UNIVERSITY OF MUMBAI

Bachelor of Engineering

Mechanical Engineering (Second Year – Sem. III & IV)

Revised course (REV- 2012) from Academic Year 2012 -13,

Under

FACULTY OF TECHNOLOGY

(As per Semester Based Credit and Grading System)

Deans Preamble:

To meet the challenge of ensuring excellence in engineering education, the issue of quality needs to be addressed, debated and taken forward in a systematic manner. Accreditation is the principal means of quality assurance in higher education.The major emphasis of accreditation process is to measure the outcomes of the program that is being accredited. In line with this Faculty of Technology of University of Mumbai has taken a lead in incorporating philosophy of outcome based education in the process of curriculum development.

Faculty of Technology, University of Mumbai, in one of its meeting unanimously resolved that, each Board of Studies shall prepare some Program Educational Objectives (PEO's) and give freedom to affiliated Institutes to add few (PEO's) and course objectives and course outcomes to be clearly defined for each course, so that all faculty members in affiliated institutes understand the depth and approach of course to be taught, which will enhance learner's learning process. It was also resolved that, maximum senior faculty from colleges and experts from industry to be involved while revising the curriculum. I am happy to state that, each Board of studies has adhered to the resolutions passed by Faculty of Technology, and developed curriculum accordingly. In addition to outcome based education, semester based credit and grading system is also introduced to ensure quality of engineering education.

Semester based Credit and Grading system enables a much-required shift in focus from teacher-centric to learner-centric education since the workload estimated is based on the investment of time in learning and not in teaching. It also focuses on continuous evaluation which will enhance the quality of education. University of Mumbai has taken a lead in implementing the system through its affiliated Institutes and Faculty of Technology has devised a transparent credit assignment policy and adopted ten points scale to grade learner's performance. Credit assignment for courses is based on 15 weeks teaching learning process, however content of courses is to be taught in 12-13 weeks and remaining 3-2 weeks to be utilized for revision, guest lectures, coverage of content beyond syllabus etc.

Credit and grading based system was implemented for First Year of Engineering from the academic year 2012-2013. Subsequently this system will be carried forward for Second Year Engineering in the academic year 2013-2014, for Third Year and Final Year Engineering in the academic years 2014-2015 and 2015-2016 respectively.

Dr. S. K. Ukarande
Dean,
Faculty of Technology,
Member - Management Council, Senate, Academic Council
University of Mumbai, Mumbai

Chairman Preamble:

Engineering education in India is expanding and is set to increase manifold. Themajor challenge in the current scenario is to ensure quality to the stakeholders along with expansion. To meet this challenge, the issue of quality needs to be addressed, debated and taken forward in a systematic manner. Accreditation is the principal means of quality assurance in higher education and reflects the fact that in achieving recognition, the institution or program of study is committed and open to external review to meet certain minimum specified standards.The major emphasis of this accreditation process is to measure the outcomes of the program that is being accredited. Program outcomes are essentially a range of skills and knowledge that a student will have at the time of graduation from the program. In line with this Faculty of Technology of University of Mumbai has taken a lead in incorporating the philosophy of outcome based education in the process of curriculum development.

As the Chairman, Board of Studies in Mechanical Engineering of University of the Mumbai, I am happy to state here that, the Program Educational Objectives were finalized in a brain storming session, which was attended by more than 20 members from different affiliated Institutes of the University. They are either Heads of Departments or their senior representatives from the Department of Mechanical Engineering. The Program Educational Objectives finalized for the undergraduate program in Mechanical Engineering are listed below;

1. To prepare the Learnerwith a sound foundation in the mathematical, scientific and engineering fundamentals.
2. To prepare the Learner to use modern tools effectively in order to solve real life problems.
3. To prepare the Learner for a successful career in Indian and Multinational Organisations and to excel in their Postgraduate studies.
4. To encourage and motivate the Learnerin the art of self-learning.
5. To inculcate a professional and ethical attitude, good leadership qualities and commitment to social responsibilities in the Learner's thought process.

In addition to the above, 2 to3 more program educational objectives of their own may be added by affiliated Institutes.

In addition to Program Educational Objectives, for each course of undergraduate program, objectives and expected outcomes from the point of view of a learnerare also included in the curriculum to support the philosophy of outcome based education. I strongly believe that even a small step taken in the right direction will definitely help in providing quality education to the major stake holders.

Dr. S. M. Khot
Chairman, Board of Studies in Mechanical Engineering, University of Mumbai

Program Structure for B E Mechanical Engineering

S. E. (Mechanical/Automobile) Sem.- III

Course Code	Course Name	Teaching Scheme (Contact Hours)		Credits Assigned		
		Theory	Pract.	Theory	Pract.	Total
MEC301	Applied Mathematics III[@]	4	--	4	--	4
MEC302	Thermodynamics[$]	4	--	4	--	4
MEC303	Strength of Materials[$]	4	2	4	1	5
MEC304	Production Process- I[$]	4	--	4	--	4
MEL305	Computer Aided M/c Drawing[+]	--	2*+4	-	3	3
MEL306	Data Base & Information Retrieval System[#]	--	2*+2	-	2	2
MEL307	Machine Shop Practice- I[$]	--	4	--	2	2
Total		**16**	**16**	**16**	**8**	**24**

Course Code	Course Name	Examination Scheme							
		Theory					Term Work	Pract. /oral	Total
		Internal Assessment			End Sem. Exam.	Exam. Duration (in Hrs)			
		Test1	Test 2	Avg.					
MEC301	Applied Mathematics III[@]	20	20	20	80	03	--	--	100
MEC302	Thermodynamics[$]	20	20	20	80	03	--	--	100
MEC303	Strength of Materials[$]	20	20	20	80	03	25	--	125
MEC304	Production Process- I[$]	20	20	20	80	03	--	--	100
MEL305	Computer Aided M/c Drawing[+]	--	--	--	--	--	50	50	100
MEL306	Data Base &Information Retrieval System[#]	--	--	--	--	--	50	50	100
MEL307	Machine Shop Practice- I[$]	--	--	--	--	--	50	--	50
Total		**--**	**--**	**80**	**320**	**--**	**175**	**100**	**675**

* Theory for entire class to be conducted, [@] Course common to Mech/Auto/Prod/Civil, [+]Course common to Mech/Auto/Prod,
[#] Course common to Mech/Auto/Prod/Civil, [$] Courses common to Mech/Auto

S. E. (Mechanical/Automobile) Sem.- IV

Course Code	Course Name	Teaching Scheme (Contact Hours)		Credits Assigned		
		Theory	Pract.	Theory	Pract.	Total
MEC401	Applied Mathematics IV[@]	4	--	4	--	4
MEC402	Fluid Mechanics[$]	4	2	4	1	5
MEC403	Theory of Machines- I[$]	4	2	4	1	5
MEC404	Production Process- II[$]	4	--	4	--	4
MEC405	Material Technology[$]	3	2	3	1	4
MEC406	Industrial Electronics[$]	3	2	3	1	4
MEL407	Machine Shop Practice- II[$]	--	4	--	2	2
Total		**22**	**12**	**22**	**6**	**28**

Course Code	Course Name	Examination Scheme							
		Theory					Term Work	Pract. /oral	Total
		Internal Assessment			End Sem. Exam.	Exam. Duration (in Hrs)			
		Test1	Test 2	Avg.					
MEC401	Applied Mathematics IV[@]	20	20	20	80	03	--	--	100
MEC402	Fluid Mechanics[$]	20	20	20	80	03	25	25	150
MEC403	Theory of Machines- I[$]	20	20	20	80	03	25	--	125
MEC404	Production Process- II[$]	20	20	20	80	03	--	--	100
MEC405	Material Technology[$]	20	20	20	80	03	25	--	125
MEC406	Industrial Electronics[$]	20	20	20	80	03	25	25	150
MEL407	Machine Shop Practice- II[$]	--	--	--	--	--	50	25	75
Total		**--**	**--**	**120**	**480**	**--**	**150**	**75**	**825**

[@] Course common to Mech/Auto/Prod/Civil, [$] Courses common to Mech/Auto

Course Code	Course/Subject Name	Credits
MEC301	**Applied Mathematics –III@**	**4**

Objectives:

1. To provide sound foundation in the mathematical fundamentals necessary to formulate, solve and analyze engineering problems.
2. To study the basic principles of Laplace Transform, Fourier Series, Complex Variables.

Outcomes: Learner should be able to ….

1. Demonstrate the ability of using Laplace Transform and Fourier Series in solving the Ordinary Differential Equations and Partial Differential Equations.
2. Identify the analytic function, harmonic function, orthogonal trajectories and to apply bilinear transformations and conformal mappings.
3. Identify the applicability of theorems and evaluate the contour integrals.

Module	Details	Hrs
1	**Laplace Transform** 1.1 Function of bounded variation, Laplace Transform of standard functions such as 1, t^n, e^{at}, $\sin at$, $\cos at$, $\sinh at$, $\cosh at$ 1.2 Linearity property of Laplace Transform, First Shifting property, Second Shifting property, Change of Scale property of L.T. (without proof) $L\{t^n f(t)\}, L\left\{\frac{f(t)}{t}\right\}, L\left\{\int_0^t f(u)du\right\}, L\left\{\frac{d^n f(t)}{dt^n}\right\}$ Heaviside Unit step function, Direc Delta function, Periodic functions and their Laplace Transform.	**6**
2	**Inverse Laplace Transform** 2.1 Linearity property, use of theorems to find inverse Laplace Transform, Partial fractions method and convolution theorem. 2.2 Applications to solve initial and boundary value problems involving ordinary differential equations with one dependent variable.	**5**
3	**Complex variables:** 3.1 Functions of complex variable, Analytic function, necessary and sufficient conditions for $f(z)$ to be analytic (without proof), Cauchy-Riemann equations in polar coordinates. 3.2 Milne- Thomson method to determine analytic function $f(z)$ when it's real or imaginary or its combination is given. Harmonic function, orthogonal trajectories. 3.3 Mapping: Conformal mapping, linear, bilinear mapping, cross ratio, fixed points and standard transformations such as Rotation and magnification, invertion and reflection, translation.	**10**
4	**Complex Integral** 4.1 Line integral of a function of a complex variable, Cauchy's theorem for analytic function, Cauchy's Goursat theorem (without proof), properties of line integral,Cauchy's integral formula and deductions. 4.2 Singularities and poles: 4.3 Taylor's and Laurent's series development (without proof) 4.4 Residue at isolated singularity and its evaluation. 4.5 Residue theorem, application to evaluate real integral of type $\int_0^{2\pi} f(\cos\theta, \sin\theta)\, d\theta$, & $\int_{-\infty}^{\infty} f(x)\, dx$	**10**

5	**Fourier Series** 5.1 Orthogonal and orthonormal functions, Expressions of a function in a series of orthogonal functions. Dirichlet's conditions. Fourier series of periodic function with period 2π & $2l$. 5.2 Dirichlet's theorem(only statement), even and odd functions, Half range sine and cosine series, Parsvel's identities (without proof) 5.3 Complex form of Fourier series.	**10**
6	**Partial Differential Equations** 4.1 Numerical Solution of Partial differential equations using Bender-Schmidt Explicit Method, Implicit method(Crank- Nicolson method) Successive over relaxation method. 4.2 Partial differential equations governing transverse vibrations of an elastic string its solution using Fourier series. 4.3 Heat equation, steady-state configuration for heat flow. 4.4 Two and Three dimensional Laplace equations.	**10**

[@] Course common to Mech/Auto/Prod/Civil

Theory Examination:

1. Question paper will comprise of total 6 questions, each of 20 Marks.
2. Only 4 questions need to be solved.
3. Question 1 will be compulsory and based on maximum part of the syllabus.
4. Remaining questions will be mixed in nature (for example suppose Q.2 has part (a) from module 3 then part (b) will be from any module other than module 3)

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

Internal Assessment:

Assessment consists of two tests out of which; one should be compulsory class test (on minimum 40% of curriculum) and the other is either a class test (on minimum 70% of curriculum) or assignment on live problems or course project.

Reference Books:

1. Elements of Applied mathematics, P N & J N Wartikar, Pune VidyarthiGruhaPrakashan
2. Higher Engineering Mathematics, Dr B. S. Grewal, Khanna Publication
3. Advanced Engineering Mathematics, E Kreyszing, Wiley Eastern Limited
4. Integral Transforms and their Engineering Applications, Dr B. B. Singh, Synergy Knowledgeware, Mumbai
5. Complex Variables: Churchill, Mc-Graw Hill
6. Numerical Methods, Kandasamy, S. Chand & CO.

Course Code	Course/Subject Name	Credits
MEC302	**Thermodynamics[$]**	**4**

Objectives:

1. To understand the concepts of Energy in general and Heat and Work in particular.
2. To understand the fundamentals of quantification and grade of energy.
3. To apply the concepts of thermodynamics to basic energy systems.

Outcomes: Learner should be able to ….

1. Demonstrate understanding of basic concepts of thermodynamics.
2. Differentiate between quality and quantity of energy, heat and work, enthalpy and entropy, etc.
3. Analyze basic power cycles.
4. Apply the laws of thermodynamics to various real life systems.

Module	Details	Hrs
1	**Introduction and Basic Concepts:** Application areas of thermodynamics, Systems and Control volumes, Properties of system, Continuum, State and equilibrium, Processes and cycles, Temperature and Zeroth law of thermodynamics, Heat and thermodynamic concept of work. **First Law of Thermodynamics:** Statement, Heat and work calculations, Application of first law to non-flow and flow systems, steady flow energy equation as applied to boiler, condenser, nozzle and turbine.	**8**
2	**Second Law of Thermodynamics:** Statements and their equivalence, thermal energy reservoirs, concept of heat engine, refrigerator, heat pump and perpetual motion machines, Carnot cycle and principles. **Entropy:** Concept of entropy, Temperature- entropy plot, Clausius inequality theorem, Principle of Increase of entropy, entropy balance, entropy generation in daily life, first and second law combined, entropy changes of an ideal gas during reversible processes.	**8**
3	**Availability:** Available and unavailable energy, Available energy (AE) referred to cycle and energy source, Availability in steady flow process, availability in non-flow process, Irreversibility, Definition of second law efficiency. **Property Relations:** Introduction to Maxwell relations, Clausius-Clapeyron equation, volume expansivity and isothermal compressibility, Mayer relation, Joule-Thomson coefficient.	**8**
4	**Properties of Steam:** Dryness fraction, enthalpy, internal energy and entropy, steam table, polynomial form of steam equations and Mollier chart, First law applied to steam processes. **Vapour Power Cycles:** Carnot vapour cycle, Rankine cycle, Ideal reheat Rankine cycle, Introduction to cogeneration.	**8**
5	**Gas Power Cycles:** Air standard assumptions, Otto cycle, Diesel cycle, dual cycle, Stirling cycle, Ericsson cycle, Atkinson cycle, Brayton cycle.	**8**

6	**Reactive Systems:** Combustion, theoretical and actual combustion processes, enthalpy of formation and enthalpy of combustion, Adiabatic flame temperature, first law analysis of reactive system.	**8**

[$] Course common to Mech/Auto

Theory Examination:

1. Question paper will comprise of total 6 questions, each of 20 Marks.
2. Only 4 questions need to be solved.
3. Question 1 will be compulsory and based on maximum part of the syllabus.
4. Remaining questions will be mixed in nature (for example suppose Q.2 has part (a) from module 3 then part (b) will be from any module other than module 3)

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

Internal Assessment:

Assessment consists of two tests out of which; one should be compulsory class test (on minimum 40% of curriculum) and the other is either a class test (on minimum 70% of curriculum) or assignment on live problems or course project.

Reference Books:

1. Thermodynamics: An Engineering Approach by Yunus A. Cengel and Michael A Boles,7e, TMH.
2. Engineering Thermodynamics- A Generalized Approach by P L Dhar, ELSEVIER
3. Thermodynamics by P K Nag, TMH, 5^{TH} Edition
4. Modern Engineering Thermodynamics by Robert T Balmer, ELSEVIER
5. Thermodynamics and Heat Engines by R Yadav, Central Publishing house.
6. Thermodynamics by Onkar Singh, New Age International
7. Thermal Engineering by Mahesh Rathod, McGrawHill Publications
8. Thermodynamics by C P Arora, TMH
9. Thermodynamics by R K Rajput, Laxmi Publications.
10. Schaum's Outlines: Thermodynamics for Engineers by Merle C. Potter
11. Engineering Thermodynamics through Examples by Y V C Rao, Universities Press (India) Pvt Lt.
12. Fundamentals of Thermodynamics by Moran & Shapiro.
13. Basic Engineering Thermodynamics by Rayner Joel, Longman Publishers
14. Fundamentals of Classical Thermodynamics by Van Wylen G.H. & Sonntag R.E., John Wiley & Sons.
15. Thermodynamics by W.C. Reynolds, , McGraw-Hill & Co.
16. Holman, J.P. Thermodynamics. McGraw- Hill
17. Basic Engineering \thermodynamics by Zemanski and Van ness, TMH

Course Code	Course/Subject Name	Credits
MEC303	**Strength of Materials$**	**4+1**

Objectives:

1. To gain knowledge of different types of stresses, strain and deformation induced in the mechanical components due to external loads.
2. To study the distribution of various stresses in the mechanical elements such as beams, shafts etc.
3. To study Effect of component dimensions and shape on stresses and deformations.

Outcomes: Learner should be able to ….

1. Demonstrate fundamental knowledge about various types of loading and stressesinduced.
2. Draw SFD and BMD for different types of loads and support conditions.
3. Compute and analyze stresses induced in basic mechanical components.
4. Analyze buckling and bending phenomenon in columns and beams respectively.

Module	Details	Hrs
1	**Moment of Inertia:** Mass Moment of Inertia , Area Moment Of Inertia, Parallel Axis theorem, Polar Moment of Inertia, Principal axes, Principal moment of inertia **Stress and Strain:** Definition**,** Stress- strain, uni-axial, bi-axial and tri-axial stresses, tensile & compressive stresses, shear stress-Elastic limit, Hooke's Law. **Elastic Constants:** Poission's Ratio, Modulus of elasticity, Modulus of rigidity, Bulk modulus, Yield stress, Ultimate stress. Factor of safety, state of simple shear, relation between elastic constants, Volumetric Strain, Volumetric strain for tri-axial loading, Deformation of tapering members, Deformation due to self-weight, bars of varying sections, composite sections, **Thermal Stress**	12
2	**Shear Force and Bending Moment in Beams:** Axial force, shear force and bending moment diagrams for statically determinate beams includingbeams with internal hinges for different types of loading, relationship between rates of loading, shearforce & bending moment.	8
3	**Stresses in Beams:** Theory of pure Bending, Assumptions, Flexural formula for straight beams, moment of resistance,bending stress distribution, Section moduli for different sections, beams for uniform strength, Flitched beams. **Direct & Bending Stresses**: Core of Section, Chimneys subjected to wind pressure **Shear Stress in Beams:** Distribution of shear stress, across plane sections used commonlyfor structural purposes, shear connectors.	8
4	**Torsion:** Torsion of circular shafts-solid and hollow, stresses in shafts when transmitting power, shafts in series and parallel. **Strain Energy:** Resilience, proof Resilience, strain energy stored in the member due to	8

	gradually applies load, suddenly applied load, impact load. Strain energy stored due to Shear, Bending and Torsion.	
5	**Deflection Of Beams:** Deflection of Cantilever, simply supported and over hanging beamsusing double integration and Macaulay's Method for different type of loadings. **Thin Cylindrical and Spherical Shells:** Cylinders and Spheres due to internal pressure. Cylindrical Shell with hemi spherical End.	8
6	**Columns and Struts:** Buckling load, Types of end conditions for column, Euler's column theory and its limitations, Rankine- Gordon Formula	4

[$] Course common to Mech/Auto

Term Work:

List of Experiment:

1. Tension test on mild steel bar (stress - strain behavior, modulus determination)
2. Test on-tor-steel bar
3. Torsion test on mild steel bar/cast iron bar
4. Brinell hardness test
5. Rockwell hardness test
6. Izod impact test / Charpy test
7. Flexural test on beam (central point load)
8. Flexural test on beam (two point load)

Distribution of marks for Term work shall be as follows:

Laboratory work (experiments/assignments): 20 marks
Attendance (Theory and practical's): 05 marks

Theory Examination:

1. Question paper will comprise of total 6 questions, each of 20 Marks.
2. Only 4 questions need to be solved.
3. Question 1 will be compulsory and based on maximum part of the syllabus.
4. Remaining questions will be mixed in nature (for example suppose Q.2 has part (a) from module 3 then part (b) will be from any module other than module 3)

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

Internal Assessment:

Assessment consists of two tests out of which; one should be compulsory class test (on minimum 40% of curriculum) and the other is either a class test (on minimum 70% of curriculum) or assignment on live problems or course project.

Reference Books:

1. Strength of Materials, Subramanyam, Oxford University Press, Edition 2005
2. Mechanics of Materials, B.C Punmia Ashok Jain, Arun Jain, Lakshmi Publications, NewDelhi.
3. Strength of Materials, Basavarajaiah and MahadevappaKhanna Publishers, New Delhi.
4. Strength of Materials, Singer Harper and Row Publications
5. Elements of Strength of Materials, Timoshenko and Young Affliated East-West Press.
6. Mechanics of Materials, James M. Gere (5th Edition), Thomson Learning
7. Strength of Materials—S. Ramamrutham, DhanpatRai Pvt. Ltd.
8. Mechanics of Materials—S. S. Rattan, TMH Pvt. Ltd.
9. Mechanics of Structures—S. B. Junnarkar, Charotar Publication.
10. Strength of Materials—W. Nash, Schaum's Outline Series, McGraw Hill Publication.

Course Code	Course/Subject Name	Credits
MEC304	**Production Process – I[$]**	**4**

Objectives:

1. To study basic production processes.
2. To study how to select appropriate production processes for a specific application.
3. To know the fundamentals of non-destructive testing.

Outcomes: Learner should be able to ……

1. Demonstrate understanding of non-chip forming processes such as casting, forging, metal joining, etc.
2. Understand basics of powder metallurgy.
3. Identify the role of Non Destructive Techniques in production processes.

Module	Details	Hrs
1	Classification of Production Processes: Examples and field of applications **Metal Casting Process:** Fundamentals of metal casting, Pattern materials and types of Patterns for casting, Types of Casting (like sand, shell-mold, CO_2 mold casting, Cold box, Hot box, Investment, vacuum, pressure, die, centrifugal, etc.), Design considerations, Inspection of castings, Casting defects.	**10**
2	**Forming Processes:**Principles and process characteristics, Rolling types and capacities, Rolling parameters: Draught, spread, elongation ,roll pressure, torque, work and power in rolling., Effect of front and back tension on rolling load, Principles of roll pass. Miscellaneous processes like thread rollingroll forging, production of seamless tube by rolling, defects in rolled products. Forging (basic principles, machines, types etc), extrusion and wire drawing	**08**
3	**Welding and Joining Processes:**Mechanical fastening (Riveting), adhesive bonding, soldering and brazing. Welding Introduction, Fusion welding, gas and arc welding, submerged arc welding, inert gas welding, Electric slag welding, Carbon-dioxide shielded welding, thermit welding, Pressure welding, solid phase welding, resistance welding, and friction welding. Welding Equipment, process capability of welding its and applications. Weld joints- types, edge preparations. Weldability – designs, process and metallurgical considerations – testing and improvement of weldability – microstructure of weld – welding defects, advancements in welding.	**16**
4	**Powder Metallurgy:** like sintering and metal injection molding: Principle, process, applications, advantages and disadvantages of powder metallurgy, Processes of powder making and mechanisms of sintering.	**06**
5	**Moulding with polymers:** Basic concepts related to Injection Molding, Compression moulding, Transfer moulding, Blow Molding, Rotational Molding, Thermoforming and Extrusion.Applications of plastics in Engineering field. **Moulding with ceramics**: Blow moulding and extrusion of glass.	**06**
6	**Non Destructive Techniques:** Dye Penetrant, Magnetic, Electrical, Ultrasonic and Radiographic non-destructive testing methods.	**04**

[$] Course common to Mech/Auto

Theory Examination:

1. Question paper will comprise of total 6 questions, each of 20 Marks.
2. Only 4 questions need to be solved.
3. Question 1 will be compulsory and based on maximum part of the syllabus.
4. Remaining questions will be mixed in nature (for example suppose Q.2 has part (a) from module 3 then part (b) will be from any module other than module 3)

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

Internal Assessment:

Assessment consists of two tests out of which; one should be compulsory class test (on minimum 40% of curriculum) and the other is either a class test (on minimum 70% of curriculum) or assignment on live problems or course project.

Reference Books:

1. Workshop Technology By W. A. J. Chapman part I, II & III
2. A Textbook of Foundry Technology by M. Lal
3. Production Technology by R. C. Patel and C. G. Gupta Vol I, II.
4. Production Technology by Jain & Gupta.
5. Manufacturing, Engineering and Technology SI by SeropeKalpakjian, Steven R. Schmid, published by Prentice Hall
6. Introduction to manufacturing processes by John A. Schey, published by McGraw-Hill
7. Manufacturing Processes & Materials for Engineers by Doyle.
8. Production Technology by HMT.
9. Production Technology by Raghuvanshi
10. Elements of Workshop Technology HazraChaudharyVol I, II.
11. Foundry technology by P.L. Jain .
12. Manufacturing processes by P. N. Rao, Vol. 1 and 2.
13. ASME Handbook Vol. 15 and 16.
14. Welding Technology by Little

Course Code	Course/Subject Name	Credits
MEL305	**Computer Aided Machine Drawing^{+}**	**3**

Objectives:

1. To visualize an object and convert it into a drawing.
2. To gain knowledge of conventional representation of various machining and mechanical details as per IS.
3. To become conversant with 2-D and 3-D drafting.

Outcomes: Learner should be able to….

1. Visualize and prepare detail drawing of a given object.
2. Draw details and assembly of mechanical systems.
3. Read and interpret a given drawing.
4. Create 2-D and 3-D models using any standard CAD software with manufacturing considerations.

Module	Details	Hrs.	
		Theory	Practical
1	**1.1 Solid Geometry:** Intersection of surfaces and interpenetration of solids- Intersection of prism or cylinder with prism; cylinder or cone, both solids in simple position only. Primary auxiliary views and auxiliary projections of simple machine parts.	08	--
	1.2 Machine Elements: Preparation of 2-D drawings of standard machine elements (nuts, bolts, keys, cotter, screws, spring etc.)	--	04
	1.3 Conventional representation of assembly of threaded parts in external and sectional views, Types of threads; thread designation, Conventional representation of machine components and materials, Designation of standard components.	01	--
2	2.1 Limits fits and tolerances: Dimensioning with tolerances indicating various types of fits in details and assembly drawings, Types of assembly drawings, part drawings, drawings for catalogues and instruction manuals, patent drawings, drawing standards.	04	--
	2.2 Details and assembly drawing: Introduction to the unit assembly drawing, steps involved in preparing assembly drawing from details and vice-versa, Sequence in assembly.	02	--
	2.3 Preparation of details and assembly drawings of *any two* from: Clapper block, Single tool post, Lathe and Milling tail stock.	--	05
	2.4 Cotter, Knuckle joint, Keys and Couplings: keys-sunk, parallel woodruff, saddle, feather etc. Coupling: simple, muff, flanged.	03	--
	2.5 Protected flange coupling, Oldham's coupling, Universal coupling.	--	06
3	**3.1 Preparation of details and assembly drawings of Bearings:** Simple, solid, Bushed bearing. I.S. conventional representation of ball and roller bearing.	01	--
	3.2 Pedestal bearing, footstep bearing	--	04
4	**4.1 Preparation of details and assembly drawings of pulleys, Pipe joints:** Classification of Pulleys, pipe joints	02	--
	4.2 Pulleys: Flat belt, V-belt, rope belt, Fast and loose pulleys.	--	05
	4.3 Pipe joints *(any two)*: Flanged joints, Socket and spigot joint, Gland and stuffing box, expansion joint.	--	06

5	**5.1 Preparation of details and assembly drawings of Valves, I.C. Engine parts:** Types of Valves, introduction to I.C. Engine 5.2 Preparation of details and assembly drawings of *(any three):* Air cock; Blow off cock, Steam stop valve, Gate valve, Globe valve, Non return Valve, I.C. Engine parts: Piston, Connecting rod, Cross head, Crankshaft, Carburetor, Fuel pump, injector, and Spark plug.	02 --	-- 08
6	**6.1 Preparation of details and assembly drawings of Jigs and Fixtures:** Introduction to Jigs and fixtures, 6.2 Jigs and Fixtures (*any two from each*) 6.3 Reverse Engineering of a physical model: disassembling of any physicalmodel having not less than five parts, sketch the minimum views required for each component, measure all the required dimensions of each component, convert these sketches into 3-D model and create an assembly drawing with actual dimensions	01 -- --	-- 06 04

[+]Course common to Mech/Auto/Prod

Term work:

A. Minimum two questions from theory part of each module should be solved as a home work in A-3 size sketch book.

B. A-3 size Printouts/plots of the problems solved in practical class from the practical part of each module

Problems from practical parts of each module should be solved using any standard CAD packages like IDEAS, PRO-E, CATIA, Solid Works, Inventor etc.

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

Home work sketch book	…….	20 marks
Printouts/Plots	…….	20 marks
Attendance (Theory and practical's)	…….	10 marks

Practical/Oral examination:

1. Practical examination duration is **three hours**, based on Part-B of the Term work, and should contain two sessions as follows:
   Session-I: Preparation of 3-D models of parts, assembling parts and preparing views of assembly from given 2-D detailed drawing.
   Session-II: Preparation of minimum five detailed 3-D part drawings from given 2-D assembly drawing.
   Oral examination should also be conducted to check the knowledge of conventional and CAD drawing.
2. Questions provided for practical examination should contain minimum five and not more than ten parts.
3. The distribution of marks for practical examination shall be as follows:

Session-I	……	20 marks
Session-II	……	20 marks
Oral	……	10 marks

4. Evaluation of practical examination to be done based on the printout of students work
5. Students work along with evaluation report to be preserved till the next examination

Reference Books:

1. Machine Drawing by N.D. Bhatt.
2. A text book of Machine Drawing byLaxminarayan&M.L.Mathur.(Jain brothers Delhi).
3. Machine DrawingbyKamat&Rao.
4. Machine DrawingbyM.B.Shah
5. A text book of Machine Drawing by R.B.Gupta(Satyaprakashan, Tech. Publication)
6. Machine Drawing by K.I.Narayana, P.Kannaiah, K.Venkata Reddy.
7. Machine Drawing by Sidheshwar and Kanheya
8. Autodesk Inventor 2011 for Engineers and Designers by ShamTickoo,SurinderRaina (dreamtech Press).
9. Engineering Drawing by P J Shah
10. Engineering Drawing by N D Bhatt

Subject Code	Subject Name	Credits
MEL306	**Database & Information Retrieval system#**	**02**

Objective:

1. Learn and practice data modeling using the entity-relationship and developing database designs.
2. Understand the use of Structured Query Language (SQL) and learn SQL syntax.
3. Apply Graphical User Interface techniques for retrieve the information from database.
4. Understand the needs of database processing and learn techniques for controlling the consequences of concurrent data access.

Outcome: The student should be able to …

1. To describe data models and schemas in DBMS.
2. To understand the features of database management systems and Relational database.
3. To use SQL- the standard language of relational databases.
4. To understand the functional dependencies and design of the database.
5. To understand the graphical user Interface design.

Module	Detailed content	Hours
1	**Introduction Database Concepts:** What is a database? , Characteristics of databases, Example of database, File system V/s Database system, What is DBMS?, Users of Database system, Advantage of using an enterprise database, Concerns when using an enterprise database, Data Independence, DBMS system architecture, Database Administrator,	02
2	**Entity–Relationship Data Model :** Introduction, Benefits of Data Modeling, Types of Models,Phases of Database Modeling, The Entity-Relationship (ER) Model,Generalization, Specialization and Aggregation,Extended Entity-Relationship (EER) Model.	04
3	**Relational Model and Algebra :** Introduction , Mapping the ER and EER Model to the Relational Model , Data Manipulation , Data Integrity ,Advantages of the Relational Model, Relational Algebra , Relational Algebra Queries, Relational Calculus.	04
4	**Structured Query Language (SQL) :** Overview of SQL , Data Definition Commands,Set operations , aggregate function , null values, , Data Manipulation commands, Data Control commands , Views-Using Virtual Tables in SQL, Nested and complex queries .	04
5	**Introduction to Transactions Management and Concurrency:** Transaction concept, Transaction states, ACID properties, Implementation of atomicity and durability, Concurrent Executions, Serializability, Recoverability, Concurrency Control: Lock-based , Timestamp-based , Validation-based protocols, Deadlock handling, Recovery System: Failure Classification, Storage structure, Recovery & atomicity, Log based recovery, Shadow paging.	04

6	**Graphical User Interface** : Murphy 's Law of G U I Design, Features of G U I, Icons and graphics, Identifying visual cues, clear communication, color selection, GUI standard, planning GUI Design Work. **Visual programming :** ***Sharing Data and Code*:** Working with Projects, Introduction to Basic language, Using inbuilt controls and ActiveX controls, creating and using classes, Introduction to Collections, Using and creating ActiveX Components, dynamic data exchange, object linking and embedding ***Creating visual software entities:*** Working with text, graphics, working with files, file management, serial communication, multimedia control interfaces.	06

* 2hours theory can be taught to entire class followed by 2hours practical in batches
# Course common to Mech/Auto/Prod/Civil

Term Work:

Assign minimum two case studies for each student to perform on their case studies following experiments-

1) Problem Definition and draw ER /EER diagram
2) Design Relational Model
3) Perform DDL operation
4) Perform DML and DCL operations
5) Design Forms using Visual programming
6) Retrieve the information through GUI.

Distribution of marks for Term work shall be as follows:

Laboratory work (programs/printouts): 40 marks
Attendance (Theory and practicals): 10 marks

Practical/Oral Examination:

1. Practical examination duration is 2hours and questions to be based on the list of experiments mentioned in Term Work.
2. Evaluation of practical examination to be done by examiner based on the printout of students work
3. Practical examination: 40 marks, oral examination based on practical examination: 10 marks
4. Students work along with evaluation report to be preserved till the next examination

Reference Books:

1. G. K. Gupta :"Database Management Systems", McGraw – Hill.
2. Korth, Slberchatz,Sudarshan, :"Database System Concepts", 6th Edition, McGraw – Hill
3. GUI Design for dummies, IDG books.
4. Visual Basic 2005, How to program (3RD Edition) Deitel & Deitel, Pearson Education.
5. Dr. P.S. Deshpande, SQL and PL/SQL for Oracle 10g,Black Book, Dreamtech Press
6. Mark L. Gillenson, Paulraj Ponniah, " Introduction to Database Management",Weley
7. SharamanShah ,"Oracle for Professional", SPD.
8. Raghu Ramkrishnan and Johannes Gehrke, " Database Management Systems",TMH
9. Mark L Gillenson, "Fundamentals of Database Management System", Wiley India

Course Code	Course/Subject Name	Credits
MEL307	**Machine Shop Practice – I[$]**	**2**

Objectives:

1. To understand basic machining processes.
2. To understand various machining operations and machine protocols.

Outcomes: Learner should be able to …

1. Operate various machines like lathe, shaper etc.
2. Perform plain turning, taper turning, and screw cutting etc. on lathe machine.
3. Perform machining operations on shaper.
4. Demonstrate metal joining process like compressive welding.

Module	Details	Hrs
1	Introduction to Lathe Machine, demonstration of various machining processes performed on lathe machine. One Job on Plain and Taper Turning One job on Precision Turning, Taper Turning and Screw Cutting	**18**
2	Introduction to Shaping Machine and various machining processes performed on Shaping Machine One job on shaping machine to make horizontal and inclined surface	**12**
3	Introduction to various forging tools. Two jobs on Forging of Cutting Tools used on Lathe Machine	**12**
4	One simple exercise on Welding, Preparation of a component using Compressive Welding Joint	**6**

[$] Course common to Mech/Auto

Term Work:

1. All the jobs mentioned above
2. Complete Work-Shop Book which give details of drawing of the job and time sheet

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

Job Work with complete workshop book ……. 40 marks
Attendance (Practicals) ……. 10 marks