F 3207 (Pages : 2) Reg. No.....

Name.....

B.TECH. DEGREE EXAMINATION, NOVEMBER 2014

Fifth Semester

Branch : Mechanical Engineering/Automobile Engineering

THERMAL ENGINEERING – I (M, U)

(Old Scheme—Prior to 2010 admissions)

[Supplementary/Mercy Chance]

Time : Three Hours Maximum : 100 Marks

Use of Mollier diagrams and steam tables are permitted.

Part A

Answer **all** *questions.*

Each question carries 4 *marks.*

1. What is meant by temperature of heat addition ?
2. Why is Carnot cycle not practicable for a steam power plant ?
3. How will you accurately estimate mass flow rate of a steam nozzle ?
4. Discuss how to choose throat area of a steam nozzle.
5. What is a back pressure turbine ?
6. Distinguish between re-heating and regeneration.
7. Briefly discuss solar water heating.
8. What are solar receivers ?
9. Draw a neat sketch of coal burner.
10. Write a note on coal handling techniques.

(10 × 4 = 40 marks)

Part B

Answer **all** *questions.*

Each full question carries 12 *marks.*

11. A steam power station uses the following cycle : Steam at boiler outlet – 150 bar, 550°C. Reheat at 40 bar to 550°C, Condenser at 0.1 bar.

    Using the Mollier chart and assuming ideal processes, find (a) quality at turbine exhaust ; (b) cycle efficiency ; (c) steam rate.

Or

12. What is Rankine cycle ? Explain Rankine cycle for wet, dry and superheated steam.

Turn over

13. Discuss the characteristics of a super saturated flow. What is the effect of friction on mass flow rate in a steam nozzle ?

Or

14. What do you mean by governing of steam turbine ? Discuss the techniques for governing of steam turbines.

15. A gas turbine plant operates on the Brayton cycle using an optimum pressure ratio for maximum network output and a regenerator of 100% effectiveness. Derive expressions for network output per kg of air and corresponding efficiency of the cycle.

Or

16. Discuss different combustion chambers of gas turbine. What are cylindrical, annular and industrial combustion chambers ? Explain.

17. Explain the working of liquid flat plate collectors. Discuss how to perform a detailed thermal analysis.

Or

18. Discuss the steps in solar thermal power generation. Explain with a block diagram.

19. With neat sketches, explain the working of diesel power plant. Discuss the energy interactions involved.

Or

20. Discuss the working of the following :

    (i) Cooling tower.

    (ii) Chimneys.

    (iii) Precipitators.

(4 + 4 + 4 = 12 marks)

[5 × 12 = 60 marks]

F 3621 (Pages : 4) Reg. No.....

Name.....

B.TECH. DEGREE EXAMINATION, NOVEMBER 2014

Fifth Semester

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

EN 010 501-A—ENGINEERING MATHEMATICS—IV

(Regular/Improvement/Supplementary)

[New Scheme—2010 Admission onwards]

Time : Three Hours Maximum : 100 Marks

Part A

Answer **all** *questions.*

Each question carries 3 *marks.*

1. An electrostatic field in the xy-plane is given by the potential function $\phi = 3x^2y - y^3$, find the stream function.
2. Find the image of the circle $|z-1|=1$ in the complex plane under the mapping $w=\frac{1}{z}$.
3. Find the real root of the equation $x^2 - 2x - 5 = 0$ by the method of false position correct to 3 decimal places.
4. Solve $\frac{dy}{dx} = 1 - y, y(0) = 0$ in the range $0 \le x \le 3$ by taking $h = 0.1$ by the modified Euler's method.
5. Construct the dual of the L.P.P.

   Maximize $z = 4x_1 + 9x_2 + 2x_3$

   subject to $2x_1 + 3x_2 + 2x_3 \le 7, 3x_1 - 2x_2 + 4x_3 = 5 ; x_1, x_2, x_3 \ge 0.$

($5 \times 3 = 15$ marks)

Part B

Answer **all** *questions.*

Each question carries 5 *marks.*

6. Show that $\sqrt{|xy|}$ is not analytic at the origin, although Cauchy-Riemann equations are satisfied at the point.
7. Find the Taylor's series expansion of $f(z) = \frac{2z^3+1}{z^2+z}$ about $z = i$.

Turn over

8. Find by the iteration method, a real root of $2x - \log_{10} x = 7$.

9. Solve $\frac{dy}{dx} = x + z$, $\frac{dz}{dx} = x - y^2$ with $y(0) = 2$, $z(0) = 1$ to get $y(0.1)$, $y(0.2)$, $z(0.1)$ and $z(0.2)$ approximately by Taylor's series.

10. Using graphical method, solve the following L.P.P.

Maximize $z = 2x_1 + 3x_2$

subject to $x_1 - x_2 \leq 2$

$x_1 + x_2 \geq 4$,

$x_1, x_2 \geq 0$.

(5 × 5 = 25 marks)

Part C

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

11. (a) Determine the analytic function $f(z) = u + iv$ if $u - v = \frac{\cos x + \sin x - e^{-y}}{2(\cos x - \cosh y)}$ and $f(\pi/2) = 0$.

(6 marks)

(b) Find the bilinear transformation which maps the points $z = 1, i, -1$ into the points $w = i, 0, -i$. Hence find the image of $|z| < 1$.

(6 marks)

Or

12. (a) Prove that the function $f(z)$ defined by $f(z) = \frac{x^3(1+i) - y^3 1 - i}{x^2 + y^2}$, $z \neq 0$ and $f(0) = 0$ is continuous and the Cauchy-Riemann equations are satisfied at the origin, yet $f'(0)$ does not exist.

(6 marks)

(b) Show that the transformation $w = \frac{3 - z}{z - 2}$ transforms the circle with center $\left(\frac{5}{2}, 0\right)$ and radius $\frac{1}{2}$ in the z-plane into the imaginary axis in the w-plane and the interior of the circle into the right half of the plane.

(6 marks)

13. (a) Evaluate $\int_C \frac{z-3}{z^2+2z+5} dz$, where C is the circle (i) $|z| = 1$; (ii) $|z + 1 - i| = 2$; (iii) $|z + 1 + i| = 2$.

(8 marks)

(b) Determine the poles of the function $f(z) = \frac{x^2}{(z-1)^2 (z+2)}$ and the residue at each pole.

(4 marks)

Or

14. (a) Find the Laurent's expansion of $f(z)=\frac{7z-2}{(z+1)\,z\,(z-2)}$ in the region $1<|z+1|<3$. (5 marks)

(b) Show the method of residues, that $\int_0^{\pi}\frac{a}{a^2+\sin^2\theta}\,d\theta=\frac{\pi}{\sqrt{1+a^2}}$. (7 marks)

15. (a) Using Newton's iterative method, find the real root of $x\log_{10}x = 1.2$ correct to five decimal places.

(6 marks)

(b) Solve by Gauss-Seidel method :

$$10x + 2y + z = 9$$
$$2x + 20y - 2z = -44$$
$$-2x + 3y + 10z = 22.$$

(6 marks)

Or

16. (a) Find a real root of the equation $x^3 - x - 11 = 0$, correct to 4 decimal places using the bisection method.

(6 marks)

(b) Find the root of the equation $\cos x - xe^x = 0$ by secant method correct to four decimal places.

(6 marks)

17. Using Runge-Kutta method of fourth order, solve $\frac{dy}{dx} = yz + x$, $\frac{dz}{dx} = xz + y$ given that $y(0) = 1$, $z(0) = -1$ for $y(0.2)$, $z(0.2)$.

Or

18. Apply Milne's method, to find a solution of the differential equation $y' = x - y^2$ in the range $0 \le x \le 1$ for the boundary condition $y = 0$ at $x = 0$.

19. (a) What is the maximization transport problem ? How do you solve it ? (3 marks)

(b) Using simplex method solve the LPP

Maximize $z = 5x_1 + 3x_2$

subject to $x_1 + x_2 \le 2$

$5x_1 + 2x_2 \le 10$

$3x_1 + 8x_2 \le 12,$

$x_1, x_2 \ge 0.$

(9 marks)

Or

20. Find the initial basic feasible solution of the following transportation problem by Vogel's approximation method (VAM). Here, F_1, F_2 and F_3 are factories, and W_1, W_2 and W_3 are warehouses.

	W_1	W_2	W_3	W_4	*Production of Factories*
F_1	21	16	25	13	11
F_2	17	18	14	23	13
F_3	32	27	18	41	19
Capacity of the warehouse	6	10	12	15	43

(5 × 12 = 60 marks)

F 3625 (Pages : 2) Reg. No.....

Name.....

B.TECH. DEGREE EXAMINATION, NOVEMBER 2014

Fifth Semester

Branch : Mechanical Engineering/Automobile Engineering

AU 010 502 / ME 010 502 – COMPUTER AIDED DESIGN AND MANUFACTURING (AU, ME)

(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. What is circle drawing?
2. What are the advantages and disadvantages of numerical control?
3. Distinguish feed world and tool world.
4. Define CAPP.
5. Define Pneumatic systems.

(5 × 3 = 15 marks)

Part B

Answer **all** *questions.*

Each question carries 5 *marks.*

6. Explain the elements of interactive graphics.
7. Write down the needs of PLC.
8. Write a short note on CNC languages.
9. Give the advantages of FMS.
10. Explain briefly about the sensors usage in robotics.

(5 × 5 = 25 marks)

Part C

Answer **all** *questions.*

Each question carries 12 *marks.*

11. (a) CAD helps in integrating CAM – Justify this statement.

Or

(b) Explain the various operations involved in 2D transformation.

Turn over

12. (a) What is a digitizer ? Explain how it can be use for transferring paper drawing to CAD system.

Or

(b) Explain the following NC motion control systems : (a) Point to point ; (b) Straight cut ; and (c) Contouring.

13. (a) Differentiate between Numeric Control (NC), Computer Numerical Control (CNC) and Direct Numerical Control (DNC) systems of CAM.

Or

(b) Explain APT language structure in detail.

14. (a) Discuss a few applications of FMS in detail.

Or

(b) Explain the concept of FMS with a typical sketch describing its components.

15. (a) Explain any *one* robot applications in detail.

Or

(b) Explain inspection and welding with suitable diagram.

(5 × 12 = 60 marks)

F 3640 (Pages : 2) Reg. No.....

Name.....

B.TECH. DEGREE EXAMINATION, NOVEMBER 2014

Fifth Semester

Branch : Production Engineering / Mechanical Engineering

ME 010 503 / PE 010 503 – ADVANCED MECHANICS OF MATERIALS (ME, PE)

(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. Define the term state of stress at a point.
2. Explain cantilever beam.
3. What are the stresses in thick cylinder under axisymmetric load?
4. Write a short note on complementary energy.
5. Write a short note on shear flow

(5 × 3 = 15 marks)

Part B

Answer **all** *questions.*

Each question carries 5 *marks.*

6. Explain the analogy between stress and strain tensors.
7. Explain Saint Venant's principle for end effects.
8. Explain Interference fit.
9. Explain Castigliano's first and second theorems.
10. Explain Prandtle's Method.

(5 × 5 = 25 marks)

Part C

Answer **all** *questions.*

Each question carries 12 *marks.*

11. The state of stress at a point is characterized by the following rectangular stress components, $\sigma_x = 30$, $\sigma_y = 20$, $\sigma_z = 15$, $\tau_{xy} = -10$, $\tau_{yz} = -15$, $\tau_{zx} = -20$. Find the values of principal stress and their directions.

Or

Turn over

12. A mild steel bar of 50 mm diameter is subjected to an axial load of 100 KN. Calculate the normal and shear stresses on a plane making an angle of 30° with the direction of applied load.

13. Explain compatibility conditions.

Or

14. An alloy steel cylinder has a 100 mm internal diameter and 400 mm outside diameter. If it is subjected to an internal pressure of 150 MPa, (Outside pressure = 0). Determine the radial and tangential stress distribution and plot them.

15. A thin steel ring of diameter 1.5 m diameter has elastic limit tensile stress of the material as 250 MN/m^2. Find the speed at which the thin steel ring will fail. Take $\rho = 8000\ Kg/m^3$.

Or

16. How will you use theories of failure for thick cylinders? Explain with neat sketches.

17. Explain the special cases of a body subjected to shear force, bending moment and torque.

Or

18. Explain Maxwell reciprocal theorem and Strain energy deformation.

19. Derive the expression for torsion in a rectangular shaped shaft.

Or

20. Derive the expression for torsion of thin walled open and closed sections.

(5 × 12 = 60 marks)

F 3656 (Pages : 2) Reg. No.....

Name.....

B.TECH. DEGREE EXAMINATION, NOVEMBER 2014

Fifth Semester

Branch : Mechanical Engineering / Automobile Engineering

ME 010 505 /AU 010 505 – I.C. ENGINES AND COMBUSTION (ME, AU)

(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. Discuss the significance of firing order in S.I. engines.
2. What are the additives commonly used in Lubricants?
3. List the factors influencing flame propagation during combustion.
4. Define Ignition Lag in S.I. engines.
5. What are after treatment devices? Why they are used in modern I.C. engines?

(5 × 3 = 15 marks)

Part B

Answer **all** *questions.*

Each question carries 5 *marks.*

6. Briefly describe any *five* types of Alternative fuels used in engines.
7. With a neat sketch, explain the methods used for Ignition advance.
8. Write the combustion equation for a general fuel of $C_x H_y$ type. What are the requirements for complete combustion?
9. What are the different types of air motions in the engine cylinder? What is the significance of each?
10. How will you calculate the frictional power in S.I. engine and C.I. engine? Explain the methods used.

(5 × 5 = 25 marks)

Turn over

Part C

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

11. (a) With a neat sketch, explain the working of a Wankel engine.

    (b) Explain the working of a Stratified charge engine.

Or

12. With a neat sketch, explain the working of a conventional ignition system in an S.I. engine. What are its disadvantages? What is the advantage of electronic ignition system over other systems?

13. (a) With a neat sketch, explain the working of a Constant Venturi carburetor.

    (b) Write short notes on : MPFI, CRDI and GDI systems.

Or

14. (a) What are the methods used for lubricating an engine?

    (b) With a neat sketch, explain the working of a fuel injector unit.

15. (a) Explain normal combustion and abnormal combustion in engines.

    (b) Explain pre-ignition and effects of pre-ignition.

Or

16. (a) Explain Supercharging and Turbo-charging in engines.

    (b) With a neat sketch, explain the pressurized cooling system with its advantages.

17. (a) Explain combustion phenomenon in C.I. engines and factors affecting combustion.

    (b) Mention the types of combustion chambers used to achieve swirl, squish and tumble motions inside the cylinder.

Or

18. (a) Explain the stages of combustion in S.I. engine with Pressure-crank angle diagram.

    (b) What are the different types of combustion chamber design for S.I. engines?

19. (a) What are the effects of pollutants from C.I. engines on environment and human life? How can these be controlled?

    (b) What are regenerative trap? Why they are used in engines?

Or

20. (a) Explain in detail the method used to measure the indicated power in S.I. and C.I. engines.

    (b) What are the major causes for the formation of CO in the exhaust of I.C. engines?

(5 × 12 = 60 marks)

F 3666 (Pages : 2) Reg. No.....

Name.....

B.TECH. DEGREE EXAMINATION, NOVEMBER 2014

Fifth Semester

Branch : Mechanical Engineering/Automobile Engineering

ME 010 506/AU 010 506 : THERMODYNAMICS (ME, AU)

(New Scheme—2010 Admission onwards)

[Regular/Improvement/Supplementary]

Time : Three Hours Maximum : 100 Marks

Use of steam tables and Psychometric chart are permitted.

Part A

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

1. What is pressure transducer ?
2. Does heat transfer inevitably cause a temperature rise ?
3. Write Kelvin Planck statement.
4. Define volume expansivity.
5. What is pure substances ?

(5 × 3 = 15 marks)

Part B

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

6. What is the scope of classical thermodynamic ?
7. What is indicator diagram ?
8. Establish the equivalence of Kelvin Planck and Clausius statement.
9. Discuss Helmontz function.
10. What is the critical state ? Explain the terms critical pressure, critical temperature.

(5 × 5 = 25 marks)

Part C

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

11. Prove that $C_p - C_v = R$. (6 marks)

Explain different types of system in brief. (6 marks)

Or

Turn over

12. (a) Discuss the concept of continuum. Define density and pressure using the concept. (6 marks)

(b) Write down the Van der Waals equation of state. (6 marks)

13. (a) Explain different types of work transfer. (6 marks)

(b) Show that enthalpy of a fluid before throattling is equal to that after throttling. (6 marks)

Or

14. (a) Explain specific heat, internal energy and enthalpy. (6 marks)

(b) 1.5 kg. of liquid having a constant specific heat of 2.5 kJ/kg. K is stirred in a well-insulated chamber causing the temperature to rise by 15° C. Find ΔE and W for the process. (6 marks)

15. (a) Explain third law of thermodynamics. (6 marks)

(b) Explain clausius inequality. (6 marks)

Or

16. (a) Explain Entropy. (6 marks)

(b) An ice-making plant produces ice at atmospheric pressure and at 0° C from water. The mean temperature of the cooling water circulating through the condenser of the refrigerating machine is 18° C. Evaluate the minimum electrical work in kWh required to produce 1 tonne of ice (The enthalpy of fusion of ice at atmospheric pressure is 333.5 kJ/kg). (6 marks)

17. Derive Maxwell equation.

Or

18. Derive :

$$C_p - C_v = T\left(\frac{\partial V}{\partial T}\right)_p \cdot \left(\frac{\partial P}{\partial T}\right)_v .$$

19. Draw the phase equilibrium diagram for a pure substance on *p*-T coordinates. Why does the fusion line for water have negative slope ?

Or

20. A rigid vessel contains 1 kg. of a mixture of saturated water and saturated steam at a pressure of 0.15 MPa. When the mixture is heated, the state passes through the critical point.

Determine :

(a) The volume of the vessel.

(b) The mass of liquid and vapour in the vessel initially.

(c) The temperature of the mixture when the pressure has risen to 3 MPa.

(d) The heat transfer required to produce the final state.

(5 × 12 = 60 marks)

F 3188 (Pages : 2) Reg. No.....

Name.....

B.TECH. DEGREE EXAMINATION, NOVEMBER 2014

Fifth Semester

Branch : Mechanical Engineering

THEORY OF MACHINES–II (M)

(Old Scheme—Supplementary/Mercy Chance)

(Prior to 2010 Admissions)

Time : Three Hours Maximum : 100 Marks

Part A

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

1. What is a free body diagram ?
2. Define dynamic force analysis.
3. What are Goremors ?
4. Draw the sketch of a flywheel.
5. Define centre of percussion.
6. What is "reversed" effective force ?
7. List the applications of gyroscopic stabilization.
8. Why are epicyclic trains important ?
9. Write a short note on classification of followers ?
10. What are convex cams ?

(10 × 4 = 40 marks)

Part B

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

11. Derive an expression for displacement, velocity and acceleration of the piston of a reciprocating engine in terms of crank radius, connecting rod length and crank angle 'θ'.

Or

12. Explain the dynamic force analysis of four bar chain. Discuss how to take into account, inertia forces.

13. Discuss all the terminology of governors. With neat sketch, explain spring controlled governors of gravity type.

Or

14. The arms of a porter governor are 31.25 cm long and are pivoted on the axis of rotation. Mass of each ball is 7.5 kg. and the central load is 45 kg. Determine the equilibrium speed corresponding to radii of 20 cm. and 25 cm.

15. Explain the energy saved in a flywheel. Discuss all aspects of application of flywheel to a punching press.

Or

16. Discuss the conditions of dynamic equivalence of two systems. Explain centre of percussion and Kinetic equivalence of the systems. Give a practical example.

17. Explain gyroscopic applied torque and reaction torque. Explain which one is more significant as regards the reaction on the bearing of a shaft on which spinning disc is rotating.

Or

18. A small high speed ship is driven by a turbine, rotor of which has a moment of inertia of 20 kgm^2 and is running at 3000 r.p.m. in clockwise direction, when viewed from the bar. The ship is speeding at 72 km/hr. taking a right turn round a curve of 600 m. radius. Determine gyroscopic couple applied to the ship and its effects.

19. Explain the construction of cam profile for simple harmonic motion to the roller follower of the cam. Also derive expression for minimum velocity and maximum acceleration of the follower.

Or

20. A dwell-rise-dwell cam has a rise of 3.75 cm in 150 degrees of cam rotation. The motion to the follower is constant velocity or uniform displacement. Plot and discuss the displacement, velocity and accelerations of the follower for rotational speed of 300 r.p.m.

(5 × 12 = 60 marks)

F 3164 (Pages : 3) Reg. No.....

Name.....

B.TECH. DEGREE EXAMINATION, NOVEMBER 2014

Fifth Semester

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

ENGINEERING MATHEMATICS – IV (CMELPASUF)

(Old Scheme—Supplementary/Mercy Chance)

[Prior to 2010 admissions]

Time : Three Hours Maximum : 100 Marks

Answer **all** *questions.*
Each full question carries 20 *marks.*

1. (a) Using Cauchy's integral formula, evaluate $\int_C \frac{z+1}{z^2+2z+5}\,dz$ where C is the circle $|z+1-i|=2$, integration being taken in the counter clockwise direction.

   (b) Expand $\frac{1}{z(z-1)(z-2)}$ in Laurent's series for $|z|>2$.

Or

2. (a) Evaluate $\oint_C \frac{z}{z(z-1)(z-2)^2}\,dz$, where C is the circle $|z-2|=\frac{1}{2}$.

   (b) Evaluate by contour integration $\int_0^\infty \frac{x^2\,dx}{(x^2+9)(x^2+4)^2}$.

3. (a) Find a root of the equation $x^6-x^4-x^3=1$ correct to three decimal places using Regula Falsi method.

   (b) Solve by Gauss-Jacobi's method :

$$\begin{aligned} 54x+y+z &= 110 \\ 2x+15y+6z &= 72 \\ -x+6y+27z &= 85. \end{aligned}$$

Or

Turn over

4. (a) Find a root of $x^3 - 4x - 9 = 0$ correct to three decimal places using Bisection method.

(b) Solve by Gauss-Seidel method :

$$10x_1 - 5x_2 - 2x_3 = 3$$
$$4x_1 - 10x_2 + 3x_3 = -3$$
$$x_1 + 6x_2 + 10x_3 = -3.$$

5. (a) Using Taylor's series method solve $\frac{dy}{dx} = x^2 - y, y(0) = 1$ at $x = 0.1, 0.2, 0.3$ and 0.4.

(b) Use Runge-Kutta method to solve $\frac{dy}{dx} = x^2 - y^2, y(1) = 1.5$ at $x = 1.2$ in steps of 0.1.

Or

6. (a) Taking $h = 0.05$ and applying modified Euler's method, solve the initial value problem $y' = x^2 + y, y(0) = 1$, obtain $y(0.1)$.

(b) Using Milne's predictor-corrector method solve the initial value problem $\frac{2dy}{dx} = (1 + x^2)y^2, y(0) = 1$ and obtain $y(0.4)$. Use the solution values :

$$y(0.1) = 1.06, y(0.2) = 1.12, y(0.3) = 1.21.$$

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

(b) Solve $x_{n+1} - y_n = 1, y_{n+1} - x_n = 0, x_0 = 0, y_0 = -1$.

Or

8. (a) Find the z-transform of :

(i) $e^{4t} \sin 3t$.

(ii) $(t + T)e^{-(t+T)}$.

(iii) $4^n + \left(\frac{1}{2}\right)^n + u(n-3)$.

(b) Find the inverse z-transform of $\frac{4z^2 - 2z}{z^3 - 5z^2 + 8z - 4}$.

9. (a) Solve the following L.P.P. by simplex method :

Maximize $Z = x_1 + 2x_2 + 3x_3 - x_4$

subject to
$$x_1 + 2x_2 + 3x_3 = 15$$
$$2x_1 + x_2 + 5x_3 = 20$$
$$x_1 + 2x_2 + x_3 + x_4 = 10.$$

(b) Solve the following transportation problem :

		Destination D_1	D_2	D_3	D_4	Avail
Origin	O_1	5	3	6	2	19
	O_2	4	7	9	1	37
	O_3	3	4	7	5	34
Require		16	18	31	25	

Or

10. (a) Using the duality theory, solve the L.P.P. :

Minimize $Z = 3x_1 - 2x_2 + 4x_3$

subject to
$$3x_1 + 5x_2 + 4x_3 \geq 7$$
$$6x_1 + x_2 + 3x_3 \geq 4$$
$$7x_1 - 2x_2 - x_3 \leq 10$$
$$x_1, x_2, x_3 \geq 0.$$

(b) Apply Vogel's method to find the transportation cost to the following transportation model :

	1	2	3	4	
1	10	2	20	11	15
2	12	7	9	20	25
3	4	14	16	18	10
	5	15	15	15	

(5 × 20 = 100 marks)

F 3199 (Pages : 3) Reg. No.....

Name.....

B.TECH. DEGREE EXAMINATION, NOVEMBER 2014

Fifth Semester

Branch : Mechanical Engineering / Automobile Engineering

MECHATRONICS AND CONTROL SYSTEMS (M, U)

(Old Scheme—Supplementary/Mercy Chance)

[Prior to 2010 Admissions]

Time : Three Hours Maximum : 100 Marks

Part A

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

1. State any *four* properties of operational amplifier, giving their ideal values.
2. What are the advantages of pneumatic system over hydraulic system ?
3. What are the advantages of digital communication compared to analog communication ?
4. What is OCR ? Give its storage and reading principle.
5. Describe a practical closed loop system and an open loop control system.
6. Give the general equation for transfer function of a system and define the following :—
   (a) Order. (b) Zeros. (c) Poles.
7. Distinguish between steady state and transient responses of a system.
8. Using Routh's criteria determine how many roots are in the right half of s-plane $s^3 - 4s^2 + s + 6 = 0$.
9. Define gain margin and phase margin with respect to a Bode diagram.
10. What is a polar plot ? Explain the steps of obtaining the polar plot ?

($10 \times 4 = 40$ marks)

Part B

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

11. What is modulation ? What is its need ? Explain different kinds of modulation bringing out their important features.

Or

12. Describe different types of control valves and their fields of applications.

Turn over

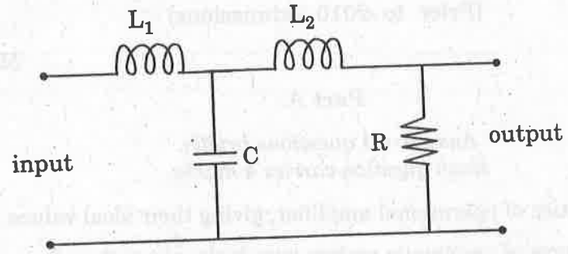
13. What are programmable Logic controllers ? Explain their principle, with the help of necessary diagrams.

Or

14. Explain, with necessary diagrams, the method of data storage and retrieval from :

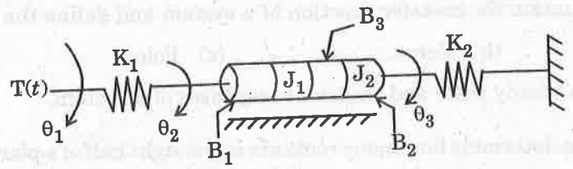
(a) DVD. (b) ROM. Compare their performances.

15. Determine the transfer function of the system shown below :—



Or

16. Obtain transfer function of the rotational mechanical system shown below :



17. A second order system has a transfer function $\frac{25}{s^2+6s+25}$. Find its rise time, peak time, peak overshoot and settling time if subjected to unit step input. Also calculate expression for its output response.

Or

18. (a) For a unity feedback system whose open-loop transfer function is $G(s)=\frac{50}{(1+0.1s)(1+2s)}$.

Find the position, velocity and acceleration error constants.

(6 marks)

(b) Find the steady state error and error constant for unit step input of the system

$G(s)=\frac{40}{s(s+2)(s+4)}, H(s)=\frac{1}{s}$.

(6 marks)

19. The closed loop transfer function of a system is $T(s)=\frac{K}{s^4+6s^3+30s^2+60s+K}$.

(a) Determine the range in which K must lie for which the system is to be stable.

(b) What should be the upper limit on K if all the poles of T (s) are required to lie on the left on the line $\sigma=-1$?

Or

20. Sketch the root locus of the open-loop transfer function $G(s)=\frac{K(s+2)}{(s+3)^2(s^2+2s+17)}$ comment on the stability.

[5 × 12 = 60 marks]

F 3644 (Pages : 3) Reg. No.....

Name.....

B.TECH. DEGREE EXAMINATION, NOVEMBER 2014

Fifth Semester

Branch : Automobile Engineering / Mechanical Engineering

ME 010 504 /AU 010 504 – KINEMATICS OF MACHINERY (AU, ME)

(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. Sketch and define Transmission angle of a four-bar mechanism. What are the worst values of transmission angle?
2. Explain how the direction of Coriolis acceleration is obtained.
3. What are precision points in synthesis of mechanisms?
4. What is the significance of pressure angle in cam?
5. What are the advantages and disadvantages of involute gear tooth profile?

(5 × 3 = 15 marks)

Part B

Answer **all** *questions.*

Each question carries 5 *marks.*

6. Explain mechanical advantage and transmission angle related to four-mechanism.
7. What are the properties of instantaneous center?
8. Explain Overlay method.
9. Define undercutting in cam. How it occurs?
10. What are the methods to avoid interference?

(5 × 5 = 25 marks)

Part C

Answer **all** *questions.*

Each full questions carries 12 *marks.*

11. Explain the working a quick return motion mechanism. Also derive an equation for the ratio of time taken for return stroke and forward strokes.

Or

Turn over

12. The crank of a slider crank mechanism rotates clockwise at a constant speed of 300 r.p.m. The crank is 150 mm and the connecting rod is 600 mm long. Determine : (a) Linear velocity and acceleration of the midpoint of the connecting rod ; and (b) Angular velocity and angular acceleration of the connecting rod, at a crank angle of 45° from inner dead center position.

13. (a) Derive the expressions for the velocity and acceleration of the piston of a reciprocating engine mechanism.

(b) A cam with a minimum radius of 25 mm, rotating clockwise at a uniform speed is to be designed to give motion to a roller follower, at the end of a valve rod, as describe below :

(i) To raise the valve through 50 mm during 1200 rotation of the cam.

(ii) To keep the valve fully raised through next 30°.

(iii) To lower the valve during next 60° and

(iv) To keep the valve closed during rest of the revolution.

The diameter of the roller is 20 mm and the diameter of the cam shaft is 25 mm. The line of the stroke is offset by 15 mm from the axis of the cam shaft. The displacement of the valve, while being raised and lowered is to take place with SHM.

1. Draw the displacement diagram. Sketch roughly the shapes of velocity and acceleration diagrams.
2. Draw the profile of the cam.

Or

14. Explain Coriolis component of acceleration. Derive the expression for Coriolis component of acceleration. Sketch its possible directions.

15. Explain two position and three position graphical synthesis of slider crank mechanism.

Or

16. Synthesis a four bar linkage that will in one of its position, satisfy the following values for the angular velocities and accelerations :

$y = x^{1.3}$, $1 \leq x \leq 5$ using Chebyshev spacing for three precision points. Take $\varphi_o = 30°$, $\psi_o = 60°$, $\Delta\varphi = \Delta\psi = 90°$.

17. Discuss the various aspects of kinematics of a circular are cam with flat faced follower.

Or

18. A cam drives a flat reciprocating follower the following manner: During first 120° rotation of the cam, follower moves outwards through a distance of 20 mm with SHM. The follower dwells during next 30° of the cam rotation. During next 120° of cam rotation, the follower moves inwards with SHM. The follower dwells for next 90° of cam rotation. The minimum radius of the cam is 25 mm. Draw the profile of the cam.

19. Two unequal gears of involute profile are to give required gear ratio. Derive an expression for the minimum number of teeth required for the pinion in order to avoid interference.

Or

20. (i) State and prove the law of gearing.

(ii) Show that the involute curves as the profile of mating gears satisfy the law of gearing.

(4 + 8 = 12 marks)

[5 × 12 = 60 marks]