F 6425 (Pages : 2) Reg. No.....

Name.....

B.TECH. DEGREE EXAMINATION, NOVEMBER 2013

Fifth Semester

Branch : Mechanical Engineering/Automobile Engineering

MECHATRONICS AND CONTROL SYSTEMS (MU)

(Old Scheme—Supplementary/Mercy Chance)

Time : Three Hours Maximum : 100 Marks

Part A

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

1. What is sampling frequency ? How does it affect the quality of sampled signal ?
2. Differentiate between thermocouples and thermopiles.
3. What is program counter register ?
4. Explain the significance of physical layer in computer networks.
5. Explain the working of an optical mouse.
6. Explain adaptive control system.
7. What are stepper motors ? What are their uses ?
8. Define a second order system with examples.
9. Differentiate between MRI and Nuclear scans.
10. Explain the term damping ratio.

(10 × 4 = 40 marks)

Part B

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

11. (a) Explain the comparator configuration of the opamp and state its uses.
    (b) Explain the working of any one type of digital to analog converter.

Or

12. (a) Explain the working of an absolute optical encoder. (8 marks)
    (b) Explain the working of laser printers. (4 marks)
13. (a) Explain address, data and control buses. (6 marks)
    (b) Discuss the data storage techniques used in flash memory cards. (6 marks)

Or

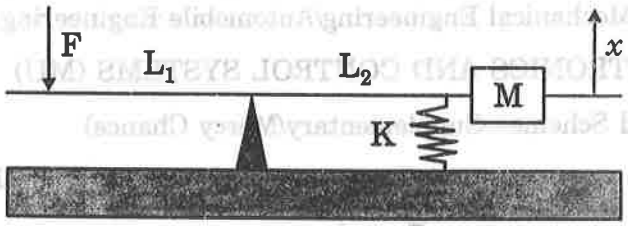
14. Explain with a block diagram the internal circuitry of a PLC unit.

Turn over

15. Explain the various modes of closed loop control using simple opamp equivalent circuits.

Or

16. Find the transfer $\frac{x}{F}$ for the following mechanical lever system.



17. Compute the steady stage step error of a control system with the following parameters.

$$G(s) = \frac{1}{s+1} \text{ and } H(s) = \frac{s+2}{s+10}.$$

Or

18. Find the steady state step and ramp errors for the unity feedback closed loop system whose open loop transfer function is $G(s) = \frac{s+4}{s(s+5)}$.

19. Determine whether the open loop control system where the transfer function $G(s) = \frac{1}{(s+3)(s-1)(s+2)}$ is stable.

Or

20. A unity feedback system has an open loop transfer function $G(s) = \frac{2.5\,K(s+2)}{(s-1)(s+1)}$. Draw the root locus diagram for this system and find the range of values for K over which the closed loop system is stable.

(5 × 12 = 60 marks)

F 6433 (Pages : 2) Reg. No.....

Name.....

B.TECH. DEGREE EXAMINATION, NOVEMBER 2013

Fifth Semester

Branch : Mechanical/Automobile Engineering

THERMAL ENGINEERING—I (M, U)

(Old Scheme—Supplementary/Mercy Chance)

Time : Three Hours Maximum : 100 Marks

Use of Mollier diagrams and Steam tables are permitted.

Answer **all** *questions.*

Part A

Each question carries 4 *marks.*

1. Draw P-V and T-s diagrams for water starting from its liquid phase to superheated steam.
2. What are the effects of friction on nozzle performance ?
3. What is the function of a safety valve ? State the minimum number of safety valves to be used on a boiler.
4. What is meant by governing ? List the important methods of governing steam turbines.
5. Draw the schematic diagram of a simple gas turbine cycle with reheat and heat exchanger. Draw also the P-V and T-S diagrams of the cycle.
6. What do you meant by surging and choking ?
7. Enumerate the different types of concentrating type solar collectors.
8. Explain the principle of conversion of solar energy into heat.
9. Define a steam condenser and state its objectives.
10. Draw the layout of a diesel power plant.

(10 × 4 = 40 marks)

Part B

Each question carries 12 *marks.*

11. (a) Explain the working of any high pressure boiler.

Or

(b) Steam initially dry and saturated at 15 bar is throttled to a pressure of 1.5 bar. What is the final condition of steam and the entropy change during the process ? Use the Mollier diagram for obtaining the solution.

Turn over

12. (a) Steam approaches a nozzle with velocity of 250 m/s. pressure of 3.5 bar and dryness fraction 0.95. If the isentropic expansion in the nozzle proceeds till the pressure at the exit is 2 bar, determine the change in enthalpy and the dryness fraction of steam. Calculate also the exit velocity from the nozzle and the area of the exit of the nozzle for flow of 0.75 kg./sec.

Or

(b) A single row impulse turbine develops 132.4 kW at a blade speed of 175 m/s using 2 kg. of steam per second. Steam leaves the nozzle at 400 m/s. Velocity coefficient of the blades is 0.9. Steam leaves the turbine blades axially. Determine (i) nozzle angle ; (ii) blade angles at entry and exit.

13. (a) The ratio of network to turbine work of an ideal gas turbine plant is 0.563. Take the inlet temperature to the compressor as 300 K. Calculate the temperature drop across the turbine if the thermal efficiency of the unit is 35 %. Assume a mass flow rate of 10 kg/s, C_p = 1 kJ/kg. K and γ = 1.4.

Or

(b) Explain the process of combustion in a gas turbine combustion chamber.

14. (a) What are the main applications of a solar pond ? Describe briefly.

Or

(b) Describe the working of a sun tracking system.

15. (a) Describe the function of cooling ponds and cooling towers in thermal stations.

Or

(b) Explain the working of a thermal power plant.

(5 × 12 = 60 marks)

F 6394 (Pages : 2) Reg. No.....

Name.....

B.TECH. DEGREE EXAMINATION, NOVEMBER 2013

Fifth Semester

Branch : Mechanical Engineering/Automobile Engineering

MANUFACTURING PROCESSES (MU)

(Old Scheme—Supplementary/Mercy Chance)

Time : Three Hours Maximum : 100 Marks

Answer **all** *questions.*

Part A

Each question carries 4 *marks.*

1. Explain cover core method of moulding.
2. What is meant by grain fineness ? How it is testing ?
3. What is meant by heat affected zone ?
4. What is meant by straight polarity and reverse polarity with respect to arc welding ?
5. Explain stretch forming.
6. Explain the sequence of operations in reducing the cross-section of a square bar to circular bar in rolling.
7. What is meant by explosive cutting ?
8. Explain projection welding.
9. Discuss the different types of binders using in silica sand to improve its binding quality.
10. What is meant by spring back in forging ? How it is reduced ?

(10 × 4 = 40 marks)

Part B

Each full question carries 12 *marks.*

11. What are chaplets ? Why are they used ? Write the various types of chaplets.

Or

12. Describe with neat sketch the procedure of making a green sand mould by turn over method.
13. Differentiate AC and DC arc welding process.

Or

14. Explain with the help of a neat sketch thermit welding.

Turn over

15. A strip with cross-section of 150 mm. × 6 mm. is being rolled with 20 % reduction area, using 400 mm. diameter steel rollers. Before and after rolling, the shear yield stress of the material is 0.35 kN/mm.^{2} respectively. Calculate (a) final strip thickness ; (b) the angle subtended by the deformation zone at the roll center.

Or

16. With the help of neat sketch, explain any two high energy forming.

17. A circular cup of 100 mm. outside diameter and 25 mm. height is to be drawn from an aluminium sheet of 1 mm. thickness the corner radius of the cup is 6 mm. Assuming a trimming allowance of 3 mm. determine the blank diameter required.

Or

18. With the help of a neat sketch, explain the working of any two press working operations.

19. Explain the concept of parting line in forging. Mention different types of parting lines.

Or

20. Explain any *four* non-destructive testing methods for testing forged components.

(5 × 12 = 60 marks)

F 6404 (Pages : 2) Reg. No.....

Name.....

B.TECH. DEGREE EXAMINATION, NOVEMBER 2013

Fifth Semester

Branch : Mechanical Engineering/Automobile Engineering

COMPUTER PROGRAMMING (MU)

(Old Scheme—Supplementary/Mercy Chance)

Time : Three Hours Maximum : 100 Marks

Answer **all** *questions.*

Part A

Each question carries 4 *marks.*

1. Compare while and do while statements.
2. Describe the-two ways to include comments in a C program.
3. What is a union ?
4. What is quick sorting ? Write the syntax.
5. What is meant by global variable ? Give an example.
6. What is the difference between a functions declaration and its definition ?
7. How do you access the memory address of a variable ?
8. What is wrong with the following code ?

```
int * p = &44 ;
```

9. Explain the use of bitwise AND, OR and NOT.
10. Explain how the end of a file is determined.

(10 × 4 = 40 marks)

Part B

Each question carries 12 *marks.*

11. Write four different data types and their declarations. Give example.

Or

12. Write a program that converts inches to centimeters. For example if the user enters 16.9 for a length in inches, the output would be 42.926 cm.

13. Write a recursive function to obtain the sum of first 20 natural numbers.

Or

14. Write a program to sort a one-dimensional array of 100 floating points ?

Turn over

15. Explain call by value and call by reference used in functions.

Or

16. Write a program to find the square and cube of an integer using macro.

17. Write notes on :

    (i) Self referential structure.

    (ii) Linked list.

(6 + 6 = 12 marks)

Or

18. Write a program to illustrate the use of unions.

19. Explain how error handling is done in file operations.

Or

20. Write short notes on :

    (i) Command line argument.

    (ii) Bitwise AND, OR and NOT.

(6 + 6 = 12 marks)

[5 × 12 = 60 marks]

F 6372 (Pages : 2) Reg. No.....

Name.....

B.TECH. DEGREE EXAMINATION, NOVEMBER 2013

Fifth Semester

Branch : Mechanical Engineering/Automobile Engineering/Production Engineering

ME 010 505/AU 010 505—INTERNAL COMBUSTION ENGINES AND COMBUSTION (ME, AU)

(New Scheme—Regular/Improvement/Supplementary)

Time : Three Hours Maximum : 100 Marks

Necessary charts are permitted.

Part A

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

1. What is the purpose of flywheel in an I.C. engine ?
2. What is the significance of excess air calculation ?
3. What are 'heat losses' in combustion ?
4. Distinguish between squish and tumble air motions.
5. How will you estimate the quantity of unburned hydrocarbons ?

(5 × 3 = 15 marks)

Part B

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

6. Discuss the techniques for rating of fuels.
7. Explain all the parts of fuel injection pumps.
8. Discuss the mechanism of turbo charging.
9. Explain all the effects of detonation.
10. How will you treat exhaust gases ? Explain any *two* methods.

(5 × 5 = 25 marks)

Part C

Answer any **one** *full question from each module.*
Each question carries 12 *marks.*

11. Explain the principles, mechanism and applications of (a) stratified charge engine and (b) free piston engine.

Or

Turn over

12. Explain the working of a four-stroke engine. Discuss all the aspects of valve timing diagram of a diesel engine.

13. Distinguish between direct and indirect injections. What are GDI engines ? Explain.

Or

14. Explain all the properties of lubricants. Discuss any two lubrication systems.

15. The volumetric composition of the 'dry' products of combustion of an unknown hydrocarbon fuel. C_xH_y gives : Co_2 12.1 %, O_2 3.8 %, CO 0.9 % and N_2 83.2 %. Determine (a) the chemical formula of the fuel, (b) the air fuel ratio, and (c) % of excess air used.

Or

16. Propane (C_3H_8) is reacted with air in such a ratio that an analysis of the products of combustion gives CO_2 11.5 %, O_2 2.7 % and CO 0.7 %. What is the percent theoretical air used during the test ?

17. Discuss all the steps in combustion in S.I. engines. Explain the conditions of occurrence of abnormal combustion.

Or

18. Explain the importance of P– Q diagram in combustion. Discuss all the factors controlling ignition delay and combustion.

19. Explain the pollutants in C.I. engines. Discuss the methods of compositional analysis of exhaust emissions.

Or

20. What are the necessary conditions for testing of I.C. engines ? Explain the procedure for Morse test and retardation tests.

(5 × 12 = 60 marks)

F 6356 (Pages : 2) Reg. No.....

Name.....

B.TECH. DEGREE EXAMINATION, NOVEMBER 2013

Fifth Semester

Branch : Mechanical Engineering / Production Engineering

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

(New Scheme—Regular/Improvement/Supplementary)

Time : Three Hours Maximum : 100 Marks

Part A

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

1. Define a strain tensor.
2. Write a note on Airy's stress function.
3. State the conditions for stress concentration.
4. How will you classify strain energies ?
5. What is membrane analogy ?

(5 × 3 = 15 marks)

Part B

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

6. Write and explain generalized Hooke's law.
7. Give examples for boundary conditions in elasticity problems.
8. Write a note on : rotating discs.
9. Explain Castigliano's second theorem.
10. Discuss the importance of shear flow.

(5 × 5 = 25 marks)

Part C

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

11. Derive the Cauchy's equations from fundamentals. State all the assumptions made.

Or

Turn over

12. A mild steel bar of 40 mm diameter is subjected to an axial load of 70 kN. Calculate the normal and shear stresses on a plane making an angle of 60° with direction of the applied load.

(12 marks)

13. Explain how will you find the solution for bending of a beam under uniform load.

Or

14. A strongest beam of rectangular cross-section is to be cut out of a cylindrical timber beam of 250 mm dia. Find the width and depth of required beam.

(12 marks)

15. Find the speed at which a thin steel ring of 1.5 m diameter will fail if the elastic limit tensile stress of the material is 250 MN/m^2. Take $\rho = 7500\ kg/m^3$.

Or

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

(12 marks)

17. Explain :

    (a) Maxwell reciprocal theorem.

    (b) Strain energy of deformation.

(6 + 6 = 12 marks)

Or

18. Discuss the method of finding resultant stress for a body subjected to (i) bending moment and (ii) torque.

(12 marks)

19. Derive an expression for torsion in a rectangular-shaped shaft.

Or

20. Explain the techniques for finding torsion of thin-walled closed section. (12 marks)

[5 × 12 = 60 marks]

F 6341

(Pages : 2)

Reg. No.....

Name.....

B.TECH. DEGREE EXAMINATION, NOVEMBER 2013

Fifth Semester

Branch : Mechanical Engineering/Automobile Engineering

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

(New Scheme—Regular/Improvement/Supplementary)

Time : Three Hours

Maximum : 100 Marks

Answer **all** *questions.*

Part A

Each question carries 3 *marks.*

1. Which are the elements of a CIM system ?
2. List the techniques for engineering analysis.
3. What is a Post Processor ?
4. What are different types of expert systems ?
5. How will you select a stepper motor for a typical robot application ?

(5 × 3 = 15 marks)

Part B

Each question carries 5 *marks.*

6. Differentiate between linear and circular interpolation. Explain.
7. What are the different line drawing algorithms ?
8. What is the need of 'adaptive control' ? Explain.
9. Discuss the concept of various 'flexibilities'.
10. Which are the different pneumatic systems used in robot technology ? Discuss.

(5 × 5 = 25 marks)

Part C

Each full question carries 12 *marks.*

MODULE I

11. (a) Explain the functioning of a CAD/CAM system in industry. (12 marks)

Or

(b) Discuss all the elements of a Manufacturing Automation Protocol (MAP) for Communication. (12 marks)

Turn over

MODULE II

12. (a) Explain the classification of Numerical Control (NC) Systems. (12 marks)

Or

(b) Explain any *two* applications of logic ladder programming in advanced machining processes. (12 marks)

MODULE III

13. (a) Write a manual program in incremental system for drilling an array of holes (100 × 100) for micromachining application. Assume suitable dimensions of tool, work piece and size of holes. (12 marks)

Or

(b) Explain the sequence of a CNC based APT language for a typical application. What do you mean by programming with interactive graphics ? (12 marks)

MODULE IV

14. (a) Explain the general methodology of group technology. Discuss how the layouts of a production system change with the introduction of group technology. (12 marks)

Or

(b) Explain the concept of JIT as applied to FMS. Discuss any *three* such applications. (12 marks)

MODULE V

15. (a) Write notes on

(i) Robot end effectors. (4 marks)

(ii) Control of robo joint. (4 marks)

(iii) Stepper motor. (4 marks)

Or

(b) Discuss typical robot applications in :

(i) Machine loading and unloading ; and (ii) Pre-cutting. Derive the necessary equations. (12 marks)

[5 × 12 = 60 marks]

F 6382 **(Pages : 3)** **Reg. No.....**

Name.....

B.TECH. DEGREE EXAMINATION, NOVEMBER 2013

Fifth Semester

Branch : Mechanical Engineering / Automobile Engineering / Production Engineering

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

(New Scheme—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 are intensive and extensive properties ?
2. What are the modes in which energy is stored in a system ?
3. What is a mechanical energy reservoir ?
4. Define Joule-Kelvin effect.
5. What is the principle of operation of an electrical calorimeter ?

(5 × 3 = 15 marks)

Part B

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

6. Discuss thermodynamic properties, processes and cycles.
7. Distinguish between universal gas constant and characteristic gas constant.
8. Define the thermal efficiency of a heat engine cycle. Can this be 100 % ?
9. "The enthalpy and internal energy of an ideal gas are functions of temperature only". Comment.
10. Why do the isobars on Mollier diagram diverge from one another ?

(5 × 5 = 25 marks)

Turn over

Part C

Answer any **one** *full question from each module.*
Each full question carries 12 *marks.*

11. The resistance of a platinum wire is found to be 11,000 ohms at the ice point, 15.247 ohms at the steam point, and 28.887 ohms at the sulphur point. Find the constants A and B in the equation : $R = R_0 (1 + At + Bt^2)$ and plot R against '*t*' in the range 0 to 660°C.

(12 marks)

Or

12. (a) What is vacuum ? How can it be measured ? (5 marks)

(b) What is a constant volume gas thermometer ? Why is it preferred to a constant pressure gas thermometer ?

(7 marks)

13. (a) What is mean effective pressure ? How is it measured ? (4 marks)

(b) A mass of 1.5 kg of air is compressed in a quasi-static process from 0.1 MPa to 0.7 MPa for which PV = constant. The initial density of air is 1.16 kg/m^3. Find the work done by piston to compress air.

(8 marks)

Or

14. A turbo compressor delivers 2.33 m^3/s at 0.276 MPa, 43°C, which is heated at this pressure to 430° C and finally expanded in a turbine which delivers 1860 kW. During the expansion, there is a heat transfer of 0.09 MJ/s to the surroundings. Calculate the turbine exhaust temperature if changes in kinetic and potential energy are negligible.

15. Which is the more effective way to increase the efficiency of a Carnot engine : to increase T_1, keeping T_2 constant ; or to decrease T_2, keeping T_1 constant ?

Or

16. Two kg of water at 80°C are mixed adiabatically with 3 kg. of water at 30°C in a constant pressure process of 1 atmosphere. Find the increase in the entropy of the total mass of water due to the mixing process (C_p of water = 4.187 kJ/kg. K).

17. Explain why the specific heat of a saturated vapour may be negative.

Or

18. Prove that the slope of a curve on a Mollier diagram representing a reversible isochoric process is equal to $\left(T + \frac{r-1}{\beta}\right)$.

19. A sample of steam from a boiler drum at 3 MPa is put through a throtling calorimeter in which the pressure and temperature are found to be 0.1 MPa, 120°C. Find the quality of the sample taken from boiler.

Or

20. (a) The specific heats of a gas are given by $C_p = a + KT$ and $C_v = b + KT$, where a, b and k are constants and T is in k. Show that for an isentropic expansion of this gas :

$$T^b V^{a-b} e^{kT} = \text{constant}.$$

(6 marks)

(b) 1.5 kg. of this gas occupying a volume of 0.06 m^3 at 5.6 MPa expands isentropically until the temperature is 240°C. If $a = 0.946$, $b = 0.662$, and $k = 10^{-4}$, calculate the work done in the expansion.

(6 marks)

[5 × 12 = 60 marks]

	A	*B*	*C*	*Supply*
F	16	20	12	200
G	14	8	18	160
H	26	24	16	90
Demand	180	120	150	450

(10 marks)

[5 × 20 = 100 marks]

F 6390 (Pages : 4) Reg. No.....

Name.....

B.TECH. DEGREE EXAMINATION, NOVEMBER 2013

Fifth Semester

Branch : Common to all branches except Computer Science and Engineering/ Information Technology

ENGINEERING MATHEMATICS–IV (CMELPASUF)

(Old Scheme—Supplementary/Mercy Chance)

Time : Three Hours Maximum : 100 Marks

Answer any **one** *question from each module.*
All questions carry equal marks.

Module I

1. (a) State Cauchy's integral formula and integral theorem. Use it to evaluate $\int_C \frac{\cos \pi z}{z^2-1}$ where C is the rectangle with vertices $2 \pm i$, $-2 \pm i$.

(12 marks)

(b) Find the Laurent's series expansion of $\frac{1}{z-z^3}$ in $1 < |z+1| < 2$. (8 marks)

Or

2. (a) If $f(a) = \int_C \frac{4z^2+z+5}{z-a} dz$ where C is the ellipse $9x^2+4y^2=36$ find $f(3)$, $f'(1)$ and $f''(-1)$.

(10 marks)

(b) Find the Taylor's series expansion of $f(z) = \frac{2z^3+1}{z^2+1}$ at $z = i$ and $z = -i$. (10 marks)

Module II

3. (a) Using method of false position, find a root of the equation $x^3 - x - 4 = 0$ lying between 1 and 2 correct to four decimal places.

(10 marks)

(b) Find by Newton's method, the root of the equation $\log x = \cos x$. (10 marks)

Or

Turn over

4. (a) Apply Gauss-Seidel method to solve the equations :

$$10x - 2y + z = 12,$$
$$x + 9y - z = 10,$$
$$2x - y + 11z = 20.$$

(12 marks)

(b) Find a root of the equation $x^3 - x = 11$ which lies between 2 and 3, using bisection method.

(8 marks)

Module III

5. (a) Use Taylor's series method to find $y(0.1)$ and $y(0.3)$ correct to four decimal places, given that $\frac{dy}{dx} = y^2 - x$, $y(0) = 1$.

(10 marks)

(b) Using Milne's Predictor-Corrector method find $y(1.2)$ taking $h = 0.1$, given $\frac{dy}{dx} = xy - x^2$, $y(1) = 1$.

(10 marks)

Or

6. (a) Use Euler's modified method to compute $y(0.4)$, given that $\frac{dy}{dx} = x^2 + y^2$, $y(0) = 3$ taking $h = 0.2$. correct to four decimal places.

(10 marks)

(b) Apply Runge-Kutta method order four to find an approximate value of y at $x = 0.1$ if $\frac{dy}{dx} = xy + y^2$ and $y(0) = 1$.

(10 marks)

Module IV

7. (a) Prove Shifting rules and hence show that $Z\left(\frac{1}{n!}\right) = e^{\frac{1}{z}}$. (8 marks)

(b) Using Z-transform solve $6y_{n+2} - y_{n+1} - y_n = 0$ with $y(0) = y(1) = 1$. (12 marks)

Or

8. (a) Solve $u_{n+2} - 2u_{n+1} + u_n = 2^n$ with $u_0 = 2, u_1 = 1$. (12 marks)

(b) Find $Z^{-1}\left[\frac{2z}{(z-1)(z^2+1)}\right]$. (8 marks)

Module V

9. (a) Using graphical method solve the following L.P.P.

Minimize $Z = 3x + 2y$

subject to the constraints,

$5x + y \geq 10$,

$x + y \geq 6$,

$x + 4y \geq 12$ with

$x, y \geq 0$.

(8 marks)

(b) How will you identify unbounded solution of an L.P.P. from its simplex table ? Using simplex algorithm, solve the following L.P.P.

Maximize $Z = 3x + 2y + 5z$

subject to the constraints,

$x + 2y + z \leq 430$,

$3x + 2z \leq 460$,

$x + 4z \leq 420$ with

$x, y, z \geq 0$.

(12 marks)

Or

10. (a) Use Big-M method to solve the following L.P.P. :

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

subject to the constraints,

$x_1 + 2x_2 + 3x_3 = 15$,

$2x_1 + x_2 + 5x_3 = 20$,

$x_1 + 2x_2 + x_3 + x_4 = 10$ with

$x_1, x_2, x_3, x_4 \geq 0$.

(10 marks)

(b) The following table gives the cost matrix of transporting one unit of a product from the sources F, G and H to the destinations A, B and C. Compute the optimum allocations and minimum cost of transportation using MODI method.

Turn over

F 6414 (Pages : 3) Reg. No.....

Name.....

B.TECH. DEGREE EXAMINATION, NOVEMBER 2013

Fifth Semester

Branch : Mechanical Engineering

THEORY OF MACHINES—II (M)

(Old Scheme—Supplementary/Mercy Chance)

Time : Three Hours Maximum : 100 Marks

Part A

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

1. (a) Differentiate between static force and dynamic force.

   (b) A four bar mechanism subjected to external forces on the coupler and the follower. Forces are F_3, F_4 and angles θ_3 and θ_4. Draw the free body diagram.

   (c) Explain the following :

   (i) Height of a Governor.

   (ii) Equilibrium speed.

   (iii) Sleeve lift.

   (iv) Mean equilibrium speed.

   (d) Draw a centrifugal Governor.

   (e) Explain (i) coefficient of fluctuation of energy ; (ii) coefficient of fluctuation of speed.

   (f) Explain the working of a flywheel.

   (g) Explain steering, pitching and rolling as applied to a naval ship.

   (h) Comment on the effect of centrifugal couple as 4 wheel drive while taking a curve.

   (i) Explain the role of pitch curve in a cam with roller follower.

   (j) Explain (i) base circle ; (ii) prime circle ; (iii) pressure angle and ; (iv) pitch point.

(10 × 4 = 40 marks)

Part B

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

2. Find out the reactive couple on the crank AB in a slider crank mechanism ABC where ABC = 5 cm makes an angle of 60° with IDC. BC = 7 cm. A force 10 N at an angle of 70° is acting on BC at a distance of 5 cm from end B.

Or

3. The connecting rod of an engine is 500 mm long between the centres and its mass is 18 kg. The CG is 125 mm from the crank pin centre and the crank radius is 100 mm. Determine the dynamically equivalent system keeping one mass at the small end. The frequency of oscillation of the rod when suspended from the centre of the small end is 43 vibrations per minute.

4. A Proell governor has equal arms of length 300 mm. The upper and lower ends of the arms are pivoted on the axis of the Governor. The extension arms of the lower links are each 80 mm long and parallel to the axis when the radii of rotation of the falls are 150 mm and 200 mm. The mass of each ball is 10 kg and the mass of the central load is 100 kg. Determine the range of speed.

Or

5. A Proell governor has all the four arms of length 250 mm. The upper and lower ends of the arms are pivoted on the axis of rotation of the Governor. The extension arms of the lower links are each 100 mm long and parallel to the axis when the radius of the ball path is 150 mm. The mass of each ball is 4.5 kg and the mass of central load is 36 kg. Determine the equilibrium speed of the Governor.

6. A vertical double acting steam engine develops 75 kW at 250 r.p.m. The maximum fluctuation of energy is 30% of the work done per stroke. The maximum and minimum speeds are not to vary more than 1 per cent either side of the mean speed. Find the mass of the flywheel required, if the radius of gyration is 0.6 M.

Or

7. A single cylinder 4 stroke IC engine develops 75 kW at 360 r.p.m. The fluctuation of energy is 0.9 times the energy developed per cycle. If the fluctuation of speed is not to exceed one per cent and the maximum centrifugal stress in the flywheel is to be 5.5 MPa, calculate the mean diameter and the cross-sectional area of the rim. The density of the material is 7200 kg/m^3.

8. The rotor of a turbine installed in a boat with its axis along the longitudinal axis of the boat makes 1500 r.p.m. cw when viewed from the stern. The rotor has a mass of 750 kg and a radius of gyration of 300 mm. If the boat pitches in the longitudinal vertical plane so that the bow rises with an angular velocity of 1 rad/sec, determine the torque acting on the boat and the direction in which it turns boat at the instant.

Or

9. A flywheelof mass 10 kg and radius of gyration 200 mm is spinning about its axis, which is horizontal and is suspended at a point distant 150 mm from the plane of rotation of the flywheel. Determine the angular velocity of precession of the flywheel. The speed of flywheel is 900 r.p.m

10. Design a cam for operating the exhaust value of an oil engine. It is required to give equal uniform acceleration and retardation during opening and closing of the value each of which corresponds to 60° of cam rotation. The value must remain in the fully open position for 20° of cam rotation. The lift of the value is 37.5 mm and the least radius of the cam is 40 mm. The roller follower has a radius of 20 mm and there is no offset.

Or

11. Construct a cam profile for the following conditions :

    Cam shaft dia = 40 mm ; least radius of cam = 25 mm. Diameter of roller = 25 mm ; Angle of lift = 120° ; Angle of fall = 150° ; Lift = 40 mm. Number of pauses are two of equal interval between motions. The line of stroke of the follower is offset 12.5 mm from the centre of the cam. During lift the motion is SHM and during fall the motion is uniform acceleration and retardation. Cam shaft speed is uniform.

(5 × 12 = 60 marks)