Seat
No.

T. Y. B.Tech. (Mechanical Engineering) (CBCS) (Part-III) (Semester - VI) Examination, March - 2023
ELECTRIC VEHICLE
Sub. Code : 81529

Day and Date : Wednesday, 05 - 07 - 2023   **Total Marks : 70**
Time : 10.30 a.m. to 01.00 p.m.

Instructions :   1)   All Questions are compulsory.
                 2)   Use of non-programmable calculator is allowed.
                 3)   Assume suitable data if necessary and state it clearly.
                 4)   Figures to the right indicate full marks.

Q1) Attempt any two from the following.

  a)   Explain with neat sketch electric drive configurations.   **[6]**

  b)   Compare with graph tractive effort and vehicle speed between gasoline engines powered vehicle and electric motor powered vehicle.   **[6]**

  c)   Write a short note on overview of electric drive technologies.   **[6]**

Q2) Attempt any two from the following.

  a)   Explain with example Amp-hr capacity, State of Charge (SOC), Depth of Discharge (DoD), Specific energy and specific power of a battery.   **[6]**

  b)   Explain the working of Lead acid battery with neat sketch with reactions at positive and negative electrode.   **[6]**

  c)   Explain different criteria of battery storage and battery pack design. **[6]**

Q3) Attempt any two from the following.

  a)   Explain Constant current and constant voltage Charging and Multistage Charging (MSC) with neat sketch.   **[6]**

b) Explain wire (conductive) and wireless (Inductive) battery charging in Electric Vehicles with neat sketch. **[6]**

c) Explain Battery charging algorithm with Flow chart. **[6]**

Q4) Attempt any two from the following.

a) Classify in detail DC motor. Explain DC series motor with neat sketch. **[6]**

b) Compare PMSM with BLDC motor. Write applications of PMSM. **[6]**

c) Explain selection criteria of motor in EVs. **[6]**

Q5) Attempt any two from the following.

a) Explain the need of power conversion required in EVs. **[6]**

b) Explain working SCR (Silicon controlled rectifier) and write applications. **[6]**

c) Explain the requirements of Regenerative braking system. **[6]**

Q6) Attempt any two from the following.

a) Explain type of approval procedure for electric vehicles and government schemes for it. **[5]**

b) Explain self driving technology from level 1 to level 5. **[5]**

c) Explain with neat sketch conductive DC charging system. **[5]**

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No.

T. Y. B.Tech. (Mechanical Engineering) (CBCS) (Part-III)
(Semester - VI) Examination, March - 2023
COMPUTER AIDED DESIGN AND MANUFACTURING
Sub. Code : 81528

Day and Date : Wednesday, 05 - 07 - 2023   **Total Marks : 70**
Time : 10.30 a.m. to 01.00 p.m.

Instructions :   1)   **All Questions are compulsory.**
                     2)   **Assume suitable data wherever necessary.**
                     3)   **Figures to the right indicate full marks.**
                     4)   **Draw neat diagrams wherever necessary.**

Q1) Answer Any Two.

   a)   Define CAD Workstation. What are functions of workstation?   **[6]**

   b)   Discuss function and working of the input and output hardware
        devices.   **[6]**

   c)   Explain in what ways CAD can help manufacturing activity?   **[6]**

Q2) Answer Any Two.

   a)   Elaborate different types of Bezier Curves in detail.   **[6]**

   b)   Differentiate between Bezier and B-Spline curve.   **[6]**

   c)   Explain properties of B-spline Curve.   **[6]**

Q3) Answer Any Two.

   a)   Differentiate between wireframe modelling and surface modelling.   **[6]**

   b)   Discuss the CSG model with suitable example.   **[6]**

   c)   What are the applications of surface modeling?   **[6]**

Q4) Answer Any Two.

    a)   Describe homogeneous coordinate transformation system in detail. **[6]**

    b)   Explain various types of Geometric transformation using suitable examples. **[6]**

    c)   Explain the concept of composite transformations in detail. **[6]**

Q5) Answer Any Two.

    a)   Classify NC Systems in detail. **[6]**

    b)   Write short note on canned cycles. **[6]**

    c)   Explain construction and working of CNC machine. **[6]**

Q6) Answer Any Two.

    a)   Explain the concept of Rapid tooling in detail. **[5]**

    b)   What is rapid manufacturing? Explain in detail. **[5]**

    c)   Explain advantages and limitations of rapid prototyping. **[5]**

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Seat
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T.Y. B.Tech. (Mechanical Engineering) (Part-III) (CBCS) (Semester-V) Examination, March - 2023
ENTERPRISE RESOURCE PLANNING
Sub. Code : 80762

Day and Date : Friday, 30 - 06 - 2023   Total Marks : 70
Time : 02.30 p.m. to 05.00 p.m.
Instructions : 1) All questions are compulsory.
              2) Figures to the right indicate full marks.

Q1) Solve any two: [12]
   a)   Discuss in brief the various causes to ERP failure in manufacturing organizations.
   b)   Define ERP. Explain the evolution of ERP.
   c)   Explain term "ENTERPRISE" and its coordination for ERP.

Q2) Solve any two: [12]
   a)   What is EIS (Executive Information System)? Discuss how it supports decisions at executive level?
   b)   What is Decision Support System? How did it evolved?
   c)   Discuss in brief the significance of data mining in context of ERP in manufacturing organization.

Q3) Solve any two: [12]
   a)   Discuss in brief the significance of CAD/CAM in Modern Manufacturing.
   b)   What is DRP (Distribution requirement Planning)? Discuss in brief how DRP package links master production schedule with market and demand forecast?
   c)   What is Manufacturing Resource planning (MRP-II)? Explain Briefly.

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Q4) Solve any two: [12]

a) What are the major functions of the manufacturing module?

b) Explain Plant maintenance module.

c) Explain sub systems of Sales and Distribution module.

Q5) Solve any two: [12]

a) Explain the following ERP implementation phases.

  i) Implementation team training

  ii) Testing

b) What is purpose of gap analysis and how the gaps are fixed?

c) What are the various phases in ERP implementation? Discuss in brief the pre-evaluation screening phase.

Q6) Solve any two: [10]

a) What is Cloud based Enterprise resource planning? Explain Briefly.

b) Current ERP market scenario in India.

c) Explain case study of ERP in marketing.

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Seat No.

T.Y. B.Tech. (Mechanical Engineering) (Semester-VI) Examination, March - 2023
INTERNAL COMBUSTION ENGINES
Sub. Code : 81527

Day and Date : Monday, 03 - 07 - 2023   **Total Marks : 70**

Time : 10.30 a.m. to 01.00 p.m.

Instructions :
1) Answer any two from each question.
2) Figures to the right indicate full marks.
3) Assume suitable data if necessary and mention it clearly.
4) Draw neat diagrams wherever necessary.

Q1) a) Define the following.   [6]
   i) Cylinder Bore
   ii) Stroke Length
   iii) Swept Volume
   iv) Compression Ratio
   v) Square Engine
   vi) Volumetric Efficiency

   b) Give the classification of I.C. Engines.   [6]

   c) Explain the valve timing diagram for 4 stroke S.I. engine.   [6]

Q2) a) Explain with neat sketch simple carburetor. Discuss the drawback of simple carburetor.   [6]

   b) Describe the types of nozzles used in fuel injection system for CI Engines.   [6]

   c) Describe MPFI system for Petrol Engines with its merits and demerits.   [6]

Q3) a) Describe the stages in combustion in S.I. Engine with P-θ diagram. **[6]**

b) What is Octane number? How it is found? What are the additives used to improve the octane number? **[6]**

c) Explain the types of combustion chamber for S.I. Engine and highlights its requirements. **[6]**

Q4) a) What is meant by Delay Period in CI engine? And what are the factors that affect it? **[6]**

b) Compare the abnormal combustion in SI and CI engine. **[6]**

c) Explain requirements of combustion chambers. **[6]**

Q5) a) Explain Morse Test. **[6]**

b) List various methods available for finding friction power of an engine. Explain Willian's Line Method. **[6]**

c) The following observations were recorded in a test of one hour duration single cylinder oil engine working on 4-stroke cycle. **[6]**

Bore = 300 mm, stroke = 450 mm, fuel used = 8.8 kg, CV of fuel = 41800 kJ/kg, Revolutions = 12000, mep = 5.8 bar, Brake load = 1860 N, Cooling water = 650 kg, Temperature rise = 22°C, Diameter of the brake load = 1.22 m. Calculate :

i) Mechanical Efficiency

ii) Brake thermal efficiency

iii) Heat balance sheet

Q6) Write short note on : (any two) **[10]**

a) Exhaust Gas Recirculation

b) Alternate fuels for IC engines

c) Types of Superchargers

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Seat No.	

T.Y. B.Tech. (Mechanical Engineering) (CBCS) (Semester - V)
Examination, March - 2023
HEAT AND MASS TRANSFER
Sub. Code : 80755

Day and Date : Monday, 26 - 06 - 2023   **Total Marks : 70**
Time : 02.30 p.m. to 05.00 p.m.

Instructions :   1)   **All questions are compulsory.**
                          2)   **Figures to the right indicate full marks.**
                          3)   **Assume if necessary suitable data and state clearly.**

Q1) Solve any two: **[12]**

   a)   Define thermal conductivity and explain factors affecting on thermal conductivity.

   b)   State assumptions in Fourier law of heat conduction.

   c)   A plane wall is 15 cm thick of surface area 4.5 m^2. Thermal conductivity of wall is 9.5 W/mK. The inner and outer surface temperatures of the wall are maintained at 150°C and 45°C respectively. Determine heat flow across wall and temperature gradient in the heat flow direction.

Q2) a)   Derive the equation for temperature distribution and heat transfer through a plane wall with uniform heat generation.   **[6]**

   b)   A plane wall of thickness 0.2 mt and thermal conductivity 20 W/mK generates heat at the 50 kw/m^3 of volume when an electric current pass through it. The convective heat transfer on each side of the wall is 10 W/m^2k. Consider steady state condition and determine the surface temperatures. Assume surrounding temperatures to be 25°C.   **[6]**

Q3) Solve any two: **[12]**

   a)   Derive the expression for temperature distribution in fin of finite length with insulated end.

   b)   What do you understand by overall fin effectiveness?

   c)   A copper rod 30 mm diameter extends from wall at 150°C the surrounding air is at 20°C assuming K = 400 W/mK for copper and h = 10 W/m^2 K for convention, find heat loss from rod assuming it to be infinitely long.

Q4) a) With the help of dimensional analysis prove that Nusset Number is a function of Grashof's Number and Prandtl Number. **[6]**

b) Liquid metal at the rate of 5 Kg/s flows in the tube of 6 mm diameter. In the enters at 400°C into the tube of 6 mm diameter. It enters at 400°C into the tube and leaves at 430°C. A constant heat flux is maintained along the tube. The tube surface temperature is 22°C higher than the temperature of liquid metal. Calculate the length of the tube required. Assume the following properties for the liquid metal. **[6]**

$\mu = 1.35 \times 10^{-3}$ kg/ms, Cp = 150 J/kgK, Pr = 0.011, k = 16 W/mK
correlation for constant heat flux is : Nu = 4.82 + 0.0185 (Re.Pr)$^{0.83}$

Q5) Solve any two: **[12]**

a) Explain planks theory of radiation. Explain how the short wave radiation have much higher energy than long wave radiations.

b) Define blackbody radiation function and explain its practical importance.

c) Consider a blackbody at the temperature of 2000 K
   i) Calculate the total hemispherical emissive power.
   ii) Calculate the Wavelength at which maximum emissive power is available from this body.

Q6) Solve any two: **[10]**

a) What do you mean by fouling factor? What are the causes of fouling?

b) Explain drop wise and film wise condensation.

c) Derive an expression for effectiveness of counter flow heat exchange in terms of NTU.

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Seat No.

T.Y. B.Tech. (Mechanical Engineering) (Part - III) (CBCS) (Semester - VI) Examination, March - 2023
INDUSTRIAL FLUID POWER
Sub. Code : 81524

Day and Date : Tuesday, 27 - 06 - 2023   **Total Marks : 70**
Time : 10.30 a.m. to 01.00 p.m.
Instructions :   1)   **All questions are compulsory.**
                       2)   **Figures to the right indicate full marks.**
                       3)   **Assume if necessary suitable data and state clearly.**

Q1) Solve any two: [12]
   a)   Draw a neat sketch of basic hydraulic system using ISO symbol and write various applications?
   b)   Explain important properties of hydraulic fluids.
   c)   What are different source of contamination in hydraulic fluid?

Q2) Solve any two: [12]
   a)   What do you mean by linear and rotary actuator?
   b)   Explain types of accumulators used in hydraulic system.
   c)   Explain with neat sketch working of intensifier.

Q3) Solve any two: [12]
   a)   Explain various centre positions of directional control valve.
   b)   Explain with neat sketch 2/2, 3/2, 4/2, 4/3 type directional control valve?
   c)   Draw schematically a sequence valve and explain function.

Q4) Solve any two: [12]
   a)   Classify compressors and draw sketch of two stage reciprocating compressor.
   b)   Compare air, hydraulic and electric motor.
   c)   Draw and explain with neat sketch of a push bottom spring return 5/2 D.C.V. used in pneumatic system.

Q5) Solve any two: [12]

    a) What do you mean by the synchronization of cylinder motion? Explain various method to obtain it.

    b) Explain meter-in circuit used in hydraulic system.

    c) Explain use of counter balance valve in a hydraulic system.

Q6) Solve any two: [10]

    a) Explain with circuit diagram (position based) working of sequencing circuit for two double acting air cylinders.

    b) What is time delay circuit? Discuss with an example.

    c) Explain the speed control circuit for an air motor.

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Correction factor (F_c) for industrial service

Type of service	Operational hours per day		
	0 -10	10-16	16-24
1) Light duty; agitators-blowers-centrifugal pumps fans (up to 7.5 kW) and compressors	1.1	1.2	1.3
2) Medium duty: conveyors-fans (above 7.5 kW) line shafts machine tools-presses and positive displacement pumps.	1.2	1.3	1.4
3) Heavy duty; conveyors-bucket elevators and hammers	1.3	1.4	1.5

σ_2(degrees)
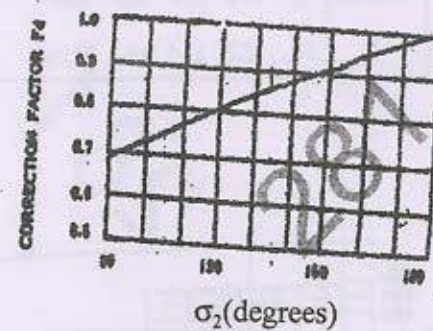
Correction factor for arc of contact (V-grooves on both pulleys)

For 'v' belts

Series of preferred values for pitch diameters (in mm) are as follows:

Pitch diameter (mm) : 125 132 140 150 160 170 180 190
200 212 224 236 250 265 280 300 315 355 375
400 425 450 475 500 530 560 600 630 670 710
750 800 900 1000

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Seat No.	

T.Y. B.Tech. (Mechanical Engineering) (CBCS)
(Semester - V) Examination, March - 2023
MACHINE DESIGN - I
Sub. Code : 80756

Day and Date : Tuesday, 27 - 06 - 2023   **Total Marks : 70**
Time : 02.30 p.m. to 05.00 p.m.

Instructions :
1) All Questions are compulsory.
2) Figures to the right indicate full marks.
3) Use of non-programmable calculator is permitted.
4) Draw neat diagrams wherever necessary.

Q1) a) State and explain maximum principle stress theory of failure. **[5]**
   b) Suggest with justification the suitable material for the following: **[6]**
      i) Side Stand Spring of Bike
      ii) Lathe Tail-Stock
      iii) Water Bottle

Q2) a) Draw neat sketch of a knuckle joint and explain the design procedure.**[6]**
   b) What is recirculating ball screw? Explain with neat sketch. **[6]**

Q3) a) An intermediate shaft of a gearbox, supporting two spur gears A and B and mounted between two bearings C_1 and C_2, is shown in Fig. The pitch circle diameters of gears A and B are 500 and 250 mm respectively. The shaft is made of alloy steel 20MnCr5. ($s_{ut} = 620$ and $S_{yt} = 480$ N/mm²). The factors kb and kt of the ASME code are 2 and 1.5 respectively. The gears are keyed to the shaft. Determine the shaft diameter using the ASME code. **[8]**

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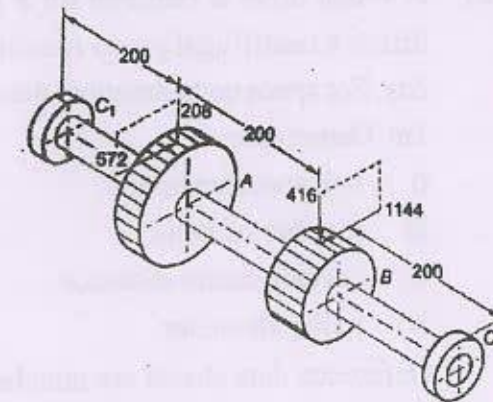
b) What types of stresses are induced in shafts? How the shaft is designed based on rigidity? [4]

Q4) a) What do you understand by the term riveted joint? Explain the necessity of such joints. [5]

b) A steel plate subjected to a force of 3 kN and fixed to a vertical channel by means of four identical bolts is shown in fig.no. 4.1 The bolts are made of plain carbon steel 45C8 with yield strength of 380 N/mm². Determine the diameter of the bolt if the factor of safety is 2. [6]
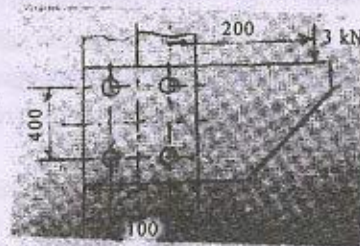
Fig. No. 4.1

Q5) a) What are the various types of spring used in practice? Explain one application of each type. [5]

b) A helical spring is made from wire of 6 mm diameter and has outside diameter of 75 mm. If the permissible shear stress is 350 MPa and modulus of rigidity is 84 kN/mm². Find the axial load which the spring can carry and the deflection per active turns. [6]

Q6) a) Give in step the procedure to design of a flat belt pulley. [5]

b) A V-belt drive is required for a 15 kW, 1440 rpm electric motor which drives a centrifugal pump running at 360 rpm for a service of 24 hrs per day. For space consideration, the centre distance should be approximately 1m. Determine: [8]

i) belt specification

ii) number of belts

iii) correct centre distance

iv) pulley diameter.

(reference data sheets are attached)

-2-

Power rating of V-belts

($\alpha_s = 180°$; speed of the faster pulley - 1440 r.p.m.)

(D = pulley diameter (mm) ; PR = Power rating in kW)

Section	D	75	80	85	90	100	106	112	118	125
A	PR	0.73	0.86	0.99	1.12	1.38	1.50	1.63	1.81	2.00
Section	D	125	132	140	150	160	170	180	190	200
B	PR	2.24	2.46	2.77	3.30	3.60	4.00	4.39	4.77	5.23
Section	D	200	212	224	236	250	265	280	300	315
C	PR	6.14	6.81	7.68	8.28	9.40	10.10	11.10	12.10	12.50
Section	D	350	375	400	425					
D	PR	15.7	17.5	19.3	20.60					
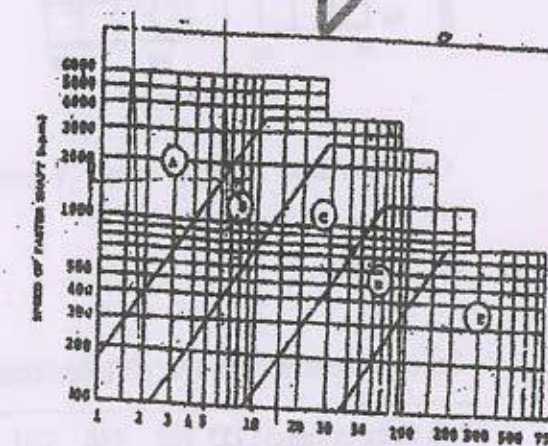
Design power (kW)

Selection of cross section of V-belt

-3-

Dimensions of standard cross-sections

Belt Section	Width W (mm)	Thickness T (mm)	Minimum pitch diameter of pulley (mm)
A	13	8	125
B	17	11	200
C	22	14	300
D	32	19	500
E	38	23	630

Conversion of inside length to pitch length of the belt

Belt Section	A	B	C	D	E
Difference between pitch length and inside length (mm)	36	43	56	79	92

Correction factor F_l for belt length

(L_i = nominal inside length of the belt in mm)

L_i	Belt section				
	A	B	C	D	E
1905	1.02	0.97	0.87	--	--
1981	1.03	0.98	--	--	--
2032	1.04	--	--	--	--
2057	1.04	0.98	0.89	--	--
2159	1.05	0.99	0.90	--	--
2286	1.06	1.00	0.91	--	--
2438	1.08	--	0.92	--	--
2464	--	1.02	--	--	--
2540	--	1.03	--	--	--
2667	1.10	1.04	0.94	--	--
2845	1.11	1.05	0.95	--	--
3048	1.13	1.07	0.97	0.86	--
3150	--	--	0.97	--	--
3251	1.14	1.08	0.98	0.87	--
3404	--	--	0.99	--	--
3658	--	1.11	1.00	0.90	--
4013	--	1.13	1.02	0.92	--
4115	--	1.14	1.03	0.92	--
4394	--	1.15	1.04	0.93	--
4572	--	1.16	1.05	0.94	--
4953	--	1.18	1.07	0.96	--
5334	--	1.19	1.08	0.96	0.94
6045	--	--	1.11	1.00	0.96
6807	--	--	1.14	1.03	0.99
7569	--	--	1.16	1.05	1.01

T.Y. B.Tech. (Mechanical Engineering) (CBCS) (Semester - V)
Examination, March - 2023
THEORY OF MACHINES - II
Sub. Code : 80754

Day and Date : Saturday, 24 - 06 - 2023

Total Marks : 70

Time : 02.30 p.m. to 05.00 p.m.

Instructions :
1) All questions are compulsory.
2) Figures to the right indicate full marks.
3) Assume if necessary suitable data and state clearly.
4) Use of non-programmable calculator is allowed.

Q1) a) Explain the interference phenomenon in involute gears.   [4]

OR

Derive the expression for the length of path of contact with usual notations.

b) The number of teeth on each of the two equal spur gears in mesh is 40. The teeth have 20° involute profile and the module is 6 mm. If the arc of contact is 1.75 times the circular pitch, find the addendum.   [8]

Q2) a) Write a note on various types of gear trains.   [4]

OR

Explain the torques in epicyclic gear train.

b) An epicyclic gear train is shown in Fig.2b. The annular gear has 72 teeth and meshes with gear B. Gear C has 32 teeth and is engaged to gear B. Arm EF which carries gears B and C rotates at a speed of 18 r.p.m. If gear A is fixed, determine the speed of gears B and C.   [8]

Fig. 2b
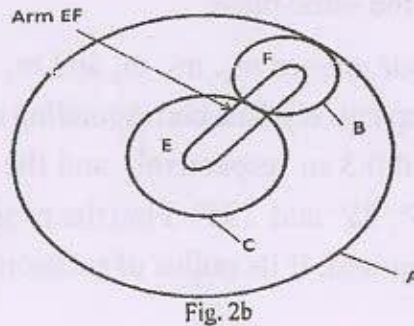
3) a) Write a note on gyroscope. [4]

OR

Derive the expression for gyroscopic couple magnitude.

b) The turbine rotor of a ship having a mass of 200 kg rotates 2000 rpm and its radius of gyration is 0.30 m. If the rotation of the rotor is clockwise looking from the aft, determine the gyroscopic couple set by the rotor when Ship takes a left hand turn at a radius of 300 m at a speed of 30 km/hr. Ship pitches with the bow rising at an angular velocity of 1 rad/sec, and Ship rolls at an angular velocity of 0.1 rad/sec [8]

4) a) Derive an expression for velocity and acceleration of the slider of der crank mechanism. [6]

OR

Explain dynamically equivalent system to replace connecting rod by a two mass system.

b) A connecting rod is suspended from a point 25 mm above the centre of small end, and 650 mm above its centre of gravity, its mass being 37.5 kg. When permitted to oscillate, the time period is found to be 1.87 seconds. Find the dynamical equivalent system constituted of two masses, one of which is located at the small end centre. [6]

25) a) Explain static and dynamic balancing. [4]

OR

Discuss how a single revolving mass is balanced by single mass rotating in the same plane.

b) Four masses m_1, m_2, m_3 and m_4 are 200 kg, 300 kg, 240 kg and 260 kg respectively. The corresponding radii of rotation are 0.2 m, 0.15 m, 0.25 m and 0.3 m respectively and the angles between successive masses are 45°, 75° and 135°. Find the position and magnitude of the balance mass required, if its radius of rotation is 0.2 m. [8]

Q6) a) Explain maximum fluctuation of energy and coefficient of fluctuation of Energy. [4]

OR

Explain Turning moment diagram for a multi cylinder Engine.

b) A horizontal cross compound steam engine develops 300 kW at 90 r.p.m. The coefficient of fluctuation of energy as found from the turning moment diagram is to be 0.1 and the fluctuation of speed is to be kept within ± 0.5% of the mean speed. Find the weight of the flywheel required, if the radius of gyration is 2 metres. [6]

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Seat No.

T.Y. B.Tech. (Mechanical) (Part - III) (CBCS)
(Semester - V) Examination, March - 2023
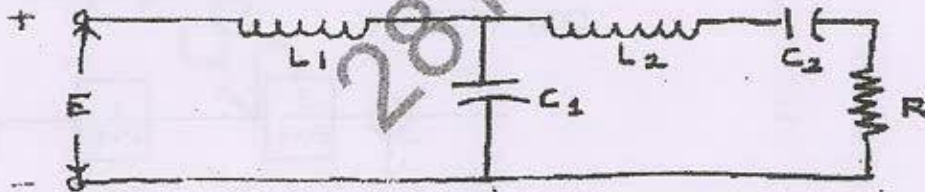## CONTROL ENGINEERING
Sub. Code : 80753

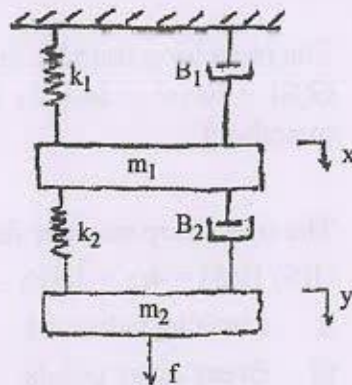Day and Date : Friday, 23 - 06 - 2023   Total Marks : 70

Time : 02.30 p.m. to 05.00 p.m.

Instructions :   1)   All questions are compulsory.

             2)   Assume suitable data if required and mention it clearly.

Q1) a)   Construct mechanical system using force voltage analog for the electrical network as shown in figure.   **[4]**

b)   Construct grounded chair representation and find relation between f and x.   **[4]**

c)   Define closed loop system with one example.   **[2]**

Q2) a) Linearise the equation $V = \dfrac{D}{T}$, where V is velocity, D is displacement and T is time. Determine the linear approximation for V due to change in d and change in t. **[6]**

b) Reduce the following block diagram as shown in figure 2b and find the transfer function. **[6]**
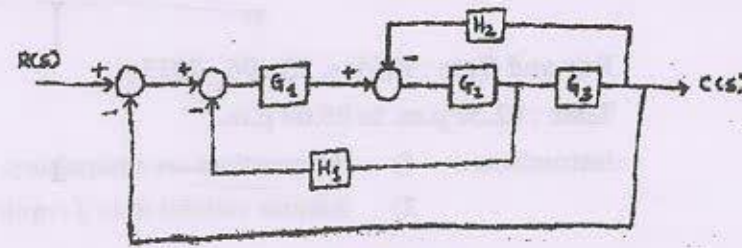
Figure 2b

Q3) a) A system for controlling the temperature of modern office building is shown in figure. Determine the response c(t) when $r(t) = u(t)$ and $C(0) = C'(0) = 0$. **[6]**
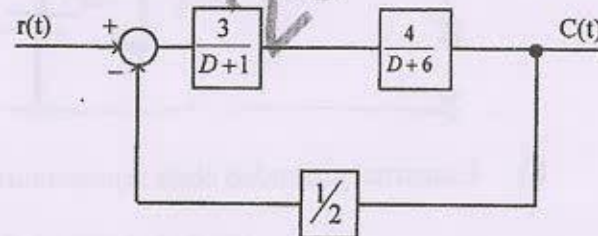
b) The open loop transfer function of a system with unity feedback gain is $G(S) = 20/(s^2 + 5s + 6)$. Determine rise time, peak time, % maximum overshoot. **[6]**

Q4) a) The open loop transfer function of a system is represented as $G(S)\,H(S) = k(s + 1)/s(s - 1)\,(s^2 + 4s + 16)$. Determine **[8]**

i) Limiting value of k

ii) Break away points

iii) Angle of asymptotes

iv) Angle of departure

b) The linear feedback system has characteristic equation as $s^4 + 4s^3 + 13s^2 + 36s + k = 0$ what is value of k for system to stable? **[4]**

Q5) a) For unity feedback control system $G(s) = 10/s(s + 1)\,(s + 5)$ sketch the bode plot. **[8]**

b) Calculate break in point for the control system having characteristic equation as $s^2 + 2s + 3 + k\,(s + 2) = 0$. **[4]**

Q6) a) Determine state space representation and computer diagram by using series programming. **[6]**

$$y(t) = \frac{2(D+5)}{(D+2)(D+3)(D+4)} f(t)$$

b) Determine state space representation and computer diagram by using general programming. **[6]**

$$y(t) = \frac{D+3}{D^3 + 9D^2 + 24D + 20} f(t)$$

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b) Seven jobs are to be processed through three machines A, B and C in the sequence ABC. the processing times are given in hrs. to process each one of the jobs through all the three machines. Find the minimum total elapsed time and ideal time associated with machines B and C.

Jobs	J_1	J_2	J_3	J_4	J_5	J_6	J_7
A	3	8	7	4	9	8	7
B	4	3	2	5	1	4	3
C	6	7	5	11	5	6	12

c) A company has six jobs hand coded 'A to F'. all the jobs have to go through two machines MI and MII. The time required for each job on each machine in hours is given below:

Job/m-c	A	B	C	D	E	F
M I	3	12	18	9	15	6
M II	9	18	24	24	3	15

Find the total elapsed time and idle time for both machines.

Seat No. ☐☐☐☐☐☐☐

T.Y. B.Tech. (Mehcanical Engineering) (Part - III) (CBCS) (Semester - VI) Examination, March - 2023

INDUSTRIAL MANAGEMENT AND OPERATION RESEARCH

Sub. Code : 81523

Day and Date : Friday, 23 - 06 - 2023   **Total Marks : 70**

Time : 10.30 a.m. to 01.00 p.m.

Instructions :   1)   **All questions are compulsory.**
2)   **Figures to the right indicate full marks.**
3)   **Assume suitable data if necessary and state it clearly.**

Q1) Solve any two from the following.   **[12]**
  a)   Explain line and staff organization structure.
  b)   List the theories of motivation, Explain any one in brief.
  c)   Explain the concept of Authority, Delegation and Responsibility.

Q2) Solve any two from the following.   **[12]**
  a)   Elaborate on advertising media and its effectiveness.
  b)   What is marketing strategy? Explain the importance of 4P's in marketing mix.
  c)   What is line balancing and explain steps in line balance technique.

Q3) Solve any two from the following.   **[10]**
  a)   State the measures to prevent accidents due to mechanical factors.
  b)   An engineering graduate wants to start an Automobile Servicing Centre for four wheelers. How he should establish the feasibility for the project.
  c)   Analyze the reasons for industrial accidents? Recommend remedial measures to prevent accidents.

Q4) Solve any two from the following.   **[12]**
  a)   Find graphically the maximum value of $Z = 8x_1 + 5x_2$ subject to constraints :
$$2x_1 + 4x_2 \geq 5$$
$$2x_1 + 2x_2 \leq 6$$
$$0 \leq x_1 \leq 7/2$$
$$0 \leq x_2 \leq 5/2$$

P.T.O.

b) A firm manufactures 3 products A, B, C. The profit per unit product are Rs. 4, Rs. 3 and Rs. 2 respectively. The firm has two machines and the required processing time in minutes for each machine on each product is given below.

		Product		
		A	B	C
Machine	X	4	3	5
	Y	2	2	4

Machines X and Y have 2500 and 2000 machine minute respectively. The firm must manufacture 100 A's, 200 B's and 50 C's but not more than 150 A's. Formulate a linear programming model to maximize the profit.

c) A used car dealer wishes to stock up his lot to maximize his profit. He can select cars A, B and C which are valued at Rs. 7000/-, Rs. 10000/- and Rs. 12000 respectively. These can be sold at Rs. 8000/-, 12000/- and 14000/- respectively. For each car probabilities of sales are :

Type of car	A	B	C
Probability of sale in 90 days	0.7	0.8	0.6

For every 2 cars of B, he should buy one car of type A or C. If he has Rs. 1,40,000/- invest, What should he buy to maximize his expected gain.

Q5) Solve any two from the following. [12]

a) A pharmaceutical company has four branches one each at city A, B, C, D. A branch manager is to be appointed one at each city, out of four candidates P, Q, R, S. The monthly business (Rs. in lakh) depends on the city and effectiveness of branch manager. Assign branch suitable manager to suitable city.

	A	B	C	D
P	11	11	9	9
Q	13	16	11	10
R	12	17	13	8
S	16	14	16	12

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b) The captain of a cricket team has to allot five middle batting positions to five batsmen. The average runs scored by each batsman at these positions are as follows.

Batting position

Batsman	I	II	III	IV	V
P	40	40	35	25	50
Q	42	30	16	25	27
R	50	48	40	60	50
S	20	19	20	18	25
T	58	60	59	55	53

Find the assignment of batsman to position which would give the maximum no of runs.

c) The unit transportation cost along with capacity and requirements from factories to warehouses is as given below:

Factory	Warehouse				Capacity
	1	2	3	4	
A	11	12	17	14	500
B	16	18	14	10	600
C	21	24	13	10	800
Requirements	400	450	550	600	

Obtain initial basic feasible solution by VAM.

Q6) Solve any two from the following. [12]

a) Draw the Project Network for the following activities and determine critical path and project duration.

Activity	A	B	C	D	E	F	G	H	I
Preceding activity	-	-	A,B	A,B	B	D,E	C,F	D,E	G,H
Duration (days)	30	20	20	20	10	10	40	20	30

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Seat
No.

T.Y. B.Tech. (Mechanical Engineering) (CBCS) (Part-III)
(Semester - VI) Examination, March - 2023
METROLOGY AND QUALITY CONTROL
Sub. Code : 81525

Day and Date : Sunday, 02 - 07- 2023   **Total Marks : 70**

Time : 10.30 a.m. to 01.00 p.m.

Instructions :
1) All Questions are compulsory.
2) Use of non-programmable calculator is allowed.
3) Draw neat labeled diagram wherever necessary.

Q1) Solve any two.

a) Explain different types of errors in measurement.   **[6]**

b) Difference between Line standard and End standard.   **[6]**

c) The slip gauge set M38 consist of the following gauge blocks.   **[6]**

Range	Steps	Pieces
1.005	-	1
1.01-1.09	0.01	9
1.1-1.9	0.1	9
1.0-9.0	1.0	9
10.0-100.0	10.0	10
Find out		
i)29.875	ii) 15.09	
iii)101.005	iv) 34.87	

Q2) Solve any two.

a) Explain construction and working principle of Mechanical-optical comparator with neat labeled diagram. [6]

b) Describe with neat sketch setup of a sine bar for measurement of a taper cylindrical job. [6]

c) What are the various instruments are used for angular measurements? Explain their advantage and limitations. [6]

Q3) Solve any two.

a) Write short note on: [6]

   i) Sampling length

   ii) RMS Value

   iii) CLA Value

b) What are Ra and RMS values? Give the importance and use of them. [6]

c) Explain the principle of interferometer. [6]

Q4) Solve any two.

a) Write a short note on: [6]

   i) Master gear

   ii) Standard rollers

b) Explain construction, working, advantages, disadvantages and applications of Gear tooth caliper (Gear tooth vernier caliper). [6]

c) Explain the three-wire method for the measurement of thread. [6]

Q5) Solve any two.

a) Discuss the specification of quality and cost of quality. [5]

b) What are the advantages and limitations of Quality Circles? [5]

c) Explain the concept of balance between cost and quality and value of Quality. [5]

Q6) Solve any two.

a) A machine is working to a specification 12.58 ± 0.05 mm a study of 25. Consecutive pieces show the following measurements. Construct the X and R chart; calculate process capability and comment on the process (For sample size of 5 take A2 = 0.58, D4 = 2.11, D3 = 0, d2 = 2.326). [6]

1st Day	2nd Day	3rd Day	4th Day	5th Day
12.54	12.58	12.61	12.57	12.57
12.58	12.57	12.60	12.61	12.60
12.62	12.60	12.64	12.56	12.62
12.56	12.60	12.58	12.59	12.61
12.59	12.61	12.64	12.59	12.58

b) List the desirable consideration for selecting a sample. [6]

c) State the advantages and applications of control charts and sketch the different patterns of control charts. [6]

Seat
No.

T.Y. B.Tech. (Mechanical Engineering) (CBCS) (Semester-VI) Examination, March - 2023

MACHINE DESIGN - II

Sub. Code : 81526

Day and Date : Saturday, 01 - 07 - 2023   **Total Marks : 70**

Time : 10.30 a.m. to 01.00 p.m.

Instructions :   1)   All questions are compulsory.

2)   Figures to the right indicate full marks.

3)   Assume if necessary suitable data and state clearly.

4)   Use of non-programmable calculator is allowed.

Q1) a)   Define Stress concentration and their causes and remedies.   **[5]**

b)   The work cycle of a mechanical component is subjected to a completely reversed bending stresses consisting of the following three elements:**[6]**

   i)   + 600 N /mm² for 5% of time

   ii)   + 550 N/mm² for 10% of time

   iii)   + 400 N/mm² for 85% of time

   Material for the component is 50C4 (S_{ut} = 660 N/mm²) and the corrected endurance Strength is 280N/mm². Determine the life of the component.

Q2) a)   Discuss the various materials used for sliding contact bearing.   **[5]**

b)   A ball bearing is subjected to a radial force of 2500 N and an axial force of 1000 N .The dynamic capacity of bearing is 7350 N. The values of X and Y factors are 0.56 and 1.6 respectively. The shaft is running at 720 rpm. Determine life of bearing in working hours.   **[6]**

Q3) a) Explain with neat sketch the theory of hydrodynamic lubrication.   [5]

b) A following data is given for a 3600 hydrodynamic bearing.

Journal diameter = 100 mm, Bearing length = 100 mm, Radial load = 50 kN, Journal speed = 1440 rpm, Radial clearance = 0.12 mm, Viscosity of lubricant = 16 cP   [8]

Determine :-

i)   Minimum oil film thickness

ii) Coefficient of friction

iii) Power lost in friction

1/d	ϵ	ho/c	S	$\varnothing$	(r/c)f	(Q/rcnsl)
1	0.4	0.6	0.264	63.10	5.79	3.99
1	0.6	0.4	0.121	50.58	3.22	4.33
1	0.8	0.2	0.0446	36.24	1.70	4.62
1	0.9	0.1	0.0188	26.45	1.05	4.74
1	0.97	0.03	0.0047	15.47	0.514	4.82

Q4) a) Derive Lewis equation for beam strength of spurs gear. State the assumptions made in deriving the equation.   [5]

b) Design a pair of spur gears with 20° full depth involute teeth consist of 20 teeth pinion meshing with 50 teeth gear. The pinion shaft is connected to 22.5 KW, 1450 rpm electric motor. The starting torque of motor is 150% of rated torque. The material for the pinion is plain carbon steel Fe410 (S_{ut} = 410 N/mm^2) and gear is made of grey cast iron FG200 (S_{ut} = 200N/mm^2). The factor of safety is 1.5. Design the gears based on Lewis equation and using the velocity factor to account for the dynamic load. Use Y for 20 teeth = 0.32 and Y for 50 teeth = 0.408.   [7]

Q5) a) Explain with sketch the concept of formative or virtual no of teeth in the design of helical gears.   [5]

b) A pair of straight tooth bevel gears has a velocity ratio 2:1. The pitch circle diameter of the pinion is 80 mm at large end of the tooth. 5 KW power is supplied to the pinion, which rotates at 800 rpm. The face width is 40 mm and the pressure angle is 20°. Determine the tangential, radial and axial components of resultant tooth force acting on the pinion.   [6]

Q6) a) Discuss the thermal consideration in the design of worm and worm wheel drive.   [5]

b) A pair of worm gear is designated as 1/40/10/4 has an effective surface area of 0.25 m^2. A fan is mounted on the worm shaft to circulate air over the surface of the fins. The coefficient of heat transfer can be taken as 25 W/m^2°C. The permissible temperature rise of the lubricating oil above the atmospheric temperature is 45°C. The coefficient of friction is 0.035 and the normal pressure angle is 20°. The worm shaft is rotating at 1440 rpm. Calculate the power transmitting capacity based on thermal considerations.   [7]