(DME 211)

B.Tech. DEGREE EXAMINATION, DECEMBER 2012.

(Examination at the end of Second Year)

Mechanical Engineering

Paper I — ENGINEERING MATHEMATICS — III

Time : Three hours Maximum : 75 marks

Answer Question No. 1 compulsorily. (15 × 1 = 15)

Answer ONE question from each Unit. (4 × 15 = 60)

1. (a) State the Euler's formula for Fourier series.

(b) Find the smallest period of the function $\sin \frac{2n\pi x}{k}$.

(c) Write conditions for Fourier Expansions of a function.

(d) What do you mean by Harmonic analysis?

(e) State Fourier integral theorem.

(f) Write any two properties of Fourier Transform.

(g) State Parseval's identity for Fourier transform.

(h) Define variance of a continuous random variable.

(i) Write any two properties of normal distribution.

(j) Define standard error.

(k) Define critical region.

(l) Define point estimation.

(m) What do you mean by degree of freedom?

(n) The variance of two samples are 25 and 225 with sample sizes 9 and 15. Find the standard error.

(o) Define Weibull distribution.

UNIT I

2. (a) Find a Fourier series to represent $x - x^2$ from $x = -\pi$ to $x = \pi$.

(b) Find the complex form of the Fourier series of $f(x) = e^{-x}$ is $-1 \le x \le 1$.

Or

3. (a) Find the half-range cosine series of the function $f(x) = x^2$ in the range $0 \le x \le \pi$.

(b) Obtain the first three coefficients in the Fourier cosine series for y, where y is given in the following :

x :	0	1	2	3	4	5
y :	4	8	15	7	6	2

UNIT II

4. (a) Find the Fourier transform of $f(x) = \begin{cases} 1 - x^2, & |x| \le 1 \\ v, & |x| \ge 1 \end{cases}$

Hence evaluate $\int_0^\infty \frac{x \cos x - \sin x}{x^3} \cos \frac{x}{2}\, dx$.

(b) Using Parseval's identity for Fourier transform, evaluate $\int_0^\infty \left(\frac{1 - \cos x}{x} \right)^2 dx$.

Or

5. (a) Find the Fourier sine transform of $e^{-|x|}$. Hence show that

$$\int_0^\infty \frac{x \sin mx}{1 + x^2}\, dx = \frac{\pi . e^{-m}}{2},\ m > 0.$$

(b) Solve the integral equation $\int_0^\infty f(x) \sin t\, x\, dx = \begin{cases} 1, & 0 \le t < 1 \\ 2, & 1 \le t < 2 \\ 0, & t \ge 2 \end{cases}$

UNIT III

6. (a) Probability density function of a continuous random variable X is

$$f(x) = \begin{cases} \frac{1}{2}\sin x, & 0 \le x \le \pi \\ 0, & \text{otherwise} \end{cases}$$

Find the mean, mode and median of the distribution.

(b) If the mean breaking strength of copper wire is 575 lbs with a standard deviation of 8.3 lbs, how large a sample must be used in order that there will be one chance in 100 that the mean breaking strength of the sample is less than 572 lbs.

Or

7. (a) The marks obtained in statistics examination are found to be normally distributed. If 15% of the students ≥ 60 marks, 40% of the students < 30 marks, find the mean and standard deviation of the marks.

(b) A die was thrown 9000 times and a throw of 5 or 6 was obtained 3240 times. On the assumption of random throwing, do the data indicate an unbiased die?

UNIT IV

8. (a) What is the size of the smallest sample required to estimate an unknown proportion to within a maximum error of 0.06 with atleast 95% confidence.

(b) A sample of 10 measurements of the diameter of a sphere gave a means of 12 cm and a standard deviation 0.15 cm. Find 95% confidence limits for the actual diameter.

Or

9. (a) Find the maximum difference that we can be expect with probability 0.95 between the means of samples of sizes 10 and 12 from a normal population if their standard deviations are found to be 2 and 3 respectively.

(b) The measurements of the output of two units have given the following results. Assuming that both samples have been obtained from normal populations at 5% of significant level, test whether two populations have the same variance.

Unit A :	14.1	10.1	14.7	13.7	14.0
Unit B :	14.0	14.5	13.7	12.7	14.1

———————

(DME 212)

B.Tech. DEGREE EXAMINATION, DECEMBER 2012.

(Examination at the end of Second Year)

Mechanical Engineering

Paper II — MECHANICS OF MATERIALS

Time : Three hours Maximum : 75 marks

Answer Question No. 1 compulsory. (15 marks)

Answer ONE question from each unit. ($4 \times 15 = 60$)

1. (a) Difference between elasticity and plasticity.

   (b) Relation between E, G and Poisson's ratio.

   (c) Shear stresses in beams.

   (d) Point of Inflection.

   (e) Pre – strain effects.

   (f) Axially loaded bars.

   (g) Strain energy.

UNIT I

2. Write in detail about the following with an example

   (a) Uniform strength, Impact loading and Poission's ratio.

   (b) A rigid bar AB, 9 m long, is suspended by two vertical loads at its ends *A* and *B* as shown in Fig. 1, and hangs in a horizontal position by its won weight. The rod at *A* is brass, length 3 m, cross-sectional area 1000 m^2 and modulus of elasticity 1×10^5 N/mm^2. The rod at *B* is steel, length 5 m, cross-sectional area 445 mm^2, modulus of elasticity 2×10^5 N/mm^2. At what distance *x* from *A* may a vertical load *P* be applied if the bar is to remain horizontal after the load is applied.

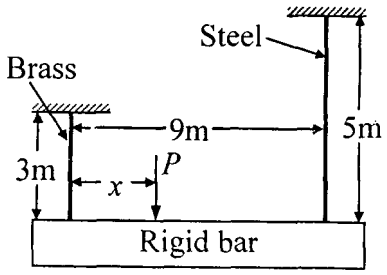


Fig. 1 Rigid bar suspended by two vertical wires

Or

3. (a) Explain the following :

(i) Normal stress – strain,

(ii) Stress – strain diagram for ductile materials and (iii) Hook's law for body in translation and rotation.

(b) Determine the elongation of a conical bar under the action of its own weight (Fig. 2). The diameter at the base is D and its length is l. Assume weight per unit volume is ρ.

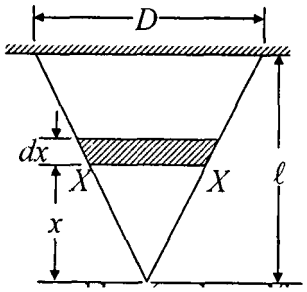


Fig. 2 Tapered bar (under self weight)

UNIT II

4. (a) Calculate the power transmitted by a solid steel shaft of diameter 30 cm at 200 rpm, if the maximum torque exceeds the mean by 25 percent and the working shear stress is 6 kN/cm^2. Find the angle of twist in a length of 20 diameters if $C = 84 \times 10^5$ N/cm^2. If a 10 cm hole is bored axially in the shaft, what power will it transmit, other conditions remaining unchanged.

(b) Define torsional rigidity; polar modulus of section; power; angle of twist and shear stress.

Or

5. (a) Explain Mohr's circle of stress, Principal plane, Principal stress and Max. shear plane and stresses.

(b) At a point in an elastic material, there are normal stresses of 80 MPa (tensile) and 60 MPa (compressive) at right angles to each other with a shear stress 30 MPa (positive). Find the principal stresses and the planes and Max. shear plane and shear stresses on which they act using analytical equations and Mohr's circle. Determine also stress on any inclined plane by making an angle of 30° and also determine the resultant stresses.

UNIT III

6. (a) Derive the relation between shear force, bending moment and Intensity of loading.

(b) Draw the SF and BM diagrams for the cantilever ABCD carrying concentrated load of 20, 40 and 50 kN at A, B and C respectively. Also carries a UDL of 10 kN/m over AC. A is the free end and D the fixed end. AB = BC 1 m, CD = 2 m.

Or

7. (a) Draw the SF and BM diagrams for the cantilever ABCD carrying concentrated load of 20, 40 and 50 kN at A, B and C respectively. Also carries a UDL of 10 kN/m over AC. A is the free end and D the fixed end. AB = BC = 1 m, CD = 2 m.

(b) Draw SF an BM diagrams with magnitudes at relevant points for a simply supported beam of 8 m span, having UDL of 10 KN/m for a distance of 4 m starting from 1 m away from left side support.

UNIT IV

8. Define Bending axis and Shear Center. A 3 mm thickness plate of steel is formed into the cross-section is shown in Fig. 3. Locate the shear center for the *C*/*S*.

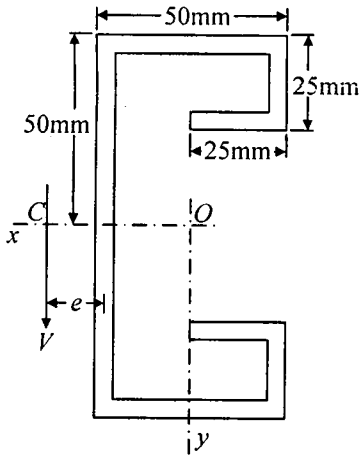


Fig.3 Symmetrical cross-section.

Or

9. (a) Derive the shear stress distribution of Triangular cross section of Beam.

   (b) Obtain Flexure formula and give the list of assumptions required for derivation of equation.

(DME 213)

B.Tech. DEGREE EXAMINATION, DECEMBER 2012.

(Examination at the end of second year)

Mechanical Engineering

Paper III — KINEMATICS OF MACHINES

Time : Three hours Maximum : 75 marks

Answer Question No. 1 compulsorily $(15 \times 1 = 15)$

Answer ONE question from each Unit. $(4 \times 15 = 60)$

1. Explain the following in brief :

   (a) Differentiate between a machine and a structure.

   (b) Inversion.

   (c) Kutzbach mobility criterion.

   (d) Space centrode and body centrode.

   (e) Types of instantaneous centres for a mechanism.

   (f) Kennedy's theorem.

   (g) Classification of synthesis.

   (h) Path generation.

   (i) What is the better displacement diagram for cam-follower mechanism and why?

   (j) Law of gearing.

   (k) Normal pitch and axial pitch of helical gears.

   (l) How Interference can be avoided in involute gears with 20° pressure angle.

   (m) Expression for the length of the arc of contact in a pair of meshed spur gears.

   (n) Differences between simple, compound, and epicyclic gear trains.

   (o) Various types of the torques in an epicyclic gear train.

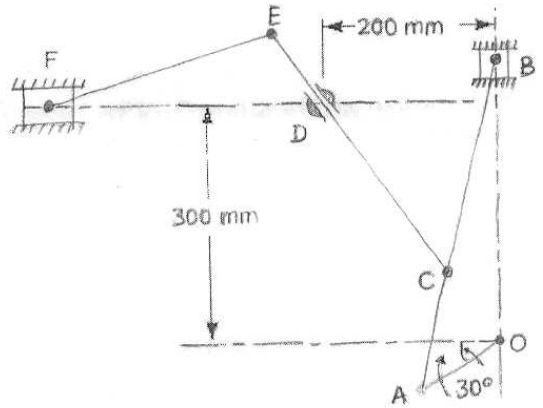
UNIT I

2. (a) Define Kinematic pair. Explain about their classification.

(b) Explain about any two inversions of double slider crank chain.

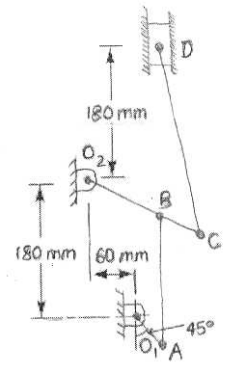
Or

3. In a mechanism shown in Fig. the crank OA is 100 mm long and rotates clockwise about O at 120 r.p.m. The connecting rod AB is 400 mm long. At a point C on AB, 150 mm from A, the rod CE 350 mm long is attached. This rod CE slides in a slot in a trunnion at D. The end E is connected by a link EF, 300 mm long to the horizontally moving slider F. For the mechanism in the position shown, find (a) velocity of F, (b) velocity of sliding of CE in the trunnion, and (c) angular velocity of CE.



UNIT II

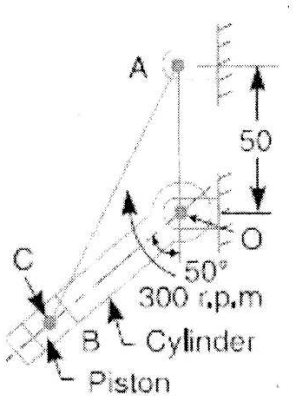
4. A mechanism, as shown in Fig., has the following dimensions : O1 A = 60 mm; AB = 180 mm; O2 B = 100 mm; O2 C = 180 mm and CD = 270 mm. The crank O1 A rotates clockwise at a uniform speed of 120 r.p.m. The block D moves in vertical guides. Find, by instantaneous centre method, the velocity of D and the angular velocity of CD.



Or

5. (a) What is coriolis acceleration component? In which cases does it occur? How is it determined?

(b) The kinematic diagram of one of the cylinders of a rotary engine is shown in Fig. The crank OA which is vertical and fixed, is 50 mm long. The length of the connecting rod AB is 125 mm. The line of the stroke OB is inclined at 50° to the vertical. The cylinders are rotating at a uniform speed of 300 r.p.m., in a clockwise direction, about the fixed centre O. Determine: (i) acceleration of the piston inside the cylinder, and (ii) angular acceleration of the connecting rod.



UNIT III

6. (a) What are the tasks of kinematic synthesis?

(b) Determine the Chebyshev spacing for function $y = e^X$ for the range [0,4] and specify three precision points. For these precision points, determine ϕ_2, ϕ_3 and ψ_2, ψ_3 if $\nabla_\phi = 80^\circ$, $\nabla\psi = 110^\circ$.

Or

7. A cam consists of a circular disc of diameter 75 mm with its centre displaced 25 mm from the camshaft axis. The follower has a flat surface (horizontal) in contact with the cam and the line of action of the follower is vertical and passes through the shaft axis as shown in Fig. 20.50. The mass of the follower is 2.3 kg and is pressed downwards by a spring which has a stiffness of 3.5 N/mm. In the lowest position the spring force is 45 N. (a) Derive an expression for the acceleration of the follower in terms of the angle of rotation from the beginning of the lift. (b) As the cam shaft speed is gradually increased, a value is reached at which the follower begins to lift from the cam surface. Determine the camshaft speed for this condition.

UNIT IV

8. (a) Derive an expression for the minimum number of teeth required on the pinion in order to avoid interference in involute gear teeth.

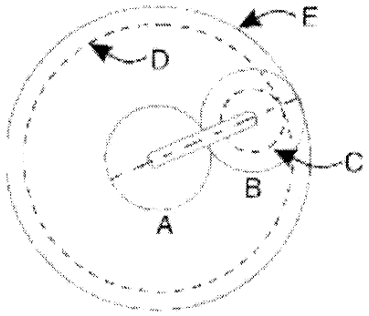
(b) in an epicyclic gear train, an arm carries two gears A and B having 36 and 45 teeth respectively. If the arm rotates at 150 r.p.m. in the anticlockwise direction about the centre of the gear A which is fixed, determine the speed of gear B. If the gear A instead of being fixed, makes 300 r.p.m. in the clockwise direction, what will be the speed of gear B? Solve the problem using tabular column method.

Or

9. (a) What are the various types of the torques in an epicyclic gear train?

(b) The figure shows an epicyclic gear train. Pinion A has 15 teeth and is rigidly fixed to the motor shaft. The wheel B has 20 teeth and gears with A and also with the annular fixed wheel F. Pinion C has 15 teeth and is integral with B (B, C being a compound gear wheel). Gear C meshes with annular wheel D, which is keyed to the machine shaft.
The arm rotates about the same shaft on which A is fixed and carries the

compound wheel B, C. If the motor runs at 1000 r.p.m., find the speed of the machine shaft. Find the torque exerted on the machine shaft, if the motor develops a torque of 100 N-m.



(DME 214)

B.Tech. DEGREE EXAMINATION, DECEMBER 2012.

(Examination at the end of Second Year)

Mechanical Engineering

Paper IV — FLUID MECHANICS

Time : Three hours Maximum : 75 marks

Answer Questions No.1 Compulsory

Answer ONE question from each unit

1. (a) What is the difference between an ideal and a real fluid?

(b) What are Newtonian and non- Newtonian fluids?

(c) What do you understand by vorticity?

(d) Differentiate between forced vortex flow and free vortex flow.

(e) What is an orifice? How are the orifices classified?

(f) Derive Darcy-Weisbach formula for calculating loss of head due to friction in a pipe

(g) Define momentum thickness.

UNIT I

2. What is capillarity? Derive an expression for the capillary rise of a liquid having surface tension σ and contact angle θ between two vertical parallel plates at a distance W apart. If the plates are of glass, what will be the capillary rise of water having σ = 0.073 N/m, θ = 0°? Take W = 1mm

Or

3. (a) Define (i) Metacentre (ii) Metacentric height. Describe the experimental method used to determine the metacentric height.

(b) A solid cube of sides 0.5 m each is made of a material of relative density 0.5. The cube floats in a liquid of relative density 0.95 with two of its faces horizontal. Examine its stability.

UNIT II

4. (a) Derive the continuity equation in Cartesian co ordinates.

(b) The velocity components in a fluid flow are given by

$u = 2xy$; $v = a^2 + x^2 - y^2$

(i) Show that the flow is possible.

(ii) Derive the relative stream function.

Or

5. (a) Define die following orifice coefficients:

(i) Coefficient of contraction,

(ii) Coefficient of velocity

(iii) Coefficient of discharge

(iv) Coefficient of resistance

(b) The head of water over the center of an orifice of diameter 30 mm is l.5 m. The actual discharge through the orifice is 2.55 litres/sec. Find the coefficient of discharge.

UNIT III

6. (a) Derive Hagen-Poiseuille equation and state the assumptions made.

(b) A crude oil of viscosity 0.9 poise and relative density 0.9 is flowing through a horizontal circular pipe of diameter 120mm and length 12m. Calculate the difference of pressure at the two ends of the pipe, if 785N of the oil is collected in a tank in 25 seconds.

Or

7. (a) Explain briefly the following:

(i) Hydraulic gradient line (HGL)

(ii) Energy gradient line (EGL)

(b) Two reservoirs have a constant difference of levels of 70m and are connected by a 250mm diameter pipe which is 4 km long. The pipe is tapped mid-way between the reservoirs and water is drawn at the rate of 0.04 m^3/s.. Assuming friction factor = 0.04, determine the rate at which water enters the lower reservoir.

UNIT IV

8. (a) What is a boundary layer? Why does it increase with distance from the upstream edge?

(b) The velocity distribution in the boundary layer is given by $\frac{u}{U} = \frac{y}{\delta}$, where u is the velocity at a distance y from the plate and u = U at y = δ, δ 8 being boundary layer thickness. Find: (i) The displacement thickness. (ii) The momentum thickness (iii) the value of δ^*/θ.

Or

9. (a) What is Mach number? Why is this parameter so important for the study of flow of compressible fluids?

(b) Air at a pressure of 220N/m^2 and temperature 27°C is moving at a velocity of 200m/s. Calculate the stagnation pressure if

(i) Compressibility is neglected

(ii) Compressibility is accounted for .

———————

(DME 215)

B.Tech. DEGREE EXAMINATION, DECEMBER 2012

(Examination at the end of Second Year)

Mechanical Engineering

Paper V — BASIC THERMODYNAMICS

Time : Three hours Maximum : 75 marks

Answer Question No.1 compulsorily. (15 × 1 = 15)

Answer ONE question from each Unit. (4 × 15 = 60)

1. (a) Define internal change in energy.

(b) Write an expression for work done during isothermal process.

(c) 10 kg of steel, specific heat capacity 480 J/kgK is heated from 15°C to 100°C. How much heat is required?

(d) Define steady flow system.

(e) A mass of 2 kg of nitrogen is stored in a cylinder of 1.5 m^3 capacity, which is at 25°C. Determine the pressure of gas in the cylinder.

(f) Define air standard efficiency.

(g) What do you mean by reversible cycle?

(h) Define mean effective pressure.

(i) State the Second law of thermodynamics.

(j) Draw the P-V-T surface for water.

(k) Sketch the Rankine cycle on a P-V plane and name the various process.

(l) Define critical pressure for water.

(m) Define the term "availability".

(n) Show that it is impossible to construct a PMM1 kind.

(o) What are the various methods of finding dryness fraction?

UNIT I

2. (a) Derive an expression for work done and heat transferred during adiabatic expansion.

(b) A volume of 0.5 m^3 gas at a pressure of 10 bar and 2000 C is expanded in a cylinder to 1.2 m^3 at constant pressure. Calculate the amount of work done by the gas and the increase in internal energy. Assume cp=1.005 kJ/kg K ; and cv = 0.712 kJ/kg K.

Or

3. (a) Distinguish between thermodynamic systems in detail.

(b) 0.05 kg of carbon dioxidde (mol.weight 44), occupying a volume of 0.03 m^3 at 1.025 bar, is compressed reversibly until the pressure is 6.15 bar. Calculate final temperature, the work done on the CO_2, the heat flow to or from the cylinder walls, (i) when the process is according to law pv 1.4 = constant, (ii) when the process is isothermal. Assume CO_2 to be a perfect gas, and take $\gamma = 1.3$.

UNIT II

4. (a) What is an isolated system and show that the stored energy of an isolated system remains constant?

(b) In a certain steam plant the turbine develops 100 kW. The heat supplied to the steam in the boiler is 2800 kJ/kg, the heat received by the system from cooling water in the condenser is 2100 kJ/kg and the feed pump work required to pump the condensate back into the boiler is 5 kW. Calculate the steam flow round the cycle in kg/s.

Or

5. (a) A cylinder contains 0.5 m^3 of a gas at 1 bar and 90°C, the gas is compressed to a volume of 0.125 m^3, the final pressure being 6 bar. Determine (i) the mass of the gas, (ii) the value of index 'n' for compression, (iii) the increase in internal energy of gas, (iv) the heat received or rejected by the gas during compression. (□=1.4, R=294.2 Nm/kg C).

(b) Derive the relationship between C_p,C_v and R.

UNIT III

6. (a) Write short notes on Heat pump and refrigerator.

   (b) Discuss about the equivalence of both the statements of Second law of Thermodynamics.

Or

7. (a) A reversible heat engine receives heat of 400 kJ from a source temperature of 800 K and has to reject heat to sink at a temperature of 200 K. Find the amount of heat rejected by the engine to the sink and the amount of work developed.

   (b) Prove that $COP_{hp} = COP_{ref} + 1$.

UNIT IV

8. (a) Explain the principle of increase of entropy.

   (b) An engine working an constant volume cycle has a compression ratio of 8, it uses petrol having a calorific value of 4400 kJ/kg, if the brake thermal efficiency of the engine is 60% of the air standard efficiency, determine the specific fuel consumption in kg/kW-hr.

Or

9. (a) Sketch the P-V diagrams of otto, diesel and dual cycle and name the various processes.

   (b) One kg of superheated steam at 0.2 MPa and 2000 C contained in a piston cylinder assembly is kept at ambient condition of 300 K till the steam is condensed to saturated liquid at constant pressure. Calculate the change in the entropy of the universe associated with this process.

———————

(DME 216)

B.Tech. DEGREE EXAMINATION, DECEMBER 2012.

(Examination at the end of Second Year)

Mechanical Engineering

Paper VI — MATERIAL SCIENCE AND METALLURGY

Time : Three hours Maximum : 75 marks

Answer Question No. 1 compulsorily. (15 × 1 = 15)

Answer ONE question from each Unit. (4 × 15 = 60)

1. Write briefly about the following :

   (a) Slip system.

   (b) Co-ordination Number of FCC.

   (c) Eutectiod Reaction.

   (d) Cementite.

   (e) Critical Temperatures.

   (f) Sub-Zero Treatment.

   (g) Precipitate hardening.

   (h) Stiffness.

   (i) Composite Material.

   (j) Free Electron Theory.

   (k) Hard magnetic materials.

   (l) Sintering of Metal powders.

   (m) Red brass.

   (n) Tool Steel.

   (o) High speed steel.

UNIT I

2. (a) Calculate the packing factor for BCC unit cell.

   (b) Explain slip and Twinning with neat Sketch.

Or

3. (a) What is eutectic reaction? Explain with neat structure the solidification of hypoeutectic alloy?

   (b) Explain the concept of ternary diagrams.

UNIT II

4. (a) Explain isothermal transformation of Pearlite from Austenite.

   (b) Draw Iron-Iron Carbide equilibrium diagram. Explain the solidification process of hypereutectoid steel.

Or

5. (a) Explain Normalising treatment with

   (i) Definition

   (ii) Mechanism

   (iii) Properties Modification.

   (b) Why tempering is compulsory for hardened components- Explain?

UNIT III

6. (a) Explain Elastic and anelastic behaviour of Materials.

   (b) Explain the mechanism of strain hardening.

Or

7. (a) What is reinforcement? Explain the fibre reinforced composite materials.

   (b) Explain the advantages and limitations of composite materials by giving examples.

UNIT IV

8. (a) Explain Dia, para and Ferro magnetism by giving examples.

(b) Explain polarization phenomenon.

Or

9. (a) Explain the application of powder metallurgy with suitable examples.

(b) Explain about Aluminum alloys giving its types and their applications.

———————

(DME 217)

B.Tech. DEGREE EXAMINATION, DECEMBER 2012.

(Examination at the end of Second Year)

Mechanical Engineering

Paper VII — MACHINE DRAWING

Time : Three hours Maximum : 75 marks

Answer ALL questions.

UNIT I

1. Show the following views of Machine component as shown in Fig. 1. (25)

   (a) Front

   (b) Top view

   (c) Left side view.

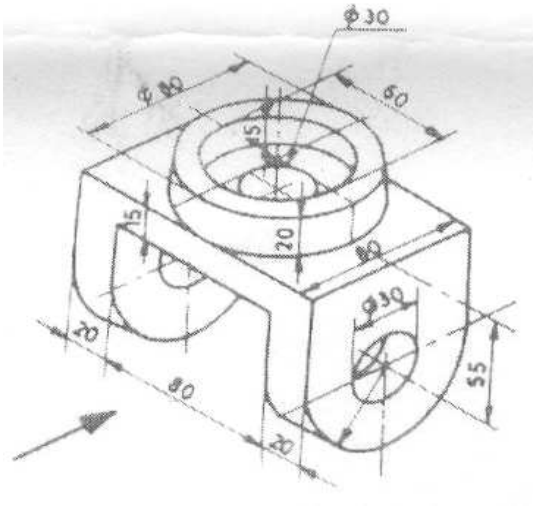


Fig. 1 Three dimensional view of Machine component

Or

2. Sketch the following threads and Bolts with proportionate dimensions : (25)

   (a) Buttress thread of 10 mm pitch.

   (b) Knuckle thread of 10 mm pitch.

   (c) Hexagonal headed bolt.

UNIT II

3. Draw the following dimensioned sketch of a knuckle joint with 50 mm as diameter each : (25)

   (a) Half sectional front view

   (b) Top view

   (c) Side view.

Or

4. Prepare a dimensioned sketch of a Bush pin type flanged coupling half sectional front view for two 50 mm diameter rods. Also draw the side view of the above. (25)

UNIT III

5. Assemble all the parts of Stuffing box as shown in Fig. 2 and draw the following assembled views : (25)

   (a) Sectional front view

   (b) Top view.

   (c) List the bill of materials.

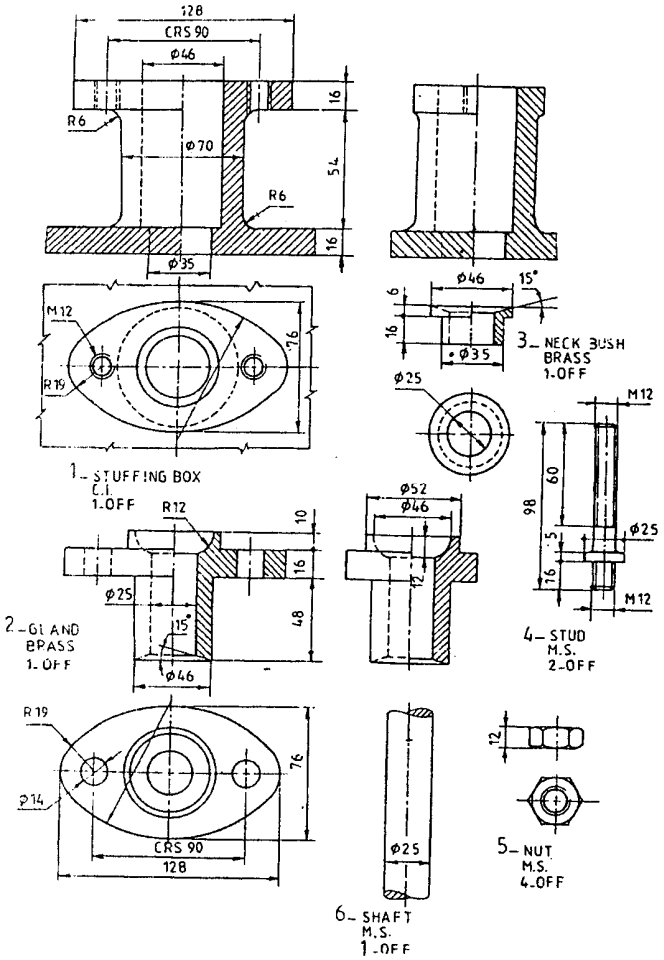


Fig. 2 Stuffing box.

Or

6. (a) Prepare the part drawing of single tool post.

(b) Prepare the production drawing of piston assembly.

(DME 221)

B.Tech. DEGREE EXAMINATION,
DECEMBER 2012.

(Examination at the end of Second Year)

Mechanical Engineering

Paper I – ENGINEERING MATHEMATICS – III

Time : Three hours Maximum : 75 marks

Answer Question No. 1 compulsorily. (15)

Answer ONE question from each Unit. (4 × 15 = 60)

1. (a) Write the possible solutions of a one dimentional wave equaiton. (2)

(b) What do you meant by steady–state condition. (2)

(c) Define analytic function. (1)

(d) Write any two properties of bilinear transformation. (2)

(e) Define conformal mapping. (2)

(f) State Canchy's integral formula. (2)

(g) Evaluate $\oint_C \left(x^2 - y^2 + 2\ in\ y\right)dz$, where $C : |z| = 1$. (2)

(h) State Residue theorem. (2)

UNIT I

2. A tightly streched string with fixed end points $x = 0$ and $x = l$ is initially at rest in its equilibrium position. if it is set vibrating by giving to each of its points a velocity $\lambda x(l - x)$, find the displacement of the string at any distance x from one end at any time t.

Or

3. Solve $\frac{\partial^2 u}{\partial x^2} + \frac{\partial^2 u}{\partial y^2} = 0$ which satisfies the conditions. $u(0, y) = u(l, y) = u(x, 0) = 0$ and $u(x, a) = \sin \frac{\pi n x}{l}$.

UNIT II

4. (a) Show that the function $f(t) = \sqrt{|xy|}$ is not regular at the origin, although Canchy–Riemanan equations are satisfied.

(b) If $u - v = (x - y)(x^2 + 4xy + y^2)$ and $f(t) = u + iv$ is an analytic function of $t = x + iy$, find $f(z)$ is terms of z.

Or

5. (a) Evaluate $\oint_C \frac{e^{2z}}{(z+1)^4} dt$, where $C : |z| = 2$.

(b) Evaluate $\oint_C (z - a)^n dz$, where $[n \neq -1 \text{ an integer}]$ and $C : |z - a| = r$.

UNIT III

6. (a) Expand $\frac{1}{z^2 - 3z + 2}$ is the region

(i) $|z| > 2$

(ii) $0 < |z - 1| < 1$.

(b) Evaluate $\oint_C \frac{e^t}{\cos t \pi z}$, where C is the unit circle $|z| = 1$.

Or

7. (a) Evaluate $\int_0^{2\pi} \frac{1}{2 + \cos\theta} d\theta$ by contour integration.

(b) Evaluate $\int_C \frac{z + 4}{z^2 + 2z + 5} dz$, where C is the circle $|z + 1 - i| = 2$.

UNIT IV

8. (a) Under the transformation $w = \frac{1}{z}$, find the image of $|z - 2i| = 2$.

(b) Discuss the transformation $w = \sin t$.

Or

9. (a) Find the bilinear transformation which maps the points $z = 1, i, -1$ into the points $w = 0, 1, \infty$.

(b) State Poisson's intergral formula. By using it, show that $\int_0^{2\pi} \frac{e^{\cos\phi}\cos(\sin\phi)}{5 - 4\cos(0 - \phi)} d\phi = \frac{2\pi}{3} e^{\cos\theta}\cos(\sin\theta)$.

(DME 222)

B.Tech. DEGREE EXAMINATION, DECEMBER 2012

(Examination at the end of Second Year)

Mechanical Engineering

Paper II — ADVANCED MECHANICS OF MATERIALS

Time : Three hours Maximum : 75 marks

Answer Question No.1 compulsorily. (15 × 1 = 15)

Answer ONE question from each Unit. (4 × 15 = 60)

1. Answer the following in brief :

   (a) Limitations of Euler's formula.

   (b) Assumptions in Winkler – Back theory.

   (c) Elastic prop.

   (d) Stress distribution in curved beams.

   (e) Slenderness ratio of column.

   (f) Secant formula.

   (g) Statically indeterminate beam.

   (h) Macaulay's method.

   (i) Use of compound cylinders.

   (j) Fixed beam.

   (k) Location of maximum hoop stress in hollow circular rotating disc.

   (l) The nature of stress at the inside surface of a crane hook is.

   (m) Curved beam theory was postulated by.

(n) The distribution of stresses in a thick spherical shell are.

(o) Lame theory.

UNIT I

2. (a) Explain clearly about the procedure to find the deflection of a beam using moment area method.

(b) A beam has supports '1' apart with equal overhangs 1/3 over each support. It carries a load W at each end and a load 2W at the centre. Find the slopes at the free end and at the support. Find also the deflections at the free end and at the centre.

Or

3. (a) Explain about limitations of Euler's formula.

(b) Derive the formula for Euler's load and equivalent length for column fixed at one end and free at the other.

UNIT II

4. (a) Briefly discuss Clapeyron's theorem of three moments.

(b) A beam ABCD 9 m long is simply supported at A,B,C such that the span AB is 3 m, span BC is 4.5 m and the overhang CD is 1.5 m. It carries a uniformly distributed load of 1.5 kH/m in span AB and a point load of 1 kN at the free end D. The moment of inertia of the beam in span AB is I and that in the span BC is 2I. Draw the bending moment and shear force diagrams for the beam.

Or

5. A continuous beam ABCDE has a built in support at A and roller supports at B,C and D, DE being an overhand. AB = 7 m, BC = 5 m, CD = 4 m and DE = 1.5 m. The values of moment of inertia of the section over each of these lengths are 3I, 2I, I and I respectively. The beam carries a point load of 10 kN at a point 3 m from A, a uniformly distributed load of 4.5 kN/m over whole of BC and a concentrated load of 9 kN in CD 1.5 m from C and another point load of 3 kN at E, the top of overhung a

shown in fig. Determine (a) the moments developed over each of the support A,B,C and D and (b) draw the bending moment diagram for the entire beam, stating values at salient points.

UNIT III

6. A steel hoop of 20 cm outer and 13 inner diameters, is shrunk on a hollow steel cylinder of 8 cm inner diameter, the pressure of shrinkage being 20 Mpa. When subjected to internal fluid pressure of 70 Mpa what will be

   (a) the greatest circumferential stress induced in the cylinder

   (b) the radial pressure between the cylinder and the hoop and

   (c) the greatest circumferential stress in the hoop?

   Assume that the stresses induced are within the proportional limit.

Or

7. Derive the necessary equations involved in Winkler-Bach theory to determine the stresses in a curved beam.

UNIT IV

8. Derive the equations for determining the radial and hoop stresses induced in a rotating solid disc.

Or

9. Calculate the maximum safe speed of a flat circular disc 0.3048 m diameter with a hole 0.0508 m diameter at the centre, the thickness of the disc being 0.038 m. The elastic limit of the material in simple tension is 232.5×10^3 kN/m^2. m = 10/3 and N = 78.61 kN/m^3.

———————

(DME 223)

B.Tech. DEGREE EXAMINATION, DECEMBER 2012

(Examination at the end of Second Year)

Mechanical Engineering

Paper III — ELECTRICAL TECHNOLOGY

Time : Three hours Maximum : 75 marks

Answer Question No.1 compulsorily. (15 × 1 = 15)

Answer ONE question from each Unit. (4 × 15 = 60)

1. (a) Define Back EMF.

(b) What is the purpose of commutator?

(c) Define peak value and RMS value in AC circuits.

(d) Define voltage regulation of an alternator.

(e) What is the condition for maximum efficiency for a DC machine?

(f) Which instrument is used for measurement in AC circuits and why?

(g) What is the time constant of a RL circuit?

(h) Explain the importance of parallel and series circuits in the network analysis.

(i) What is a linear network?

(j) Define Average and RMS values of AC quantity.

(k) In India what are the supply specifications for traction?

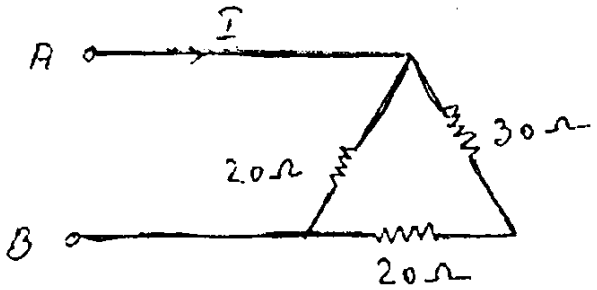
(l) What is the principle of Dynamometer type wattmeter?

(m) What are the advantages of Electric heating?

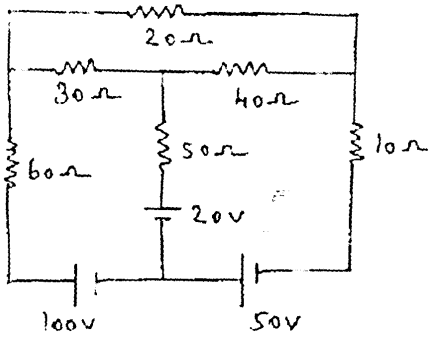
(n) Why is synchronous motor not self starting?

UNIT I

2. (a) A battery connected across AB in the circuit shown in the figure below is delivering 28 watts into the network of resistors. Calculate the voltage across AB, if the emf of the battery is 22 volts. Also find the internal resistance of the battery.



(b) Calculate the current in the 50 ohms resistor in the network in the figure below using Mesh analysis.



Or

3. (a) A coil having a resistance of 7 ohms and an inductance of 31.8 mH is connected to 230 volts, 50 Hz supply. Calculate the circuit current, phase angle, power factor and power consumed.

(b) A series RLC circuit with R=10 ohms, L=0.1 Henry and C=50 micro farad has an applied voltage of 50 L at variable frequency. Find the resonant frequency and the frequency at which maximum voltage occurs across the inductor and capacitor.

UNIT II

4. (a) Explain the development of the equivalent circuit of single phase transformer.

(b) The O.C. and S.C. test results on a single-phase, 50 Hz, 250/500 volts transformer are as :

O.C test (L.V. side) : 250 volts, 1 Amp, 70 watts

S.C. test (H.V. side) : 20 volts, 11 Amp, 120 watts

Calculate the efficiency and approximate regulation while supplying 10 Amps at
500 volts at 0.7 power factor lagging.

Or

5. (a) Explain the characteristics of a D.C. series generator.

(b) A 240 V, 50A, 800 rpm DC shunt motor has armature resistance of 0.2. If the load torque is reduced to 60% of its full load value and a resistance of 2. is inserted in series with armature circuit, find the motor speed. Armature reaction weakens the field flux by 4% at full load and by 2% at 60% of full load.

UNIT III

6. (a) Explain, how is rotating magnetic field produced in 1-phase induction motor.

(b) Explain the principle of operation, construction and give the applications of capacitor start induction motor.

Or

7. (a) Explain the constructional features of alternator.

(b) How e.m.f. is induced in an 3-phase alternator? Derive the expression for e.m.f. induced in an alternator in terms of pitch and distribution factors.

UNIT IV

8. (a) Describe resistance heating methods and its temperature control.

(b) What is the principle of electric traction?

Or

9. (a) Explain the principle of Moving Coil meter.

(b) Explain the principle of Moving Iron meter.

———————

(DME 224)

B.Tech. DEGREE EXAMINATION, DECEMBER 2012.

(Examination at the end of Second Year)

Mechanical Engineering

Paper IV — COMPUTER BASED NUMERICAL METHODS

Time : Three hours Maximum : 75 marks

Answer Question No. 1 compulsorily. (15)

Answer ONE question from each Unit. (4 × 15 = 60)

1. Answer the following in brief :

   (a) Differences between bracketing methods and direct methods in finding the roots of an equation. (2)

   (b) Pitfalls of Newton-Raphson method. (2)

   (c) Pitfalls of Elimination methods. (3)

   (d) Advantages of R-K method over Euler's method. (2)

   (e) Explain graphically how error of integration can be minimized using Simpsons rule over trapezoidal rule. (2)

   (f) Advantages of Newton's divided difference formula over other. (2)

   (g) Derive Lagrange's interpretation formula from Newton's divided difference formula for a simple 2-point case. (2)

UNIT I

2. Find the root of $\cos(x) - x^2 - x$ using false-position method.

Or

3. Find the solution for the simultaneous equations $4x + y - z = 13$, $x - 5y - z = -8$, $2x - y - 5z - 2$ using Gauss-Seidel method.

UNIT II

4. Find the number of students whose weight is between 60 and 70 using Newton's forward interpolation formula :

Weight :	0-40	40-60	60-80	80-100	100-120
No. of students :	250	120	100	70	50

Or

5. The following are the number of deaths in four successive ten year age groups. Calculate the number of deaths at 45 – 50 using stirling formula compare the same using Bessel formula.

Age group :	26-35	35-45	45-55	55-65
Deaths :	13229	18139	24225	31496

UNIT III

6. (a) Calculate integral of $(e^{-x}x^{1/2})$ between the limits 0.5 to 0.7 taking 5 intervals using Simpsons 1/3 rule.

   (b) A rod is rotating in a plane. The following table gives the angle θ (radians) through which the rod has turned for various values of time t(sec). Calculate the angular velocity and the angular acceleration of the rod when $t = 0.6$ sec using Stirling formula.

t :	0	0.2	0.4	0.6	0.8	1.0
θ :	0	0.12	0.49	1.12	2.02	3.20

Or

7. (a) From the following data obtain the first and second derivatives of $y = \log_e x$

   (i) at $x = 500$

   (ii) at $x = 550$

   (iii) $x = 520$

   using suitable formulae. Also calculate the actual values of the derivatives at these points and compare the result.

x :	500	510	520	530	540	550
y :	6.2146	6.2344	6.2538	6.2729	6.2916	6.3099

UNIT IV

8. $\frac{dy}{dx} = (y^2 - x^2)/(y^2 + x^2)$ with $y(0) = 1$ find y at $x = 0.2, 0.4$ using fourth order R-K method.

Or

9. Prove $\frac{\delta^2 u}{\delta x^2} + \frac{\delta^2 u}{\delta y^2} = 0$ in $0 \le x \le 4$; $0 \le y \le 4$ given that $u(0, y) = 0$, $u(4, y) = 8 + 2y$; $y(x, 0) = x^2/2$, $y(x, 4) = x^2$ with $\Delta x = \Delta y = 1$.

(DME 225)

B.Tech. DEGREE EXAMINATION, DECEMBER 2012

(Examination at the end of Second Year)

Mechanical Engineering

Paper V — APPLIED THERMODYNAMICS

Time : Three hours Maximum : 75 marks

Answer Question No.1 compulsorily. (15 × 1 = 15)
Answer ONE question from each Unit. (4 × 15 = 60)

1. (a) Define critical pressure and temperature for water.

(b) Sketch the Rankine cycle on a P-V plane.

(c) Define specific humidity.

(d) Define critical pressure and temperature for water.

(e) Define Dew point temperature.

(f) What is adiabatic mixing?

(g) What is meant by compounding of turbine?

(h) Define latent heat of vaporization.

(i) What is meant by free air delivered.

(j) What is the purpose is of inter cooler.

(k) Define tone of refrigeration.

(l) What is enthalpy of steam?

(m) Define dryness fraction.

(n) Sketch the P–V and T–S diagram for the reversed Carnot cycle.

(o) What are the effects of frictional losses in a steam nozzle?

UNIT I

2. (a) Steam at a pressure of 2.5 MPa and 500°C is expanded in a steam turbine to a condenser pressure of 0.005 MPa. Determine for Rankine cycle :

(i) The thermal efficiency of Rankine cycle.

(ii) Specific steam Consumption.

If the steam pressure is reduced to 1 MPa and the temperature is kept same 500°C. Determine the thermal efficiency and the specific steam consumption. Neglect feed pump work.

(b) How the efficiency of Combustion can be improved by providing the following accessories :

(i) Economiser.

(ii) Air preheater.

(iii) Superheater.

Or

3. (a) A boiler working at a pressure of 14 bars evaporates 8.6 kg of water per kg of coal fired from feed water entering at 39°C. The steam at the boiler stop valve is 0.92 dry. Determine the thermal efficiency of the boiler if the calorific value of the coal is 30200 kJ/kg.

(b) What are reheating and regeneration in a Rankine cycle? How efficiency of the Rankine cycle can be improved by them?

UNIT II

4. (a) An adiabatic steam nozzle is to be designed for discharge rate of 10 kg/sec of steam from 10 bar and 400°C to a back pressure of 1 bar. The nozzle efficiency is 0.92 and the friction loss is assumed to take place in the diverging portion of the nozzle only. Assume a critical pressure ratio of 0.5457. Determine the throat and exit areas.

(b) Discuss in detail about Compounding of Steam Turbines and its types.

Or

5. (a) A De Laval steam turbine receives superheated steam at 20 bar and 300°C and exhausts at a pressure of 0.2 bar. The nozzle angle is 20°. The blades are symmetrical with an angle of 35°. If the friction factor is 0.95 and the mechanical efficiency is 90%, find the steam consumption per kWh, the storage efficiency and axial thrust when 1 kg of steam flows through the turbine for second. Assume the nozzle efficiency as 100%.

(b) Derive an expression for critical pressure ratio and the corresponding exit velocity, mass flow of the steam flow through nozzles.

UNIT III

6. (a) Explain the working of a single cylinder reciprocating air compressor with a neat sketch.

(b) A surface condenser is designed to handle 10×10^3 kg of steam per hour. The steam of quality 0.9 enters at 0.075 bar absolute. The condensate leaves at the saturation temperature corresponding to the pressure 0.075 bar. The pressure is constant throughout condenser. Estimate the rate of flow of the cooling water through the condenser per hour if the rise temperature of the cooling water is 10°C.

Or

7. (a) A cylinder reciprocating air compressor has a displacement of 0.15 m^3. The suction condition of air is 1 bar and 15°C. The air after compression to 8 bar is delivered to a receiver at constant pressure. The compression takes place adiabatically and gamma – 1.4. Determine (i) The temperature at the end of compression, (ii) Work done by air during suction, (iii) Work done on air during delivery and (iv) Network done on air per cycle. Take R = 0.287 kJ/kgK.

(b) Explain in detail about different types of Steam condensers.

UNIT IV

8. (a) Explain the vapour compression cycle with the help of T-S diagram.

(b) An air refrigerator working on Bell-Coleman cycle takes air from cold chamber at 1 bar and –5°C and compresses to 6 bar following the law $PV^{1.25} = C$. The compressor air is cooled to 37°C in the cooler before entering into the expander. The expansion is isentropic. Determine (i) COP of the cycle, (ii) Mass of air circulated per minute, if 500 kg of ice is produced per day at 0°C when the water is supplied on 20°C and (iii) Refrigeration capacity of the plant in tons. Neglect the clearance in compressor and expander take ? = 1.4 and Cp = 1kJ/kg K for air, latent heat of ice = 335 kJ/kg, Cp of water is 4.1868 kJ/kg K.

Or

9. (a) Explain the window air conditioning system with a neat sketch.

(b) A refrigeration system works on reversed Carnot's cycle between temperature limits of 40°C and –10°C. The capacity of the unit is 10 tonne. Determine (i) COP, (ii) work input into the system.

———————

(DME 226)

B.Tech. DEGREE EXAMINATION, DECEMBER 2012

(Examination at the end of Second Year)

Mechanical Engineering

Paper VI — CASTING, FORMING AND WELDING TECHNOLOGY

Time : Three hours Maximum : 75 marks

Answer Question No.1 compulsorily. (15 × 1 = 15)

Answer ONE question from each Unit.(4 × 15 = 60)

1. Write briefly about the following :

   (a) Pattern materials.

   (b) Furnaces used for making of ferrous materials.

   (c) Permeability.

   (d) Core.

   (e) Zone in eupola.

   (f) Fettling equipment.

   (g) Moulding material for permanent mould casting.

   (h) Testing methods used for casting.

   (i) Fuel gases used in gas welding.

   (j) Brazing.

   (k) Soldering.

   (l) Weld porocity.

   (m) Embosing.

   (n) Blanking.

   (o) Punching.

UNIT I

2. (a) Explain the properties of molding sand used in foundry.

   (b) What are the methods to control the moulding sand in mechanical foundry?

Or

3. (a) What are the different types of cores? Explain them with neat diagrams.

   (b) Explain principles of operation of cupola and also find its charge calculations.

UNIT II

4. (a) Explain in detail about fettling of the casting.

   (b) Explain Permanent Mould casting process with neat diagram. Explain advantages and disadvantages.

Or

5. (a) Explain Shell moulding process with neat diagram. Mention the applications of the process.

   (b) Explain CO_2 process with neat diagram. Explain advantages and disadvantages.

UNIT III

6. (a) Explain the principle of Thermit welding processes and explain process with neat diagram.

   (b) List out various welding defects with neat diagrams mention their cases and remedies.

Or

7. (a) Explain the principle of Arc welding processes and explain process with neat diagram.

   (b) Explain submerged are process with neat diagram.

UNIT IV

8. (a) Enumerate the differences between Hot working and Cold working of metals.

   (b) Mention the different processes used to make the tubes? Explain any one process in detail with neat diagram.

Or

9. Write short notes on any THREE of the following :

   (a) HERF

   (b) Wire drawing.

   (c) Extrusion.

   (d) Explosive Forming.

———————

(DME 227/DCE 227/DEC 227)

B.Tech. DEGREE EXAMINATION, DECEMBER 2012.

(Examination at the end of Second Year)

Electronics and Communications

Paper VII — ENVIRONMENTAL SCIENCE

Time : Three hours Maximum : 75 marks

Answer question No.1 Compulsory. (15 × 1 = 15)

Answer ONE question from each unit. (4 × 15 = 60)

All questions carry equal marks.

1. (a) What are the Biotic and Abiotic components of the Environment?

(b) What is meant by Eutrophication?

(c) What is the composition of Biogas?

(d) Define the term soil erosion.

(e) Distinguish between the terms Detrivores and decomposers.

(f) What are the hot spots of biodiversity in India?

(g) Distinguish between National Parks and Zoological parks.

(h) Define Water pollution.

(i) What are the reasons for landslides?

(j) Mention few water conservation measures.

(k) What are acid rains?

(l) What is the significance of stratospheric ozone?

(m) Define the term 'Health'.

(n) What is WHO?

(o) What is AIDS?

UNIT I

2. (a) What is the importance of Forests?

   (b) What are the benefits and problems of dams?

Or

3. (a) What are the effects of modern agriculture?

   (b) Mention the various energy resources. Explain the advantages of non-conventional sources of energy.

UNIT II

4. (a) Distinguish between Food chain and Food web.

   (b) Explain Desert Ecosystem.

Or

5. (a) Define genetic, species and ecosystem diversity. Explain the values of biodiversity.

   (b) Explain the various ex-situ and in-situ measures of biodiversity conservation.

UNIT III

6. (a) What are the causes, effects and control measures of Air pollution?

Or

7. (a) Explain resettlement and rehabilitation of people; its problems and concerns.

   (b) Write the Salient features of Forest Conservation Act.

UNIT IV

8. Write short notes on

   (a) Man's impact on environment

   (b) Sanitation and Public Health.

Or

9. Write about:

   (a) Chipko movement

   (b) Narmada Bchao Andolan.

———————