

Course Description for all On-campus Programmes**Analysis & Application Oriented Courses****AAOC C111 Probability and Statistics 3 0 3**

Probability spaces; conditional probability and independence; random variables and probability distributions; marginal and conditional distributions; independent random variables; mathematical expectation; mean and variance; binomial, Poisson and normal distributions; sum of independent random variables; law of large numbers; central limit theorem (without proof); sampling distribution and test for mean using normal and student's t-distribution; test of hypothesis; correlation and linear regression.

AAOC C221 Graphs and Networks 3 0 3

Basic concepts of graphs and digraphs behind electrical communication and other networks behind social, economic and empirical structures; connectivity, reachability and vulnerability; trees, tournaments and matroids; planarity; routing and matching problems; representations; various algorithms; applications.

AAOC C222 Optimization 3 0 3

Prerequisite: MATH C191 and MATH C192

Introduction to optimization; linear programming; simplex methods; duality and sensitivity analysis; transportation model and its variants; integer linear programming nonlinear programming; multi-objective optimization; evolutionary computation techniques.

AAOC C311 Data Processing 3 0 3

Prerequisite: TA C162

Introduction to Data Processing; Files and File Structures; Indexing Techniques; Sorting, Searching and Merging Techniques; Introduction to Database Management Systems; Design of Information Systems; Emerging trends in Data Processing.

AAOC C312 Operations Research 3 0 3

Prerequisite: AAOC C111

Introduction to operations research; dynamic programming; network models - including CPM and PERT; probability distributions; inventory models; queuing systems; decision making- under certainty, risk, and uncertainty; game theory; simulation techniques, systems reliability.

AAOC C321 Control Systems 0 3 3

Prerequisites: (ES C241 or ENGG C111) and (MATH C191)

Mathematical models of physical systems, feedback characteristics of control systems, control system components, time response analysis, stability, frequency response, state-space analysis, compensation.

AAOC C322 Systems 3 0 3

Prerequisite: ES C241 or ENGG C111

Systems and systems approach; signals and systems; modelling of physical systems and modelling of non-physical systems; continuous and discrete systems; time domain analysis; systems stability.

AAOC C341 Numerical Analysis 3 0 3

Prerequisite: MATH C191 and MATH C192

Solution of non-linear algebraic equation; interpolation and approximation; numerical differentiation and quadrature; solution of ordinary differential equations; systems of linear equations; matrix inversion; eigenvalue and eigenvector problems; round off and conditioning.

Bioengineering**BENG C411 Anatomy, Physiology and Hygiene 2 3 3**

Course description is same as given under PHA C321.

BENG G511 Biomaterials 3 2 5

Introduction to biomaterials, structure and characterizations of materials, metallic implant materials, ceramic implant materials, polymeric implant materials, composites as biomaterials, structure property relationship, tissue response to implants, certain aspects of different kinds of prostheses.

BENG G512 Biomechanics 3 2 5

Introduction to biomechanics, kinematics, kinetics, anthropometry, muscle and joint biomechanics, electromyography, synthesis of human movement, muscle mechanics, kinesiology, biomechanics in sports.

BENG G521 Bioinformatics 3 2 5

General search methods, means-ends analysis, problem reduction, goal tree, optimal search, dynamic programming principle, minimax procedure, alpha-beta pruning. Statistical preliminaries, sampling and sampling distribution, estimation, hypothesis testing. Scoring systems and comparison of two sequences. Global multiple alignment. Construction of phylogenetic trees. Search in biological database, pattern discovery in set of sequences. Sequences and structure of macromolecules. Transcription and translation.

BENG G522 Biotransport Processes 3 2 5

Introduction to basic principles of fluid mechanics and of energy and mass transport, with emphasis on applications to living systems. Mass, momentum and energy conservation, mass diffusion, convection and diffusion. Modelling of momentum, energy and mass transport processes in physiological systems. Boundary layer, Penetration, and compartment models; inter-phase transport. Applications to respiratory, circulatory and other systems.

BENG G531 Telemetry 3 2 5

Major components and concerns of telemetry systems, including: sensors, signal conditioning and calibration, analogue-to-digital conversion, frame and packet construction, time and position determination, multiplexing,

payment system and security issues; Secure Transport Protocols, Secure Transactions, Secure Electronic Payment Protocol (SEPP), Secure Electronic Transaction (SET); Security features – certificates for authentication (SSL, third party certifications); security on Web servers and Enterprise Network. Emerging e-Businesses Scenario- Changing economic considerations; Emerging business opportunities and revenue models; emerging technologies; Social aspects.

ITEB G521 e-Business Technologies I 4

Overview of E-Business Architecture- DNA concept; Evolution of DNA – 3-tier and n-tier; Introduction to Presentation, Business and Data layers; HTTPS, Secure Socket Layer, Firewall, Proxy, Network Address Translator. Internet Servers – IIS, Netscape and Apache Servers; Installation, configuration and administration. Presentation Layer – HTML, DHTML, XML, CGI, Perl Script, Java Script; MS Platform – ASP, Active X controls, VB Scripts; SUN Platform- JSP, Java Applets. Business Layer - Technology/computing-COM/DCOM, COM+, CORBA, Java Servlets, EJB.

ITEB G522 e-Business Technologies II 4

Business Layer – Application servers- Weblogic, ATG Dynamo, Websphere, Coldfusion, iPlanet; Transaction Servers- MTS, Jaguar CTS, Tuxedo; MOM Servers- MSMQ, MQ Series, third party MOM servers. Data Layer – Data warehousing concepts; OLAP- concept and tools; XML support in ORACLE and SQL server; ADO, ODBC/JDBC, OLEDB. Case studies using Microsoft and Sun Technologies.

ITEB G621 Supply Chain Management 4

Customer driven strategies in production and distribution systems; Integrated production & distribution networks; SCM in the context of JIT and MRP-II; Distribution Resource Planning; Management of dealer networks; Total Quality Control & product innovation across the supply chain; Incoming logistics & supplier relationships; Value addition analysis; Metrics for management of supply chain performance; Mathematical models and computer assisted decision support for SCM; mathematical programming for SCM.

ITEB G542 Knowledge Management 3

Increasing knowledge work in organizations; technologies to support growth of knowledge work in organizations; scope, cost, efficiency and reliability of technologies to support knowledge work; role of knowledge in an enterprise; knowledge management process; knowledge management strategies; human aspects of knowledge management; knowledge management technologies; applications of technologies to be covered through cases, reading assignments and use of appropriate software.

ITEB G552 Change Management 3

Nature of organizational change; change management; change perspectives and paradigms; Action Re-

search Teaming; Understanding the human change process; need and opportunity in change initiatives; teamwork; data based change process; motivating and enabling change; becoming an effective change leader; change management competencies and its development.

Japanese

JAP N101T Beginning Japanese 3 0 3

Basic Japanese scripts (Hiragana, Katakana and Kanji); constructing words using Hiragana and Katakana and understanding their meanings; forming sentences, understanding their meanings, learning the related Kanjis; listening and reading comprehension, conversion practice, revision and additional practice through audio cassettes.

Mathematics

MATH C191 Mathematics I (Advanced Calculus) 3 0 3

Functions and graphs; limit and continuity; applications of derivative and integral. Conics; polar coordinates; convergence of sequences and series. Maclaurin and Taylor series. Partial derivatives. Vector calculus in R^n ; vector analysis; theorems of Green, Gauss and Stokes.

MATH C192 Mathematics II (Complex Variables 3 0 3 and Linear Algebra)

Complex numbers, analytic functions, Cauchy's theorems; elementary functions; series expansions; calculus of residues and applications.

Vector space; basis and dimension; linear transformation; range and kernel of a linear transformation; row reduction method and its application to linear system of equations.

MATH C222 Discrete Structures for Computer 3 0 3 Science

Introduction to discrete mathematical structures; Formal logic and predicate calculus; Sets, relations and functions; Proof techniques; Graphs and trees; Primes, factorization, greatest common divisor, residues and application to cryptology; Boolean algebra; Permutations, combinations and partitions; Recurrence relations and generating functions; Introduction to error-correcting codes; Formal languages and grammars, finite state machines.

MATH C231 Number Theory 3 0 3

Primes and factorization; division algorithm; congruences and modular arithmetic; Chinese remainder theorem Euler phi-function and primitive roots of unity; Gauss's quadratic reciprocity law; applications to periodic decimals and periodic continued fractions.

MATH C241 Mathematics III (Differential Equations) 3 0 3

Eigen-values and eigen-vectors. Inner product space and orthonormal bases. Elementary differential equa-

tions, Hypergeometric equations, Legendre polynomials, Bessel functions; Fourier series; Sturm-Liouville problem, series solution for differential equation, systems of first order equations; Laplace transformation and application to differential equations; one dimensional wave equation, one dimensional heat equation & Laplace equation in rectangular form.

MATH C311 Algebra I 3 0 3

Groups, subgroups, a counting principle, normal subgroups and quotient groups, Cayley's theorem, automorphisms, permutation groups, and Sylow's theorems.

Rings, ring of real quaternions, ideals and quotient rings, homomorphisms, Euclidean rings, polynomial rings, and polynomials over the rational field.

MATH C312 Algebra II 3 0 3

Prerequisite: MATH C311

Dual spaces, modules, fields, finite fields, extension of fields: algebraic extension, separable and inseparable extension, normal extension, splitting fields, Galois extension, and Galois group.

The algebra of linear transformations, characteristic roots and characteristic vectors, canonical forms: triangular form, nilpotent form, and Jordan form.

MATH C321 Elementary Real Analysis 3 0 3

Countability and uncountability of sets; real numbers; limits and continuity; compactness and connectedness in a metric space; Riemann integration; uniform convergence.

MATH C322 Measure and Integration 3 0 3

Prerequisite: MATH C321

Lebesgue measure and integration in real numbers, Convergence and Convergence theorems, absolutely continuous functions, differentiability and integrability, theory of square integrable functions, and abstract spaces.

MATH C331 Introduction to Topology 3 0 3

Metric Spaces; Topological Spaces – subspaces, Continuity and homeomorphism, Quotient spaces and product spaces; separation Axioms; Urysohn's Lemma and Tietze extension Theorem; Connectedness; Compactness, Tychonoff's Theorem, Locally Compact Spaces; Homotopy and the fundamental group.

MATH C332 Introduction to Functional Analysis 3 0 3

Prerequisite: MATH C321

Banach spaces; fundamental theorems of functional analysis; Hilbert space; elementary operator theory; spectral theory for self-adjoint operators.

MATH C352 Differential Geometry 3 0 3

Prerequisite: MATH C321

Curve in the plane and 3D-space; Curvature of curves;

Surfaces in 3D-space; First Fundamental form; Curvature of Surfaces; Gaussian and mean Curvatures; Theorema Egregium; Geodesics; Gauss-Bonnet Theorem.

MATH C353 Statistical Inference and Applications 3 0 3

(Prerequisite: AAOC C111 Probability and Statistics)

Review of elements of probability and statistical methods, Classical Decision theory including parametric and non-parametric methods for testing of hypotheses, Analysis of Variance: One way and two way classifications, Design of experiments: Analysis of Completely randomized design, Randomized block design and Latin square design with one or more missing values, Statistical Quality control for variables and measurements.

MATH C411 Complex Analysis 3 0 3

A rigorous treatment of the theory of analytic functions of complex variables including Cauchy's theorems; maximum modulus theorem; the principles of argument; Jensen's formula; Mittag Leffler theorem; Weierstrass canonical products and analytic continuation.

MATH C412 Concepts of Geometry 3 0 3

Euclidean geometry and non-Euclidean geometries; affine and projective geometry; synthetic projective geometry, duality, perspectivity, projectivity, coordinatization; analytic projective geometry, polarities, involutions, conics, finite geometries and their applications.

MATH C413 Topological Groups 3 0 3

Basic concepts and examples; compact and locally compact groups; integration on locally compact groups; convolutions of functions and measures; representation theory; characters and duality theory; applications.

MATH C421 Combinatorial Mathematics 3 0 3

Course description is same as given under CS C451.

MATH C422 Algebraic and Differential Topology 3 0 3

Fundamental group; universal covering space; simplicial approximation; simplicial homology theory; differentiable structures and smoothness; ideas of curvature.

MATH C431 Distribution Theory 3 0 3

Prerequisite: MATH C321

C-infinity functions, distributions and their derivatives; support, convolution and regularization; distributions of finite order; multiplication of distributions; Fourier transforms of distributions; temperate distributions and their Fourier transforms; fundamental solutions.

MATH C441 Discrete Mathematical Structures	3 0 3	simple functions and their applications; integral as anti-derivative; methods of integration; definite integral.
Course description is same as given under CS C453.		
MATH C451 Ordinary Differential Equations	3 0 3	MATH F111 Mathematics I
Existence and uniqueness theorems; properties of linear systems; behaviour of solutions of nth order equations; asymptotic behaviour of linear systems; stability of linear and weakly nonlinear systems; conditions for boundedness and the number of zeros of the nontrivial solutions of second order equations; stability by Liapunov's direct method; autonomous and nonautonomous systems.		3 0 3
Course description is same as given under MATH C191.		
MATH C452 Partial Differential Equations	3 0 3	MATH F112 Mathematics II
Non linear equations of first order, Charpits Method, Method of Characteristics; Elliptic, parabolic and hyperbolic partial differential equations of order 2, maximum principle, Duhamels principle, Greens function, Laplace transform & fourier transform technique, solutions satisfying given conditions, partial differential equations in engineering & science.		3 0 3
Course description is same as given under MATH C192.		
MATH C461 Integral Equations	3 0 3	MATH F113 Probability & Statistics
Classification of integral equations; modelling of problems as integral equations; Volterra equations of the first and second kind; Green's functions; Fredholm equations with degenerate kernels and symmetric kernels; Fredholm equations of the second kind; existence of solutions; numerical solutions.		3 0 3
Course description is same as given under AAOC C111.		
MATH C471 Nonlinear Optimization	3 0 3	MATH F211 Mathematics III
Introduction; convexity and cones; Kuhn Tucker theory; unconstrained and constrained optimization; gradient methods; polynomial optimization; penalty function; generalized convex functions; duality in non-linear programming; optimality criterion for generalised convex functions; fractional programming.		3 0 3
Course description is same as given under MATH C241.		
MATH C481 Commutative Algebra	3 0 3	MATH F212 Optimization
Modules; direct sums and products; finitely generated modules, exact sequences; tensor product of modules; rings and modules of fractions; localization; Noetherian modules and primary decompositions; integral dependence and valuation theory; integrally discrete valuation rings and Dedekind domains; fractional ideals.		3 0 3
Course description is same as given under AAOC C222.		
MATH C491 Special Projects	3	MATH F213 Discrete Mathematics
Course description is same as given under BIO C491.		3 0 3
MATH D021 Remedial Mathematics	5 0 5	Logic and methods of proof, Elementary Combinatorics, recurrence relations, Relations and digraphs, orderings, Boolean algebra and Boolean functions.
Algebra: Number systems; quadratic equations; progression; permutations and combinations; binomial theorem; vectors, matrices and determinants. Coordinate Geometry: Systems of coordinates, equation of a line and a circle.		MATH F214 Elementary Real Analysis
Trigonometry: Trigonometric functions, heights and distances; trigonometric identities; sum and product formulae; properties of triangles.		3 0 3
Calculus: Functions and graphs; limits; derivatives of		Course description is same as given under MATH C321.
		MATH F215 Algebra-I
		3 0 3
		Course description is same as given under MATH C311.
		MATH F231 Number Theory
		3 0 3
		Course description is same as given under MATH C231.
		MATH F241 Mathematical Methods
		3 0 3
		Integral Transforms: Fourier, Fourier sine/cosine and their inverse transforms (properties, convolution theorem and application to solve differential equation), Discrete Fourier Series, Fast Fourier transform, Calculus of Variation: Introduction, Variational problem with functionals containing first order derivatives and Euler equations, Variational problem with moving boundaries. Integral equations: Classification of integral equations, Volterra equations, Fredholm equations, Greens functions.
		MATH F242 Operations Research
		3 0 3
		Course description is same as given under AAOC C312.
		MATH F243 Graphs and Networks
		3 0 3
		Course description is same as given under AAOC C221.

Mechanical Engineering

ME C211 Applied Thermodynamics 3 0 3

Thermodynamics of power developing and power absorbing reciprocating machines; vapour, gas and refrigeration cycles; regeneration, reheat, compound cycle modifications, combined gas turbine-vapour cycle, binary systems; thermodynamic relations; reactive systems; combustion, adiabatic flame temperature, dissociation, equilibrium.

ME C212 Transport Phenomena I 3 0 3

Fundamentals of the momentum, heat and mass transfer; the control volume approach and integral equations; differential analysis for momentum, heat and mass transfer, and solutions for one-dimensional steady state situations; convective heat and mass transfer; dimensional analysis.

ME C312 Design of Machine Elements 3 0 3

Fundamentals and principles of design; design and selection of machine elements such as shafts, bearings and gears etc; design of mechanisms.

ME C314 Power Plant Engineering 3 0 3

Classification of power plants. Components and layout of; thermal, nuclear, hydro electric power plants. Site selection for various power plants. Combined cycle power plants. Magneto Hydro Dynamics (MHD) systems. Economics of power generation, economic loading of power stations. Load curve analysis; load factor, diversity factor. Power plant instrumentation and controls.

ME C331 Transport Phenomena II 3 2 4

(For Mechanical Engineering)

Fundamental concepts of heat transfer; steady-state and unsteady-state heat conduction; analytical and empirical relations for forced and free convection heat transfer; heat exchanger analysis and design, heat transfer by radiation; elements of mass transfer; one dimensional compressible flow; flow in open channels, associated laboratory.

ME C332 Prime Movers and Fluid Machines 3 2 4

Theoretical analysis of energy and momentum transfer between fluid and rotor; principles of axial, mixed and radial flow compressors, turbines and pumps; design considerations; cascade aerodynamics and performance limitations; applications to power plant systems, laboratory exercises in testing reciprocating machines; rotary machines and refrigeration plants.

ME C342 Production Techniques 3 2 4

Analysis, economics and quality control of metal cutting, plastic working of metals, joining and casting processes, laboratory exercises in metal cutting, plastic working of metals, testing and inspection of weldments

and castings.

ME C382 Computer Aided Design 3 0 3

Course description is same as given under EA C342.

ME C392 Advanced Mechanics of Solids & Kinematics 3 0 3

Energy methods; asymmetrical bending; curved beams; thick cylinders; contact stresses; introduction to mechanisms; velocity and acceleration analysis using vector polygon method; kinematics of cams & synthesis of cam profile; gear trains.

ME C412 Production Planning & Control 3 0 3

Course description is same as given under ET C412.

ME C422 Dynamics of Machines & Vibration 3 0 3

Dynamic force analysis in mechanisms; determination of flywheel size; balancing of rotating & reciprocating masses; whirling of shafts; forced vibration & vibration isolation; multi-degree freedom systems; systems with distributed mass & elasticity.

ME C432 Computer Aided Manufacturing 3 0 3

Introduction, features of NC machine tools, NC part programming, CAM system devices, interpolators for manufacturing systems, control loops of NC systems, computerized numerical control, adaptive control systems, CAD to CAM, CAPP, industrial robots, computer aided production planning & control, computer aided inspection and quality control, CIM systems.

ME C441 Automotive Vehicles 3 0 3

Internal combustion engines; vehicle performance; analysis and design of vehicle components. Experimental or theoretical investigation of problems selected from the field of automotive vehicles.

ME C442 Advances in Materials Science 3 0 3

Deformation of materials, deformation at high temperatures and creep, recovery, recrystallization and grain growth, fracture of materials and fatigue failure, deterioration of materials, corrosion and oxidation, surface properties, surface energy and tribology, polymers and fibre reinforced polymeric composites, mechanical testings, nondestructive testing techniques.

ME C443 Quality Control, Assurance & Reliability 3 0 3

Basic concepts of probability and probability distributions, standard probability distribution, sampling and sampling distributions, confidence intervals, testing significance, statistical tolerance, various types of control charts, statistical process control techniques, value analysis, defect diagnosis and prevention, basic concepts of reliability, reliability design evaluation and control, methods of applying total quality management, production process.

ME C451 Mechanical Equipment Design	3 0 3	Design analysis for additional machine elements; retainment of bearings and design of machine housing; introduction to techniques of optimisation reliability and value analysis; exercises in detail design; design solutions to meet specified functional requirements.	stress-strain-temperature relations; torsion of circular member, stress and deflection due to bending, stability of equilibrium. Static failure criteria, ductile & brittle material; Dynamic failure criteria.
ME C452 Composite Materials and Design	3 0 3	Introduction to composites, concepts of reinforcement, strengthening mechanisms, fibrous reinforcements, matrix materials, micro-mechanical aspects of composites, manufacturing methods, composite production design methods-design of tensile members, pressure vessels, storage tanks, and other chemical process equipment made of FRP, design of joints, damage of composites by impact, FRP grids, recent development in manufacturing of composites and technologies.	ME F212 Fluid Mechanics 3 0 3 Fluid Statics; fundamentals of mass, momentum and energy transfer, control volume approach and integral equations. Differential analysis of mass, momentum and energy transfer, solutions for one dimensional steady state situations. Viscous and in-viscid flow. Dimensional analysis. Introduction to computational fluid dynamics.
ME C461 Refrigeration and Air Conditioning	3 0 3	Course description is same as given under CE C461.	ME F213 Materials Science & Engineering 2 0 2 Introduction, Structure of Materials (Metal and Ceramics), Dislocations, heat treatment of steel and strengthening Mechanisms of Metals, Phase diagrams, Iron-carbide phase diagram, Phase transformation in Metals, Mechanical and thermal properties of Metals, Polymers (Structure, processes and properties), powder metallurgy.
ME C472 Precision Engineering	3 0 3	Concept of accuracy, accuracy of numerical control systems, tolerances and fits, acceptance tests for machine tools, static stiffness and its influence on machining accuracy, inaccuracies due to thermal effects, influence of forced vibrations on accuracy, dimensional wear of cutting tools and its influences on accuracy, clamping and setting errors, location principles and errors due to location, surface roughness and microfinishing processes, dimensioning and dimensional chains, methods of improving accuracy and surface finish, thread and gear measuring instruments, coordinate measuring machines, introduction to computer aided tolerancing.	ME F214 Applied Thermodynamics 3 0 3 Availability and irreversibility, thermodynamic relations, gas and vapor cycles, combined power generation cycles, gas mixtures, refrigeration cycles, psychometrics and heat load calculations, gas turbine cycles, compressors, boilers and accessories
ME C481 Project Appraisal	3 0 3	Prerequisite: ECON C212 Course description is same as given under ECON C411.	ME F215 Mechanical Engineering Laboratory 0 2 2 The course shall aim to train the student in the skill of operation of instruments and equipments. Testing of mechanical properties like tensile testing, hardness, impact, bending of beams, spring testing, basic fluid mechanics experiments like measurements of pressure, temperature, viscosity, flow measurement, basic electrical & electronics like experiments on diodes, rectifiers, OPAMPS, dc motors, transformers, induction and synchronous motors.
ME C491 Special Projects	3	Course description is same as given under BIO C491.	ME F241 Machine Design & Drawing 3 1 4 Fundamentals and principles of Design. Design and selection of Machine elements such as shafts, Screw fasteners, Welded joints, Springs, Brakes & Clutches, Bearings & Gears. Fundamentals of Machine Drawing; practices for Orthographic drawing of machine parts, sectional view, assembly drawing & exploded view.
ME F110 Workshop Practice	0 4 2	Laboratory exercises for different manufacturing processes like machining on lathe, drilling, grinding, milling and shaper; sand moulding and casting; metal forming; joining processes like arc welding, gas welding, brazing and soldering; carpentry; fitting; use of metrology equipments in measurement; demonstrations on CNC machines and CNC part programming.	ME F242 IC Engines 2 0 2 Working cycles and operation of two stroke, four stroke SI and CI engine cycles. Ignition, combustion, alternative fuels, emission and their control.
ME F211 Mechanics of Solids	3 0 3	Fundamental Principles of mechanics; introduction of mechanics of deformable bodies; force and moment transmitted by slender members; stress and strain;	ME F243 Production Techniques I 2 1 3 Metal casting methods, patterns and molding, different types of casting processes, injection molding, die casting and casting defects. Casting analysis. Metal forming, different bulk metal forming processes like rolling, extrusion, forging and wire drawing. Metal forming pro-

cess analysis and forming defects. Welding, brazing and soldering, different techniques and welding defects. Welding analysis. Simple description of various machining operations, machine tools and cutting tool geometry. Limits & Fits and Metrology. Fabrication project.

ME F244 Kinematics & Dynamics of Machinery 3 0 3

Kinematics of mechanism: introduction to mechanisms, position, displacement, velocity, acceleration analysis, Synthesis of mechanisms (Planer), cam design, Kinematics of gears (spur, helical, bevel and worm), gear trains, Dynamics of machines: static force analysis, dynamic force analysis (planar), dynamics of reciprocating engines, balancing, cam dynamics, fly-wheels, governors and gyroscopes.

ME F266 Study Project 3

Course description is same as given under BIO F266.

ME F311 Heat Transfer 3 1 4

Fundamental concepts of heat transfer; steady state and unsteady- state heat conduction; analytical and empirical relations for forced and free convection heat transfer; heat exchanger analysis and design, heat transfer by radiation; associated laboratory.

ME F312 Advanced Mechanics of Solids 3 0 3

Generalized Hooke's law; Energy methods; torsion of non-circular members; shear center and asymmetrical bending; curved beams; thick cylinders; plates and shells; contact stress.

ME F313 Production Techniques II 3 1 4

Metal cutting theory. Analysis, economics and quality control of metal cutting, laboratory exercises in metal cutting and fabrication project. Different machine tools their description and operation. Non-traditional machining processes. Micro-manufacturing technologies. Introduction to computer aided manufacturing (CAM), CNC machines and CNC part programming.

ME F341 Prime Movers & Fluid Machines 2 1 3

Theoretical analysis of energy and momentum transfer between fluid and rotor; principles of axial, mixed and radial flow compressors, turbines and pumps; design considerations; cascade aerodynamics and performance limitations; applications to power plant systems; model similitude for turbo-machines; Introduction to fluid power system, laboratory exercises in testing reciprocating machines, rotary machines and fluid power system.

ME F342 Computer Aided Design 3 1 4

CAD software and CAD hardware. Mathematical modeling of parametric curves, surfaces and solids, and their computer simulation on spreadsheets and using specialized solid modeling packages. CAD/CAM data exchange. Introduction to finite element analysis and FEM practice on a specialized CAE package. Rapid

prototyping. Students will be required to do several assignments and one CAD project.

ME F343 Mechanical Vibrations 3 0 3

Small oscillations of linear dynamical systems, free and forced vibrations of single and multi-degree-of-freedom systems, normal modes and orthogonality relations, generalized co-ordinates and Lagrange's equations, matrix formulation, eigenvalue problem and numerical solutions, transient response of one-dimensional systems, approximate energy methods, continuous system, vibration of string, rods, bars and beams. Introduction to control systems.

ME F344 Engineering Optimization 2 0 2

Linear programming methods, simplex method, transportation model and its variants, queuing systems, PERT/CPM, Optimal problem formulation, engineering optimization problems, single variable optimization algorithms, multivariable optimization algorithms, constrained optimization algorithms.

ME F366 Lab Project 3

ME F367 Lab Project 3

Course description is same as given under BIO F366 and BIO F367.

ME F376 Design Project 3

ME F377 Design Project 3

Course description is same as given under BIO F376 and BIO F377.

ME F411 Fluid Power Systems 3 1 4

Introduction to Fluid power, advantages of fluid power, applications, Introduction to Pneumatics, Air preparation and Components, Pneumatics Circuits and Applications, Electro pneumatics, Electrical Controls for fluid power circuits, , Physical properties of hydraulic fluids, Energy and Power in Hydraulic Systems, Frictional Losses in Hydraulic Pipelines, Hydraulic Pumps, Hydraulic Cylinders and Cushioning Devices, Hydraulic Motors, Hydraulic Valves, Hydraulic Circuit Design and Analysis, Ancillary Hydraulic Devices, Hydraulic Conductions and Fittings, Maintenance of Hydraulic Systems, Use of PLC programming for interfacing pneumatics and Hydraulic Circuits.

ME F412 Production Planning and Control 3 0 3

Course description is same as given under me C412.

ME F413 Nonlinear Vibrations 3 0 3

Introduction, sources of nonlinearity, examples, qualitative analysis: phase plane, singular points, stability of singular points, Forced response, Perturbation methods: straightforward expansion, the method of multiple scales, harmonic balance, method of averaging, Non-linear normal modes, Nonlinear Multiple-DOF Systems, Bifurcations, Centre manifold reduction,

Flouquet Theory, Chaos Theory, Melnikov Criterion, Applications to vehicle dynamics, structures and microsystems etc. Use of softwares for simulations and numerical solutions.

ME F415 Gas Dynamics 3 0 3

Introduction to Gas Dynamics, Basic equations of compressible flow, Wave propagation, Steady one-dimensional flow (Varying-area adiabatic flow), Normal shock waves, Oblique shock and expansion waves, Prandtl-Meyer Flow, Flow with Friction and Heat Transfer, Potential equation for compressible flow, Similarity rule.

ME F416 Reverse Engineering and Rapid Prototyping 3 0 3

Introduction to reverse engineering, methodologies and techniques for reverse engineering, reverse engineering hardware and software, selecting reverse engineering system, introduction to rapid prototyping, relationship between reverse engineering and rapid prototyping. Reverse engineering in automotive engineering, aerospace engineering, medical device industry. Legal aspects and barriers for reverse engineering. Project work.

ME F417 Advanced Metal Forming 3 0 3

The stress and strain tensors in macroscopic plasticity and failure criteria for metal forming, effective stress and effective strain, flow rules for plastic deformation and principle of normality. Work hardening, determination of work hardening exponent. Plastic instability and effect of inhomogeneity on uniform strain. Strain rate and temperature effects on plastic deformation and flow stress, super-plasticity, temperature rise during metal forming. Ideal work and redundant work. Slab, upper-bound, slip-line field and finite element methods of analysis of various bulk and sheet metal forming processes. Bulk and sheet metal formability tests and forming limit diagram. Sheet metal properties and plastic anisotropy.

ME F418 Rocket and Spacecraft Propulsion 3 0 3

Thrust and specific impulse. Compressible flows. Detailed analysis of liquid, solid and hybrid propulsion systems. Includes propellants, injection systems, combustion and chemical equilibrium, thrust chambers, nozzles and plumes. Electro-thermal thrusters. Plasmas and electromagnetic thrusters.

ME F419 Total Product Integration Engineering 3 0 3

Quality design across global supply chain. Robust product architecture for market variety and technology advances. Product development risk management.

ME F420 Power Plant Engineering 3 0 3

Course description is same as given under ME C314.

ME F423 Micro Fluidics and its Application 4*

Course description is same as given under EA C417.

ME F432 Computer Aided manufacturing 3 0 3

Course description is same as given under ME C422.

ME F433 Solar Thermal Process Engineering 3 1 4

Fundamentals of solar energy, earth-sun angles, solar spectrum, solar radiation, measurement and estimation of solar energy on horizontal and tilted surface, conversion routes and technologies, Standards and Performance Testing, thermal utilization of solar energy, modes of heat transfer and equations for performance calculations of systems- conduction, convection and radiation of heat, Flat plate collectors, solar concentrator systems, geometric optics, tracking methods, thermal analysis, energy storage, materials and properties, solar process loads and system calculations for time dependent loads, Life cycle cost analysis and economic analysis for various applications of solar thermal processes, solar water heating, space heating and cooling in Buildings, Industrial process heating, solar air-conditioning and refrigeration, Use of Simulation tools for performance simulation and Project Assignments, solar thermal power generation, Role of Govt., policies and plans.

ME F441 Automotive Vehicles 3 0 3

Course description is same as given under ME C441.

ME F443 Quality Control, Assurance and Reliability 3 0 3

Course description is same as given under ME C443.

ME F451 Mechanical Equipment Design 3 0 3

Course description is same as given under ME C451.

ME F452 Composite Materials & Design 3 0 3

Course description is same as given under ME C452.

ME F461 Refrigeration and Air conditioning 3 0 3

Course description is same as given under CE C461.

ME F472 Precision Engineering 3 0 3

Course description is same as given under ME C472.

ME F481 Project Appraisal 3 0 3

Course Description is to be developed.

ME F482 Combustion 3 0 3

Fuels, Combustion, Adiabatic Flame Temperature, Chemical Kinetics, Chain Reactions, Conservation Equations for Reacting Flows, Laminar and Turbulent Premixed Flames, Diffusion Flames, Droplet and Particle Combustion, Emissions, Applications.

ME F483 Wind Energy 3 0 3

Historic development of wind energy technology, basic principles of wind energy conversion, different types of wind machines and their performances, wind rotor aerodynamics and its application in the turbine design, statistical methods of measurement and analysis of wind spectra for energy use, developing models for es-

timating the wind energy potential of a prospective site, Constructional features of various systems and sub-systems of a Wind Energy Conversion System (WECS), Features of wind farms, performance models of WECS, Optimal matching of WECS, environmental aspects of wind energy conversion, Economics of wind energy conversion.

ME F484 Automotive Technology 3 0 3

Historic development of wind energy technology, basic principles of wind energy conversion, different types of wind machines and their performances, wind rotor aerodynamics and its application in the turbine design, statistical methods of measurement and analysis of wind spectra for energy use, developing models for estimating the wind energy potential of a prospective site, Constructional features of various systems and sub-systems of a Wind Energy Conversion System (WECS), Features of wind farms, performance models of WECS, Optimal matching of WECS, environmental aspects of wind energy conversion, Economics of wind energy conversion.

ME F485 Numerical Techniques for Fluid Flow and Heat Transfer 3 0 3

Introduction to CFD, Partial Differential Equation (PDE): Physical classifications, Mathematical Classifications, Well posed problem. Basic of Discretization Methods: Finite difference method, Truncation error, consistency, error and stability analysis, convergence, various discretization schemes. Introduction commercial software: OpenFOAM or Fluent. Application of numerical methods to selected model equations: Wave equation, Heat equation, Laplace's equations. Solution of Navier-Stokes equation for incompressible flows.

ME F491 Special Projects 3

Course description is same as given under BIO F491.

ME G511 Mechanisms & Robotics 2 3 5

Classification of robots & manipulators; fields of application; synthesis of planar & spatial mechanisms; methods of function & path generation; coupler curve synthesis; linkages with open loop; actuators & drive elements; microprocessor application and control of robots.

ME G512 Finite Element Methods 5

Fundamental concepts, matrix algebra and gaussian elimination, one-dimensional problems, trusses, two-dimensional problems using constant strain triangles, axisymmetric solids subjected to axisymmetric loading, two-dimensional isoparametric elements and numerical integration, beams and frames, three-dimensional problems in stress analysis, scalar field problems, dynamic considerations, pre-processing and post processing.

ME G513 Heating and Cooling of Buildings 3 2 5

Introduction to HVAC design, basic scientific principles,

climatic conditions, building heat transmission surfaces, infiltration and ventilation, heating loads, heat gains and cooling loads, HVAC psychometrics, codes and standards for HVAC systems design, acoustics and vibration, human comfort, air distribution, duct system design, fans and central air systems, air system heating and cooling, air cleaning and filtration, introduction to electrical systems, controls for air distribution systems.

ME G514 Turbomachinery 3 2 5

Introduction, thermodynamics, gas turbine plants, steam turbine plants, fluid dynamics, dimensional analysis and performance parameters, flow through cascades, axial turbine stages, high temperature turbine stages, axial compressor stages, centrifugal compressor stages, radial turbine stages, axial fans and propellers, centrifugal fans and blowers, and wind turbines.

ME G515 Computational Fluid Dynamics 3 2 5

Philosophy of computational fluid dynamics (CFD), governing equations of fluid dynamics, mathematical behavior of partial differential equations, basics of the numerics : basic aspects of discretization, grids with appropriate transformations, and simple CFD techniques, applications, numerical solutions of quasi-one-dimensional nozzle flows, numerical solution of a two-dimensional supersonic flow, incompressible couette flow, and supersonic flow over a flat plate, advanced topics in CFD.

ME G516 Energy Systems Engineering 5

Basic concepts of energy conversion, generation of electrical and thermal energy, transmission and distribution of electrical energy, load management, detailed analysis of utilization of thermal energy in : boilers, furnaces, compressors, heat transfer equipments, and HVAC systems, energy audit, waste heat recovery systems, cogeneration, demand side management, and management and organization of energy saving projects.

ME G521 Mechanical System Design 3 2 5

Concept of system design; modeling of structural and kinematic systems, and determination of system characteristics; reliability of systems; design of machine elements for specified reliability; concepts of optimization; techniques of design optimization for linear and non-linear problems.

ME G532 Machine Tool Engineering 3 2 5

Design principles of machine tools; stiffness and rigidity of separate construction elements and their combined behaviour under load; design of stepped and stepless drives; electrical, mechanical and hydraulic drives; design of bearings and sideways; machine tool controls; machine tool dynamics; recent developments in machine tool design.

ME G533 Conduction and Radiation Heat 5* Transfer

Conduction: Steady and unsteady problems and their solutions in cartesian, cylindrical and spherical coordinates. Separation of variables. Duhamel's theorem. Laplace transform. Problems involving change of phase. Inverse heat conduction, Microscale heat transfer, Radiation: Radiative exchange among black and grey and spectral surfaces, Shape factors. Applications to cavities and enclosures. Integral equations approach. Radiation from gases, vapours and flames.

ME G534 Convective Heat and Mass Transfer 5*

Conservation equations, boundary layers, free convection, forced convection. Heat transfer in laminar and turbulent, internal as well as external flows, mixed convection. Combined convection and radiation. Boiling and Condensation. Molecular diffusion in fluids, mass transfer coefficient. Simultaneous heat and mass transfer; Applications.

ME G535 Advanced Engineering Mathematics 3 2 5

Boundary value problems; wave equations; nonlinear partial differential equations; calculus of variations; Eigen value problems; iteration problems including forward and inverse iteration schemes – Graham Schmidt deflation – simultaneous iteration method – subspace iteration – Lanczo's algorithm – estimation of core and time requirements.

ME G536 Thermal Equipment Design 5

Course description is to be developed.

ME G537 Cryogenic Engineering 5

Introduction to cryogenics and its applications, properties of cryogenic fluids, properties of materials at cryogenic temperature, gas-Liquefaction and refrigeration systems, gas separation, cryocoolers, cryogenic insulations, vacuum technology, instrumentation in cryogenics, safety in cryogenics.

ME G538 Toyota Production System 3 2 5

Birth of Toyota production system, house of Toyota production system, stability, standardization, just-in-time, jidoka, involvement, hoshin planning, Toyota culture, Toyota way, Case Studies.

ME G539 Computer Integrated Manufacturing 3 2 5

Computer Modeling for mass property analysis. Computer Numerical Control. Computer-aided Manufacturing, operation of CNC machine tools. Design of manufacturing work cells, Automated Manufacturing and Programmable Controller.

ME G611 Computer Aided Analysis and Design 2 3 5

Course description is same as given under CE G611.

ME G612 Plastics Engineering 3 2 5

General properties of Plastics, Mechanical Behavior of Plastics, Processing of Plastics like Extrusion, injection

moulding, thermoforming, calendaring, rotational moulding, compression moulding, transfer moulding, analysis of polymer melt flow, rheological models for polymer melt flow, analysis of heat transfer during polymer processing, elastic behavior of polymer melts, testing methods of polymers like DSC, TGA, DMA, XRD etc. FRP composites, Properties of FRP composites in longitudinal and transverse directions, volume and weight fraction relationships of fibers, failure mechanisms, mechanical properties and fiber orientation effects, processing of composite materials, advancement of composite materials in applications like wind mill blades, bullet proof jackets, etc.

ME G621 Fluid Dynamics 2 3 5

Course description is same as given under CE G621.

ME G631 Advanced Heat Transfer 3 2 5

(= CHE G614)

Course description is same as given under CHE G614.

ME G641 Theory of Elasticity and Plasticity 3 2 5

Course description is same as given under CE G641.

Microelectronics**MEL G512 Optoelectronic Devices, Circuits 3 2 5 and Systems**

Course description is same as given under EEE G521.

MEL G531 Testable Design and Fault Tolerant 3 2 5 Computing

Course description is same as given under CS G531.

MEL G532 Digital Signal Processing 3 2 5

Course description is same as given under EEE G572.

MEL G611 IC Fabrication Technology 3 2 5

Material properties; crystal growth and doping; diffusion; oxidation; epitaxy; ion implantation; deposition of films using CVD, LPCVD and sputtering techniques; wet and dry etching and cleaning; lithographic process; device and circuit fabrication; process modeling and simulation.

MEL G612 Integrated Electronics Systems Design 2 2 4

General architectural features of 8/16/32 bit microprocessors, programmers model of 8086, assembly language programming, hardware design around 8086, bus based systems design, system design around IBM PC, design of real-time systems, ASIC's development tools.

MEL G621 VLSI Design 3 2 5

Introduction to NMOS and CMOS circuits; NMOS and CMOS processing technology; CMOS circuits and logic design; circuit characterization and performance estimation; structured design and testing; symbolic layout systems; CMOS subsystem design; system case studies.

to cell cycle, Experiments related to hematology, DNA quantification from the plant organs; Water analysis.

BIO F111 General Biology 3 0 3

Course description is same as given under BIO C111.

BIO F201 Introductory Biology 3 1 4

Living systems and their properties; classification of organisms; biochemical pathways operative in organisms; introductory genetics, Introductory recombinant DNA technology, ecology and environmental sciences and related basic labs.

BIO F211 Biological Chemistry 3 0 3

The molecular process of life presents us with a seemingly never ending succession of chemical mechanisms of almost incredible fascination. This course is introduced at the cellular and molecular level and focus upon bio -macromolecules, biosynthesis of macromolecules, energy yielding and requiring processes, genetic information etc. This would help going for higher level activities, appreciation of biochemical problems, evaluation and problem solving. It also includes theory of techniques used in biochemistry and related experiments.

BIO F212 Microbiology 3 1 4

Introduction and classification of microbes; structure, physiology and genetics of microbial cell; isolation, cultivation, physiological and biochemical characterization of microbes; host parasite relationship; microbiology of soil, water and food; physical chemical methods of controlling microbes; antimicrobial drugs; clinical microbiology; and related lab components.

BIO F213 Cell Biology 3 0 3

Types and properties of cells; microscopy; membrane structure, function and transport; endomembrane system and its functions; nuclear organization and functions; ribosomes and protein synthesis; cytoskeleton; cell communication; cell cycle, cell growth and cancer; apoptosis; techniques, related experiments and applications of cell biology.

BIO F214 Integrated Biology 3 0 3

The Integrative Biology course is a course which bridges as well as opens new vistas to a student taking up biology. The course covers two tracks, essentially. The first track introduces the student to the ordering that helps biologists to actually study the vast diversity of the living world. This track would encompass questions related to the origin and evolutionary pathways followed in Nature, as well as the methods followed by biologists to systematically categorize and document them. The second track highlights the uses and applications of biology in everyday life – whether in the economic or in the social realms. Together, the course projects the subject in a way from which the student can choose and implement his biological knowledge vis-à-vis his/her interests.

BIO F215 Biophysics 3 0 3

A study of molecules and their interaction forces; bioenergetics and physical techniques as applied to biological phenomena and related labs.

BIO F231 Biology Project Laboratory 3

Course description is same as given under BIO C231.

BIO F241 Ecology and Environmental Sciences 3 0 3

Biotic and abiotic components of environment; limiting factors; regional ecology; ecosystem productivity and trophism; population and community ecology; succession and evolution; pollution; environmental biotechnology; Indian environmental movement. Associated with related labs.

BIO F242 Introduction to Bioinformatics 3 0 3

Introduction to genomic & Proteomics, Biological databases and data mining, sequence similarity search and sequence alignment algorithms, Phylogenetic tree construction algorithms, Protein structure prediction and structure analysis, use of software package in Bioinformatics; Related lab components.

BIO F243 Genetics 3 0 3

Facts and theories of heredity, their relation to the present state of biological theory in general; elements of population genetics; genetics and species concept and related labs.

BIO F244 Instrumental Methods of Analysis 1 3 4

Principles, configuration, applications of instruments like mass spectrophotometer, NMR, UV, IR, X-ray apparatus, atomic spectrophotometer, Fluorescence Spectroscopy, gas chromatography, liquid scintillation spectrophotometer, laser device, high voltage electrophoresis, ultracentrifuge, DTA, TGA, Thermo Cycler-PCR, SDS-PAGE, ELISA etc. The course is specially designed for students in the first degree majoring in experimental sciences and would require groups of students to work with the above instruments in order to appreciate the potentiality of such modern instrumental methods of analysis.

BIO F266 Study Project 3

These courses include projects which are oriented towards readings from published literature or books about new frontiers of development or analysis of available database. These courses are normally available to students in second or higher levels. These courses must coterminate with project reports.

BIO F311 Recombinant DNA Technology 3 0 3

The course deals with theoretical aspects and lab exposure to selected experiments of recombinant DNA manipulation. Emphasis will be placed on procedures to create chimeric molecules using examples from actual experimental work. Vector designing, PCR, qPCR, DNA sequencing, in-vitro mutagenesis, cloning in prokaryotic and eukaryotic systems and whole genome

approaches will be covered with related lab components.

BIO F312 Plant Physiology 3 0 3

Basic functional processes in plants; Plant tissue system, Plant-water relations, Gaseous exchange, Stomatal regulations, Mineral nutrition and absorption, Transport of material, Growth and development, Hormones and PGRs, Photoperiodism, Vernalization, Plant defense mechanisms, Stress Physiology and related lab components.

BIO F313 Animal Physiology 3 0 3

Principles and concepts underlying the function of tissues and organ systems in animals, with emphasis on mammalian systems and integration of systems at the level of the whole organism. Several biological systems are considered, including respiratory, circulatory, nervous, endocrine, immune, excretory, muscles, skeletal and reproductive systems. Laboratory session will help to study function of any organ system; Related lab components.

BIO F314 Conservation Biology 2 1 3

Biological diversity: its measurement, value and crisis; conservation at ecosystem, population and species levels; protection, management and restoration of ecosystems; sustainable development and community-based conservation; conservation legislation. Course practicum will be effected through classroom and field activities.

(This course is introduced in the pool of discipline electives for M.Sc. (Hons.) Biological Sciences programme).

BIO F341 Developmental Biology 3 0 3

Scope and problems in developmental biology; major model organisms (vertebrates, invertebrates and plants) and their life cycles; patterning and axis formation; morphogenesis; organogenesis; nervous system; germ cells and sex; cell differentiation and stem cells; growth, ageing and regeneration; applications of developmental biology. The course will emphasize universal principles that govern the process of development; Related lab components.

BIO F342 Immunology 3 0 3

Introduction to immune system, cell mediated and humoral immunity, immune system in health and disease immunity to infectious diseases, immune mechanisms involved in cancer, immunodeficiency and auto-immunity. Vaccination and transplantation Immunology; Related lab components.

BIO F352 Cell and Tissue Culture Technology 3 1 4

Theories and practices on *in vitro* techniques for plants and animals, development of normal and tumor cell lines, somatic hybridization, monoclonal antibody production, hairy root cultures, secondary metabolite pro-

duction, scale-up strategies for large scale production of biomass.

BIO F366 Lab Project 3

BIO F367 Lab Project 3

These courses include projects involving laboratory investigation or laboratory development in the students discipline or interdisciplinary areas. These courses are normally available to students in third or higher levels. These courses must coterminate with project reports.

BIO F376 Design Project 3

BIO F377 Design Project 3

These courses are intended to impart training in design of product/ process or other artifact to the students in the discipline or interdisciplinary areas. These courses are normally available to students in third or higher levels. These courses must coterminate with project reports.

BIO F411 Laboratory 0 9 3

Specially designed for M.Sc. (Hons). Biological Sciences; cannot be taken by others under any circumstances.

This laboratory course is designed only for M.Sc.(Hons) Biological Sciences students and aims to expose the students to and build competence in selected techniques of modern biology.

BIO F413 Molecular Biology of Cell 3 0 3

Course description is same as given under BIO C413.

BIO F417 Biomolecular Modelling 3 0 3

Course description is same as given under BIO C417.

BIO F418 Genetic Engineering Techniques 1 3 4

Course description is same as given under BIO C418.

BIO F419 Molecular Evolution 3 0 3

Course description is same as given under BIO C419.

BIO F421 Enzymology 3 0 3

Course description is same as given under BIO C421.

BIO F431 Reproductive Physiology 3 0 3

Course description is same as given under BIO C431.

BIO F441 Biochemical Engineering 3 0 3

Course description is same as given under BIO C441.

BIO F451 Bioprocess Technology 3 0 3

Course description is same as given under BIO C451.

BIO F491 Special Projects 3

This is an unstructured open-ended course where under the overall supervision of an instructor-in-charge, batches of students will be attached to different instructors. Each batch will work on a specific time-bound project which is of basic or peripheral concern of his discipline. Each student must submit a project

गोवा शिपयार्ड लिमिटेड
GOA SHIPYARD LIMITED

आयएसओ 9001-2008 कंपनी प्रमाणित
AN ISO 9001-2008 CERTIFIED COMPANY

(भारत सरकार का उपक्रम)
(A GOVT. OF INDIA UNDERTAKING)

रक्षा मंत्रालय
MINISTRY OF DEFENCE

वास्को-द-गामा, गोवा.
VASCO-DA-GAMA, GOA - 403 802, INDIA



दुरभाष / Tel. : (0832) 2512152-56, 2512359
फैक्स / Fax : (0091-832) 2514232, 2512148
ई-मेल / E-mail : contactus@goashipyard.com
वेब / Website : www.goashipyard.com

GSL CORPORATE IDENTITY NUMBER (CIN)
U63032GA1967GOI000077

पंजीकृत कार्यालय और यार्ड : वास्को-द-गामा, गोवा-४०३८०२.
Registered Office & Yard : Vasco-Da-Gama, Goa-403802, India

सभी उत्तर अध्यक्ष एवं प्रबंध निदेशक को संबोधित करना है |
All replies to be addressed to the Chairman & Managing Director

CIN of GSL : U63032GA1967GOI000077

Date : 16.07.2015

Our Ref. GSL/HR&A/L&D/Cert/01/HD

TO WHOM-SO-EVER IT MAY CONCERN

This is to certify that **Mr. Mohit H.Deshmukh**, a student of second year Bachelor of Engineering (Honors) Mechanical Engineering of Birla Institute of Technology & Science, Pilani, Hyderabad Campus has undergone '**Industrial Training**' from 22.05.2015 to 16.07.2015 in Design/Technical Services Department in GSL.

We wish him all the success his further endeavors.

For **GOA SHIPYARD LIMITED**



CHIEF GEN. MANAGER (HR & ADMN.)

16/7/15

"Best Professionally Managed Company & World Class Shipbuilders of the Nation"
Committed to Quality, Committed to Excellence



BITS Pilani
Hyderabad Campus

CERTIFICATE OF APPRECIATION



This is to certify that MOHIT. H. DESHMUKH has participated in the Prodigal designer event and has been placed at 1st position, at **ATMOS'15**, the National Techno-Management festival of **BITS Pilani** Hyderabad campus.

PRESIDENT
(Student's Union)

TECHNICAL CONVENER

ASSOCIATE DEAN
(Student Welfare Division)



Birla Institute of Technology & Science, Pilani
Hyderabad Campus

Certificate of Participation

2nd National Conference
on

Design and Manufacturing Technologies for Product Life Cycle
(DPLC-2016)

March 19 & 20, 2016

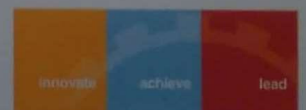
Organized by:

Department of Mechanical Engineering,
Birla Institute of Technology & Science, Pilani, Hyderabad Campus

This is to certify that ~~Prof/Dr/Mr/Mrs~~ MOHIT DESHMUKH participated and presented
a paper titled Smart solar tracking
in the 2nd National Conference on Design and Manufacturing Technologies for Product Life
Cycle (DPLC-2016) held at BITS-Pilani, Hyderabad Campus on March 19 & 20, 2016.


Organising Chairman


Organising Convener





**National Conference on
SUSTAINABLE MECHANICAL ENGINEERING: TODAY AND BEYOND
SMETB 2017**

March 25-26, 2017

Department of Mechanical Engineering, Tezpur University, Assam, India

This is to certify that Prof./Dr./Mr./Ms. Mohit Deshmukh of
BITS Pilani, Hyderabad campus participated
and presented a paper titled Performance investigation on sustainable screw turbine using
computational fluid dynamics for micro and pico-hydro applications
in the National Conference on SUSTAINABLE MECHANICAL ENGINEERING: TODAY AND
BEYOND, 2017 held at Tezpur University, Assam, India.

(Dr. Partha P. Dutta)
Chairman

(Prof. Tapan K. Gogoi)
Organizing Secretary

(Dr. Seikh M. Kamal)
Joint Organizing Secretary



Certified Associate



CERTIFICATE OF RECOGNITION

Mohit Deshmukh

Oracle Certified Associate, Java SE 7 Programmer

THIS CERTIFIES THAT ABOVE NAMED IS
RECOGNIZED BY ORACLE CORPORATION AS AN
ORACLE CERTIFIED ASSOCIATE.

November 27, 2017

DATE

DAMIEN CAREY
SENIOR VICE PRESIDENT, ORACLE UNIVERSITY

Semester-wise Pattern for Students Admitted to B.E. Mechanical Programme								
Year	First Semester			U	Second Semester			U
I	BIO	F110	Biology Laboratory	1	MATH	F112	Mathematics II	3
	BIO	F111	General Biology	3	ME	F110	Workshop Practice	2
	CHEM	F110	Chemistry Laboratory	1	CS	F111	Computer Programming	4
	CHEM	F111	General Chemistry	3	EEE	F111	Electrical Sciences	3
	MATH	F111	Mathematics I	3	BITS	F112	Technical Report Writing	2
	PHY	F110	Physics Laboratory	1	MATH	F113	Probability and Statistics	3
	PHY	F111	Mechanics, Oscillations and Waves	3	BITS	F111	Thermodynamics	3
	BITS	F110	Engineering Graphics	2				
			17				20	
II	MATH	F211	Mathematics III	3	ECON	F211	Principles of Economics	3
			Humanities Electives	3(min)			or	or
	ME	F213	Materials Science & Engineering	2	MGTS	F211	Principles of Management	3
							Humanities Electives	3(min)
	ME	F212	Fluid Mechanics	3	ME	F241	Machine Design & Drawing	4
	ME	F211	Mechanics of Solids	3	ME	F242	IC Engines	2
	ME	F214	Applied Thermodynamics	3	ME	F243	Production Techniques I	3
	ME	F215	Mechanical Engineering Laboratory	2	ME	F244	Kinematics & Dynamics of Machinery	3
			19(min)				18(min)	
Summer BITS F221 Practice School – I (for PS Option Only)								
III			Open/Humanities Electives	1 to 4			Open/Humanities Electives	3 to 6
	ME	F311	Heat Transfer	4	ME	F341	Prime Movers & Fluid Machines	3
	ME	F312	Advanced Mechanics of Solids	3	ME	F343	Mechanical Vibrations	3
	ME	F313	Production Techniques II	4	ME	F342	Computer Aided Design	4
			Discipline Electives	6(min)	ME	F344	Engineering Optimization	2
							Discipline Electives	3(min)
				18/21				18/21
	IV			Open Electives	7to13	BITS	F412	Practice School-II
			Discipline Electives	3(min)			or	or
					BITS	F421T	Thesis	16
							or Thesis (9) and Electives (6 to 9)	15 to 18
			10/16				15/20	

Discipline Core - 48 Units (16 Courses)

Discipline Electives - 12 Units (4 Courses)

Note: This is operative pattern for the students who are admitted from August 2011 onwards as approved by the Senate-appointed committee, subject to change if the situation warrants.

MF F214	Applied Thermodynamics	3	0	3
MF F215	Mechanical Engineering Laboratory	0	2	2
MF F241	Machine Design & Drawing	3	1	4
MF F242	Manufacturing Management	2	0	2
MF F243	Manufacturing Processes	2	1	3
MF F244	Kinematics & Dynamics of Machinery	3	0	3
MF F311	Mechatronics & Automation	2	1	3
MF F312	Tool & Fixture Design	3	0	3
MF F313	Metal Forming & Machining	3	1	4
MF F341	Design of Machine Tools	3	0	3
MF F342	Computer Aided Design	3	1	4
MF F343	Casting & Welding	3	1	4
MF F344	Engineering Optimization	2	0	2
DISCIPLINE ELECTIVE COURSES		L	P	U
BITS F415	Introduction To MEMS	3	1	4
ECON F411	Project Appraisal	3	0	3
ME F415	Noise Engineering	3	0	3
ME F416	Reverse Engineering and Rapid Prototyping	3	0	3
ME F416	Work System Design	3	0	3
ME F417	Advanced Metal Forming	3	0	3
ME F419	Total Product Integration Engineering	3	0	3
ME F432	Computer Aided Manufacturing	3	0	3
ME F443	Quality Control Assurance and Reliability	3	0	3
ME F484	Automotive Technology	3	0	3
MF F411	Fluid Power Systems	3	1	4
MF F412	Automotive Systems	3	0	3
MF F413	Mechanical Vibrations and Acoustics	3	0	3
MF F414	Manufacturing Excellence	3	0	3
MF F418	Lean Manufacturing	3	0	3
MF F421	Supply Chain Management		4	
MF F442	Advances in Materials Science	3	0	3
MF F453	Industrial Relations	3	0	3
MF F463	Maintenance and Safety	3	0	3
MF F471	Instrumentation and Control	3	0	3
MF F472	Precision Engineering	3	0	3
MF F473	Product Design and Development	3	0	3
MF F474	Product Design and Development Projects	0	0	3

MF F485	Sustainable Manufacturing	3	0	3
---------	---------------------------	---	---	---

MECHANICAL ENGINEERING

CORE COURSES		L	P	U
ME F211	Mechanics of Solids	3	0	3
ME F212	Fluid Mechanics	3	0	3
ME F213	Materials Science & Engineering	2	0	2
ME F214	Applied Thermodynamics	3	0	3
ME F215	Mechanical Engineering Laboratory	0	2	2
ME F241	Machine Design & Drawing	3	1	4
ME F242	IC Engines	2	0	2
ME F243	Production Techniques I	2	1	3
ME F244	Kinematics & Dynamics of Machinery	3	0	3
ME F311	Heat Transfer	3	1	4
ME F312	Advanced Mechanics of Solids	3	0	3
ME F313	Production Techniques II	3	1	4
ME F341	Prime Movers & Fluid Machines	2	1	3
ME F342	Computer Aided Design	3	1	4
ME F343	Mechanical Vibrations	3	0	3
ME F344	Engineering Optimization	2	0	2

DISCIPLINE ELECTIVE COURSES		L	P	U
BITS F415	Introduction to MEMS	3	1	4
DE G513	Tribology	3	2	5
DE G514	Fracture Mechanics	3	2	5
DE G531	Product Design	3	2	5
ECON F411	Project Appraisal	3	0	3
ME F411	Fluid Power Systems	3	1	4
ME F412	Production Planning & Control	3	0	1
ME F413	Nonlinear Vibrations	3	0	3
ME F415	Gas Dynamics	3	0	3
ME F416	Reverse Engineering and Rapid Prototyping	3	0	3
ME F417	Advanced Metal Forming	3	0	3
ME F418	Rocket and Spacecraft Propulsion	3	0	3
ME F419	Total Product Integration Engineering	3	0	3
ME F420	Power Plant Engineering	3	0	3
ME F423	Microfluidics and Applications	3	0	3
ME F432	Computer Aided manufacturing	3	0	3
ME F433	Solar Thermal Process Engineering	3	1	4

ME F441	Automotive Vehicles	3	0	3	PHA F342	Medicinal Chemistry II	2	1	3
ME F443	Quality Control, Assurance and Reliability	3	0	3	PHA F343	Forensic Pharmacy	2	-	2
ME F451	Mechanical Equipment Design	3	0	3	PHA F344	Natural Drugs	2	1	3
ME F452	Composite Materials & Design	3	0	3	* To be offered to B.Pharm. students admitted in 2014 onwards in place of PHA F243				
ME F461	Refrigeration and Air conditioning	3	0	3	DISCIPLINE ELECTIVE COURSES				
ME F472	Precision Engineering	3	0	3	MATH F212	Optimization	3	0	3
ME F482	Combustion	3	0	3	PHA F413	Pharmaceutical Management and Quality Control	3	0	3
ME F483	Wind Energy	3	0	3	PHA F414	Biopharmaceutics	3	0	3
ME F484	Automotive Technology	3	0	3	PHA F415	Pathophysiology	3	0	3
ME F485	Numerical Techniques for Fluid Flow and Heat Transfer	3	0	3	PHA F416	Chemistry of Synthetic Drugs	3	0	3
ME G511	Mechanism and Robotics	3	2	5	PHA F417	Pharmacoeconomics	3	0	3
ME G512	Finite Element Methods	3	2	5	PHA F422	Cosmetic Science	2	1	3
ME G514	Turbomachinery	3	2	5	PHA F432	Hospital Pharmacy	3	0	3
ME G515	Computational Fluid Dynamics	3	2	5	PHA F441	Biochemical Engineering	3	0	3
ME G533	Conduction and Radiation Heat Transfer	3	2	5	PHA F442	Applied Pharmaceutical Chemistry	3	0	3
ME G534	Convective Heat and Mass Transfer	3	2	5	PHA F461	Phytochemistry	2	1	3
MF F421	Supply chain management			4	BIOLOGICAL SCIENCES				
MF F485	Sustainable Manufacturing	3	0	3	CORE COURSES				
MST G522	Advanced Composites	3	2	5	BIO F211	Biological Chemistry	3	0	3
PHARMACY					BIO F212	Microbiology	3	1	4
CORE COURSES					BIO F213	Cell Biology	3	0	3
BITS F219	Process Engineering	2	1	3	BIO F214	Integrated Biology	3	0	3
PHA F211	Pharmaceutical Analysis	2	1	3	BIO F215	Biophysics	3	0	3
PHA F212	Dispensing Pharmacy	2	1	3	BIO F241	Ecology & Environmental Science	3	0	3
PHA F213	Microbiology	2	1	3	BIO F242	Introduction to Bioinformatics	3	0	3
PHA F214	Anatomy, Physiology & Hygiene	2	1	3	BIO F243	Genetics	3	0	3
PHA F215*	Introduction to Molecular Biology and Immunology	3	0	3	BIO F244	Instrumental Methods of Analysis	1	3	4
PHA F241	Pharmaceutical Chemistry	2	1	3	BIO F311	Recombinant DNA Technology	3	0	3
PHA F242	Biological Chemistry	2	1	3	BIO F312	Plant Physiology	3	0	3
PHA F243	Industrial Pharmacy	2	1	3	BIO F313	Animal Physiology	3	0	3
PHA F244	Physical Pharmacy	2	1	3	BIO F341	Developmental Biology	3	0	3
PHA F311	Pharmacology I	2	1	3	BIO F342	Immunology	3	0	3
PHA F312	Medicinal Chemistry I	2	1	3	DISCIPLINE ELECTIVE COURSES				
PHA F313	Instrumental Methods of Analysis	2	1	4	BIO F314	Conservation Biology	2	1	3
PHA F314	Pharmaceutical Formulations and Biopharmaceutics	2	1	3	BIO F352	Cell and Tissue Culture Technology	3	1	4
PHA F341	Pharmacology II	2	1	3	BIO F411	Laboratory	0	3	3
					BIO F413	Molecular Biology of Cell	3	0	3
					BIO F417	Biomolecular Modelling	3	0	3