F 3125 (Pages : 4) Reg. No.....

Name.....

B.TECH. DEGREE EXAMINATION, NOVEMBER 2014

Third Semester

Branch : Common to all branches except CS and IT

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)

[Regular/Improvement/Supplementary/ST—Regular]

Time : Three Hours Maximum : 100 Marks

Part A

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

1. Find grad ϕ if $\phi = \log\left(x^2 + y^2 + z^2\right)$.

2. If $\vec{f}(t) = t\,\hat{i} + \left(t^2 - 2t\right)\hat{j} + \left(3t^2 + 4t^3\right)\hat{k}$, find $\int_0^1 \vec{f}(t)\,dt$.

3. Evaluate $\Delta^2 E^3 x^2$.

4. Solve $\left(E^2 + 6E + 9\right) y_n = 0$.

5. Find the z-transform of $3^n \sin \frac{n\pi}{2}$.

(5 × 3 = 15 marks)

Part B

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

6. The position vector of a particle at time t is $\vec{r} = \cos(t-1)\,\hat{i} + \sinh(t-1)\,\hat{j} + \alpha r^3\,\hat{k}$. Find the condition imposed on α by requiring that at time $t = 1$, the acceleration is normal to the position vector.

Turn over

7. Find the work done when a force $\vec{F} = \left(x^2 - y^2 + x\right)\hat{i} - (2xy + y)\,\hat{j}$ moves a particle in the xy plane from $(0, 0)$ to $(1, 1)$ along the parabola $y^2 = x$.

8. Prove that $\delta = \Delta\ (1 + \Delta)^{-1/2} = \nabla\,(1 - \nabla)^{-1/2}$.

9. Solve the difference equation $y_{n+2} + 3y_{n+1} + 2y_n = \sin\dfrac{n\pi}{2}$.

10. Find the inverse z-transform of $\dfrac{4 - 8z^{-1} + 6z^{-2}}{\left(1 + z^{-1}\right)\left(1 - 2z^{-1}\right)}$.

(5 × 5 = 25 marks)

Part C

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

11. (a) The temperature at a point (x, y, z) in space is given $T(x, y, z) = x^2 + y^2 - z$. A mosquito located at $(1, 1, 2)$ desires to fly in such a direction that it will get warm as soon as possible. In what direction should it fly ?

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

Or

12. (a) A particle moves along the curve $\vec{r}\left(r^3 - 4t\right)\hat{i} + \left(t^2 + 4t\right)\hat{j} + \left(8t^2 - 3t^3\right)\hat{k}$ where t is the time. Find the magnitudes of acceleration along the tangent and normal at time $t = 2$.

(b) Find the directional derivative of $\nabla.\ (\nabla\,\phi)$ at the point $(1, -2, 1)$ in the direction of the normal to the surface $xy^2z = 3x + z^2$, where $\phi = 2x^3\,y^2\,z^4$.

13. (a) Evaluate the line integrals $\int_C \left\{\left(x^2 + xy\right) dx + \left(x^2 + y^2\right) dy\right\}$ where C is the square formed by the lines $y = \pm 1$ and $x = \pm 1$.

(b) Find the circulation of $\vec{F}$ round the curve C, where $\vec{F} = e^x \sin(y)\,\hat{i} + e^x \cos(y)\,\hat{j}$ C is the rectangle whose vertices are (0, 0), (1, 0), $\left(1, \frac{\pi}{2}\right)$ and $\left(0, \pi/2\right)$.

Or

14. Apply stoke's theorem to evaluate $\int_C \left[(x + y)\,dx + (2x - z)\,dy + (y + z)\,dz\right]$ where C is the boundary of the triangle with vertices (2, 0, 0), (0, 3, 0) and (0, 0, 6).

15. Find the interpolation the missing values in the following data :

x	:	0	5	10	15	20	25
y	:	6	10	–	17	–	31

Or

16. Use Newton's divided difference formula to find $f(7)$, if $f(3) = 24$, $f(5) = 120$, $f(8) = 502$, $f(9) = 720$, $f(12) = 1616$.

Or

17. Apply Simpson's rule to find the are a abounded by the x-axis, the lines $x = 1$, $x = 4$ and the curve through the points.

x	:	1.0	1.5	2.0	2.5	3.0	3.5	4.0
y	:	2.0	2.4	2.7	2.8	3.0	2.6	2.1

Or

18. Find the complete solution for the following :

(a) $y_{n+2} - 4y_{n+1} + 4y_n = 3n + 2^n$.

(b) $u_{x+2} - 2m\,u_{x+1} + \left(m^2 + n^2\right) u_x = m^x$.

19. (a) Using $z(n) = \frac{z}{(z-1)^2}$, show that $z(n \cos n\theta) = \frac{(z^3 + z)\cos\theta - 2z^2}{(z^2 - 2z\cos\theta + 1)^2}$.

(b) Using convolution theorem, find the inverse z-transform of $\frac{8z^2}{(2z-1)(4z-1)}$.

Or

20. (a) Solve the following using z-transforms :

$$y(n) - y(n-1) = u(n) + u(n-1).$$

(b) Given $z(u_n) = \frac{2z^2 + 3z + 4}{(z-3)^3}, |z| > 3$, show that $u_1 = 2, u_2 = 21, u_3 = 139$.

(5 × 12 = 60 marks)

F 3127 (Pages : 2) Reg. No.....

Name.....

B.TECH. DEGREE EXAMINATION, NOVEMBER 2014

Third Semester

Common to all Branches

EN 010 302—ECONOMICS AND COMMUNICATION SKILLS (AI, AN, AU, CE, CH, CS, EC, EE, EI, IC, IT, ME, MT, PE, PO, ST)

(New Scheme—2010 Admission onwards)

[Regular/Improvement/Supplementary]

Time : Three Hours Maximum : 100 Marks

Part A

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

1. What are the objectives of credit control ?
2. What is WTO ? What are its objectives ?
3. State the merits of indirect taxes.
4. List the different types of inflation.
5. Distinguish between free trade and protection.

(5 × 3 = 15 marks)

Part B

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

6. What is meant by credit creation ? What are the tendencies behind credit creation ?
7. Render your comments on the disinvestment of public sector undertakings.
8. What are the differences between a tax on income and tax on a commodity ? Why is a tax on income preferred in modern times ?
9. What are the major methods of measuring national income ? Explain.
10. State and explain the various items included in the balance of payments of a country.

(5 × 5 = 25 marks)

Turn over

Part C

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

11. What are the main functions of banks ? Explain the role played by Commercial banks in the economic development of a country.

Or

12. "Stock market can be regarded as an economic barometer." Critically examine this statement in the context of Indian economy.

13. What are the measures taken by Indian Government in the case of Globalisation, Liberalisation and Privatisation. Explain their impacts on Indian economy.

Or

14. Discuss the past, present and future prospects of Information Technology industries on Indian economy.

15. (a) Distinguish between Forward and Backward shifting of tax. Explain the impact and incidence of tax. (7 marks)

(b) Explain progressive, proportional and regressive taxes with suitable examples. (5 marks)

Or

16. (a) Explain the important problems associated with deficit financing in Indian Economy. (7 marks)

(b) Define tax evasion. Explain the reasons for the same in India. (5 marks)

17. (a) Define National Income. What are its concepts ? Explain the difficulties arising in the calculation of National Income. (7 marks)

(b) Explain the significance of national income statistics. (5 marks)

Or

18. Describe the different types of inflation and their causes. What are the steps taken by the Government to control the same ? Explain.

19. What are the different types of disequilibrium in BOP ? Explain the causes for and the methods of correcting disequilibrium in BOP.

Or

20. What are the main causes of India's adverse balance of payments ? Explain the measures that have been adopted to correct the adverse balance of payments. Critically examine India's trade policy.

[5 × 12 = 60 marks]

F 3158 (Pages : 3) Reg. No.....

Name.....

B.TECH. DEGREE EXAMINATION, NOVEMBER 2014

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)

[Regular/Improvement/Supplementary]

Time : Three Hours Maximum : 100 Marks

Part A

Answer **all** *questions.*

Each question carries 3 *marks.*

1. Distinguish between axial strain and shear strain.
2. Sketch an overhanging beam and mention its applications.
3. Define "economic section beams of uniform strength" ?
4. What are "compound pipes" ?
5. Differentiate between flexural and torsional loads.

(5 × 3 = 15 marks)

Part B

Answer **all** *questions.*

Each question carries 5 *marks.*

6. Briefly discuss the procedure for uniaxial tension test.
7. Differentiate between concentrated and uniformly distributed loading, with a neat sketch.
8. Derive an expression for deflection for cantilever with a U.D.L. over whole of its span.
9. Derive the torsional formula for circular shafts.
10. Does a long column undergo yielding or fracture when buckling load is reached ?

(5 × 5 = 25 marks)

Turn over

Part C

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

11. (a) A rigid beam is suspended from three rods having 300 mm spacing between the adjacent rods. The outer rods are 1 m long but the middle rod is made 0.5 mm shorter than the outer two rods and assembled with initial stress. Determine the stresses in the rods. The cross sectional area of each rod is $2cm^2$, and E= 200 GPa.

Or

(b) Derive an expression for the relationship among the elastic constants E, G, K and μ.

12. (a) A beam 9m long is simply supported at left end and at 6m from left end. The beam carries a concentrated load of 1.5 kN at its right end in addition to a total uniformly distributed load of 8 kN on the left 3 m of the beam. Draw shear force and bending moment diagrams giving maximum shear force and bending moment where does the point of contra flexure occur ?

Or

(b) A simply supported beam, with equal overhangs on the two ends, carries a U.D.L. of 500 N/m over whole of its length. If the supported length is 10m, find the overhangs such that (i) the bending moment is zero at the centre and (ii) the maximum negative and maximum positive bending moments are equal. Draw bending moment and shear force diagrams for cases (i) and (ii).

13. (a) A beam 300 cm long simply supported at ends carries a U.D.L over whole of its span. The beam is supported with its cross-sectional width inclined at 70° to the vertical. The cross-section is rectangular 7.5 cm deep × 5 cm wide. If the direct stress in the section is to be 80 MN/m^2, find the safe U.D.L. what is the vertical direction of the mid-span of the beam ?

Or

(b) A beam $4l$ long is simply supported at distance l and $3l$. The beam carries concentrated loads P1, P2 at distances 0, 2l and 4l respectively from one end. Find the ratio P_2/P_1 for equal deflection under the loads.

14. (a) Two shafts A and B are made of same material. Each shaft transmits the same power, shaft A running at 200 r.p.m. while the shaft B running at 20,000 r.p.m. Find the ratio of diameters of the two shafts, if the same maximum shear stress is developed in each shaft.

Or

(b) Plot a curve showing the percentage increase in maximum circumferential stress over average circumferential stress for ratios of thickness to the inside radius of a thick walled cylinder varying from 0 to 3. The cylinder has only internal pressure.

15. (a) The maximum normal stress and the maximum shear stress for a shaft of 150 mm diameter, under combined bending and torsion, were found to be 120 MN/m^2 and 80 MN/m^2 respectively. Find the bending moment and torque to which shaft is subjected. If the maximum shear stress be limited to 100 MN/m2, find by how much the torque can be increased if bending moment is kept constant.

Or

(b) For a steel column having area of cross-section of 100 cm^2 with least radius of gyration of 6.3 cm, find the safe load if the length of column is (i) 2.52 m (ii) 6.3 m and (iii) 11.34 m. Use the following set of formulae.

$$P/A = 87.5\times10^6 N/m^2 \text{ for } 0 \le l/k \le 50 \quad P/A = 105\times10^6\left(1-\frac{l}{300k}\right)N/m^2, \text{ for } 50 \le l/k \le 150.$$

$$P/A = \frac{6.4\,\epsilon}{(l/k)^2} \text{ for } l/k > 150.$$

In each of the above formula, P is the safe load. Take ϵ = 200 GN/m^2.

(5 × 12 = 60 marks)

F 3149 (Pages : 2) Reg. No.....

Name.....

B.TECH. DEGREE EXAMINATION, NOVEMBER 2014

Third Semester

Branch : Automobile Engineering/Mechanical Engineering/Production Engineering

AU 010 305
ME 010 305
PE 010 305
MT 010 305
} PROGRAMMING IN C (AU, ME, PE, MT)

(2010 Admission onwards—New Scheme)

[Regular/Improvement/Supplementary]

Time : Three Hours Maximum : 100 Marks

Write neat and efficient C programs wherever needed.

Part A

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

1. What is a preprocessor directive ? Give one example and its functioning.
2. With examples, show how one-dimensional and two-dimensional arrays are initialised.
3. How the array name is interpreted when it is passed to a function ? Give an example.
4. What are the practical differences between arrays and pointers ?
5. How random files can be implemented ?

(5 × 3 = 15 marks)

Part B

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

6. What are variables in C ? Give different ways of variable declaration.
7. Write a structure specification that includes give "float" variables called length, breadth, height, surface area and volume. Call this structure "cube".
8. When a multi-dimensional array is passed to a function, how are the formal argument declarations written ? Compare with one-dimensional arrays.
9. List out and explain various linear list operations.
10. Describe the file closing and file opening c mmands in C.

(5 × 5 = 25 marks)

Turn over

Part C

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

11. Write an interactive C program to check whether the given number n is a prime. If not, find out and print any two factors of the given number n.

Or

12. Evaluate sin (x) for x in the range 0 to 90° at intervals of 5° and print the result as a table. Use Trapezoidal rule.

13. Write an interactive C program to find the longest word in a given sentence and print the longest word.

Or

14. A square matrix is symmetric if the row elements and column elements are identical. Write a program to check if the given square matrix A is symmetric or not ?

15. Write a function SORT that arranges the elements of an array in descending order. Assume that the array does not contain more than 300 elements.

Or

16. Trace of a matrix is the sum of the leading diagonal elements of the matrix. Write a function to obtain the trace of the given matrix of order $n \times n$. Prove a matrix of order not greater than 20×20.

17. Using pointers, write a C program to add and subtract two matrices of order $m \times n$.

Or

18. Develop a linked list program to read the following information of employees :

    Employee name, date of birth, permanent number, salary. The program should display the list of employees with their salary in ascending order. Also make provision for deleting an employee.

19. Write an interactive file-oriented C program that will maintain a list of names, addresses and telephone numbers in alphabetical order with a menu that will allow the user to select any of the following features :

    (i) Add a new record.

    (ii) Delete a record.

    (iii) Exit.

Or

20. (a) Write a C program to read a line of text from a file and display the text on the screen. **(7 marks)**

    (b) Explain the various bit-wise operators in C with appropriate examples. **(5 marks)**

[5 × 12 = 60 marks]

F 3139 (Pages : 2) Reg. No.....

Name.....

B.TECH. DEGREE EXAMINATION, NOVEMBER 2014

Third Semester

Branch : Automobile Engineering/ Mechanical Engineering/Production Engineering

AU 010 304/ME 010 304/PE 010 304—METALLURGY AND MATERIAL SCIENCE

(AU, ME, PE)

(2010 Admission onwards—New Scheme)

[Regular/Improvement/Supplementary]

Time : Three Hours Maximum : 100 Marks

Part A

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

1. What is the significance of modulus of elasticity in metal cutting process ?
2. What do you mean by "dendritic growth" ?
3. What are the conditions for martensite formation ?
4. What are the effects of adding Vanadium and Cobalt on steel ?
5. What is the effect of temperature on fatigue ?

(5 × 3 = 15 marks)

Part B

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

6. Distinguish between deeper energy well band and shallow energy well band.
7. Define and explain Hall-petch equations.
8. Differentiate between austempering and martempering.
9. Write a note : Applications of cast irons.
10. How will you quantify crack growth and its effect on fatigue ?

(5 × 5 = 25 marks)

Part C

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

11. Draw and explain the BCC, FCC and HCP structures. Determine the atomic packing factor for these structures.

Or

Turn over

12. Differentiate between primary bands and secondary bands. Classify each and explain their characteristics.

13. Explain the various steps in metallographic specimen preparation. How will you determine microstructure using polishing and etching ?

Or

14. Describe the different mechanisms of diffusion. What are the applications of diffusion in mechanical engineering.

15. What is the need of alloying ? Explain the classification of alloys and solid solutions.

Or

16. Define hardness. Explain hardening process. What are the different hardness and microhardness tests ?

17. Explain the mircostructure, properties and applications of any *four* non-ferrous alloys.

Or

18. Discuss : (i) Dislocation movement and ; (ii) Nickel steels.

19. Draw and explain the S-N curve. Explain the mechanism of fatigue failure.

Or

20. Define creep. What are creep curves ? Explain the mechanism of creep deformation.

(5 × 12 = 60 marks)

F 3129 (Pages : 3) Reg. No.....

Name.....

B.TECH. DEGREE EXAMINATION, NOVEMBER 2014

Third Semester

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

[Regular/Improvement/Supplementary—ST Regular]

Time : Three Hours Maximum : 100 Marks

Part A

Answer **all** *questions.*

Each question carries 3 *marks.*

1. Define Bulk modulus.
2. Write an expression for flow rate through a *v*-notch. Briefly explain.
3. Define : Hydraulic gradient line.
4. Distinguish between steady flow and unsteady flow.
5. What do you mean by laminar sublayer ?

(5 × 3 = 15 marks)

Part B

Answer **all** *questions.*

Each question carries 5 *marks.*

6. Find the kinematic viscosity of an oil having density 980 kg/m^3 when at a certain point in the oil, the shear stress is 0.25 N/m^2 and velocity gradient 0.3/s.
7. Explain the principle of a pitot tube with a neat sketch.
8. Obtain an expression for head loss in a sudden expansion in the pipe.
9. What do you mean by the equipotential line and a line of constant stream function ?
10. Differentiate between stream-lines body and bluff body. Give examples.

(5 × 5 = 25 marks)

Turn over

Part C

Answer **either** *(a)* **or** *(b) of each question.*
Each question carries 12 *marks.*

11. (a) The velocity distribution for flow over a flat plate is given $u = \frac{3}{4}y - y^2$ in which u is the velocity in metre per second at a distance y metre above the plate. Determine the shear stress at $y = 0.15$ m. Take the dynamic viscosity of fluid as 8.6 poise.

(12 marks)

Or

(b) A rectangular tank of length 6 m, width 2.5 m height 2 m is completely filled with water when at rest. The tank is open at the top. The tank is subjected to a horizontal constant linear acceleration of 2.4 m/s^2 in the direction of its length. Find the volume of water spilled from the tank.

(12 marks)

12. (a) An orifice meter with orifice diameter 15 cm is inserted in a pipe of 30 cm diameter. The pressure ganges fitted upstream and downstream of the orifice meter give readings of 14.715 N/cm^2 and 9.81 N/cm^2 respectively. Find the rate of flow of water through the pipe in litres/s.

(12 marks)

Or

(b) Prove that for viscous flow through a circular pipe the kinetic energy correction factor is equal to 2 while momentum.

(12 marks)

13. (a) A pipeline AB of diameter 300 mm and of length 400 m carries water at the rate of 50 litres/s. The flow takes place from A to B where point B is 30 metres above A. Find the pressure at A if the pressure at B is 19.62 N/cm^2. Take $f = 0.008$.

(12 marks)

Or

(b) What do you mean by hydraulic jump ? Derive an expression for depth of hydraulic jump.

(12 marks)

14. (a) Sketch the stream lines represented by $\psi = xy$. Also find out the velocity and its direction at point (2, 3).

Or

(b) Define circulation. Sketch the flow pattern of an ideal fluid flow past a cylinder with circulation.

(12 marks)

15. (a) Oil with a free-stream velocity of 1.5 m/s flow over a thin plate 1.4 m wide and 2.2 m long. Calculate the boundary layer thickness and the shear stress at the trailing end point and determine the total surface resistance of the plate. Take specific gravity of oil as 0.80 and kinematic viscosity as 0.1 stoke.

(12 marks)

Or

(b) What do you mean by boundary layer separation ? How will you determine whether a boundary layer flow is attached flow, detached flow or on the verge of separation ?

(12 marks)

[5 × 12 = 60 marks]

F 3118 (Pages : 2) Reg. No.....

Name.....

B.TECH. DEGREE EXAMINATION, NOVEMBER 2014

Third Semester

Branch : Mechanical Engineering/Polymer Engineering/Automobile Engineering

STRENGTH OF MATERIALS AND STRUCTURAL ENGINEERING (M,P,U,)

(Prior to 2010 Admissions—Old Scheme)

[Supplementary/Mercy Chance]

Time : Three Hours Maximum : 100 Marks

Assume missing data if any suitably.

Part A

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

1. How will you determine temperature stresses in a composite bar ?
2. Determine the expression for extension in a uniformly tapering circular bar, subjected to an axial force 'P'.
3. What are statically indeterminate beams ?
4. Briefly explain the warping of cross-section of a beam due to shear.
5. State Mohr's first theroem in area moment method.
6. Briefly discuss the concept of similarity between shear force of conjugate beam and slope of real beam.
7. Derive an expression for axial torque in an open-coiled helical spring.
8. Derive an expression for volumetric strain of thin cylindrical shell.
9. Define 'Radius of gyration and 'slenderness ratio'.
10. What are the different types of reinforcements ?

(10 × 4 = 40 marks)

Part B

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

11. (a) Derive an expression for temperature stresses in a composite bar. List all the necessary assumptions.

Or

Turn over

(b) A reinforced concrete column 500 mm diameter has four steel rods of 30 mm diameter embedded in it and carries a load of 680 kN. Find the stresses in steel and concrete. Take 'E' for steel = 2.04×10^5 N/mm^2 and 'E' for concrete = 0.136×10^5 N/mm^2. Find also the adhesive force between steel and concrete.

12 (a) A beam of span 'L', simply supported at the ends, is loaded with a triangular load with intensity zero at one end to 'w' per unit length at the other end. Plot the shear force and bending moment diagrams, indicating the principal values.

Or

(b) Show that for all values of 'D/d' of a hollow circular section of outer diameter 'D' and inner diameter 'd' the ratio of maximum to average stress intensities lies between 4/3 to 2.

13. (a) A beam of length 'L' hinged at the ends, carries a couple 'μ' at a distance 'a' from the left end. Find the slope at each end and the deflection at the point of application of the couple.

Or

(b) A beam, simply supported at ends A and B is loaded with two point loads of 30 kN each at a distance of 2m and 3m respectively from end A. Determine the position and magnitude of the maximum deflection. Take E = 2×10^5 N/mm^2 and I = 7200 cm^4.

14. (a) Calculate the angle of twist for a shaft having diameter of 60 mm at one end and 70 mm at the other end in a length of 2m. Also, find the percentage error committed in calculating θ, if it is calculated on the basis if an average diameter of 65 mm.

Or

(b) Describe the characteristics of semi-elliptic springs. Derive an expression for deflection of the spring.

15. (a) A mild steel column is of hollow circular section with 100 mm as external diameter and 80 mm as internal diameter. The column is 2.4 m long, hinged at both ends and has to carry a load of 60 kN at an eccentricity of 16 mm from the geometrical axis. Calculate the maximum and minimum intensities of stresses. Also calculate the maximum possible eccentricity so that no tension is induced anywhere in the section. Take E = 2×10^5 N/mm^2.

Or

(b) A hollow cast iron column with fixed ends supports an axial load of 800 kN. If the column is 3m long and has an external diameter of 200 mm, find the thickness of metal required. Use Rankine's formula, taking a constant of $\frac{1}{6400}$ and assume a working stress of 90 N/mm^2.

(5 × 12 = 60 marks)

F 3110 (Pages : 2) Reg. No.....

Name.....

B.TECH. DEGREE EXAMINATION, NOVEMBER 2014

Third Semester

Branch : Mechanical Engineering/Automobile Engineering

THERMODYNAMICS (M,U)

(Prior to 2010 Admissions—Old Scheme)

[Supplementary/Mercy Chance]

Time : Three Hours Maximum : 100 Marks

Part A

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

1. Differentiate between closed system and isolated system.
2. Explain (i) chemical and (ii) thermal equilibrium.
3. How does the resistance thermometer measure temperature ?
4. What is meant by effective pressure ? How is it measured ?
5. How is entropy related to molecular disorder in a system ?
6. Why is the second law called a directional law of nature ?
7. What is meant by availability ?
8. Why is the Joule-Thomson coefficient zero for an ideal gas ?
9. What do you understand by triple point ?
10. Why cannot a throtting calorimeter measure the quality if the steam is very wet ?

(10 × 4 = 40 marks)

Part B

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

11. Distinguish between the terms 'change of state' 'path' and 'process'. What is a thermodynamic cycle ?

Or

12. (a) Discuss the different types of pressure transducers. (5 marks)

Turn over

(b) A turbine is supplied with steam at a gauge pressure of 1.4 MPa. After expansion in the turbine the steam flows into a condenser which is maintained at a vacuum of 710 mm Hg. The barometric pressure is 772 mm Hg. Express the inlet and exhaus steam pressures in Pascals (absolute). Take density of mercury as 13.6×10^3 kg/m^3.

(7 marks)

13. Account for the existence of two values for specific heat of a gas, and derive the relation between them and the characteristic gas constant.

Or

14. (a) Define enthalpy. How is it related to internal energy ? (6 marks)

(b) State and explain Joule's law of internal energy for an ideal gas. (6 marks)

15. Derive the Clausius inequality and explain its significance.

Or

16. A reversible heat engine receives equal quantity of heat from two thermal reservoirs at temperature T_1 and T_2, and rejects heat to a heat sink at T_3. Presuming that efficiency of this engine is 'α' times the efficiency of a reversible engine, absorbing the same amount of heat only from reservoir at T_1, and rejecting heat to sink at T_3, show that

$$\alpha = \frac{1}{2}\left[\frac{T_2 - T_3}{T_1 - T_3} + \frac{T_2}{T_3}\right] \times \frac{T_1}{T_2}$$

17. Air enters a compressor in steady flow at 140 KPa, 17°C and 70 m/s and leaves it at 350 KPa, 127°C and 110 m/s. The environment is at 100 KPa, 7°C. Calculate per kg of air (a) the actual amount of work required, (b) the minimum work required, and (c) the irreversibility of the process.

Or

18. Over a certain range of pressures and temperature the equation of a certain substance is given by the relation $V = \frac{RT}{P} - \frac{C}{T^3}$, where C is a constant. Derive an expression for (a) the change of enthalpy and (b) the change of entropy of this substance in an isothermal process.

19. Steam initially at 1.5 MPa, 300°C expands reversibility and adiabatically in a steam turbine to 40°C. Determine the ideal work output of the turbine per kg of steam.

Or

20. (a) Derive the expression for properties of mixture of gases based at Dalton's law. (6 marks)

(b) Show that for an ideal gas, the slope of the constant volume line on the T-s diagram is more than that of the constant pressure line.

(6 marks)

(5 × 12 = 60 marks)

F 3102 (Pages : 2) Reg. No.....

Name.....

B.TECH. DEGREE EXAMINATION, NOVEMBER 2014

Third Semester

Branch—Mechanical Engineering/Automobile Engineering

METALLURGY AND MATERIAL SCIENCE (M, U)

(Prior to 2010 Admissions—Old Scheme)

[Supplementary/Mercy Chance]

Time : Three Hours Maximum : 100 Marks

Part A

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

1. What is the significance of using miller indices ?
2. Give examples for line defects.
3. What is the significance of recrystallization temperature ?
4. Distinguish between the microstructures of pearlite and cementite.
5. List out the objectives of heat treatment.
6. What are the advantages of coating of metals ?
7. Briefly discuss the phenomenon of Polymorphism.
8. Write a note on testing of high speed steels for strength.
9. What do you mean by inter-crystalline fracture ?
10. Which are the notable microstructural changes due to creap ?

(10 × 4 = 40 marks)

Part B

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

11. (a) Which are the optical properties of elements ? Discuss the effect of amorphous structure on the optical properties.

Or

(b) Define point defect, line defect and surface imperfections. Explain any three types of line defects.

Turn over

12. (a) List out any *five* reasons for alloying. Discuss any six prominent alloying elements. Identify any five alloys used in aerospace applications and discuss their properties.

Or

(b) Explain the Fe-C equilibrium diagram, in detail. What are its applications ?

13. (a) Compare the performance of cast Irons for any four mechanical applications. How their microstructure influence the mechanical properties ? Explain.

Or

(b) Explain the importance of all the non-ferrous alloys in automotive applications. Elaborate on the composition, properties and typical applications of any five non-ferrous alloys.

14. (a) Distinguish between tempering and austempering. Compare the microstructures, properties and applications of a part treated using these two methods.

Or

(b) Why strengthening of metals are required ? Explain any four such mechanisms, with the governing factors and effect on the properties.

15. (a) Explain the effect of impact loading as a ductile material. How is it useful in metal working such as forging ?

Or

(b) Explain the various bonding forces and energies influencing fracture and crack propagation. Discuss their variations for different metals and alloys.

(5 × 12 = 60 marks)

F 3093 (Pages : 2) **Reg. No.....**

Name.....

B.TECH. DEGREE EXAMINATION, NOVEMBER 2014

Third Semester

Branch : Mechanical Engineering

FLUID MECHANICS (M)

(Prior to 2010 Admissions—Old Scheme)

[Supplementary/Mercy Chance]

Time : Three Hours Maximum : 100 Marks

Part A

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

1. Give examples where surface tension effects play a prominent role.
2. Give one example where pressure distribution is non-hydrostatic.
3. How can the unsteady flow be transformed to steady flow ?
4. Can Bernaulli's equation be applied to a forced vertex flow ?
5. Differentiate between momentum equation and impulse momentum equation.
6. List all the assumptions in derivative of Euler's equation.
7. What is magnus effect ?
8. What is the effect of pressure gradient an boundary layer separation ?
9. What do you mean by 'viscous flow' ?
10. Why the Prandtl's velocity distribution is called 'universal' ?

(10 × 4 = 40 marks)

Part B

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

11. The dynamic viscosity of an oil, used for lubrication between a shaft and sleeve is 6 poise. The shaft is of diameter 0.4 m and rotates at 190 r.p.m. Calculate the power lost in the bearing for a sleeve length of 90 mm. The thickness of the oil film is 1.5 mm.

Or

Turn over

12. A Caisson for closing the entrance to a dry dock is of trapezoidal form 16 m wide at the top and 10 m wide at the bottom and 6m deep. Find the total pressure and centre of pressure on the caisson if the water on the outside is just level with the top and dock is empty.

13. The velocity potential function (ϕ) is given by an expression $(\phi) = -\frac{xy^3}{3} - x^2 + \frac{x^3 y}{3} + y^2$

    (a) Find the velocity components in x and y direction.

    (b) Show that (ϕ) represents a possible case of flow.

Or

14. A cylindrical vessel 15 cm in diameter and 40 cm long is completely filled with water. The vessel is open at the top. Find the quantity of water left in the vessel, when it is rotated about its vertical axis with a speed of 300 r.p.m.

15. State the different devices that one can use to measure the discharge through a pipe and also through an open channel. Describe one of such devices with a neat sketch and explain how one can obtain the actual discharge with its help ?

Or

16. An orifice meter with orifice diameter 15 cm is inserted in a pipe of 30 cm diameter. The pressure difference measured by a mercury oil differential nanometer on the two sides of the orifice meter gives a reading of 50 cm of mercury. Find the rate of flow of oil specific gravity 0.9 when the coefficient of discharge of the meter is 0.64.

17. From fundamentals derive an expression for lift force acting an a rotating cylinder.

Or

18. A crude oil of Kinematic viscosity 0.4 stoke is flowing through a pipe of a diameter 300 mm at the rate of 300 litres per sec. Find the head lost due to friction for a length of 50 m of the pipe.

19. The difference is water surface levels in two tanks, which are connected by three pipes in series of lengths 300 m 170 m and 210 m and of diameters 300 mm, 200 mm and 400 mm respectively is 12m. Determine the rate of flow of water if coefficient of friction are 0.005, 0.0052 and 0.0048 respectively, considering minor losses also.

Or

20. Explain :

    (a) Siphon losses in pipes. (4 marks)

    (b) Hydraulic jump. (4 marks)

    (c) Chezy's equation. (4 marks)

(5 × 12 = 60 marks)

F 3084 **(Pages : 3)** **Reg. No.....**

Name.....

B.TECH. DEGREE EXAMINATION, NOVEMBER 2014

Third Semester

Branch : Mechanical Engineering and Automobile Engineering

MACHINE DRAWING—I (M, U)

(Old Scheme—Prior to 2010 Admissions—Supplementary/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 :—

   (a) Two vertical plates each 25 mm thick are bolted by means of a square bolt M12 × 70 N. Draw a sectional elevation of the assembly and indicate all dimensions.

   (b) Make a neat sectional view of (i) both internal and external I.S. recommended square thread ; and (ii) Acme thread, taking a pitch of 30 mm. Indicate all proportions in the drawing and show at least three threads.

   (c) Draw a double riveted lap joint to connect two plates 10 mm thick. Use flat head rivet.

   (2 × 7½ = 15 marks)

2. An isometric view of a flexible coupling (pin type) is shown in Fig. 1 (on page 2). Draw the top half-sectional elevation and end view of the coupling.

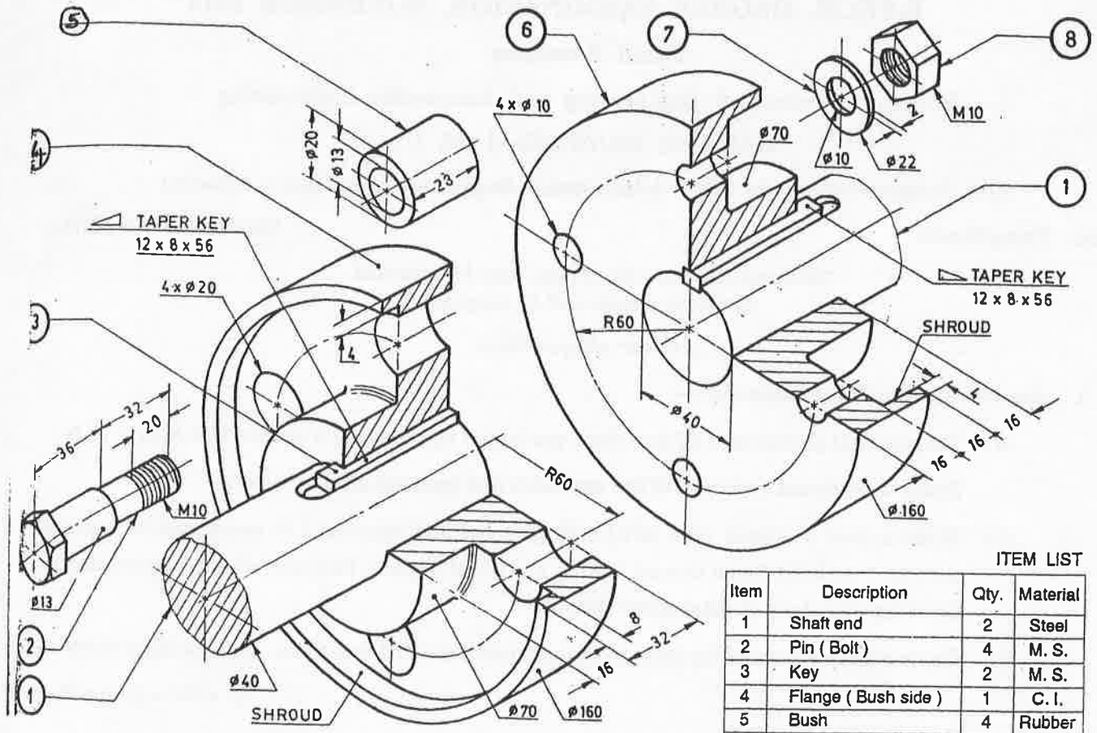
   (25 marks)

3. Fig. 2 shows (on page 3) details of steam engine piston (box type). Assemble the parts and draw

   (a) Top half-sectional elevation. (40 marks)

   (b) End view. (20 marks)

Turn over

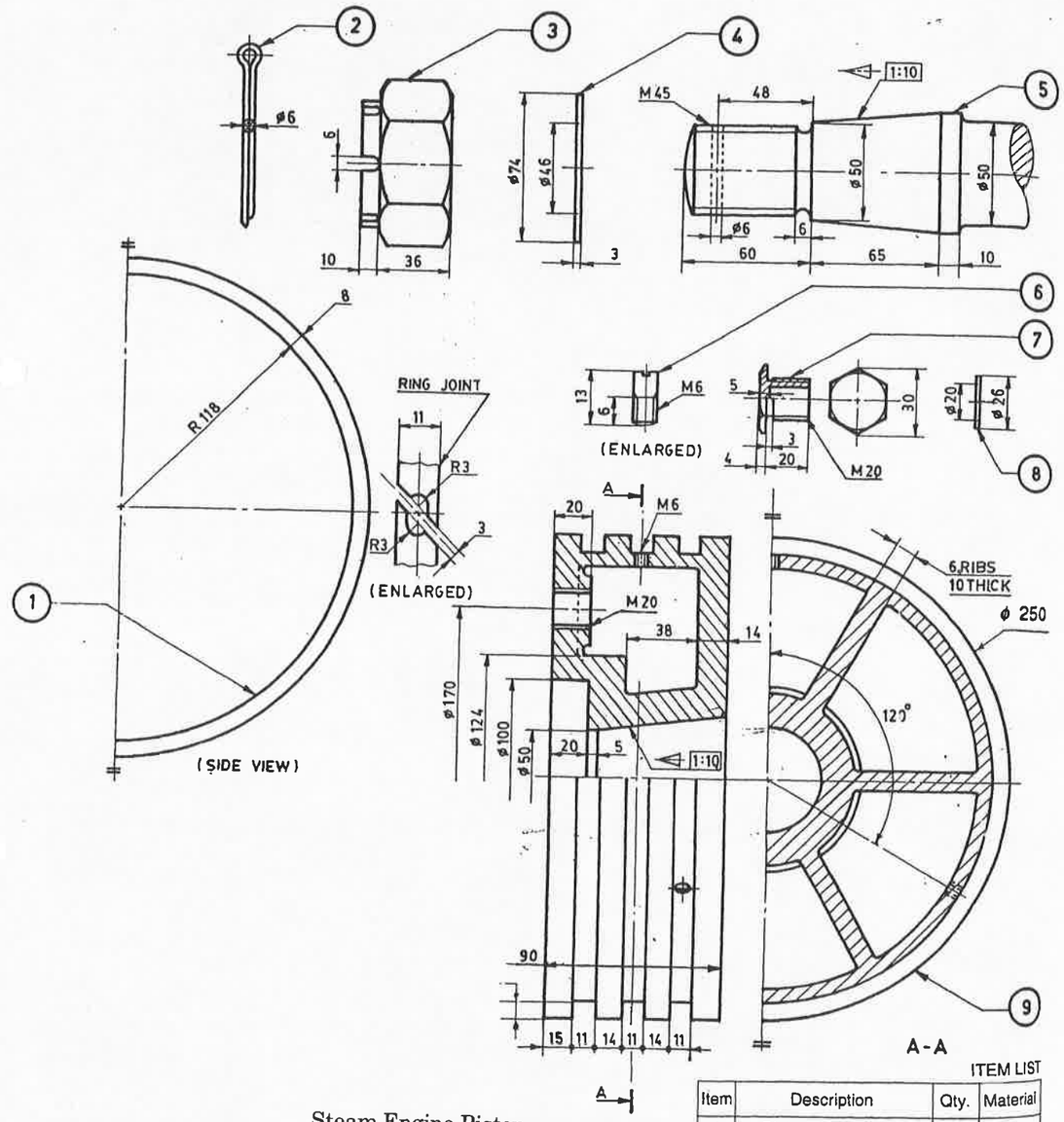


ITEM LIST

Item	Description	Qty.	Material
1	Shaft end	2	Steel
2	Pin (Bolt)	4	M. S.
3	Key	2	M. S.
4	Flange (Bush side)	1	C. I.
5	Bush	4	Rubber
6	Flange (Nut side)	1	C. I.
7	Washer	4	M. S.
8	Nut	4	M. S.

Flexible Coupling

Figure 1.



ITEM LIST

Item	Description	Qty.	Material
1	Piston ring	3	C.I.
2	Split pin	1	M.S.
3	Castle nut	1	Steel
4	Washer	1	M.S.
5	Piston rod	1	Steel
6	Peg screw	3	Brass
7	Plug screw	6	Steel
8	Washer for plug	6	Steel
9	Piston	1	C.I.

Steam Engine Piston

Figure 2.

10. (a) From the following data :

x	:	0.00	0.05	0.10	0.15	0.20	0.25
y	:	0.00000	0.10018	0.20132	0.30458	0.41075	0.52110

Evaluate $\frac{dy}{dx}$ at $x = 1.00$.

(b) Find $\frac{dy}{dx}$ and $\frac{d^2y}{dx^2}$ at $x = 1.1$ and $x = 1.6$.

x	:	1.0	1.1	1.2	1.3	1.4	1.5	1.6
y	:	7.989	8.413	8.782	9.129	9.452	9.750	10.022

(5 × 20 = 100 marks)

F 3081 ME (Pages : 4) Reg. No.....

Name.....

B.TECH. DEGREE EXAMINATION, NOVEMBER 2014

Third Semester

Branch : Common to all Branches except Computer Science and Information Technology

ENGINEERING MATHEMATICS—II (CMEPLANSUF)

(Old Scheme—Prior to 2010 admissions)

[Supplementary/Mercy Chance]

Time : Three Hours Maximum : 100 Marks

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

Module 1

1. (a) Verify the formula, $\frac{d}{dt}\left(\vec{A}\cdot\vec{B}\right) = \vec{A}\cdot\frac{d\vec{B}}{dt} + \frac{d\vec{A}}{dt}\cdot\vec{B}$ for $\vec{A} = 5t^2\hat{i} + t\,\hat{j} - t^3\hat{K}, \vec{B} = \sin t\,\hat{i} - \cos t\,\hat{j}$.

(b) A particle (position vector $\vec{r}$) is moving in a circle with constant angular velocity w. Show by vector methods, that the acceleration is equal to $-w^2\vec{r}$.

(c) If $u = x^2 + y^2 + z^2$ and $\vec{V} = x\,\hat{i} + y\,\hat{j} + z\,\hat{k}$, show that $\text{div}\left(u\vec{V}\right) = 5u$.

Or

2. (a) If $u = x + y + z$, $v = x^2 + y^2 + z^2$, $w = yz + zx + xy$, prove that :

$(\text{grad}\,u)\cdot\left[(\text{grad}(V))\times(\text{grad}(w))\right] = 0$.

(b) Show that the vector field $\vec{A}$, where $\vec{A} = \left(x^2 - y^2 + x\right)i - (2xy + y)\,\hat{j}$ is irrotational, and find the scalar ϕ such that $A = \text{grad}\,\phi$.

Module 2

3. (a) Find the work done in moving a particle once round the circle $x^2 + y^2 = 9$ in the x-y-plane if the field of force is $\vec{F} = (2x - y - z)\,\hat{i} + \left(x + y - z^2\right)\hat{j} + (3x - 2y + 4z)\,\hat{k}$.

(b) Show that $\iint_S \vec{F}\cdot\hat{n}\,dS = \frac{3}{2}$, where $\vec{F} = 4xz\,\hat{i} - y^2\,\hat{j} + yz\,\hat{k}$ and S is the surface of the cube bounded by the planes $x = 0, x = 1, y = 0, y = 1, z = 0, z = 1$.

(c) Use divergence theorem to show that $\oint_C r^n \vec{r}\cdot d\vec{S} = (n+3) = \int_V r^n dV (n \neq -3)$.

Or

4. (a) If S is any closed surface enclosing a volume V and $\vec{F} = x\,\hat{i} + 2y\,\hat{j} + 3z\,\hat{k}$, prove that

$$\iint_S \vec{F}\cdot\vec{n}\,dS = 6V$$

(b) Verify Stoke's theorem for the function $\vec{F} = x^2\,\hat{i} + xy\,\hat{j}$ integrated round the square whose sides are $x = 0, y = 0, x = a$ and $y = a$ in the plane $z = 0$.

(c) The acceleration of a particle at any time t is given by $\vec{a} = 12\cos 2t\,\hat{i} - 8\sin 2t\,\hat{j} + 16t\,\hat{k}$. If the velocity $\vec{v}$ and displacement $\vec{r}$ are zero at $t = 0$, find $\vec{v}$ and $\vec{r}$ at any time t.

Module 3

5. (a) If z_0 is the upper half of the z-plane, show that the bilinear transformation $w = e^{i\alpha}\left(\frac{z - z_0}{z - z_0}\right)$ maps the upper half of the z-plane into the interior of the unit circle at the origin in the w-plane.

(b) Find the analytic function whose real part is $e^x(x\cos y - y\sin y)$.

(c) Show that the transform $w = z + \frac{(a^2 - b^2)}{4z}$ transforms the circle of radius $\frac{a+b}{2}$, centre at the origin, in the z-plane into ellipse of semi-axes $a; b$ in the w-plane.

Or

6. (a) If $f(z)$ is an analytic function prove that $\left(\frac{\partial^2}{\partial x^2} + \frac{\partial^2}{\partial y^2}\right)\log|f'(z)| = 0$.

(b) If $w = \phi + i\,\psi$ represents the complex potential for an electric field and $\psi = x^2 - y^2 + \frac{x}{x^2 + y^2}$, determine the function ϕ.

(c) Under the transformation $w = \frac{z - i}{1 - iz}$, find the map of the circle $|z| = 1$ in the w-plane.

Module 4

7. (a) Evaluate $\Delta^2 \cos(cx + d)$, the interval of differencing being h.

(b) If $u_0 = 3, u_1 = 12, u_2 = 81, u_3 = 200, u_4 = 100, u_5 = 8$, find the value of $\Delta^5 u_0$.

(c) A function $f(x)$ is given by the following table. Find $f(0.2)$ by a suitable formula :

x :	0	1	2	3	4	5	6
$f(x)$:	178	183	190	202	218	222	230

Or

8. (a) Use Lagrange's interpolation formula to find the value of y when $x = 10$, if the following table of x and y is given :

x :	5	6	9	11
y :	12	13	14	16

(b) Apply Stirling's formula to find $f(0.42)$ if $f(0.30) = 0.1179, f(0.35) = 0.1368, f(0.40) = 0.1554, f(0.45) = 0.1736, f(0.50) = 0.1915$.

Module 5

9. (a) The following table gives the values of a function at equal intervals :

x :	0.0	0.5	1.0	1.5	2.0
$f(x)$:	0.3988	0.3522	0.2421	0.1290	0.0541

Evaluate $f(1.8)$, $f'(1.5)$ and $\int_0^2 f(x)\,dx$, stating the formula used. (15 marks)

(b) Solve $u_{n+2} - 7u_{n+1} + 10u_n = 12e^{3n} + 4^n$. (5 marks)

Or