

Department of Applied Mechanics

Sep 03, 2012

Subject: Implementation of the new undergraduate curriculum.

The expertise of faculty of AM department is in the broad areas of mechanics, Solid, Fluid and Computational Mechanics, Material Sciences and Design Engg. The teaching of foundation and subsequent courses in these areas are therefore the prime responsibility of the AM department. In fact, it is through the teaching of foundation courses that the department engages in the undergraduate curriculum of the institute. The department has been successfully and with excellence carrying out this mandate for the last five decades.

The department reaffirms its obligation to offer these courses in the above areas to students of all the disciplines across the Institute.

The response to the note from Dean (Academics) is as under:

1. Institute Core Course to be offered under EAS Category:

AML 110 (4 cr.): Engineering Mechanics- This is conducted as a 3-0-2 course at present.

But, we are debating whether we will change to 3-1-0 mode. After the DFB takes a decision on it, the same will be communicated separately.

2. Other Courses to be offered under EAS Category:

- | | | |
|-------|--|-------------------------------------|
| i) | AML 130 (5 cr.): Experimental Methods and Analysis | (3-1-2) |
| ii) | AML 140 (4 cr.): Mechanics of Solids | (3-1-0) |
| iii) | AML 150 (5 cr.): Mechanics of Solids and Fluids | (3-1-2) |
| iv) | AML 160 (4 cr.): Mechanics of Fluids | (3-1-0) |
| v) | AML 170 (5 cr.): Fluid Mechanics | (3-1-2) |
| vi) | AML 180 (5 cr.): Solid Mechanics | (3-1-2) |
| vii) | AML 190 (4 cr.): Design Engineering | To be conducted as a (3-0-2) course |
| viii) | AML 262 (1.5 cr.): Fluids and Solids Laboratory | |

Note1: The essential difference between AML 160 and AML 170 is the presence of the laboratory component in AML 170. The material covered in these two courses is essentially the same (barring a couple of topics). Similar is the case for AML 140 and AML 180. For those opting for AML 140 and AML 160 (without the laboratory), there is AMP 262 just for the laboratory. These options may be retained or removed depending upon the requirements of the degree awarding departments.

Course content of the above listed courses is attached.

3. Courses to be offered as Programme Linked Core under Materials Category:

AML 120 (4 cr.): Material Science (3-0-2)

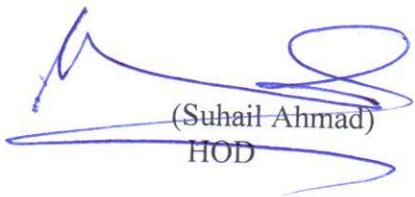
The DFB is of the opinion that this should be a 4 credit course with a laboratory component to do justice to the subject and considering its implications on all modern engineering designs. The course content is attached herewith. It is felt that the course as such caters to the most engineering

disciplines. However, depending upon the feedback from departments, if there are specific needs for some departments, we will be open to address the same.

4. The department proposes the Programme linked courses under EAS category as:

Programme	Courses	L-T-P	Credits
B.Tech. (Chemical Engg.)	AML 120	3-0-2	4
	AML 150	3-1-2	5
B.Tech. (Civil Engg.)	AML 120	3-0-2	4
	AML 140	3-1-0	4
	AML 160	3-1-0	4
	AMP 262	0-0-3	1.5
B.Tech. (Electrical Engg.)	AML 120	3-0-2	4
	AML 150	3-1-2	5
B.Tech.(Electrical Engg. Power)	AML 120	3-0-2	4
	AML 150	3-1-2	5
B.Tech. (Engg. Ph.)	AML 120	3-0-2	4
B.Tech.(Mech. Engg.)	AML 120	3-0-2	4
	AML 140	3-1-0	4
	AML 160*	3-1-0	4
	AMP 262*	0-0-3	1.5
B.Tech (Ind. Engg. & Production Mech.Engg.)	AML 120	3-0-2	4
	AML 150*	3-1-2	5
B.Tech. (Textile Tech.)	AML 120	3-0-2	4
	AML 140	3-1-0	4
	AML 160	3-1-0	4
	AMP 262	0-0-3	1.5
	Or		
	AML 120	3-0-2	4
B.Tech. (Bio Chem. Engg.& Bio Tech.)	AML 150	3-1-2	5
B.Tech. (Maths & Computing)	AML 150	3-1-2	5

*courses as PC in existing programmes.


 (Suhail Ahmad)
 HOD

DEPARTMENT OF APPLIED MECHANICS

Course content of courses to be offered under EAS category.

AML110 Engineering Mechanics

4 credits (3-0-2)

Laws of mechanics, equivalent force systems and equations of equilibrium, Internal force in structures and beams, friction and its applications, Kinematics of point mass and rigid body, Center of mass, System of particles, Inertia tensor, Dynamics of rigid bodies, Euler's equations of motion, Impulse-momentum, Work-energy methods with applications, Principle of virtual work and stability.

AML120 Materials Science

4 credits (3-0-2)

Structures of materials- crystal structure, substructure, microstructure, etc. Phase diagram and phase transformation. Diffusion phenomenon. Mechanical behavior- strength, hardness, deformation, creep, fatigue, etc. Mechanisms of strengthening and toughening of materials. Metallic alloys, Ceramics, Polymeric and Composite materials. Conductors, semiconductors and magnetic materials.

AML130 Experimental Methods and Analysis

5 credits (3-1-2)

- (a) Experimental Analysis: measurements and errors, internal and external estimates of errors, statistical analysis, accuracy and precision, best estimate, accuracy of the mean, significant digits, methods of least squares, curve fitting, linear regression, comparison and combination of measurements, extensions of least square method. Theory of errors, Gaussian distribution, confidence limits, significance test, and goodness of fit.
- (b) Instrumentation: Principal of measurements, Basic elements of measurement device, various types of measurement systems, standards and calibration, Dynamic characteristics of first and second order instruments, Transducers.
- (c) Experimental Devices: displacement measurement dial gauge, optical method pneumatic transducer, variable resistance, inductance and capacitance transducer, Seismic devices for motion measurement. Principal of planimeter, Strain and stress measurements, Force and torque measurements, various types of load cells and their applications.

AML140 Mechanics of Solids

4 credits (3-1-0)

Overlaps with: AML150, AML180

Introduction, Definition of stress, Equations of equilibrium, Principal stress, Maximum shear stress, Plane stress, Concept of strain, Strain displacement relations, Principal strains, Plane strain, Constitutive relations, Uniaxial tension test, Idealized stress-strain diagram, Isotropic linear elastic, viscoelastic and plastic

materials, Uniaxial deformations, Thermal stresses, Torsion of shafts, Bending and shear of beams, Energy methods, Fracture, Deflection, Stability.

AML150 Mechanics of Solids and Fluids

5 credits (3-1-2)

Overlaps with: AML140, AML160, AML170, AML180, CHL231, CHL204, AMP262

Introduction, fundamental concepts, mathematical preliminaries.

Analysis of strain deformation, strain displacement relations, Normal and shear strains, Transformation, Principal strains and Maximum shear strains, Volumetric strain, Compatibility equations, Plane strain, Strain rosettes, Velocity field and strain rates.

Constitutive relations; Hookean elastic solids, Yield criteria and plasticity, Viscoelasticity, Non-viscous fluid, Newtonian fluid.

Solid mechanics applications- Axisymmetric thin shells, uniaxial deformation. Torsion, bending, buckling, etc.

Fluid mechanics applications - Fluid statics, fluid motion; Material and spatial description. Integral and differential flow analysis, ideal fluid flow, simple viscous flow; Dimensional analysis.

AML 160 Mechanics of Fluids

4 credits (3-1-0)

Overlaps with: AML150, AML170, CHL231, CHL204

Introduction, Definitions, Fluid properties: classification of fluids and flow regimes. Fluid statics: Stationary fluids and liquids subjected to constant linear acceleration and to constant rotation. Fluid kinematics: Lagrangian and Eulerian descriptions, pathlines, streaklines and streamlines, acceleration. Integral flow analysis: Reynolds transport theorem, conservation of mass/continuity equation and conservation of linear and angular momentum for a control volume in inertial and accelerating reference frames, energy equation, Bernoulli's equation, engineering applications. Differential analysis of flow: Continuity and Navier –Stokes equations. Dimensional analysis and Similitude theory. Inviscid flows: Irrotational flow, circulation, velocity potential and applications. Viscous flows in pipes and ducts. External viscous flows: concept of boundary layer, momentum integral equation, drags and lifts separation. Fluid machinery: Introduction and classification of machines, types of hydraulic turbines and pumps and their performance characteristics, turbomachinery analysis and velocity triangles, cavitations, NPSH concept, similarity rules, applications.

AML170 Fluid Mechanics

5 credits (3-1-2)

Overlaps with: AML150, AML160, CHL231, CHL204, AMP262

Introduction, fluid properties, classification, fluid statics, rigid body motions, kinematics, of fluid motions, Reynolds transport theorem, mass, momentum and energy laws with applications, governing equations for Newtonian fluids, exact solutions, laminar and turbulent pipe flow. Introduction to boundary layer theory, Dimensional analysis and modeling, open channel flow.

AML180 Solid Mechanics

5 credits (3-1-2)

Overlaps with: AML140, AML150, AMP262

Introduction, Definition of stress, Equations of equilibrium, Principal stress, Maximum shear stress, Plane stress, Concept of strain, strain displacement relations, Principal strains, Plane strain, Constitutive relations, Uniaxial tension test, Idealized stress-strain diagram, Isotropic linear elastic, viscoelastic and plastic materials, Uniaxial deformations, Thermal stresses, Torsion of shafts, Bending and shear of beams, Energy methods, Fracture, Deflection, Stability.

AML190 Design Engineering

5 credits (3-1-2)

Introduction to Design: History of Design, Industrial Design, Engineering Design, Craft Design. Design Process: Recognition of need, Conceptualization and Creativity, Feasibility Assessment, Preliminary Design, Detailed Design, Prototype Testing. Important Design Considerations: Design Materials, Manufacturing Processes, Human Factors, Applied Ergonomics, Reliability, Safety and Environmental Protection, Optimization, Engineering Economics, Engineering Ethics. Advanced Technocly For Design: Concurrent/ Simultaneous Design, CAD and CAM, Rapid Prototyping, CIM.

AMP262 Fluids and Solids Laboratory

1.5 credits (0-0-3)

Pre-requisites: AML140& AML160

Overlaps with: AML150, AML170, AML180

Experiments will build-up on knowledge of Mechanics of Solids and Mechanics of Fluids. Applications of uncertainty analysis. A professional report is to be prepared for each experiment. Students work in a group of two.