

UNIVERSITY OF MUMBAI

No. UG/246 of 2010

CIRCULAR:-

A reference is invited to the Ordinances, Regulations and syllabi relating to the Bachelor of Engineering (B.E.) degree course vide this office Circular No.UG/60 of 2004, dated 24th February, 2004 and the Principals of the affiliated Colleges in Engineering are hereby informed that the recommendation made by the faculty of Technology at its meeting held on 9th December, 2009 has been accepted by the Academic Council at its meeting held on 27th July, 2010 vide item No. 4.3 and that, in accordance therewith, the revised syllabus of Fourth Year (Semester VII & VIII) of the B.E. Degree Course in branch of Automobile Engineering is as per Appendix and that the same has been brought into force with effect from the academic year 2010-2011.

MUMBAI-400 032
12th August, 2010

L. R. Mane
Offg. Registrar

To,

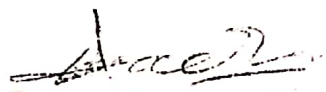
The Principals of the affiliated Colleges in Engineering.

A.C./4.3/27/07/2010

No. UG/246 -A of 2010, MUMBAI-400 032 12th August, 2010

Copy forwarded with compliments for information to:-

- 1) The Dean, Faculty of Technology,
- 2) The Chairman, Board of Studies in Mechanical Engineering.
- 3) The Controller of Examinations,
- 4) The Co-Ordinator, University Computerization Centre,


(D. N. Jadhav)
Ag. Deputy Registrar
(UG/PG Section)

8/12/10

Copy to:-

The Director, Board of College and University Development, the Deputy Registrar (Eligibility and Migration Section), the Director of Students Welfare, the Executive Secretary to the Vice-Chancellor, the Pro- Vice-Chancellor, the Registrar and the Assistant Registrar, Administrative sub-center, Ratnagiri for information.

The Controller of Examinations (10 copies), the Finance and Accounts Officer (2 copies), Record Section (5 copies), Publications Section (5 copies), the Deputy Registrar, Enrolment, Eligibility and Migration Section (3 copies), the Deputy Registrar, Statistical Unit (2 copies), the Deputy Registrar (Accounts Section), Vidyanagari (2 copies), the Deputy Registrar, Affiliation Section (2 copies), the Professor-cum- Director, Institute of Distance and Open Learning Education, (10 copies), the Director University Computer Center (IDE Building), Vidyanagari, (2 copies) the Deputy Registrar (Special Cell), the Deputy Registrar, (PRO) the Assistant Registrar, Academic Authorities Unit (2 copies) and the Assistant Registrar, Executive Authorities Unit (2 copies). They are requested to treat this as action taken report on the concerned resolution adopted by the Academic Council referred to in the above



COURSE: B.E. (AUTOMOBILE ENGINEERING)

YEAR: B.E., SEMESTER. VII (2007)

(with effect from the academic year 2010-2011)

PART (A)

Sr. No	Subjects	No. of periods of 1 Hour			Duration of Theory Paper in Hours	Marks				
		Lecture	Practical	Tutorial		Theory Paper	Term Work	Practical	Oral	Total
1	In plant Training & Project	--	--	--	--	--	100	--	50	150
	TOTAL(A)	--	--	--	--	--	100	--	50	150

In plant Training & Project should be of 6 weeks duration (including summer vacation after sem. VI)

Contact teacher hours for project guidance – one hour per student per week

PART (B) At least 10 weeks of instruction

Sr. No	Subjects	No. of periods of 1 Hour			Duration of Theory Paper in Hours	Marks				
		Lecture	Practical	Tutorial		Theory Paper	Term Work	Practical	Oral	Total
1	Advance Design of Machine Elements	6	2	--	4	100	25	--	25	150
2	CAD /CAM/ CIM *	6	2	--	4+2PT	100	25	25	--	150
3	Autotronics	6	2	--	3	100	25	--	25	150
4	Elective –I	6	2	--	3	100	25	--	25	150
	TOTAL(B)	24	08	--	--	400	100	25	75	600
	TOTAL (A+B)	24	08	--	--	400	200	25	125	750

* Common with Mechanical Engineering .

(PT) - Practical Examination.

COURSE: B.E. (AUTOMOBILE ENGINEERING)
YEAR: B.E., SEMESTER: VIII

Sr. No	Subjects	No. of periods of 1 Hour			Duration of Theory Paper in Hours	Marks			
		Lecture	Practical	Tutorial		Theory Paper	Term Work	Practical	Oral
1	Vehicle Design	4	2	--	4	100	25	--	25
2	FEA*	4	2	--	4	100	25	--	25
3	Vehicle Maintenance	4	2	--	3	100	25	--	25
4	Vehicle Dynamics	4	2	--	3	100	--	--	--
5	Elective –II	4	2	--	3	100	25	--	25
	TOTAL	20	10	--	--	500	100	--	100

* Common with Mechanical Engineering

Open Electives

Sr. No	Elective I	Sr. No	Elective II
1	Transport Management & motor industry	1	Vehicle Safety
2	Noise , Vibration and Harshness	2	Business Process Re engineering*
3	Supply Chain Management*	3	Non Conventional Energy Sources*
4	Power Plant Engineering*	4	Introduction to Nanotechnology *
5	Micro Electro Mechanical Systems(MEMS)*	5	Project management*
6	Operations Research*	6	Product Life Cycle Management*
7	Information Technology for Management of Enterprises*	7	Artificial and Machine Intelligence*
8	Virtual Reality*	8	Process Equipment Design*
9	Computational Fluid Dynamics*	9	Automotive Refrigeration & Air Conditioning
10	Industrial Robotics*		
11	Piping Engineering*		
12	Dynamic System Modelling & Analysis*		

* Common with Mechanical Engineering

Open Electives :- Students can select any one subject as elective-I in semester-VII and any one subject as elective-II in semester-VIII. from the list.

NOTE:

Semester VII consists of two parts.

1. Part A consists of 6 weeks In Plant Training & Project including summer vacation after semester VI.
2. Part B consists of theory subjects with at least 10 weeks of instruction.

CLASS: BE Automobile			Semester:- VII
SUBJECT: ADVANCED DESIGN OF MACHINE ELEMENTS			
Periods per week 1Period of 60 min.	Lecture	6	
	Practical	2	
	Tutorial	--	
		Hours	Marks
Evaluation System	Theory Examination	4	100
	Practical	--	--
	Oral Examination	--	25
	Term Work	--	25
	TOTAL		150

Sr. No.	Details	Hrs.
Module 01	1. PISTON 1.1 Material of construction 1.2 Types of piston 1.3 Manufacturing processes 1.4 Design of piston 1.5 Design of piston pin 1.6 Design of piston rings	08
Module 02	2. CONNECTING ROD 2.1 Material of construction 2.2 Types of connecting rod ,Manufacturing processes 2.3 Design calculation of split type connecting rod and its drawing	08
Module 03	3 CRANK SHAFT 3.1 Material of construction 3.2 Types of crankshaft 3.3 Manufacturing processes 3.4 Design calculation and drawing	10
Module 04	4 CAMSHAFT AND VALVE OPERATING MECHANISM 4.1 Material of construction 4.2 Types of cam profile 4.3 Manufacturing processes 4.4 Design of cam profile for 4.4.1 Tangent cam and 4.4.2 Generated cam 4.5 Design calculation and drawings of valve operating mechanism 4.5.1 Rocker arm 4.5.2 Valves 4.5.3 Valve springs	10
Module 05	5 FLYWHEEL, 5.1 Material of construction 5.2 Types of flywheel 5.3 Manufacturing processes 5.4 Design calculation and drawing	08

Module 06	6. DESIGN OPTIMIZATION AND CAD/CAE APPLICATION 6.1 Optimization methodology and its methods. 6.2 Use of CAD/CAE for the designing of engine components	04
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Theory Examination:

1. Question paper will comprise of total seven question. each of 20 Marks
2. Question one will be compulsory and based on maximum part of syllabus.
3. Remaining questions will be mixed in nature (for example supposed Q.2 has part (a) from module 3 then part (b) will be from any module other than module 3)
4. Only five question need to be solved.

In question paper weightage of each module will be proportional to number of respective lecture hours as mention in the syllabus.

Term Work:

Term work shall consist of minimum 6 assignments and written test. The distribution of marks for term work shall be as follows:

- Laboratory work (experiments/assignments): (15) Marks.
- Test (at least one): (10) Marks.
- TOTAL:** (25) Marks.

Text Books:

1. High Speed Diesel Engines by P.M. Heldt.
2. Machine Design by Pandya and Shah.
3. Internal Combustion Engine by L.C. Lichty
4. Machine Design by Sharma & Purohit

Reference Books :

1. Automobiles Design by Giles-Vol. I, II & III
2. Internal Combustion Engine by V.L. Maleev
3. Gasoline Engine Analysis by J.B. Fenton
4. Automotive design by Colchin and Demidov
5. Internal combustion Engine by Mathur and Sharma
6. Machine design by Khurmi and Gupta

CLASS: BE Automobile			Semester:-VII	
SUBJECT: CAD/CAM/CIM				
Periods per week 1Period of 60 min.	Lecture	6		
	Practical	2		
	Tutorial	--		
		Hours	Marks	
Evaluation System	Theory Examination	4	100	
	Practical	2 (PE)	25	
	Oral Examination		--	
	Term Work		25	
	TOTAL		150	

Sr. No.	Details	Hrs.
Module 01	INTRODUCTION & ELEMENTS OF INTERACTIVE COMPUTER GRAPHICS The design process, the role of modeling & communication, modeling using CAD, Product life cycle & CAD/ CAM, Concurrent engineering in Product design & development, Collaborative Engineering, computers for design Process, CAD System Architecture. The design workstation & its functions, Operator input devices (Mouse, keyboard, tracker ball & Joy Stick etc.), Output devices (Printers & Plotters), two dimensional computer graphics, vector generation, the windowing transformation, three dimensional Computer graphics, viewing transformation, Homogeneous coordinates, Perspective projection, Visual realism, Hidden line removal & hidden surface removal algorithm, light & shade ray tracing.	08
Module 02	TECHNIQUES FOR GEOMETRIC MODELING Graphic standards, The parametric representation of geometry, Bezier curves, Cubic Spline curve, B-Spline curve, parametric representation of line, circle, ellipse & parabola constructive solid geometry (CSG), Boundary Representation (B-Rep), Wire Frame Modeling, Solid Modeling, Surface Modeling, Parametric Modeling, feature based modeling, Feature recognition, Design by feature.	06
Module 03	TRANSFORMATION, MAINPULATION & DATA STORAGE 2D & 3D Transformations (Translation, Rotation, & Scaling & Magnification), Concatenations, Matrix representation, Problems & object oriented programming on Transformations, Object transformation, mirror transformation, Data Structures for interactive modeling, Bill of materials from attribute data, The use of Object Orientation & associatively, Engineering data management system, relational data base for design, object Oriental database, Structured Query language, Design information Systems, Artificial Intelligence in Design & Manufacturing, Representation of Knowledge, and Knowledge base Engineering.	08

Module 04	NC & CNC TECHNOLOGY Introduction, basic components of NC system, NC Procedure, NC Coordinate Systems, & NC motion control systems, Applications, Advantages & Disadvantages of NC machines, Punched tape in NC, Tape coding & format, Manual Part Programming, Computer Aided Part Programming, Problems with conventional NC, CNC functions & advantages, DNC, adaptive Control, CNC programming concepts, Trends & new developments in NC, Part programmers job, functions of a post processor, NC part programming languages, Elements of a APT language. The Macro Statement in APT. Subroutines, NC programming with interactive graphics. Constructional details of CNC machines. Feed back devices- Velocity & displacement, FMS, Machining Centers and its types, Automated Material Handling & storage Systems like Robots, AGVs and AS/RS etc.	12
Module 05	Group Technology, CAPP, and CAQC Introduction to GT, Part Families, parts Classification & Coding, GT Machine cells, Benefits of GT Introduction to Computer Aided Process Planning (CAPP), Retrieval type Process Planning Systems, Generative type Process Planning Systems, Benefits of CAPP, Artificial Intelligence in CAPP, PFA, Similarity coefficient matrix. Introduction to Computer Aided Quality Control (CAQC), Computers in QC, Contact Inspection methods, Non Contact Inspection methods, Computer Aided Testing, Integration of CAQC with CAD/CAM	08
Module 06	COMPUTER INTEGRATED MANUFACTURING & TECHNOLOGY DRIVEN PRACTICES Introduction, Evolution, Objectives, CIM Hardware and Software, CIM Benefits, Nature and role of the elements of CIM, Identifying CIM needs, Data base requirements of CIM, Role of CAD/CAM in CIM, Obstacles to Computer Integrated Manufacturing, Concept of the future CIM systems, Socio -techno- economic aspects of CIM, Rapid Prototyping, Virtual Prototyping, Design for Manufacturing, Design for Assembly and Dis- Assembly, Reverse Engineering and Data Capture techniques Green Manufacturing.	07

TERM WORK:

Term work shall consist of class assignments, laboratory assignments, programming for transformations, part programming, part fabrication on CNC trainer, and written test. The distribution of marks for term work shall be as follows:

1. Assignments (at least one on each topic) - (05 Marks)
2. Assignments using 3D Modeling Software's like PRO-E, CATIA, UNIGRAPHICS, SOLID WORKS, IDEAS, HYPER MESH, Programming for Algorithms, transformations - (05 Marks)
3. Part Programming Exercises and machining/fabrication of components (at least two) on CNC machines (Turning and Milling each one) - (05 Marks)
4. Class test - (10 Marks)
5. Total (25 Marks)

Theory Examination:

1. Question paper will comprise of total seven question, each of 20 Marks
2. Question one will be compulsory and based on maximum part of syllabus.

3. Remaining questions will be mixed in nature (for example supposed Q.2 has part (a) from module 3 then part (b) will be from any module other than module 3)
4. Only five question need to be solved.

In question paper weightage of each module will be proportional to number of respective lecture hours as mention in the syllabus.

Practical Examination:

Practical examination of 2 hours duration based on any one of the followings

- 1) Programming for Algorithms, transformations
- 2) Part Programming and machining/fabrication of components (only simulation)
- 3) 3D Modeling Software's like PRO-E, CATIA, UNIGRAPHICS, SOLID WORKS, IDEAS, HYPER MESH, etc.

Text Books:

1. "CAD/CAM Computer Aided and Manufacturing" by Mikell P. Groover and Emory W. Zimmers, Jr., *Eastern Economy Edition*
2. "CAD/ CAM , Theory & Practice" by Ibrahim Zeid, R. Sivasubramanian, *Tata McGraw Hill Publications*
3. "Computer Graphics" by Donald Hearn and M. Pauline Baker, *Eastern Economy Edition*
4. "CAD/CAM Principles, Practice and Manufacturing Management" by Chris McMahon, Jimmie Browne, *Pearson Education*
5. "CAD/CAM/CIM" by P. Radhakrishnan, S. Subramanyan, V. Raju, *New Age International Publishers*
6. "CAD/CAM Principles and Applications" by P.N. Rao, *Tata McGraw Hill Publications*
7. "Principle of Computer Graphics" by William .M. Neumann and Robert .F. Sproul, *McGraw Hill Book Co. Singapore.*
8. David L. Goetsch, Fundamental of CIM technology ,Delmar publication
9. David Bedworth. Computer Integrated Design and Manufacturing. *McGraw Hill*
10. "CNC Machines" by B.S. Pabla and M. Adithan, *New Age International Publishers.*
11. "Numerical Control and Computer Aided Manufacturing" , T.K. Kundra, P.N. Rao, N.K. Tiwari, *Tata McGraw Hill*
12. "CNC Technology and Programming", Krar, S., and Gill, A., *McGraw Hill publishers*
13. "Computer Integrated Manufacturing- An Introduction with Case Studies" by Paul G. Ranky, *Prentice Hall International*
14. "Flexible Manufacturing Systems" by H.K. Shivanand, M.M. Benal, V.Koti, *New Age International Publishers*
15. "Automation, Production Systems and Computer Integrated Manufacturing ". Groover M.P., *Prentice-Hall of India Pvt. Ltd*
16. "Mathematical Elements for Computer Graphics". Rogers D F I and Adams J A. *McGraw-Hill.*

REFERENCE BOOKS

1. "Computer Integrated Manufacturing Hand Book" by Eric Teicholz, Joel N. Orr, *McGraw Hill International Editions*

CLASS: BE Automobile			Semester:- VII
SUBJECT: AUTOTRONICS			
Periods per week 1 Period of 60 min.	Lecture	6	
	Practical	2	
	Tutorial	--	
		Hours	Marks
Evaluation System	Theory Examination	3	100
	Practical	--	--
	Oral Examination	--	25
	Term Work	--	25
	TOTAL		150

Sr. No.	Details	Hrs.
Module 01	1. Battery, Fuel Cells And 42volt Technology	08
	1.1 Battery	
	1.1.1 Requirements	
	1.1.2 Construction	
	1.1.3 Principle of operation	
	1.1.4 Working of the following types of batteries	
	i. Lead-Acid	
	ii. Alkaline	
	iii. ZEBRA	
	iv. Sodium Sulphur	
	v. Swing	
	1.1.5 Ratings	
	1.1.6 Charging	
	1.1.7 Maintenance and testing of Lead-Acid battery.	
	1.2 Fuel Cells	
	1.2.1 Introduction to fuel cells and fuels used.	
	1.2.2 Construction	
	1.2.3 Operation of Proton Exchange Membrane	
	1.2.4 Alkaline Electrolyte	
	1.2.5 Medium & High Temperature fuel cells	
	1.2.6 Reformers	
	1.3 42 Volt Technology	
	1.3.1 Introduction to 42 V technology	
	1.3.2 Transition from 12V to 42V electrical system	
	1.3.3 Need of 42V automotive electrical system	
	1.3.4 42V automotive power system	
	1.3.5 Method of controlling 12 V system in 42 V architecture	
	1.3.6 Present developments in 42V technology	

Module 02	2. Charging And Starting System 2.1 Requirements of a charging system 2.2 Dynamo 2.2.1 Principle of operation 2.2.2 Construction 2.2.3 Working 2.2.4 Regulators, Combined current and voltage regulator, etc. 2.3 Alternator 2.3.1 Principle of operation 2.3.2 Construction 2.3.3 Working 2.3.4 Rectification from AC to DC. 2.4 Starting system 2.4.1 Requirements of starting system 2.4.2 Various torque terms used 2.4.3 Starter motor drives i. Bendix ii. Flow through Barrel iii. Rubber compression iv. Compression Spring v. Friction Clutch vi. Overrunning Clutch vii. Dyer 2.4.4 Starter motor solenoids and switches 2.4.5 Glow plugs	08
Module 03	3. Electronic Ignition System And Engine Controls 3.1 Electronic Ignition System 3.1.1 Capacitor Discharge Ignition System 3.1.2 Distributor less ignition system 3.1.3 Direct ignition system 3.1.4 Hall effect pulse generator 3.1.5 Inductive pulse generator 3.1.6 Constant dwell system 3.1.7 Constant energy system. 3.2 Electronic Engine Controls 3.2.1 Electronic Control Module (ECM) 3.2.2 Operating modes of ECM (closed loop and open loop) 3.2.3 Inputs required and output signals from ECM 3.2.4 Electronic Spark Timing 3.2.5 Electronic Spark control 3.2.6 Air Management System 3.2.7 Idle speed control	08

Module 04	4. Sensors And Actuators 4.1 Automotive Sensors 4.1.1 Thermistors 4.1.2 Inductive sensors 4.1.3 Position sensors (rotary, linear) 4.1.4 Pressure Sensors 4.1.5 Knock sensors 4.1.6 Hot wire and thin film air flow sensors 4.1.7 Vortex flow/Turbine fluid flow sensors 4.1.8 Optical sensors 4.1.9 Oxygen sensors 4.1.10 Light sensors 4.1.11 Methanol sensor 4.1.12 Rain sensor operating principles 4.1.13 Application and new developments in the sensor technology 4.2 Automotive Actuators 4.2.1 Introduction 4.2.2 Functions and operating principles 4.2.3 Construction of solenoid actuators 4.2.4 Relays 4.2.5 Motorized actuators 4.2.6 Thermal actuators 4.2.7 Electro hydraulic and Electromechanical valve actuators 4.2.8 Application and new developments in the actuator technology	08
Module 05	5. Lighting And Wiring 5.1 Lighting 5.1.1 Energy demand of lighting systems 5.1.2 Types of lamps i. Head lamps: construction and types, setting and control ii. Fog lamp iii. Side lamp iv. Tail lamp v. Parking lamp vi. Brake warning light vii. Trafficators viii. Blinkers ix. Flashers x. Electronic flasher circuit xi. Instrument panel lights xii. Body interior illumination 5.1.3 Reflectors: parabolic, bifocal, homifocal, poly-ellipsoidal. 5.1.4 Gauges: Fuel, temperature, oil pressure etc. 5.1.5 Accessories: Electric horn, wipers, fuel pump, power operated windows. 5.2 Wiring 5.2.1 Cables 5.2.2 Sizes 5.2.3 Colors and color codes 5.2.4 Connectors 5.2.5 Multiplex wiring system 5.2.6 Harness system 5.2.7 CAN system	06

Module 06	6. Telematics And Intelligent Vehicle Systems	10
	6.1 Telematics 6.1.1 Introduction 6.1.2 Services and application 6.1.3 Telematics system view and Present developments in Telematics Technology. 6.2 Intelligent Vehicle Systems 6.2.1 Requirements, working, components, system control of the following systems i. Anti-Lock Braking System ii. Active suspension iii. Traction Control iv. Electric power steering v. Global Position System vi. Advanced vehicle navigation vii. Driver assistance concept viii. Adaptive cruise control ix. Introduction to Intelligent Transportation System. x. E- differential	

List of Experiments:

01. Study of Battery
02. Study of Fuel Cells
03. Dismantling, Inspection, and Assembly of Alternator/Dynamo
04. Dismantling, Inspection, and Assembly of Starter Motor
05. Study of Temperature sensors
06. Study of Pressure sensors
07. Study of Position sensors
08. Study of Oxygen sensors
09. Study of operation of Air management System under different operating conditions
10. Study of Effects of operating variables on injector activating pulses
11. Study of functioning /Working of Idle speed Control system
12. Study of effect of Spark Advances on the engine emissions
13. Study of the electro-magnetic fuel injector
- 14 Troubleshooting

Theory Examination:

1. Question paper will comprise of total seven question, each of 20 Marks
2. Question one will be compulsory and based on maximum part of syllabus.

3. Remaining questions will be mixed in nature (for example supposed Q.2 has part (a) from module 3 then part (b) will be from any module other than module 3)
4. Only five question need to be solved.

In question paper weightage of each module will be proportional to number of respective lecture hours as mention in the syllabus.

Term Work:

Term work shall consist of minimum **eight** experiments, assignments and written test. The distribution of marks for term work shall be as follows:

• Laboratory work (experiments/assignments):	(15)	Marks.
• Test (at least one):	(10)	Marks.
TOTAL:	(25)	Marks.

Text Books:

1. Understanding Automotive Electronics by William B. Ribbens
2. Automobile Electrical and Electronics by Tom Denton
3. Intelligent Vehicle Technologies by Michel Parent, Ljubo Vlacic, Fumio Harashima.
4. Light Weight Electric/Hybrid Vehicle Design by John Fenton and Ron Hodgkinson
5. Computerised engine control by Dick King
6. Automotive Electrical Equipments by P L Kohli

References:

1. Automotive Electronic Hand book By Ronald K. Jurgen
2. Car Electronics (second edition) edited by Shuji Mizutani
3. SAE Journals and special Publications.
4. Stability enhanced traction and yaw control using electronic limited slip differential – SAE paper, 2006-01-1016, by D. piyabongkam, Jae Lew, John Grogg

CLASS: BE Automobile (Elective -I)			Semester:- VII
SUBJECT: TRANSPORT MANAGEMENT AND MOTOR INDUSTRY			
Periods per week 1 Period of 60 min.	Lecture	6	
	Practical	2	
	Tutorial	--	
		Hours	Marks
Evaluation System	Theory Examination	3	100
	Practical	--	--
	Oral Examination	--	25
	Term Work	--	25
	TOTAL		150

Sr. No.	Details	Hrs.
Module 01	1. Motor Vehicle Act 1.1 Short titles & definitions 1.2 Laws governing to use of motor vehicle & vehicle transport 1.3 Licensing of drivers & conductors 1.4 Registration of vehicle 1.5 State & interstate permits 1.6 Traffic rules, Signals & controls 1.7 Accidents, Causes & analysis 1.8 Liabilities & preventive measures 1.9 Rules & regulations 1.10 Responsibility of driver 1.11 Public & public authorities 1.12 Offences, penalties & procedures 1.13 Different types of forms 1.14 Government administration structure 1.15 Personnel, Authorities & duties 1.16 Rules regarding construction of motor vehicles	10
Module 02	2. Taxation 2.1 Objectives 2.2 Structure & methods of laying taxation 2.3 One time tax 2.4 Tax exemption & tax renewal	08
Module 03	3. Insurance 3.1 Insurance types & significance 3.1.1 Comprehensive 3.1.2 Third party insurance 3.2 Furnishing of particulars of vehicles involved in accident 3.3 MACT (Motor Accident Claims Tribunal) 3.4 Solatium Fund 3.5 Hit & Run case 3.6 Duty of driver in case of accident 3.7 Surveyor & Loss Assessor, Surveyor's report	10

Module 04	4. Passenger Transport Operation 4.1 Structure of passenger transport organizations 4.2 Typical depot layouts 4.3 Requirements and Problems on fleet management 4.4 Fleet maintenance 4.5 Planning - Scheduling operation & control 4.6 Personal & training-training for drivers & conductors 4.7 Public relations, Propaganda, publicity and passenger amenities 4.8 Parcel traffic. 4.9 Theory of fares-Basic principles of fare charging 4.10 Differential rates for different types of services 4.11 Depreciation & debt charges 4.12 Operation cost and Revenues 4.13 Economics & records	10
Module 05	5. Goods Transport Operation 5.1 Structure of goods transport organizations 5.2 Scheduling of goods transport 5.3 Management Information System (MIS) in passenger / goods transport operation 5.4 Storage & transportation of petroleum products	06
Module 06	6. Advance Techniques in Traffic Management 6.1 Traffic navigation 6.2 Global positioning system	04

Experiments

1. Organization & Management of Motor Vehicle Department
2. Collection & study of different types of RTO forms.
3. Central Motor Vehicle rules
4. Taxation, Insurance & Permits
5. Study of accidents claims & survey report including post accident procedure
6. Study of depot layouts (passenger & goods transport)
7. Case study of MIS in passenger / goods transports organization
8. Collection & study of goods transport records.
9. Study of vehicle navigation system
10. Advanced traffic control devices

Theory Examination:

1. Question paper will comprise of total seven question, each of 20 Marks
2. Question one will be compulsory and based on maximum part of syllabus.

3. Remaining questions will be mixed in nature (for example supposed Q.2 has part (a) from module 3 then part (b) will be from any module other than module 3)
4. Only five question need to be solved.

In question paper weightage of each module will be proportional to number of respective lecture hours as mention in the syllabus.

Term Work:

Term work shall consist of minimum 8 experiments, assignments and written test. The distribution of marks for term work shall be as follows:

• Laboratory work (experiments/assignments):	(15)	Marks.
• Test (at least one):	(10)	Marks.
TOTAL:	(25)	Marks.

Text Books:

1. Motor Vehicle Act - Govt. of India Publications.
2. S.K. Shrivastava, "Economics of Transport"
3. "Transport Development in India", S. Chand & Co. Pvt. Ltd., New Delhi.

References:

1. Santosh Sharma, "Productivity in Road Transport", 2nd Edition, Association of State Road Transport Undertakings, New Delhi.
2. P.G.Patankar, "Road Passenger Transport in India", CIRT, Pune.

CLASS: BE Automobile (Elective -I)			Semester:- VII
SUBJECT: NOISE,VIBRATION & HARSHNESS			
Periods per week 1 Period of 60 min.	Lecture	6	
	Practical	2	
	Tutorial	--	
		Hours	Marks
Evaluation System	Theory Examination	3	100
	Practical	--	--
	Oral Examination	--	25
	Term Work	--	25
	TOTAL		150

Sr. No.	Details	Hrs.
Module 01	1. Basics of vibrations 1.1 Basic concept 1.2 Mathematical models 1.3 System characteristics & response 1.4 Single & multi dof systems	08
Module 02	2. Vibration control 2.1 Isolators 2.2. Tuned absorbers 2.3 Untuned viscous dampers 2.4 Applications –single cylinder engines, multicylinder engines. 2.5 Simple rubber engine mounts 2.6 Hydro-elastic mounts 2.7 Semi-active mounts and active mounts 2.8 Mass elastic models & measurements. 2.9 Limits for passenger comforts	10
Module 03	3. Sound & sound measurement 3.1 Fundamentals of acoustics 3.1.1 General sound propagation 3.1.2 Plane wave propagation 3.1.3 Spherical wave propagation. 3.2 Human response to sound - The audible range 3.3 Sound measurement 3.3.1 Instrumentation 3.3.2 Sound level meters 3.3.3 Frequency analysers 3.3.4 Sound intensity analysers 3.3.5 Real time measurements.	10

Module 04	4. Automotive noise 4.1 Automotive noise criteria 4.1.1 Drive by noise test 4.1.2 Noise from stationary vehicles 4.1.3 Interior noise in vehicles 4.2 Automotive noise 4.2.1 Sources & control methods i. Engine noise ii. Transmission noise iii. Intake & exhaust noise iv. Aerodynamic noise v. Tyre noise vi. Brake noise.	08
Module 05	5. General noise control principles 5.1 Sound in enclosures 5.2 Sound energy absorption 5.3 Sound transmission through barriers	06
Module 06	6. Harshness 6.1 Causes 6.2 Frequency limits	06

Theory Examination:

1. Question paper will comprise of total seven question, each of 20 Marks
2. Question one will be compulsory and based on maximum part of syllabus.
3. Remaining questions will be mixed in nature (for example supposed Q.2 has part (a) from module 3 then part (b) will be from any module other than module 3)
4. Only five question need to be solved.

In question paper weightage of each module will be proportional to number of respective lecture hours as mention in the syllabus.

Term Work:

Term work shall consist of minimum 6 assignments and written test. The distribution of marks for term work shall be as follows

- Laboratory work (experiments/assignments): (15) Marks.
- Test (at least one): (10) Marks.
- TOTAL: (25) Marks.**

Text Books:

1. Mechanical vibrations by S.S.Rao
2. Theory of machines & mechanisms – by Shigley & Uicker.
3. Automotive Mechanics- By Dr. N. K. Giri.

References:

- 1) Road vehicle aerodynamic design-an introduction. -By Barnard R.H. (Longman)
- 2) Structural vibrations: Analysis & damping. -By Beards C.F. (Longman)
- 3) Noise & vibration control By Beranek L.L.(McGrawhill)
- 4) Vibration problems in Engg. By Timoshenko, weaver, s.young.
- 5) Noise control: Measurement, analysis and control of sound & vibrations
By Wilson C.E. Publisher - Harper & row
- 6) An introduction to modern vehicle design. By jullian.happian.smith.
- 7) Noise & vibrations -By white R.G.
- 8) Accoustics design & noise control. - By Rettinger, Michael.
- 9) Fundamentals of vehicle dynamics. - By Thomas Gellespie

CLASS: BE Automobile (Elective -I)		Semester-VII	
SUBJECT: SUPPLY CHAIN MANAGEMENT (Elective I)			
Periods per week. 1 Period of 60 min.	Lecture	6	
	Practical	2	
	Tutorial	--	
		Hours	Marks
Evaluation System	Theory Examination	3	100
	Practical	-	-
	Oral Examination	-	25
	Term Work	-	25
	TOTAL		150

Sr. No.	Details	Hrs.
Module 01	1. INTRODUCTION TO SUPPLY CHAIN MANAGEMENT: Current Business Scenario, Value Matrix Analysis, Evolution of SCM Function. Theme and Pillars of SCM System, How Supply chain works? Participants in the Supply Chain, Supply chain drivers, Supply chain structure	04
Module 02	2. SUPPLY CHAIN OPERATIONS: <u>2.1 Planning and Sourcing</u> Demand forecasting, Pricing and Promotional Impacts on demand, CPFR Concepts, CODP Concepts, Consensus Forecasting, Demand and Pricing Optimization <u>2.2 Making and Delivering</u> Product Design, Production Scheduling, Facility Management, Order Management, Delivery Scheduling, Distribution network design, channels of Distribution, Plant and warehouse location.	12
Module 03	3. MATERIALS MANAGEMENT IN SUPPLY CHAIN Scope, importance, classification of materials, Procurement, Purchasing policies, vendor development and evaluation, Inventory control systems of stock replenishment, Cost elements New Supply Planning Paradigms, VMI, CMI, Green Channel supply, KM Model of Supplier Partnership, Multi-tier Supplier Partnerships Use of computers for materials function.	08
Module 04	4. LOGISTICS 4.1 Logistics Evolution, 8 wings of Logistics, Distribution Network Systems, Warehousing and Inventory Cross-Docs, Multi-Modal Optimization, Inbound and Outbound handling, Containerization, TPL, FPL, MPL Partnering, Reverse Logistics 4.2 <u>Transportation</u> : Individual Freight and passenger modes, intermodal transportation and third party transportation services, economic social, and political roles of transportation, demand, cost and service characteristics of different transport services, carrier selection and evaluation methods, contracting for transportation services, freight rate structure, Private fleet management, Claim management, International transportation, Ocean carrier management, port administration and regulation, costing and pricing issues of international transportation, logistics, cost transport mode choice, Dispatch decisions, routing decisions, routing Models, packaging to suit mode of Transport	10

Module 05	5. SUPPLY CHAIN COORDINATION AND USE OF TECHNOLOGY The “Bullwhip” Effect, Supply Chain Coordination factors, Collaborative Planning, Forecasting, and Replenishment, supported information systems, E-Business and Supply Chain Integration, SCM systems Vendors, Types of Applications, Optimization Modeling, E-Business and Systems Integrations from ERP to SCM. KM, APS Systems, Further integration to CRM	06
Module 06	6.1 MEASURING PERFORMANCE: SUPPLY CHAIN METRICS Market Performance Categories, Framework for Performance Measurement, Internal Efficiency Metrics, Demand Flexibility Metrics, Product Development Metrics, Benchmarking and SCM SCORE modeling 6.2 TOTAL DISTRIBUTION COST ANALYSIS	06

Theory Examination:

1. Question paper will comprise of total seven question, each of 20 Marks
2. Question one will be compulsory and based on maximum part of syllabus.
3. Remaining questions will be mixed in nature (for example supposed Q.2 has part (a) from module 3 then part (b) will be from any module other than module 3)
4. Only five question need to be solved.

In question paper weightage of each module will be proportional to number of respective lecture hours as mention in the syllabus.

Oral Examination:

Oral examination will be on maximum portion of the syllabus.

Term Work:

Case Study /Course Project: Report of 10 - 15 pages on any topic from syllabus

Term work shall consist of minimum 06 assignments and written test. The distribution of marks for term work shall be as follows:

- Laboratory work (course project / assignments): (15) Marks.
- Test (at least one): (10) Marks.
- TOTAL:** (25) Marks.

Text Books:

1. “Supply Chain Management: Concepts and Cases”. Altekhar Rahul V., *Prentice Hall of India*. 2005
2. Materials Management and purchasing. Ammer DS Taraporewala
3. “Modeling the Supply Chain”. Jeremy F. Shapiro. *Thomson Learning Publication*

References:

1. Supply Chain Management Theories and Practices(Set) by R.P. Mohanty and S. G. Deshmukh . Biztantra Publication.
2. Logistics and Supply Chain Management. Martin Christopher, Richard Irwin
3. Supply Chain Management: Janat Shah. Pearson Education.
4. Principles of Supply Chain Management. Joel Wisner, G. Keong. Cengage Learning

CLASS: BE Automobile (Elective -I)			Semester:-VII	
SUBJECT: POWER PLANT ENGINEERING (ELECTIVE-I)				
Periods per week 1 Period of 60 min.	Lecture	06		
	Practical	02		
	Tutorial	--		
		Hours	Marks	
Evaluation System	Theory Examination	03	100	
	Practical	--	--	
	Oral Examination		25	
	Term Work		25	
TOTAL			150	

Sr. No.	Details	Hrs.
Module 01	1 Economics of the power plant: Load curve, load duration curve, various factors, effect of fluctuating load on operation and design of the plant, methods of meeting fluctuating load. Selection of the generating equipments, load sharing, cost of electrical energy. Tariff methods. Performance and operating characteristics of Power Plants.	
Module 02	2.1 Hydro power plant: Rainfall, runoff and its measurement, hydrograph, flow duration curve, mass curve, and reservoir storage capacity. Classification of the plants- Run-off river plant, storage river plant, pumped storage plant. 2.2 Fluidized bed combustion- regimes of combustion, circulating and pressurized fluidized bed combustion system, Fluidized bed boilers, its important features, classification. Control of Nitrogen oxides.	
Module 03	3.1 Nuclear power plant: Introduction of nuclear engineering- radioactive decay, half life, fission, fusion nuclear materials. Thermal fission reactors and power plant - PWR, BWR, Liquid metal fast breeder reactors. Reactor control.	
Module 04	4.2 Diesel and Gas turbine power plant: General layout, application of diesel power plant, advantages and disadvantages, component, performance of gas turbine power plant, gas turbine material.	
Module 05	5.1 Combined cycle power generation: Coupled cycle- thermodynamics, combined cycle plant-thermodynamics of GT-ST plant operation; Advantages. Base Load plants. Peak load plants. Co-ordination of different types of power plants.	
Module 06	Environmental impact of power plant: Social and economical issues of the power plants, Greenhouse effect, Acid precipitation- acid rain and acid snow, dry deposition and acid fog, Thermal pollution, air pollution, Radiation from nuclear power plant effluents. Coal storage, Inplant handling of coal. Ash handling systems. Dust collectors. Flue gas, desulfarization methods.	

Educational Visit:

Organize at least one visit to power station. Student shall submit a brief technical report of the visit as a part of term work.

Theory Examination:

1. Question paper will comprise of total seven question, each of 20 Marks
2. Question one will be compulsory and based on maximum part of syllabus.
3. Remaining questions will be mixed in nature (for example supposed Q.2 has part (a) from module 3 then part (b) will be from any module other than module 3)
4. Only five question need to be solved.

In question paper weightage of each module will be proportional to number of respective lecture hours as mention in the syllabus.

Oral Examination:

Oral examination will be on maximum portion of the syllabus.

Term Work:

Term work shall consist of minimum 06 assignments at least one on each module, and written test. The distribution of marks for term work shall be as follows:

- | | | |
|---------------------------------------|-------------|---------------|
| • Assignments and visit report: | (15) | Marks. |
| • Test (at least one): | (10) | Marks. |
| TOTAL: | (25) | Marks. |

Text Books:

1. Power Plant Engineering - P. K. Nag - *Tata McGraw Hill*
2. Power Plant Technology - M. M. EL - Wakil - *McGraw Hill*
3. Power Plant Engineering - Morse
4. Power Plant Engineering - Domkundwar
5. Power Plant Engineering - P. C. Sharma
6. Power Plant Engineering - Rajput

References:

1. Power Plant Engineering - Gaffert
2. Power Plant Theory & Design - P.J. Potter - Ronald Press
3. Modern Power Plant Engineering - J. Weisman, R. Eekart
4. Power Station Engineering & Economy'- Skrotzki
5. The Elements of Nuclear Power - Bennet. Thomson
6. Standard handbook of Power Plant Engineering - Elliott
7. Modern Power Station Practice: Vol. 1 to 8 - *British Electricity Intl., London - Paragamon Press*

CLASS: BE Automobile (Elective -I)			Semester:-VII	
SUBJECT: MICRO ELECTRO MECHANICAL SYSTEMS (MEMS) ELECTIVE-I				
Periods per week 1Period of 60 min.	Lecture	6		
	Practical	02		
	Tutorial	--		
		Hours	Marks	
Evaluation System	Theory Examination	03	100	
	Practical		---	
	Oral Examination		25	
	Term Work		25	
	TOTAL			150

Sr. No.	Details	Hrs.
Module 01	Historical Background: Silicon Pressure sensors, Micromachining, Micro Electro Mechanical Systems. Microfabrication and Micromachining: Integrated Circuit Processes. Potential of MEMS in industry.	6
Module 02	Bulk Micromachining : Isotropic Etching and Anisotropic Etching, Wafer Bonding, High Aspect-Ratio Processes (LIGA)	7
Module 03	Physical Microsensors: Classification of physical sensors. Integrated, Intelligent, or Smart sensors, Sensor Principles and Examples: Thermal sensors. Electrical Sensors, Mechanical Sensors. Chemical and Biosensors. Microactuators: Electromagnetic and Thermal microactuation. Mechanical design of microactuators, Microactuator examples, microvalves, micropumps, micromotors Microactuator systems: Success Stories, Ink-Jet printer heads, Micro-mirror TV Projector.	8
Module 04	Microstereolithography (MSL) for 3D fabrication, Two photon MSL, Dynamic mask MSL. scanning systems. Optomechatronics system for MSL. Ceramic and Metal Microstereolithography.	9
Module 05	Ceramic and Metal Microstereolithography. Scattering of light by small particles. Effect of particle properties on accuracy and resolution of component in Ceramic and Metal MSL. Monte carlo ray tracing method. Nanolithography.	8
Module 06	Surface Micromachining: One or two sacrificial layer processes. Surface micromachining requirements, Polysilicon surface micromachining. Other compatible materials, Silicon Dioxide, Silicon, Micromotors, Gear trains, Mechanisms. Characterisation of MEMS devices.	8

Theory Examination:

- Question paper will comprise of total seven question, each of 20 Marks
- Question one will be compulsory and based on maximum part of syllabus.

- Remaining questions will be mixed in nature (for example supposed Q.2 has part (a) from module 3 then part (b) will be from any module other than module 3)
- Only five question need to be solved.

In question paper weightage of each module will be proportional to number of respective lecture hours as mention in the syllabus.

Oral Examination:

Oral examination will be on maximum portion of the syllabus.

Term Work:

Term work shall comprise of

- 1) Exercises on the above topics in the form of design and manufacturing strategies for MEMS components.
- 2) Assignments (at least one on each module)
- 3) Educational visit to any one MEMS industry. Student shall submit the brief report of visit.
- 4) Seminar on topic related to MEMS
- 5) Class Test based on above syllabus.

The distribution of marks for term work shall be as follows:

- Laboratory work (Exercise/assignments/visit report/seminar) : (15)Marks.
- Test (at least one): (10)Marks.
- TOTAL: (25)Marks.**

Text Books: .

1. MEMS. Vijay Vardan. *Wiley Publication*
2. MEMS and Microsystems Design and Manufacture, Tai- Ran Hsu, *Tata McGraw Hill*
3. MEMS, Nitaigour Mahalik, *Tata McGraw Hill*
4. MEMS and MOEMS Technology and Applications. Rai Chaoudhary, PHI Learning

References:

1. Stephen D. Senturia. *Microsystem Design, Kluwer Academic Publishers,*
2. Marc Madou. *Fundamentals of Microfabrication, CRC Press*
3. Kovacs. *Micromachined Transducers Sourcebook, WCB McGraw-Hill, Boston*
4. M-II. Bao. Elsevier, *Micromechanical Transducers: Pressure sensors, accelerometers, and gyroscopes.* New York, 2000.

CLASS: BE Automobile (Elective -I)		Semester:-VII	
SUBJECT OPERATION RESEARCH (ELECTIVE-I)			
Periods per week 1 Period of 60 min.	Lecture	06	
	Practical	02	
	Tutorial	--	
		Hours	Marks
Evaluation System	Theory Examination	03	100
	Practical	--	--
	Oral Examination		25
	Term Work		25
	TOTAL		150

Sr. No.	Details	Hrs.
Module 01	Linear Programming: Linear Programming Problem Formulation – Graphical solution – Simplex method – Artificial variables techniques – Two-phase method, Big-M method – Duality Principle	12
Module 02	Transportation problem: Formulation – Optimal solution, unbalanced transportation problem – Degeneracy. Assignment problem – Formulation – Optimal solution - Variants of Assignment Problem- Traveling Salesman problem. Sequencing – Introduction – Flow –Shop sequencing – n jobs through two machines – n jobs through three machines – Job shop sequencing – two jobs through 'm' machines	7
Module 03	Replacement: Introduction – Replacement of items that deteriorate with time – when money value is not counted and counted – Replacement of items that fail completely, group replacement. Queuing Models: Introduction – Single Channel – Poisson arrivals – exponential service times – with infinite population and finite population models– Multichannel – Poisson arrivals – exponential service times with infinite population single channel Poisson arrivals	7
Module 04	Game Theory: Introduction – Minimax (maximin) – Criterion and optimal strategy – Solution of games with saddle points – Rectangular games without saddle points – 2 X 2 games – dominance principle – m X 2 & 2 X n games –graphical method.	6
Module 05	Inventory Models: Introduction – Single item – Deterministic models – Purchase inventory models with one price break and multiple price breaks – shortages are not allowed – Stochastic models – demand may be discrete variable or continuous variable – Instantaneous production. Instantaneous demand and continuous demand and no set up cost.	8
Module 06	Dynamic programming: Introduction – Bellman's Principle of optimality – Applications of dynamic programming- capital budgeting problem – shortest path problem – linear programming problem Simulation: Definition – Types of simulation models – phases of simulation– applications of simulation – Inventory and Queuing problems Advantages and Disadvantages – Simulation Languages	8

CLASS: BE Automobile (Elective -I)		Semester:-VII	
SUBJECT OPERATION RESEARCH (ELECTIVE-I)			
Periods per week 1 Period of 60 min.	Lecture	06	
	Practical	02	
	Tutorial	--	
		Hours	Marks
Evaluation System	Theory Examination	03	100
	Practical	--	--
	Oral Examination		25
	Term Work		25
	TOTAL		150

Sr. No.	Details	Hrs.
Module 01	Linear Programming: Linear Programming Problem Formulation – Graphical solution – Simplex method – Artificial variables techniques – Two-phase method, Big-M method – Duality Principle	12
Module 02	Transportation problem: Formulation – Optimal solution, unbalanced transportation problem – Degeneracy. Assignment problem – Formulation – Optimal solution - Variants of Assignment Problem- Traveling Salesman problem. Sequencing – Introduction – Flow –Shop sequencing – n jobs through two machines – n jobs through three machines – Job shop sequencing – two jobs through 'm' machines	7
Module 03	Replacement: Introduction – Replacement of items that deteriorate with time – when money value is not counted and counted – Replacement of items that fail completely, group replacement. Queuing Models: Introduction – Single Channel – Poisson arrivals – exponential service times – with infinite population and finite population models– Multichannel – Poisson arrivals – exponential service times with infinite population single channel Poisson arrivals	7
Module 04	Game Theory: Introduction – Minimax (maximin) – Criterion and optimal strategy – Solution of games with saddle points – Rectangular games without saddle points – 2 X 2 games – dominance principle – m X 2 & 2 X n games –graphical method.	6
Module 05	Inventory Models: Introduction – Single item – Deterministic models – Purchase inventory models with one price break and multiple price breaks – shortages are not allowed – Stochastic models – demand may be discrete variable or continuous variable – Instantaneous production. Instantaneous demand and continuous demand and no set up cost.	8
Module 06	Dynamic programming: Introduction – Bellman's Principle of optimality – Applications of dynamic programming- capital budgeting problem – shortest path problem – linear programming problem Simulation: Definition – Types of simulation models – phases of simulation– applications of simulation – Inventory and Queuing problems Advantages and Disadvantages – Simulation Languages	8

Theory Examination:

1. Question paper will comprise of total seven question, each of 20 Marks
2. Question one will be compulsory and based on maximum part of syllabus.
3. Remaining questions will be mixed in nature (for example supposed Q.2 has part (a) from module 3 then part (b) will be from any module other than module 3)
4. Only five question need to be solved.

In question paper weightage of each module will be proportional to number of respective lecture hours as mention in the syllabus.

Oral Examination:

Oral examination will be on maximum portion of the syllabus.

Term Work:

Term work shall consist of minimum 06 assignments at least one on each module, and written test. The distribution of marks for term work shall be as follows:

- Assignments and visit report: (15) Marks.
- Test (at least one): (10) Marks.
- TOTAL: (25) Marks.**

Text Books:

1. A.Ravindran , D Phillips, Operations Research :Principal and Practices
2. Operations Research / S.D.Sharma-Kedarnath.

References:

1. Operations Research /A.M.Natarajan,P.Balasubramani,A. Tamilarasi /Pearson Education
2. Operations Research: Methods and Problems / Maurice Saseini, Arthur Yaspan and Lawrence Friedman
3. Operations Research / R.Pannerselvam, PHI Publications.
4. Introduction to O.R/Hiller & Libermann (TMH) O.R/Wayne L.Winston/Thomson Brooks/cole
5. Introduction to O.R /Taha/PHI

CLASS: BE Automobile (Elective –I)			Semester:-VII	
SUBJECT: INFORMATION TECHNOLOGY FOR MANAGEMENT OF ENTERPRISES (ELECTIVE I)				
Periods per week 1Period of 60 min.	Lecture	06		
	Practical	02		
	Tutorial	--		
		Hours	Marks	
Evaluation System	Theory Examination	03	100	
	Practical		--	
	Oral Examination		25	
	Term Work		25	
	TOTAL			150

Sr. No.	Details	Hrs.
Module 01	<u>IT in the Organization</u> 1.1 Organizational Performance: IT support and Applications. Doing Business In the Digital Economy, Business pressures, organizational performance and responses and IT support. Information Systems and Information Technology, the adaptive , Agile, Real time Enterprise. Information Technology Development and Trends. 1.2 IT Support Systems: Concepts and Management Information Systems Concepts and Definitions. Classifications and Types of Information Systems, How IT supports People and Organizational Activities, How It supports Supply Chains and Enterprise Systems, Information Systems Infrastructure and Architecture, Emerging Computing Enviornments:SaaS, SOA and more. Managerial issues.	05
Module 02	<u>IT Infrastructure:</u> 2.1 Managing Data: Databases and warehousing. Data Management A Critical success Factor,. File management, Databases and Data Base Management Systems. Creating Databases, Data warehousing, Marketing databases in action, Web Based Data Management Systems. Managerial issues. 2.2 Networks Computing for Collaboration Discovery Search and Customized Delivery. Communication, Messaging and Collaboration. Social and Ethical issues, Managerial Issues.	07

Module 03	<u>The Web revolution</u> 3.1 E Commerce and E Business: Overview of E Business and E commerce, Major EC Mechanisms. Business to Consumer applications, B2B Applications, Major models of E Business : From E-Government to C2C, e Commerce Support Services : Advertising Payments and order Fulfillment, Ethical and legal issues in E Business, Managerial Issues. 3.2 Wireless Devices and their applications: Mobile Computing and Commerce: Overview Benefits and Drivers. Mobile applications in Financial Services, Mobile Shopping Advertising and Content providing, Mobile enterprise and Interbusiness Applications, Mobile consumer Services and Entertainment, Location Based Services and Commerce, Pervasive Computing, Managerial Issues.	08
Module 04	<u>Organizational Applications</u> 4.1 IT Compliance: Functional Applications and Transaction Processing Functional informational Systems, transaction processing Information systems. Managing Production / Operations and Logistics, Managing Marketing and Sales Systems, Managing the accounting and Finance. Systems. Managing human Resource Systems, Integrating Functional Information Systems. How IT supports compliance, Managerial Issues. Understanding Enterprise Systems: Supply Chain Essentials of Enterprise systems and supply chains, supply chain challenges. supply chain opportunities. Business value of Enterprise systems. Enterprise resource planning systems, Business Process Management, Product life cycle Management, Customer Relationship Management, Managerial Issues 4.2 Global and Interorganizational Information Systems: Interorganizational Activities and order fulfillment, interorganizational information Systems and Virtual Corporations. Global Information Systems. Facilitating IOS and Global Systems from Demand driven Networks to RFID. Interorganizational Information Integration, Partner relationship Management and collaborative commerce, Managerial issues.	10

Module 05	<u>Managerial and Decision Support Systems</u> 5.1 Managing Knowledge Introduction to Knowledge Management, Organizational Learning and Memory, knowledge management activities, Approaches to Knowledge management, Information Technology in Knowledge Management, knowledge Management Systems implementation, Roles of people in knowledge management, Ensuring Success of KM Efforts, Managerial Issues. 5.2 Corporate Performance Management and Business Intelligence: A framework of Business Intelligence: concepts and Benefits, Business Analytics: Online analytical processing reporting and querying, Data Text Web mining and Predictive Analytics, Data Visualization, Geographical Information Systems and virtual reality, real time business intelligence, and competitive Intelligence, Business Performance Management Scorecards and Dashboards, Managerial Issues. 5.3 Managerial Decision making and IT support systems Managers and Decision making, Decision support systems.: for Individuals groups and Enterprise, Intelligent Support Systems : The basics, Expert Systems, Other intelligent systems, Automated Decision Support (ADS), Managerial Issues.
Module 06	<u>Implementing and Managing IT</u> 6.1 IT: Strategic objectives and Planning IT Strategic Alignment, Competitive Forces Model, Value Chain Model, Strategic Resources and Capabilities, IT Planning, Interorganizational and international IT planning, Managing the IS department, Managerial issues. 6.2 Economics of IT: Financial and Economic Trends and the productivity paradox, Evaluating IT investment: Benefits Costs and Issues, Methods for evaluating and justifying IT Investment, IT Economics strategies: Chargeback and Outsourcing, Economic aspects of IT and Web Based Systems, Managerial Issues. 6.3 IT Application Acquisitions and Options The landscape and framework of IT Application Acquisition, Identifying Justifying and planning IT systems applications, Acquiring IT applications: available options, Outsourcing, application service providers and utility computing, selecting an acquisition approach and other implementation issues, Connecting to Databases, Enterprise systems and Business Partners, Business Process Redesign, Managerial Issues.

Theory Examination:

1. Question paper will comprise of total seven question, each of 20 Marks
2. Question one will be compulsory and based on maximum part of syllabus.
3. Remaining questions will be mixed in nature (for example supposed Q.2 has part (a) from module 3 then part (b) will be from any module other than module 3)
4. Only five question need to be solved.

In question paper weightage of each module will be proportional to number of respective lecture hours as mention in the syllabus.

Oral Examination:

Oral examination will be on maximum portion of the syllabus.

Term Work:

Term work shall consist of minimum **06** assignments (at least one on each module) and written test. The distribution of marks for term work shall be as follows:

- Laboratory work (experiments/assignments): (15) Marks.
- Test (at least one): (10) Marks.
- TOTAL:** (25) Marks.

Text Books:

1. Efrain Turban, Dorothy Leidner, Ephraim McLean, James Wetherbe "Information Technology for Management: Transforming Organizations in the Digital Economy", 6th edition. ISBN: 978-8126-51441
2. Management of Information Technology, Carroll Frenzel, Cengage Learning
3. Information Technology for Management- Henry Lucas, Tata McGraw Hill

Reference

1. IT systems Management , Rich Schiesser, Eastern Economy Edition
2. IT Strategy and Management, Sanjiva Shankar Dubey, Prentice Hall

CLASS: BE Automobile (Elective –I)			Semester:-VII	
SUBJECT: VIRTUAL REALITY (ELECTIVE I)				
Periods per week 1Period of 60 min.	Lecture	06		
	Practical	02		
	Tutorial	--		
		Hours	Marks	
Evaluation System	Theory Examination	03	100	
	Practical		--	
	Oral Examination		25	
	Term Work		25	
	TOTAL		150	

Sr. No.	Details	Hrs.
Module 01	1.1 Introduction: A short history of early virtual reality, early commercial VR Technology, VR becomes an Industry, The five classical components of VR Systems. 1.2 Input Devices: Trackers, Navigations and Gesture Interfaces. Three Dimensional Position Trackers: Tracker performance parameters, Mechanical trackers, Magnetic trackers, Ultrasonic trackers, Optical Trackers and Hybrid Inertial Trackers Navigation and Manipulation Interfaces: Tracker based Navigation/Manipulation Interfaces, Trackballs, and three Dimensional Probes Gesture Interfaces: The Pinch Glove, the 5DT Data Glove, the Didjiglove, the Cyberglove	06
Module 02	2. Output Devices: Graphical, Three Dimensional Sound and Haptic Displays. Graphical Display: The human visual system, personal graphics displays, large volume displays. Sound displays: the human auditory system, the convolvotron, Speaker based three dimensional sound. Haptic Feedback: The human haptic system, Tactile Feedback Interfaces, Force Feedback Interfaces.	08
Module 03	3. Computing Architectures for Virtual Reality: The Rendering Pipeline: The graphical rendering pipeline, The haptics rendering pipeline. PC Graphics Architectures: Pc Graphics Accelerators, Graphics Benchmarks. Work Station Based Architectures: the Sun Blade 1000 Architecture, The SGI Infinite Reality Architecture. Distributed VR Architectures: Multipipeline Synchronization, Colocated rendering Pipelines, Distributed Virtual Environments.	08
Module 04	4. Modeling: Geometric Modeling: Virtual Object Shape, Object Visual Appearance. Kinematics Modeling: Homogeneous Transformation Matrices, Object Position, Transformation Invariants, Object Hierarchies, viewing the three dimensional words. Physical Modeling: Collision Detection, Surface Deformation, Force Computation, Force Smoothing and Mapping, Haptic Texturing.	08

	Behavior Modeling and Model Management: Level of Detail Management, Cell Segmentation.	
Module 05	5.1 Virtual Reality Programming: Toolkits and Scene Graphs. World Toolkit: Model Geometry and Appearance, The WTK Scene Graph, Sensors and Action Functions, WTK Networking, JAVA 3D: Model Geometry and Appearance, Java 3D Scene graph, Sensors and Behaviors, Java 3D Networking, WTK and Java 3D Performance Comparison. General Haptics Open Software Toolkit: GHOST Integration with the Graphics Pipeline, The GHOST Haptic Scene Graph, Collision Detection and response, Graphics and PHANToM Calibration. 5.2 Human Factors in Virtual Reality: Methodology and Terminology: Data Collection and Analysis, Usability Engineering Methodology. User Performance Studies: Test bed Evaluation of universal VR Tasks, Influence of System Responsiveness on User Performance, Influence of Feedback Multimodality.	10
Module 06	6.1 Traditional Virtual Reality Applications: Medical Application of VR: Virtual Anatomy, Triage and Diagnostic, Surgery and Rehabilitation. Education, Arts and Entertainment: VR in Education, VR and the Arts, Entertainment Application of VR. Military VR Application: Army use of VR, VR Application in Navy, Air Force use of VR. 6.2 Emerging Application of VR: VR Application and Manufacturing: Virtual Prototyping, other VR Application in Manufacturing. Application of VR in Robotics: Robot Programming, Robot Tele operation. Information Visualization: Oil Exploration and Well Management, Volumetric Data Visualization.	08

Theory Examination:

1. Question paper will comprise of total seven question, each of 20 Marks
2. Question one will be compulsory and based on maximum part of syllabus.
3. Remaining questions will be mixed in nature (for example supposed Q.2 has part (a) from module 3 then part (b) will be from any module other than module 3)
4. Only five question need to be solved

In question paper weightage of each module will be proportional to number of respective lecture hours as mention in the syllabus.

Oral Examination:

Oral examination will be on maximum portion of the syllabus.

Term Work:

Term work shall consist of minimum 06 assignments (at least one on each module) and written test. The distribution of marks for term work shall be as follows:

- Laboratory work (assignments): (15) Marks.
- Test (at least one): (10) Marks.
- TOTAL:** (25) Marks.

References:

1. Grigore Burdea, Philippe Coiffet. "Virtual Reality Technology" 2nd edition. Wiley India
2. John Vince "Virtual Reality Systems" Pearson Education Asia
3. Understanding Virtual Reality, Sherman, Elsevier.

CLASS: BE Automobile (Elective –I)			Semester:- VII
SUBJECT: COMPUTATIONAL FLUID DYNAMICS			
Periods per week 1 Period of 60 min.	Lecture	06	
	Practical	02	
	Tutorial	--	
Evaluation System		Hours	Marks
	Theory Examination	3	100
	Practical		--
	Oral Examination		25
	Term Work		25
	TOTAL		150

Sr. No.	Details	Hrs.
Module 01	1. Introduction 1.1 What is CFD 1.2 Scope and Application of CFD 1.3 Methods of Predictions like Experimental, Theoretical 1.4 Working of Commercial CFD Softwares 1.5 Solution methodology-Preprocessing, Solver, Post processing	6
Module 02	2. Mathematical description of Physical Phenomenon 2.1 Governing Differential Equations 2.1.1 Meaning of Differential equation 2.1.2 The Continuity Equation 2.1.3 A Momentum equation 2.1.4 The Energy Equation 2.1.5 The General Differential Equation 2.2 Boundary Conditions 2.2.1 Initial and Boundary Conditions 2.2.2 Initial and Boundary Value problems	10
Module 03	3. Grid Generation and Discretization Methods 3.1 Structured and unstructured Grids 3.1.1 O-type, H-type, C-type of Structured Grid Generation 3.1.2 Mesh Adaptation 3.2 The Nature of Numerical Methods 3.2.1 The Discretization Concept 3.2.2 The Structure of the Discretization Equation 3.3 Methods of Deriving the Discretization Equations 3.3.1 Taylor-Series Formulation 3.3.2 Variational Formulation 3.3.3 Method of Weighted Residuals 3.3.4 Control Volume Formulation 3.4 Methods for finding the Solution of Discretized Equations	12

Module 04	4 Heat Conduction 4.1 Steady One-dimensional Conduction 4.2 Unsteady One-dimensional Conduction 4.3 Two and Three-dimensional Situations 4.4 Over relaxation and Under relaxation	6
Module 05	5. Convection and Diffusion 5.1 Steady One-dimensional and Two Dimensional Convection-Diffusion 5.2 Unsteady One-dimensional Convection-Diffusion 5.3 Unsteady Two-dimensional Convection-Diffusion 5.4 Solution of Steady heat Conduction by FEM	6
Module 06	6. Incompressible Fluid Flow 6.1 Governing Equations, 6.2 Stream Function-Vorticity Method 6.3 Determination of Pressure for Viscous Flow 6.4 The SIMPLE, SIMPLER Algorithm 6.5 Introduction to Turbulence Modeling 6.5.1 Basic Theories of Turbulence 6.5.2 The Time-Averaged Equations for Turbulent Flow	8

Theory Examination:

1. Question paper will comprise of total seven question, each of 20 Marks
2. Question one will be compulsory and based on maximum part of syllabus.
3. Remaining questions will be mixed in nature (for example supposed Q.2 has part (a) from module 3 then part (b) will be from any module other than module 3)
4. Only five question need to be solved.

In question paper weightage of each module will be proportional to number of respective lecture hours as mention in the syllabus.

Oral Examination:

Oral examination will be on maximum portion of the syllabus.

Term Work:

Term work shall consist of minimum 06 assignments/tutorials and written test. The distribution of marks for term work shall be as follows:

- Tutorials/assignments: (15) Marks.
- Test (at least one): (10) Marks.
- TOTAL: (25) Marks.**

Text Books:

1. Versteeg, H.K., Malalasekera, W.: "An introduction to computational fluid dynamics- The finite volume method", Prentice Hall
2. Anderson, D.A., Tannehill, I.I., and Pletcher, R.H., Computational Fluid Mechanics and Heat Transfer, Hemisphere Publishing Corporation, New York, USA, 1984.
3. Niyogi, P., Laha M.K., Chakrabarty S.K.: "Introduction to Computational Fluid Dynamics", Pearson Education, India.

References:

1. Muralidhar, K., and Sundararajan, T., "Computational Fluid Flow and Heat Transfer", Narosa Publishing House, New Delhi 1995.
2. Ghoshdasgupta, P.S., "Computer Simulation of flow and heat transfer" Tata McGraw-Hill Publishing Company Ltd., 1998.
3. Subas, V. Patankar "Numerical heat transfer fluid flow", Hemisphere Publishing Corporation
4. Taylor, C and Hughes J.B., Finite Element Programming of the Navier Stock Equation, Pineridge Press Ltd., U.K. 1981.
5. Fletcher, C.A.J., "Computational Techniques for Fluid Dynamics 1" Fundamental and General Techniques, Springer-Verlag, 1987.
6. Fletcher, C.A.J., "Computational Techniques for Different Flow Categories, Springer-Verlag
7. Bose, T.K., "Numerical Fluid Dynamics" Narosa Publishing House, 1997.
8. Schlichting, H.: "Boundary layer theory, McGraw-Hill, New York
9. Pope Stephen: "Turbulence"
10. Computational Fluid Dynamics, A practical approach to et al, ELSEVIER.

CLASS: BE Automobile (Elective -I)		Semester:-VII	
SUBJECT: INDUSTRIAL ROBOTICS (ELECTIVE I)			
Periods per week Period of 60 min.	Lecture	06	
	Practical	02	
	Tutorial	---	
		Hours	Marks
Evaluation System	Theory Examination	03	100
	Practical	--	--
	Oral Examination		25
	Term Work		25
	TOTAL		150

Sr. No.	Details	Hrs.
Module 01	1.1 INTRODUCTION: Automation & robotics, Robotic System & Anatomy Classification, Future Prospects 1.2 DRIVES: Control Loops, Basic Control System Concepts & Models, Control System Analysis, Robot Activation & Feedback Components, Position & Velocity Sensors, Actuators, Power Transmission Systems. 1.3 ROBOT & ITS PERIPHERALS: End Effecters - types, Mechanical & other grippers, Tool as end effector 1.4 SENSORS: Sensors in Robotics, Tactile Sensors, Proximity & Range Sensors, Sensor Based Systems, Uses Vision Systems - Equipment	8
Module 02	2 MACHINE VISION: Introduction, Low level & High level vision, Sensing & Digitising, Image processing & analysis, Segmentation, Edge detection, Object description & recognition, Interpretation, Applications	8
Module 03	3 PROGRAMMING FOR ROBOTS: Methods, Robot programme as a path in space, Motion interpolation, level & task level languages, Robot languages: Programming in suitable languages Characteristics of robot.	8
Module 04	4 ROBOT KINEMATICS: Forward, Reverse - & Homogeneous Transformations, Manipulator Path Control, Robot Dynamics.	7
Module 05	5 ROOT INTELLIGENCE & TASK PLANNING: Introduction, State space search, Problem, reduction, Use of predictive logic, Means -Ends Analysis, Problem solving, Robot learning,- Robot task planning.	9
Module 06	6.1 ROBOTIC APPLICATION IN MANUFACTURING: Material transfer, Machine loading & unloading, Processing operations, Assembly & Inspectors, Robotic Cell Design & Control. 6.2 SOCIAL ISSUES & ECONOMICS OF ROBOTICS	8

Theory Examination:

1. Question paper will comprise of total seven question, each of 20 Marks
2. Question one will be compulsory and based on maximum part of syllabus.
3. Remaining questions will be mixed in nature (for example supposed Q.2 has part (a) from module 3 then part (b) will be from any module other than module 3)
4. Only five question need to be solved.

In question paper weightage of each module will be proportional to number of respective lecture hours as mention in the syllabus.

Oral Examination:

Oral examination will be on maximum portion of the syllabus.

Term Work:

Term work shall consist of minimum 06 assignments at least one on each module, programming of robots and written test.

- Laboratory work (assignments, programming of robots): (15) Marks.
- Test (at least one): (10) Marks.

TOTAL: (25) Marks.

References:

1. Robotics for Engineers - Ycrem Koren
2. Robotics in Practice - J. F. Engelberger
3. Computer Integrated Manufacturing Technology and Systems - Ulrich rembolds, Christial Blume .
4. Computer Aided Design in Mechanical Engineering - Ramamurthy
5. Robot Dynamics
6. Robotics - John Craig
7. Robot manipulators: mathematics, Programming and Control - Paul r p
8. Industrial Robotics - Groover and Simmers
9. Measurement systems - Ernest deoblin
10. Meechanical Measurements - Beckwith and Lewisbuck
11. Modern control Engineering - K. Ogata
12. Automatic -Control- Systems - Benjamin Kus
13. Robotic Engineering An Integrated approach - Richard D. Kiafter and et. al.
14. Intelligent Robotic Systems - Spyros G. Tzafestas

CLASS: BE Automobile (Elective –I)		Semester:-VII	
SUBJECT : PIPING ENGINEERING (ELECTIVE-I)			
Periods per week 1Period of 60 min.	Lecture	06	
	Practical	02	
	Tutorial	--	
		Hours	Marks
Evaluation System	Theory Examination	03	100
	Practical	--	--
	Oral Examination		25
	Term Work		25
	TOTAL		150

Sr. No.	Details	Hrs.
Module 01	Introduction to Piping Introduction to phases of plant design, Role of Piping within project plan. Design Philosophy, Process data sheets, Process flow diagram, Piping & Instrumentation diagrams, and Equipment layout. Interdisciplinary inputs/coordination.	8
Module 02	Piping fundamentals Piping elements (pipes, fittings, flanges , gasket ,bolting , Valves) , Pipe schedule, Pipe thickness calculations, pipe fittings (bends, elbow ,Tees , Reducers. Stub ends, cross), Special pipe fittings, expansion joints, types of flanges, pressure temperature rating for flanges, Pipe hydraulics & Sizing.	10
Module 03	Piping Codes & Standards American Standards. Indian standards, British Standards for Piping Engineering. Selection of Design code. Unified numbering system (UNS). Piping materials : ASME ,ASTM , IS , DIN materials for piping components such as pipe , fittings , flanges ,bolting , supports ,expansion joints, valves etc. Selection of materials.	8
Module 04	Piping Drawing Piping symbols, orthographic (Plan & Elevation) drawings, Isometric Drawings. Plot Plan, Equipment Layout, & Piping GA Drawings. Plot Plan Development & Requirements(General guidelines) Equipment Layout Terminology. Control Point & Battery Limits. Preparation of Equipment Layout. Piping GA Drawing Requirements and Layout Procedure. Pump GA Drawing and Layout Consideration. Tank & Vessel Layout Consideration. GA - Print Reading Exercise	10
Module 05	Piping supports Fixed supports like Rest , Line guide, Line stop ,Hold down, Rigid strut etc., Flexible supports like variable spring support, constant spring support, Snubber etc.	4
Module 06	Piping Stress Analysis : Need of Stress Analysis, Procedure to carry out stress analysis, Loads on the piping system(such as sustained , thermal, occasional, hydro-test loads, water hammer, relief valve outlet), Allowable stress, Flexibility analysis, thermal load calculations, critical line list preparation , Steps involve in stress analysis of piping system,	8

Theory Examination:

5. Question paper will comprise of total seven question, each of 20 Marks
6. Question one will be compulsory and based on maximum part of syllabus.
7. Only five question need to be solved.

In question paper weightage of each module will be proportional to number of respective lecture hours as mention in the syllabus.

Oral Examination:

Oral examination will be on maximum portion of the syllabus.

Term Work:

ASSIGNMENTS

- 1 Introduction to Piping .
- 2 Piping fundamentals .
- 3 Piping Codes & Standards.
- 4 Piping materials.
- 5 Piping supports
- 6 Piping Stress Analysis.
- 7 Introduction to Modeling software's (PDMS, PDS etc.) & Stress analysis (CAESAR II) software's.

PRACTICALS

- 1 Draw Piping Symbols.
- 2 Draw General Arrangement for Plant Layout.
3. Pipe rack width calculation.
4. Draw Isometric drawing of any 5 piping systems

• Laboratory work (experiments/assignments):	(15)	Marks.
• Test (at least one):	(10)	Marks.
TOTAL:	(25)	Marks.

References:

1. Mohinder L. Nayyar , Piping Handbook , McGraw-Hill Publication
2. Macetta . John. "Piping Design Handbook", M. Dekker , 1992
3. ASME code for Process Piping .ASME B31.1
4. ASME code for Process Piping , ASME B31.3
5. ASME B16.5 . Pipe ,Flanges & Flange Fittings
6. An International Code 2007 ASME Boiler & Pressure Vessel Code. Rules For Construction of Pressure Vessels , Section II A,B,C&D.

CLASS: BE. Automobile (Elective -I)		Semester:- VII	
SUBJECT: DYNAMIC SYSTEM MODELLING & ANALYSIS (ELECTIVE I)			
Periods per week 1Period of 60 min.	Lecture	06	
	Practical	--	
	Tutorial	02	
Evaluation System		Hours	Marks
	Theory Examination	03	100
	Practical	--	
	Oral Examination	--	25
	Term Work	--	25
	TOTAL		150

Sr. No.	Details	Hrs.
Module 01	Introduction to dynamic systems. Mathematical Modeling of Dynamic Systems:--Using Newton's law of cooling, Torricelli's law, Radiocarbon dating, Radioactive Decay, Skydiver, Mixing problem, Kirchhoff's law, Terminal velocity, Motion of chain on pulley etc. Analysis and Design of Dynamic Systems.	08
Module 02	Complex Analysis: Complex numbers in Rectangular & Polar forms. Complex variables and Complex function. Differential Equations: Linear Differential Equations with constant Coefficients. Laplace Transform: Laplace transformation of Derivatives & Integrals. Inverse Laplace Transformation, Shift on t-axis & S-axis Applications of Laplace Transform: System Response- First order system / Second order systems. Initial Value Theorems, Final Value Theorems.	08
Module 03	Matrix Analysis: Vectors & Matrices, Determinants, Inverse & Rank of matrix, Eigen values & Eigen vectors, Partitioning of Matrices, Matrix Transformation & Diagonalization.	04
Module 04	System Model Representation Configuration Form State Space Representation Input- Output Equation. State Space Representation From I / O Equation & from Transfer function & Transfer Function from State Space.	08

Module 05	Mechanical System: Translation system, Rotational system ,Geared system. Electromechanical system: Elemental Relations of Electromechanical systems, Armature-Controlled DC Motors, Field-Controlled DC Motors, Electric Network Fluid & Thermal Systems	12
Module 06	MATLAB Basics: Introduction, Statements of variables, Vectors, MATLAB Functions, Printing and Graphics, Linear Algebra, Matrix Operations, Laplace Transforms. MATLAB Tutorial: Single Degree of Freedom Systems, Tow Degree of Freedom Systems, Transient Response Analysis, Response to Initial Condition	08

TERM WORK:

Term work shall comprise of the class assignments and a class test based on above syllabus.

Class Assignments : 15 Marks

Class test : 10 Marks

Total : 25 Marks

TEXT BOOKS:

- DYNAMIC SYSTEMS Modeling and Analysis – Hung V. Vu & Ramin S. Esfandiari. McGRAW-HILL INTERNATIONAL EDITIONS
- System Dynamics – Katsuhiko Ogata PEARSON Education
- Engineering System Dynamics—Rao V. Dukkupati. Narosa Publication
- Control Systems Engineering – Norman S. Nise. WILEY STUDENT EDITION

REFERENCES:

SYSTEM DYNAMICS & CONTROL—Eronini Umez- Eronini THOMSON

Theory Examination:

5. Question paper will comprise of total seven question, each of 20 Marks
6. Question one will be compulsory and based on maximum part of syllabus.
7. Remaining questions will be mixed in nature (for example supposed Q.2 has part (a) from module 3 then part (b) will be from any module other than module 3)
8. Only five question need to be solved.

In question paper weightage of each module will be proportional to number of respective lecture hours as mention in the syllabus.

CLASS: BE Automobile		Semester:- VIII	
SUBJECT: VEHICLE DESIGN			
Periods per week 1Period of 60 min.	Lecture	4	
	Practical	2	
	Tutorial	--	
Evaluation System	Theory Examination	Hours	Marks
	Practical	4	100
	Oral Examination	--	--
	Term Work	--	25
	TOTAL	--	25
			150

Sr.No	Details	Hrs.
Module 01	1. Springs: 1.1 Types. Material, stresses in helical springs of circular wire, surge in springs. design and numerical solutions of all types of springs used in Automobile ie leaf spring , coil spring etc. 2.Clutch 2.1 Numerical exercises on single plate 2.2 Design of multiplate, cone and centrifugal clutch.	10
Module 02	3. Gear Box 3.1 Design of spur gear . 3.2 Design of helical gears 3.3 Design of simple gear box 3.4 Design of bearings	10
Module 03	4. Propeller shaft, Universal Joint. 4.1 Theory and numerical. 4.2 Design and design consideration. 5. Front axle and steering 5.1 Design and numerical 6 Frame 6.1 Design and numerical	10
Module 04	7. Differantial & Steering System 7.1 Design of differential and axles etc. 7.2 Numerical problems on steering systems.	06
Module 05	8 Brakes 8.1 Numerical and design calculations on brakes	06

Module 06	9. Latest Trends 9.1 Transmissions like CVT , IVT and Brakes etc	06
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Theory Examination:

1. Question paper will comprise of total seven question, each of 20 Marks
2. Question one will be compulsory and based on maximum part of syllabus.
3. Remaining questions will be mixed in nature (for example supposed Q.2 has part (a) from module 3 then part (b) will be from any module other than module 3)
4. Only five question need to be solved.

In question paper weightage of each module will be proportional to number of respective lecture hours as mention in the syllabus.

Term Work:

Term work shall consist of minimum 6 assignments (sheets) and written test. The distribution of marks for term work shall be as follows:

- Laboratory work (assignments):(10) Marks.
- Test (at least one): (10) Marks.
- Attendance (practical & theory): (05) Marks.
- TOTAL: (25) Marks.

Text Books:

1. Machine Design by Pandya & Shah
2. Machine drawing by K.R. Gopalkrishna
3. Automobile Engineering Drawing by R. B. Gupta
4. Machine Design By Khurmi & Gupta
5. Machine Design By Sharma & Purohit

References:

- 1) Automobile Design bu Giles – Vol I, II & III
- 2) High Speed Diesel Engine by P.M. Heldt.
- 3) Internal Combustion Engine by V. L. Malcev
- 4) Internal Combustion Engine by L.C. Lichty
- 5) Internal Combustion Engines – Vol I by C.F. Taylor
- 6) Automobile Chassis – Design and calculations Mir Publication by P. Lukin and Gaspariyants and Radionaov

CLASS: BE Automobile		Semester:-VIII	
SUBJECT: FINITE ELEMENT ANALYSIS			
Periods per week. 1Period of 60 min.	Lecture	04	
	Practical	02	
	Tutorial	--	
		Hours	Marks
Evaluation System	Theory Examination	04	100
	Practical		--
	Oral Examination		25
	Term Work		25
	TOTAL		150

Sr. No.	Details	Hrs.
Module 01	1.1 Introductory Concepts: Introduction to FEM. Brief History. General FEM procedure. Applications of FEM in various fields. Advantages and disadvantages of FEM. 1.2 Differential Equations in different fields : Types of Differential Equations. Primary and Secondary Variables and types of Boundary Conditions. 1.3 Matrix Algebra: Matrix operations, Gauss Elimination Method to get inverse of a Matrix. Partitioning of Matrix. 1.4 Numerical Integration: Trapezoidal rule, simpson's 1/3 rd rule, Newton cotes formula, Gauss quadrature formula, Gauss quadrature in two dimensions.	6
Module 02	2.1 Approximate solution of differential equations-- Weighted residual techniques. collocation, Least squares and Galerkin methods. 2.2 FEM Procedure : Definitions of various terms used in FEM like element, order of the element, internal and external node/s, degree of freedom, primary and secondary variables, essential boundary conditions, natural boundary conditions, homogeneous and non-homogeneous boundary conditions.	7
Module 03	3.1 Minimization of a functional. Principle of minimum total potential. Piecewise Rayleigh-Ritz method. Comparison with weighted residual method. 3.2 Piecewise approximations. Basis of Finite Element Methods. Formulation of matrix method--"stiffness matrix"; transformation and assembly concepts.	8
Module 04	4.1 Example problems in one dimensional structural analysis, heat transfer and fluid flow (Stepped and Taper Bars, Fins, Fluid Network, Spring-Cart systems, Plane Trusses, Beams). 4.2 Elements of variational calculus. Band-width, aspect ratio, coarse and fine meshing, etc..	9
Module 05	5.1 Two dimensional finite element formulations. Introduction, Three noded triangular element, four noded rectangular element, six noded triangular element, compatibility, four noded quadrilateral element, eight noded quadrilateral element, nine noded quadrilateral element. 5.2 Natural coordinates and coordinate transformations: Alternate methods for deriving shape functions. Natural coordinates – quadrilateral elements, Natural coordinates – triangular elements.	11

	5.3 Isoparametry. Algorithms for solution of equations. Convergence criterion, patch test and errors in finite element analysis. Method of Elimination. Sources of error.	
Module 06	6.1 Finite element formulation of dynamics. Applications to free vibration problems. Lumped and consistent mass matrices. Algorithms for solution of Eigen value problems. Transient dynamics problems in heat transfer and solid mechanics.	7

List of Experiments:

At list three exercises from the following areas.

- 1) Thermal analysis
- 2) Fluid dynamics
- 3) Mechanical vibrations
- 4) Coupled field/ multiphysics

Each exercise shall cover tasks like Model-preparation, Mesh generation, Simulation, Post-processing etc. in any analysis software such as ANSYS, NASTRAN, ABACUSS etc.

Students shall attach the solution of above exercise as part of term work.

Course Project

In course project students shall integrate and apply the knowledge gained during the fundamental courses of Mechanical Engineering. The projects will be developed by teams of maximum two students (using any analysis software) and shall consist problem definition, model preparation, appropriate selection of elements, mesh generation, post processing, simulation and validation of results.

Theory Examination:

1. Question paper will comprise of total seven question, each of 20 Marks
2. Question one will be compulsory and based on maximum part of syllabus.
3. Remaining questions will be mixed in nature (for example supposed Q.2 has part (a) from module 3 then part (b) will be from any module other than module 3)
4. Only five question need to be solved.

In question paper weightage of each module will be proportional to number of respective lecture hours as mention in the syllabus.

Oral Examination:

Oral examination will be on maximum portion of syllabus.

Term Work:

Term work shall consist of minimum 03 experiments, assignments (one on each module) and written test. The distribution of marks for term work shall be as follows:

• Laboratory work (experiments/assignments):	(15)	Marks.
• Test (at least one):	(10)	Marks.
TOTAL:	(25)	Marks.

Text Books:

- 1) The Finite Element Method its Basis & Fundamentals –O.C.Zienkiewicz, R.L.Taylor & J.Z.Zhu, *Butterworth-Heinemann, Elsevier*
- 2) Finite Element Method, Reddy J. N., *McGrawHill*
- 3) The Finite Element Method in Engineering . 4th Edition, S.S.Rao, *Academic Press, Elsevier*
- 4) Finite Element Methods for Engineers, U.S.Dixit, *Cengage Learning*
- 5) Textbook of FE Analysis. P.Seshu, *Prentice Hall*
- 6) Introduction to Finite Elements Methods by Desai and Abel, *CBS Publication.*
- 7) Introduction to Finite Elements in Engineering by Tirupati R. Chandrupatla & Ashok D.Belegundu.

References:

- 1) Applied Finite Elements Analysis by Larry J: Segerlind John Wiley.
- 2) Finite Elements Hand Book by H. Kardestuneer.
- 3) Concepts & Applications of Finite Element Analysis by R.D.Cook.
- 4) Bathe, K.J., Finite Element Procedures in Engineering Analysis, *Prentice Hall of India.*
- 5) Huebener K.H., Dewhirst D.D., Smith D.E. and Byrom T.G., The Finite Element Method for Engineers. John Wiley, New York.
- 6) Finite Element Methods ,Logan, *Cengage Learning*
- 8) Finite Elements Analysis . George Buchanan *McGrawHill*
- 9) Finite Elements Analysis . C.S.Krishnamoorthy, *Tata McGrawHill*
- 10) Concept and Application of Finite Element Methods by Robert Cook, Wiley India.

CLASS: BE Automobile			Semester:- VIII
SUBJECT: VEHICLE MAINTENANCE			
Periods per week 1 Period of 60 min.	Lecture	4	
	Practical	2	
	Tutorial	--	
Evaluation System	Theory Examination	Hours 3	Marks 100
	Practical	--	--
	Oral Examination	--	25
	Term Work	--	25
	TOTAL		150

Sr. No.	Details	Hrs.
Module 01	1. Engine Maintenance-I 1.1 Engine Tuning & Vehicle care Definition. Necessity, procedure. it's effects, preparation of check sheet for engine tuning and important steps in vehicle maintenance, Maintenance and its types. 1.2 Engine analysis Definition. Testing and diagnosis of various engine and vehicle systems by engine analyzer. Computerized engine analysis for SI and CI engines, various tests conducted on computerized engine analyzer or Auto Master and test procedure 1.3 Engine compression and Vacuum test- Testing equipments and test procedure	10
Module 02	2. Engine Maintenance-II 2.1 Engine overhauling Definition. types of overhaul: i)Top overhaul or Decarbonising,ii)Major Overhaul and overhauling procedure 2.2 Diagnosis of Various engine faults such as failure to start, misfire, overheating . lack of power, etc. Engine noises and engine wear 2.3 Engine lubricating systems Purpose. various lubricating systems. types of lubricants used in different vehicle components. Characteristics of lubricants, Engine oil. and analysis of fresh and used oil.	08
Module 03	3. Troubleshooting And Servicing 3.1 Ignition systems Battery troubles and their causes. effects and remedies. Ignition timing. 3.2 Starter motor. Generator and alternator Types of starting devices used in an automobile. Differences between starter motor generator and alternator. Routine maintenance & servicing procedures for all 3.3 Present trends in Painting and Denting Painting technology. paint defects. causes and remedies. Body	08

	repairing & reconditioning methods.	
Module 04	4. Fault Tracing-I 4.1 Transmission and drive line components Introduction, Manual transmission-troubles diagnosis and servicing, Manual transaxles trouble diagnosis and servicing. Automatic transmission-trouble diagnosis and servicing. 4.2 Steering and Suspension systems Trouble diagnosis, their causes, inspection and servicing of steering and suspension components, Wheel alignment, procedure of Computerized wheel alignment.	08
Module 05	5. Fault Tracing-II 5.1 Braking Systems Drum brakes and Disc brakes, troubles, causes, and their remedies, Power brakes, ABS trouble diagnosis and their servicing 5.2 Wheels and tyres Wheel balance, wheel run out, static and dynamic balancing, wheel repairing, Computerized wheel balancing procedure. Tyre inspection, tyre wear and its remedy, Tyre retreading, Tyre servicing and repair, Demounting of tyre from rim.	08
Module 06	6. Fault Tracing-III 6.1 On Board Diagnostics Diagnostic equipments, Study of operation of latest diagnostic equipments such as Oscilloscopes, Engine analyzers, serial port communications. On Board diagnostics, Networking, Electronic Service Bay, Multi Protocol Adaptor etc.	06

List of Experiments:

1. To perform engine analysis of petrol & diesel engines using a computerized engine analyzer or Auto Master.
2. To perform wheel balancing on a computerized wheel balancer.
3. To find the steering geometry of a vehicle using a computerized wheel aligner
4. Removing and refitting of tyre using an automatic tyre changer.
5. Dismantling, inspection and repairing and assembly of engine components.
6. Experiment on calibration of the fuel injection pump.
7. Study of body repairing and reconditioning methods.

Theory Examination:

1. Question paper will comprise of total seven question, each of 20 Marks
 1. Question one will be compulsory and based on maximum part of syllabus.
 2. Remaining questions will be mixed in nature (for example supposed Q.2 has part (a) from module 3 then part (b) will be from any module other than module 3)
 3. Only five question need to be solved.
- In question paper weightage of each module will be proportional to number of respective lecture hours as mention in the syllabus.

Practical and Oral Examination:

Practical and oral examination will be based on one experiment performed from the list of experiment given in the syllabus and the oral will be based on the same experiment.

Term Work:

Term work shall consist of minimum 7 experiments, assignments, one automotive industry visit report and written test. The distribution of marks for term work shall be as follows:

• Laboratory work (experiments/assignments):	(15)	Marks.
• Test (at least one):	(10)	Marks.
TOTAL:	(25)	Marks.

Text Books:

1. Automotive Mechanics by W.H. Crouse and Anglin.
2. Automobile Electrical and electronic systems(Second Edition) by Tom Denton
3. Automotive Mechanics by Joseph Heitner.
4. Automotive Engines Theory & Services , Pearson Education by J.D. Halderman , C.D. Mitchell Jr.

References:

1. Mechanics of road vehicle by W. Steeds
2. The Motor vehicle by Newton Steeds Garrett.
3. The Mechanism of Car by Arthur W. Judge.
4. Automobile repair Guide by Dwaggins.
5. AA Book of car- Drive publication Ltd., London
6. Maruti Service Manual-MUL, Haryana.
7. Maruti Gypsy Service Manual-MUL, Haryana.
8. SAE Journals.

CLASS: BE Automobile			Semester:- VIII
SUBJECT: VEHICLE DYNAMICS			4
Periods per week 1 Period of 60 min.	Lecture		2
	Practical		--
	Tutorial		--
Evaluation System		Hours	Marks
	Theory Examination	3	100
	Practical	--	--
	Oral Examination	--	--
	Term Work	--	--
	TOTAL		100

Sr. No.	Details	Hrs.
Module 01	1. Fundamentals of vehicle dynamics Simple spring mass system of two masses Motion after the hump Acceleration for stepped input Single mass system with two degree of freedom Theory and problems from Conjugate points Fundamental approach to vehicle modeling. Road loads 1.8 Aerodynamics - Drag, side force, Lift force, Rolling resistance, Total road loads, Ride, Vehicle response properties, Perception of ride.	10
Module 02	2. Tyres & Suspension systems: Tyres Tyre construction Tractive properties Cornering properties Camber thrust Aligning moment Combined braking and cornering Conicity and ply steer Tire vibrations Jack Knifeing of articulated vehicles Tyre properties affecting vehicle rollover. Suspension systems Solid axles Independent suspensions Anti- Squat and anti- pitch suspension geometry Equalizing type of suspension Interconnected suspension Active suspension Variable rate leaf spring.	10

Module 03	3. Steering Systems 3.1 Steering geometry 3.2 Front wheel geometry 3.3 Steering system forces and moments 3.4 Steering system effects 3.5 Influence of front wheel drive 3.6 Four wheel steering 3.7 Steering oscillations, Shimmy & wheel wobble	06
Module 04	4. Dynamics of systems Steady state cornering Low speed turning High speed cornering Suspension effect of cornering Stability derivatives (Derivation and problems) Analysis of two degree of freedom model in yaw and side slip Steady state and Transient behavior	08
Module 05	5. Vehicle Rollover Roll Center of suspension linkages Roll axes and roll angles Non- Roll layout No Roll suspensions Anti- roll bar and its effects Euler's equation of motion Inertia tensor axes Characteristics of on road rollover Rollover resistance 5.10 Anti rollover Braking	08
Module 06	6. Recent trends in vehicle dynamics 6.1 Stability Control systems 6.2 Introduction of vehicle sensors 6.3 Central tyre inflation systems 6.4 Influence of parameters at vehicle rollover 6.5 Vehicle dynamics simulations 6.6 Latest trends	06

Theory Examination:

1. Question paper will comprise of total seven question, each of 20 Marks
2. Question one will be compulsory and based on maximum part of syllabus.
3. Remaining questions will be mixed in nature (for example supposed Q.2 has part (a) from module 3 then part (b) will be from any module other than module 3)
4. Only five question need to be solved.

In question paper weightage of each module will be proportional to number of respective lecture hours as mention in the syllabus.

Practical and Oral Examination:

Practical and oral examination will be based on one experiment performed from the list of experiment given in the syllabus and the oral will based on the same experiment.

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Term Work:

Term work shall consist of minimum 6 assignments and written test. The distribution of marks for term work shall be as follows:

• Laboratory work (experiments/assignments):	(15)	Marks.
• Test (at least one):	(10)	Marks.
TOTAL:	(25)	Marks.

Text Books:

1. Vehicle dynamics By S.R. Ellis.
2. Fundamentals of Vehicle Dynamics By Thomas. D. Gillespie.
3. Road Dynamics By W. Steed

References:

1. Mechanics of Road vehicle By Steeds.
2. Vehicle Dynamics- R.K.Kulkarni, Narosa Publication, New Delhi
3. Mechanics of vehicles By J.J. Taborelc.
4. Automobile suspension and Handling By Colin Campell.
5. Car suspension By Bastow.
6. SAE SP-1445
7. SAE 2000-01-1624
8. SAE 2000-01-2669

CLASS: BE Automobile		Semester:- VIII	
SUBJECT: VEHICLE SAFETY (ELECTIVE II)			
Periods per week Period of 60 min.	Lecture	4	
	Practical	2	
	Tutorial	--	
Evaluation System	Theory Examination	Hours	Marks
	Practical	3	100
	Oral Examination	--	--
	Term Work	--	25
	TOTAL	--	25
			150

Sr. No.	Details	Hrs.
Module 01	1. Basic Concepts Of Vehicle Safety 1.1 Importance of Vehicle Safety 1.2 Global priority for vehicle safety 1.3 Underlying principles 1.4 Fail-safe 1.5 Alternative design 1.6 Redundancy and derating 1.7 Fault tolerance 1.8 Safety factors 1.9 Positive guidance 1.10 Warnings and instructions 1.11 Universal design 1.12 Survivability and injury reduction 1.13 System engineering 1.14 Digital models and Man testing	08
Module 02	2. Study And Design for structural & pedestrian safety 2.1 preliminary consideration in vehicle structural design 2.2 structural design for occupant protection 2.3 passenger car body structure for energy absorption 2.4 design of school bus for safety 2.5 Design of front end system for pedestrian safety 2.6 comprehensive approach to increased pedestrian safety in pedestrian to car accidents	10
Module 03	3. Study and design for impacts 3.1 Side impact 3.1.1 Side impact barrier – Development & evolution 3.1.2 IIHS side impact barrier – development & crash test 3.1.3 side impact motor vehicle structural characteristics from crash tests 3.2 Compatibility Development of test procedures & performance criteria to improve compatibility in car frontal collisions improvement in car to car compatibility	12

	3.3 Rear impact 3.3.1 Whiplash injury 3.3.2 kinematics of human spine in rear impact and the bio-fidelity of current dummies 3.3.4 Design of dummies & simulation of impacts	
Module 04	4. Occupant Injury Prevention: Biokinetics 4.1 Introduction . 4.2 Active and Passive safety 4.3 Seat belts and passenger restraint systems 4.4 Seats and Seat frames 4.5 Door locking and retention devices 4.6 Safety glasses 4.7 Child protection devices 4.8 Warning and signaling devices 4.9 Anti theft devices 4.10 design of visual displays & controls 4.11 Heads –up displays	06
Module 05	5. Steering Column, Braking Systems And Crash Testing 5.1 Collapsible and impact protection devices 5.2 Design of running gear for safety 5.3 Load sensing and pressure regulating devices 5.4 Split or dual braking systems 5.5 Antilock braking systems 5.6 Traction control devices 5.7 Crash Testing 5.7.1 Human testing 5.7.2 Crashworthiness 5.7.3 Compliance testing 5.7.4 Component testing 5.7.5 Proving ground testing 5.7.6 In-field testing	06
Module 06	6. Future Technology 6.1 Collision avoidance radar warning system 6.2 Low tyre pressure warning system 6.3 Advanced driver information system 6.4 Safety Regulations of EEC, FMVSS AND CMVR 6.5 In car safety & personal security . needs of female drivers & passengers	06

List of Experiments:

1. Measurement of wiping area.
2. Eye lids and H-point determination
3. Study of Tell Tale symbols in Indian cars.
4. Study of signaling and warning devices-turn Indicators, horns-performance evaluation.
5. Lighting devices-study of legal requirements, testing and evaluation.
6. Testing of vehicles for braking regulations.
7. Study of control devices in two wheelers.
8. Measurement of turning circles and steering behaviour in transient operation.
9. Calibration of speedometer and odometer.
10. Study of maneuverability as per ISO.
11. Safety belt-evaluation for compliance with regulations.
12. Impact testing of bumpers.
13. Study of dummies for impact test,
14. Door latch testing.
15. Hood latch (bonnet) testing.
16. Rear view mirror testing.
17. Evaluation of bypass noise.
18. Measurement of interior noise in vehicles.
19. Rollover test.

Theory Examination:

1. Question paper will comprise of total seven question, each of 20 Marks
2. Question one will be compulsory and based on maximum part of syllabus.
3. Remaining questions will be mixed in nature (for example supposed Q.2 has part (a) from module 3 then part (b) will be from any module other than module 3)
4. Only five question need to be solved.

In question paper weightage of each module will be proportional to number of respective lecture hours as mention in the syllabus.

Practical and Oral Examination:

Practical and oral examination will be based on one experiment performed from the list of experiment given in the syllabus and the oral will based on the same experiment.

Term Work:

Term work shall consist of minimum 8 experiments, assignments and written test. The distribution of marks for term work shall be as follows:

- Laboratory work (experiments/assignments): (15) Marks.
- Test (at least one): (10) Marks.
- TOTAL:** (25) Marks.

Text Books:

1. Automotive vehicle safety by George Peters and Barbara Peters
2. International conference on Vehicle Safety 2002
3. Understanding Automotive electronics by William Ribbens.
4. Central Motor vehicle Rules (CMVR).

References:

1. SAE Handbook
2. Vehicle safety by Limpert
3. EEC Regulations
4. SAE special publications
5. Body Design By Polowski

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CLASS: BE Automobile		Semester:-VIII	
SUBJECT: BUSINESS PROCESS REENGINEERING (ELECTIVE II)			
Periods per week 1 Period of 60 min.	Lecture	04	
	Practical	02	
	Tutorial	---	
		Hours	Marks
Evaluation System	Theory Examination	03	100
	Practical	---	---
	Oral Examination		25
	Term Work		25
	TOTAL		150

Sr. No.	Details	Hrs.
Module 01	1.1 What is BPR 1.2 Considerations in BPR 1.3 TQM 1.4 SW available for BPR	5
Module 02	2.1 How to Plan Your Project, .Select the Right Team, and Choose Your Approach 2.2 Articulate the business issues driving the project 2.3 Clearly define your project's objectives	8
Module 03	3.1 Gain buy-in from key business leaders 3.2 Define the project scope 3.3 Create a powerful team	8
Module 04	4.1 Choose your reengineering steps 4.2 Select and work with consultants	8
Module 05	5.1 Prepare a project budget 5.2 Project Planning Template and Guidelines 5.3 Reengineering Team Selection Criteria and Approach	9
Module 06	6.1 Methodology Selection 6.2 Project Readiness Assessment 6.3 Case Studies of BPR	10

Theory Examination:

1. Question paper will comprise of total seven question, each of 20 Marks
2. Question one will be compulsory and based on maximum part of syllabus.
3. Remaining questions will be mixed in nature (for example supposed Q.2 has part (a) from module 3 then part (b) will be from any module other than module 3)
4. Only five question need to be solved.

In question paper weightage of each module will be proportional to number of respective lecture hours as mention in the syllabus.

Oral Examination:

Oral examination will be on maximum portion of the syllabus.

Term Work:

Term work shall consist of minimum 06 assignments at least one on each module, two case studies and written test. The distribution of marks for term work shall be as follows:

• Assignments and case studies:	(15)	Marks.
• Test (at least one):	(10)	Marks.
TOTAL.	(25)	Marks.

Text Books:

1. Reengineering the Corporation - A Manifesto for Business Revolution by M. Hammer and James Champy.
2. Reengineering for Results: Keys to Success from Government Experience Sharon L. Caudle; *National Academy of Public Administration*.
3. The Breakthrough Strategy For Total Quality, Productivity, And Competitiveness James Harrington
4. The Change Management Toolkit for Reengineering
For companies and individuals involved in reengineering and represents a practical approach to the management of change - in any organization - from Holland and Davis, WorthingBrighton Press.
5. Competing for the Future. Gary Hamel and C.K. Prahalad; book review and ordering info.

References:

1. Deming Management Method, The Mary Walton; Perigee, Books, Book review Best Practices In Reengineering, McGraw-Hill New York, NY, 1995 by David K. Carr and Henry J. Johansson, Coopers and Lybrand
2. Managing the Change Process: A Field Book for Change Agents, Team, Leaders and Reengineering Managers; David K. Carr, Kelvin J. Hard, William J. Trahan
3. New Tools For New Times: The Workflow Paradigm, Second Edition, WARIA Book Review on line, <http://www.waria.com/waria/fischer.html>
4. Process Innovation: Reengineering Work Through Information Technology, Thomas Davenport; Harvard Business School Press
5. Reengineering Revolution, A Handbook (The) HarperCollins - Publishers, Inc. New York, 1995. Michael Hammer and Steven A. Stanton: Book Review Only
6. The Wisdom of Teams: Creating the High-Performance Organization. Jon R. Katzenbach Douglas K. Smith.
7. Winning With Quality: Applying Quality Principles In Product Development, John W. Wesner, Jeffrey M. Hiatt, and David C. Trimble
8. Business Process Re-Engineering and Change Management by B R Dey, Biztantra Publication.

CLASS: BE(Automobile)			Semester:- VIII	
SUBJECT: NON-CONVENTIONAL ENERGY SOURCES Elective II				
Periods per week 1Period of 60 min.	Lecture	04		
	Practical	02		
	Tutorial	--		
		Hours	Marks	
Evaluation System	Theory Examination	03	100	
	Practical	--	--	
	Oral Examination		25	
	Term Work		25	
	TOTAL		150	

Sr. No.	Details	Hrs.
Module 01	1. ENERGY REQUIREMENT - OF INDIA AND WORLD : Present energy scenario, conventional energy sources- World's production and reserves, India's production and reserves. Global energy crises, shortcomings and limitations to the existing energy sources. need for alternative energy sources.	6
Module 02	SOLAR ENERGY: Solar radiation- Terrestrial and extra terrestrial, extra instruments. Energy potential of sun, simple flat plate collector. design of liquid flat plate collector, selective coatings, Application of LFPC performance, analysis of LFPC. Concentrating collectors, solar ponds, solar distillators, solar satellite power system, solar cooker, solar air heaters, solar driers, photovoltaic direct energy conversion, solar cells, solar thermal power system, solar energy storage. HYDRO-POWER: Principle of hydro-power- prospects of small hydropower. mini and micro power systems. hydropower conversion devices-Turbine. status in India.	10
Module 03	WIND ENERGY: History. principle of wind power. Betz model. wind mills- horizontal axis and vertical axis. horizontal axis wind turbines. their components. Operation. recent developments and their site characteristics. Vertical axis- Magnus effect. Madaras & Darrieus turbine. Application of wind energy.	7
Module 04	GEO THERMAL ENERGY: History and future, origin and types of geothermal energy regions, dry rock and hot Aquifer analysis, vapor dominated and liquid nominated geothermal systems. operational and environmental problems.	7
Module 05	OCEAN ENERGY: Types of ocean energy sources, Ocean temperature difference, OTEC cycles-closed and open. Comparison with normal thermal power cycles. Ocean waves-Wave motion. Energy power from waves. Wave energy conversion devices. Tidal Power-Formation and causes of tides. power from tides. Tidal	9

	power devices.	
Module 06	BIOMASS ENERGY: Various forms of biomass as a potential energy source, energy plantation, Bio-fuel production processes, Biogas plants, Gassifiers, principle, construction and design of gassifiers, individual and community bio and gobar gas plants, Types of gobar gas plants. CHEMICAL ENERGY SOURCES: Fuel cells-principle, classification, advantage and disadvantage, application and recent development	9

Theory Examination:

1. Question paper will comprise of total seven question, each of 20 Marks
2. Question one will be compulsory and based on maximum part of syllabus.
3. Remaining questions will be mixed in nature (for example supposed Q.2 has part (a) from module 3 then part (b) will be from any module other than module 3)
4. Only five question need to be solved.

In question paper weightage of each module will be proportional to number of respective lecture hours as mention in the syllabus.

Oral Examination:

Oral examination will be on maximum portion of the syllabus.

Term Work:

Term work shall consist of minimum **06** assignments (at least one on each module) and written test. The distribution of marks for term work shall be as follows:

- Laboratory work (experiments/assignments): (15) Marks.
- Test (at least one): (10) Marks.
- TOTAL:** (25) Marks.

Text Books:

1. Renewable Energy Sources - John W. Twidell & Anthony D. Weir. ELBS Pub.
2. Non-Conventional energy sources - G.D. Rai

References:

1. Solar Energy - Principle of thermal collection and Storage -- S.P. Sukhatme, J.K. Nayak Tata McGraw Hill
2. Solar Energy. Fundamentals and Applications, Garg, Prakash, Tata McGraw Hill

CLASS: BE Automobile			Semester:-VIII	
SUBJECT: INTRODUCTION TO NANOTECHNOLOGY (ELECTIVE II)				
Periods per week 1Period of 60 min.	Lecture	04		
	Practical	02		
	Tutorial	--		
		Hours	Marks	
Evaluation System	Theory Examination	03	100	
	Practical		--	
	Oral Examination		25	
	Term Work		25	
	TOTAL		150	

Sr. No.	Details	Hrs.
Module 01	Basic Solid State Physics-Crystal structures, size dependence of properties, semiconductors, energy bands, excitons.	6
Module 02	Measurement of properties-particle size, TEM, SEM, STM, AFM, Spectroscopy and magnetic resonance Properties of individual nanoparticles – Metal nanocrystals, magic numbers and theoretical modeling, geometric structure, semiconducting nanoparticles, carbon nanoparticles.	9
Module 03	Synthesis and characterization Bulk nanocrystals- synthesis methods thin film deposition, multilayers, magnetic nanoparticles, spin valve, giant and colossal magnetoresistance, ferrofluids Quantum wells, wires and dots –	8
Module 04	Carbon nanostructures, carbon molecules, carbon clusters, carbon nanotubes : Fabrication, structure, Electrical properties, vibration properties, Mechanical properties. Application of carbon Nanotubes; Field emission and shielding, Computers, Fuel cells, Chemical sensors, Catalysis, Mechanical Reinforcement.	9
Module 05	Organic compounds and polymers-forming and characterization, size effects, supramolecules, micelles Biological materials –biological building blocks, DNA double nanowire, genetic code, biological nanostructures (proteins, micelles and vesicles), multilayer films.	8
Module 06	MEMS, NEMS – design, fabrication and applications. (Nanostereolithography, Plasma CVD), coating of nanoparticles.	9

Theory Examination:

1. Question paper will comprise of total seven question, each of 20 Marks
2. Question one will be compulsory and based on maximum part of syllabus.
3. Remaining questions will be mixed in nature (for example supposed Q.2 has part (a) from module 3 then part (b) will be from any module other than module 3)
4. Only five question need to be solved.

In question paper weightage of each module will be proportional to number of respective lecture hours as mention in the syllabus.

Oral Examination:

Oral examination will be on maximum portion of the syllabus.

Term Work:

At least six assignments (at least one on each topic), seminar and class test.

The distribution of marks for term work shall be as follows:

- Laboratory work (Assignments/Seminar): (15) Marks.
- Test (at least one): (10) Marks.
- TOTAL:** (25) Marks.

Text Books:

1. Charles P Poole Jr. and Frank J Owens, Introduction to Nanotechnology, *Wiley*
2. Hari Singh Nalwa (Editor), Nanostructured Materials & Nanotechnology Concise Edition, *Academic*.
3. William A Goddard, Donald W Brenner, Sergey Edward Lyshevski, Goddard III, Handbook of Nanoscience, Engineering, and Technology *CRC Press*.
4. Peyghambarian., S.W. Koch and A. Mysyrowicz, Introduction to Semiconductor Optics, *Prentice Hall*.
5. S.V. Gaponenko., Optical Properties of Semiconductor Nanocrystals, *Cambridge Univeristy Press*.
6. David Sellmyer and R Skomski Ed., Advanced magnetic nanostructures, *Springer*.
7. Gabriel O Shonaike, Suresh G Advani, Advanced Polymeric Materials *CRC Press*.

References:

1. T. Pradeep, Nano: The essentials Understanding Nanoscience and Nanotechnology, *Tata McGraw Hill*.
2. Nanotechnology, Lynn Foster, Pearson Education

CLASS: BE Automobile			Semester:- VIII
SUBJECT: PROJECT MANAGEMENT Elective II			
Periods per week Period of 60 min.	Lecture	04	
	Practical	02	
	Tutorial	--	
		Hours	Marks
Evaluation System	Theory Examination	03	100
	Practical	--	--
	Oral Examination		25
	Term Work		25
	TOTAL		150

Sr. No.	Details	Hrs.
Module 01	Projects in Contemporary Organization, project initiation, Strategic Management and Project Selection, The Project Manager, Project Organization, Project Planning, Conflict and Negotiation., project implementation, Budgeting and Cost Estimation., Scheduling, Resource Allocation, Monitoring and Information Systems, Project Control, Project termination, Project Auditing, Project Termination	8
Module 02	project risk - scope Project management - definitions - overview - project plan - management principles applied to project management - project management life cycles and uncertainty	8
Module 03	Project planning -- scope - problem statement -- project goals -- objectives success criteria - assumptions - risks - obstacles - approval process - projects and strategic planning	8
Module 04	Project implementation - project resource requirements - types of resources - men - materials - finance Project monitoring - evaluation - control - project network technique - planning for monitoring and evaluation - project audits - project management information system	8
Module 05	project scheduling - PERT & CPM - Project inventory management - nature of project inventory - supply and transportation of materials project communication - post project reviews Project team management - recruitment - organizing - human resources - team operating rules - project organization - various forms of project organizations, project organization charting	8
Module 06	project contracts - principles - compilation of contracts - practical aspects - legal aspects - global tender, negotiations - insurance . Closing the project -- types of project termination - strategic implications project in trouble, termination strategies, evaluation of termination possibilities - termination procedures	8

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Theory Examination:

1. Question paper will comprise of total seven question, each of 20 Marks
2. Question one will be compulsory and based on maximum part of syllabus.
3. Remaining questions will be mixed in nature (for example supposed Q.2 has part (a) from module 3 then part (b) will be from any module other than module 3)
4. Only five question need to be solved.

In question paper weightage of each module will be proportional to number of respective lecture hours as mention in the syllabus.

Oral Examination:

Oral examination will be on maximum portion of the syllabus.

Term Work:

Term work shall consist of minimum 06 assignments (at least one on each module) and written test. The distribution of marks for term work shall be as follows:

- Laboratory work (experiments/assignments): (15) Marks.
- Test (at least one): (10) Marks.
- TOTAL: (25) Marks.**

Text Books:

1. Jack Meredith, Project Management 6th edition, Wiley India
2. Project Management – for 21st Century-Beenet P Lientz, Kathryn Prea- Academic Press, 1995
3. Project Management – Denislok
4. Project Management- Gido Clements, Cengage Learning

Reference books:

1. Project management, David I Cleland, McGrawHill International Edition, 1999
2. Project Management – Gopalakrishnan – Mcmillan India Ltd.
3. Project Management-Harry-Maylor-Pearson Publication
4. Project Management- Jeffrey Pinto, Pearson Publication
5. Contemporary Project Management, Timothy Kloppenborg, Cengage Learning.
6. Project Management Core text Book by Gopalan, Wiley India.

CLASS: BE Automobile			Semester:- VIII
SUBJECT: PRODUCT LIFE CYCLE MANAGEMENT Elective II			
Periods per week 1 Period of 60 min.	Lecture	04	
	Practical	02	
	Tutorial	--	
Evaluation System		Hours	Marks
	Theory Examination	03	100
	Practical		--
	Oral Examination		25
	Term Work		25
	TOTAL		150

Sr. No.	Details	Hrs.
Module 01	Introduction to PLM Need for PLM, opportunities and benefits of PLM, different views of PLM, components of PLM, phases of PLM, PLM feasibility study, PLM visioning.	4
Module 02	PLM Strategies Industrial strategies, strategy elements, its identification, selection and implementation, change management for PLM Product Data Management (PDM) PDM systems and importance, reason for implementing a PDM system, financial justification of PDM, barriers to PDM implementation	7
Module 03	5. Product Design Engineering design, organization and decomposition in product design, product design process, methodical evolution in product design, concurrent engineering, design for 'X' and design central development model. Strategies for recovery at end of life, recycling, human factors in product design. Modeling and simulation in product design 5. New Product Development Structuring new product development, building decision support system, Estimating market opportunities for new product, new product financial control, implementing new product development, market entry decision, launching and tracking new product program. Concept of redesign of product	12
Module 04	6. Technology Forecasting Future mapping, invoking rates of technological change, methods of technology forecasting such as relevance trees, morphological methods and mission flow diagram, combining forecast of different technologies, uses in manufacture alternative	9

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Module 05	Integration of technological product innovation and product development in business processes within enterprises, methods and tools in the innovation process according to the situation, methods and tools in the innovation process according to the situation Virtual product development tools for components, machines, and manufacturing plants: 3D CAD systems, digital mock-up, model building, model analysis, production (process) planning, and product data technology	9
Module 06	Product conception process: Business processes, data-process relationship, from the idea to waste disposal Product structures: Variant management, product configuration, material master data, product description data, Data models, Life cycles of individual items, status of items	7

Theory Examination:

1. Question paper will comprise of total seven question, each of 20 Marks
2. Question one will be compulsory and based on maximum part of syllabus.
3. Remaining questions will be mixed in nature (for example supposed Q.2 has part (a) from module 3 then part (b) will be from any module other than module 3)
4. Only five question need to be solved.

In question paper weightage of each module will be proportional to number of respective lecture hours as mention in the syllabus.

Oral Examination:

Oral examination will be on maximum portion of the syllabus.

Term Work:

Term work shall consist of minimum 06 assignments (at least one on each module) and written test. The distribution of marks for term work shall be as follows:

- Laboratory work (experiments/assignments): (15) Marks.
- Test (at least one): (10) Marks.
- TOTAL:** (25) Marks.

Text Books:

1. Stark, John. *Product Lifecycle Management: Paradigm for 21st Century Product Realisation*. Springer-Verlag. 2004. ISBN 1852338105
2. Fabio Giudice, Guido La Rosa, *Product Design for the environment-A life cycle approach*, Taylor & Francis 2006
3. 3. Saaksvuori Antti / Immonen Anselmie, *product Life Cycle Management* Springer, ISBN-10: 3-540-25731-4
4. *Product Lifecycle Management*, Michael Grieves, Tata McGraw Hill

CLASS: BE Automobile		Semester:- VIII	
SUBJECT: ARTIFICIAL AND MACHINE INTELLIGENCE, Elective II			
Periods per week Period of 50 min.	Lecture	04	
	Practical	02	
	Tutorial	--	
		Hours	Marks
Evaluation System	Theory Examination	03	100
	Practical	--	--
	Oral Examination	--	25
	Term Work	--	25
	TOTAL		150

Sr. No.	Details	Hrs.
Module 01	1. AI AND INTERNAL REPRESENTATION: Artificial Intelligence and the World, Representation in AI, Properties of Internal Representation, The Predicate Calculus, Predicates and Arguments, Connectives Variables and Quantification, How to Use the Predicate Calculus, Other Kinds of Inference Indexing, Pointers and Alternative Notations, Indexing, The Isa Hierarchy Slot-Assertion Notation, Frame Notation	08
Module 02	2. LISPS: Lisps, Typing at Lisp, Defining Programs, Basic Flow of Control in Lisp, Lisp Style, Atoms and Lists, Basic Debugging, Building Up List Structure, More on Predicates, Properties, Pointers, Cell Notation and the Internals (Almost) of Lisp, Destructive Modification of Lists, The for Function, Recursion, Scope of Variables Input Output, Macros.	08
Module 03	3. NEURAL NETWORKS AND FUZZY SYSTEMS: Neural and fuzzy machine Intelligence, Fuzziness as Multivalence, The Dynamical Systems approach to Machine Intelligence, The brain as a dynamical system, Neural and fuzzy systems as function Estimators, Neural Networks as trainable Dynamical system, Fuzzy systems and applications, Intelligent behavior as Adaptive Model free Estimation, Generalization and creativity, Learning as change, Symbol V's Numbers, Rules V's Principles, Expert system Knowledge as rule trees, Symbolic V's Numeric Processing, Fuzzy systems as Structured Numerical estimators, Generating Fuzzy rules	08

	with product space Clustering, Fuzzy Systems as Parallel associators, Fuzzy systems as Principle based Systems.	
Module 04	1. NEURAL NETWORK THEORY: Neuronal Dynamics: Activations and signals, Neurons as functions, signal monotonicity, Biological Activations and signals, Neuron Fields, Neuron Dynamical Systems. Common signal functions. Pulse-Coded Signal functions	08
Module 05	2. GENETIC ALGORITHMS: A simple genetic algorithm. A simulation by hands, similarity templates(Schemata). Mathematical foundations, Schema Processing at work, The two- armed and k- armed Bandit Problem, The building block hypothesis, The minimal Deceptive Problem Computer implementation of Genetic algorithm, Data Structures, Reproduction, Cross over and Mutation. Time to reproduce and time to Cross Mapping objective function to fitness, form, Fitness scaling. Applications of genetic algorithm, De Jong and Function Optimization. Improvement in basic techniques. Introduction to Genetics based machine learning. applications of genetic based machine leaning.	08
Module 06	3. DATA MINING: Introduction to Data Mining. Computer systems that can learn, Machine learning and methodology of science, Concept learning, Data ware house, designing decision support systems, Client server and data warehousing, Knowledge Discovery Process. Visualization Techniques. K- nearest neighbor, Decision tree, OLAP tools. Neural networks. Genetic algorithm. Setting up a KDD environment. Real life applications. Customer profiling. Discovering foreign key relationships	08

Theory Examination:

1. Question paper will comprise of total seven question, each of 20 Marks
2. Question one will be compulsory and based on maximum part of syllabus.
3. Remaining questions will be mixed in nature (for example supposed Q.2 has part (a) from module 3 then part (b) will be from any module other than module 3)
4. Only five question need to be solved.

In question paper weightage of each module will be proportional to number of respective lecture hours as mention in the syllabus.

Oral Examination:

Oral examination will be on maximum portion of the syllabus.

Term Work:

Term work shall consist of:

- a) Software development in lisp and other languages and packages for practices and algorithm discussed in the syllabus.
- b) Written assignment on any four topics discussed above
- c) One seminar by every student from the aforesaid area.
- d) One class test

The distribution of marks for term work shall be as follows:

• Laboratory work (Assignments/Seminar):	(15)	Marks.
• Test (at least one):	(10)	Marks.
TOTAL:	(25)	Marks.

Text Books:

1. Introduction to Artificial intelligence By Eugene Charniak, Drew McDermott
Addison Wesley
2. Neural Networks and fuzzy systems A dynamical systems approach to machine Intelligence
by Bart Kosko- PHI
3. Genetic Algorithms in search, Optimization & Machine Learning by David E Goldberg-
Addison wesley
4. Data Mining by Pieter Adriaans and Dolt Zantinge - Pearson Education Asia
5. Data Warehousing in the Real World by Sam Anahory and Dennis Murray.
6. Artificial Intelligence, Elaine Rich, Kevin Knight, S. Nair, *McGraw Hill Publishing Company Ltd*

Reference:

1. Industrial Robotics, Mikell Groover, Mitchell Weiss, Nagel, Odrey, *Tata McGraw Hill Publishing Company Ltd*
2. Artificial Intelligence, Michael Negnevitsky, *Tata McGraw Hill Publishing Company Ltd*
3. Intelligence, Patrick Winston, *Tata McGraw Hill Publishing Company Ltd*
4. Artificial Intelligence, Stuart Russell, Peter Norvig, *Tata McGraw Hill Publishing Company Ltd*

CLASS: BE (Automobile)		Semester:-VIII	
SUBJECT : PROCESS EQUIPMENT DESIGN (ELECTIVE-II)			
Periods per week 1 Period of 60 min.	Lecture	04	
	Practical	02	
	Tutorial	--	
Evaluation System		Hours	Marks
	Theory Examination	03	100
	Practical	--	--
	Oral Examination		25
	Term Work		25
	TOTAL		150

Sr. No.	Details	Hrs.
Module 01	Types of Process Equipments and their components Static Equipments : Vertical / Horizontal vessels , Columns , Reactors , Spherical vessels (Horton sphere) , Heat Exchangers , Tanks , Mounded Bullets , Fire Heaters etc. Rotating Equipments :Pumps ,Compressors, Agitators ,Rotary Dryers	4
Module 02	Design Loads : Design Pressure , Design temperature , Dead loads , Wind loads, Earthquake loads , Piping loads , Combinations of design loads.	10
Module 03	Stress Categories and Design Limit Stresses General design criteria of ASME pressure Vessel code Section VIII Div. 1. ASME pressure vessel code Section VIII Div. 2, IS 2825, Indian Boiler Regulations .BS 5500 , etc. Design stress limits & minimum thicknesses as per TEMA for Heat Exchangers &API 650 /620 for tanks. Membrane stress analysis of Vessel shell components	5
Module 04	Material selection & Design of Cylindrical Vessels components as per codes and Standards Design of shell , Formed closures (Ellipsoidal , Spheroidal , Torispherical , conical ,Flat) , Nozzles , standard flanges , girth flanges , Supports (Lug , Leg , Skirt , saddle etc.) ,expansion joints. Design of cylindrical vessels with formed closures operating under external pressure. Wind and Seismic calculation for tall vertical vessels as per IS 875 & IS 1893 . Empty weight ,hydrostatic weight & operating weight calculations.	18
Module 05	Brief Introduction -Tank Design as per API 650/API 620 Heat Exchanger Design as per ASME Section VIII UHX Types & Different parts of Heat Exchangers as per TEMA	5
Module 06	Inspection , Testing & Heat Treatment requirements for pressure vessels (As per ASME Section VIII ,Division 1, division 2 , ASME Section V, IS2825 , IBR etc.) Hydrostatic test , Dye Penetration test , Ultrasonic testing, fatigue test, creep test etc. Requirement of Radiography , Post Weld Heat Treatment.	6

Theory Examination:

8. Question paper will comprise of total seven question, each of 20 Marks
9. Question one will be compulsory and based on maximum part of syllabus.
10. Only five question need to be solved.

In question paper weightage of each module will be proportional to number of respective lecture hours as mention in the syllabus.

Oral Examination:

Oral examination will be on maximum portion of the syllabus.

Term Work:

ASSIGNMENTS

- 1 Explain types of process equipments (Static & Rotary).
- 2 Design of Shell, Formed heads for internal & external pressure.
- 3 Design of flanges.
- 4 Design of vessel supports.
- 5 Wind & Seismic calculation for pressure vessel.
- 8 Empty, Operating & hydrostatic weight calculation for pressure vessel.
- 9 Explain inspection & testing requirement for pressure vessels.
- 10 Briefly explain Design of storage tanks.
- 11 Discuss types of heat exchangers.

PRACTICALS

Preparation of General Arrangement Drawing & Detailed fabrication drawing with bill of materials based on design calculation for pressure vessel.

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|--|-------------|---------------|
| • Laboratory work (experiments/assignments): | (15) | Marks. |
| • Test (at least one): | (10) | Marks. |
| TOTAL: | (25) | Marks. |

Text Books:

1. Brownell & Young, Process Equipment Design., Wiley India
2. Henry H. Bednar, P. E., Pressure Vessel Design Handbook.
3. Joshi M. V., Process Equipment design.
4. Denis Moss, Pressure vessel Design Manual.
5. E. F. Megyesy, Pressure Vessels Handbook

References:

1. An International Code 2007 ASME Boiler & Pressure Vessel Code, Rules For Construction of Pressure Vessels, Section VIII Division I & 2.
2. IS 2825, IS 875, IS 1893, IBR.
3. BS 5500.
4. ASME B16.5, Pipe, Flanges & Flange Fittings
5. An International Code 2007 ASME Boiler & Pressure Vessel Code, Rules For Construction of Pressure Vessels, Section II A, B, C & D
6. Standards of Tubular Exchanger Manufacturers Association (TEMA)
7. API Standards 650, 620.

CLASS: BE Automobile

Semester:-
VIII

SUBJECT: AUTOMOTIVE REFRIGERATION & AIR CONDITIONING

Periods per week 1 Period of 60
min.

Lecture

4

Practical

2

Tutorial

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Evaluation System

Theory Examination

Hours

3

Marks

100

Practical

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Oral Examination

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25

Term Work

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25

TOTAL

150

Sr. No.	Details	Hrs.
Module 01	1. Refrigeration 1.1 Introduction 1.2 Methods of refrigeration 1.3 Air Refrigeration System and its applications 1.4 Vapour compression refrigeration system 1.5 Vapour absorption refrigeration system 1.6 Applications of refrigeration & air conditioning 1.7 Automobile air conditioning 1.8 Air conditioning for passengers isolated vehicles, transport vehicles 1.8 Applications related with very low temperatures	12
Module 02	2. Refrigerant 2.1 Classification, properties and selection criteria 2.2 Commonly used refrigerants 2.2.1 Alternative refrigerants 2.2.2 Eco-friendly refrigerants 2.2.3 Applications of refrigerants 2.3 Refrigerants used in automobile air conditioning	04
Module 03	3. Psychrometry 3.1 Psychrometric properties, tables, charts 3.2 Psychrometric processes 3.3 Comfort charts 3.4 Factor affecting comfort 3.5 Effective temperature 3.6 Ventilation requirements	06

Module 04	4. Air Conditioning Systems and Load Analysis 4.1 Classification and layouts 4.2 Central / unitary air conditioning systems 4.3 Components like compressors, evaporators, condensers, expansion devices, fan blowers, heating systems etc. 4.4 Load Analysis: 4.4.1 Outside & inside design consideration 4.4.2 Factors forming the load on refrigeration & air conditioning systems 4.4.3 Cooling & heating load calculations 4.4.4 Load calculations for automobiles 4.4.5 Effect of air conditioning load on engine performance	10
Module 05	5. Air Distribution Systems 5.1 Distribution duct system, sizing, supply / return ducts 5.2 Types of grills, diffusers, ventilation, air noise level 5.3 Layout of duct systems for automobiles and their impact on load calculations 5.4 Air Routine & Temperature Control: 5.4.1 Objectives - evaporator care air glow 5.4.2 Through the dash recirculating unit 5.4.3 Automatic temperature control 5.4.4 Controlling flow 5.4.5 Control of air handling systems.	08
Module 06	6. Air Conditioning Service and Control 6.1 Air conditioner maintenance & service - servicing heater system 6.2 Removing & replacing components 6.3 Trouble shooting of air conditioning system 6.4 Compressor service, methods of dehydration, charging & testing. 6.5 Air Conditioning Control 6.5.1 Common control such as thermostats 6.5.2 Humidistat us 6.5.3 Control dampers 6.5.4 Pressure cutouts and relays	08

List of Experiments (At least eight expt.)

1. Study of refrigeration methods & controls
2. Study of air conditioning systems & controls
3. Study of different components with the help of cut section/models/charts- Compressor, condenser, Evaporators, expansion device, Blower, Fans, heating systems etc.
4. Trial on Refrigeration Tutor.
5. Study of window air conditioning system & packaged units.
6. Trail on air conditioning tutor
7. Study of layout of air conditioning system for Car & Bus
8. Study of different tools, equipments used for automobile air conditioning systems.
9. Study of joints, dehydration, charging, & testing system
10. Study of Leak testing, leak detection methods
11. Automobile air conditioning system design- case studies.

Theory Examination:

1. Question paper will comprise of total seven question, each of 20 Marks
2. Question one will be compulsory and based on maximum part of syllabus.
3. Remaining questions will be mixed in nature (for example supposed Q.2 has part (a) from module 3 then part (b) will be from any module other than module 3)
4. Only five question need to be solved.

In question paper weightage of each module will be proportional to number of respective lecture hours as mention in the syllabus.

Practical and Oral Examination:

Practical and oral examination will be based on one experiment performed from the list of experiment given in the syllabus and the oral will based on the same experiment.

Term Work:

Term work shall consist of minimum **eight** experiments, assignments and written test. The distribution of marks for term work shall be as follows:

- Laboratory work (experiments/assignments): (15) Marks.
- Test (at least one): (10) Marks.
- TOTAL:** (25) Marks.

Text Books:

1. Refrigeration and Air-Conditioning - W.F. Stoecker and J.W. Jones, Tata McGraw Hill Pub.
2. Modern Air-Conditioning Practice - Norman C. Harris, Principles of Refrigeration - R.J. Dessat, Wiley Eastern Pub.
3. Refrigeration and Air-Conditioning - C.P. Arora, Tata McGraw Hill Pub

References:

4. Heating & Air Conditioning Systems – Mitchell Information Services
5. Thermal Engineering- Kumar & Sah, Narosa Publication, second edition, New Delhi
6. Paul Lung, "Automotive Air Conditioning", C.B.S. Publisher & Distributor, Delhi.
7. Harris, "Modern Air Conditioning".

ASHRAE Handbook – 1985 Fundamentals, American Society of Heating, Refrigeration & Air Conditioning