F 6877 (Pages : 3) **Reg. No.....**

Name.....

B.TECH. DEGREE EXAMINATION, NOVEMBER 2017

Third Semester

Branch : Common to all Branches Except C.S. and I.T.

EN 010 301 A—ENGINEERING MATHEMATICS—II

(CE, ME, EE, AU, AN, EC, AI, EI, IC, PE, PO, MT, CH and ST)

[New Scheme—2010 Admission onwards]

{Supplementary}

Time : Three Hours Maximum : 100 Marks

Part A

Answer **all** *questions.*

Each question carries 3 *marks.*

1. Find the divergence of $3x^2i + 5xy^2j + xyz^3k$ at (1, 2, 3).

2. If $\bar{A}(t) = (3t^2 - 2t)i + (6t - 4)j + 4\bar{k}$, evaluate $\int_2 A(t)\,dt$.

3. Evaluate $(\nabla + \Delta)^2 (x^2 + x), h = 1$.

4. Solve the difference equation $u_{n+3} - 3u_{n+2} + 4u_n = 0$.

5. Find $z\left\{\frac{1}{n}\right\}$.

(5 × 3 = 15 marks)

Part B

Answer **all** *questions.*

Each question carries 5 *marks.*

6. Find the constants a, b, c, such that $\bar{F} = (x + 2y + az)i + (bx - 3y - z)j + (4x + cy + 2z)\bar{k}$ is irrotational.

7. Apply Green's theorem to evaluate $\int_C (2x^2 - y^2)dx + (x^2 + y^2)dy$ where C is the boundary of the area enclosed by the x-axis and the upper half of the circle $x^2 + y^2 = a^2$.

Turn over

8. Prove that

   (i) $\delta = \Delta E^{-1/2} = \nabla E^{-1/2}$.

   (ii) $\mu\delta = \frac{1}{2}(\nabla + \Delta)$.

   (iii) $E^{-1/2} = \mu + \frac{1}{2}\delta$.

9. Use Trapezoidal rule to evaluate $\int_0^1 x^3 dx$ considering 5 subintervals.

10. Find the z-transform of $f * g$ if $f(n) = u(n)$, $g(n) = 2^n\, u(n)$.

(5 × 5 = 25 marks)

Part C

Answer **all** *questions.*

Each full question carries 12 *marks.*

11. (a) Find the angle between the normals to the Surface $xy = z^2$ at the points (–2, –2, 2) and (1, 9, –3).

(6 marks)

(b) Find the function ϕ, if grad $\phi = (y^2 - 2xyz^3)i + (3 + 2xy - x^2z^3)j + (6z^3 - 3x^2yz^2)\bar{k}$.

(6 marks)

Or

12. (a) Show that $\bar{F} = (y^2 - z^2 + 3yz - 2x)i + (3xz + 2xy)j + (3xy - 2xz + 2z)\bar{k}$ is both solenoidal and irrotational.

(6 marks)

(b) If $\bar{r}$ is the position vector of the point (x, y, z) with respect to the origin, prove that $\nabla(r^n) = nr^{n-2}\,\bar{r}$.

(6 marks)

13. Verify Stokes theorem for $\bar{F} = -yi + 2yzj + y^2\bar{k}$, where S is the upper half of the sphere $x^2 + y^2 + z^2 = a^2$ and c is the circular boundary on the XOY-plane.

Or

14. Verify Divergence theorem for $\bar{F} = x^2i + zj + yz\bar{k}$ over the cube formed by $x = \pm 1, y = \pm 1, z = \pm 1$.

15. Find the cubic polynomial which takes the following values :

x	:	0	1	2	3
$f(x)$	:	1	2	1	10

Hence or otherwise evaluate $f(4)$.

Or

16. Using Newton's divided difference formula, evaluate $f(8)$ and $f(18)$ from the following table :

x	:	5	7	11	13	17
$f(x)$	:	150	392	1452	2366	5202

17. Find $\frac{dy}{dx}$ and $\frac{d^2y}{dx^2}$ at $x = 1.1$ from the following table :

x	:	1.0	1.1	1.2	1.3	1.4	1.5	1.6
y	:	7.98	8.40	8.78	9.12	9.45	9.75	10.03

Or

18. The velocity v of a particle at a distance S from a point on its path is given by the table :

S *(ft)*	:	0	10	20	30	40	50	60
Velo (ft/Sec)	:	47	58	64	65	61	52	38

Estimate the time taken to travel 60 ft. by using Simpson's $\frac{1}{3}$ rule. Compare the result with Simpson's $\frac{3}{8}$ rule.

19. (a) Using convolution theorem, find $z^{-1}\left\{\frac{z^2}{(z-a)(z-b)}\right\}$. (6 marks)

(b) Find the inverse Z-transform of $\frac{2z^2 + 3z}{(z+2)(z-4)}$. (6 marks)

Or

20. Solve $y_{n+2} + 4\,y_{n+1} + 3y_n = 2^n$ with $y_0 = 0, y_1 = 1$.

[5 × 12 = 60 marks]

F 6881 (Pages : 3) Reg. No.....

Name.....

B.TECH. DEGREE EXAMINATION, NOVEMBER 2017

Third Semester

Branch : Naval Architecture and Ship Building/Aeronautical/Mechanical/ Production Engineering

AN 010 303/ME 010 303/PE 010 303/ST 010 303—FLUID MECHANICS [AN, ME, PE, ST]

(New Scheme—2010 Admission onwards)

[Supplementary]

Time : Three Hours Maximum : 100 Marks

Part A

Answer **all** *questions.*
Each question carries 3 *marks.*

1. Discuss about dynamic and kinematic viscosity.
2. What do you understand by Vena contracta ?
3. Define Hydraulic radius.
4. What is streamline and stream tube ?
5. What do you mean by boundary layer separation ?

(5 × 3 = 15 marks)

Part B

Answer **all** *questions.*
Each question carries 5 *marks.*

6. State and explain Pascal's law.
7. Define velocity of approach. How does it effect the discharge over a weir ?
8. A rectangular channel having hydraulic mean depth of 2 m discharges water with a velocity of 1 m/s. Find the value of Chezy's constant, if the bed slope of the channel is 1 : 8000.
9. Explain Rankine half body.
10. Describe the growth of boundary layer along a smooth plate.

(5 × 5 = 25 marks)

Turn over

Part C

Answer **all** *questions.*
Each full question carries 12 *marks.*

11. (i) Calculate the maximum capillary depression of mercury in a vertical glass tube of 1 mm diameter at 20°C. Take angle of contact as 140° and surface tension as 0.51 N/m.

(5 marks)

(ii) A U-tube differential manometer connects two pressure pipes A and B. The pipe A contains Carbon tetrachloride having a specific gravity of 1.594 under a pressure of 12 N/cm^2. The pipe B contains an oil of specific gravity 0.8 under a pressure of 20 N/cm^2. The pipe A lies 2.5 m above pipe B. Find the difference of pressure measured by mercury as fluid filling U-tube.

(7 marks)

Or

12. Show that a cylindrical buoy of 1 m diameter and 2.5 m height weighing 1000 kg will not float vertically in sea water. Find the force necessary in a vertical chain attached at the centre of base of the buoy that will keep it vertical.

13. Find the throat diameter of a venturimeter, when fitted to a horizontal main 10 cm diameter having a discharge of 20 litres/sec. The differential U-tube mercury manometer shows a reading of 60 cm. Take coefficient of discharge as 0.95. In case, this venturimeter is introduced in a vertical pipe, with the water flowing upwards, find the difference in the readings of mercury gauge. The dimensions of pipe and venturimeter remains unaltered, as well as the discharge through the pipe.

Or

14. (i) With the help of a neat sketch, explain how Pitot tube is used to measure the velocity of a flowing liquid.

(5 marks)

(ii) Derive the expression for time of emptying a rectangular tank through an orifice at its bottom.

(7 marks)

15. The pressure at the inlet of a pipe is 700 N/cm^2 and the pressure drop is 70 N/cm^2. The pipeline is 1.5 km long. If 100 HP is to be transmitted over this pipeline, find the diameter of the pipe and efficiency for transmission. Take coefficient of friction as 0.006.

Or

16.. For sudden expansions in pipe flow, what is the optimum ratio between the diameter of the pipe before expansion and the diameter of the pipe after expansion so that the pressure rise may be maximum.

17. Sketch the streamlines represented by $\psi = x^2 + y^2$ and $\psi = x^2 - y^2$ showing the direction of flow in each case. Also find out the velocity and its direction at (1, 1).

Or

18. A pipe converges from 0.2 m diameter to 0.1 m diameter over 1 m length such that velocity varies uniformly. If the rate of flow is 10 litres/sec, find the convective acceleration at the middle of the pipe. If the rate of flow changes uniformly from 10 litres/sec to 20 litres/sec in 20 sec, find the total acceleration at the middle of the pipe at the 10th second.

19. For a steady Poiseuille flow in a circular pipe of radius 'R', obtain an expression for the ratio of displacement and momentum thickness.

Or

20. A smooth plate of 10 m length is dragged along lengthwise fully submerged in water of 20°C at a velocity of 5 m/s. Calculate : (a) the thickness of laminar sublayer, and ; (b) the velocity at the edge of sublayer at a distance of 5 m from the leading edge.

(5 × 12 = 60 marks)

F 6915 (Pages : 3) Reg. No.....

Name.....

B.TECH. DEGREE EXAMINATION, NOVEMBER 2017

Third Semester

Branch : Automobile Engineering/Mechanical Engineering/Production Engineering/Polymer Engineering

AU 010 306
ME 010 306
PE 010 306
PO 010 306
—STRENGTH OF MATERIALS AND STRUCTURAL ENGINEERING (AU, ME, PE, PO]

(New Scheme—2010 Admission onwards)

[Supplementary]

Time : Three Hours Maximum : 100 Marks

Part A

Answer **all** *questions.*
Each question carries 3 *marks.*

1. Explain (i) Normal stress ; (ii) Shear stress ; (iii) Bearing stress.
2. Define point of 'Contraflexure'.
3. What are the assumptions taken in the analysis of shear stress in beams.
4. Distinguish between circumferential and longitudinal stresses in thin cylindrical shell.
5. Why plane of maximum shear stress and principal stress planes are inclined at 45^{o} to each other.

(5 × 3 = 15 marks)

Part B

Answer **all** *questions.*
Each question carries 5 *marks.*

6. A bar ABCD of steel is 600 mm. long and the two ends AB and CD are respectively 30 mm and 40 mm in diameter respectively and each is 150 mm. in length. The middle portion BC being 25 mm in diameter. Determine the final length of the bar when subjected to an axial compressive load of 120 kN. Take $E = 2.1 \times 10^5$ N/mm^2.
7. Prove that bending moment diagram varies parabolically for a cantilever beam with uniformly distributed load of intensity 'w' per unit length.
8. Draw the shear stress distribution diagram for a π-section.

Turn over

9. Derive an expression for shear stress produced in a circular shaft subject to torsion.

10. Derive an expression for Euler's crippling load for a long column with it both ends are fixed.

(5 × 5 = 25 marks)

Part C

Answer **all** *questions.*

Each question carries 12 *marks.*

11. Three bars made of copper, Zinc and aluminium are of equal length and have cross-section 500 mm^2, 750 mm^2, and 1000 mm^2 respectively. They are rigidly connected at their ends. If this compound member is subjected to a longitudinal pull of 300 kN, estimate the proportion of the load carried on each rod and induced stresses.

Take the value of 'E' for copper = 1.3×10^5 N/mm^2, for Zinc = 1×10^5 N/mm^2 and for Aluminium = 0.8×10^5 N/mm^2.

Or

12. A steel bar 50 mm × 50 mm in section is 1.2 m long. It is subjected to an axial pull of 200 kN. Determine :

(i) Volumetric strain and final volume.

(ii) Bulk Modulus.

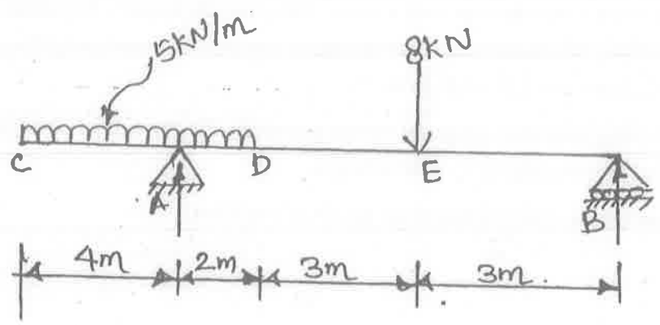
(iii) Rigidity Modulus.

Take Youngs Modulus = 200 GPa and Poisson's ratio is 0.3.

13. A cantilever beam of length 6 m. carries two point loads of 2 kN and 3 kN at a distance of 1 m and 6 m from the fixed end respectively. In addition to this the beam also carries a uniformly distributed load of 1 kN/m. over a length of 2 m at a distance of 3 m from the fixed. Draw the shear force and bending moment diagrams. Determine the maximum value of shear force and bending moment.

Or

14. Draw the shear force and bending moment diagrams for the beam loaded as shown in Figure. Determine the maximum bending moment and locate the point of contraflexure if any :



15. A beam of I Section is 350 mm deep over all and 200 mm wide. The flayers are 15 mm thick while web thickness is 10 mm. If at any cross-section, the bending moment is M and shear force is F, calculate the portion in which the flange and web resist the bending moment M and shear force F.

Or

16. A simply supported beam of span 6 m is subjected to a uniformly distributed load of 2 kN/m on the entire span and a point load of 3 kN at 4 m from the left support. Find the value of maximum deflection in terms of EI and its position.

17. A 2 m long and 40 mm. diameter aluminium shaft is to be replaced by a hollow steel shaft of the same length and the same outside diameter with the same angle of twist over the total length. Determine the inside diameter of the hollow shaft. Take the modulus of rigidity of the steel is thrice that of the aluminium.

Or

18. A compound cylinder is made by shrinking a cylinder of external diameter 200 mm and internal diameter 160 mm over another cylinder of external diameter 160 mm and internal diameter 120 mm. The radial pressure at the function after shrinking is 8 N/mm^2. Find the final stresses set up across the section, when the compound cylinder is subjected to an internal fluid pressure of 60 N/mm^2.

19. The stresses at a point in a material is $\sigma_x = 200$ N/mm^2, $\sigma_y = -150$ N/mm^2 and $\tau_{xy} = 80$ N/mm^2. Find the principal stresses, principal planes, maximum shear stress and plane on which maximum shear stress occurs by using Mohr's circle method and verify using analytical method.

Or

20. A 1.5 m long column has a circular cross-section of 5 cm diameter. One of the ends of the column is fixed in direction and the other end is free. Taking factor of safely as 3. Calculate the safe load using :

(a) Rankine's formula, take yield stress, $f_c = 560$ N/mm^2 and Rankines constant $\alpha = \frac{1}{1600}$.

(b) Euler's formula, Youngs modulus is 2.1×10^5 N/mm^2. Compare both the answers.

(5 × 12 = 60 marks)

F 6974 (Pages : 3) Reg. No.....

Name.....

B.TECH. DEGREE EXAMINATION, NOVEMBER 2017

Third Semester

Branch : Mechanical Engineering/Automobile Engineering

MACHINE DRAWING—I (M,U)

(Old Scheme—Prior to 2010 Admissions)

[Mercy Chance]

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 questions :

   (a) Draw the front and top views of a square headed nut of size M24 when two faces of the nut are equally seen in front view. (7 ½ marks)

   (b) Sketch any *three* locking arrangements of Nuts. (7 ½ marks)

   (c) Sketch any *four* types of rivet heads used for boiler work and show the portions in drawing. (7 ½ marks)

   [2 × 7 ½ = 15 marks]

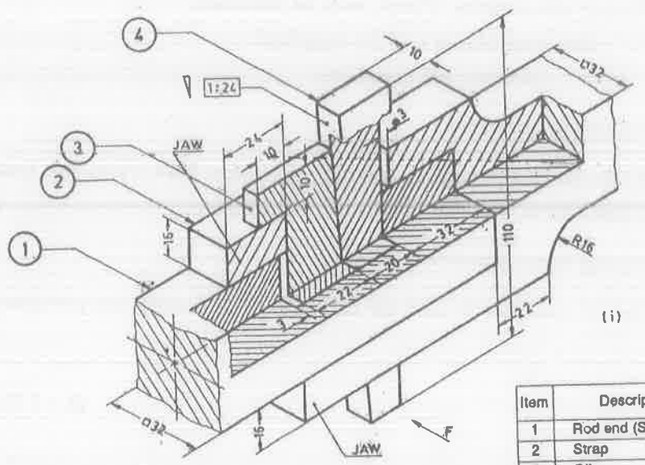
Turn over

2. An isometric view of a Gib and cotter joint is shown in Fig. 1. Draw the following view :

   (a) Top half sectional elevation. (15 marks)

   (b) End view. (10 marks)

   Indicate all the dimensions in the drawing as per standards.



ITEM LIST

Item	Description	Qty.	Material
1	Rod end (Square)	1	M. S.
2	Strap	1	M. S.
3	Gib	1	M. S.
4	Cotter	1	M. S.

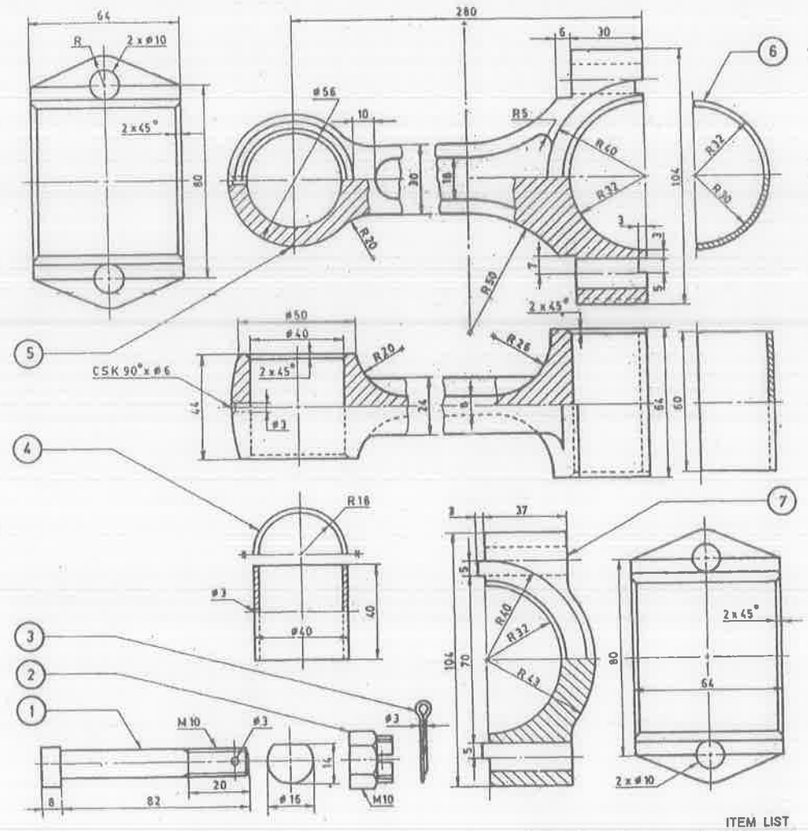
GIB AND COTTER JOINT
(STRAP JOINT WITH GIB AND COTTER)

Fig. 1

3. Fig. 2 shows the details of a I.C. engine connecting rod. Assemble the components and draw the following views :

   (a) Bottom half sectional elevation. (40 marks)

   (b) End view from small end side. (20 marks)



ITEM LIST

Item	Description	Qty.	Material
1	Bolt	2	M. S.
2	Lock nut	2	M. S.
3	Split pin	2	M. S.
4	Bush (Small end)	1	Bronze
5	Body	1	Steel
6	Bush (Big end)	2	Bronze
7	Cap	1	Steel

CONNECTING ROD
(I. C. ENGINE)

Fig. 2

F 7000 (Pages : 3) Reg. No.....

Name.....

B.TECH. DEGREE EXAMINATION, NOVEMBER 2017

Third Semester

Branch : Mechanical Engineering/Automobile Engineering

THERMODYNAMICS (M, U)

(Old Scheme—Prior to 2010 Admissions)

[Mercy Chance]

Time : Three Hours Maximum : 100 Marks

Part A

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

1. What do you mean by thermodynamic equilibrium ?
2. Distinguish between macroscopic and microscopic approach of thermodynamics.
3. Show that energy is a property.
4. What is thermometry ? What is a thermometer and list the different types of thermometer ?
5. State and explain Carnot's theorem.
6. What are the causes of irreversibility ?
7. Define volume expansivity and isothermal compressibility.
8. If the boiling point of benzene at 1 a.t.m. pressure is 353 K, estimate the approximate value of the vapour pressure of benzene at 303 K.
9. State and explain Dalton's law of partial pressures.
10. Why does the enthalpy of an air-vapour mixture remain constant during an adiabatic saturation process ?

(10 × 4 = 40 marks)

Part B

Answer **all** *questions.*
Each question carries 12 *marks.*

11. (i) Explain the concept of continuum. (6 marks)

    (ii) A cylinder contains $1m^3$ of gas at 100 kPa, 100°C. The gas is polytropically compressed to a volume of $0.25\ m^3$. The final pressure is 600 kPa. Determine the mass of the gas and polytropic index. (6 marks)

Or

Turn over

12. (i) Differentiate between ideal and real gas. (4 marks)

(ii) State and explain law of corresponding states. Obtain an expression for the law of corresponding states.

(8 marks)

13. A turbine operates under steady flow conditions, receiving steam at the following state : pressure 1.2 MPa, temperature 188°C, enthalpy 2785 kJ/kG, velocity 33.3 m/s and elevation 3 m. The steam leaves the turbine at the following state : pressure 20 kPa, enthalpy 2512 kJ/kG, velocity 100 m/s, and elevation 0 m. Heat is lost to the surroundings at the rate of 0.29 kJ/s. If the rate of steam flow through the turbine is 0.42 kg/s, what is the power output of the turbine in kW ?

Or

14. (i) Derive the expression for work done in a polytropic process. (6 marks)

(ii) 2 kg of air at 32°C is expanded in a closed system process following $pv^{1.25} = c$ until the pressure is halved. Compute the charge in internal energy and work done.

(6 marks)

15. (i) State and explain the two classical statements of second law of thermodynamics. Also, prove their equivalence.

(7 marks)

(ii) Show that the COP of a heat pump is greater than the COP of a refrigerator by unity.

(5 marks)

Or

16. (i) What is the absolute thermodynamic temperature scale ? How does heat play the role of thermometric property in the Kelvin scale.

(7 marks)

(ii) State and explain Fowler–Guggenheim statement of the third law. (5 marks)

17. Derive Maxwell's equations. With the help of Maxwell's equations derive the two TdS equations.

Or

18. Derive the Clasius–Clapeyron equation. Using the Clausius–Clapeyron equation. Show that the fusion line of water on p-T diagram has negative slope.

19. 0.5 kg of Helium and 0.5 kg of nitrogen are mixed at 20°C and at a total pressure of 100 kPa, find :

(a) The volume of the mixture,

(b) The partial volumes of the components,

(c) The partial pressures of the components,

(d) The mole fractions of the components,

(e) The specific heats C_p and C_v of the mixture, and

(f) The gas constant of the mixture.

Or

20. Saturated air at 2°C is required to be supplied to a room where the temperature must be held at 20°C with a relative humidity of 50%. The air is heated and then water at 10°C is sprayed in to give the required humidity. Determine the temperature to which the air must be heated and the mass of spray water required per m^3 of air at room conditions. Assume that the total pressure is constant at 1.013 bar and neglect the fan power.

[5 × 12 = 60 marks]