G 1278 (Pages : 2) Reg. No.....

Name.....

B.TECH. DEGREE EXAMINATION, MAY 2012

Seventh Semester

Branch : Mechanical Engineering/Automobile Engineering

INDUSTRIAL ENGINEERING (MU)

(Improvement/Supplementary)

Time : Three Hours Maximum : 100 Marks

Answer **all** *questions.*

Part A

Each question carries 4 *marks.*

1. What is the significance of an organizations structure ?
2. Define continuous production. What are the various types and characteristics of continuous production ?
3. What are the factors influencing plant location ?
4. What are the objectives of good plant layout ?
5. Define job evaluation. What are the objectives and procedure of job evaluation ?
6. Define Merit rating. What are the objectives of merit rating ?
7. What are the merits and demerits of trade union ?
8. What do you mean by quality circle ? Explain the significance.
9. Define (i) Cost ; (ii) Cost accounting. What is the need of cost accounting ?
10. Explain how overheads are classified.

(10 × 4 = 40 marks)

Part B

Each question carries 12 *marks.*

11. Explain the different phases of value analysis.

Or

12. Explain the various applications of value analysis.
13. Compare process layout, product layout and combination layout.

Or

14. What are the various material handling equipments and explain any *three* of them.
15. Explain the various methods of job evaluation.

Or

16. Explain the various methods for merit rating.

Turn over

17. Explain the statutory provisions in labour legislation.

Or

18. Explain the objectives and functions of labour welfare.

19. Explain any *three* nondestructive testing methods.

Or

20. Explain the various process control charts.

(5 × 12 = 60 marks)

G 1307 (Pages : 2) Reg. No.....

Name.....

B.TECH. DEGREE EXAMINATION, MAY 2012

Seventh Semester

Mechanical Engineering

MACHINE DESIGN AND DRAWING—1 (M)

(Improvement / Supplementary)

Time : Three Hours Maximum : 100 Marks

Answer any **two** *from Part A and* **two** *from Part B.*
Suitably assume any missing data.

Part A

1. Determine the thickness of rectangular plate 120 mm wide subjected to a maximum tensile load 25,000 kgf and a minimum load of 10000 kgf. Assume endurance limit = 2250 kgf/cm^2 Yield stress = 3200 kgf /cm^2. Factor of safety = 105.
2. Design a cotter joint to transmit 15 kN of tensile or compressive force Allowable stresses are σ_t = 55 MPa ; σ_c = 85 MPa and τ = 45 MP.
3. The gas pressure inside a cylindrical tank is 10 N/mm^2. Inner radius of the shell is 160 mm. The material of the shell is steel with σ_y = 340 MPa, υ = 0.3. Taking factor of safety as 2. determine the thickness of shell wall as per maximum shear stress theory.
4. A boiler drum of internal diameter 1.5 m is to be designed to sustain internal pressure of 2.0N/mm^2. Design longitudinal and circumferential joint for the material σ_t = 420 MPa σ_c = 640 MPa and τ = 330 Mpa.

(2 × 25 = 50 marks)

Part B

5. Design a helical compression spring for a maximum load of 1500 N for a deflection of 30 mm. Assume maximum permissible stress for spring wire as 420 N/mm^2 and Modulus of rigidity 84 kN/mm^2.
6. A solid steel shaft is transmitting 16kW power at 300 r.p.m. The shaft is supported on two ball bearings 0.75m apart. Gear B is fixed to the shaft 150 cm to the right of left hand bearing. Gear C is fixed to the shaft 100 mm to the left of right hand bearing. The gear B has 80 teeth and gear C has 40 teeth, of module 6 mm each. The gear B receives power in horizontal direction, and gear C delivers in vertical direction. Take allowable stress in shear 50 MPa Design the diameter of shaft.

7. An engine runs at a constant load at 500 r.p.m. The crank-torque diagram is drawn to scale of 1 mm = 100 Nm torque and 1 mm = 3° crank angle. Areas of diagram above or below the mean torque line in mm^2 are in the following order + 216, – 260, + 310, –330, + 398, – 334. Design the fly wheel of the total fluctuation of the speed is not to exceed 8 r.p.m. Centrifugal stress in rim is only 5.6 MPa. Assume 90 % of the moment of inertia is due to the rim. Density of material is 7200 kg /m^3, Rim breadth = twice the rim thickness.

8. A solid circular bar of 100 mm diameter and 300 mm length is welded to structural member by a fillet weld all around the bar. A vertical load of 16 kN is acting at the end of the bar. The permissible shear stress in the weld is 90 N/mm^2. Determine the leg dimension of the fillet weld.

(2 × 25 = 50 marks)

G 1325 (Pages : 2) Reg. No.....

Name.....

B.TECH. DEGREE EXAMINATION, MAY 2012

Seventh Semester

Branch : Mechanical Engineering

WELDING TECHNOLOGY (Elective I) (M)

Time : Three Hours Maximum : 100 Marks

Answer **all** *questions.*

Part A

Each question carries **4** *marks.*

1. Differentiate Brazing and Soldering.
2. List different types of solders.
3. Sketch a carburising flame and brief.
4. Explain rightward welding technique.
5. Brief straight and reverse polarities.
6. How electrodes are classified ?
7. Brief laser beam welding.
8. What are the applications of USW ?
9. Sketch HAZ.
10. Discuss about cracks is welding.

(10 × 4 = 40 marks)

Part B

Each question carries **12** *marks.*

11. (a) (i) Explain principle of brazing. (6 marks)

(ii) What are the limitations of soldering as joining. (6 marks)

Or

(b) (i) Sketch and explain any one Brazing operation. (6 marks)

(ii) Explain percussion welding. (6 marks)

12. (a) Sketch and explain an oxy-acetylene welding equipment. (12 marks)

Or

(b) (i) Sketch and explain different types of flames. (8 marks)

(ii) Brief the welding of copper. (4 marks)

Turn over

13. (a) (i) Draw various welding symbols. (6 marks)

(ii) Explain the "Shielding gas" in welding. (6 marks)

Or

(b) Explain the arc welding electrodes. (12 marks)

14. (a) Sketch and explain Electron beam welding. (12 marks)

Or

(b) (i) Write a note on explosive welding. (6 marks)

(ii) Write a note on cold welding processes. (6 marks)

15. (a) Explain :

(i) Ultrasonic test. (4 marks)

(ii) Dye-penetrant test. (4 marks)

(iii) Radiographic test. (4 marks)

Or

(b) Explain residual stress in welding and how it is removed. (12 marks)

[5 × 12 = 60 marks]

G 1328 (Pages : 2) Reg. No.....

Name.....

B.TECH. DEGREE EXAMINATION, MAY 2012

Seventh Semester

Branch : Mechanical Engineering

MARKETING AND SALES MANAGEMENT (Elective I) (M)

(Improvement/Supplementary)

Time : Three Hours Maximum : 100 Marks

Answer **all** *questions.*

Part A

Each question carries 4 *marks.*

1. What do you mean by Market segmentations ?
2. What do you mean by marketing mix ?
3. Define strategy ? Briefly explain its relevance in marketing.
4. What are the characteristics of SBU ?
5. Explain the features of online marketing.
6. What are the important marketing strategies to be employed in the growth stage of the product life cycle ?
7. Studying buyer behaviour is a basic requirement of marketing. Comment on this statement.
8. What are the major features of an ideal buying centre ?
9. What decisions do companies face in designing a sales force.
10. Explain the process of recruiting and selecting sales representatives.

(10 × 4 = 40 marks)

Part B

Each question carries 12 *marks.*

11. (a) Explain the major actors and forces in the company marketing environment.

Or

(b) Explain the role and importance of advertizing and sale promotion.

12. (a) Explain the SWOT analysis with an example.

Or

(b) Explain the procedure of business strategic planning.

13. (a) Explain the concept of product life cycle ? Illustrating its various stages ? Explain the significance of each stage.

Or

(b) Explain the marketing strategies at the introduction stage.

Turn over

14. (a) How does the external environment help and influence the individual determinants of consumer behaviour.

Or

(b) Explain the various stages in the buying decision process.

15. (a) A part from personnel selling skills what other factors can help or hinder a sales person's performance.

Or

(b) Explain various phases for formulating sales policies.

(5 × 12 = 60 marks)

20. A company manufactures around 200 bike. Depending upon the availability of raw materials and other conditions, the daily production has been varying from 196 bikes to 204 bikes per day, whose probability distribution is as given below :—

Production per day	196	197	198	199	200	201	202	203	204
Probability	0.05	0.09	0.12	0.14	0.20	0.15	0.11	0.08	0.06

The finished bikes are transported in a specially designed three storied lorry that can accommodate only 200 bikes. Using the following 15 random numbers 82, 89, 78, 24, 53, 61, 18, 45, 23, 50, 77, 27, 54 and 10, simulate the bikes waiting in the factory.

(a) What will be the number of bikes waiting in the factory ?

(b) What will be the number of empty spaces in the lorry ?

(5 × 12 = 60 marks)

G 1327 **(Pages : 4)** **Reg. No.....**

Name.....

B.TECH. DEGREE EXAMINATION, MAY 2012

Seventh Semester

Branch : Mechanical Engineering

ADVANCED OPERATIONS RESEARCH (Elective I) (M)

(Improvement/Supplementary)

Time : Three Hours Maximum : 100 Marks

Answer **all** *questions.*

Part A

Each question carries 4 *marks.*

1. Write the standard form of Linear Programming problem.
2. What do you mean by alternate optimal solution for linear programming ?
3. Write the steps for Vogal approximation method.
4. Write the steps for Least cost method.
5. Explain Gomory's Mixed integer cutting plan.
6. Cite the situations where goal programming is used.
7. Explain the shortest path method.
8. Discuss briefly the general similarities between dynamic programming linear programming.
9. Distinguish between solutions derived from simulation models and solutions derived from analytical models.
10. What are random numbers ? Why are random numbers useful in simulation models ?

(10 × 4 = 40 marks)

Part B

Each question carries 15 *marks.*

11. Use graphical method to solve the following LP problem :

Maximize $Z = 20\,x_1 + 10\,x_2$

subject to the constraints

$x_1 + 2x_2 \leq 40$

$3x_1 + x_2 \geq 30$

$4x_1 + 3x_2 \geq 60$

$x_1, x_2 \geq 0.$

Or

12. Use Big M method to solve the following LP problem.

Minimize $Z = 5x_1 + 3x_2$

subject to the constraints

$2x_1 + 4x_2 \leq 12$

$2x_1 + 2x_2 = 10$

$5x_1 + 2x_2 \geq 10$

$x_1, x_2 \geq 0$.

13. Obtain the optimal solution to the transportation problem :

Destination

Source	D_1	D_2	D_3	D_4	Supply
S_1	19	30	50	10	7
S_2	70	30	40	60	9
S_3	40	8	70	20	18
Demand	5	8	7	14	34

Or

14. A company has factories F_1, F_2 and F_3 which supply warehouses at W_1, W_2 and W_3. Weekly factory capacities are 200, 160 and 90 units respectively. Weekly warehouse requirements are 180, 120 and 150 units respectively. Unit shipping costs are (in rupees) as follows :

Warehouses

Factories	W_1	W_2	W_3	Supply
F_1	16	20	12	200
F_2	14	8	18	160
F_3	26	24	16	90
Demand	180	120	150	450

15. Solve the following goal programming using graphical method :

Minimize $Z = P_1 d_1^- + P_2 d_2^- + P_3 d_3^-$

subject to $2x_1 + 3x_2 \leq 30$

$6x_1 + 4x_2 \leq 60$

$x_1 + x_2 + d_2^- - d_2^+ = 8$

$x_2 + d_3^- - d_3^+ = 7$

and $x_1, x_2, d_i^-, d_i^+ \geq 0$ for all i.

Or

16. Use modified simplex method to solve the following GP problem :

Minimize $Z = P_1 d_1^- + P_2 \left(2d_2^- + d_3^-\right) + P_3 d_1^+$

subject to constraints

$x_1 + x_2 + d_1^- - d_1^+ = 400$

$x_1 + d_2^- = 240$

$x_1 + d_3^- = 300$

and $x_1, x_2, d_1^-, d_1^+ d_2^- d_2^+ \geq 0$.

17. Use dynamic programming to find the value of

Maximize $Z = y_1 * y_2 * y_3$

subject to the constraint

$y_1 + y_2 + y_3 = 5$

and $y_1, y_2, y_3 \geq 0$.

Or

18. Use dynamic programming to solve the following problem :—

Minimize $Z = y_1^2 + y_2^2 + y_3^2$

subject to the constraint

$y_1 + y_2 + y_3 = 10$

and $y_1, y_2, y_3 \geq 0$.

19. A company keeps stock of a special product. Previous experience indicates the daily demand as given below :

Daily demand	5	10	15	20	25	30
Probability	0.01	0.2	0.15	0.50	0.12	0.02

Simulate the data for 10 days using the following random numbers : 82, 96, 18, 96, 20, 84, 56, 11, 52, 03. Also find the daily average demand for the product on the basis of simulated data.

Or

G 1269 (Pages : 3) Reg. No.....ME

Name.....

B.TECH. DEGREE EXAMINATION, MAY 2012

Seventh Semester

Branch : Mechanical Engineering

GAS DYNAMICS AND JET PROPULSION (M)

(Improvement/Supplementary)

Time : Three Hours Maximum : 100 Marks

Use of approved Gas Tables and Charts are permitted.

Part A

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

1. Draw the Mach cone surface of a supersonic flow and explain briefly the developments related to it.
2. Classify the fluid flow based on Mach number and discuss.
3. Define the terms : Nozzle efficiency and Chocking of flow.
4. What is meant by the terms Under expansion and Over expansion in Nozzles.
5. What are the assumptions in deriving Isothermal flow and how it is different from fanno flow?
6. Air is heated in a constant area duct. The inlet Mach number is 0.2 and the Exit Mach number is 0.8. The inlet total conditions are 2 bar and 92° C. Neglecting friction, what are the exit stagnation conditions? $\gamma = 1.4$.
7. Shock waves carnot develop in subsonic flow. Prove it.
8. Define Compression and rarefaction shocks.
9. Write four differences between Rocket and jet propulsion.
10. Sketch the configuration and T–S diagram of the Jet Engine used for aircrafts.

(10 × 4 = 40 marks)

Part B

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

11. Air ($\gamma = 1.4$, R = 287 J/kgK enters a straight axisymmetric duct at 300 K, 3.45 bar and 150 m/s and leaves it at 277 K, 2.058 bar and 260 m/s. The area of cross section at entry is 500 cm^2. Assuming adiabatic flow, determine : (a) Stagnation temperature, maximum velocity ; (b) Mass flow rate and area of cross section at exit ; (c) Crocco Number and Mach number at exit.

(4 + 4 + 4 = 12 marks)

Or

12. (a) Derive the continuity equation for a compressible fluid assuming it to be steady and 3 dimensional.

(b) Prove for $\gamma = 1.4$, $\dfrac{P_o - P}{\frac{1}{2}\rho C^2} = 1 + 0.25\,M^2 + \dfrac{M^4}{40} + \ldots$

(6 + 6 = 12 marks)

13. A conical diffuser has entry and exit diameters of 15 cm and 30 cm respectively. The pressure, temperature and velocity of air at entry are 0.69 bar, 340 K and 180 m/s respectively. Determine (a) the exit pressure and velocity ; (b) the force exerted on the diffuser walls. Assume Isentropic flow with $\gamma = 1.4$, $C_p = 1000$ J/kgK.

(10 + 2 = 12 marks)

Or

14. Air is discharged from a reservoir at $P_o = 6.91$ bar and $t_o = 325°$ C through a nozzle to an exit pressure of 0.98 bar. If the flow rate is 3600 kg/hr, determine for Isentropic flow : (a) Thrust area, pressure and velocity ; (b) Exit area and Mach number ; (c) Maximum velocity.

(6 + 4 + 2 = 12 marks)

15. A circular duct passes 8.25 kg/s of air at an exit Mach number of 0.5. The entry pressure and temperature are 3.45 bar and 38° C respectively and the coefficient of friction is 0.005. If the Mach number at entry is 0.15, determine (a) The diameter and length of the duct ; (b) Pressure and temperature at the exit ; (c) Stagnation pressure loss and exit velocity of gas.

(4 + 4 + 4 = 12 marks)

Or

16. The data for a combustion chamber employing a hydrocarbon fuel is given below : $\gamma = 1.3$, $C_p = 2.144$ kJ/kgK, Entry : Gas velocity = 152 m/s, Pressure = 4 bar, Temperature = 400 K.
Exit : Mach Number = 0.8
Calorific value of the fuel burnt = 43 MJ/kg and products of combustion have $\gamma = 1.3$, $C_p = 2.144$ kJ/kgK. Determine (a) Entry Mach number ; (b) Air fuel ratio required ; (c) Pressure, temperature and velocity of the gas at exit ; (d) Stagnation pressure loss.

(2 + 2 + 6 + 2 = 12 marks)

17. A gas ($\gamma = 1.4$, R = 0.287 kJ/kgK) at a Mach number of 1.8, P = 0.8 bar and T = 373 K passes through a Normal shock. Determine its density after the shock. Compare this value in an isentropic compression through the same pressure ratio. Derive Rankine Hugoniot relation for a normal shock wave.

(6 + 6 = 12 marks)

Or

18. (a) A jet of air at 275 K and 0.69 bar has an initial Mach number of 2. If it passes through a normal shock wave, determine (i) Mach number ; (ii) Pressure and temperature ; (c) Density, speed of sound and Jet velocity downstream of the shock.

(b) Define the term shock strength of wave.

(1 + 3 + 6 + 2 = 12 marks)

19. (a) an aircraft flies at 960 kmph. One of its turbojet engines takes in 40 kg/s of air and expands the gases to the ambient pressure. The Air fuel ratio is 50 and the lower calorific value of fuel is 43 MJ/kg. For Maximum thrust power, Determine :

(i) Jet velocity ; (ii) Thrust ; (iii) Specific Thrust and (iv) Thrust power.

(b) With neat sketch, explain the working of Liquid Propellant Rocket Engine.

(6 + 6 = 12 marks)

Or

20. (a) A Rocket has the following data :

Propellant flow rate = 5.0 kg/s

Nozzle exit diameter and exit pressure = 10 cm and 1.02 bar.

Thrust = 7 kN.

Determine the effective jet velocity, Actual Jet velocity, Specific impulse and Propellant consumption.

(b) With a neat sketch, explain the working of a Ram Jet Engine.

(6 + 6 = 12 marks)

[5 × 12 = 60 marks]

G 1286 (Pages : 3) Reg. No.....

Name.....

B.TECH. DEGREE EXAMINATION, MAY 2012

Seventh Semester

Branch : Mechanical Engineering/Automobile Engineering

REFRIGERATION AND AIRCONDITIONING (MU)

(Improvement/Supplementary)

Time : Three Hours Maximum : 100 Marks

Use of Ref. & A/c Tables and Charts and steam tables are permitted.

Part A

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

1. A cold storage is to be maintained at –5°C while the surroundings are at 35°C. The heat leakage from the surroundings into the cold storage is estimated to be 29 kW. The actual COP of the refrigeration plant is ⅓ of an ideal plant working between same temperatures. Find the power required to drive the plant.
2. Explain the working principle of Bell Coleman Cycle.
3. What is subcooling and superheating ? Explain with help of diagrams.
4. What is the function of a flash intercooler provided in a Multistage Vapour Compression refrigeration system ?
5. What is the function of following components in an absorption system ? Analyser and Rectifier.
6. What are the desirable properties of an ideal refrigerant ?
7. Explain the working of an Evaporative Condenser.
8. Discuss the operation of a capillary tube in a refrigeration system.
9. Write short note on the factors affecting comfort Air conditioning.
10. Describe Unitary and Central Air conditioning systems.

(10 × 4 = 40 marks)

Part B

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

11. A dense air refrigeration cycle operates between pressures of 4 bar and 16 bar. The air temperature after heat rejection to the surroundings is 37°C and air temperature at Exit of refrigerator is 7°C. The Isentropic Efficiencies of compressor and turbine work per Tonne of Refrigeration ; COP ; and power per TR. Assume $\gamma = 1.4$ and $C_p = 1005$ J/kg K.

(12 marks)

Or

Turn over

12. An air refrigeration system works between the pressure limits of 1 bar and 5 bar. The temperature of the air entering the compressor and expander cylinder are 10°C and 25°C respectively. The Expander and compressor follow the law $pv^{1.3} = C$ for expansion and compression. Find the following :

    (a) Theoretical COP of Refrigeration Cycle. (3 marks)

    (b) If the load on the refrigeration machine is 10 TR, find the amount of air circulated per minute through the system assuming that actual COP is 50% of the theoretical COP. (3 marks)

    (c) The stroke length and piston diameter of single acting compressor if the compressor runs at 300 r.p.m. and the Volumetric Efficiency is 85%. Assume L/d = 1.5, C_p = 1005 J/kg K and C_v = 0.71 kJ/kg K. (6 marks)

13. A simple NH_3 vapour compression system has compressor with piston displacement of 2 m^3/min, condenser pressure of 12 bar and Evaporator pressure of 2.5 bar. The liquid is subcooled to 20°C by soldering the liquid line to suction line. The temperature of vapour leaving the compressor is 100°C, heat rejected to condenser cooling water is 5000 kJ/hr, and volumetric Efficiency of compressor is 0.8. Compute capacity, Indicated power and COP of the system. (12 marks)

Or

14. A single compressor using R12 as refrigerant has 3 Evaporators of capacity 10 TR, 20 TR and 30 TR. All the Evaporators operate at –10°C and the vapours leaving the Evaporators are dry and saturated. The condensing temperature is 40°C . The liquid refrigerant leaving the condenser is subcooled to 30°C. Assuming Isentropic Compression, find :

    (a) The mass of refrigerant flowing through each evaporator. (8 marks)

    (b) Power required to drive the compressor. (2 marks)

    (c) COP of the system. (2 marks)

15. Draw a neat diagram of three fluid system of Refrigeration (Electrolux Refrigerator) and Explain its working. (12 marks)

Or

16. Differentiate between physical and thermodynamic properties of a refrigerant. Explain which are more important giving specific examples. (4 + 8 = 12 marks)

17. (a) Explain the working of float valve. (6 marks)

    (b) Compare the working of a float valve with solenoid valve. (6 marks)

Or

18. Explain the working of Dry Expansion Evaporators and Natural Convection Evaporators. (12 marks)

19. (a) Explain the working of Winter Air Conditioning System. (6 marks)

    (b) Explain the Equal pressure drop method used for duct design. (6 marks)

Or

20. An Air conditioned auditorium is to be maintained at 27°C DBT and 60% RH. The ambient condition is 40°C DBT and 30°C WBT. The total sensible heat load is 100 MJ/h and the total latent heat load is 40 MJ/h. 60% of the return air is recirculated and mixed with 40% of make up air after the cooling coil. The condition of air leaving the cooloing coil is at 18°C. Determine :

    (a) RSHF.

    (b) Condition of air entering the auditorium.

    (c) Amount of make up air.

    (d) Apparatus Dew Point temperature

    (e) By pass factor of cooling coil and

    (f) Plot the process in Psychrometric Chart type of representation.

    (2 + 2 + 2 + 2 + 2 + 2 = 12 marks)

[5 × 12 = 60 marks]

G 1296 (Pages : 3) Reg. No.....

Name.....

B.TECH. DEGREE EXAMINATION, MAY 2012

Seventh Semester

Branch : Mechanical Engineering

DYNAMICS OF MACHINERY (M)

(Improvement / Supplementary)

Time : Three Hours Maximum : 100 Marks

Part A

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

1. With a neat sketch briefly describe the working of a Cradle type balancing machine ?
2. Derive an expression for the maximum Swaying couple.
3. Find the frequency of free oscillations of a cylinder shown in Fig. 1. The roller rolls on the surface without slipping.

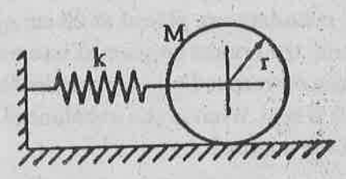

Fig. 1 A Cylinder rolling on a floor

4. Derive an expression for the energy dissipated per cycle in a single degree of freedom system with viscous damping.
5. Determine the Influence coefficients of the system shown in Fig. 2.

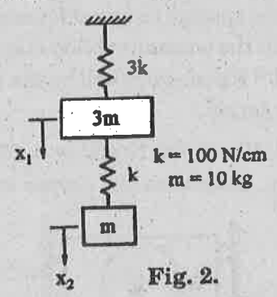

Fig. 2.

6. Develop the necessary equations for transferring a shaft with a rotor belongs to geared system from low speed section to high speed section.

Turn over

7. What is a gate function? Obtain the Lapalce transform of the gate function.
8. Sketch the load deflection characteristics of a linear spring, a soft spring and a hard spring and describe its non-linear behaviour.
9. Describe how sound pressure can be expressed in decibel (dB) ?
10. Show that as the distance from a point source doubles, the sound intensity level decreases by 6 dB.

(10 × 4 = 40 marks)

Part B

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

11. A rotating shaft carries four radial masses A, B, C and D. The mass centres are 3.5 cm. 4 cm. 4.2 cm, and 4.5 cm. respectively from the axis of rotation. The masses A, C, and D weigh 70 N, 55 N, and 35 N respectively. The axial distance between planes of rotation of A and B is 60 cm ; and between B and C is 80 cm. The masses A and C are at right angles to each other. Determine for complete balance, the angle between the masses A and B; and between A and D.

Or

12. The crank and connecting rod of a four-cylinder in- line engine running at 3000 r.p.m. are 7 cm and 28 cm respectively. The cylinders are placed at 20 cm apart. If the cylinders are numbered 1 to 4 in sequence from one end, the cranks appears at intervals of 90° in an end view in the order 1-4-2-3. The reciprocating mass corresponding to each cylinder is 2 kg. Determine the unbalanced primary and secondary forces if any. What is the unbalanced primary and secondary couple with reference to central plane of the engine ?
13. A 10 Kg. mass is connected to a spring of stiffness 3000 N/m. and released after giving an initial displacement of 100 mm. Assuming that the mass moves on a horizontal surface, determine the position at which the mass comes to rest. Assume that the coefficient of friction between the mass and the surface is 0.12

Or

14. Determine the total stiffness of the springs required for mounting a bench grinder of mass 50 Kg. and rated speed 2500 r.p.m. so that the transmissibility is less than or equal to 0.2. If the unbalance in the rotor is estimated to be 10^{-3} Kg-m, what will be the dynamic amplitude of the grinder and the force transmitted to the foundation.
15. For the system shown in Fig. 3, W = 1000 N and w = 250 N. If W is excited by a 100 N–cm. unbalance rotating at 1800 r.p.m, determine the proper values of the absorber K. What will be amplitude of absorber ?

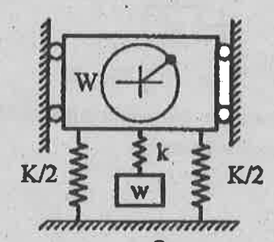

Fig. 3

Or

16. A centrifugal pump rotating at 600 r.p.m. is driven by an electric motor running at 1500 r.p.m. through a single stage reduction gearing. The moment of inertia of the pump impeller and the motor are 150 Kg-m^2 and 450 Kg-m^2 respectively. The lengths of the pump shaft and the motor shaft are 500 mm. and 300 mm. and their diameters are 100 mm. and 60 mm. respectively. Neglecting the inertia of the gears, find the frequency of torsional oscillations of the system, and draw the mode shape. Take G = 82 GPa
17. A rotor has a mass of 9.5 Kg. and is mounted midway on a 24 mm. diameter horizontal shaft supported at the ends by two bearings. The bearings are 1.2 m. apart. The shaft rotates at 2,000 r.p.m. If the centre of mass of the rotor is 0.12 mm. away from the axis of rotation, find the amplitude of the steady state vibration and the dynamic force transmitted to the bearing. Take E = 200 GPa.

Or

18. In the vibration testing of a structure, an Impact hammer with a load cell to measure the impact force is used to cause excitation as shown in Fig. 4. Assuming that the mass of the structure as 5 kg, stiffness k is 2000 N/m, damping coefficient c is 10N-s/m and the impulse $\hat{F}$ is 20N-s. Find the response of the system (a) for a single impact, (b) for a double impact with period τ = 0.2 S and the impulse due to second impact is half the first impact

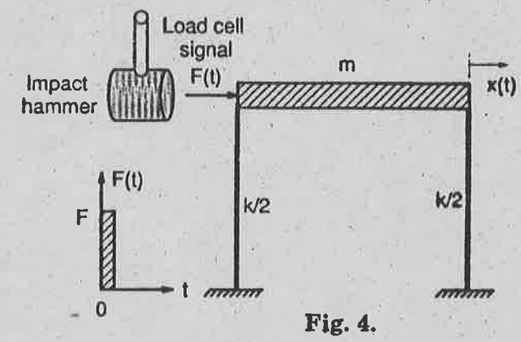

Fig. 4.

19. How decibel scale is defined ? Using appropriate equation describe the following :—
    (a) Sound power level.
    (b) Sound intensity level.
    (c) Sound pressure level.

    Also specify the reference quantities and their values chosen to define the above scales.

Or

20. Give a brief account on the major industrial noise sources. What you meant by Noise Control at the Source ? How it is categorized ? Describe one by one.

(5 × 12 = 60 marks)