G 6741 (Pages : 3) Reg. No. M E

Name.....

B.TECH. DEGREE EXAMINATION, APRIL 2011

Third Semester

Branch : Civil, Mechanical, Electrical and Electronics, Polymer Electronics and Communication, Applied Electronics and Instrumentation, Instrumentation and Control Electronics and Instrumentation, Automobile Engineering, Aeronautical Engineering

ENGINEERING MATHEMATICS—II (CMEPLANSUF)

(2002 admission onwards—Supplementary)

Time : Three Hours Maximum : 100 Marks

Answer any **one** *full question from each module.*
Each full question carries 20 *marks.*

Module 1

1. (a) Find a unit vector normal to the surface $z = x^2 + y^2$ at the point (1, 3, 4). (5 marks)

(b) Find the directional derivative of the function $\phi = xy + yz + zx$ at (2, 1, 3) along $3\vec{i} + 4\vec{j} + 5\vec{k}$. (6 marks)

(c) Prove that curl curl $\vec{F}$ = grad div $\vec{F} - \nabla^2\vec{F}$ and hence deduce that curl curl curl curl $\vec{F} = \nabla^4 \vec{F}$, if $\vec{F}$ is solenoidal. (9 marks)

Or

(d) If $\phi = \phi(r)$ show that div $\{\phi(r)\vec{r}\} = 3\phi(r) + r\phi'(r)$ Hence evaluate div $(\phi(r)\hat{r})$. (8 marks)

(e) Find the constants a and b so that $\vec{F} = (axy + x^3)\hat{i} + (3x^2 - z)\hat{j} + (bxz^2 - y)\hat{k}$ is irrotational and find ϕ such that $\vec{F} = \nabla\phi$. (7 marks)

(f) Define the gradient of a scalar function. Show that $\nabla\phi$ is a vector normal to the surface $\phi(x, y, z) = c$. (5 marks)

Module 2

2. (a) Find the circulation $\vec{F}$ around the closed curve C, where $\vec{F} = y\vec{i} + z\vec{j} + x\vec{k}$ and C : curve $x^2 + y^2 = 1, z = 0$. (5 marks)

(b) State Gauss theorem and use it to evaluate $\iint_S \vec{F} \cdot \hat{n} ds$ where $\vec{F} = x^2\hat{i} + y\hat{j} + z\hat{k}$ and S is the surface of the cube bounded by the planes $x = 0, x = a, y = 0, y = a$ and $z = 0, z = a$. (8 marks)

(c) Find the work done in moving a particle once round a circle (in the xy plane) which has centre at the origin and radius = 2. Given that the force field is $\vec{F} = (2x - y + 2z)\hat{i} + (x + y - z^2)\hat{j} + (3x - 2y - 5z)\hat{k}$. (7 marks)

Turn over

(d) Using Green's theorem, evaluate $\int_C (x^2+xy)\,dx+(x^2-y^2)\,dy$ where C is the square formed by the lines $x=\pm 1, y=\pm 1$.

(10 marks)

(e) Verify divergence theorem for $\vec{F}=(x^2-y^2)\,\hat{i}+(y^2-2x)\hat{j}+(z^2-xy)\hat{k}$ taken over the rectangular parallelopiped $0\le x\le a, 0\le y\le b, 0\le z\le c$.

(10 marks)

Module 3

3. (a) Construct the analytic function whose real part is $r^2\cos 2\theta$. (5 marks)

(b) (i) Does the function $f(z)=\begin{cases} e^{-(1/z^4)}, & z\neq 0 \\ 0, & z=0 \end{cases}$ satisfy the Cauchy-Riemann equations at $z=0$?

(5 marks)

(ii) For what values of z is $f(z)$ analytic? (5 marks)

(iii) Show that f is continuous at $z=0$. (5 marks)

Or

(c) If $\phi+i\psi$ represents the complex potential of an electrostatic field where $\psi=(x^2-y^2)+\frac{x}{x^2+y^2}$, find the complex potential as a function of the complex variable z and hence determine ϕ.

(8 marks)

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

(7 marks)

(e) If $f(z)=u+iv$ is analytic, show that $u=c_1$ and $v=c_2$ cut orthogonally.

(5 marks)

Module 4

4. (a) Prove that $e^x=\left[\frac{\Delta^2}{E}\right]e^x\cdot\frac{Ee^x}{\Delta^2 e^x}$, the interval of differencing being h. (5 marks)

(b) Prove the identify :

$$u_1x+u_2x^2+u_3x^3+\ldots=\frac{x}{1-x}u_1+\frac{x^2}{(1-x)^2}\Delta u_1+\frac{x^2}{(1-x)^3}\Delta^2 u_1.$$

(7 marks)

(c) Employ Stirling's formula to compute $u_{12.2}$ from the table : ($u_x = 1 + \log \sin x$) :

x° :	10	11	12	13	14
$10^5 u_x$:	23967	28060	31755	35201	38638

(8 marks)

Or

(d) Given the values :

x :	5	7	11	13	17
$f(x)$:	150	392	1452	2388	5201

Evaluate $f(9)$, using Lagrange's and Newton's divided difference formula.

(10 marks)

(e) Given

θ :	0°	5°	10°	15°	20°	25°	30°
$\tan\theta$:	0	0.0875	0.1763	0.2679	0.364	0.4663	0.5774

Using Stirling's formula, show that $\tan 16^\circ = 0.2867$.

(10 marks)

Module 5

5. (a) Evaluate $\int_0^1 \frac{dx}{1+x}$ with $h = 0.25$ and $h = 0.5$ using trapezoidal and Simpson's 1/3rd rule and compare the values.

(10 marks)

(b) A rocket is launched from the ground. Its acceleration is registered during the first 80 seconds and is given in the table below. Using Simpson's 1/3 rd rule, find the velocity of the rocket at $t = 80$ seconds.

t(sec) :	0	10	20	30	40	50	60	70	80
$f(\text{cm/sec}^2)$:	30	31.63	33.34	35.47	37.75	40.33	43.25	46.69	50.67

(10 marks)

Or

(c) A river is 80 ft wide. The depth d in feet at a distance x ft. From one bank is given by the following table :

x :	0	10	20	30	40	50	60	70	80
d :	0	4	7	9	12	15	14	8	3

Find approximately the area of the cross-section.

(10 marks)

(d) Evaluate $\int_0^4 e^x dx$ Simpson's rule, given that $e = 2.72$, $e^2 = 7.39$, $e^3 = 20.09$, $e^4 = 54.6$ and compare it with the actual value.

(10 marks)

(5 × 20 = 100 marks)

G 6743 (Pages : 2) Reg. No.....

Name.....

B.TECH. DEGREE EXAMINATION, APRIL 2011

Third Semester

Branch : Mechanical Engineering and Automobile Engineering

MACHINE DRAWING–I (M, U)

(2002 admission onwards)

[Supplementary]

Time : Three Hours Maximum : 100 Marks

Missing dimensions, if any, may be assumed.
Drawing sheets will be supplied.

Answer **all** *questions.*

1. Answer any *two* of the following :

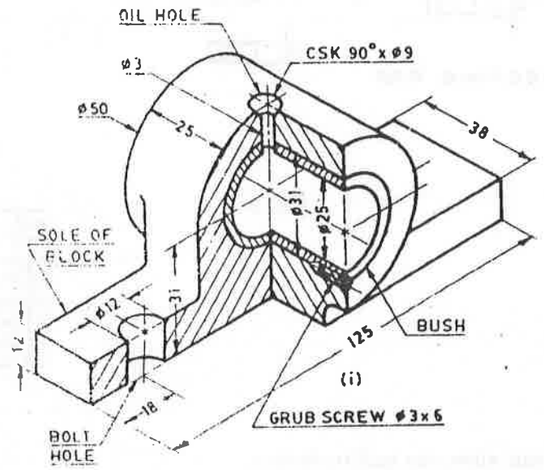
   (a) Sketch an eye end foundation bolt and show all dimensions.

   (b) Draw the three views of a square headed bolt with nut. Take appropriate dimensions.

   (c) Draw the two views of a double riveted lap joint (chain type).

   (2 × 7½ = 15 marks)

2. Fig. 1 shows the details of a bushed (Journal bearing). Draw the following views :



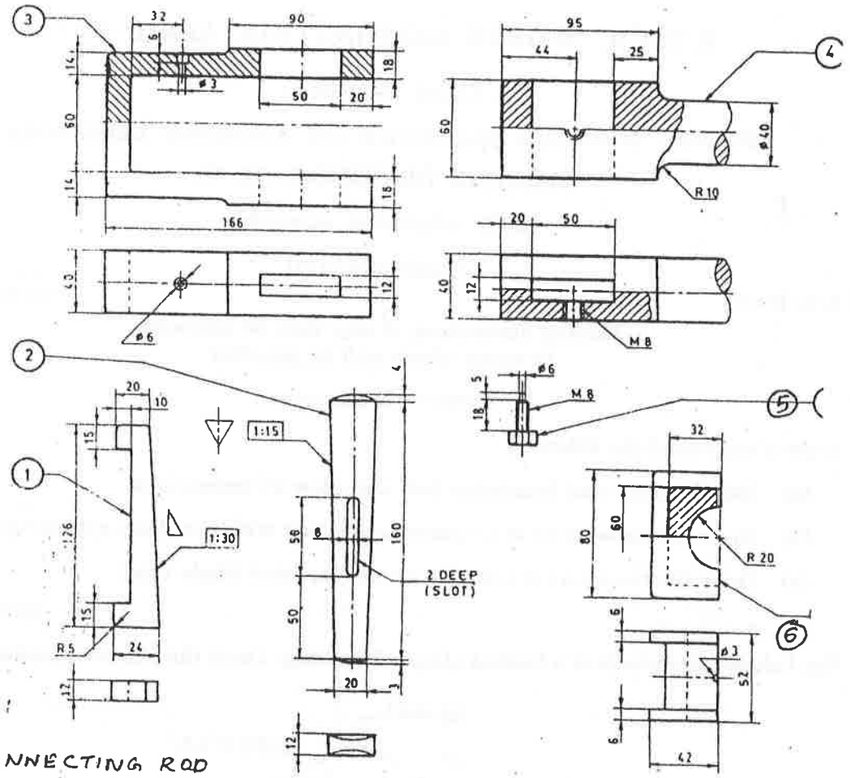
Bushed Bearing
Fig. 1

   (a) Front view, left half in section. (16 marks)

   (b) Side view. (9 marks)

Turn over

3. Fig.2 shows the details of a connecting rod. Assemble the parts and draw the , following views :



CONNECTING ROD

Fig. 2

ITEM

Item	Description	Qty.	Mate
1	Gib	2	Ste
2	Cotter	1	Ste
3	Strap	1	St
4	Conn. rod end	1	St
5	Set screw	1	M
6	Bush (Half)	2	Br

(a) Front view, top half in section. (40 marks)

(b) Top view. (20 marks)

G 6751 (Pages : 2) Reg. No.....

Name.....

B.TECH. DEGREE EXAMINATION, APRIL 2011

Third Semester

Branch : Mechanical Engineering

FLUID MECHANICS (M)

(2002 admission onwards)

[Supplementary]

Time : Three Hours Maximum : 100 Marks

Part A

Answer **all** *questions.*

Each question carries 4 *marks.*

1. What is a Newtonian fluid ?
2. What is the significance of metacentric height ?
3. Differentiate between a steady flow and unsteady flow.
4. What do you mean by the strength of a doublet ?
5. What is Euler's momentum equation ?
6. What is a Pitot tube ?
7. What is an aerofoil ?
8. What do you mean by skin friction ?
9. Differentiate between a laminar and a turbulent flow.
10. What is water hammer ?

(10 × 4 = 40 marks)

Part B

11. A U-tube differential manometer connects two pressure pipes A and B. Pipe A contains a fluid having a specific gravity 1.5 under a pressure of 11.5 N/cm^2 and pipe B contains oils of specific gravity 0.8 under a pressure of 8 N/cm^2. The pipe A lies 2 m above pipe B. Find the difference of mercury level shown by the manometer.

Or

Turn over

12. A circular disc 4 m diameter is immersed in water in such a way that the plane of the disc makes an angle of 60° with the free surface of water. Determine the total pressure and position of centre of pressure when the upper edge of the disc is 3 m below the free surface of water.

13. The velocity potential function Φ is given by $\Phi = x^2 - y^2$. Find the velocity components in x and y direction. Also show that it is a possible case of fluid flow.

Or

14. Explain (a) Rotational and irrotational flow (b) flow past a cylinder.

15. A horizontal venturimeter with inlet diameter 22 cm and throat diameter 12 cm is used to measure flow through a pipe. The pressure at inlet is 14 N/cm^2 and vacuum pressure at throat is 40 cm of mercury. Find the discharge through the pipe. Take $C_d = 0.98$.

Or

16. Explain (a) momentum and energy correction factor (b) notches and weirs.

17. Explain the various factors affecting boundary layer separation and the methods to prevent it.

Or

18. A plate 200 mm wide and 500 mm long is placed longitudinally in a stream of crude oil flowing with undisturbed velocity of 5 m/s. The specific gravity of oil is 0.925 and kinematic viscosity is 0.9 stokes. Determine the frictional drag on one side of the plate, the thickness of boundary layer and the shear stress at the trailing edge of the plate.

19. Define and derive expressions for (i) displacement thickness and (ii) momentum thickness in a boundary layer.

Or

20. Briefly explain (i) hydraulic gradient line, (ii) total energy line, (iii) flow through a siphon, (iv) Moody's chart.

(5 × 12 = 60 marks)

G 6759 (Pages : 2) Reg. No.....

Name.....

B.TECH. DEGREE EXAMINATION, APRIL 2011

Third Semester

Branch : Mechanical Engineering/Automobile Engineering

METALLURGY AND MATERIAL SCIENCE (MU)

(2002 admission onwards)

[Supplementary]

Time : Three Hours Maximum : 100 Marks

Part A

Answer **all** *questions.*
Each carries 4 *marks.*

1. What do you mean by amorphous structure ?
2. Differentiate between slip and twinning.
3. Differentiate between recovery and recrystallisation in a metal.
4. What is polymorphism ?
5. What is martempering ?
6. What is solid solution hardening ?
7. What are the constituents of cast iron and how do they vary in grey, white and malleable cast irons ?
8. What is duralumin and what are its properties ?
9. What are the factors leading to crack propagation ?
10. What is the effect of stress concentration on fatigue ?

(10 × 4 = 40 marks)

Part B

11. (a) What are the important features of miller indices ?

    (b) Draw the (112) and (111) planes in a simple cubic cell.

(6 + 6 = 12 marks)

Or

Turn over

12. With the help of suitable sketches explain point, line and surface imperfections found in solid crystals.

(12 marks)

13. (a) Compare cold working and hot working of metals.

(b) What are inter metallic compounds ?

(8 + 4 = 12 marks)

Or

14. What is lever rule ? Explain the equilibrium diagram of a solid solution in which two metals are completely soluble in the liquid and solid states.

(12 marks)

15. (a) Explain the processes of full annealing and subcritical annealing.

(b) What are hot dipping and coating ?

(8 + 4 = 12 marks)

Or

16. Explain the following processes (i) carburizing, (ii) cyaniding, (iii) induction hardening.

(12 marks)

17. Explain (a) stainless steel (b) high speed steel (c) displacement of the eutectoid point.

Or

18. Describe the composition, properties, and uses of (i) spheroidal cast iron (ii) Brass and bronze (iii) Gun metal.

(12 marks)

19. (a) Differentiate between ductile and brittle fracture.

(b) Explain the effect of impact loading on ductile material fracture.

(6 + 6 = 12 marks)

Or

20. Explain (i) stress cycles, (ii) mechanism of creep deformation, (iii) creep curve

(12 marks).

[5 × 12 = 60 marks]

G 6766 (Pages : 2) Reg. No.....

Name.....

B.TECH. DEGREE EXAMINATION, APRIL 2011

Third Semester

Branch : Mechanical Engineering and Automobile Engineering

THERMODYNAMICS (MU)

(2002 admission onwards)

[Supplementary]

Time : Three Hours Maximum : 100 Marks

Part A

Answer **all** *questions.*
Each question carries 4 *marks.*

1. What is meant by thermodynamic equilibrium ?
2. What is quasi-static process ?
3. Write a note on (i) specific heat, (ii) internal energy and (iii) enthalpy of a system.
4. Explain international temperature scale.
5. State Causius inequality.
6. The entropy of an isolated system always increases. Justify.
7. Derive an expression for the entropy change between any *two* states of an ideal gas.
8. What is principle of increase of entropy ?
9. With a neat sketch explain Mollier diagram.
10. What is a pure substance ? Show different processes in the p-v. diagram of water.

(10 × 4 = 40 marks)

Part B

11. (a) Explain macroscopic and microscopic analysis of matters. (6 marks)

    (b) State law of corresponding states. (6 marks)

Or

12. (a) Explain compressibility factor. (6 marks)

    (b) A gas having a volume of $0.05m^3$ and pressure of 6.9 bar expands reversibly in a cylinder behind a piston according to law pV = constant until the volume is $0.08\ m^3$. Calculate the work done by the gas. Also sketch the process on a p-v diagram.

(6 marks)

Or

Turn over

13. Air flows steadily at the rate of 0.5 kg/s through an air compressor, entering at 7 m/s velocity, 100 kPa pressure, and 0.95 m^3/kg volume, and leaving at 5m/s, 700 kPa, and 0.19 m^3/kg. The internal energy of the air leaving is 90 kJ/kg greater than that of the air entering. Cooling water in the compressor jacket absorbs heat from the air at the rate of 58 kW.

(a) Compute the rate of shaft work input to the air in kW.

(b) Find the ratio of the inlet pipe diameter to outlet pipe diameter.

(12 marks)

Or

14. Derive Steady flow energy equation. Apply this equation to get the energy equation for a Compressor. (12 marks)

15. (a) Explain (i) efficiency of a heat engine and (ii) C.O.P of a refrigerator. (6 marks)

(b) A cyclic heat engine operates between a source temperature of 700°C and a sink temperature of 20°C. What is the least rate of heat rejection per kW net out put of the engine. (6 marks)

Or

16. With a neat sketch explain Carnot cycle. (12 marks)

17. (a) Explain Clausius-claperyon equations. (6 marks)

(b) Write notes on Gibbs and Helmholts functions. (6 marks)

Or

18. Derive Maxwell's equations. (12 marks)

19. (a) Explain Dalton's law of partial pressure. (6 marks)

(b) Explain Gibb's law. (6 marks)

Or

20. (a) What are the psychrometric properties ? (5 marks)

(b) Draw psychrometric chart and mark the following processes on it :—

(i) sensible cooling.

(ii) Chemical dehumidification and

(iii) Adiabatic humidification. (7 marks)

[5 × 12 = 60 marks)

G 6773 (Pages : 2) Reg. No.....

Name.....

B.TECH. DEGREE EXAMINATION, APRIL 2011

Third Semester

Branch : Mechanical, Polymer Engineering and Automobile Engineering

STRENGTH OF MATERIALS AND STRUCTURAL ENGINEERING—(MPU)

(2002 admission onwards—Supplementary)

Time : Three Hours Maximum : 100 Marks

Answer **all** *questions.*

Assume missing data if any suitably.

Part A

1. The diameter of a circular rod varies uniformly from (D + a) to (D – a). Show that the percentage error involved in finding Young's modulus of the rod by considering the rod as a uniform rod of mean diameter is $(10\ a/D)^2$.
2. Define principal stresses and principal planes. Give expressions for the same.
3. Define the following in the case of a loaded beam :
   (a) Shear force ; (b) Bending moment ; (c) Point of contraflexure.
4. Derive the relationship $M/I = f/y$.
5. Obtain an expression for maximum slope and deflection for a simply supported beam subjected to a concentrated load W at midspan.
6. Explain conjugate beam method of finding the deflection of a beam.
7. Show that hollow shaft is strongest than the solid shaft of same material, length and weight.
8. A pipe of 180 mm internal diameter and 40 mm thickness carries a fluid at a pressure of $10\ MN/m^2$. Calculate the maximum and minimum intensities of circumferential stresses across the section.
9. Define the effective length of column. Give the effective length of columns for different end conditions.
10. Derive the expression for safe load for a long column under eccentric loading by Rankine's formula.

(10 × 4 = 40 marks)

Part B

11. (a) Three short pillars, each 450 mm^2 in section, support a weight of 190 kN. The central pillar is of steel and the outer ones are of copper. The pillars are so adjusted that at a temperature of 15°C each carries equal load. The temperature is then raised to 120°C. Estimate the stresses in each pillar.

Take $E_s = 210\ GN/m^2$ $E_b = 105\ GN/m^2$

$\alpha_s = 12.0 \times 10^{-6}/°C$ $\alpha_b = 17.5 \times 10^{-6}/°C$.

Or

(b) A rectangular block of material is subjected to a tensile of 150 MN/m^2 on one plane and a tensile stress of 80 MN/m^2 on a plane at right angles, together with the shear stress of 75 MN/m^2. Find the principal stresses and position of principal planes. Find also the maximum shear stress and its plane.

12. (a) An overhanging beam ABC length 7 m supported on AB of length 5 m. The overhanging portion BC is of length 2 m. A.U.D.L. of 2 kN/m is acting over a length of 3 m from the left support. Two point loads of 4 kN and 6 kN acting at a distance of 4 m from left support and at the free end C. Draw S.F. and B.M. diagrams. Also find the location of point of contraflexure.

Or

(b) Three beams have the same length, same allowable bending stress and subjected to same bending moment. The cross-section of the beams are square, circle and rectangle with depth twice the breadth. Find the ratio of the weight of circular and rectangular beam with respect to the square beam.

13. (a) A steel girder of uniform section, 12 m long, is simply supported at its ends. It carries concentrated loads of 140 kN and 70 kN at two points 3 m and 4.5 m from the two ends respectively. If for the section $I_{XX} = 16 \times 10^{-4}$ m^4 and 210 GN/m^2, find (i) the deflection and slope under the loads and (ii) position and amount of maximum deflection.

Or

(b) A 6 m long cantilever is loaded with a UDL of 2 kN/m over the 4 m from the fixed end and a point load of 1 kN at the free end. If the section is rectangular 80 mm (wide) × 160 mm (deep), and E = 10 GN/m^2, calculate the slope and deflection (i) at the free end of the cantilever and (ii) at a distance of 0.6 m from the free end.

14. (a) A hollow shaft is of external diameter 90 mm and diameter ratio 0.8. It transmits a power of 2 H.P. at 30 r.p.m. If the maximum torque exceeds the average torque by 25%, draw the shear stress distribution across the section of the shaft.

Or

(b) A thick cylinder of internal and external diameters of 200 mm and 320 mm is subjected to an internal pressure of 40 N/mm^2 and external pressure of 10 N/mm^2. Determine the stresses in the material. Plot the curves showing the variation of hoop stress and radial stress through the material. If the external pressure is doubled, what internal pressure can be maintained without exceeding the previously determined maximum stress.

15. (a) A hollow cast iron 5 m long column with both ends fixed is required to support a load of 1100 kN. If the external diameter of the column is 300 mm, find its thickness. Take working stress as 80 MPa and Rankine's constant as 1/1600.

Or

(b) (i) Briefly explain the principles of R.C.C.

(ii) Prepare the detailed sketch of a RCC footing for a square column.

(5 × 12 = 60 marks)