prepare report on the constructional details, working principles and operation of the Charging System.

6.   To study and prepare report on the constructional details, working principles and operation of the following

(a)   Front Suspension System. (b) Rear Suspension System.

7.   To study and prepare report on the constructional details, working principles and operation of Rack and Pinion Power steering system.

8.   Adjusting of brake shoes and bleeding the hydraulic brake system.

SEMESTER – III
AutoCAD LABORATORY   ME – 213 (P)

Course Code	ME – 213 (P)	L-0, T-0, P-2	
Name of the Course	AutoCAD Lab.		
Lectures to be delivered	26 hours of Lab sessions (2 Hrs per week)		
Semester End Examination	Max. Marks: 25	Min. Pass Marks: 10	Maximum Time: 3 Hrs
Continuous Assessment	Lab work 30%, Lab record 25%, Viva 25%, Attendance 20%	Max. Marks: 25	

INSTRUCTIONS FOR PAPER SETTER/CANDIDATES:

Laboratory examination will consist of two parts:
i)   Performing a practical examination assigned by the examiner.
ii)   Viva-voce examination.
Viva-voce examination will be related to the practical's performed/projects executed by the candidate related to the paper during the course of 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
HUMAN VALUES AND PROFESSIONAL ETHICS   HS-203

Course Code	**HS-203**	L-2, T-0, P-2	
Name of the Course	**Human Values and Professional Ethics**		
Lectures to be delivered	**52 (1 Hr Each) (L = 39, T = 13 for each semester)**		
Semester End Examination	**Max. Time = 3 hrs.**	**Max. Marks: 100**	**Min. Pass Marks: 40**
Continuous Assessment (based on sessional tests 2) 50%, Tutorials/Assignments 30%, Quiz/Seminar 10%, Attendance 10%)	**Max. Marks: 50**		

INSTRUCTIONS:

1. For Paper Setters: The question paper will consist of five sections A, B, C, D & E. Section A, B, C & D will have two questions from the respective sections of the syllabus and each section will carry 20% of the total marks of the semester end examination for the course. Section E will be compulsory, it will consist of a single question with 10-20 subparts of short answer type, which will cover the entire syllabus and each question will carry 20% of the total marks of the semester end examination for the course.

2. For candidates: Candidates are required to attempt five questions in all selecting one question from each of the sections A, B, C & D of the question paper and all the subparts of the questions in Section E. Use of non-programmable calculators is allowed.

SYLLABUS:

OBJECTIVES:

a. To help the students appreciate the essential complementarily between 'VALUES' and 'SKILLS' to ensure sustained happiness and prosperity which are the core aspirations of all human beings.

b. To facilitate the development of a Holistic perspective among students towards life, profession and happiness, based on a correct understanding of the Human reality and the rest of Existence. Such a holistic perspective forms the basis of Value based living in a natural way.

c. To highlight plausible implications of such a Holistic understanding in terms of ethical human conduct, trustful and mutually satisfying human behavior and mutually enriching interaction with Nature.

Thus, this course is intended to provide a much needed orientation input in Value Education to the young enquiring minds.

COURSE METHODOLOGY:

• The methodology of this course is universally adaptable, involving a systematic and rational study of the human being vis-à-vis the rest of existence.

• It is free from any dogma or value prescriptions.

• It is a process of self-investigation and self-exploration, and not of giving sermons.

• Whatever is found as truth or reality is stated as proposal and the students are facilitated to verify it in their own right based on their Natural Acceptance and Experiential Validation.

- This process of self-exploration takes the form of a dialogue between the teacher and the students to begin with, and within the student himself/herself finally.
- This self-exploration also enables them to evaluate their pre-conditionings and present beliefs.

Content
SECTION A

Course Introduction - Need, Basic Guidelines, Content and Process for Value Education

1. Understanding the need, basic guidelines, content and process for Value Education
2. Self Exploration–what is it?-its content and process; 'Natural Acceptance' and Experiential Validation- as the mechanism for self exploration
3. Continuous Happiness and Prosperity- A look at basic Human Aspirations
4. Right understanding, Relationship and Physical Facilities- the basic requirements for fulfillment of aspirations of every human being with their correct priority
5. Understanding Happiness and Prosperity correctly- A critical appraisal of the current scenario
6. Method to fulfill the above human aspirations: understanding and living in **harmony** at various levels

SECTION B

Understanding Harmony in the Human Being - Harmony in Myself!

7. Understanding human being as a co-existence of the sentient 'I' and the material 'Body'
8. Understanding the needs of Self ('I') and 'Body' - *Sukh* and *Suvidha*
9. Understanding the Body as an instrument of 'I' (I being the doer, seer and enjoyer)
10. Understanding the characteristics and activities of 'I' and harmony in 'I'
11. Understanding the harmony of I with the Body: *Sanyam* and *Swasthya*; correct appraisal of Physical needs, meaning of Prosperity in detail
12. Programs to ensure *Sanyam* and *Swasthya*
   - Practice Exercises and Case Studies will be taken up in Practice Sessions.

SECTION C

Understanding Harmony in the Family and Society- Harmony in Human- Human Relationship

13. Understanding harmony in the Family- the basic unit of human interaction
14. Understanding values in human-human relationship; meaning of *Nyaya* and program for its fulfillment to ensure *Ubhay-tripti*; Trust (*Vishwas)* and Respect (*Samman)* as the foundational values of relationship
15. Understanding the meaning of *Vishwas*; Difference between intention and competence
16. Understanding the meaning of *Samman*, Difference between respect and differentiation; the other salient values in relationship
17. Understanding the harmony in the society (society being an extension of family): *Samadhan, Samridhi, Abhay, Sah-astitva* as comprehensive Human Goals

18.   Visualizing a universal harmonious order in society- Undivided Society (*Akhand Samaj),* Universal Order (*Sarvabhaum Vyawastha)*- from family to world family!
       - Practice Exercises and Case Studies will be taken up in Practice Sessions.

SECTION D

Understanding Harmony in the Nature and Existence - Whole existence as Co-existence
19.   Understanding the harmony in the Nature
20.   Interconnectedness and mutual fulfillment among the four orders of nature- recyclability and self-regulation in nature
21.   Understanding Existence as Co-existence (*Sah-astitva*) of mutually interacting units in all-pervasive space
22.   Holistic perception of harmony at all levels of existence
       - Practice Exercises and Case Studies will be taken up in Practice Sessions.

SECTION E

Implications of the above Holistic Understanding of Harmony on Professional Ethics
23.   Natural acceptance of human values
24.   Definitiveness of Ethical Human Conduct
25.   Basis for Humanistic Education, Humanistic Constitution and Humanistic Universal Order
26.   Competence in professional ethics:
a)   Ability to utilize the professional competence for augmenting universal human order,
b)   Ability to identify the scope and characteristics of people-friendly and ecofriendly production systems,
c)   Ability to identify and develop appropriate technologies and management patterns for above production systems.
27.   Case studies of typical holistic technologies, management models and production systems
28.   Strategy for transition from the present state to Universal Human Order:
a)   At the level of individual: as socially and ecologically responsible engineers, technologists and managers
b)   At the level of society: as mutually enriching institutions and organizations.

TEXT BOOK:
1.   R R Gaur, R Sangal, G P Bhagaria, 2009, *A Foundation Course in Value Education*.

REFERENCE BOOKS:
1.   Ivan Illich, 1974, *Energy & Equity,* The Trinity Press, Worcester, and HarperCollins, USA
2.   E.F. Schumacher, 1973, *Small is Beautiful: a study of economics as if people mattered*, Blond & Briggs, Britain.
3.   A Nagraj, 1998, *Jeevan Vidya ek Parichay,* Divya Path Sansthan, Amarkantak.
4.   Sussan George, 1976, *How the Other Half Dies,* Penguin Press. Reprinted 1986, 1991
5.   PL Dhar, RR Gaur, 1990, *Science and Humanism*, Commonwealth Purblishers.
6.   A.N. Tripathy, 2003, *Human Values*, New Age International Publishers.

7.   Subhas Palekar, 2000, *How to practice Natural Farming,* Pracheen (Vaidik) Krishi Tantra Shodh, Amravati.
8.   Donella H. Meadows, Dennis L. Meadows, Jorgen Randers, William W. Behrens III, 1972, *Limits to Growth – Club of Rome's report*, Universe Books.
9.   E G Seebauer & Robert L. Berry, 2000, *Fundamentals of Ethics for Scientists & Engineers,* Oxford University Press
10.   M Govindrajran, S Natrajan & V.S. Senthil Kumar, *Engineering Ethics (including Human Values)*, Eastern Economy Edition, Prentice Hall of India Ltd.

RELEVANT CDS, MOVIES, DOCUMENTARIES & OTHER LITERATURE:
1.   Value Education website, *http://www.uptu.ac.in*
2.   Story of Stuff, *http://www.storyofstuff.com*
3.   Al Gore, *An Inconvenient Truth*, Paramount Classics, USA

SEMESTER – IV
NUMERICAL METHODS FOR ENGINEERS   NS-207

Course Code	**NS-207**	L-3, T-1, P-0	
Name of the Course	**Numerical Methods for Engineers**		
Lectures to be delivered	**52 (1 Hr Each) (L = 39, T = 13 for each semester)**		
Semester End Examination	**Max. Time = 3 hrs.**	**Max. Marks: 100**	**Min. Pass Marks: 40**
Continuous Assessment (based on sessional tests (2) 50%, Tutorials/Assignments 30%, Quiz/Seminar 10%, Attendance 10%)	**Max. Marks: 50**		

INSTRUCTIONS:

1. **For Paper Setters:** The question paper will consist of five sections A, B, C, D & E. Section E will be compulsory, it will consist of a single question with 10-20 subparts of short answer type, which will cover the entire syllabus. Section A, B, C & D will have two questions from the respective sections of the syllabus. Each section will have a weightage of 20% of the total marks of the semester end examination for the course.

2. **For candidates:** Candidates are required to attempt five questions in all selecting one question from each of the sections A, B, C & D of the question paper and all the subparts of the questions in Section E.

SECTION –A
SOLUTION OF ALGEBRAIC AND TRANSCENDENTAL EQUATIONS: Bisection method, Method of false position, secant method, Iteration method, Newton-Raphson method and Generalized Newton-Raphson method, Rate of convergence and condition of convergence, solution of simultaneous equations by Iteration method and Newton-Raphson method
SOLUTION OF SIMULTANEOUS ALGEBRAIC EQUATIONS: Partial and Complete Pivoting, Gauss Elimination method, Gauss Jordan method, Jacobi's method, Gauss-Seidal method, Relaxation method and LU-decomposition method.

SECTION-B
FINITE DIFFERENCE AND INTERPOLATION: Errors and approximation analysis, Interpolation, Various difference operators and relation between them, Newton's forward and backward interpolation formulae, Central difference Interpolation formula, Gauss's forward and backward interpolation formulae, Stirling formula, Bessel formula, Lagrange's interpolation formula of unequal intervals, Newton's divided difference formulae.

SECTION-C
NUMERICAL DIFFERENTIATION AND INTEGRATION: Numerical differentiation: Derivatives using Newton forward, backward and central difference formulas, Derivatives using Gauss forward and backward formulas, Derivatives using Bessel formula, Derivatives using Newton divided difference formulas, Maxima and minima of tabulated functions.

NUMERICAL INTEGRATION: Newton-Cotes Quadrature formula, Trapezoidal rule, Simpson's $1/3^{rd}$ and $3/8^{th}$ rules, Boole's and Weddle's rules, Errors and accuracy of these formulae (Trapezoidal rule, Simpson's $1/3^{rd}$ rule) Romberg's integration.

SECTION-D

NUMERICAL SOLUTIONS OF ORDINARY EQUATIONS: Picard method, Taylor's series method, Euler's method, Runge's method, Runge-Kutta method, Predictor- Corrector Methods: Milne's method and Adams-Bashforth method.

NUMERICAL SOLUTIONS OF PARTIAL DIFFERENTIAL: Finite difference approximations of partial derivatives, solution of Laplace equation (Standard five-point formula and Diagonal five-point formula), Solution of Poisson equation.

TEXT BOOKS:
1.   Numerical methods for Scientific & Engg. Computations: M. K. Jain, S. R. K. Iyengar & R. K. Jain; Wiley Eastern Ltd.
2.   Introductory Methods of Numerical Analysis Engineers & Sciences: S. S. Sastry, PHI Learning Private Limited New Delhi, (2009).

REFERENCE BOOKS:
1.   Numerical Methods in Engineers & Sciences : J.N Sharma : Narosa Publishers.
2.   Numerical Methods in Engg. & Sciences : B.S.Grewal : Khanna Publishers.
3.   Computer Oriented Numerical methods: U. Rajaraman Orebtuce; Hall of India.
4.   Introduction to Numerical Analysis: C. E. Froberg; Addison Wesley.

SEMESTER – IV
AUTO FUEL AND LUBRICATION   AU- 221

Course Code	**AU- 221**	L-3, T-1, P-0	
Name of the Course	**Auto Fuel and Lubrication**		
Lectures to be delivered	**52 (1 Hr Each) (L = 39, T = 13 for each semester)**		
Semester End Examination	**Max. Time = 3 hrs.**	**Max. Marks: 100**	**Min. Pass Marks: 40**
Continuous Assessment (based on sessional tests (2) 50%, Tutorials/Assignments 30%, Quiz/Seminar 10%, Attendance 10%)	**Max. Marks: 50**		

INSTRUCTIONS:

1.   **For Paper Setters:** The question paper will consist of five sections A, B, C, D & E. Section A, B, C & D will have two questions from the respective sections of the syllabus and each section will carry 20% of the total marks of the semester end examination for the course. Section E will be compulsory, it will consist of a single question with 10-20 subparts of short answer type, which will cover the entire syllabus and each question will carry 20% of the total marks of the semester end examination for the course.

2.   **For candidates:** Candidates are required to attempt five questions in all selecting one question from each of the sections A, B, C & D of the question paper and all the subparts of the questions in Section E. Use of non-programmable calculators is allowed.

Section A
MANUFACTURE OF FUELS AND LUBRICANTS
Structure of petroleum refining process, classification of petroleum fuels, thermal cracking, catalytic cracking,polymerization, alkylation isomerisation, blending, products of refining process. Manufacture of lubricating oil base stocks, manufacture of finished automotive lubricants.

PROPERTIES & TESTINGOF FUELS
Thermo-chemistry of fuels, properties and testing of fuels & Lubricants, relative density, calorific value, fire point, distillation, vapor pressure, flash point, spontaneous ignition temperature, viscosity, pour point, flammability, ignitability, diesel index. API gravity, aniline point Viscosity index etc.

Section B
Fuel rating & additives Cetane rating, fuel requirements. Additive - mechanism, requirements of an additive, petrol fuel additives and dieselfuel additives - specifications of fuels.
COMBUSTION SI Engine - name propagation and mechanism of combustion, normal combustion, knocking, octane, rating. Fuel requirements. CI engine, mechanism of combustion, diesel knock.

Section C

ALTERNATE FUELS

Use of alternate fuel in engines- LPG. CNG need for alternate fuels, availability & their properties, general use of alcohols. LPG. CNG. LNG, hydrogen, ammonia, vegetable oils, bio-diesel & biogas. merits & demerits of alternate fuels. Introduction to alternate energy sources like, electric vehicle, hybrid, fuel cell & solar cars.

LUBRICANTS

Classification of lubricating oils, properties of lubricating oils, tests on lubricants. Grease- classification, properties, test. Specific requirements for automotive lubricants, oxidation, deterioration and degradation oflubricants, additives, synthetic lubricants.

Section D

THEORY OF LUBRICANTS

Engine friction - introduction, total engine friction, effect of engine variables on friction, hydrodynamic lubrication, elasto hydrodynamic lubrication, boundary lubrication, bearing lubrication, functions of the lubrication system, introduction to design of a lubricating system.

TEXT BOOKS

1. Internal Combustion Engineering by Ganesan V. TaU McGraw -Hill Publishing Co .. Nev, Delhi.
2. Lubrication. Raymond G. Gunther, Chipton Book Co., 1971.

REFERENCEBOOKS

1. Fuels - Solids. Liquids. Gaseous by Brame. J.S.S. and King. I .G.
2. Fuels and Fuel Technology by Francis, W, Vol. I & II
3. Modern Petroleum Technology by Hobson, G.D. & Pohl. W
4. Lubrication-A practical guide to lubricant selection by A.R. Lansdown. Pergamon press, 1982.
5. Energy today & tomorrow by Maheswar Dayal, I & B Horishr India.
6. Internal Combustion Engineering and Air Pollution by Oibert. E.F.: International Book Co 1988.

SEMESTER – IV
MANUFACTURING PROCESS   AU - 222

Course Code	AU -222	L-3, T-1, P-0	
Name of the Course	**Manufacturing Process**		
Lectures to be delivered	**52 (1 Hr Each) (L = 39, T = 13 for each semester)**		
Semester End Examination	**Max. Time = 3 hrs.**	**Max. Marks: 100**	**Min. Pass Marks: 40**
Continuous Assessment (based on sessional tests (2) 50%, Tutorials/Assignments 30%, Quiz/Seminar 10%, Attendance 10%)	**Max. Marks: 50**		

INSTRUCTIONS:

1.   **For Paper Setters:** The question paper will consist of five sections A, B, C, D & E. Section A, B, C & D will have two questions from the respective sections of the syllabus and each section will carry 20% of the total marks of the semester end examination for the course. Section E will be compulsory, it will consist of a single question with 10-20 subparts of short answer type, which will cover the entire syllabus and each question will carry 20% of the total marks of the semester end examination for the course.

2.   **For candidates:** Candidates are required to attempt five questions in all selecting one question from each of the sections A, B, C & D of the question paper and all the subparts of the questions in Section E. Use of non-programmable calculators is allowed.

SYLLABUS
Section-A

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, Molding material, Molding sand composition, and preparation, sand properties and testing type of sand molds. 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.

Section-B

Special Casting Processes: Shell molding, precision investment casting, permanent mold casting, die casting, centrifugal casting, and continuous casting.

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.

Section-C

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.

64

Welding and Welding Defects: Introduction to Welding, Gas and Arc Welding, Classification: Oxy- acetylene 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.

Section-D

Other Welding Processes: Introduction: Thermit welding, electro slag welding, electron beam welding, forge welding, friction welding, diffusion welding, brazing and soldering.

Machine Tools: Introduction, constructional features, specialization, operations and devices of basic machine tools such as lathe, shaper, planner, drilling machining, and milling machine. Indexing in Lathe, Indexing in milling and other operations. Working principles of capstan and turret lathes.

Text Books:

1. Principles of Manufacturing Materials & Processes – Campbell J.S., Mc Graw Hill.
2. Manufacturing Science – Ghosh A., Malik A.K. Affiliated East-West Press Pvt. Ltd., New Delhi.

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.

SEMESTER – IV
STRENGTH OF MATERIALS – II   ME - 223

Course Code	**ME - 223**	L-4, T-1, P-0
Name of the Course	**Strength of Materials – II**	
Lectures to be delivered	**65 (1 Hr Each) (L = 52, T = 13 for each semester)**	
Semester End Examination	**Max. Time = 3 hrs.**	**Max. Marks: 100 Min. Pass Marks: 40**
Continuous Assessment (based on sessional tests (2) 50%, Tutorials/Assignments 30%, Quiz/Seminar 10%, Attendance 10%)	**Max. Marks: 50**	

INSTRUCTIONS:
1.   **For Paper Setters:** The question paper will consist of five sections A, B, C, D & E. Section A, B, C & D will have two questions from the respective sections of the syllabus and each section will carry 20% of the total marks of the semester end examination for the course. Section E will be compulsory, it will consist of a single question with 10-20 subparts of short answer type, which will cover the entire syllabus and each question will carry 20% of the total marks of the semester end examination for the course.

2.   **For candidates:** Candidates are required to attempt five questions in all selecting one question from each of the sections A, B, C & D of the question paper and all the subparts of the questions in Section E. Use of non-programmable calculators is allowed.

Section-A
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 thick cylinders and spherical shells. Compound cylinders and spherical shells subjected to internal fluid pressure only, hub shrunk on solid shaft. Wire-wound cylinders. Numerical problems.

Section-B
Rotating Rims, Discs & Cylinders: Stresses and strains in (i) rotating rims, neglecting the effect of spokes,   (ii) rotating discs, including disc of uniform strength and disc shrunk on hub (iii) rotating cylinders (solid & hollow). Numerical problems.

Section-C
Bending of Curved Bars: Stresses in bars of initial large radius of curvature, bars of initial small radius of curvature. Stresses in crane hooks, rings and chain links of circular & trapezoidal sections. Numerical Problems.

Springs: Stresses in closed and open coiled helical springs subjected to axial loads and twisting couples. Leaf springs, flat spiral springs. Numerical Problems.

Section-D

Unsymmetrical Bending: Properties of beam cross section, product of inertia, ellipse of inertia, slope of the neutral axis, stresses & deflections, shear center and the flexural axis, Numerical problems.

Continuous Beams: Clapeyrons Theorem, Wilson's method, Numerical problems

Text Books:

1.   Mechanics of Materials-E.J. Hearn, Elsevier Publications.
2.   Mechanics of Materials-R.C.Hibbeler, Pearsons India (9th Edition).

Reference Books:

1.   Strengths of Materials-R.K. Rajput, S.Chand & Sons.
2.   Strengths of Materials-Sadhu Singh, Khanna Publishers.
3.   Mechanics of Materials-Dr. Kirpal Singh, Standard Publishers Distributors, New Delhi.
4.   Strengths of Materials-Popov , PHI, New Delhi
5.   G.H. Ryder-Third Edition in S.I. units 1969 Macmillan India.

SEMESTER – IV
KINEMATICS OF MACHINES   ME – 224

Course Code	ME – 224	L-3, T-1, P-0	
Name of the Course	**Kinematics of Machines**		
Lectures to be delivered	**52 (1 Hr Each) (L = 39, T = 13 for each semester)**		
Semester End Examination	**Max. Time: 3 hrs.**	**Max. Marks: 100**	**Min. Pass Marks:40**
Continuous Assessment (based on sessional tests 50%, Tutorials/Assignments 30%, Quiz/Seminar 10%, Attendance 10%)		**Max. Marks: 50**	

INSTRUCTIONS:

1. For Paper Setters: The question paper will consist of five sections A, B, C, D & E. Section A, B, C & D will have two questions from the respective sections of the syllabus and each section will carry 20% of the total marks of the semester end examination for the course. Section E will be compulsory, it will consist of a single question with 10-20 subparts of short answer type, which will cover the entire syllabus and each question will carry 20% of the total marks of the semester end examination for the course.

2. For candidates: Candidates are required to attempt five questions in all selecting one question from each of the sections A, B, C & D of the question paper and all the subparts of the questions in Section E. Use of non-programmable calculators is allowed.

SYLLABUS: Section-A
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.

Section-B
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.

Belt, Rope and Chain drives: Design of belt drives, Flat & V-belt drives, Conditions for Transmission of max. Power, Selection of belt, design of rope drives, and design of chain drives with sprockets.

Section-C
Gears: fundamental law of gearing, involute spur gears, characteristics of involute action, Interference and undercutting, center distance variation, non standard gear teeth, helical, spiral bevel and worm gears.

Gear Trains: Synthesis of simple, compound and reverted gear trains, analysis of epicyclic gear trains.

Section-D

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.

Text Books:
1.   Theory of Mechanisms and Machines: Amitabha Ghosh and Ashok Kumar Mallik, Third Edition Affiliated East West Press.
3.   Theory of Machines: S.S.Rattan, Tata McGraw Hill.

Reference Books:
1.   Mechanism and Machine Theory: J.S.Rao and R.V.Dukkipati, Second Edition, New age International.
2.   Theory of Machines and Mechanisms: Joseph Edward Shigley and john Joseph Uicker, Jr. Second Edition McGraw Hill, Inc.
3.   Theory of Machines: V.P.Singh, Dhanpat Rai Publications.

SEMESTER – IV
AUTO FUEL AND LUBRICATION LAB.   AU – 221 (P)

Course Code	AU– 221 (P) L-0, T-0, P-2	
Name of the Course	**Auto Fuel and Lubrication Lab.**	
Lectures to be delivered	**26 hours of Lab sessions (2 Hrs per week)**	
Semester End Examination	**Max. Marks: 25 Min. Pass Marks: 10**	**Maximum Time: 3 Hrs**
Continuous Assessment	**Lab work 30%, Lab record 25%, Viva 25%, Attendance 20%**	**Max. Marks: 25**

INSTRUCTIONS FOR PAPER SETTER/CANDIDATES:

Laboratory examination will consist of two parts:
iii)   Performing a practical examination assigned by the examiner. iv)   Viva-voce examination.
Viva-voce examination will be related to the practical's performed/projects executed by the candidate related to the paper during the course of the semester.

EXPERIMENTS

1. Temperature dependence of viscosity of lubrication oil by Redwood Viscometer.
2. Viscosity Index of lubricating oil by Saybott Viscometer.
3. Flash and Fire points of Diesel, K-Oil, Bio Diesel.
4. Flash and Fire points of lubricants.
5. Drop point of grease and mechanical penetration in grease.
6. Calorific value of liquid fuel.
7. Calorific value of gaseous fuel
8. Study of semi solid lubrication in various Automobile Unit & Joints
9. Study of lubrication in transmission, final drive, steering gearbox.
10. Study of analytical equipment for oil analysis.
11. To find out volatility characteristic of different fuels by ASTM distillation methods (diesel, gasoline lubricants).

SEMESTER – IV
KINEMATICS OF MACHINES LAB.   ME – 224 (P)

Course Code	ME– 224 (P)	L-0, T-0, P-2	
Name of the Course	**Kinematics of Machines Lab.**		
Lectures to be delivered	**26 hours of Lab sessions (2 Hrs per week)**		
Semester End Examination	**Max. Marks: 25**	**Min. Pass Marks: 10**	**Maximum Time: 3 Hrs**
Continuous Assessment	**Lab work 30%, Lab record 25%, Viva 25%, Attendance 20%**		**Max. Marks: 25**

INSTRUCTIONS FOR PAPER SETTER/CANDIDATES:

Laboratory examination will consist of two parts:

i)   Performing a practical examination assigned by the examiner. ii)   Viva-voce examination.

Viva-voce examination will be related to the practical's performed/projects executed by the candidate related to the paper during the course of the semester.

LIST OF EXPERIMENTS:

1.   To study various types of kinematic links, Pairs, Chains and Mechanisms.

2.   To study inversions of 4 Bar Mechanisms, Single and Double slider crank mechanisms.

3.   To plot slider displacement, velocity and acceleration against crank rotation for Single Slider Crank mechanism.

4.   To find Coefficient of friction between Belt and Pulley.

5.   To study various type of Cam and Follower arrangements.

6.   To plot follower displacement vs cam rotations for various Cam Follower systems.

7.   To generate spur gear involute tooth profile using simulated gear shaping process.

8.   To study various types of gears – Helical, worm & bevel gears.

9.   To study various types of gear trains – simple, compound, reverted, epicyclic and differential.

SEMESTER – V
FLUID MECHANICS & FLUID MACHINES   AU – 311

Course Code	**AU– 311**	L-3, T-1, P-0	
Name of the Course	**FLUID MECHANICS & FLUID MACHINES**		
Lectures to be delivered	**52 (1 Hr Each) (L = 39, T = 13 for each semester)**		
Semester End Examination	**Max. Time: 3 hrs.**	**Max. Marks: 100**	**Min. Pass Marks:40**
Continuous Assessment (based on sessional tests 50%, Tutorials/Assignments 30%, Quiz/Seminar 10%. Attendance 10%)	**Max. Marks: 50**		

INSTRUCTIONS:

1.   **For Paper Setters:** The question paper will consist of five sections A, B, C, D & E. Section A, B, C & D will have two questions from the respective sections of the syllabus and each section will carry 20% of the total marks of the semester end examination for the course. Section E will be compulsory, it will consist of a single question with 10-20 subparts of short answer type, which will cover the entire syllabus and each question will carry 20% of the total marks of the semester end examination for the course.

2.   **For candidates:** Candidates are required to attempt five questions in all selecting one question from each of the sections A, B, C & D of the question paper and all the subparts of the questions in Section E. Use of non-programmable calculators is allowed.

SYLLABUS:
Section-A
Introduction: Fluid and flow-definition and types, properties of ideal and real fluids, continuum concept, Lagrangian & Eulerian approach.

Fluid Statics: General differential equation, manometry, Force on plane and curved surfaces, stability of floating and submerged bodies, Relative equilibrium.

Section-B
Kinematics of fluid: Steady flow, uniform flow, stream, streak and path lines, continuity equation, stream function, irrotational flow, velocity potential, flow nets, circulation, simple flows, flow around circular cylinder with and without rotation, lift and drag.

Dynamics of fluids: Concept of system and control volume, Reynold's transportation theorem, Euler's equation, Bernoulli's equation, Navier Stoke's equation and their application to nozzle, venturimeter, orifices and mouth pieces, time taken in emptying a vessel. Pitot - Prandtl tube.
Section-C
Laminar flow of viscous fluids: Boundary layer concept, boundary layer thickness, displacement, momentum and energy thickness, integral method, drag on flat plate, flow around an airfoil, boundary layer separation**.**

Flow in pipes: Laminar flow through pipe, total and hydraulic gradient lines, series and parallel connection of pipes, transmission of power through pipes.. Turbulent flow: Fluid

friction and Reynolds number

Section-D

Centrifugal Pumps: Classification, velocity vector diagrams and work done, hydraulic and manometric efficiency, vane shape, head capacity relationship and pump losses, pressure rise in impeller, minimum starting 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 vs. reciprocating pumps.

Text Books:

1.   Modi and Seth, Fluid Mechanics and Hydraulic Machines, CBS Publishers.
2.   Munson, Young, Okiishi and Huebsch, Fundamentals of Fluid Mechanics, Wiley India (6th Edition).
3.   R.K. Bansal, A Text Book of Fluid Mechanics and Hydraulic Machines, Laxmi Publications (P) Ltd., New Delhi

Reference Books:

1.   White F.M., Fluid Mechanics, Tata McGraw Hill.
2.   Douglas, Gasiorek, Swaffield and Jack, Fluid Mechanics, Pearsons (5th Edition).
3.   Som, S.K. and Biswas, G., Introduction to Fluid Mechanics and Fluid Machines, Tata Mc- Graw Hill.
4.   Bansal, R.K., Text Book of Fluid Mechanics and Hydraulic Machines, Laxmi Publications (P) Ltd.
5.   Agarwal, Fluid Mechanics and Machinery, Tata McGraw Hill.
6.   Rajput, R.K., A Text Book of Hydraulics, S. Chand and Sons, New Delhi

SEMESTER – V
AUTOMOTIVE ELECTRICALS & ELECTRONICS   AU – 312

Course Code	**AU – 312**	L-3, T-1, P-0
Name of the Course	**AUTOMOTIVE ELECTRICALS & ELECTRONICS**	
Lectures to be delivered	**52 (1 Hr Each) (L = 39, T = 13 for each semester)**	
Semester End Examination	**Max. Time: 3 hrs.**	**Max. Marks: 100** **Min. Pass Marks:40**
Continuous Assessment (based on sessional tests 50%, Tutorials/Assignments 30%, Quiz/Seminar 10%. Attendance 10%)	**Max. Marks: 50**	

INSTRUCTIONS:
1. For Paper Setters: The question paper will consist of five sections A, B, C, D & E. Section A, B, C & D will have two questions from the respective sections of the syllabus and each section will carry 20% of the total marks of the semester end examination for the course. Section E will be compulsory, it will consist of a single question with 10-20 subparts of short answer type, which will cover the entire syllabus and each question will carry 20% of the total marks of the semester end examination for the course.

2. For candidates: Candidates are required to attempt five questions in all selecting one question from each of the sections A, B, C & D of the question paper and all the subparts of the questions in Section E. Use of non-programmable calculators is allowed.

SYLLABUS:
Section A
Storage Battery: Principles of lead acid cells and their characteristics, construction and working of lead acid battery. types of batteries, testing of batteries, effect of temperature on capacity and voltage, battery capacity, voltage, efficiency, charging of batteries, sulphation and desulphation, maintenance and servicing.Fault diagnosis. New developments in electrical storage.
Section B
Ignition System: Conventional ignition system and study of its components. Types of ignition systems, spark advance and retarding mechanisms. Types of spark plugs, ignition timing, maintenance, servicing and fault diagnosis. Electronic ignition systems, programmed ignition, dislributorless ignition,
a) **Starter motor**: Construction and working of series and shunt automotive starter motor, types of device arrangement, solenoid switches, starter motor troubles and repairs.
b) **Electronic controls of carburetion**, component of fuel injection systems, multipoint injection. Bosch Lvariation electronic control diesel fuel injection.

Section C

Charging system: Principle of generation of direct current. Principle, construction and working of alternator generating systems. Maintenance, servicing and trouble shooting. Bosch com- pact alternator. Wiring for auto

electrical Systems: Earth return and insulated return systems, six volt and twelve volt systems, fusing of circuits, low and high voltage automotive cables, wiring diagram for typical automotive wiring systems, maintenance and servicing.

Section D

Dash board units and electrical accessories: Principle of automobile illumination, head lamp construction and wiring, hom, wind screen wiper signalling devices, fog lamps, auxiliary lighting, temperature gauge, oil pressure gauge, fuel gauge, speedometer, odometer. Number system codes and data representation: Binary numbers, number base conversion, decimal, octal and hexadecimal numbers, BCD codes, memory representation of positive and negative integers, conversion real numbers, floating point notations and representations of floating point numbers, binary arithmetics, addition and subtraction of binary numbers, ones and two's complement method. Logic gates, arithmetic circuits and introduction to microprocessors: Study of basic and universal logic gates, study of X-OR and X-NOR gates, flip flop, S-R, S-J flip flop and counters.and shift resistance, half adders and subtracters.

TEXTBOOKS:
1. Automotive Electrical auxiliary systems -By N R. Khatawale Digital
2. Logic and Computer Design by Mano, Prentice hall of India

REFERENCES:
1. Automotive Electrical systems -By Young and Griffith, Butterworth
2. Basic automotive electrical systems -By C.P. Nakra, Dhanpat Rai.
3. Automotive mechanics -By William H. Grouse, TMH 5. Modem Electrical Equipments - By A. W. Judge,
4. Automotive Electrical Equipment -By P.I. Kohli, TMH

SEMESTER – V
HEAT TRANSFER ME – 313

Course Code	ME – 313	L-3, T-1, P-0	
Name of the Course	**Heat Transfer**		
Lectures to be delivered	**52 (1 Hr Each) (L = 39, T = 13 for each semester)**		
Semester End Examination	**Max. Time: 3 hrs.**	**Max. Marks: 100**	**Min. Pass Marks:40**
Continuous Assessment (based on sessional tests 50%, Tutorials/Assignments 30%, Quiz/Seminar 10%, Attendance 10%)	**Max. Marks: 50**		

INSTRUCTIONS:

1. For Paper Setters: The question paper will consist of five sections A, B, C, D & E. Section A, B, C & D will have two questions from the respective sections of the syllabus and each section will carry 20% of the total marks of the semester end examination for the course. Section E will be compulsory, it will consist of a single question with 10-20 subparts of short answer type, which will cover the entire syllabus and each question will carry 20% of the total marks of the semester end examination for the course.

Note: The paper setter will be required to mention a note in the question paper that the use of steam table, graphical plots and data book is permitted.

2. For candidates: Candidates are required to attempt five questions in all selecting one question from each of the sections A, B, C & D of the question paper and all the subparts of the questions in Section E. Use of non-programmable calculators is allowed.

Section-A
Steady State Heat Conduction: Introduction, I-D 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 – D heat conduction with heat sources, Extended surfaces (fins), Fin effectiveness 2-D heat conduction.

Section-B
Transient Heat Conduction: Systems with negligible internal resistance, Transient heat conduction in plane wall, cylinders, spheres with convective boundary conditions, Chart solution, Relaxation Method.

Convection: Forced convection – Thermal and hydro-dynamic boundary layers, Equation of continuity, Momentum and energy equations, some results for 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.

Section-C
Thermal Radiation: The Stephen – Boltzmann law, The black body radiation, Shape factors and their relationships, Heat exchange between non black bodies, Electrical network for radiative exchange in an enclosure of two or three gray bodies, Radiation shields.

Section-D

Heat Exchangers: Classification, Performance variables, Analysis of a parallel/counter flow heat exchanger, Heat exchanger effectiveness.

Heat Transfer with change of Phase: Laminar film Condensation on a vertical plate, Drop-wise condensation, Boiling regimes, Free convective, Nucleate and film boiling.

Text Books:

1. Fundamentals of Heat and Mass Transfer: Incropera, F.P. & Dewitt, D.P., John Wiley & Sons.
2. Heat and Mass Transfer: Yunus A. Cengel, Tata McGraw Hill.

Reference Books:

1. Heat Transfer: Holman, J.P., John Wiley & Sons, New York.
2. Heat Transfer: Kumar, D.S., Kataria & Sons, Delhi.
3. Heat Mass Transfer: Domkundwar.
4. Conduction Heat Transfer: Arpasi, V.S., Addison-Wesley.
5. Thermal Radiation Heat Transfer: Siegel, R. and J.R.Howell, McGaw Hill.
6. Heat Transmission: W.M., Mc. Adams, McGraw Hill.

SEMESTER – V
DESIGN OF AUTOMOBILE COMPONENTS – I   AU – 313

Course Code	AU– 313	L-4, T-1, P-0	
Name of the Course	**Design of Automobile Components – I**		
Lectures to be delivered	**65 (1 Hr Each) (L = 52, T = 13 for each semester)**		
Semester End Examination	**Max. Time: 3 hrs.**	**Max. Marks: 100**	**Min. Pass Marks:40**
Continuous Assessment (based on sessional tests 50%, Tutorials/Assignments 30%, Quiz/Seminar 10%, Attendance 10%)	**Max. Marks: 50**		

INSTRUCTIONS:
1.   **For Paper Setters:** The question paper will consist of five sections A, B, C, D & E. Section A, B, C & D will have two questions from the respective sections of the syllabus and each section will carry 20% of the total marks of the semester end examination for the course. Section E will be compulsory, it will consist of a single question with 10-20 subparts of short answer type, which will cover the entire syllabus and each question will carry 20% of the total marks of the semester end examination for the course.

Note: The paper setter will be required to mention in the note in the question paper that the use of Design Data book is permitted.

2.   **For candidates:** Candidates are required to attempt five questions in all selecting one question from each of the sections A, B, C & D of the question paper and all the subparts of the questions in Section E. Use of non-programmable calculators is allowed.

Section-A
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 interchangeability, 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).

Section-B
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.

Section-C

Screwed joints: Types of power screws, comparison of square and trapezoidal threads, efficiency of screws, stresses in screwed fastenings, bolted joints in tension, eccentrically loaded bolted joints in shear and under combined stresses.

Riveted and welded joints: Methods of riveting, rivet materials, caulking and fullering, design of rivets for boiler joints, eccentrically loaded riveted joints, WELDS: Design for various loading conditions in torsion, shear or direct load, eccentrically loaded welded joints.

Section-D

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.

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.   Design of Machine Elements - V.B.Bhandari - Tata McGraw Hill, New Delhi.
2.   Machine Design - R.S.Khurmi, J.K. Gupta, S. Chand & Sons.

Reference Books:

1.   Machine design - Sharma and Aggrawal, kataria publications.
2.   Mechanical Engg. Design - First Metric Editions: Joseph Edward Shigley - McGraw Hill Book Co.
3.   Fundamentals of machine elements - Bernard J. Hamrock, Steven R. Schmid, Bo Jacobson, McGraw Hill.
4.   Design Data Book Compiled by PSG College of Engineering &Technology, Coimbatore.
5.   Design Data Book Compiled by Mahadevan.

SEMESTER – V
DYNAMICS OF MACHINES   ME - 315

Course Code	ME - 315	L-3, T-1, P-0	
Name of the Course	**Dynamics Of Machines**		
Lectures to be delivered	**52 (1 Hr Each) (L = 39, T = 13 for each semester)**		
Semester End Examination	**Max. Time = 3 hrs.**	**Max. Marks: 100**	**Min. Pass Marks: 40**
Continuous Assessment (based on sessional tests (2) 50%, Tutorials/Assignments 30%, Quiz/Seminar 10%, Attendance 10%)	**Max. Marks: 50**		

INSTRUCTIONS:

1.   **For Paper Setters:** The question paper will consist of five sections A, B, C, D & E. Section A, B, C & D will have two questions from the respective sections of the syllabus and each section will carry 20% of the total marks of the semester end examination for the course. Section E will be compulsory, it will consist of a single question with 10-20 subparts of short answer type, which will cover the entire syllabus and each question will carry 20% of the total marks of the semester end examination for the course.

2.   **For candidates:** Candidates are required to attempt five questions in all selecting one question from each of the sections A, B, C & D of the question paper and all the subparts of the questions in Section E. Use of non-programmable calculators is allowed.

Section-A
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.

Section-B
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.

Section-C
Governors: Introduction, types of governors, characteristics of centrifugal governors, gravity controlled and spring controlled centrifugal governors, hunting of centrifugal governors.

Flywheel: Introduction, Coefficient of fluctuation of energy and speed, design of flywheel – solid disk and rimmed flywheels.

Section-D

Dynamometers: types of dynamometers, prony brake, rope brake and band brake dynamometers, belt transmission dynamometer, torsion dynamometer, hydraulic dynamometer.

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.

Text Books:

1. Theory of Mechanisms and Machines: Amitabha Ghosh and Ashok Kumar Mallik, Third Edition, Affiliated East West Press.
2. Theory of Machines: S.S.Rattan, Tata McGraw Hill.

Reference Books:

1. Theory of Machines and Mechanisms: Joseph Edward Sigley and John Joseph Uicker, Jr. Second Edition, McGraw Hill.
2. Mechanism and Machine Theory: J.S.Rao and R.V.Dukkipati, Second Edition, New age International.
3. Theory of Machines: Thomas Beven.
4. Theory of Machines: V.P.Singh, Dhanpat Rai Publications.

SEMESTER – V
FLUID MECHANICS & FLUID MACHINES LAB.   AU – 311 (P)

Course Code	**AU– 311 (P)**	L-0, T-0, P-2	
Name of the Course	**Fluid Mechanics & Fluid Machines Lab**		
Lectures to be delivered	**26 hours of Lab sessions (2 Hrs per week)**		
Semester End Examination	**Max. Marks: 25**	**Min. Pass Marks: 10**	**Maximum Time: 3 Hrs**
Continuous Assessment	**Lab work 30%, Lab record 25%, Viva 25%, Attendance 20%**		**Max. Marks: 25**

INSTRUCTIONS FOR PAPER SETTER/CANDIDATES:

Laboratory examination will consist of two parts:
i) Performing a practical examination assigned by the examiner. ii) Viva-voce examination.
Viva-voce examination will be related to the practical's performed/projects executed by the candidate related to the paper during the course of 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.

5.   To determine the coefficient of discharge, contraction & velocity of an orifice.

6.   To find critical Reynolds number for a pipe flow.

7.   To determine the meta-centric height of a floating body.

8.   To determine the minor losses due to sudden enlargement, sudden contraction and bends.

9.   To study the constructional details of a Centrifugal Pump and draw its characteristic curves.

10.   To study the constructional details of a Reciprocating Pump and draw its characteristic curves.

11.   To study the constructional details of a Hydraulic Ram and determine its various efficiencies.

SEMESTER – V
AUTOMOTIVE ELECTRICALS AND ELECTRONICS LAB   AU – 312 (P)

Course Code	AU– 312 (P) L-0, T-0, P-2	
Name of the Course	**AUTOMOTIVE ELECTRICALS AND ELECTRONICS LAB**	
Lectures to be delivered	**26 hours of Lab sessions (2 Hrs per week)**	
Semester End Examination	**Max. Marks: 25 Min. Pass Marks: 10**	**Maximum Time: 3 Hrs**
Continuous Assessment	**Lab work 30%, Lab record 25%, Viva 25%, Attendance 20%**	**Max. Marks: 25**

INSTRUCTIONS FOR PAPER SETTER/CANDIDATES:

Laboratory examination will consist of two parts:
i)   Performing a practical examination assigned by the examiner. ii) Viva-voce examination. Viva-voce examination will be related to the practical's performed/projects executed by the candidate related to the paper during the course of the semester.

LIST OF EXPERIMENTS:

1. Study of different type of Battery construction and different battery test.
2. Study of different automotive electrical system (Starting system, Ignition system, lighting system, wiring harness.)
3. Assembling and dismantling of Starter motor used in automobile.
4. Assembling and dismantling of alternator used in automobile.
5. Trouble shooting with Ignition system.
6. Study of different color code system used in automotive wiring system.
7. Study of different Electrical Equipments & Accessories (Speedometer, Warning lights , Electric Horn , Wind shield wipers system)
8. Study of different sensor used in modern automotive system.
9. Study of various electronics system (Electronic fuel injection system, Electronic ignition system , Air bag , ABS , Electronic fuel injector cleaner).

SEMESTER – V
HEAT TRANSFER LAB.   ME – 313 (P)

Course Code	**ME– 313 (P)**	L-0, T-0, P-2	
Name of the Course	**Heat Transfer Lab**		
Lectures to be delivered	**26 hours of Lab sessions (2 Hrs per week)**		
Semester End Examination	**Max. Marks: 25**	**Min. Pass Marks: 10**	**Maximum Time: 3 Hrs**
Continuous Assessment	**Lab work 30%, Lab record 25%, Viva 25%, Attendance 20%**		**Max. Marks: 25**

INSTRUCTIONS FOR PAPER SETTER/CANDIDATES:

Laboratory examination will consist of two parts:
i)   Performing a practical examination assigned by the examiner. ii)   Viva-voce examination.
Viva-voce examination will be related to the practical's performed/projects executed by the candidate related to the paper during the course of the semester.

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 a 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 emmisivity of the gray body (plate) at different temperature and plot the variation of emmisivity 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 Boltzman constant for thermal radiation.

SEMESTER – V
DYNAMICS OF MACHINES LAB.   ME – 315 (P)

Course Code	ME– 315 (P)	L-0, T-0, P-2	
Name of the Course	**Dynamics of Machines Lab**		
Lectures to be delivered	**26 hours of Lab sessions (2 Hrs per week)**		
Semester End Examination	**Max. Marks: 25**	**Min. Pass Marks: 10**	**Maximum Time: 3 Hrs**
Continuous Assessment	**Lab work 30%, Lab record 25%, Viva 25%, Attendance 20%**	**Max. Marks: 25**	

INSTRUCTIONS FOR PAPER SETTER/CANDIDATES:

Laboratory examination will consist of two parts:
i)   Performing a practical examination assigned by the examiner. ii)   Viva-voce examination.
Viva-voce examination will be related to the practical's performed/projects executed by
the candidate related to the paper during the course of the semester.

LIST OF EXPERIMENTS:

1.   To perform experiment on Watt and Porter Governors to prepare performance characteristic curves and to find stability and sensitivity.

2.   To perform experiment on Proell Governor to prepare performance characteristic curves and to find stability and sensitivity.

3.   To perform experiment on Hartnell Governor to prepare performance characteristic curves and to find stability and sensitivity.

4.   To study gyroscopic effects through models.

5.   To determine gyroscopic couple on motorized gryoscope.

6.   To perform the experiment for static balancing on static balancing machine.

7.   To perform the experiment for dynamic balancing on dynamic balancing machine.

8.   Determine the moment of inertial of connecting rod by compound pendulum method.

SEMESTER - VI
MEASUREMENT AND CONTROL   ME – 322

Course Code	**ME – 322**	L-3, T-1, P-0	
Name of the Course	**Measurement and Control**		
Lectures to be delivered	**52 (1 Hr Each) (L = 39, T = 13 for each semester)**		
Semester End Examination	**Max. Time: 3 hrs.**	**Max. Marks: 100**	**Min. Pass Marks:40**
Continuous Assessment (based on sessional tests 50%, Tutorials/Assignments 30%, Quiz/Seminar 10%, Attendance 10%)	**Max. Marks: 50**		

INSTRUCTIONS:

1.   **For Paper Setters:** The question paper will consist of five sections A, B, C, D & E. Section A, B, C & D will have two questions from the respective sections of the syllabus and each section will carry 20% of the total marks of the semester end examination for the course. Section E will be compulsory, it will consist of a single question with 10-20 subparts of short answer type, which will cover the entire syllabus and each question will carry 20% of the total marks of the semester end examination for the course.

2.   **For candidates:** Candidates are required to attempt five questions in all selecting one question from each of the sections A, B, C & D of the question paper and all the subparts of the questions in Section E. Use of non-programmable calculators is allowed.

Section-A
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.

Section-B
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.

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.

Section-C
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: metal resistance thermometers and thermistors; optical and radiation pyrometers, calibration, standards.

Section-D

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.

Text Books:

1. Measurement system: Application and Design by Doebelin E.O., McGraw Hill.
2. Mechanical Measurement and Control by Kumar D.S., Metropolitan Book Co. Pvt. Ltd., New Delhi.

Reference Books:

1. Experimental Method for Engineers by Holman J.P., McGraw Hill Publication Company.
2. Automatic Control System by Kuo B.C., Prentice Hall of India.

SEMESTER – VI
AUTOMOTIVE POLLUTION & CONTROL   AU – 322

Course Code	**AU – 322**	L-3, T-1, P-0	
Name of the Course	**Automotive Pollution & Control**		
Lectures to be delivered	**52 (1 Hr Each) (L = 39, T = 13 for each semester)**		
Semester End Examination	**Max. Time: 3 hrs.**	**Max. Marks: 100**	**Min. Pass Marks:40**
Continuous Assessment (based on sessional tests 50%, Tutorials/Assignments 30%, Quiz/Seminar 10%, Attendance 10%)	**Max. Marks: 50**		

INSTRUCTIONS:
1.   **For Paper Setters:** The question paper will consist of five sections A, B, C, D & E. Section A, B, C & D will have two questions from the respective sections of the syllabus and each section will carry 20% of the total marks of the semester end examination for the course. Section E will be compulsory, it will consist of a single question with 10-20 subparts of short answer type, which will cover the entire syllabus and each question will carry 20% of the total marks of the semester end examination for the course.

2.   **For candidates:** Candidates are required to attempt five questions in all selecting one question from each of the sections A, B, C & D of the question paper and all the subparts of the questions in Section E. Use of non-programmable calculators is allowed.

Section A
Introduction
Pollutants - sources - formation - effects - transient operational effects on pollution. Introduction, Pollutants, sources, formation of HC and CO in SI engines, NO formation in SI and CI engines, Particulate emission from SI and CI engines, Smoke Emission in CI engines. Effect of operating variables on Emission formation

SI Engine Combustion And Pollutant Formation
Chemistry of SI engine combustion - HC and CO formation in 4-stoke and 2-stroke SI engines - NO formation in SI engines - Particulate emissions form SI engines - Effects of operating variables on emission formation.

Section B
CI Engine Combustion And Emissions
Basics of diesel combustion. Smoke emission in diesel engines, NOx emission from diesel engines. Particulate emission in diesel engines. Color and aldehyde emissions from Diesel engines. Effects of operating variables on emission formation.
Post Combustion Treatment
Introduction, physical conditions and exhaust gas compositions before treatment, catalytic mechanism. Thermal reactions, installation of catalyst in exhaust lines, NOx treatment in diesel engines. Diesel trap oxidizers

Section C
Control Techniques Engine Emission Reduction
Design changes - Optimization of operating factors - Exhaust gas recirculation - Fumigation - Air injection PCV system - Exhaust treatment in SI engines - Thermal reactors - Catalytic converters - Catalysts - Use of unleaded petrol.

Test Procedure & Instrumentation For Emission Measurement
Test procedures, NDIR analyser, thermal conductivity and flame ionization detectors, Chemiliuminescent analyser, analysers for NOx, Gas chromatograph - Orsat apparatus - Smoke meters, spot sampling and continuous indication types like Bosch, Hart ridge.

Section D
Laws and Regulations
Historical background, regulatory test procedures (European cycles), exhaust gas pollutants (European rail road limits), particulate pollutants, European statutory values, inspection of vehicles in circulation (influence of actual traffic conditions and influence of vehicle maintenance) Indian Emission Standards

Text Books:
1. Springer and Patterson, Engine Emission, Plenum Press, 1990.

References:
1. Ganesan.V., " Internal Combustion Engines ", Tata McGraw Hill Co.,
2. SAE Transactions, " Vehicle emission ", 1982 (3 volumes).
3. Obert.E.F., " Internal Combustion Engines ",.
4. Taylor.C.F., " Internal Combustion Engines ", MIT Press,.
5. Heywood.J.B. "Internal Combustion Engine Fundamentals", McGraw Hill
6. Automoblies and Pollution SAE Transaction.
7. Motor Vehicles Act / Emission Norms – Govt of India Publications

SEMESTER – V
DESIGN OF AUTOMOBILE COMPONENTS-II   AU – 323

Course Code	**AU – 323**	L-4, T-1, P-0	
Name of the Course	**Design of Automobile Components -II**		
Lectures to be delivered	**65 (1 Hr Each) (L = 52, T = 13 for each semester)**		
Semester End Examination	**Max. Time: 3 hrs.**	**Max. Marks: 100**	**Min. Pass Marks:40**
Continuous Assessment (based on sessional tests 50%, Tutorials/Assignments 30%, Quiz/Seminar 10%, Attendance 10%)	**Max. Marks: 50**		

INSTRUCTIONS:

1. For Paper Setters: The question paper will consist of five sections A, B, C, D & E. Section A, B, C & D will have two questions from the respective sections of the syllabus and each section will carry 20% of the total marks of the semester end examination for the course. Section E will be compulsory, it will consist of a single question with 10-20 subparts of short answer type, which will cover the entire syllabus and each question will carry 20% of the total marks of the semester end examination for the course.

Note: The paper setter will be required to mention in the note in the question paper that the use of Design Data book is permitted.

2. For candidates: Candidates are required to attempt five questions in all selecting one question from each of the sections A, B, C & D of the question paper and all the subparts of the questions in Section E. Use of non-programmable calculators is allowed.

Section-A
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.

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.

Section-B
Drives: Design of belt, rope and chain drives.

Gears: Classification, Selection of gears, terminology of gears, selection of material for gears, law of gearing, forms of gear teeth, interference and undercutting, 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.

Section-C

Springs: Types of springs, Design for helical springs against tension, compression and fluctuating loads, Design of leaf springs, nipping, Surging phenomenon in springs.

Friction clutches: Torque transmitting capacity, multi-disc clutches friction materials, cone clutches, centrifugal clutches, thermal considerations.

Section-D

Design of IC engines parts: Design of cylinder, piston, connecting rod and crankshaft.

Design of Crane Hook.

Text Books:

1.   Design of Machine Elements: V.B.Bhandari , Tata McGraw Hill, New Delhi.
2.   Machine Design: R.S.Khurmi, J.K. Gupta, S. Chand & Sons.

Reference Books:

1.   Machine design: Sharma and Aggrawal, kataria publications.
2.   Mechanical Engg. Design: First Metric Editions: Joseph Edward Shigley, McGraw Hill Book Co.
3.   Fundamentals of Machine Elements: Bernard J. Hamrock, Steven R. Schmid, Bo Jacobson, McGraw Hill.
4.   Design Data Book Compiled by PSG College of Engineering &Technology, Coimbatore.
5.   Design Data Book Compiled by Mahadevan.

SEMESTER – VI
INTERNAL COMBUSTION ENGINES   ME – 325

Course Code	**ME – 325**	L-3, T-1, P-0	
Name of the Course	**Internal Combustion Engines**		
Lectures to be delivered	**52 (1 Hr Each) (L = 39, T = 13 for each semester)**		
Semester End Examination	**Max. Time: 3 hrs.**	**Max. Marks: 100**	**Min. Pass Marks:40**
Continuous Assessment (based on sessional tests 50%, Tutorials/Assignments 30%, Quiz/Seminar 10%, Attendance 10%)	**Max. Marks: 50**		

INSTRUCTIONS:
1. For Paper Setters: The question paper will consist of five sections A, B, C, D & E. Section A, B, C & D will have two questions from the respective sections of the syllabus and each section will carry 20% of the total marks of the semester end examination for the course. Section E will be compulsory, it will consist of a single question with 10-20 subparts of short answer type, which will cover the entire syllabus and each question will carry 20% of the total marks of the semester end examination for the course.

2. For candidates: Candidates are required to attempt five questions in all selecting one question from each of the sections A, B, C & D of the question paper and all the subparts of the questions in Section E. Use of non-programmable calculators is allowed.

Section-A
Introduction: I.C.Engines and their classification, Piston – Cylinder Arrangement and Related Terms, parts and their functions, Cycle of operation of four stroke and two stroke Engines, Applications. Analysis of Air Standard Otto, Diesel and Dual Cycles, Air Standard Efficiency and Mean Effective Pressure, Deviation of Actual Engine Cycle from Ideal Cycle, Valve Timing Diagrams for I.C.Engines.

Two Stroke Engines: Principle of working, Scavenging and Scavenging Methods, Port Timing Diagram, Merits and Demerits, Applications, Comparison with Four Stroke Engines.

Section-B
Carburetion and Fuel Ignition Systems: Purpose, Main Requirements and Principle of a Carburetor, Constructional and Operational Details of a Single jet Carburetor, Compensating Devices, Salient Features and Comparative Merits/Demerits of Battery Ignition system and Magneto Ignition System, Timings and Spark Advance, Introduction to Basic Electronic Petrol Injection System, and Multipoint Fuel Injection System.

Fuel Injection in CI Engines: Requirements of Diesel Fuel Injection System, Air Injection and Airless Injection systems, constructional and Operational Details of Fuel Pump and Fuel Atomizer.
Section-C
Combustion Process: Stages of combustion in S.I.Engines, Flame Ignition and Propagation, Effect of Engine Variables on Flame Speed, Pre-Ignition and Detonation, Engine Variables Affecting Detonation, Theories of Detonation, Highest Useful Compression Ratio and Octane Rating of Fuels. Combustion in CI Engines, Effect of Operating Variables on Delay Period and Diesel Knock, Comparison between Knocking in

SI and CI Engines, Rating of Diesel Fuel – Cetane Number and Diesel Index.

Cooling and Lubrication Systems: Need for Cooling, Classification of Cooling Systems – Thermo System, Radiator and Air-Cooling Systems. Function of a Lubricating System, Splash and Pressure Lubrication System, Wet and Dry Sump Lubrications, Lubrication of different Engine Parts, S.A.E. Rating of Lubricants.

<div align="center">Section-D</div>

Engine Testing and Performance: Purpose of Testing, Performance Parameters: Brake Power, Indicated Power, Mechanical Efficiency, Fuel and Air Consumption. Thermal Efficiency and Specific Fuel consumption. Heat balance Calculations and Performance Maps. Supercharging: Objective, Effects and its limits in SI and CI Engines, Numerical Problems.

Engine Pollution and Alternative Fuels: Pollutants from SI and CI Engines, Methods of Emission Control, Alternate Fuels – Alcohol, LPG, Hydrogen, CNG, Biogas, Relative Merits and Demerits of these Fuels.

Text Books:

1.   Internal Combustion Engines Fundamentals - John Heywood, McGraw Hill.
2.   Internal Combustion Engines - V.Ganeshan, Tata McGraw Hill.

Reference Books:

1.   Internal Combustion Engines - Mathur and Sharma, Dhanpat Rai and Sons.
2.   Internal Combustion Engines - Romalingum, Scitech Publication.
3.   IC Engines - Maleev, McGraw Hill.
4.   Mechanics of Automotive Engines - Srockan.

SEMESTER – VI
MATERIALS TECHNOLOGY   ME – 326

Course Code	**ME – 326**	L-4, T-0, P-0	
Name of the Course	**Materials Technology**		
Lectures to be delivered	**52(1 Hr Each) (L = 52 for each semester)**		
Semester End Examination	**Max. Time: 3 hrs.**	**Max. Marks: 100**	**Min. Pass Marks:40**
Continuous Assessment (based on sessional tests 50%, Tutorials/Assignments 30%, Quiz/Seminar 10%, Attendance 10%)	**Max. Marks: 50**		

INSTRUCTIONS:
1.   **For Paper Setters:** The question paper will consist of five sections A, B, C, D & E. Section A, B, C & D will have two questions from the respective sections of the syllabus and each section will carry 20% of the total marks of the semester end examination for the course. Section E will be compulsory, it will consist of a single question with 10-20 subparts of short answer type, which will cover the entire syllabus and each question will carry 20% of the total marks of the semester end examination for the course.

2.   **For candidates:** Candidates are required to attempt five questions in all selecting one question from each of the sections A, B, C & D of the question paper and all the subparts of the questions in Section E. Use of non-programmable calculators is allowed.

SYLLABUS: Section-A
Materials: Resources   and   Their   Implications,   Materials   and   Engineering, Engineering Materials and Selected Applications

Solid Solutions and Phase diagram: Introduction to single and multiphase solid solutions and types of solid solutions,Importance and objectives of phase diagram, systems, phase and structural constituents, cooling curves,   unitary & binary phase diagrams, Gibb's phase rule, Lever rule, eutectic and eutectoid systems, peritectic and peritectoid systems, iron carbon equilibrium diagram and TTT diagram.

Section-B
Heat Treatment: Principles, purpose, classification of heat treatment processes, annealing normalizing, stress relieving, hardening, tempering, carburizing, nitriding, cyaniding, flame and induction hardening. Allotropic transformation of iron and steel, properties of 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, season cracking.   Recovery,   re- crystallization and grain growth. Mechanical

Section-C

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.

Section-D

Failures of metals: Failure analysis, fracture- process & its types and their characteristics, Brittle fracture theories, Cleavage fracture, Methods to improve fracture strength, fatigue, characteristics of fatigue, S-N curve, fatigue limit, mechanism of fatigue, factor affecting fatigue, Miner's law, simple numerical problems on fatigue.

Creep & Corrosion: Definition and concept, creep curve, mechanism of creep, impact of time and temperature on creep, creep fracture, creep testing and prevention against creep. Corrosion: Mechanism and effect of corrosion, prevention of corrosion.

Text Books:

1. Elements of Material Science and Engineering: VanVlack, Pearsons Education.
2. Material Science & Engineering: V. Raghvan, Prentice Hall of India Pvt. Ltd, New Delhi.

Reference Books:

1. Material Science and Engineering-An Introduction: Callister W.D., John Wiley & Sons. Delhi.
2. A Text Book of Material Science & Metallurgy: O.P. Khanna, Dhanpat Rai & Sons.
3. Engineering Materials: Kenneth G. Budinski, Prentice Hall of India, New Delhi.

SEMESTER – VI
MEASUREMENT AND CONTROL LAB.   ME – 322 (P)

Course Code	**ME–322 (P)** L-0, T-0, P-2	
Name of the Course	**Measurement and Control lab.**	
Lectures to be delivered	**26 hours of Lab sessions (2 Hrs per week)**	
Semester End Examination	**Max. Marks: 25 Min. Pass Marks: 10 Maximum Time: 3 Hrs**	
Continuous Assessment	**Lab work 30%, Lab record 25%, Viva 25%, Attendance 20%**	**Max. Marks: 25**

INSTRUCTIONS FOR PAPER SETTER/CANDIDATES:

Laboratory examination will consist of two parts:
i)   Performing a practical examination assigned by the examiner. ii)   Viva-voce examination .
Viva-voce examination will be related to the practical's performed/projects executed by the candidate related to the paper during the course of the semester.

LIST OF EXPERIMENTS:

1.   Calibration of pressure-gauge with the help of a dead weight gauge tester.

2.   Use of the engine indicator for recording the cylinder pressure against cylinder volume.

3.   Preparation of a thermocouple for measurement of temperature and a study of the use of potentiometer in temperature measurement with the help of a thermocouple.

4.   Use of a tachometer and stroboscope for measurement of speed of a shaft.

5.   Measurement of torque with the help of an absorption dynamometer.

6.   Study of the use of a strain gauge for displacement measurement.

7.   Measurement of flow with the help of obstruction meters.

8.   Use of Pitot tube to plot the velocity profile of a fluid flow through a duct.

SEMESTER –VI
I.C.ENGINES LAB. ME – 325 (P)

Course Code	**ME–325 (P)**	L-0, T-0, P-2
Name of the Course	**I.C.Engines lab.**	
Lectures to be delivered	**26 hours of Lab sessions (2 Hrs per week)**	
Semester End Examination	**Max. Marks: 25 Min. Pass Marks: 10**	**Maximum Time: 3 Hrs**
Continuous Assessment	**Lab work 30%, Lab record 25%, Viva 25%, Attendance 20%**	**Max. Marks: 25**

INSTRUCTIONS FOR PAPER SETTER/CANDIDATES:

Laboratory examination will consist of two parts:
i) Performing a practical examination assigned by the examiner. ii) Viva-voce examination.

Viva-voce examination will be related to the practical's performed/projects executed by the candidate related to the paper during the course of the semester.

LIST OF EXPERIMENTS:

1.   To study the constructional details and working principles of two-stroke/four stroke petrol engine.

2.   To study the constructional details and working of two-stroke/four stroke diesel engine.

3.   To prepare heat balance sheet on multi-cylinder diesel engine/petrol engine.

4.   To find the Indicated Power (IP) on multi-cylinder petrol engine/diesel engine by Morse Test.

5.   To find FP of a multi-cylinder diesel engine/petrol engine by Willian's line method and by motoring method.

6.   To prepare variable speed performance test of a multi-cylinder/single cylinder petrol engine/diesel engine and prepare the curves (i) BP, IP, FP, vs speed.   (ii) Volumetric Efficiency and Indicated Specific Fuel Consumption vs speed.

7.   To perform constant speed performance test on a single cylinder/multi cylinder diesel engine and draw curves of (i) BP vs fuels rate, air rate and A/F and (ii) BP vs. mech efficiency and bsfc.

8.   To measure CO & Hydrocarbons in the exhaust of 2 stroke / 4 stroke petrol engine.

9.   To find intensity of smoke from a single cylinder / multicylinder diesel engine.

SEMESTER –VI
AUTOMOTIVE POLLUTION & CONTROL LAB.   AU – 322 (P)

Course Code	AU–322 (P)	L-0, T-0, P-2	
Name of the Course	**Automotive Pollution & Control Lab.**		
Lectures to be delivered	**26 hours of Lab sessions (2 Hrs per week)**		
Semester End Examination	**Max. Marks: 25**	**Min. Pass Marks: 10**	**Maximum Time: 3 Hrs**
Continuous Assessment	**Lab work 30%, Lab record 25%, Viva 25%, Attendance 20%**	**Max. Marks: 25**	

INSTRUCTIONS FOR PAPER SETTER/CANDIDATES:

Laboratory examination will consist of two parts:
i) Performing a practical examination assigned by the examiner. ii) Viva-voce examination.
Viva-voce examination will be related to the practical's performed/projects executed by the candidate related to the paper during the course of the semester.

LIST OF EXPERIMENTS:

1. Study of Pressure pickups, charge amplifier, storage oscilloscope and signal analysers used for IC engine testing.
2. Performance study of petrol and diesel engines both at full load and part load conditions.
3. Morse test on petrol and diesel engines.
4. Determination of compression ratio, volumetric efficiency and optimum cooling water flow rate in engines.
5. Heat balance test on an automotive engine.
6. Testing of 2 and 4 wheelers using chassis dynamometers.
7. Study of NDIR Gas Analyser and FID
8. Study of Chemiluminescent NOx analyzer
9. Measurement of HC, CO, CO2,N02 using exhaust gas **analyzer**
10. Diesel smoke measurement

SEMESTER – VII
MECHANICAL VIBRATIONS   ME – 412

Course Code	**ME – 412**	L-3, T-1, P-0	
Name of the Course	**Mechanical Vibrations**		
Lectures to be delivered	**52 (1 Hr Each) (L = 39, T = 13 for each semester)**		
Semester End Examination	**Max. Time: 3 hrs.**	**Max. Marks: 100**	**Min. Pass Marks:40**
Continuous Assessment (based on sessional tests 50%, Tutorials/Assignments 30%, Quiz/Seminar 10%, Attendance 10%)	**Max. Marks: 50**		

INSTRUCTIONS:
1.   **For Paper Setters:** The question paper will consist of five sections A, B, C, D & E. Section A, B, C & D will have two questions from the respective sections of the syllabus and each section will carry 20% of the total marks of the semester end examination for the course. Section E will be compulsory, it will consist of a single question with 10-20 subparts of short answer type, which will cover the entire syllabus and each question will carry 20% of the total marks of the semester end examination for the course.

2.   **For candidates:** Candidates are required to attempt five questions in all selecting one question from each of the sections A, B, C & D of the question paper and all the subparts of the questions in Section E. Use of non-programmable calculators is allowed.

Section-A
Basic Concepts of Vibrations: Importance and scope, definition and terminology, representation of harmonic motions, introduction to various types of vibrations and types of excitation.

Section-B
Single Degree of Freedom Systems:
a)   Undamped Free Vibrations: D Alemberts 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, sub- critical, critical and overdamping, logarithomic 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.

Section-C
Two Degree of Freedom Systems:
a)   Undamped Fee Vibrations: Normal modes vibrations, natural frequencies, mode shapes, forced harmonic vibrations, torsional vibrations of two rotor systems.
b)   Applications: Dynamic vibration absorber, centrifugal pendulum absorber, torsional vibration absorber, untuned vibration damper, gyroscopic effect on rotating shaft.

Section-D

Multi-Degree of Freedom Systems:
Undamped free vibrations: Reciprocity theorem, Rayleigh and Dunkerley 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.

Text Books:

1. Mechanical Vibration by S.S. Rattan, Tata McGraw Hill.
2. Mechanical Vibrations by Nag, Wiley India.

Reference Books:

1. Mechanical Vibration by V.P. Singh, Dhanpat Rai Publications.
2. Mechanical Vibration by G.K. Grover, Nem Chand & Bros, Roorkee, India.
3. Mechanical Vibration by S.S.Rao, Pearsons Education.
4. Vibration and Noise for Engineers by Kewal Pujara, Dhanpat Rai Publications.

SEMESTER – VII
VEHICLE MAINTENANCE   AU- 412

Course Code	AU- 412	L-4, T-0, P-0	
Name of the Course	**Vehicle Maintenance**		
Lectures to be delivered	**65 (1 Hr Each) (L = 52, T = 13 for each semester)**		
Semester End Examination	**Max. Time: 3 hrs.**	**Max. Marks: 100**	**Min. Pass Marks:40**
Continuous Assessment (based on sessional tests 50%, Tutorials/Assignments 30%, Quiz/Seminar 10%. Attendance 10%)	**Max. Marks: 50**		

INSTRUCTIONS:
1. For Paper Setters: The question paper will consist of five sections A, B, C, D & E. Section A, B, C & D will have two questions from the respective sections of the syllabus and each section will carry 20% of the total marks of the semester end examination for the course. Section E will be compulsory, it will consist of a single question with 10-20 subparts of short answer type, which will cover the entire syllabus and each question will carry 20% of the total marks of the semester end examination for the course.

2. For candidates: Candidates are required to attempt five questions in all selecting one question from each of the sections A, B, C & D of the question paper and all the subparts of the questions in Section E. Use of non-programmable calculators is allowed.

SYLLABUS:
Section A
Automobile maintenance: Importance of maintenance, scheduled and unscheduled maintenance. preparation of check lists, analysis of breakdown, preventive measures, unit replacement system, maintenance schedule, chassis lubrication schedule, component retrieval, estimating repair cost, maintenance record, warranty period, servicing. Inspection forms. Log books. Trip sheets. Other maintenance record forms. Garage practice : Types of service station/garage, layout of garage. Factors affecting layout, tools & equipments, transport service undertakings, design a layout for different garage. 8

Section B
Engine Maintenance : Dismantling of engine components, cleaning methods, visual inspection and dimensional check of various engine components, minor and major tune up, reconditioning and repairing methods of engine components. Assembly procedure, special tools used for maintenance, repair and overhauling. Cooling Systems-Anti corrosion and antifreeze solutions, radiator, and thermostat. Lubrication oil topping up, oil change, oil relief valve; fuel feed systems, FIP adjustment and testing, injector testing.

Section C
Chassis and drive line maintenance: Mechanical automotive type gear box- mechanical automatic types. Final reduction, propeller shaft, front and rear suspension systems, brake systems-hydraulic, servo, air. Air bleeding, steering system, axles, wheel alignment-tires. 7

Electric system maintenance : Battery testing method, starter motor, charging system - a DC generator, AC alternator, regulator, ignition system- coil ignition, transistor assisted ignition, capacitor discharge ignition .Electric horn, wiper motor, flasher, electric fuel pump, gauges. Lighting system- head lights focusing. Wiring harness testing.

Section D

Body repair : Minor body panel beating, tinkering, shouldering.

Painting : Introduction of automotive paints, types of paints, corrosion and anticorrosion method, rubbing polishing, working of paint booth, door lock mechanism, window glass actuation mechanism.

TEXT BOOK:
1. John Doke "Fleet Management", McGraw-Hill Co. 1984.
2. Maleev. V.L., "Diesel Engine operation and Maintenance", Maintenance, McGraw Hill book Co., New York, 1954.

REFERENCES:
1. Judge. A.N., "Motor vehicle engine servicing, 3rd, Edition", Pitman Paperpack, London, 69.
2. Judge. A.W., "Maintenance of High speed diesel engines", Chapman Hall Ltd., London, 56.
3. John. W.Vale.J.R., "Modern Aut Body and Finder repair".
4. Venk. Spicer. "Automotive Maintenance and Trouble shooting".
5. "Vehicle Service Manuals of reputed manufactures. "

SEMESTER – VII
AUTOMOTIVE TRANSMISSIONS   AU- 413

Course Code	**AU- 413**	L-4, T-1, P-0	
Name of the Course	**Automotive Transmissions**		
Lectures to be delivered	**65 (1 Hr Each) (L = 52, T = 13 for each semester)**		
Semester End Examination	**Max. Time: 3 hrs.**	**Max. Marks: 100**	**Min. Pass Marks:40**
Continuous Assessment (based on sessional tests 50%, Tutorials/Assignments 30%, Quiz/Seminar 10%, Attendance 10%)	**Max. Marks: 50**		

INSTRUCTIONS:

1. For Paper Setters: The question paper will consist of five sections A, B, C, D & E. Section A, B, C & D will have two questions from the respective sections of the syllabus and each section will carry 20% of the total marks of the semester end examination for the course. Section E will be compulsory, it will consist of a single question with 10-20 subparts of short answer type, which will cover the entire syllabus and each question will carry 20% of the total marks of the semester end examination for the course.

2. For candidates: Candidates are required to attempt five questions in all selecting one question from each of the sections A, B, C & D of the question paper and all the subparts of the questions in Section E. Use of non-programmable calculators is allowed.

SYLLABUS:
Section A

Introduction

Need for Transmission system. Tractive Effort and Resistances to Motion of a vehicle. Requirements of transmission system. Classification of Transmission systems. Single, Two or Four Wheel drive systems. Multi axle drives. Chain, Shaft and Electric drives. Location of transmission system. Different transmissions in scooter, car, MUVs and transport vehicles of Indian make.

Clutch

Principle of operation, Constructional details, torque capacity and design aspects. Different types of clutches. Operation of single plate: helical spring and diaphragm type, and multiplate clutch. Centrifugal and Automatic Clutch. Dry and Wet type of clutch. Friction lining materials. Over-running clutch. Modes of operating a clutch – mechanical, hydraulic and electric.

Section B

Gear box

Determination of gear ratios for vehicles. Performance characteristics in different speeds. Different types of gear boxes – sliding, constant and synchromesh type. Need for double declutching and working of synchronizing unit. Power and economy modes in gearbox. Transfer box. Transaxles. Overdrives. Gear shifting mechanisms – mechanical link and wire types

Section C

Hydrodynamic drive

Fluid coupling- principle of operation, constructional details. Torque capacity. Performance characteristics, Reduction of drag torque. Torque converter-Principle of operation, constructional details, performance characteristics, converter coupling, multistage torque converters and Polyphase torque converters.

Hydrostatic drive

Hydrostatic drive - Various types of hydrostatic systems - Principles of hydrostatic drive system, Advantage and limitations, Comparison of hydrostatic drive with hydrodynamic drive - Construction and working of typical Janny hydrostatic drive.

Section D

Electric drive

Electric drive Principle of early and modified Ward Leonard Control system. Advantage & limitations. Performance characteristics. Study of drive system in an electric and hybrid vehicle.

Automatic transmission applications

Chevrolet "Turboglide" Transmission, Powerglide Transmission Toyota "ECT-i" Automatic Transmission with Intelligent Electronic controls system, Hydraulic Actuation system.

References:
1. Heldt.P.M., " Torque converters ", Chilton Book Co.
2. Newton and Steeds, " Motor vehicles ", llliffe Publishers.
3. Judge.A.W., " Modern Transmission systems ", Chapman and Hall Ltd.
4. SAE Transactions 900550 & 930910.
5." Hydrostatic transmissions for vehicle applications", I Mech E Conference,1981-88.
6. Crouse. W.H., Anglin., D.L., " Automotive Transmission and Power Trains construction ", McGraw-Hill.
7. Automobile Engineering Vol-1 by Kirpal Singh.

SEMESTER – VII
OPERATIONS RESEARCH   ME – 415

Course Code	**ME – 415**	L-4, T-1, P-0	
Name of the Course	**Operations Research**		
Lectures to be delivered	**65 (1 Hr Each) (L = 52, T = 13 for each semester)**		
Semester End Examination	**Max. Time: 3 hrs.**	**Max. Marks: 100**	**Min. Pass Marks:40**
Continuous Assessment (based on sessional tests 50%, Tutorials/Assignments 30%, Quiz/Seminar 10%, Attendance 10%)	**Max. Marks: 50**		

INSTRUCTIONS:

1.**For Paper Setters:** The question paper will consist of five sections A, B, C, D & E. Section A, B, C & D will have two questions from the respective sections of the syllabus and each section will carry 20% of the total marks of the semester end examination for the course. Section E will be compulsory, it will consist of a single question with 10-20 subparts of short answer type, which will cover the entire syllabus and each question will carry 20% of the total marks of the semester end examination for the course.

2. **For candidates:** Candidates are required to attempt five questions in all selecting one question from each of the sections A, B, C & D of the question paper and all the subparts of the questions in Section E. Use of non-programmable calculators is allowed.

SYLLABUS:

Section-A

Definition and characteristics of 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.

Section-B

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.

Graphical and simplex techniques to solve linear models, modifications of minimization situation so as to be solvable by simplex method. Duality and degeneracy in simplex method. Applications and limitations of linear optimization models

Section-C

Net-work 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.

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.

Section-D

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.

(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.   An Introduction to Operation Research by A.H.Taha, Tata McGraw Hill.
2.   Operations Research by Prem Kumar Gupta and D.S.Hira, S.Chand Publications.

Reference Books:
1.   Operations Research by Manohar Prasad, Dhanpat Rai Publications
2.   Operations Research by Swarup, Kanti, Gupta, P.K. and Manmohan, Sultan Chand & Sons.

SEMESTER – VII
VEHICLE MAINTENANCE LAB.   AU- 412 (P)

Course Code	AU- 412 (P)	L-0, T-0, P-2	
Name of the Course	**Vehicle Maintenance Lab.**		
Lectures to be delivered	**26 hours of Lab sessions (2 Hrs per week)**		
Semester End Examination	**Max. Marks: 25**	**Min. Pass Marks: 10**	**Maximum Time: 3 Hrs**
Continuous Assessment	**Lab work 30%, Lab record 25%, Viva 25%, Attendance 20%**	**Max. Marks: 25**	

INSTRUCTIONS FOR PAPER SETTER/CANDIDATES:

Laboratory examination will consist of two parts:
i)   Performing a practical examination assigned by the examiner. ii)   Viva-voce examination.
Viva-voce examination will be related to the practical's performed/projects executed by the candidate related to the paper during the course of the semester.

LIST OF EXPERIMENTS:

1.   Study and practice on service station equipments and their specifications and servicing of vehicles.
2.   Study of the faults in the electrical systems such as headlights, side or parking lights, trafficator lights, electric horn, starter and charging system, wind screen wiper.
3.   Simple tinkering and soldering works of body panel, study of door lock and window glass rising mechanisms.
4.   Adjustment of pedal play in clutch, brake and hand brake lever and steering wheel play; air bleeding from hydraulic brakes and diesel fuel system
5.   Wheel bearing, tightening and adjustment.
6.   Removal and fitting of tires and tubes.
7.   Drawing of general wiring diagram of various vehicles, like mopeds, scooters, motorcycles, cars.

SEMESTER – VII
AUTOMOTIVE TRANSMISSIONS   AU- 413 (P)

Course Code	**AU- 413 (P)**	L-0, T-0, P-2	
Name of the Course	**Automotive Transmissions Lab.**		
Lectures to be delivered	**26 hours of Lab sessions (2 Hrs per week)**		
Semester End Examination	**Max. Marks: 25**	**Min. Pass Marks: 10**	**Maximum Time: 3 Hrs**
Continuous Assessment	**Lab work 30%, Lab record 25%, Viva 25%, Attendance 20%**	**Max. Marks: 25**	

INSTRUCTIONS FOR PAPER SETTER/CANDIDATES:

Laboratory examination will consist of two parts:
i)   Performing a practical examination assigned by the examiner. ii)   Viva-voce examination.
Viva-voce examination will be related to the practical's performed/projects executed by the candidate related to the paper during the course of the semester.

LIST OF EXPERIMENTS:

1.   Technical Specification of two and four wheeled (Petrol and diesel) vehicle and trouble shooting chart of all the chassis and transmission components.
2.   Dismantling and assembly of chassis and transmission component by using special tools measurement and comparison like clutches, gearboxes, propeller shafts, differential gearbox, steering mechanism and braking system, inspection for wear and tear, crack breakdown, servicing and cleaning and necessary adjustments.
3.   Calculation of gear ratios of respective assemblies.
4.   Study of torque converter.
5.   Study of janny hydrostatic drive.
6.   Study of Ward Leonard control system

SEMESTER – VIII
COMPUTER AIDED DESIGN AND MANUFACTURING   ME – 422

Course Code	**ME – 422**	L-4, T-1, P-0		
Name of the Course	**Computer Aided Design and Manufacturing**			
Lectures to be delivered	**65 (1 Hr Each) (L = 52, T = 13 for each semester)**			
Semester End Examination	**Max. Time: 3 hrs.**	**Max. Marks: 100**	**Min. Pass Marks:40**	
Continuous Assessment (based on sessional tests 50%, Tutorials/Assignments 30%, Quiz/Seminar 10%, Attendance 10%)	**Max. Marks: 50**			

INSTRUCTIONS:

1.   **For Paper Setters:** The question paper will consist of five sections A, B, C, D & E.Section A, B, C & D will have two questions from the respective sections of the syllabus and each section will carry 20% of the total marks of the semester end examination for the course. Section E will be compulsory, it will consist of a single question with 10-20 subparts of short answer type, which will cover the entire syllabus and each question will carry 20% of the total marks of the semester end examination for the course.

2.   **For candidates:** Candidates are required to attempt five questions in all selecting one question from each of the sections A, B, C & D of the question paper and all the subparts of the questions in Section E. Use of non-programmable calculators is allowed.

SYLLABUS:
Section-A

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: Basics of geometric and solid modeling coordinate systems. 2-D and 3-D Wire Frame Models, Hardware for drafting Packages, Command and Menu Driven Softwares, Features of a Drafting Package, Drawing Utilities, Entities, Edit Commands, Blocks and Symbols, Viewports.

Section-B

Curves, Surfaces and Solids: Algebraic and geometric forms, tangents and normal, blending functions reparametrization, 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.

Section-C

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.

Section-D

Group Technology: Part families, part classification and coding, 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, Procedure,

Text Books:

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

Reference Books:

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

SEMESTER – VIII
TRANSPORT MANAGEMENT   AU – 422

Course Code	**AU – 422**	L-3, T-1, P-0	
Name of the Course	**Transport Management**		
Lectures to be delivered	**52 (1 Hr Each) (L = 39, T = 13 for each semester)**		
Semester End Examination	**Max. Time: 3 hrs.**	**Max. Marks: 100**	**Min. Pass Marks: 40**
Continuous Assessment Tutorials/Assignments 30%, Quiz/Seminar 10%, Attendance 10%)	(based on sessional tests 50%,		**Max. Marks: 50**

INSTRUCTIONS:

1.   **For Paper Setters:** The question paper will consist of five sections A, B, C, D & E. Section A, B, C & D will have two questions from the respective sections of the syllabus and each section will carry 20% of the total marks of the semester end examination for the course. Section E will be compulsory, it will consist of a single question with 10-20 subparts of short answer type, which will cover the entire syllabus and each question will carry 20% of the total marks of the semester end examination for the course.

2.   **For candidates:** Candidates are required to attempt five questions in all selecting one question from each of the sections A, B, C & D of the question paper and all the subparts of the questions in Section E. Use of non-programmable calculators is allowed.

SYLLABUS:
Section A
Historical Back ground: Introduction, the growth of a network, trams, trolley buses, private car's subsidies The Infrastructure: Road- Approach Road. Highways National, State, District, traffic condition, relief of congestion, pedestrians, zebra lines, margins, shopping centres. Bus-stops, shelters. Bus stations. Garages layout of premises, equipment, use of machinery, conveyance of staff, facilities for passengers. Maintenance preventive, breakdown, overhauling -major, minor.

Section B
Organisation and Management: Forms of ownership, principle of transport, management – internal organisation, centralised condition, decentralised condition (Engineering, traffic and administration), staff administration: industrial relation, administration, recruitment and training, welfare, health and safety. Public relations divisions: Dissemination of information, maintaining goodwill- handling complaints, traffic advisory, committees- local contractors co-operation with the press news and articles- facilities for visitors- forms of publicity importance of quality -inter departmental liaison advertisements, signs, notice and directions general appearance of premises, specialized publicity.

Section C
Prevention of accidents: Emphasis of safe driving-annual awards bonus encouragement vehicle design platform, layout, location of steps, scheduled route hazards records elimination of accident prone devices. Route planning: Source of traffic, town planning, turning paints, stopping places, shelters survey of route preliminary schedule test runs elimination of hazards factors affecting. Frequency direction of traffic flow estimated traffic possibility single verses double deck. Timing, bus working and schedules: Time table layout uses of flat graph method of presentation preparation of vehicle and crew schedule preparation of the duty roster, co-operation with employers use of the vehicle running numbering determination of vehicle

efficiency, checking efficiency of crew, duty arrangements. Fare collections systems: Principles of collection the way bill, bell punch system reduced ticket stocks wilk brew system T.I.M and straight M/C/S. The verometer lenson parason coach tickets exchanges, box system personal and common stock flat fare platform control.

Section D

The fare structure: Basis of fares historical background effects of competition and control calculating average zone system straight and tapered scale elastic and inelastic demand coordination of fares concessions fares changes for workman. Anomalies double booking inter availability through booking and summation private hire charges. Operating cost and types of vehicles: Classification costs, average speed running costs supplementary costs depreciation obsolescence, life of vehicles sinking fund factor affecting post per vehicles mile incidence of wages and overheads 100 seats miles basis, average seating capacity vehicles size and spread overs, types of vehicle economic considerations authorization of trolley, bus services, statuary procedure taxes and hire cars.

TEXTBOOKS:
1. Bus operation -L.d kitchen, iliffe & sons
2. Bus & coach operation -Rex w. fautks. butterworth version of 1987

SEMESTER – VIII
MECHATRONICS ME-424

Course Code	**ME – 424**	L-3, T-1, P-0	
Name of the Course	**Mechatronics**		
Lectures to be delivered	**52 (1 Hr Each) (L = 39, T = 13 for each semester)**		
Semester End Examination	**Max. Time: 3 hrs.**	**Max. Marks: 100**	**Min. Pass Marks:40**
Continuous Assessment (based on sessional tests 50%, Tutorials/Assignments 30%, Quiz/Seminar 10%, Attendance 10%)	**Max. Marks: 50**		

INSTRUCTIONS:

1. **For Paper Setters:** The question paper will consist of five sections A, B, C, D & E. Section A, B, C & D will have two questions from the respective sections of the syllabus and each section will carry 20% of the total marks of the semester end examination for the course. Section E will be compulsory, it will consist of a single question with 10-20 subparts of short answer type, which will cover the entire syllabus and each question will carry 20% of the total marks of the semester end examination for the course.

2. **For candidates:** Candidates are required to attempt five questions in all selecting one question from each of the sections A, B, C & D of the question paper and all the subparts of the questions in Section E. Use of non-programmable calculators is allowed.

SYLLABUS:
Section-A
Introduction and Basics: What is Mechatronics?; A Measurement System with its constituent elements; Open and Closed Loop System; Sequential Controllers; Micro-processor Based Controller; The Mechatronic Approach

Section-B
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, Ratehet & Pawl. Belt & Chain Drivers, Bearings. Mechanical aspect of Motor Selection; Electrical Systems; Mechanical & Solid State Switches; Solenoids; D.C. & A.C. Motors; Stepper Motors.

Section-C
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.

Section-D

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.

Text Books:

1. Mechatronics by W. Bolton – Pearsons Education.
2. Mechatronics- Ramachandran, Vijaraghavan – Wiley India.

Reference Book:

1. Introduction to Mechatronics and Measuring System - David G. Alciation and Michal B. Hist Tata McGraw Hill.

SEMESTER – VIII
COMPUTER AIDED DESIGN LAB.   ME – 422 (P)

Course Code	ME–422 (P)	L-0, T-0, P-2	
Name of the Course	**Computer Aided Design Lab.**		
Lectures to be delivered	**26 hours of Lab sessions (2 Hrs per week)**		
Semester End Examination	**Max. Marks: 25**	**Min. Pass Marks: 10**	**Maximum Time: 3 Hrs**
Continuous Assessment	**Lab work 30%, Lab record 25%, Viva 25%, Attendance 20%**		**Max. Marks: 25**

INSTRUCTIONS FOR PAPER SETTER/CANDIDATES:

Laboratory examination will consist of two parts:
i)   Performing a practical examination assigned by the examiner. ii)   Viva-voce examination.
Viva-voce examination will be related to the practical's performed/projects executed by the candidate related to the paper during the course of 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 various components of the valve.

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

5.   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.

6.   Draw 3D model of Plummer Block.

7.   Draw 3D model of Universal Joint.

8.   Any project on 3d modelling with animation.

Notes: Any 2-D and 3-D software may be used to get the desired output. At Least Six Experiments should be preformed from the above list. Remaining TWO Experiments may be designed and set by the concerned Institution as per the scope of the syllabus.

DEPARTMENTAL ELECTIVE – I

Departmental Elective-I will be **offered by the respective department.**

Sr. No.	Departmental Elective-I	Subject Code
1.	Automotive Chassis & Suspensions	AU-411 (a)
2.	Aerodynamics of Automobile Vehicles	AU-411 (b)
3.	Vehicle Body Engineering	AU-411 (c)
4.	Robotics Engineering	AU-411 (d)
5.	Total Quality Control	AU-411 (e)

SEMESTER – VII
AUTOMOTIVE CHASSIS & SUSPENSIONS   AU – 411 (a)

Course Code	AU – 411 (a)	L-3, T-0, P-0	
Name of the Course	**Automotive Chassis & Suspensions**		
Lectures to be delivered	**39 (1 Hr Each) (L = 39 for each semester)**		
Semester End Examination	**Max. Time: 3 hrs.**	**Max. Marks: 100**	**Min. Pass Marks:40**
Continuous Assessment (based on sessional tests 50%, Tutorials/Assignments 30%, Quiz/Seminar 10%, Attendance 10%)	**Max. Marks: 50**		

INSTRUCTIONS:
1. For Paper Setters: The question paper will consist of five sections A, B, C, D & E. Section A, B, C & D will have two questions from the respective sections of the syllabus and each section will carry 20% of the total marks of the semester end examination for the course. Section E will be compulsory, it will consist of a single question with 10-20 subparts of short answer type, which will cover the entire syllabus and each question will carry 20% of the total marks of the semester end examination for the course.

2. For candidates: Candidates are required to attempt five questions in all selecting one question from each of the sections A, B, C & D of the question paper and all the subparts of the questions in Section E. Use of non-programmable calculators is allowed.

SYLLABUS:
Section A
Introduction : Types of chassis, chassis layout, vehicle body, chassis lubrication, four wheel drive, transfer box rear engine vehicles. Materials of chassis and body. Vibration dampers.

Propeller shaft & universal joints : torque tube & Hotchkiss drive, hook's types universal joint, shaft whirling, C.V. joint, divided propeller shaft, rubber universal coupling, slip joint.

Final drive & rear Axle : purpose of differential, construction and working, non slip differential, chain sprocket final drive, cone pulleys. Live & dead axles. Fully floating, semi floating & three quarter floating axles, uses.

Steering System : types of steering system, Ackermann principle, davis steering gears, system components, steering gear boxes. Rack and pinion steering gear, types of steering linkages, power steering wheel geometry, caster, camber, toe-in, toe-out, wheel alignment, balancing

Section B
Brakes : types of brake, mechanical, hydraulic, pneumatic brakes, disc and drum brakes, self energizing brakes,engine brakes, brake system components, valves, caliper, and brake shoes.

Suspension : purpose, front and rear suspension, two & 4 wheel independent suspension. Suspension systemcomponents, leaf springs, coil springs, dampers, torsion bars. MacPhreson strut, stabilizer bars, arms etc. Air suspension system. Types of front and rear suspension system.

Section C

Wheel & tyres. : Types of wheels, construction, wired wheels, tyres, construction, types, radial, bias & belted bias, comparison, slip angle, under and over steering, tread patterns, tyre re-treading cold and hot, tyre specification tubeless tyre. **Transmission requirements** : Requirements of transmission system, general arrangements for power transmission for front engine, rear engine vehicle, four wheel drive vehicle, dead axle and axle less transmission.

Clutch : Single plate, multi plate clutch, centrifugal clutch, electromagnetic clutch, constructional details, torque apacity and clutch friction materials.

Gear Box : Requirements of gear box, sliding mesh gear box, constant mesh gear box synchromesh gear box, epicyclic gear box, velocity ratio and gear ratio for vehicle, performance characteristics in different speed, overdrive .

Section D

Fluid Coupling: principle of operation, constructional details, torque capacity and performance curve. **Torque converter** : principle of operation, constructional details, torque capacity and performance curve. Multistage torque converter, converter fluid.

Hydrostatic drive : Various types of hydrostatic system, working principle of hydrostatic system, advantage and limitations, Jenny hydrostatic drive, comparison of hydrostatic and hydrodynamic drive. **Electric drive** : Principle of electric drive, Early ward leonard control system, Modify Leonard control system, advantage of electric drive, limitation of electric drive.

Automatic Transmission : Need for automatic Transmission, Chevrolet turbo glide transmission system, torque Flite, Automatic transmission fluid, effect of automatic transmission on vehicle performance and fuel economy.

Text Book
1. "Automobile engineering", Dr. Kripal Singh.
2. Automobile engineering" K.M. Gupta.
3. Heldt P.M., "Automotive chassis", Chilton Co., New York.
4. Giles J.G., "Steering, Suspension and tyres", Iliffe Book Co., London.

SEMESTER – VII
AERODYNAMICS OF AUTOMOBILE VEHICLES   AU-411 (b)

Course Code	AU – 411 (b)	L-3, T-0, P-0	
Name of the Course	**Aerodynamics of Automobile Vehicles**		
Lectures to be delivered	**39 (1 Hr Each) (L = 39 for each semester)**		
Semester End Examination	**Max. Time: 3 hrs.**	**Max. Marks: 100**	**Min. Pass Marks:40**
Continuous Assessment (based on sessional tests 50%, Tutorials/Assignments 30%, Quiz/Seminar 10%, Attendance 10%)	**Max. Marks: 50**		

INSTRUCTIONS:
1.   **For Paper Setters:** The question paper will consist of five sections A, B, C, D & E. Section A, B, C & D will have two questions from the respective sections of the syllabus and each section will carry 20% of the total marks of the semester end examination for the course. Section E will be compulsory, it will consist of a single question with 10-20 subparts of short answer type, which will cover the entire syllabus and each question will carry 20% of the total marks of the semester end examination for the course.

2.   **For candidates:** Candidates are required to attempt five questions in all selecting one question from each of the sections A, B, C & D of the question paper and all the subparts of the questions in Section E. Use of non-programmable calculators is allowed.

SYLLABUS:
Section A
INTRODUCTION
Scope, historical development trends, Fundamental of fluid mechanics, Flow phenomenon related to vehicles, External & Internal flow problem, Resistance to vehicle motion, Performance, Fuel consumption and performance, Potential of vehicle aerodynamics.

Section B
AERODYNAMIC DRAG OF CARS
Cars as a bluff body, Flow field around car, drag force, types of drag force, analysis of aerodynamic drag, drag coefficient of cars, strategies for aerodynamic development, low drag profiles.

SHAPE OPTIMIZATION OF CARS
Front end modification, front and rear wind shield angle, Boat tailing, Hatch back, fast back and square back, Dust flow patterns at the rear, Effects of gap configuration, effect of fasteners.

Section C
VEHICLE HANDLING
The origin of forces and moments on a vehicle, side wind problems, methods to calculate forces and moments, vehicle dynamics Under side winds, the effects of forces and moments, Characteristics of forces and moments, Dirt accumulation on the vehicle, wind noise, drag reduction in commercial vehicles.

Section D
WIND TUNNELS FOR AUTOMOTIVE AERODYNAMIC

Introduction, Principle of wind tunnel technology, Limitation of simulation, Stress with scale models, full scale wind tunnels, measurement techniques, Equipment and transducers, road testing methods, Numerical methods.

Text Books:

1. Hucho.W.H., " Aerodynamic of Road vehicles ", Butterworths Co. Ltd., 1997.
2. Pope. A., " Wind Tunnel Testing ", John Wiley & Sons, 2nd Edn, New York, 1974.
3. Automotive Aerodynamic : Update SP-706, SAE, 1987nt: Controlling Noise and Vibration in Road Vehicles, SAE

SEMESTER - VII
VEHICLE BODY ENGINEERING   AU-411 (c)

Course Code	AU – 411 (c)	L-3, T-0, P-0	
Name of the Course	**Vehicle Body Engineering**		
Lectures to be delivered	**39 (1 Hr Each) (L = 39 for each semester)**		
Semester End Examination	**Max. Time: 3 hrs.**	**Max. Marks: 100**	**Min. Pass Marks:40**
Continuous Assessment (based on sessional tests 50%, Tutorials/Assignments 30%, Quiz/Seminar 10%, Attendance 10%)	**Max. Marks: 50**		

INSTRUCTIONS:

1.   **For Paper Setters:** The question paper will consist of five sections A, B, C, D & E. Section A, B, C & D will have two questions from the respective sections of the syllabus and each section will carry 20% of the total marks of the semester end examination for the course. Section E will be compulsory, it will consist of a single question with 10-20 subparts of short answer type, which will cover the entire syllabus and each question will carry 20% of the total marks of the semester end examination for the course.

2.   **For candidates:** Candidates are required to attempt five questions in all selecting one question from each of the sections A, B, C & D of the question paper and all the subparts of the questions in Section E. Use of non-programmable calculators is allowed.

SYLLABUS:
Section A
Structural materials: Aluminum alloy sheet, extrusion and casting, Austenitic and Ferritic stainless steels, alloy steels. Different types of composites, FRP & metal Matrix Composites. Structural timbers properties designing in GRP and high strength composites different manufacturing techniques of composites. Thermo plastics, ABS and styrenes. Load bearing plastics, semi rigid PUR foams and sandwich panel construction

Section B
Shaping and packaging: Product design and concepts, Aesthetics and industrial design, formal aesthetics and shape, computer aided drafting, surface development, interior ergonomics, ergonomics system design, dashboard instruments, advances in electronic display, CV legal dimension. CV-cab ergonomics, mechanical packagelayout. Body Fitting and I Controls: Driver's seat, window winding mechanism, Door lock mechanism, other interior mechanisms, driver's visibility' and tests for, visibility, minimum space, requirements and methods or improving space in cars, electric wiring and electronic control systems, advanced body electronics, networking or body systems controls.

Section C
Aerodynamics: Basics, aerofoils, aerodynamics drag lift, pitching, yawing and rolling moments, determination of aerodynamic coefficients (wind tunnel testing), racing car aerodynamics, bluff body aerodynamics, local air flows. Load Distribution: Types of load carrying structures -closed, integral, open, flat types. Calculation of loading cases-static, asymmetric, vertical loads. Load distribution, stress analysis of structure, body shell analysis.

Section D

Noise, Vibration, Harshness: Noise and vibration basics, body structural vibrations, chasis bearing vibration, designing against fatigue, rubber as an isolator. CV body mountings, automatic enclosures, sandwich panels, structure dynamics applied, surety under impact: Impact protection basics, design for crash worthiness, occupant and cargo restraints. Passive restraint systems, slide impact analysis, bumper system, energy absorbant foams, laws of mechanisms applied 10 safety. Vehicle stability: Steering geometry vehicle and a curvilinear path, and lateral stability, effects of tyre factors, mass distribution and engine location on stability. Vans, trucks and buses: Types of mini coach with trailers, single and double deckers, design criteria based on passenger capacity, goods to be transported and distance to be Covered, constructional details: weights and dimensions, conventional and integral type.

TEXTBOOKS:
1. Body Engineering -Sydney F Page
2. Vehicle body engineering -Giles J Pawlowski,

REFERENCES:
1. Automotive chassis -P.M. Heldt. chilton & Co
2. Handbook on vehicle body design -SAE Publications.

SEMESTER – VII
ROBOTICS   AU-411 (d)

Course Code	**AU – 411 (d)**	L-3, T-0, P-0	
Name of the Course	**Robotics Engineering**		
Lectures to be delivered	**39 (1 Hr Each) (L = 39 for each semester)**		
Semester End Examination	**Max. Time: 3 hrs.**	**Max. Marks: 100**	**Min. Pass Marks:40**
Continuous Assessment (based on sessional tests 50%, Tutorials/Assignments 30%, Quiz/Seminar 10%. Attendance 10%)	**Max. Marks: 50**		

INSTRUCTIONS:

1.   **For Paper Setters:** The question paper will consist of five sections A, B, C, D & E. Section A, B, C & D will have two questions from the respective sections of the syllabus and each section will carry 20% of the total marks of the semester end examination for the course. Section E will be compulsory, it will consist of a single question with 10-20 subparts of short answer type, which will cover the entire syllabus and each question will carry 20% of the total marks of the semester end examination for the course.

2.   **For candidates:** Candidates are required to attempt five questions in all selecting one question from each of the sections A, B, C & D of the question paper and all the subparts of the questions in Section E. Use of non-programmable calculators is allowed.

SYLLABUS: Section-A
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.

Section-B
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.

Section-C
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 singularties; generalised inverses; resolved motion rate control; n>6; rate control of reuntant rebots: n>6: rate control using (1)–inverse, the manipulator jacobian.

Section-D

Manipulator dynamics: Lagranges equation; kinetic & potential energy; generalized force; laqranges 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; linear feedback system; single axis PID control; PD gravity control; computer – torque control; variable structure control; impedance control.

Text Books:

1.   Fundamental of Robotics (analysis & control) by Robot J. Schilling Published by PHI, Pvt. Ltd., New Delhi.
2.   Introduction to Robotics (Mechanics & control) by John J.Craig Published by Pearsons.

Reference Books:

1.   Analysis Robotics & Mechatronics by Wolfram Stadler Published by McGraw Hill.
2.   Industrial Robotics – Technology programmer & application by Mikell P Grover, Weiss Nagel and Ordef Published by McGraw Hill.
3.   Foundations of Robotics (analysis and control) by Tsuneo Yashikawa Published by MIT Press.
4.   Robots and control – R.K. Mittal and Nagrath – Tata McGraw Hill New Delhi.

SEMESTER – VII
TOTAL QUALITY CONTROL   AU – 411 (e)

Course Code	**AU – 411 (e)**	L-3, T-0, P-0
Name of the Course	**Total Quality Control**	
Lectures to be delivered	**39 (1 Hr Each) (L = 39 for each semester)**	
Semester End Examination	**Max. Time: 3 hrs.**	**Max. Marks: 100** | **Min. Pass Marks:40**
Continuous Assessment (based on sessional tests 50%, Tutorials/Assignments 30%, Quiz/Seminar 10%, Attendance 10%)	**Max. Marks: 50**	

INSTRUCTIONS:

1.   **For Paper Setters:** The question paper will consist of five sections A, B, C, D & E. Section A, B, C & D will have two questions from the respective sections of the syllabus and each section will carry 20% of the total marks of the semester end examination for the course. Section E will be compulsory, it will consist of a single question with 10-20 subparts of short answer type, which will cover the entire syllabus and each question will carry 20% of the total marks of the semester end examination for the course.

2.   **For candidates:** Candidates are required to attempt five questions in all selecting one question from each of the sections A, B, C & D of the question paper and all the subparts of the questions in Section E. Use of non-programmable calculators is allowed.

SYLLABUS: Section-A
Quality Control: introduction, objectives, quality of design, quality of production, quality of conformance to design, quality of inspection, process monitoring, quality and productivity, quality cost Advantages of statistical Quality Control in Industry.

Fundamentals of Statistics and Probability in Quality Control: Events and probability, laws of probability, Statistical Distributions: Normal and Poisson distribution, their importance in SQC. Poisson Probability as approximation to Normal Probability, use of Normal and Poisson distribution tables.

Section-B
Control Charts for Variables: Fundamentals of process control, tool of process control, quality characteristic, Design and use of Control for Variables: Trial control limits, control limits for future use, revision of control limits. Cause and effect diagram. Inferences on the state of the process from control charts, Type I and Type II errors and methods to reduce them. Use of X (X bar) charts and R-charts, and R- charts, X (X bar) and σ- charts. Efficiency of a control chart. OC curve of a control chart. Computing average run length for X- chart.

Section-C
Trend Control Charts, Control Charts with Reject limits and Modified Control Charts: Introduction to Trend Control Charts, Control Charts with Reject limits and Modified Control Charts, Relationship between Specification Limits and Control Chart Limits, Process capability analysis and its importance in quality of conformance.

Section-D

Control Charts for Attributes: Defectives, control charts for fraction defectives and percent fraction defectives and number of defectives. Control charts for number of defects. Comparison of control charts for variables with the charts for variables with the charts for attributes. Computing Average run length for a p-chart.

Text Books:

1.   Quality control Application – By Hansen BL, PH: Prentice Hall of India.
2.   Statistical Quality Control – By E.L. Grant & R.S. Levenworth: Tata McGraw Hill.

Reference Books:

1.   Quality Control – Paranthaman, D; Tata McGraw Hill, India
2.   Quality Planning and Analysis- Juran J.M. and F.M. Gryna (Jr.); Tata McGraw Hill
3.   Total Quality Control – By Montgomery, D.C. John Wiley & Sons

Note: Statistical Q.C. Tables will be supplied in examination.

DEPARTMENTAL ELECTIVE-II

Departmental Elective-II will be **OFFERED BY THE RESPECTIVE DEPARTMENT**

Sr. No.	Departmental Elective-II	Subject Code
1.	Emerging Automotive Technologies	AU-421 (a)
2.	Earth Moving Equipments	AU-421 (b)
3.	Alternative Fuels	AU-421 (c)
4.	Advance IC Engines	AU-421 (d)
5.	Advanced Operations Research	AU-421 (e)

SEMESTER-VIII
EMERGING AUTOMOTIVE TECHNOLOGIES   **AU-421 (a)**

Course Code	**AU-421 (a)**	L-3, T-0, P-0	
Name of the Course	**Emerging Automotive Technologies**		
Lectures to be delivered	**39 (1 Hr Each) (L=39 for each semester)**		
Semester End Examination	**Max. Time: 3 hrs.**	**Max Marks:100**	**Min. Pass Marks:40**
Continuous Assessment (based on sessional tests 50 %, Tutorials Assignments 30%, Quiz/Seminars 10% Attendance 10%)		**Max. Marks:50**	

INSTRUCTIONS:

1. For Paper Setters: The question paper will consist of five sections A, B, C, D & E. Section A, B, C & D will have two questions from the respective sections of the syllabus and each section will carry 20% of the total marks of the semester end examination for the course. Section E will be compulsory, it will consist of a single question with 10-20 subparts of short answer type, which will cover the entire syllabus and each question will carry 20% of the total marks of the semester end examination for the course.

2. For candidates: Candidates are required to attempt five questions in all selecting one question from each of the sections A, B, C & D of the question paper and all the subparts of the questions in Section E. Use of non-programmable calculators is allowed.

SECTION – A
Fuel Cell Technology for Vehicles: What is fuel cell, Type of fuel cell, Advantage of fuel cell. Current state of the technology. Potential and challenges. Advantages and disadvantages of hydrogen fuel.

SECTION – B
Latest Engine Technology Features: Advances in diesel engine technology, Direct fuel injection Gasoline engine. Diesel particular emission control. Throttling by wire. Variable Valve Timing, Method used to effect variable Valve Timing. Electromagnetic Valves. Camless engine actuation.

42 Volt System: Need, benefits, potentials and challenges. Technology Implications for the Automotive Industry. Technological evolution that will occur as a result of the adoption of 42 volt systems.

SECTION – C
Electrical and Hybrid Vehicles: Types of hybrid systems, Objective and Advantages of hybrid systems. Current status, Future developments and prospects of Hybrid Vehicles.

Integrated Starter Alternator: Starts stop operation, Power Assist. Regenerative braking. Advanced lead acid batteries, Alkaline batteries, Lithium batteries, Development of new energy storage systems. Deep discharge and rapid charging ultra capacitors.

SECTION – D
X-By Wire Technology: What is X-By Wire, Advantage over hydraulic systems, Use of Automotive micro controllers, Types of censors. Use of actuators in an automobile environment.

Vehicle Systems: Constantly Variable Transmission, benefits, Brake by wire, Advantages over power Braking systems. Electrical assist. Steering, Steering by wire, Advantages of steering by wire. Semi-active and fully active suspension system. Advantages of fully active suspension system.

Text and Reference Books:

1. Advanced Vehicle technologies by Heinz Heisler – SAE International Publication.
2. Electric and Hybrid Electric Vehicles by Ronald K.Jurgen – SAE International Publication.
3. Batteries for Electric Vehicles by DAJ Rand, R.Woods and R.M.Dell – SAE International Publication.
4. Electronics Braking, Traction and Stability Control – SAE Hardboud papers.
5. Electronics steering and suspension systems – SAE Hardboud papers.
6. 42 Volt systems by Daniel J. Holt – SAE International Publication.
7. Diesel Particulate Emission by J. H. Johnson – SAE Hardboud papers.
8. Fuel Cell Technologies for Vehicles by Richard Stobart – SAE Hardboud papers.

SEMESTER-VIII
EARTH MOVING EQUIPMENTS   AU-421 (b)

Course Code	**AU-421 (b)**	L-3, T-0, P-0	
Name of the Course	**Earth Moving Equipments**		
Lectures to be delivered	**39 (1 Hr Each) (L=39 for each semester)**		
Semester End Examination	**Max. Time: 3 hrs.**	**Max Marks:100**	**Min. Pass Marks:40**
Continuous Assessment (based on sessional tests 50 %, Tutorials Assignments 30%, Quiz/Seminars 10% Attendance 10%)			**Max. Marks:50**

INSTRUCTIONS:
1.   **For Paper Setters:** The question paper will consist of five sections A, B, C, D & E. Section A, B, C & D will have two questions from the respective sections of the syllabus and each section will carry 20% of the total marks of the semester end examination for the course. Section E will be compulsory, it will consist of a single question with 10-20 subparts of short answer type, which will cover the entire syllabus and each question will carry 20% of the total marks of the semester end examination for the course.
2.   **For candidates:** Candidates are required to attempt five questions in all selecting one question from each of the sections A, B, C & D of the question paper and all the subparts of the questions in Section E. Use of non-programmable calculators is allowed.

SYLLABUS:
Section A
Fundamentals soil and machinery, equipments and operation, different types and purpose, System of Earth Moving Equipments:-
(a) Engine- All systems of engine and special features like automatic timer, turbochargers, after collars etc.
(b) Transmission- Basic types and planetary transmission constructional and working principles. Hydro shift automatic Trans torque converters, retarders, Trans hydraulic circuits and controls valves.
Section B
Hydraulics- Basic components of hydraulic systems like pumps (types), control valves, relief valves and hydraulic motors, hydraulic cylinders. Final Drive- Types of reductions, structure and function suspensions like hydraulic suspension.Brakes and Steering- Hydraulic power steering, main components and circuit.
Section C
Tyre brakes and components and functions. Under carriage- Tyre and tracked vehicle, advantages and disadvantages, tractor and components.

Section D
Earth Moving Equipments Management- Earth moving equipments maintenance- Type of maintenance schedules, purpose and advantages, organization set ups and documentation. Method of selection of equipments- selection of machine, basic rules of matching machine, selection of equipment including the nature of operation, selection based on type of soil, based on haul distance, based on weather condition.
Text Book
1. "Automobile engineering", Dr. Kripal Singh.
2. Automobile engineering" K.M. Gupta.

SEMESTER-VIII
ALTERNATIVE FUELS   AU-421 (c)

Course Code	**AU-421 (c)**	L-3, T-0, P-0	
Name of the Course	**Alternative Fuels**		
Lectures to be delivered	**39 (1 Hr Each) (L=39 for each semester)**		
Semester End Examination	**Max. Time: 3 hrs.**	**Max Marks:100**	**Min. Pass Marks:40**
Continuous Assessment (based on sessional tests 50 %, Tutorials Assignments 30%, Quiz/Seminars 10% Attendance 10%)		**Max. Marks:50**	

INSTRUCTIONS:

1. **For Paper Setters:** The question paper will consist of five sections A, B, C, D & E. Section A, B, C & D will have two questions from the respective sections of the syllabus and each section will carry 20% of the total marks of the semester end examination for the course. Section E will be compulsory, it will consist of a single question with 10-20 subparts of short answer type, which will cover the entire syllabus and each question will carry 20% of the total marks of the semester end examination for the course.

2. **For candidates:** Candidates are required to attempt five questions in all selecting one question from each of the sections A, B, C & D of the question paper and all the subparts of the questions in Section E. Use of non-programmable calculators is allowed.

SYLLABUS:
Section A

Introduction: Need for non conventional energy sources. Energy alternative : solar, photo-voltaic, Hydrogen, Bio mass. Electrical - their merits and demerits. Solar photo-voltaic conversion, Collection and storage of solar energy, collection devices, flat plate collectors, concentrating *type* collectors, principles and working of photo-voltaic Conversion, Applications to automobiles.

Section B

Energy from Bio mass: Photosynthesis, photosynthetic oxygen production, energy plantation. Bio gas production from organic waste, description of Bio gas plant, types of Bio gas plants, problems involved inproduction and transportation. Application of Bio gas in engines as a single fuel and dual fuel modification -Merits and demerits performance characteristics and their comparison. Hydrogen Energy: Properties of Hydrogen, sources of Hydrogen, Thermodynamics of water splitting Production of Hydrogen, Electrolysis of water. Thermal decomposition of water. Thermo-chemical production, Biochemical production.

Section C

Hydrogen fuel, Storage and Transportation methods, Applications to engines modifications necessary,precautions a«d safety measures - Performance characteristics in Engine and their comparision Electric Automobiles: Design considerations, limitations, opportunities for improvement Batteries, problems, future possibilities , capacities, types , material requirement, Applicability of electric cars, comparative use of fuel and energy. Availability of energy for recharging, impacts on use of fuel and energy .impact on urban air quality, impact on price, material requirement Traction motors and types.

Section D

Vegetable Oils: Various vegetable oils for engines-Esterification-Performance in engines-Performance and emission characteristics.Use of gas turbines in cars, arrangement, control merits and de- merits. Design of turbochargers for automobiles,their usefulness on the performance.

Text Books:
1. G.D. Rai "Non-conventional sources of energy Khanna Lab.
2. William Hamilton 'Electric Automobiles', PHI

Reference Books:
1. S.P. Sukhatme 'Solar Energy', Tata McGraw Hill
2. .S. Rao & B,B. Larulekar 'Energy Technology', Khanna Lab
3. Frank Kreith & Jan F. Krieder1 Principles of Solar Engineering1 McGraw Hill.
4. J.A. Duffie&W.A. Beckman 'Solar Energy -thermal Process' McGrawHill
5. T.N. Veziroglu. Alternative energy sources

SEMESTER – VIII
Advanced IC Engines   AU- 421(d)

Course Code	AU– 421 (d)	L-3, T-0, P-0	
Name of the Course	**Advanced IC Engines**	Lecturesto be delivered	**39(1HrEach) (L= 39 for each semester)**
Semester End exam	Max. Time:3 hrs.	Max. Marks:100	**Min.PassMarks: 40**
ContinuousAssessment(based on sessional tests 50%, Tutorials / Assignments 30% Quiz/Seminar 10 % Attendance 10%)			Max. Marks :50

INSTRUCTIONS:1. **For Paper Setters:** The question paper will consist of five sections A,B,C,D &E .Section A,B, C&D will have two questions from the respective sections of the syllabus and each section will carry 20% of the total marks of the semester end examination for the course. Section E will be compulsory, it will consist of a single question with 10-20 subparts of short answertype, which will cover the entire syllabus and each question will carry 20% of the total marks of thesemester end examinationfor thecourse.

2.   **For candidates:** Candidates are required to attempt five questions in all selecting one questionfromeachofthesectionsA,B,C&Dofthequestionpaperandallthesubpartsofthe questionsinSectionE. Use of non-programm able calculators is allowed.

SECTION:-A

COMBUSTION MODELLING :Basic concepts of engine simulation, governing equations, simulation of various engine processes for SI and CI engines. Adiabatic flame temperature, Heat release calculations. Thermodynamic and Fluid mechanic based models.

SECTION:- B

ADVANCES IN IC ENGINES:LHR engines, surface ignition concept and multi fuel engines, stratified charge and lean burn engines, performance and emission characteristics, merits and demerits.

ELECTRONIC ENGINE MANAGEMENT
Computer control of SI & CI engines for better performance and low emissions, closed loop control of engine parameters of fuel injection and ignition

SECTION:- C

ENGINE EXHAUST EMISSION CONTROL : Formation of NOX , HC/CO mechanism , Smoke and Particulate emissions, Green House Effect , Methods of controlling emissions , Three way catalytic converter andParticulate Trap, Emission (HC,CO, NO and NOX,)

measuring equipments, Smoke and Particulate measurement, Indian Driving Cycles and emission norms.

SECTION-D

RECENT TRENDS: Homogeneous Charge Compression Ignition Engine, Lean Burn Engine, Stratified Charge Engine, Surface Ignition Engine, Four Valve and Overhead cam Engines, Electronic Engine Management, Common Rail Direct Injection Diesel Engine, Gasoline Direct Injection Engine, Data Acquisition System –pressure pick up, charge amplifier PC for Combustion and Heat release analysis in Engines.

TEXT BOOK:

1. Heinz Heisler, 'Advanced Engine Technology," SAE International Publications, USA,1998
2. Ganesan V.." Internal Combustion Engines" , Third Edition, Tata Mcgraw-Hill ,2007

REFERENCES:

1. John B Heywood," Internal Combustion Engine Fundamentals", Tata McGraw-Hill 1988
2. Patterson D.J. and HeneinN.A,"Emissions from combustion engines and their control," Ann Arbor Science publishers Inc, USA, 1978
3. Gupta H.N, "Fundamentals of Internal Combustion Engines" ,Prentice Hall of India, 2006
4. UltrichAdler ," Automotive Electric / Electronic Systems, Published by Robert Bosh GmbH,1995

SEMESTER – VIII
ADVANCED OPERATIONS RESEARCH   AU – 421 (e)

Course Code	AU – 421 (e)	L-3, T-0, P-0	
Name of the Course	**Advanced Operations Research**		
Lectures to be delivered	**39 (1 Hr Each) (L = 39 for each semester)**		
Semester End Examination	**Max. Time: 3 hrs.**	**Max. Marks: 100**	**Min. Pass Marks: 40**
Continuous Assessment (based on sessional tests 50%, Tutorials/Assignments 30%, Quiz/Seminar 10%, Attendance 10%)		**Max. Marks: 50**	

INSTRUCTIONS:

1. **For Paper Setters:** The question paper will consist of five sections A, B, C, D & E. Section A, B, C & D will have two questions from the respective sections of the syllabus and each section will carry 20% of the total marks of the semester end examination for the course. Section E will be compulsory, it will consist of a single question with 10-20 subparts of short answer type, which will cover the entire syllabus and each question will carry 20% of the total marks of the semester end examination for the course.

2. **For candidates:** Candidates are required to attempt five questions in all selecting one question from each of the sections A, B, C & D of the question paper and all the subparts of the questions in Section E. Use of non-programmable calculators is allowed.

SYLLABUS:
Section-A
Introduction to Operations Research: Formulation of problems, simplex method problem of degenerals, dual simplex method revised simplex method, bounded variable problems.

Integer Programming: Graphical method, the branch and bound technique, Gomary's ALL-IPP method, transportation model, unbalance in transportation, transshipment problem, sensitivity analysis in transportation problems.

Section-B
Dynamic Programming: Bellman's principle of optimality, examples on the application on routing problem, inventory problem, simplex problem, marketing problem.
Network Analysis: PERT and CPM, probability of achieving completion data, cost analysis, graph reduction theory, updating, resource allocation, resource smoothing.

Section-C
Inventory Method: Variables in an inventory problem, inventory problem, inventory models with penalty, storage and quantity discount, safety stock, inventory models with probability, demand, multi item deterministic model.

Queuing Theory: Poison arrivals and exponential service times, waiting time and idle time cost, single channel multi channel problem. Monte technique applied to queuing problems, Poisson arrivals and service time.

Section-D

Decision Theory Game: Examples on the application of theory of games 2 XM and MX2 Problems, graphic dominance and linear programming method for different problems, decision trees.

Replacement Models: Replacement of items that deteriorate, gradually, fail suddenly, group placement policy, concept of system reliability.

Text Books:
1.   Kumar Gupta, Prem and Hira, D.S., "Operations Research", S Chand & Company Limited, 1986.
2.   Swarup, Kanti, Gupta, P.K. and Manmohan, "Operations Research", Sultan Chand & Sons, New Delhi 1988.

Reference Books:
1.   Srinath L.S., "PERT & CPM Principles and Applications", Affiliate East West Press (P) Limited, New Delhi, 1975.

OPEN ELECTIVE

Open Elective to be opted from list below but one which is NOT OFFERED BY HIS DEPARTMENT

Sr. No.	Open Elective	Sub. Code
1.	Energy Assessment and Auditing	EE-300
2.	Total Quality Management	ME-300
3.	Optimization methods for Engineering System	NS-300
4.	Remote Sensing & GIS	CE-300
5.	Operating Systems	CS-300

Semester –VI
Open Elective
ENERGY ASSESSMENT AND AUDITING - EE-300

Course Code	EE-300	L - 3, T- 0, P – 0	
Name of Course	Energy Assessment and Auditing		
Lectures to be delivered	39 (L-39 for each semester)		
Semester End Examination	MM: 100	Min. Marks; 40	Time Allowed: 3 Hrs.
Continue Assessment (based on sessional tests 50%) Tutorial/ Assignment: 30%, Quiz/ Seminar: 10 %, Attendance: 10 %.			MM: 50.

INSTRUCTIONS:

1. **For Paper Setters:** The question paper will consist of five sections A, B, C, D & E. Section E will be compulsory, it will consist of a single question with 10-20 subparts of short answer type, which will cover the entire syllabus. Section A, B, C & D will have two questions from the respective sections of the syllabus. Each section will have a weightage of 20% of the total marks of the semester end examination for the course.

2. **For candidates:** Candidates are required to attempt five questions in all selecting one question from each of the sections A, B, C & D of the question paper and all the subparts of the questions in Section E.

SECTION A

Energy Scenario: Commercial and Non-commercial energy, primary energy resources, commercial energy production, final energy consumption, energy needs of growing economy, long term energy scenario, energy pricing, energy sector reforms, energy and environment, energy security, energy conservation and its importance, re-structuring of the energy supply sector, energy strategy for the future, air pollution, climate change. Energy Conservation Act-2001 and its features.

Basics of Energy and its various forms: Electricity basics- DC & AC currents, electricity tariff, load management and maximum demand control, power factor improvement, selection & location of capacitors, Thermal Basics-fuels, thermal energy contents of fuel, temperature & pressure, heat capacity, sensible and latent heat, evaporation, condensation, steam, moist air and humidity & heat transfer, units and conversion.

SECTION B

Energy Management & Audit: Definition, energy audit, need, types of energy audit. Energy management (audit) approach-understanding energy costs, bench marking, energy performance, matching energy use to requirement, maximizing system efficiencies, optimizing the input energy requirements, fuel & energy substitution, energy audit instruments.

Material and Energy balance: Facility as an energy system, methods for preparing process flow, material and energy balance diagrams.

SECTION C

Energy Action Planning: Key elements, force field analysis, Energy policy purpose, perspective, contents, formulation, ratification, Organizing - location of energy management, top management support, managerial function, roles and responsibilities of energy manager,

accountability. Motivating-motivation of employees: Information system-designing barriers, strategies; Marketing and communicating-training and planning.

Financial Management: Investment-need, appraisal and criteria, financial analysis techniques-simple pay back period, return on investment, net present value, internal rate of return, cash flows, risk and sensitivity analysis; financing options, energy performance contracts and role of ESCOs.

SECTION D

Project Management: Definition and scope of project, technical design, financing, contracting, implementation and performance monitoring. Implementation plan for top management, Planning Budget, Procurement Procedures, Construction, Measurement & Verification.

Energy Monitoring, Targeting and Global environmental concerns: Defining monitoring & targeting, elements of monitoring & targeting, data and information-analysis, techniques - energy consumption, production, cumulative sum of differences (CUSUM). United Nations Framework Convention on Climate Change (UNFCC), sustainable development, Kyoto Protocol, Conference of Parties (COP), Clean Development Mechanism (CDM), Prototype Carbon fund (PCF).

TEXT BOOKS:
1. L.C. Witte, P.S. Schmidt, D.R. Brown, "Industrial Energy Management and Utilisation" Hemisphere Publ, Washington, 1988.
2. O. Callaghn, P.W. "Design and Management for Energy Conservation", Pergamon Press, Oxford.

REFERENCE BOOKS:
1. I.G.C. Dryden, "The Efficient Use of Energy" Butterworths, London.
2. W.C. turner, "Energy Management Hand book" Wiley, New York.
3. W.R. Murphy and G. Mc KAY "Energy Management" Butterworths, London.
4. Handbook of Energy Audits by Albert Thuman – Fairman Press Inc.
5. Energy basis for man and nature by Howard T.Odum & Elisbeth. C. Odum.

TOTAL QUALITY MANAGEMENT - ME-300

Course Code	ME-300	L - 3, T- 0, P – 0	
Name of Course	Total Quality Management		
Lectures to be delivered	39 (L-39 for each semester)		
Semester End Examination	MM: 100	Min. Marks; 40	Time Allowed: 3 Hrs.
Continue Assessment (based on sessional tests 50%) Tutorial/ Assignment: 30%, Quiz/ Seminar: 10 %, Attendance: 10 %.			MM: 50.

INSTRUCTIONS:

1. **For Paper Setters:** The question paper will consist of five sections A, B, C, D & E. Section E will be compulsory, it will consist of a single question with 10-20 subparts of short answer type, which will cover the entire syllabus. Section A, B, C & D will have two questions from the respective sections of the syllabus. Each section will have a weightage of 20% of the total marks of the semester end examination for the course.

2. **For candidates:** Candidates are required to attempt five questions in all selecting one question from each of the sections A, B, C & D of the question paper and all the subparts of the questions in Section E.

SECTION A

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).

SECTION B

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.

SECTION C

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.

SECTION D

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.

TEXT BOOKS:
1. Dale H. Besterfiled, et at., "Total Quality Management", Pearson Education Asia, 3rd Edition, Indian Reprint.
2. Ross, J.E.: Total Quality Management, Vanity Books International.

REFERENCE BOOKS:
1. James R. Evans and William M. Lindsay, "The Management and Control of Quality", South-Western (Thomson Learning).
2. Oakland, J.S., "TQM – Text with Cases", Butterworth – Heinemann Ltd., Oxford.
3. Suganthi,L and Anand Samuel, "Total Quality Management", Prentice Hall (India)Pvt. Ltd.
4. Janakiraman, B and Gopal, R.K, "Total Quality Management – Text and Cases", Prentice Hall (India) Pvt. Ltd.
5. Goetsch, D.L. & Davis,S. : Introduction to Total Quality, Prentice Hall.
6. Juran, J.M. & Gryna, F.M. : Quality Planning and Analysis, Tata McGraw Hill Publishing Co. Ltd., New Delhi
7. Charantimath, P.M. : Total Quality Management, Pearson Education.

OPTIMIZATION METHODS FOR ENGINEERING SYSTEMS - NS-300

Course Code	**NS-300**	**L - 3, T- 0, P – 0**
Name of Course	**Optimization Methods For Engineering Systems**	
Lectures to be delivered	**39 (L-39 for each semester)**	
Semester End Examination	**MM: 100**	**Min. Marks; 40**	**Time Allowed: 3 Hrs.**
Continue Assessment (based on sessional tests 50%) Tutorial/ Assignment: 30%, Quiz/ Seminar: 10 %, Attendance: 10 %.		**MM: 50.**

INSTRUCTIONS:

1. **For Paper Setters:** The question paper will consist of five sections A, B, C, D & E. Section E will be compulsory, it will consist of a single question with 10-20 subparts of short answer type, which will cover the entire syllabus. Section A, B, C & D will have two questions from the respective sections of the syllabus. Each section will have a weightage of 20% of the total marks of the semester end examination for the course.

2. **For candidates:** Candidates are required to attempt five questions in all selecting one question from each of the sections A, B, C & D of the question paper and all the subparts of the questions in Section E.

SECTION A

Introduction: Engineering Application; Statement of the Optimal Problem; Classification; Optimization Techniques;

Classical Method: Single Variable Optimization; Multivariable Optimization Without any Constraints with Equality and Inequality Constraints.

SECTION B

One-Dimensional Minimization Method: Unimodal Function; Elimination Method – Dichotomous Search, Fibonocci and Golden Method; Interpolation Method – Quadratic and Cubic Interpolation Method.

Unconstrained Minimization Method: Univariate, Conjugate Directions, Gradient And Variable Metric Method.

SECTION C

Constrained Minimization Method: Characteristics of a constrained problem; Direct Method of feasible directions; Indirect Method of interior and exterior penalty functions.

Geometric Programming: Formulation and Solutions of Unconstrained and Constrained geometric programming problem.

SECTION D

Dynamic Programming: Concept of Sub-optimization and the principal of optimality: Calculus, Tabular and Computational Method in Dynamic Programming: An Introduction to Continuous Dynamic Programming.

Integer Programming: Gomory's Cutting Plane Method for Integer Linear Programming; Formulation & Solution of Integer Polynomial and Non- Linear problems.

TEXT BOOKS:

1. Optimization (Theory & Application)- S.S. Rao, Wiley Eastern Ltd, New Delhi.
2. Optimization Concepts and Applications in Engineering – Ashok D.Belegundu and Tirupathi R Chandrupatla – Pearson Education 1999, First India Reprint 2002.

REFERENCE BOOKS:

1. Optimization: Theory and Practice, C.S.G. Beveridge and R.S. Schechter, McGraw Hill, New York.
2. Kalyanamoy Deb, "Optimization for Engineering design algorithms and Examples", Prentice Hall of India Pvt. Ltd. 2006.
3. Rao, Singaresu, S., "Engineering Optimization – Theory & Practice", New Age International (P) Limited, New Delhi, 2000.
4. Johnson Ray, C., "Optimum design of mechanical elements", Wiley, John & Sons, 1990.
5. Goldberg, D.E., "Genetic algorithms in search, optimization and machine", Barnen, Addison-Wesley, New York, 1989.

REMOTE SENSING AND GIS- CE-300

Course Code	CE-300	L - 3, T- 0, P – 0	
Name of Course	Remote Sensing and GIS		
Lectures to be delivered	39 (L-39 for each semester)		
Semester End Examination	MM: 100	Min. Marks; 40	Time Allowed: 3 Hrs.
Continue Assessment (based on sessional tests 50%) Tutorial/ Assignment: 30%, Quiz/ Seminar: 10 %, Attendance: 10 %.			MM: 50.

INSTRUCTIONS:

1. **For Paper Setters:** The question paper will consist of five sections A, B, C, D & E. Section E will be compulsory, it will consist of a single question with 10-20 subparts of short answer type, which will cover the entire syllabus. Section A, B, C & D will have two questions from the respective sections of the syllabus. Each section will have a weightage of 20% of the total marks of the semester end examination for the course.

2. **For candidates:** Candidates are required to attempt five questions in all selecting one question from each of the sections A, B, C & D of the question paper and all the subparts of the questions in Section E.

SECTION A
EMR AND ITS INTERACTION WITH ATMOSPHERE & EARTH MATERIAL: Definition of remote sensing and its components – Electromagnetic spectrum – wavelength regions important to remote sensing – Wave theory, Particle theory, Stefan-Boltzman and Wein's Displacement Law – Atmospheric scattering, absorption – Atmospheric windows – spectral signature concepts – typical spectral reflective characteristics of water, vegetation and soil.
PLATFORMS AND SENSORS: Types of platforms – orbit types, Sun-synchronous and Geosynchronous – Passive and Active sensors – resolution concept – Pay load description of important Earth Resources and Meteorological satellites – Airborne and spaceborne TIR and microwave sensors.

SECTION B
IMAGE INTERPRETATION AND ANALYSIS: Types of Data Products – types of image interpretation – basic elements of image interpretation - visual interpretation keys – Digital Image Processing – Pre-processing – image enhancement techniques – multispectral image Classification – Supervised and unsupervised.

SECTION C
GEOGRAPHIC INFORMATION SYSTEM: Introduction – Maps – Definitions – Map Projections – types of map projections – map analysis – GIS definition – basic components of GIS – standard GIS softwares – Data type – Spatial and non-spatial (attribute) data – measurement scales – Data Base Management Systems (DBMS).

SECTION D
DATA ENTRY, STORAGE AND ANALYSIS: Data models – vector and raster data – data compression – data input by digitization and scanning – attribute data analysis – integrated data Analysis – Modeling in GIS Highway alignment studies – Land Information System.

TEXT BOOKS:
1. Lillesand, T.M., Kiefer, R.W. and J.W. Chipman. (2004). Remote Sensing and Image Interpretation. V Edn. John Willey and Sons (Asia) Pvt. Ltd., New Delhi.
2. Anji Reddy, M. (2001). Textbook of Remote Sensing and Geographical Information System.
   Second edn. BS Publications, Hyderabad.

REFERENCE BOOKS:
1. Lo. C.P. and A.K.W. Yeung (2002). Concepts and Techniques of Geographic Information Systems. Prentice-Hall of India Pvt. Ltd., New Delhi.
2. Peter A. Burrough, Rachael A. McDonnell (2000), Principles of GIS. Oxford University Press.
3. Ian Heywood (2000), An Introduction to GIS, Pearson Education Asia.

OPERATING SYSTEMS- CS-300

Course Code	CS-300	L - 3, T- 0, P – 0	
Name of Course	Operating Systems		
Lectures to be delivered	39 (L-39 for each semester)		
Semester End Examination	MM: 100	Min. Marks; 40	Time Allowed: 3 Hrs.
Continue Assessment (based on sessional tests 50%) Tutorial/ Assignment: 30%, Quiz/ Seminar: 10 %, Attendance: 10 %.			MM: 50.

INSTRUCTIONS:

1. **For Paper Setters:** The question paper will consist of five sections A, B, C, D & E. Section E will be compulsory, it will consist of a single question with 10-20 subparts of short answer type, which will cover the entire syllabus. Section A, B, C & D will have two questions from the respective sections of the syllabus. Each section will have a weightage of 20% of the total marks of the semester end examination for the course.

2. **For candidates:** Candidates are required to attempt five questions in all selecting one question from each of the sections A, B, C & D of the question paper and all the subparts of the questions in Section E.

SECTION A

Introduction to System Software: Overview of all system software's: Compiler, Assembler, Linker, Loader, Operating system, I/O manager
Fundamentals of Operating System: OS services and Components, Multitasking, Multiprogramming, Multiprocessing, Time Sharing, Buffering, Spooling, Distributed OS

SECTION B

Process and Thread Management: Concept of process and threads, Process states, Process management, Context switching, Interaction between processes and OS Multithreading
Example OS : Linux
Concurrency Control: Concurrency and Race Conditions, Mutual exclusion requirements, Software and hardware solutions, Semaphores, Monitors, Classical IPC problems and solutions, Deadlock, Characterization, Detection, Recovery, Avoidance and Prevention

SECTION C

Memory Management: Memory partitioning, Swapping, Paging, Segmentation, Virtual, memory, Overlays, Demand paging, Performance of Demand paging, Virtual memory concepts, Page replacement algorithms, Allocation algorithms, Example OS : Linux
I/O Systems: Secondary-Storage Structure, Disk structure, Disk scheduling, Disk management, Swap-space management, Disk reliability, Stable storage implementation, Introduction to clock, Clock hardware, Clock software
SECTION D

File systems: File concept, File support, Access methods, Allocation methods, Directory Systems, File protection, Free space management, Example OS : Linux
Protection & Security: Protection, Goals of protection, Domain of protection, Access matrix, Implementation of access matrix, Revocation of access rights, Security, The security problem, Authentication, One-Time passwords, Threats, Example OS: Linux **Case Study:** Android OS

TEXT BOOKS:
1. Operating System Concepts by Silberschatz and Galvin, Wiley.
2. Operating Systems Achyut S. Godbole Tata McGraw Hill

REFERENCE BOOKS:
1. Operating Systems – Internals and Design Principles, by William Stallings, Prentice Hall.
2. Modern Operating Systems by Andrew S Tanenbaum, Prentice Hall India.
3. Operating Systems by Gary Nutt, Nabendu Chaki, Sarmishtha Neogy, Pearson
4. Operating Systems Design & Implementation Andrew S. Tanenbam, Albert S. Woodhull Pearson
5. Operating Systems D. M. Dhardhere Tata McGraw Hill